

## **APPENDIX K**

### **EXISTING TRAFFIC CONDITIONS FREEWAY RAMP LEVEL OF SERVICE CALCULATION WORKSHEETS – CALTRANS FACILITIES ANALYSIS (HCM METHODOLOGY)**

*APPENDIX K-1*

**EXISTING TRAFFIC CONDITIONS – CALTRANS  
FREEWAY RAMP ANALYSIS (HCM METHODOLOGY)**

*MERGE/DIVERGE ANALYSIS*

## RAMPS AND RAMP JUNCTIONS WORKSHEET

### General Information

Analyst2 ZS  
 Agency or Company LLG Engineers  
 Date Performed 07/14/10  
 Analysis Time Period AM Peak Hour

### Site Information

Freeway/Dir of Travel I-5 NB  
 Junction On-Ramp at Katella  
 Jurisdiction Caltrans D12  
 Analysis Year Existing 2008

Project Description AM Existing (Year 2008) I-5 NB On-Ramp at Katella

### 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> = 1400 ft V <sub>u</sub> = 230 veh/h	Terrain Level  S <sub>FF</sub> = 70.0 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
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### 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	4710	0.90	Level	9	0	0.957	1.00	5469
Ramp	200	0.90	Level	9	0	0.957	1.00	232
UpStream	230	0.90	Level	9	0	0.957	1.00	267
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> = 0.348 using Equation 4  
 V<sub>12</sub> = 1904 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?		Actual	Maximum	LOS F?
V <sub>FO</sub>	5701	See Exhibit 25-7	No	V <sub>FI</sub> = V <sub>F</sub>		See Exhibit 25-14	
				V <sub>12</sub>		4400:All	
V <sub>R12</sub>	2136	4600:All	No	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> = 18.9 (pc/ m/l/n)  
 LOS = B (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> = 0.319 (Exhibit 25-19)  
 S<sub>R</sub> = 61.1 mph (Exhibit 25-19)  
 S<sub>0</sub> = 65.4 mph (Exhibit 25-19)  
 S = 63.7 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

Analyst2 ZS  
 Agency or Company LLG Engineers  
 Date Performed 07/14/10  
 Analysis Time Period PM Peak Hour

### Site Information

Freeway/Dir of Travel I-5 NB  
 Junction On-Ramp at Katella  
 Jurisdiction Caltrans D12  
 Analysis Year Existing 2008

Project Description PM Existing (Year 2008) I-5 NB On-Ramp at Katella

### 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> = 1400 ft V <sub>u</sub> = 320 veh/h	Terrain Level   S <sub>FF</sub> = 70.0 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
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### 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	7230	0.90	Level	9	0	0.957	1.00	8395
Ramp	280	0.90	Level	9	0	0.957	1.00	325
UpStream	320	0.90	Level	9	0	0.957	1.00	372
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> = 0.336 using Equation 4  
 V<sub>12</sub> = 2825 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?		Actual	Maximum	LOS F?
V <sub>FO</sub>	8720	See Exhibit 25-7	No	V <sub>FI</sub> =V <sub>F</sub>		See Exhibit 25-14	
				V <sub>12</sub>			
V <sub>R12</sub>	3150	4600:All	No	V <sub>FO</sub> = V <sub>F</sub> -		See Exhibit 25-14	
				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> = 26.8 (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> = 0.377 (Exhibit 25-19)  
 S<sub>R</sub> = 59.4 mph (Exhibit 25-19)  
 S<sub>0</sub> = 60.6 mph (Exhibit 25-19)  
 S = 60.2 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	
Analyst	ZS	Freeway/Dir of Travel	I-5 SB
Agency or Company	LLG Engineers	Junction	Off-Ramp at Katella
Date Performed	07/14/10	Jurisdiction	Caltrans D12
Analysis Time Period	AM Peak Hour	Analysis Year	Existing 2008

