APPENDIX F

2007 Existing Ramp Analysis

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SSS	Freeway/Dir of Travel	Route 128 NB
Agency or Company	McMahon	Junction	Rt 128 NB to Highland Ave EB
Date Performed	8/8/07	Jurisdiction	
Analysis Time Period	AM	Analysis Year	2007 Existing

Project Description: Route 128 Add-a-Lane

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☑ Yes ☑ On
☑ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 55.0 mph S_{FR} = 35.0 mph	L_{down} = 885 ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = 603 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 f_{HV} f_p
Freeway	8776	0.90	Level	2	0	0.990	1.00	9849
Ramp	636	0.90	Level	2	0	0.990	1.00	714
UpStream								
DownStream	603	0.90	Level	2	0	0.990	1.00	677

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 4697 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	9849	9000	Yes
V_{12}	4697	4400:All	Yes
$V_{FO} = V_F - V_R$	9135	9000	Yes
V_R	714	2000	No

Level of Service Determination (if not F)

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

D_R = 44.6 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

D_s = 0.492 (Exhibit 25-19)

S_R= 48.6 mph (Exhibit 25-19)

S_0= 54.2 mph (Exhibit 25-19)

S = 51.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst2	SSS	Freeway/Dir of Travel	Route 128 NB
Agency or Company	McMahon	Junction	Highland Ave EB to Route 128 N
Date Performed	8/8/07	Jurisdiction	
Analysis Time Period	AM	Analysis Year	2007 Existing

Project Description Route 128 Add-a-Lane

Site Information

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

Vu = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{down} = 560 ft

VD = 151 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 f_{HV} f_p
Freeway	8140	0.90	Level	2	0	0.990	1.00	9135
Ramp	603	0.90	Level	2	0	0.990	1.00	677
UpStream								
DownStream	151	0.90	Level	2	0	0.990	1.00	169

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.133 using Equation 4

V_{12}= 1217 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	9812	See Exhibit 25-7	Yes
V_{R12}	1894	4600:All	No

Level of Service Determination (if not F)

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

D_R = 19.9 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.347 (Exibit 25-19)

S_R= 50.5 mph (Exhibit 25-19)

S_0= 38.5 mph (Exhibit 25-19)

S= 40.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

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

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SSS	Freeway/Dir of Travel	Route 128 NB
Agency or Company	McMahon	Junction	Rt 128 NB to Highland Ave WB
Date Performed	8/8/07	Jurisdiction	
Analysis Time Period	AM	Analysis Year	2007 Existing

Project Description: Route 128 Add-a-Lane

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☑ Yes ☑ On		☐ Yes ☐ On
☐ No ☐ Off		☑ No ☐ Off
L_{up} = 560 ft		L_{down} = ft
Vu = 603 veh/h	S_{FF} = 55.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = 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 f_{HV} f_p
Freeway	8743	0.90	Level	2	0	0.990	1.00	9812
Ramp	151	0.90	Level	2	0	0.990	1.00	169
UpStream	603	0.90	Level	2	0	0.990	1.00	677
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 4373 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	9812	9000	Yes
V_{12}	4373	4400:All	No
$V_{FO} = V_F - V_R$	9643	9000	Yes
V_R	169	2000	No

Level of Service Determination (if not F)

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

D_R = 41.9 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

D_s = 0.443 (Exhibit 25-19)

S_R= 49.2 mph (Exhibit 25-19)

S_0= 53.6 mph (Exhibit 25-19)

S = 51.6 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst2	SSS	Freeway/Dir of Travel	Route 128 NB
Agency or Company	McMahon	Junction	Highland Ave WB to Rt 128 NB
Date Performed	8/8/07	Jurisdiction	
Analysis Time Period	AM	Analysis Year	2007 Existing

Project Description Route 128 Add-a-Lane

Site Information

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 610 ft

V_u = 151 veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ 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 f_{HV} f_p
Freeway	8592	0.90	Level	2	0	0.990	1.00	9642
Ramp	377	0.90	Level	2	0	0.990	1.00	423
UpStream	151	0.90	Level	2	0	0.990	1.00	169
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.165 using Equation 4

V_{12}= 1590 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	10065	See Exhibit 25-7	Yes
V_{R12}	2013	4600:All	No

Level of Service Determination (if not F)

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

D_R = 21.0 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.350 (Exibit 25-19)

S_R= 50.4 mph (Exhibit 25-19)

