

## **APPENDIX K**

### **2025 Build 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 C-D Road NB
Date Performed	11/19/07	Jurisdiction	
Analysis Time Period	AM	Analysis Year	2025 Build

Project Description Route 128 Add-a-Lane

### Inputs

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
<input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off		<input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off
$L_{up} =$ ft	$S_{FF} = 55.0$ mph $S_{FR} = 35.0$ mph	$L_{down} =$ 1060 ft
$V_u =$ veh/h	Sketch ( show lanes, $L_A, L_D, V_R, V_f$ )	$VD =$ 100 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	8500	0.90	Level	2	0	0.990	1.00	9539
Ramp	900	0.90	Level	2	0	0.990	1.00	1010
UpStream								
DownStream	100	0.90	Level	2	0	0.990	1.00	112

Merge Areas

Diverge 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

### 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

$V_{12} = 4729$  pc/h

### Capacity Checks

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

### Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI} = V_F$	9539	9000	Yes
$V_{12}$	4729	4400:All	Yes
$V_{FO} = V_F - V_R$	8529	9000	No
$V_R$	1010	2000	No

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

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

$D_R =$     (pc/ mi /ln)

LOS =    (Exhibit 25-4)

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

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

$D_R =$  40.5 (pc/ mi /ln)

LOS = F (Exhibit 25-4)

### Speed Estimation

$M_s =$  (Exhibit 25-19)

$S_R =$  mph (Exhibit 25-19)

$S_0 =$  mph (Exhibit 25-19)

$S =$  mph (Exhibit 25-14)

### Speed Estimation

$D_s =$  0.519 (Exhibit 25-19)

$S_R =$  48.3 mph (Exhibit 25-19)

$S_0 =$  54.9 mph (Exhibit 25-19)

$S =$  51.4 mph (Exhibit 25-15)

## 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 Kendrick St
Date Performed	11/26/2007	Jurisdiction	
Analysis Time Period	AM	Analysis Year	2025 Build

Project Description Route 128 Add-a-Lane

**Inputs**

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L <sub>up</sub> =        ft Vu =        veh/h	Terrain Level  <div style="text-align: center;">                     S<sub>FF</sub> = 55.0 mph                      S<sub>FR</sub> = 35.0 mph                      Sketch ( show lanes, L<sub>A</sub>, L<sub>D</sub>, V<sub>R</sub>, V<sub>f</sub>)                 </div>	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off L <sub>down</sub> =    1575 ft VD =        900 veh/h
--	--	--

**Conversion to pc/h Under Base Conditions**

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f <sub>HV</sub>	f <sub>p</sub>	v=V/PHF f <sub>HV</sub> f <sub>p</sub>
Freeway	9300	0.90	Level	0	0	1.000	1.00	10333
Ramp	800	0.90	Level	0	0	1.000	1.00	889
UpStream								
DownStream	900	0.90	Level	0	0	1.000	1.00	1000

## Merge Areas

## Diverge Areas

**Estimation of v<sub>12</sub>**

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

L<sub>EQ</sub> = (Equation 25-2 or 25-3)  
 P<sub>FM</sub> = using Equation  
 V<sub>12</sub> = pc/h

**Estimation of v<sub>12</sub>**

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

L<sub>EQ</sub> = (Equation 25-8 or 25-9)  
 P<sub>FD</sub> = 0.436 using Equation 8  
 V<sub>12</sub> = 5007 pc/h

**Capacity Checks**
**Capacity Checks**

	Actual	Maximum	LOS F?		Actual	Maximum	LOS F?
V <sub>FO</sub>		See Exhibit 25-7		V <sub>FI</sub> =V <sub>F</sub>	10333	9000	Yes
				V <sub>12</sub>	5007	4400:All	Yes
V <sub>R12</sub>		4600:All		V <sub>FO</sub> = V <sub>F</sub> -	9444	9000	Yes
				V <sub>R</sub>			

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

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

D<sub>R</sub> =        (pc/ mi /ln)  
 LOS =        (Exhibit 25-4)

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

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

D<sub>R</sub> =    45.1 (pc/ mi /ln)  
 LOS =    F (Exhibit 25-4)

**Speed Estimation**

M<sub>S</sub> =        (Exhibit 25-19)  
 S<sub>R</sub> =        mph (Exhibit 25-19)  
 S<sub>0</sub> =        mph (Exhibit 25-19)  
 S =        mph (Exhibit 25-14)

**Speed Estimation**

D<sub>s</sub> =    0.508 (Exhibit 25-19)  
 S<sub>R</sub> =    48.4 mph (Exhibit 25-19)  
 S<sub>0</sub> =    53.8 mph (Exhibit 25-19)  
 S =    51.1 mph (Exhibit 25-15)

# RAMPS AND RAMP JUNCTIONS WORKSHEET

## General Information

Analyst2 SSS  
 Agency or Company McMahon  
 Date Performed 11/26/2007  
 Analysis Time Period AM

## Site Information

Freeway/Dir of Travel Route 128 NB  
 Junction Kendrick St to Rt 128 NB  
 Jurisdiction  
 Analysis Year 2025 Build

Project Description Route 128 Add-a-Lane

## Inputs

Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off L <sub>up</sub> = 1060 ft V <sub>u</sub> = 900 veh/h	Terrain Level  S <sub>FF</sub> = 55.0 mph    S <sub>FR</sub> = 35.0 mph Sketch ( show lanes, L <sub>A</sub> , L <sub>D</sub> , V <sub>R</sub> , V <sub>f</sub> )	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L <sub>down</sub> = ft V <sub>D</sub> = veh/h
--	---	--

## Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f <sub>HV</sub>	f <sub>p</sub>	v=V/PHF f <sub>HV</sub> f <sub>p</sub>
Freeway	7600	0.90	Level	0	0	1.000	1.00	8444
Ramp	100	0.90	Level	0	0	1.000	1.00	111
UpStream	900	0.90	Level	0	0	1.000	1.00	1000
DownStream								

Merge Areas

Diverge Areas

## Estimation of v<sub>12</sub>

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

L<sub>EQ</sub> = (Equation 25-2 or 25-3)  
 P<sub>FM</sub> = 0.261 using Equation 4  
 V<sub>12</sub> = 2206 pc/h

## Estimation of v<sub>12</sub>

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

L<sub>EQ</sub> = (Equation 25-8 or 25-9)  
 P<sub>FD</sub> = using Equation  
 V<sub>12</sub> = pc/h

## Capacity Checks

	Actual	Maximum	LOS F?
V <sub>FO</sub>	8555	See Exhibit 25-7	No
V <sub>R12</sub>	2317	4600:All	No

## Capacity Checks

	Actual	Maximum	LOS F?
V <sub>FI</sub> =V <sub>F</sub>		See Exhibit 25-14	
V <sub>12</sub>		4400:All	
V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>		See Exhibit 25-14	
V <sub>R</sub>		See Exhibit 25-3	

## Level of Service Determination (if not F)

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

D<sub>R</sub> = 22.4 (pc/ m/ln)  
 LOS = C (Exhibit 25-4)

## Level of Service Determination (if not F)

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

D<sub>R</sub> = (pc/ m/ln)  
 LOS = (Exhibit 25-4)

## Speed Estimation

M<sub>S</sub> = 0.348 (Exhibit 25-19)  
 S<sub>R</sub> = 50.5 mph (Exhibit 25-19)  
 S<sub>0</sub> = 43.6 mph (Exhibit 25-19)  
 S = 45.2 mph (Exhibit 25-14)