Project Description AM Existing (Year 2008) I-5 SB Off-Ramp at Katella

Inputs		
Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> On		<input type="checkbox"/> Yes <input type="checkbox"/> On
<input type="checkbox"/> No <input checked="" type="checkbox"/> Off		<input checked="" type="checkbox"/> No <input type="checkbox"/> Off
$L_{up} =$ 1130 ft		$L_{down} =$ ft
$V_u =$ 450 veh/h	$S_{FF} = 70.0$ 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	5590	0.90	Level	9	0	0.957	1.00	6491
Ramp	540	0.90	Level	9	0	0.957	1.00	627
UpStream	450	0.90	Level	9	0	0.957	1.00	523
DownStream								

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	$P_{FD} = 0.260$ using Equation 0
$V_{12} =$ pc/h	$V_{12} = 1899$ pc/h

**Capacity Checks**

	Actual	Maximum	LOS F?		Actual	Maximum	LOS F?
$V_{FO}$		See Exhibit 25-7		$V_{FI} = V_F$	5518	9600	No
				$V_{12}$	1899	4400:All	No
$V_{R12}$		4600:All		$V_{FO} = V_F - V_R$	4891	9600	No
				$V_R$	627	3800	No

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

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)	$D_R = 1.7$ (pc/ mi /ln)
LOS = (Exhibit 25-4)	LOS = A (Exhibit 25-4)

**Speed Estimation**

Speed Estimation	Speed Estimation
$M_s =$ (Exhibit 25-19)	$D_s = 0.484$ (Exhibit 25-19)
$S_R =$ mph (Exhibit 25-19)	$S_R = 56.4$ mph (Exhibit 25-19)
$S_0 =$ mph (Exhibit 25-19)	$S_0 = 73.6$ mph (Exhibit 25-19)
$S =$ mph (Exhibit 25-14)	$S = 66.6$ mph (Exhibit 25-15)

**RAMPS AND RAMP JUNCTIONS WORKSHEET**

General Information		Site Information	
Analyst	ZS	Freeway/Dir of Travel	I-5 SB
Agency or Company	LLG Engineers	Junction	Off-Ramp at Katella
Date Performed	07/14/10	Jurisdiction	Caltrans D12
Analysis Time Period	PM Peak Hour	Analysis Year	Existing 2008

Project Description PM Existing (Year 2008) I-5 SB Off-Ramp at Katella

**Inputs**

Upstream Adj Ramp	Terrain Level	Downstream Adj Ramp
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off		<input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off
$L_{up} = 1130$ ft	$S_{FF} = 70.0$ mph $S_{FR} = 35.0$ mph Sketch ( show lanes, $L_A, L_D, V_R, V_f$ )	$L_{down} =$ ft
$V_u = 440$ veh/h		$VD =$ 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	6930	0.90	Level	9	0	0.957	1.00	8047
Ramp	200	0.90	Level	9	0	0.957	1.00	232
UpStream	440	0.90	Level	9	0	0.957	1.00	511
DownStream								

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)  
 $P_{FD} = 0.260$  using Equation 0  
 $V_{12} = 1846$  pc/h

**Capacity Checks**

**Capacity Checks**

	Actual	Maximum	LOS F?		Actual	Maximum	LOS F?
$V_{FO}$		See Exhibit 25-7		$V_{FI} = V_F$	6438	9600	No
				$V_{12}$	1846	4400:All	No
$V_{R12}$		4600:All		$V_{FO} = V_F - V_R$	6206	9600	No
				$V_R$	232	3800	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)**

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$   
 $D_R = 1.2$  (pc/ mi /ln)  
 $LOS = A$  (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**

$D_s = 0.449$  (Exhibit 25-19)  
 $S_R = 57.4$  mph (Exhibit 25-19)  
 $S_0 = 71.7$  mph (Exhibit 25-19)  
 $S = 67.0$  mph (Exhibit 25-15)

## RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	ZS	Freeway/Dir of Travel	SR-57 NB
Agency or Company	LLG Engineers	Junction	EB On-Ramp at Katella
Date Performed	07/14/10	Jurisdiction	Caltrans D12
Analysis Time Period	AM Peak Hour	Analysis Year	Existing 2008