S_0= 38.1 mph (Exhibit 25-19)

S= 40.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

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

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SSS	Freeway/Dir of Travel	Route 128 SB
Agency or Company	McMahon	Junction	Rt 128 SB to Highland Ave EB
Date Performed	8/8/07	Jurisdiction	
Analysis Time Period	AM	Analysis Year	2007 Existing

Project Description: Route 128 Add-a-Lane

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☑ Yes ☑ On		☐ Yes ☐ On
☐ No ☐ Off		☑ No ☐ Off
L_{up} = 730 ft		L_{down} = ft
Vu = 409 veh/h	S_{FF} = 55.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = 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 f_{HV} f_p
Freeway	6495	0.90	Level	2	0	0.990	1.00	7289
Ramp	1067	0.90	Level	2	0	0.990	1.00	1197
UpStream	409	0.90	Level	2	0	0.990	1.00	459
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3853 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	7289	9000	No
V_{12}	3853	4400:All	No
$V_{FO} = V_F - V_R$	6092	9000	No
V_R	1197	2000	No

Level of Service Determination (if not F)

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

D_R = 37.4 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

D_s = 0.536 (Exhibit 25-19)

S_R= 48.0 mph (Exhibit 25-19)

S_0= 57.5 mph (Exhibit 25-19)

S = 52.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst2	SSS	Freeway/Dir of Travel	Route 128 SB
Agency or Company	McMahon	Junction	Highland Ave EB to Rt 128 SB
Date Performed	8/8/07	Jurisdiction	
Analysis Time Period	AM	Analysis Year	2007 Existing

Project Description Route 129 Add-a-Lane

Site Information

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 905 ft

Vu = 1067 veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

VD = 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 f_{HV} f_p
Freeway	5428	0.90	Level	2	0	0.990	1.00	6091
Ramp	151	0.90	Level	2	0	0.990	1.00	169
UpStream	1067	0.90	Level	2	0	0.990	1.00	1197
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.197 using Equation 4

V_{12}= 1198 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	6260	See Exhibit 25-7	No
V_{R12}	1367	4600:All	No

Level of Service Determination (if not F)

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

D_R = 16.1 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.336 (Exibit 25-19)

S_R= 50.6 mph (Exhibit 25-19)

S_0= 47.6 mph (Exhibit 25-19)

S= 48.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

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

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SSS	Freeway/Dir of Travel	Route 128 SB
Agency or Company	McMahon	Junction	Rt 128 SB to Highland Ave WB
Date Performed	8/8/07	Jurisdiction	
Analysis Time Period	AM	Analysis Year	2007 Existing

Project Description: Route 128 Add-a-Lane

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☑ Yes ☑ On
☑ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 55.0 mph S_{FR} = 35.0 mph	L_{down} = 545 ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = 409 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 f_{HV} f_p
Freeway	6937	0.90	Level	2	0	0.990	1.00	7785
Ramp	851	0.90	Level	2	0	0.990	1.00	955
UpStream								
DownStream	409	0.90	Level	2	0	0.990	1.00	459

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3933 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	7785	9000	No
V_{12}	3933	4400:All	No
$V_{FO} = V_F - V_R$	6830	9000	No
V_R	955	2000	No

Level of Service Determination (if not F)

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

D_R = 38.1 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

D_s = 0.514 (Exhibit 25-19)

S_R= 48.3 mph (Exhibit 25-19)

S_0= 56.7 mph (Exhibit 25-19)

S = 52.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst2	SSS	Freeway/Dir of Travel	Route 128 SB
Agency or Company	McMahon	Junction	Highland Ave WB to Rt 128 SB
Date Performed	8/8/07	Jurisdiction	
Analysis Time Period	AM	Analysis Year	2007 Existing

Project Description Route 128 Add-a-Lane

Site Information

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 545 ft

Vu = 851 veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

VD = 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 f_{HV} f_p
Freeway	6086	0.90	Level	2	0	0.990	1.00	6830
Ramp	409	0.90	Level	2	0	0.990	1.00	459
UpStream	851	0.90	Level	2	0	0.990	1.00	955
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.160 using Equation 4

V_{12}= 1096 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	7289	See Exhibit 25-7	No
V_{R12}	1555	4600:All	No

Level of Service Determination (if not F)

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

D_R = 17.4 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.339 (Exibit 25-19)

S_R= 50.6 mph (Exhibit 25-19)