## Speed Estimation

D<sub>s</sub> = (Exhibit 25-19)  
 S<sub>R</sub> = mph (Exhibit 25-19)  
 S<sub>0</sub> = mph (Exhibit 25-19)  
 S = mph (Exhibit 25-15)

# RAMPS AND RAMP JUNCTIONS WORKSHEET

## General Information

## Site Information

Analyst2	SSS	Freeway/Dir of Travel	Route 128 SB
Agency or Company	McMahon	Junction	C-D Road SB to Route 128 SB
Date Performed	11/26/2007	Jurisdiction	
Analysis Time Period	AM	Analysis Year	2025 Build

Project Description Route 128 Add-a-Lane

## Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L <sub>up</sub> =        ft V <sub>u</sub> =        veh/h	Terrain Level    S <sub>FF</sub> = 55.0 mph                      S <sub>FR</sub> = 35.0 mph Sketch ( show lanes, L <sub>A</sub> , L <sub>D</sub> , V <sub>R</sub> , V <sub>f</sub> )	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L <sub>down</sub> =        1835 ft V <sub>D</sub> =        200 veh/h
--	---	--

## Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f <sub>HV</sub>	f <sub>p</sub>	v=V/PHF f <sub>HV</sub> f <sub>p</sub>
Freeway	5900	0.90	Level	0	0	1.000	1.00	6556
Ramp	500	0.90	Level	0	0	1.000	1.00	556
UpStream								
DownStream	200	0.90	Level	0	0	1.000	1.00	222

Merge Areas

Diverge Areas

## Estimation of v<sub>12</sub>

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

L<sub>EQ</sub> = (Equation 25-2 or 25-3)  
 P<sub>FM</sub> = 0.357 using Equation 4  
 V<sub>12</sub> = 2340 pc/h

## Estimation of v<sub>12</sub>

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

L<sub>EQ</sub> = (Equation 25-8 or 25-9)  
 P<sub>FD</sub> = using Equation  
 V<sub>12</sub> = pc/h

## Capacity Checks

	Actual	Maximum	LOS F?
V <sub>FO</sub>	7112	See Exhibit 25-7	No
V <sub>R12</sub>	2896	4600:All	No

## Capacity Checks

	Actual	Maximum	LOS F?
V <sub>FI</sub> =V <sub>F</sub>		See Exhibit 25-14	
V <sub>12</sub>		4400:All	
V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>		See Exhibit 25-14	
V <sub>R</sub>		See Exhibit 25-3	

## Level of Service Determination (if not F)

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

D<sub>R</sub> = 23.7 (pc/ m/ln)  
 LOS = C (Exhibit 25-4)

## Level of Service Determination (if not F)

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

D<sub>R</sub> = (pc/ m/ln)  
 LOS = (Exhibit 25-4)

## Speed Estimation

M<sub>S</sub> = 0.346 (Exhibit 25-19)  
 S<sub>R</sub> = 50.5 mph (Exhibit 25-19)  
 S<sub>0</sub> = 49.2 mph (Exhibit 25-19)  
 S = 49.7 mph (Exhibit 25-14)

## Speed Estimation

D<sub>s</sub> = (Exhibit 25-19)  
 S<sub>R</sub> = mph (Exhibit 25-19)  
 S<sub>0</sub> = mph (Exhibit 25-19)  
 S = mph (Exhibit 25-15)

# RAMPS AND RAMP JUNCTIONS WORKSHEET

## General Information

## Site Information

Analyst2	SSS	Freeway/Dir of Travel	Route 128 SB
Agency or Company	McMahon	Junction	Kendrick St to Route 128 SB
Date Performed	11/26/2007	Jurisdiction	
Analysis Time Period	AM	Analysis Year	2025 Build

Project Description Route 128 Add-a-Lane

## Inputs

Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L <sub>up</sub> = 1835 ft V <sub>u</sub> = 500 veh/h	Terrain Level  <div style="text-align: center;">                     S<sub>FF</sub> = 55.0 mph                      S<sub>FR</sub> = 35.0 mph                      Sketch ( show lanes, L<sub>A</sub>, L<sub>D</sub>, V<sub>R</sub>, V<sub>f</sub>)                 </div>	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L <sub>down</sub> = ft V <sub>D</sub> = veh/h
--	--	--

## Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f <sub>HV</sub>	f <sub>p</sub>	v=V/PHF f <sub>HV</sub> f <sub>p</sub>
Freeway	6400	0.90	Level	0	0	1.000	1.00	7111
Ramp	200	0.90	Level	0	0	1.000	1.00	222
UpStream	500	0.90	Level	0	0	1.000	1.00	556
DownStream								

Merge Areas

Diverge Areas

## Estimation of v<sub>12</sub>

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

L<sub>EQ</sub> = (Equation 25-2 or 25-3)  
 P<sub>FM</sub> = 0.263 using Equation 4  
 V<sub>12</sub> = 1872 pc/h

## Estimation of v<sub>12</sub>

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

L<sub>EQ</sub> = (Equation 25-8 or 25-9)  
 P<sub>FD</sub> = using Equation  
 V<sub>12</sub> = pc/h

## Capacity Checks

	Actual	Maximum	LOS F?
V <sub>FO</sub>	7333	See Exhibit 25-7	No
V <sub>R12</sub>	2094	4600:All	No

## Capacity Checks

	Actual	Maximum	LOS F?
V <sub>FI</sub> = V <sub>F</sub>		See Exhibit 25-14	
V <sub>12</sub>		4400:All	
V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>		See Exhibit 25-14	
V <sub>R</sub>		See Exhibit 25-3	

## Level of Service Determination (if not F)

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

D<sub>R</sub> = 20.3 (pc/ m/ln)  
 LOS = C (Exhibit 25-4)

## Level of Service Determination (if not F)

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

D<sub>R</sub> = (pc/ m/ln)  
 LOS = (Exhibit 25-4)

## Speed Estimation

M<sub>S</sub> = 0.337 (Exhibit 25-19)  
 S<sub>R</sub> = 50.6 mph (Exhibit 25-19)  
 S<sub>0</sub> = 46.6 mph (Exhibit 25-19)  
 S = 47.6 mph (Exhibit 25-14)

## Speed Estimation

D<sub>s</sub> = (Exhibit 25-19)  
 S<sub>R</sub> = mph (Exhibit 25-19)  
 S<sub>0</sub> = mph (Exhibit 25-19)  
 S = mph (Exhibit 25-15)