Project Description AM Existing (Year 2008) SR-57 NB EB On-Ramp at Katella

### 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> = 70.0 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> =      1090 ft V <sub>D</sub> =        150 veh/h
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### 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	4010	0.87	Level	6	0	0.971	1.00	4747
Ramp	300	0.87	Level	6	0	0.971	1.00	355
UpStream								
DownStream	150	0.87	Level	6	0	0.971	1.00	178

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> = 0.333 using Equation 4  
 V<sub>12</sub> = 1579 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>	5102	See Exhibit 25-7	No
V <sub>R12</sub>	1934	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> = 17.3 (pc/ m/ln)  
 LOS = B (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> = 0.313 (Exhibit 25-19)  
 S<sub>R</sub> = 61.2 mph (Exhibit 25-19)  
 S<sub>0</sub> = 66.1 mph (Exhibit 25-19)  
 S = 64.2 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

Analyst2 ZS  
 Agency or Company LLG Engineers  
 Date Performed 07/14/10  
 Analysis Time Period PM Peak Hour

### Site Information

Freeway/Dir of Travel SR-57 NB  
 Junction EB On-Ramp at Katella  
 Jurisdiction Caltrans D12  
 Analysis Year Existing 2008

Project Description PM Existing (Year 2008) SR-57 NB EB On-Ramp at Katella

### 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  <hr/> S <sub>FF</sub> = 70.0 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> =        1090 ft V <sub>D</sub> =        240 veh/h
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### 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	7230	0.87	Level	6	0	0.971	1.00	8560
Ramp	450	0.87	Level	6	0	0.971	1.00	533
UpStream								
DownStream	240	0.87	Level	6	0	0.971	1.00	284

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> = 0.310 using Equation 4  
 V<sub>12</sub> = 2658 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?		Actual	Maximum	LOS F?
V <sub>FO</sub>	9093	See Exhibit 25-7	No	V <sub>FI</sub> = V <sub>F</sub>		See Exhibit 25-14	
				V <sub>12</sub>		4400:All	
V <sub>R12</sub>	3191	4600:All	No	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> = 27.0 (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> = 0.381 (Exhibit 25-19)  
 S<sub>R</sub> = 59.3 mph (Exhibit 25-19)  
 S<sub>0</sub> = 59.6 mph (Exhibit 25-19)  
 S = 59.5 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	ZS	Freeway/Dir of Travel	SR-57 SB
Agency or Company	LLG Engineers	Junction	WB On-Ramp at Katella
Date Performed	07/14/10	Jurisdiction	Caltrans D12
Analysis Time Period	AM Peak Hour	Analysis Year	Existing 2008

Project Description AM Existing (Year 2008) SR-57 SB WB On-Ramp at Katella

### 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> = 70.0 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> =        1015 ft V <sub>D</sub> =        160 veh/h
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### 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	5490	0.87	Level	6	0	0.971	1.00	6500
Ramp	240	0.87	Level	6	0	0.971	1.00	284
UpStream								
DownStream	160	0.87	Level	6	0	0.971	1.00	189

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> = 0.342 using Equation 4  
 V<sub>12</sub> = 2220 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>	6784	See Exhibit 25-7	No
V <sub>R12</sub>	2504	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> = 21.7 (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> = 0.334 (Exhibit 25-19)  
 S<sub>R</sub> = 60.7 mph (Exhibit 25-19)  
 S<sub>0</sub> = 64.1 mph (Exhibit 25-19)  
 S = 62.8 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

### Site Information

Analyst2	ZS	Freeway/Dir of Travel	SR-57 SB
Agency or Company	LLG Engineers	Junction	WB On-Ramp at Katella
Date Performed	07/14/10	Jurisdiction	Caltrans D12
Analysis Time Period	PM Peak Hour	Analysis Year	Existing 2008

Project Description PM Existing (Year 2008) SR-57 SB WB On-Ramp at Katella

### 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> = 70.0 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>D</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> =        1015 ft V <sub>D</sub> =        360 veh/h
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### 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	6690	0.87	Level	6	0	0.971	1.00	7920
Ramp	460	0.87	Level	6	0	0.971	1.00	545
UpStream								
DownStream	360	0.87	Level	6	0	0.971	1.00	426