S_0= 45.1 mph (Exhibit 25-19)

S= 46.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

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

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SSS	Freeway/Dir of Travel	Route 128 NB
Agency or Company	McMahon	Junction	Rt 128 NB to Highland Ave EB
Date Performed	8/9/07	Jurisdiction	
Analysis Time Period	PM	Analysis Year	2007 Existing

Project Description Route 128 Add-a-Lane

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☑ Yes ☑ On
☑ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 55.0 mph S_{FR} = 35.0 mph	L_{down} = 885 ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = 797 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 f_{HV} f_p
Freeway	6687	0.90	Level	2	0	0.990	1.00	7504
Ramp	517	0.90	Level	2	0	0.990	1.00	580
UpStream								
DownStream	797	0.90	Level	2	0	0.990	1.00	894

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3599 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	7504	9000	No
V_{12}	3599	4400:All	No
$V_{FO} = V_F - V_R$	6924	9000	No
V_R	580	2000	No

Level of Service Determination (if not F)

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

D_R = 35.2 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

D_s = 0.480 (Exhibit 25-19)

S_R= 48.8 mph (Exhibit 25-19)

S_0= 56.6 mph (Exhibit 25-19)

S = 52.6 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SSS	Freeway/Dir of Travel	Route 128 NB
Agency or Company	McMahon	Junction	Highland Ave EB to Rt 128 NB
Date Performed	8/9/07	Jurisdiction	
Analysis Time Period	PM	Analysis Year	2007 Existing

Project Description Route 128 Add-a-Lane

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

Vu = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{down} = 560 ft

VD = 140 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 f_{HV} f_p
Freeway	6170	0.90	Level	2	0	0.990	1.00	6924
Ramp	797	0.90	Level	2	0	0.990	1.00	894
UpStream								
DownStream	140	0.90	Level	2	0	0.990	1.00	157

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.106 using Equation 4

V_{12}= 734 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	7818	See Exhibit 25-7	No
V_{R12}	1628	4600:All	No

Level of Service Determination (if not F)

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

D_R = 17.8 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.341 (Exibit 25-19)

S_R= 50.6 mph (Exhibit 25-19)

S_0= 43.7 mph (Exhibit 25-19)

S= 45.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

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

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SSS	Freeway/Dir of Travel	Route 128 NB
Agency or Company	McMahon	Junction	Rt 128 NB to Highland Ave WB
Date Performed	8/9/07	Jurisdiction	
Analysis Time Period	PM	Analysis Year	2007 Existing

Project Description Route 128 Add-a-Lane

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☑ Yes ☑ On		☐ Yes ☐ On
☐ No ☐ Off		☑ No ☐ Off
L_{up} = 560 ft		L_{down} = ft
Vu = 797 veh/h	S_{FF} = 55.0 mph S_{FR} = 35.0 mph	VD = veh/h
	Sketch (show lanes, L_A, L_D, V_R, V_f)	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	6967	0.90	Level	2	0	0.990	1.00	7819
Ramp	140	0.90	Level	2	0	0.990	1.00	157
UpStream	797	0.90	Level	2	0	0.990	1.00	894
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 3498 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	7819	9000	No
V_{12}	3498	4400:All	No
$V_{FO} = V_F - V_R$	7662	9000	No
V_R	157	2000	No

Level of Service Determination (if not F)

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

D_R = 34.3 (pc/ mi /ln)

LOS= D (Exhibit 25-4)

Speed Estimation

D_s = 0.442 (Exhibit 25-19)

S_R= 49.3 mph (Exhibit 25-19)

S_0= 55.8 mph (Exhibit 25-19)

S = 52.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst2	SSS	Freeway/Dir of Travel	Route 128 NB
Agency or Company	McMahon	Junction	Highland Ave WB to Rt 128 NB
Date Performed	8/9/07	Jurisdiction	
Analysis Time Period	PM	Analysis Year	2007 Existing

Project Description Route 128 Add-a-Lane

Site Information

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 610 ft

Vu = 140 veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

VD = 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 f_{HV} f_p
Freeway	6827	0.90	Level	2	0	0.990	1.00	7661
Ramp	1110	0.90	Level	2	0	0.990	1.00	1246
UpStream	140	0.90	Level	2	0	0.990	1.00	157
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.062 using Equation 4

V_{12}= 475 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	8907	See Exhibit 25-7	No
V_{R12}	1721	4600:All	No

Level of Service Determination (if not F)