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 Kendrick St			
Date Performed	11/26/2007			Jurisdiction				
Analysis Time Period	PM			Analysis Year	2025 Build			
Project Description Route 128 Add-a-Lane								
Inputs								
Upstream Adj Ramp		Terrain Level				Downstream Adj Ramp		
<input type="checkbox"/> Yes <input type="checkbox"/> On		$S_{FF} = 55.0$ mph $S_{FR} = 35.0$ mph Sketch ( show lanes, $L_A, L_D, V_R, V_f$ )				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> On		
<input checked="" type="checkbox"/> No <input type="checkbox"/> Off						<input type="checkbox"/> No <input checked="" type="checkbox"/> Off		
$L_{up} =$	ft					$L_{down} =$	1575 ft	
$V_u =$	veh/h					$V_D =$	550 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	7600	0.90	Level	0	0	1.000	1.00	8444
Ramp	300	0.90	Level	0	0	1.000	1.00	333
UpStream								
DownStream	550	0.90	Level	0	0	1.000	1.00	611
Merge Areas				Diverge Areas				
Estimation of $v_{12}$				Estimation of $v_{12}$				
$V_{12} = V_F (P_{FM})$				$V_{12} = V_R + (V_F - V_R)P_{FD}$				
$L_{EQ} =$ (Equation 25-2 or 25-3)				$L_{EQ} =$ (Equation 25-8 or 25-9)				
$P_{FM} =$ using Equation				$P_{FD} = 0.436$ using Equation 8				
$V_{12} =$ pc/h				$V_{12} = 3869$ pc/h				
Capacity Checks				Capacity Checks				
	Actual	Maximum	LOS F?		Actual	Maximum	LOS F?	
$V_{FO}$		See Exhibit 25-7		$V_{FI} = V_F$	8444	9000	No	
				$V_{12}$	3869	4400:All	No	
$V_{R12}$		4600:All		$V_{FO} = V_F - V_R$	8111	9000	No	
				$V_R$	333	2000	No	
Level of Service Determination (if not F)				Level of Service Determination (if not F)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$				$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$				
$D_R =$ (pc/ mi /ln)				$D_R = 35.3$ (pc/ mi /ln)				
LOS = (Exhibit 25-4)				LOS= E (Exhibit 25-4)				
Speed Estimation				Speed Estimation				
$M_S =$ (Exhibit 25-19)				$D_s = 0.458$ (Exhibit 25-19)				
$S_R =$ mph (Exhibit 25-19)				$S_R = 49.0$ mph (Exhibit 25-19)				
$S_0 =$ mph (Exhibit 25-19)				$S_0 = 55.3$ mph (Exhibit 25-19)				
$S =$ mph (Exhibit 25-14)				$S = 52.3$ mph (Exhibit 25-15)				

# RAMPS AND RAMP JUNCTIONS WORKSHEET

## General Information

Analyst2 SSS  
 Agency or Company McMahon  
 Date Performed 11/26/2007  
 Analysis Time Period PM

## Site Information

Freeway/Dir of Travel Route 128 NB  
 Junction Kendrick St to Rt 128 NB  
 Jurisdiction  
 Analysis Year 2025 Build

Project Description Route 128 Add-a-Lane

## Inputs

Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off L <sub>up</sub> = 1060 ft V <sub>u</sub> = 550 veh/h	Terrain Level  S <sub>FF</sub> = 55.0 mph                      S <sub>FR</sub> = 35.0 mph Sketch ( show lanes, L <sub>A</sub> , L <sub>D</sub> , V <sub>R</sub> , V <sub>f</sub> )	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L <sub>down</sub> =        ft V <sub>D</sub> =        veh/h
--	---	--

## Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f <sub>HV</sub>	f <sub>p</sub>	v=V/PHF f <sub>HV</sub> f <sub>p</sub>
Freeway	6750	0.90	Level	0	0	1.000	1.00	7500
Ramp	800	0.90	Level	0	0	1.000	1.00	889
UpStream	550	0.90	Level	0	0	1.000	1.00	611
DownStream								

Merge Areas

Diverge Areas

## Estimation of v<sub>12</sub>

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

L<sub>EQ</sub> = (Equation 25-2 or 25-3)  
 P<sub>FM</sub> = 0.164 using Equation 4  
 V<sub>12</sub> = 1230 pc/h

## Estimation of v<sub>12</sub>

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

L<sub>EQ</sub> = (Equation 25-8 or 25-9)  
 P<sub>FD</sub> = using Equation  
 V<sub>12</sub> = pc/h

## Capacity Checks

	Actual	Maximum	LOS F?
V <sub>FO</sub>	8389	See Exhibit 25-7	No
V <sub>R12</sub>	2119	4600:All	No

## Capacity Checks

	Actual	Maximum	LOS F?
V <sub>F1</sub> =V <sub>F</sub>		See Exhibit 25-14	
V <sub>12</sub>		4400:All	
V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>		See Exhibit 25-14	
V <sub>R</sub>		See Exhibit 25-3	

## Level of Service Determination (if not F)

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

D<sub>R</sub> = 20.5 (pc/ m/l/n)  
 LOS = C (Exhibit 25-4)

## Level of Service Determination (if not F)

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

D<sub>R</sub> = (pc/ m/l/n)  
 LOS = (Exhibit 25-4)

## Speed Estimation

M<sub>S</sub> = 0.341 (Exhibit 25-19)  
 S<sub>R</sub> = 50.6 mph (Exhibit 25-19)  
 S<sub>0</sub> = 43.5 mph (Exhibit 25-19)  
 S = 45.1 mph (Exhibit 25-14)

## Speed Estimation

D<sub>s</sub> = (Exhibit 25-19)  
 S<sub>R</sub> = mph (Exhibit 25-19)  
 S<sub>0</sub> = mph (Exhibit 25-19)  
 S = mph (Exhibit 25-15)



# RAMPS AND RAMP JUNCTIONS WORKSHEET

## General Information

## Site Information

Analyst2	SSS	Freeway/Dir of Travel	Route 128 SB
Agency or Company	McMahon	Junction	C-D Road SB to Route 128 SB
Date Performed	11/26/2007	Jurisdiction	
Analysis Time Period	PM	Analysis Year	2025 Build

Project Description Route 128 Add-a-Lane

## Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L <sub>up</sub> =        ft V <sub>u</sub> =        veh/h	Terrain Level    S <sub>FF</sub> = 55.0 mph                      S <sub>FR</sub> = 35.0 mph Sketch ( show lanes, L <sub>A</sub> , L <sub>D</sub> , V <sub>R</sub> , V <sub>f</sub> )	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L <sub>down</sub> =        1835 ft V <sub>D</sub> =        800 veh/h
--	---	--

## Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f <sub>HV</sub>	f <sub>p</sub>	v=V/PHF f <sub>HV</sub> f <sub>p</sub>
Freeway	7400	0.90	Level	0	0	1.000	1.00	8222
Ramp	850	0.90	Level	0	0	1.000	1.00	944
UpStream								
DownStream	800	0.90	Level	0	0	1.000	1.00	889

Merge Areas

Diverge Areas

## Estimation of v<sub>12</sub>

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

L<sub>EQ</sub> = (Equation 25-2 or 25-3)  
 P<sub>FM</sub> = 0.308 using Equation 4  
 V<sub>12</sub> = 2536 pc/h

## Estimation of v<sub>12</sub>

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

L<sub>EQ</sub> = (Equation 25-8 or 25-9)  
 P<sub>FD</sub> = using Equation  
 V<sub>12</sub> = pc/h

## Capacity Checks

	Actual	Maximum	LOS F?
V <sub>FO</sub>	9166	See Exhibit 25-7	Yes
V <sub>R12</sub>	3480	4600:All	No

## Capacity Checks

	Actual	Maximum	LOS F?
V <sub>FI</sub> =V <sub>F</sub>		See Exhibit 25-14	
V <sub>12</sub>		4400:All	
V <sub>FO</sub> = V <sub>F</sub> -		See Exhibit 25-14	
V <sub>R</sub>		See Exhibit 25-3	

## Level of Service Determination (if not F)

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

D<sub>R</sub> = 28.1 (pc/ m/ln)  
 LOS = F (Exhibit 25-4)