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> = 0.309 using Equation 4  
 V<sub>12</sub> = 2447 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>	8465	See Exhibit 25-7	No
V <sub>R12</sub>	2992	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> = 25.4 (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> = 0.364 (Exhibit 25-19)  
 S<sub>R</sub> = 59.8 mph (Exhibit 25-19)  
 S<sub>0</sub> = 60.9 mph (Exhibit 25-19)  
 S = 60.5 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)

*WEAVING ANALYSIS*

## FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst	ZS	Freeway/Dir of Travel	SR-57 NB
Agency/Company	LLG Engineers	Weaving Seg Location	Orangewood On to Katella Off
Date Performed	07/14/10	Jurisdiction	Caltrans D12
Analysis Time Period	AM Peak Hour	Analysis Year	Existing 2008

### Inputs

Freeway free-flow speed, $S_{FF}$ (mi/h)	65	Weaving type	B
Weaving number of lanes, $N$	5	Volume ratio, $VR$	0.19
Weaving seg length, $L$ (ft)	1360	Weaving ratio, $R$	0.17
Terrain	Level		

### Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	$E_T$	$E_R$	$f_{HV}$	$f_p$	v
$V_{o1}$	3860	0.87	6	0	1.5	1.2	0.971	1.00	4569
$V_{o2}$	10	0.87	6	0	1.5	1.2	0.971	1.00	11
$V_{w1}$	730	0.87	6	0	1.5	1.2	0.971	1.00	864
$V_{w2}$	150	0.87	6	0	1.5	1.2	0.971	1.00	177
$V_w$				1041	$V_{nw}$				4580
$V$									5621

### Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving ( $i = w$ )	Non-Weaving ( $i = nw$ )	Weaving ( $i = w$ )	Non-Weaving ( $i = nw$ )
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, $W_i$	0.43	0.17		
Weaving and non-weaving speeds, $S_i$ (mi/h)	53.44	62.05		

Number of lanes required for unconstrained operation, $N_w$	1.16
Maximum number of lanes, $N_w$ (max)	3.50
<input checked="" type="checkbox"/> If $N_w < N_w(\text{max})$ unconstrained operation <span style="margin-left: 100px;"><input type="checkbox"/> if <math>N_w &gt; N_w(\text{max})</math> constrained operation</span>	

### Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, $S$ (mi/h)	60.25
Weaving segment density, $D$ (pc/mi/ln)	18.66
Level of service, LOS	B
Capacity of base condition, $c_b$ (pc/h)	11477
Capacity as a 15-minute flow rate, $c$ (veh/h)	11143
Capacity as a full-hour volume, $c_h$ (veh/h)	9694

### Notes

- a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- b. Capacity constrained by basic freeway capacity.
- c. Capacity occurs under constrained operating conditions.
- d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- f. Capacity constrained by maximum allowable weaving flow rate: 2,600 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

## FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst	ZS	Freeway/Dir of Travel	SR-57 NB
Agency/Company	LLG Engineers	Weaving Seg Location	Orangewood On to Katella Off
Date Performed	07/14/10	Jurisdiction	Caltrans D12
Analysis Time Period	PM Peak Hour	Analysis Year	Existing 2008

Inputs			
Freeway free-flow speed, SFF (mi/h)	65	Weaving type	B
Weaving number of lanes, N	5	Volume ratio, VR	0.11
Weaving seg length, L (ft)	1360	Weaving ratio, R	0.33
Terrain	Level		

Conversions to pc/h Under Base Conditions									
(pc/h)	V	PHF	Truck %	RV %	$E_T$	$E_R$	fHV	$f_p$	v
Vo1	6960	0.87	6	0	1.5	1.2	0.971	1.00	8240
Vo2	10	0.87	6	0	1.5	1.2	0.971	1.00	11
Vw1	550	0.87	6	0	1.5	1.2	0.971	1.00	651
Vw2	270	0.87	6	0	1.5	1.2	0.971	1.00	319
Vw				970	Vnw				8251
V									9221