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

D_R = 18.3 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.343 (Exibit 25-19)

S_R= 50.5 mph (Exhibit 25-19)

S_0= 40.7 mph (Exhibit 25-19)

S= 42.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

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

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SSS	Freeway/Dir of Travel	Route 128 SB
Agency or Company	McMahon	Junction	Rt 128 SB to Highland Ave EB
Date Performed	8/9/07	Jurisdiction	
Analysis Time Period	PM	Analysis Year	2007 Existing

Project Description Route 128 Add-a-Lane

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☑ Yes ☑ On		☐ Yes ☐ On
☐ No ☐ Off		☑ No ☐ Off
L_{up} = 730 ft		L_{down} = ft
Vu = 528 veh/h	S_{FF} = 55.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	7957	0.90	Level	2	0	0.990	1.00	8930
Ramp	442	0.90	Level	2	0	0.990	1.00	496
UpStream	528	0.90	Level	2	0	0.990	1.00	593
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 4173 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	8930	9000	No
V_{12}	4173	4400:All	No
$V_{FO} = V_F - V_R$	8434	9000	No
V_R	496	2000	No

Level of Service Determination (if not F)

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

D_R = 40.1 (pc/ mi /ln)

LOS= E (Exhibit 25-4)

Speed Estimation

D_s = 0.473 (Exhibit 25-19)

S_R= 48.9 mph (Exhibit 25-19)

S_0= 55.0 mph (Exhibit 25-19)

S = 51.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SSS	Freeway/Dir of Travel	Route 128 SB
Agency or Company	McMahon	Junction	Highland Ave EB to Rt 128 SB
Date Performed	8/9/07	Jurisdiction	
Analysis Time Period	PM	Analysis Year	2007 Existing

Project Description Route 128 Add-a-Lane

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 905 ft
Vu = 442 veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
VD = 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 f_{HV} f_p
Freeway	7515	0.90	Level	2	0	0.990	1.00	8434
Ramp	237	0.90	Level	2	0	0.990	1.00	266
UpStream	442	0.90	Level	2	0	0.990	1.00	496
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM}= 0.185 using Equation 4
V_{12}= 1556 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	8700	See Exhibit 25-7	No
V_{R12}	1822	4600:All	No

Level of Service Determination (if not F)

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

D_R = 19.6 (pc/ m/ln)
LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.345 (Exibit 25-19)
S_R= 50.5 mph (Exhibit 25-19)
S_0= 41.6 mph (Exhibit 25-19)
S= 43.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation
V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

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

D_R = (pc/ m/ln)
LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SSS	Freeway/Dir of Travel	Route 128 SB
Agency or Company	McMahon	Junction	Rt 128 SB to Highland Ave WB
Date Performed	8/9/07	Jurisdiction	
Analysis Time Period	PM	Analysis Year	2007 Existing

Project Description Route 128 Add-a-Lane

Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
☐ Yes ☐ On		☑ Yes ☑ On
☑ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 55.0 mph S_{FR} = 35.0 mph	L_{down} = 545 ft
Vu = veh/h	Sketch (show lanes, L_A, L_D, V_R, V_f)	VD = 528 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 f_{HV} f_p
Freeway	8162	0.90	Level	2	0	0.990	1.00	9160
Ramp	733	0.90	Level	2	0	0.990	1.00	823
UpStream								
DownStream	528	0.90	Level	2	0	0.990	1.00	593

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= using Equation

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 25-4)

Speed Estimation

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S= mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} =0.436 using Equation 8

V_{12} = 4458 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	9160	9000	Yes
V_{12}	4458	4400:All	Yes
$V_{FO} = V_F - V_R$	8337	9000	No
V_R	823	2000	No

Level of Service Determination (if not F)

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

D_R = 42.6 (pc/ mi /ln)

LOS= F (Exhibit 25-4)

Speed Estimation

D_s = 0.502 (Exhibit 25-19)

S_R= 48.5 mph (Exhibit 25-19)

S_0= 55.1 mph (Exhibit 25-19)

S = 51.6 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst2	SSS	Freeway/Dir of Travel	Route 128 SB
Agency or Company	McMahon	Junction	Highland Ave WB to Rt 128
Date Performed	8/9/07	Jurisdiction	
Analysis Time Period	PM	Analysis Year	2007 Existing