## Level of Service Determination (if not F)

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

D<sub>R</sub> = (pc/ m/ln)  
 LOS = (Exhibit 25-4)

## Speed Estimation

M<sub>s</sub> = 0.402 (Exhibit 25-19)  
 S<sub>R</sub> = 49.8 mph (Exhibit 25-19)  
 S<sub>0</sub> = 45.2 mph (Exhibit 25-19)  
 S = 46.8 mph (Exhibit 25-14)

## Speed Estimation

D<sub>s</sub> = (Exhibit 25-19)  
 S<sub>R</sub> = mph (Exhibit 25-19)  
 S<sub>0</sub> = mph (Exhibit 25-19)  
 S = mph (Exhibit 25-15)

# RAMPS AND RAMP JUNCTIONS WORKSHEET

## General Information

Analyst2  
Agency or Company  
Date Performed  
Analysis Time Period

SSS  
McMahon  
11/26/2007  
PM

## Site Information

Freeway/Dir of Travel  
Junction  
Jurisdiction  
Analysis Year

Route 128 SB  
Kendrick St to Route 128 SB  
2025 Build

Project Description Route 128 Add-a-Lane

## Inputs

Upstream Adj Ramp  <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On  <input type="checkbox"/> No <input type="checkbox"/> Off  L <sub>up</sub> = 1835 ft  V <sub>u</sub> = 850 veh/h	Terrain Level          S <sub>FF</sub> = 55.0 mph                      S <sub>FR</sub> = 35.0 mph  Sketch ( show lanes, L <sub>A</sub> , L <sub>D</sub> , V <sub>R</sub> , V <sub>f</sub> )	Downstream Adj Ramp  <input type="checkbox"/> Yes <input type="checkbox"/> On  <input checked="" type="checkbox"/> No <input type="checkbox"/> Off  L <sub>down</sub> =                      ft  V <sub>D</sub> =                      veh/h
--	---	--

## Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f <sub>HV</sub>	f <sub>p</sub>	v=V/PHF f <sub>HV</sub> f <sub>p</sub>
Freeway	8250	0.90	Level	0	0	1.000	1.00	9167
Ramp	800	0.90	Level	0	0	1.000	1.00	889
UpStream	850	0.90	Level	0	0	1.000	1.00	944
DownStream								

Merge Areas

Diverge Areas

## Estimation of v<sub>12</sub>

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

L<sub>EQ</sub> = (Equation 25-2 or 25-3)  
 P<sub>FM</sub> = 0.180 using Equation 4  
 V<sub>12</sub> = 1650 pc/h

## Estimation of v<sub>12</sub>

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

L<sub>EQ</sub> = (Equation 25-8 or 25-9)  
 P<sub>FD</sub> = using Equation  
 V<sub>12</sub> = pc/h

## Capacity Checks

	Actual	Maximum	LOS F?
V <sub>FO</sub>	10056	See Exhibit 25-7	Yes
V <sub>R12</sub>	2539	4600:All	No

## Capacity Checks

	Actual	Maximum	LOS F?
V <sub>F1</sub> =V <sub>F</sub>		See Exhibit 25-14	
V <sub>12</sub>		4400:All	
V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>		See Exhibit 25-14	
V <sub>R</sub>		See Exhibit 25-3	

## Level of Service Determination (if not F)

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

D<sub>R</sub> = 23.4 (pc/ m/ln)  
 LOS = F (Exhibit 25-4)

## Level of Service Determination (if not F)

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

D<sub>R</sub> = (pc/ m/ln)  
 LOS = (Exhibit 25-4)

## Speed Estimation

M<sub>S</sub> = 0.354 (Exhibit 25-19)  
 S<sub>R</sub> = 50.4 mph (Exhibit 25-19)  
 S<sub>0</sub> = 39.7 mph (Exhibit 25-19)  
 S = 42.0 mph (Exhibit 25-14)

## Speed Estimation

D<sub>s</sub> = (Exhibit 25-19)  
 S<sub>R</sub> = mph (Exhibit 25-19)  
 S<sub>0</sub> = mph (Exhibit 25-19)  
 S = mph (Exhibit 25-15)

## RAMPS AND RAMP JUNCTIONS WORKSHEET

### General Information

### Site Information

Analyst	TC	Freeway/Dir of Travel	Route I-95/128 NB
Agency or Company	McMahon	Junction	Route 9 on ramp-Ups
Date Performed		Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	2025 Partial Cloverleaf

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

### Inputs

Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off  $L_{up} = 610$ ft  $V_u = 958$ 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 <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	$f_{HV}$	$f_p$	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7126	0.92	Level	3	0	0.985	1.00	7862
Ramp	1611	0.92	Level	3	0	0.985	1.00	1777
UpStream	958	0.92	Level	3	0	0.985	1.00	1057
DownStream								

#### Merge Areas

#### Diverge Areas

### Estimation of $v_{12}$

$V_{12} = V_F (P_{FM})$   
(Equation 25-2 or 25-3)

$L_{EQ} =$

$P_{FM} = 0.182$  using Equation (Exhibit 25-5)

$V_{12} = 1431$  pc/h

$V_3$  or  $V_{av34} = 3215$  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,  $V_{12a} = 2462$  pc/h (Equation 25-8)

### Estimation of $v_{12}$

$V_{12} = V_R + (V_F - V_R)P_{FD}$   
(Equation 25-8 or 25-9)

$L_{EQ} =$

$P_{FD} =$  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?
$V_{FO}$	9639	Exhibit 25-7	Yes

### 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?
$V_{R12}$	4239	Exhibit 25-7 4600:All	No

### Flow Entering Merge Influence Area

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

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

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

$D_R = 34.1$  (pc/mi/ln)

LOS = F (Exhibit 25-4)

### 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

$M_S = 0.550$  (Exhibit 25-19)

$S_R = 47.8$  mph (Exhibit 25-19)

$S_0 = 46.1$  mph (Exhibit 25-19)

$S = 46.8$  mph (Exhibit 25-14)

### Speed Determination

$D_S =$  (Exhibit 25-19)

$S_R =$  mph (Exhibit 25-19)

$S_0 =$  mph (Exhibit 25-19)

$S =$  mph (Exhibit 25-15)

## RAMPS AND RAMP JUNCTIONS WORKSHEET

### General Information

### Site Information

Analyst	TC	Freeway/Dir of Travel	Route I-95/128 NB
Agency or Company	McMahon	Junction	Route 9 WB offramp-Ds
Date Performed		Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	2025 Partial Cloverleaf

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

### Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off  $L_{up} =$ ft  $V_u =$ veh/h	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 <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off  $L_{down} =$ 610 ft  $V_D =$ 1611 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	8084	0.92	Level	3	0	0.985	1.00	8919
Ramp	958	0.92	Level	3	0	0.985	1.00	1057
UpStream								
DownStream	1611	0.92	Level	3	0	0.985	1.00	1777

#### Merge Areas

#### Diverge 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)

### 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)  
 $V_{12} =$                       4485 pc/h  
 $V_3$  or  $V_{av34}$                       2217 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?
$V_{FO}$		Exhibit 25-7	

### Capacity Checks

	Actual	Capacity	LOS F?
$V_F$	8919	Exhibit 25-14	9000 No
$V_{FO} = V_F - V_R$	7862	Exhibit 25-14	9000 No
$V_R$	1057	Exhibit 25-3	2000 No