Project Description Route 128 Add-a-Lane

Site Information

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

Vu = veh/h

Terrain Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{down} = 730 ft

VD = 442 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 f_{HV} f_p
Freeway	7429	0.90	Level	2	0	0.990	1.00	8337
Ramp	528	0.90	Level	2	0	0.990	1.00	593
UpStream								
DownStream	442	0.90	Level	2	0	0.990	1.00	496

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.144 using Equation 4

V_{12}= 1198 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	8930	See Exhibit 25-7	No
V_{R12}	1791	4600:All	No

Level of Service Determination (if not F)

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

D_R = 19.2 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.344 (Exibit 25-19)

S_R= 50.5 mph (Exhibit 25-19)

S_0= 40.9 mph (Exhibit 25-19)

S= 42.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

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

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	TC	Freeway/Dir of Travel	Route 128/I-95 NB
Agency or Company	McMahon	Junction	Rt 128 NB to Rt 9 EB-Ds
Date Performed		Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing (2007)

Project Description I-95/Route 128 at Route 9 IJR

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 900 ft
V_D = 475 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	8969	0.92	Level	3	0	0.985	1.00	9895
Ramp	602	0.92	Level	3	0	0.985	1.00	664
UpStream								
DownStream	475	0.92	Level	3	0	0.985	1.00	524

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
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 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

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 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4689 pc/h
V_3 or V_{av34} 2603 pc/h (Equation 25-15 or 25-16)
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 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9895	Exhibit 25-14	9000	Yes
$V_{FO} = V_F - V_R$	9231	Exhibit 25-14	9000	Yes
V_R	664	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4689	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 39.0 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.488 (Exhibit 25-19)
S_R= 48.7 mph (Exhibit 25-19)
S_0= 54.1 mph (Exhibit 25-19)
S = 51.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	TC	Freeway/Dir of Travel	Route 128/I-95 NB
Agency or Company	McMahon	Junction	Rt 9 WB to Rt 128 NB-Us
Date Performed		Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing (2007)

Project Description I-95/Route 128 at Route 9 IJR

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 845 ft

V_u = 936 veh/h

Terrain: Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ 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	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7906	0.92	Level	3	0	0.985	1.00	8722
Ramp	1099	0.92	Level	3	0	0.985	1.00	1212
UpStream	936	0.92	Level	3	0	0.985	1.00	1033
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.200 using Equation (Exhibit 25-5)

V_{12} = 1745 pc/h

V_3 or V_{av34} 3488 pc/h (Equation 25-4 or 25-5)

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} = 3322 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9934	Exhibit 25-7		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4534	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

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

D_R = 37.6 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Speed Determination

M_S = 0.655 (Exibit 25-19)

S_R= 46.5 mph (Exhibit 25-19)

S_0= 46.1 mph (Exhibit 25-19)

S = 46.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

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 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	TC	Freeway/Dir of Travel	Route 128/I95 SB
Agency or Company	McMahon	Junction	Rt 9 EB to Rt 128 SB-Us
Date Performed		Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing (2007)

Project Description I-95/Route 128 at Route 9 IJR

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 845 ft

V_u = 857 veh/h

Terrain: Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ 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	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6277	0.92	Level	3	0	0.985	1.00	6925
Ramp	660	0.92	Level	3	0	0.985	1.00	728
UpStream	857	0.92	Level	3	0	0.985	1.00	945
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.261 using Equation (Exhibit 25-5)

V_{12} = 1805 pc/h

V_3 or V_{av34} 2560 pc/h (Equation 25-4 or 25-5)

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} = 2770 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7653	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3498	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

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

D_R = 29.8 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.420 (Exibit 25-19)

S_R= 49.5 mph (Exhibit 25-19)

S_0= 49.3 mph (Exhibit 25-19)

S = 49.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

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 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	TC	Freeway/Dir of Travel	Route 128/I-95 SB
Agency or Company	McMahon	Junction	Rt 128 SB to Rt 9 WB-Ds
Date Performed		Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing (2007)

Project Description I-95/Route 128 at Route 9 IJR

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 505 ft
V_D = 469 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	7368	0.92	Level	3	0	0.985	1.00	8129
Ramp	703	0.92	Level	3	0	0.985	1.00	776
UpStream								
DownStream	469	0.92	Level	3	0	0.985	1.00	517

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
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 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