### Flow Entering Merge Influence Area

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

### Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
$V_{12}$	4485	Exhibit 25-14	4400:All No

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

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$   
 $D_R =$                       (pc/mi/ln)  
 LOS =                      (Exhibit 25-4)

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

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$   
 $D_R =$                       37.7 (pc/mi/ln)  
 LOS =                      E (Exhibit 25-4)

### Speed Determination

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

### Speed Determination

$D_S =$                       0.523 (Exhibit 25-19)  
 $S_R =$                       48.2 mph (Exhibit 25-19)  
 $S_0 =$                       55.6 mph (Exhibit 25-19)  
 $S =$                       51.6 mph (Exhibit 25-15)

## RAMPS AND RAMP JUNCTIONS WORKSHEET

### General Information

### Site Information

Analyst	TC	Freeway/Dir of Travel	Route I-95/128 NB
Agency or Company	McMahon	Junction	Route 9 WB offramp-U.S.
Date Performed		Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	2025 Partial Cloverleaf

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

### Inputs

Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off  $L_{up} = 1670$ ft  $V_u = 616$ 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 <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	$f_{HV}$	$f_p$	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8084	0.92	Level	3	0	0.985	1.00	8919
Ramp	958	0.92	Level	3	0	0.985	1.00	1057
UpStream	616	0.92	Level	3	0	0.985	1.00	680
DownStream								

#### Merge Areas

#### Diverge Areas

### Estimation of $v_{12}$

### 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)

$V_{12} = V_R + (V_F - V_R)P_{FD}$   
 $L_{EQ} =$  (Equation 25-8 or 25-9)  
 $P_{FD} = 0.436$  using Equation (Exhibit 25-12)  
 $V_{12} = 4485$  pc/h  
 $V_3$  or  $V_{av34} 2217$  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

### Capacity Checks

	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?	
$V_{FO}$		Exhibit 25-7		$V_F$	8919	Exhibit 25-14	9000	No
			$V_{FO} = V_F - V_R$	7862	Exhibit 25-14	9000	No	
			$V_R$	1057	Exhibit 25-3	2000	No	

### Flow Entering Merge Influence Area

### Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?	
$V_{R12}$		Exhibit 25-7		$V_{12}$	4485	Exhibit 25-14	4400:All	No

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

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

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$   
 $D_R =$  (pc/mi/ln)  
 LOS = (Exhibit 25-4)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$   
 $D_R = 37.7$  (pc/mi/ln)  
 LOS = E (Exhibit 25-4)

### Speed Determination

### Speed Determination

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

$D_S = 0.523$  (Exhibit 25-19)  
 $S_R = 48.2$  mph (Exhibit 25-19)  
 $S_0 = 55.6$  mph (Exhibit 25-19)  
 $S = 51.6$  mph (Exhibit 25-15)

# RAMPS AND RAMP JUNCTIONS WORKSHEET

## General Information

## Site Information

Analyst	TC	Freeway/Dir of Travel	Route I-95/128 SB
Agency or Company	McMahon	Junction	Route 9 EB offramp-Ds
Date Performed		Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	2025 Partial Cloverleaf

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

### Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off  $L_{up} =$ ft  $V_u =$ veh/h	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 <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off  $L_{down} =$ 950 ft  $V_D =$ 1156 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	7921	0.92	Level	3	0	0.985	1.00	8739
Ramp	877	0.92	Level	3	0	0.985	1.00	968
UpStream								
DownStream	1156	0.92	Level	3	0	0.985	1.00	1275

#### Merge Areas

#### Diverge 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)

### 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)  
 $V_{12} =$  4356 pc/h  
 $V_3$  or  $V_{av34}$  2191 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?
$V_{FO}$		Exhibit 25-7	

### Capacity Checks

	Actual	Capacity	LOS F?
$V_F$	8739	Exhibit 25-14	9000 No
$V_{FO} = V_F - V_R$	7771	Exhibit 25-14	9000 No
$V_R$	968	Exhibit 25-3	2000 No

### Flow Entering Merge Influence Area

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

### Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
$V_{12}$	4356	Exhibit 25-14	4400:All No

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

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$   
 $D_R =$  (pc/mi/ln)  
 LOS = (Exhibit 25-4)

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

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$   
 $D_R =$  38.5 (pc/mi/ln)  
 LOS = E (Exhibit 25-4)

### Speed Determination

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

### Speed Determination

$D_S =$  0.515 (Exhibit 25-19)  
 $S_R =$  48.3 mph (Exhibit 25-19)  
 $S_0 =$  55.7 mph (Exhibit 25-19)  
 $S =$  51.7 mph (Exhibit 25-15)

## RAMPS AND RAMP JUNCTIONS WORKSHEET

### General Information

### Site Information

Analyst	TC	Freeway/Dir of Travel	Route I-95/128 SB
Agency or Company	McMahon	Junction	Route 9 EB off-ramp-U.S.
Date Performed		Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	2025 Partial Cloverleaf

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

### Inputs

Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off  $L_{up} = 1310$ ft  $V_u = 720$ 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 <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	$f_{HV}$	$f_p$	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7921	0.92	Level	3	0	0.985	1.00	8739
Ramp	877	0.92	Level	3	0	0.985	1.00	968
UpStream	720	0.92	Level	3	0	0.985	1.00	794
DownStream								

#### Merge Areas

#### Diverge Areas

### Estimation of $v_{12}$

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

### Estimation of $v_{12}$

$V_{12} = V_R + (V_F - V_R)P_{FD}$   
 (Equation 25-8 or 25-9)  
 $L_{EQ} =$  0.436 using Equation (Exhibit 25-12)  
 $P_{FD} =$  4356 pc/h  
 $V_{12} =$  2191 pc/h (Equation 25-15 or 25-16)  
 $V_3$  or  $V_{av34}$  2191 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?
$V_{FO}$		Exhibit 25-7	

### Capacity Checks

	Actual	Capacity	LOS F?
$V_F$	8739	Exhibit 25-14	9000 No
$V_{FO} = V_F - V_R$	7771	Exhibit 25-14	9000 No
$V_R$	968	Exhibit 25-3	2000 No

### Flow Entering Merge Influence Area

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

### Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
$V_{12}$	4356	Exhibit 25-14	4400:All No

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

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$   
 $D_R =$  (pc/mi/ln)  
 LOS = (Exhibit 25-4)

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

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$   
 $D_R = 38.5$  (pc/mi/ln)  
 LOS = E (Exhibit 25-4)

### Speed Determination

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

### Speed Determination

$D_S = 0.515$  (Exhibit 25-19)  
 $S_R = 48.3$  mph (Exhibit 25-19)  
 $S_0 = 55.7$  mph (Exhibit 25-19)  
 $S = 51.7$  mph (Exhibit 25-15)

## RAMPS AND RAMP JUNCTIONS WORKSHEET

### General Information

### Site Information

Analyst	TC	Freeway/Dir of Travel	Route I-95/128 SB
Agency or Company	McMahon	Junction	Route 9 WB offramp-Ds
Date Performed		Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	2025 Partial Cloverleaf

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

### Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off  $L_{up} =$ ft  $V_u =$ veh/h	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 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off  $L_{down} =$ 1310 ft  $V_D =$ 877 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	8641	0.92	Level	3	0	0.985	1.00	9533
Ramp	720	0.92	Level	3	0	0.985	1.00	794
UpStream								
DownStream	877	0.92	Level	3	0	0.985	1.00	968