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 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3982 pc/h
V_3 or V_{av34} 2073 pc/h (Equation 25-15 or 25-16)
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 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8129	Exhibit 25-14	9000	No
$V_{FO} = V_F - V_R$	7353	Exhibit 25-14	9000	No
V_R	776	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3982	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$
D_R = 33.7 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.498 (Exhibit 25-19)
S_R= 48.5 mph (Exhibit 25-19)
S_0= 56.2 mph (Exhibit 25-19)
S = 52.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	TC	Freeway/Dir of Travel	Route 128/I95 SB
Agency or Company	McMahon	Junction	Rt 128 NB to Rt 9 EB-Ds
Date Performed		Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing (2007)

Project Description I-95/Route 128 at Route 9 IJR

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 900 ft
V_D = 706 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	7937	0.92	Level	3	0	0.985	1.00	8757
Ramp	476	0.92	Level	3	0	0.985	1.00	525
UpStream								
DownStream	706	0.92	Level	3	0	0.985	1.00	779

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
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 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

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 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4114 pc/h
V_3 or V_{av34} 2321 pc/h (Equation 25-15 or 25-16)
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 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8757	Exhibit 25-14	9000	No
$V_{FO} = V_F - V_R$	8232	Exhibit 25-14	9000	No
V_R	525	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4114	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$
D_R = 34.1 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.475 (Exhibit 25-19)
S_R= 48.8 mph (Exhibit 25-19)
S_0= 55.2 mph (Exhibit 25-19)
S = 52.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	TC	Freeway/Dir of Travel	Route 128/I-95 NB
Agency or Company	McMahon	Junction	Rt 9 WB ro Rt 128 NB-Us
Date Performed		Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing (2007)

Project Description I-95/Route 128 at Route 9 IJR

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 845 ft
V_u = 661 veh/h

Terrain: Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ 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	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7506	0.92	Level	3	0	0.985	1.00	8281
Ramp	973	0.92	Level	3	0	0.985	1.00	1073
UpStream	661	0.92	Level	3	0	0.985	1.00	729
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.217 using Equation (Exhibit 25-5)
V_{12} = 1801 pc/h
V_3 or V_{av34} 3240 pc/h (Equation 25-4 or 25-5)
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} = 2881 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9354	Exhibit 25-7		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3954	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

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

D_R = 33.2 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

M_S = 0.495 (Exibit 25-19)
S_R= 48.6 mph (Exhibit 25-19)
S_0= 46.1 mph (Exhibit 25-19)
S = 47.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
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 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	TC	Freeway/Dir of Travel	Route 128/I-95 SB
Agency or Company	McMahon	Junction	Rt 9 EB to Rt 128 SB-Us
Date Performed		Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing (2007)

Project Description I-95/Route 128 at Route 9 IJR

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 845 ft
V_u = 730 veh/h

Terrain: Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ 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	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7316	0.92	Level	3	0	0.985	1.00	8071
Ramp	884	0.92	Level	3	0	0.985	1.00	975
UpStream	730	0.92	Level	3	0	0.985	1.00	805
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.230 using Equation (Exhibit 25-5)
V_{12} = 1854 pc/h
V_3 or V_{av34} 3108 pc/h (Equation 25-4 or 25-5)
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} = 2671 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9046	Exhibit 25-7		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3646	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

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

D_R = 30.8 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

M_S = 0.441 (Exibit 25-19)
S_R= 49.3 mph (Exhibit 25-19)
S_0= 46.1 mph (Exhibit 25-19)
S = 47.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
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 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	TC	Freeway/Dir of Travel	Route 128/I-95 SB
Agency or Company	McMahon	Junction	Rt 128 SB to Rt 9 WB-Ds
Date Performed		Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing (2007)

Project Description I-95/Route 128 at Route 9 IJR

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 55.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 505 ft
V_D = 570 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	7759	0.92	Level	3	0	0.985	1.00	8560
Ramp	283	0.92	Level	3	0	0.985	1.00	312
UpStream								
DownStream	570	0.92	Level	3	0	0.985	1.00	629

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
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 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

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 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3908 pc/h
V_3 or V_{av34} 2326 pc/h (Equation 25-15 or 25-16)
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 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8560	Exhibit 25-14	9000	No
$V_{FO} = V_F - V_R$	8248	Exhibit 25-14	9000	No
V_R	312	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3908	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 33.0 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.456 (Exhibit 25-19)
S_R= 49.1 mph (Exhibit 25-19)
S_0= 55.2 mph (Exhibit 25-19)
S = 52.2 mph (Exhibit 25-15)

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