#### Merge Areas

#### Diverge Areas

### Estimation of $v_{12}$

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

### Estimation of $v_{12}$

$V_{12} = V_R + (V_F - V_R)P_{FD}$   
 (Equation 25-8 or 25-9)  
 $L_{EQ} =$                       0.436 using Equation (Exhibit 25-12)  
 $P_{FD} =$                       4604 pc/h  
 $V_{12} =$                       2464 pc/h (Equation 25-15 or 25-16)  
 $V_3$  or  $V_{av34}$                       pc/h  
 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?		Actual	Capacity	LOS F?
$V_{FO}$		Exhibit 25-7		$V_F$	9533	Exhibit 25-14	9000    Yes
				$V_{FO} = V_F - V_R$	8739	Exhibit 25-14	9000    No
				$V_R$	794	Exhibit 25-3	2000    No

### Flow Entering Merge Influence Area

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

### Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
$V_{12}$	4604	Exhibit 25-14	4400:All    No

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

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$   
 $D_R =$         (pc/mi/ln)  
 LOS =        (Exhibit 25-4)

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

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$   
 $D_R =$         42.3 (pc/mi/ln)  
 LOS =        F (Exhibit 25-4)

### Speed Determination

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

### Speed Determination

$D_S =$         0.499 (Exhibit 25-19)  
 $S_R =$         48.5 mph (Exhibit 25-19)  
 $S_0 =$         54.6 mph (Exhibit 25-19)  
 $S =$         51.5 mph (Exhibit 25-15)



# RAMPS AND RAMP JUNCTIONS WORKSHEET

## General Information

## Site Information

Analyst	TC	Freeway/Dir of Travel	Route I-95/128 NB
Agency or Company	McMahon	Junction	Route 9 on ramp-Ups
Date Performed		Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	2025 Partial Cloverleaf

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

### Inputs

Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off  $L_{up} = 610$ ft  $V_u = 704$ 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 <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	$f_{HV}$	$f_p$	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8039	0.92	Level	3	0	0.985	1.00	8869
Ramp	1788	0.92	Level	3	0	0.985	1.00	1973
UpStream	704	0.92	Level	3	0	0.985	1.00	777
DownStream								

#### Merge Areas

#### Diverge Areas

### Estimation of $v_{12}$

$V_{12} = V_F (P_{FM})$   
(Equation 25-2 or 25-3)

$L_{EQ} =$

$P_{FM} = 0.158$  using Equation (Exhibit 25-5)

$V_{12} = 1397$  pc/h

$V_3$  or  $V_{av34} = 3736$  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,  $V_{12a} = 3469$  pc/h (Equation 25-8)

### Estimation of $v_{12}$

$V_{12} = V_R + (V_F - V_R)P_{FD}$   
(Equation 25-8 or 25-9)

$L_{EQ} =$

$P_{FD} =$  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?
$V_{FO}$	10842	Exhibit 25-7	Yes

### 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?
$V_{R12}$	5442	Exhibit 25-7 4600:All	No

### Flow Entering Merge Influence Area

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

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

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

$D_R = 43.3$  (pc/mi/ln)

LOS = F (Exhibit 25-4)

### 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

$M_S = 1.181$  (Exhibit 25-19)

$S_R = 39.7$  mph (Exhibit 25-19)

$S_0 = 46.1$  mph (Exhibit 25-19)

$S = 42.6$  mph (Exhibit 25-14)

### Speed Determination

$D_s =$  (Exhibit 25-19)

$S_R =$  mph (Exhibit 25-19)

$S_0 =$  mph (Exhibit 25-19)

$S =$  mph (Exhibit 25-15)

## RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	TC	Freeway/Dir of Travel	Route I-95/128 NB
Agency or Company	McMahon	Junction	Route 9 WB offramp-Ds
Date Performed		Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	2025 Partial Cloverleaf

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

Inputs	
Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L <sub>up</sub> =        ft V <sub>u</sub> =        veh/h	Terrain: Level  Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L <sub>down</sub> =        610 ft V <sub>D</sub> =        1788 veh/h  S <sub>FF</sub> = 55.0 mph      S <sub>FR</sub> = 35.0 mph Sketch ( show lanes, L <sub>A</sub> , L <sub>D</sub> , V <sub>R</sub> , V <sub>f</sub> )

### Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f <sub>HV</sub>	f <sub>p</sub>	v = V/PHF x f <sub>HV</sub> x f <sub>p</sub>
Freeway	8743	0.92	Level	3	0	0.985	1.00	9646
Ramp	704	0.92	Level	3	0	0.985	1.00	777
UpStream								
DownStream	1788	0.92	Level	3	0	0.985	1.00	1973

#### Merge Areas

#### Diverge Areas

Estimation of v <sub>12</sub>	Estimation of v <sub>12</sub>
$V_{12} = V_F (P_{FM})$ L <sub>EQ</sub> =                      (Equation 25-2 or 25-3) P <sub>FM</sub> =                      using Equation (Exhibit 25-5) V <sub>12</sub> =                      pc/h V <sub>3</sub> or V <sub>av34</sub> pc/h (Equation 25-4 or 25-5) Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V <sub>12a</sub> =                      pc/h (Equation 25-8)	$V_{12} = V_R + (V_F - V_R)P_{FD}$ L <sub>EQ</sub> =                      (Equation 25-8 or 25-9) P <sub>FD</sub> =                      0.436 using Equation (Exhibit 25-12) V <sub>12</sub> =                      4644 pc/h V <sub>3</sub> or V <sub>av34</sub> 2501 pc/h (Equation 25-15 or 25-16) Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V <sub>12a</sub> =                      pc/h (Equation 25-18)

### Capacity Checks

### Capacity Checks

	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?	
V <sub>FO</sub>		Exhibit 25-7		V <sub>F</sub>	9646	Exhibit 25-14	9000	Yes
			V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>	8869	Exhibit 25-14	9000	No	
			V <sub>R</sub>	777	Exhibit 25-3	2000	No	

### Flow Entering Merge Influence Area

### Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?	
V <sub>R12</sub>		Exhibit 25-7		V <sub>12</sub>	4644	Exhibit 25-14	4400:All	No

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

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

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$ D <sub>R</sub> =    (pc/mi/ln) LOS =    (Exhibit 25-4)	$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$ D <sub>R</sub> =    39.1 (pc/mi/ln) LOS =    F (Exhibit 25-4)
---	---

### Speed Determination

### Speed Determination

M <sub>S</sub> =    (Exhibit 25-19) S <sub>R</sub> =    mph (Exhibit 25-19) S <sub>0</sub> =    mph (Exhibit 25-19) S =    mph (Exhibit 25-14)	D <sub>S</sub> =    0.498 (Exhibit 25-19) S <sub>R</sub> =    48.5 mph (Exhibit 25-19) S <sub>0</sub> =    54.5 mph (Exhibit 25-19) S =    51.4 mph (Exhibit 25-15)
---	--

## RAMPS AND RAMP JUNCTIONS WORKSHEET

### General Information

### Site Information

Analyst	TC	Freeway/Dir of Travel	Route I-95/128 NB
Agency or Company	McMahon	Junction	Route 9 WB offramp-Us
Date Performed		Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	2025 Partial Cloverleaf

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

### Inputs

Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off  $L_{up} = 1670$ ft  $V_u = 507$ 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 <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	$f_{HV}$	$f_p$	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8743	0.92	Level	3	0	0.985	1.00	9646
Ramp	704	0.92	Level	3	0	0.985	1.00	777
UpStream	507	0.92	Level	3	0	0.985	1.00	559
DownStream								

#### Merge Areas

#### Diverge Areas

### Estimation of $v_{12}$

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

### Estimation of $v_{12}$

$V_{12} = V_R + (V_F - V_R)P_{FD}$   
 (Equation 25-8 or 25-9)  
 $L_{EQ} =$  0.436 using Equation (Exhibit 25-12)  
 $P_{FD} =$  4644 pc/h  
 $V_{12} =$  2501 pc/h (Equation 25-15 or 25-16)  
 $V_3$  or  $V_{av34}$  2501 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?		Actual	Capacity	LOS F?
$V_{FO}$		Exhibit 25-7		$V_F$	9646	Exhibit 25-14	9000 Yes
				$V_{FO} = V_F - V_R$	8869	Exhibit 25-14	9000 No
				$V_R$	777	Exhibit 25-3	2000 No

### Capacity Checks

### Flow Entering Merge Influence Area

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

### Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
$V_{12}$	4644	Exhibit 25-14	4400:All No

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

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$   
 $D_R =$  (pc/mi/ln)  
 LOS = (Exhibit 25-4)

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

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$   
 $D_R = 39.1$  (pc/mi/ln)  
 LOS = F (Exhibit 25-4)

### Speed Determination

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

### Speed Determination

$D_S = 0.498$  (Exhibit 25-19)  
 $S_R = 48.5$  mph (Exhibit 25-19)  
 $S_0 = 54.5$  mph (Exhibit 25-19)  
 $S = 51.4$  mph (Exhibit 25-15)

## RAMPS AND RAMP JUNCTIONS WORKSHEET

### General Information

### Site Information

Analyst	TC	Freeway/Dir of Travel	Route I-95/128 SB
Agency or Company	McMahon	Junction	Route 9 EB offramp-Ds
Date Performed		Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	2025 Partial Cloverleaf

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

### Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off  $L_{up} =$ ft  $V_u =$ veh/h	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 <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off  $L_{down} =$ 950 ft  $V_D =$ 1548 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	8329	0.92	Level	3	0	0.985	1.00	9189
Ramp	777	0.92	Level	3	0	0.985	1.00	857
UpStream								
DownStream	1548	0.92	Level	3	0	0.985	1.00	1708

#### Merge Areas

#### Diverge 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)

### 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)  
 $V_{12} =$                       4490 pc/h  
 $V_3$  or  $V_{av34}$                       2349 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?
$V_{FO}$		Exhibit 25-7	

### Capacity Checks

	Actual	Capacity	LOS F?
$V_F$	9189	Exhibit 25-14	9000 Yes
$V_{FO} = V_F - V_R$	8332	Exhibit 25-14	9000 No
$V_R$	857	Exhibit 25-3	2000 No

### Flow Entering Merge Influence Area

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

### Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
$V_{12}$	4490	Exhibit 25-14	4400:All No

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

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$   
 $D_R =$                       (pc/mi/ln)  
 LOS =                      (Exhibit 25-4)

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

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$   
 $D_R =$                       39.6 (pc/mi/ln)  
 LOS =                      F (Exhibit 25-4)

### Speed Determination

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

### Speed Determination

$D_S =$                       0.505 (Exhibit 25-19)  
 $S_R =$                       48.4 mph (Exhibit 25-19)  
 $S_0 =$                       55.1 mph (Exhibit 25-19)  
 $S =$                       51.6 mph (Exhibit 25-15)

## RAMPS AND RAMP JUNCTIONS WORKSHEET

### General Information

### Site Information

Analyst	TC	Freeway/Dir of Travel	Route I-95/128 SB
Agency or Company	McMahon	Junction	Route 9 EB offramp-Us
Date Performed		Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	2025 Partial Cloverleaf

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

### Inputs

Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off  $L_{up} = 1310$ ft  $V_u = 301$ 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 <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	$f_{HV}$	$f_p$	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8329	0.92	Level	3	0	0.985	1.00	9189
Ramp	777	0.92	Level	3	0	0.985	1.00	857
UpStream	301	0.92	Level	3	0	0.985	1.00	332
DownStream								

#### Merge Areas

#### Diverge Areas

### Estimation of $v_{12}$

### 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)

$V_{12} = V_R + (V_F - V_R)P_{FD}$   
 $L_{EQ} =$  (Equation 25-8 or 25-9)  
 $P_{FD} = 0.436$  using Equation (Exhibit 25-12)  
 $V_{12} = 4490$  pc/h  
 $V_3$  or  $V_{av34} 2349$  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

### Capacity Checks

	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
$V_{FO}$		Exhibit 25-7		$V_F$	9189	Exhibit 25-14	9000 Yes
				$V_{FO} = V_F - V_R$	8332	Exhibit 25-14	9000 No
				$V_R$	857	Exhibit 25-3	2000 No

### Flow Entering Merge Influence Area

### Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
$V_{R12}$		Exhibit 25-7		$V_{12}$	4490	Exhibit 25-14	4400:All No

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

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

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$   
 $D_R =$  (pc/mi/ln)  
 LOS = (Exhibit 25-4)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$   
 $D_R = 39.6$  (pc/mi/ln)  
 LOS = F (Exhibit 25-4)

### Speed Determination

### Speed Determination

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

$D_S = 0.505$  (Exhibit 25-19)  
 $S_R = 48.4$  mph (Exhibit 25-19)  
 $S_0 = 55.1$  mph (Exhibit 25-19)  
 $S = 51.6$  mph (Exhibit 25-15)

## RAMPS AND RAMP JUNCTIONS WORKSHEET

### General Information

### Site Information

Analyst	TC	Freeway/Dir of Travel	Route I-95/128 SB
Agency or Company	McMahon	Junction	Route 9 WB offramp-Ds
Date Performed		Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	2025 Partial Cloverleaf

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

### Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off  $L_{up} =$ ft  $V_u =$ veh/h	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 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off  $L_{down} =$ 1310 ft  $V_D =$ 777 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	8630	0.92	Level	3	0	0.985	1.00	9521
Ramp	301	0.92	Level	3	0	0.985	1.00	332
UpStream								
DownStream	777	0.92	Level	3	0	0.985	1.00	857

#### Merge Areas

#### Diverge 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)

### 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)  
 $V_{12} =$                       4338 pc/h  
 $V_3$  or  $V_{av34}$                       2591 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?
$V_{FO}$		Exhibit 25-7	

### Capacity Checks

	Actual	Capacity	LOS F?
$V_F$	9521	Exhibit 25-14	9000 Yes
$V_{FO} = V_F - V_R$	9189	Exhibit 25-14	9000 Yes
$V_R$	332	Exhibit 25-3	2000 No

### Flow Entering Merge Influence Area

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

### Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
$V_{12}$	4338	Exhibit 25-14	4400:All No

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

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$   
 $D_R =$                       (pc/mi/ln)  
 LOS =                      (Exhibit 25-4)

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

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$   
 $D_R =$                       40.0 (pc/mi/ln)  
 LOS =                      F (Exhibit 25-4)

### Speed Determination

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

### Speed Determination

$D_S =$                       0.458 (Exhibit 25-19)  
 $S_R =$                       49.0 mph (Exhibit 25-19)  
 $S_0 =$                       54.1 mph (Exhibit 25-19)  
 $S =$                       51.7 mph (Exhibit 25-15)

Job Route 128 Add-a-Lane      McMahon Project No. \_\_\_\_\_      Sheet \_\_\_\_\_ of \_\_\_\_\_  
 Description C-D Road Merge      Designed By ECP      Date 6/7/2010  
CD Rd NB to 95 NB      Checked By \_\_\_\_\_      Date \_\_\_\_\_

## CD Road NB to Rt 128 NB - Major Merge Analysis

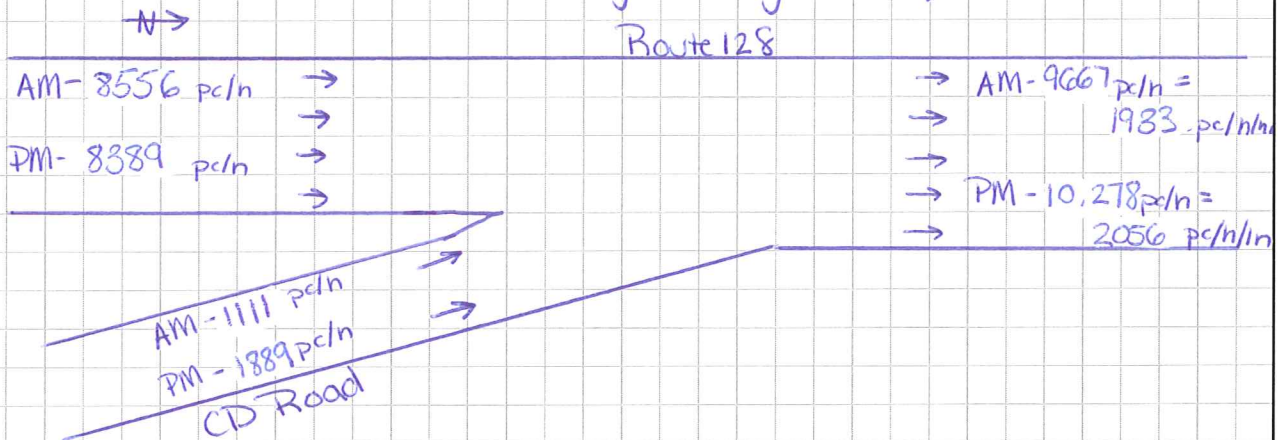


Exhibit 25-7

Using 70mph, > 4 lanes in one direction ↓

$$\text{Max down stream freeway flow} = 2400 \text{ pc/h/ln} * 5_{ln} = 12000 \text{ pc/h}$$

$$\text{AM Peak Demand} = 9667 \text{ pc/h} < 12,000 \text{ pc/h}$$

$$\text{PM Peak Demand} = 10,278 \text{ pc/h} < 12,000 \text{ pc/h}$$

∴ There is adequate capacity upstream of this major merge

Job Rte 128 Add-a-Lane McMahon Project No. \_\_\_\_\_ Sheet \_\_\_\_\_ of \_\_\_\_\_  
 Description CD Road Diverge Designed By ECP Date 6/7/10  
95SB to CDRdSB Checked By \_\_\_\_\_ Date \_\_\_\_\_

## Major Merge Analysis



Exhibit 25-7

Using 70 mph, > 4 lanes in one direction

$$\text{Max down stream freeway flow} = 2400 \text{ pc/h/ln} \times 4 \text{ lanes} = 9600 \text{ pc/h}$$

$$\text{AM Peak Demand} = 6555 \text{ pc/h} < 9600 \text{ pc/h}$$

$$\text{PM Peak Demand} = 8222 \text{ pc/h} < 9600 \text{ pc/h}$$

∴ There is adequate capacity at this major merge.



Job Route 128 Add-a-Lane  
Description Rte 9 Interchange  
Analysis

Project No. \_\_\_\_\_  
Designed By ECD  
Checked By \_\_\_\_\_

Sheet \_\_\_\_\_ of \_\_\_\_\_  
Date 6/7/2010  
Date \_\_\_\_\_

2025 Build  
Ramp W-5 (Rt 9 EB to Rt 128 SB)

North

AM - 7771 pc/h →

→

PM - 8332 pc/h →

→

→ AM - 9046 pc/h =

→

1809 pc/h/in

→

→ PM - 10,040 pc/h =

→

2008 pc/h/in

AM - 1215 pc/h →  
PM - 1708 pc/h →

Max downstream freeway flow =  $2400 \text{ pc/h/in} \times 5 \text{ lanes} = 12,000 \text{ pc/h}$

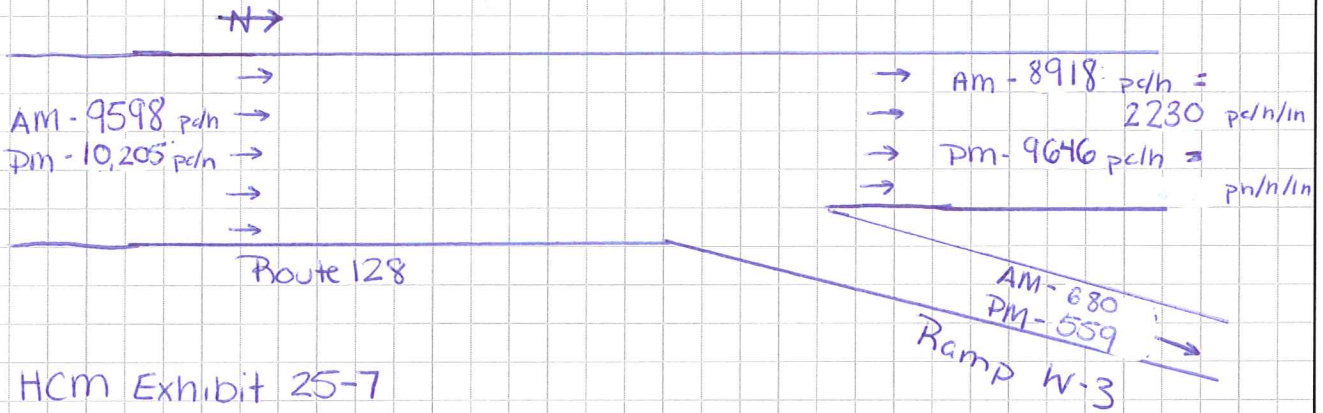
AM Peak demand =  $9046 \text{ pc/h} < 12,000 \text{ pc/h}$

PM Peak demand =  $10,040 \text{ pc/h} < 12,000 \text{ pc/h}$

∴ Adequate capacity

Job Route 128 Add-a-lane      McMahon Project No. \_\_\_\_\_      Sheet \_\_\_\_\_ of \_\_\_\_\_  
 Description Route 9 Interchange      Designed By ECP      Date 6/7/2010  
Ramp W-3 (128 NB to Rte 9 EB)      Checked By \_\_\_\_\_      Date \_\_\_\_\_

## 2025 Build - Ramp W-3 (Rte 128 NB to Rte 9 EB)



HCM Exhibit 25-7

Using 70mph, >4 lanes in one direction ↓

$$\text{Max down stream flow} = 2400 \text{ pc/h/ln} \times 4 \text{ lanes} = 9600 \text{ pc/h}$$

$$\text{AM Peak Demand} = 8918 \text{ pc/h} < 9600 \text{ pc/h}$$

$$\text{PM Peak Demand} = 9646 \text{ pc/hr} > 9600 \text{ pc/h}$$

∴