Weaving and Non-Weaving Speeds				
	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, Wi	0.52	0.18		
Weaving and non-weaving speeds, Si (mi/h)	51.13	61.52		
Number of lanes required for unconstrained operation, Nw			0.72	
Maximum number of lanes, Nw (max)			3.50	
		<input checked="" type="checkbox"/> If Nw < Nw(max) unconstrained operation		<input type="checkbox"/> if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity	
Weaving segment speed, S (mi/h)	60.23
Weaving segment density, D (pc/mi/ln)	30.62
Level of service, LOS	D
Capacity of base condition, $c_b$ (pc/h)	11733
Capacity as a 15-minute flow rate, c (veh/h)	11391
Capacity as a full-hour volume, $c_h$ (veh/h)	9910

**Notes**

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

## FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst	ZS	Freeway/Dir of Travel	SR-57 SB
Agency/Company	LLG Engineers	Weaving Seg Location	Katella On to Orangewood Off
Date Performed	07/14/10	Jurisdiction	Caltrans D12
Analysis Time Period	AM Peak Hour	Analysis Year	Existing 2008

Inputs			
Freeway free-flow speed, SFF (mi/h)	65	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.13
Weaving seg length, L (ft)	1780	Weaving ratio, R	0.18
Terrain	Level		

Conversions to pc/h Under Base Conditions									
(pc/h)	V	PHF	Truck %	RV %	$E_T$	$E_R$	fHV	$f_p$	v
Vo1	5490	0.87	6	0	1.5	1.2	0.971	1.00	6499
Vo2	10	0.87	6	0	1.5	1.2	0.971	1.00	11
Vw1	700	0.87	6	0	1.5	1.2	0.971	1.00	828
Vw2	150	0.87	6	0	1.5	1.2	0.971	1.00	177
Vw				1005	Vnw				6510
V									7515

Weaving and Non-Weaving Speeds				
	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.60	0.28		
Weaving and non-weaving speeds, Si (mi/h)	49.40	57.81		
Number of lanes required for unconstrained operation, Nw			1.22	
Maximum number of lanes, Nw (max)			1.40	
		<input checked="" type="checkbox"/> If Nw < Nw(max) unconstrained operation		<input type="checkbox"/> if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity	
Weaving segment speed, S (mi/h)	56.53
Weaving segment density, D (pc/mi/ln)	26.59
Level of service, LOS	C
Capacity of base condition, $c_b$ (pc/h)	11047
Capacity as a 15-minute flow rate, c (veh/h)	10725
Capacity as a full-hour volume, $c_h$ (veh/h)	9331

**Notes**

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

## FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst	ZS	Freeway/Dir of Travel	SR-57 SB
Agency/Company	LLG Engineers	Weaving Seg Location	Katella On to Orangewood Off
Date Performed	07/14/10	Jurisdiction	Caltrans D12
Analysis Time Period	PM Peak Hour	Analysis Year	Existing 2008

Inputs			
Freeway free-flow speed, SFF (mi/h)	65	Weaving type	A
Weaving number of lanes, N	5	Volume ratio, VR	0.14
Weaving seg length, L (ft)	1780	Weaving ratio, R	0.32
Terrain	Level		

Conversions to pc/h Under Base Conditions									
(pc/h)	V	PHF	Truck %	RV %	$E_T$	$E_R$	fHV	$f_p$	v
Vo1	6680	0.87	6	0	1.5	1.2	0.971	1.00	7908
Vo2	20	0.87	6	0	1.5	1.2	0.971	1.00	23
Vw1	710	0.87	6	0	1.5	1.2	0.971	1.00	840
Vw2	340	0.87	6	0	1.5	1.2	0.971	1.00	402
Vw				1242	Vnw				7931
V									9173

Weaving and Non-Weaving Speeds				
	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.15	0.00		
b (Exhibit 24-6)	2.20	4.00		
c (Exhibit 24-6)	0.97	1.30		
d (Exhibit 24-6)	0.80	0.75		
Weaving intensity factor, Wi	0.73	0.37		
Weaving and non-weaving speeds, Si (mi/h)	46.81	55.11		
Number of lanes required for unconstrained operation, Nw			1.26	
Maximum number of lanes, Nw (max)			1.40	
		<input checked="" type="checkbox"/> If Nw < Nw(max) unconstrained operation		<input type="checkbox"/> if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity	
Weaving segment speed, S (mi/h)	53.82
Weaving segment density, D (pc/mi/ln)	34.09
Level of service, LOS	D
Capacity of base condition, $c_b$ (pc/h)	11035
Capacity as a 15-minute flow rate, c (veh/h)	10714
Capacity as a full-hour volume, $c_h$ (veh/h)	9321

**Notes**

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.



## FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst	ZS	Freeway/Dir of Travel	SR-57 NB
Agency/Company	LLG Engineers	Weaving Seg Location	Katella On to Ball Off
Date Performed	07/14/10	Jurisdiction	Caltrans D12
Analysis Time Period	AM Peak Hour	Analysis Year	Existing 2008

Inputs			
Freeway free-flow speed, SFF (mi/h)	65	Weaving type	B
Weaving number of lanes, N	4	Volume ratio, VR	0.21
Weaving seg length, L (ft)	2130	Weaving ratio, R	0.14
Terrain	Level		

Conversions to pc/h Under Base Conditions									
(pc/h)	V	PHF	Truck %	RV %	$E_T$	$E_R$	fHV	$f_p$	v
Vo1	3600	0.87	6	0	1.5	1.2	0.971	1.00	4262
Vo2	10	0.87	6	0	1.5	1.2	0.971	1.00	11
Vw1	840	0.87	6	0	1.5	1.2	0.971	1.00	994
Vw2	140	0.87	6	0	1.5	1.2	0.971	1.00	165
Vw				1159	Vnw				4273
V									5432

Weaving and Non-Weaving Speeds				
	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, Wi	0.41	0.19		
Weaving and non-weaving speeds, Si (mi/h)	53.90	61.30		

Number of lanes required for unconstrained operation, Nw	0.85
Maximum number of lanes, Nw (max)	3.50
<input checked="" type="checkbox"/> If Nw < Nw(max) unconstrained operation <span style="margin-left: 100px;"><input type="checkbox"/> if Nw &gt; Nw (max) constrained operation</span>	

Weaving Segment Speed, Density, Level of Service, and Capacity	
Weaving segment speed, S (mi/h)	59.56
Weaving segment density, D (pc/mi/ln)	22.80
Level of service, LOS	C
Capacity of base condition, $c_b$ (pc/h)	9318
Capacity as a 15-minute flow rate, c (veh/h)	9047
Capacity as a full-hour volume, $c_h$ (veh/h)	7871

**Notes**

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

## FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst	ZS	Freeway/Dir of Travel	SR-57 NB
Agency/Company	LLG Engineers	Weaving Seg Location	Katella On to Ball Off
Date Performed	07/14/10	Jurisdiction	Caltrans D12
Analysis Time Period	PM Peak Hour	Analysis Year	Existing 2008

### Inputs

Freeway free-flow speed, $S_{FF}$ (mi/h)	65	Weaving type	B
Weaving number of lanes, N	4	Volume ratio, VR	0.11
Weaving seg length, L (ft)	2130	Weaving ratio, R	0.26
Terrain	Level		

### Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	$E_T$	$E_R$	fHV	$f_p$	v
Vo1	7050	0.87	6	0	1.5	1.2	0.971	1.00	8346
Vo2	10	0.87	6	0	1.5	1.2	0.971	1.00	11
Vw1	660	0.87	6	0	1.5	1.2	0.971	1.00	781
Vw2	230	0.87	6	0	1.5	1.2	0.971	1.00	272
Vw				1053	Vnw				8357
V									9410

### Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (i = nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, $W_i$	0.50	0.19		
Weaving and non-weaving speeds, $S_i$ (mi/h)	51.63	61.12		

Number of lanes required for unconstrained operation, $N_w$	0.41
Maximum number of lanes, $N_w$ (max)	3.50
<input checked="" type="checkbox"/> If $N_w < N_w(\text{max})$ unconstrained operation <span style="margin-left: 200px;"><input type="checkbox"/> if <math>N_w &gt; N_w(\text{max})</math> constrained operation</span>	

### Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (mi/h)	59.88
Weaving segment density, D (pc/mi/ln)	39.28
Level of service, LOS	E
Capacity of base condition, $c_b$ (pc/h)	9400
Capacity as a 15-minute flow rate, c (veh/h)	9126
Capacity as a full-hour volume, $c_h$ (veh/h)	7940

### Notes

- a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- b. Capacity constrained by basic freeway capacity.
- c. Capacity occurs under constrained operating conditions.
- d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

## FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst	ZS	Freeway/Dir of Travel	SR-57 SB
Agency/Company	LLG Engineers	Weaving Seg Location	Ball On to Katella Off
Date Performed	07/14/10	Jurisdiction	Caltrans D12
Analysis Time Period	AM Peak Hour	Analysis Year	Existing 2008

Inputs			
Freeway free-flow speed, SFF (mi/h)	65	Weaving type	B
Weaving number of lanes, N	4	Volume ratio, VR	0.23
Weaving seg length, L (ft)	2490	Weaving ratio, R	0.42
Terrain	Level		

Conversions to pc/h Under Base Conditions									
(pc/h)	V	PHF	Truck %	RV %	$E_T$	$E_R$	fHV	$f_p$	v
Vo1	4890	0.87	6	0	1.5	1.2	0.971	1.00	5789
Vo2	30	0.87	6	0	1.5	1.2	0.971	1.00	35
Vw1	840	0.87	6	0	1.5	1.2	0.971	1.00	994
Vw2	600	0.87	6	0	1.5	1.2	0.971	1.00	710
Vw				1704	Vnw				5824
V									7528

Weaving and Non-Weaving Speeds				
	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, WI	0.49	0.26		
Weaving and non-weaving speeds, Si (mi/h)	51.86	58.77		

Number of lanes required for unconstrained operation, Nw	0.86
Maximum number of lanes, Nw (max)	3.50
<input checked="" type="checkbox"/> If Nw < Nw(max) unconstrained operation <span style="margin-left: 200px;"><input type="checkbox"/> if Nw &gt; Nw (max) constrained operation</span>	

Weaving Segment Speed, Density, Level of Service, and Capacity	
Weaving segment speed, S (mi/h)	57.05
Weaving segment density, D (pc/mi/ln)	32.99
Level of service, LOS	D
Capacity of base condition, $c_b$ (pc/h)	9275
Capacity as a 15-minute flow rate, c (veh/h)	9005
Capacity as a full-hour volume, $c_h$ (veh/h)	7834

- Notes**
- a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
  - b. Capacity constrained by basic freeway capacity.
  - c. Capacity occurs under constrained operating conditions.
  - d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
  - e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
  - f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
  - g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
  - h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
  - i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

## FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst	ZS	Freeway/Dir of Travel	SR-57 SB
Agency/Company	LLG Engineers	Weaving Seg Location	Ball On to Katella Off
Date Performed	07/14/10	Jurisdiction	Caltrans D12
Analysis Time Period	PM Peak Hour	Analysis Year	Existing 2008

Inputs			
Freeway free-flow speed, SFF (mi/h)	65	Weaving type	B
Weaving number of lanes, N	4	Volume ratio, VR	0.16
Weaving seg length, L (ft)	2490	Weaving ratio, R	0.43
Terrain	Level		

Conversions to pc/h Under Base Conditions									
(pc/h)	V	PHF	Truck %	RV %	$E_T$	$E_R$	fHV	$f_p$	v
Vo1	6190	0.87	6	0	1.5	1.2	0.971	1.00	7328
Vo2	30	0.87	6	0	1.5	1.2	0.971	1.00	35
Vw1	660	0.87	6	0	1.5	1.2	0.971	1.00	781
Vw2	500	0.87	6	0	1.5	1.2	0.971	1.00	591
Vw				1372	Vnw				7363
V									8735

Weaving and Non-Weaving Speeds				
	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.20	6.00		
c (Exhibit 24-6)	0.70	1.00		
d (Exhibit 24-6)	0.50	0.50		
Weaving intensity factor, WI	0.48	0.21		
Weaving and non-weaving speeds, Si (mi/h)	52.15	60.45		
Number of lanes required for unconstrained operation, Nw			0.56	
Maximum number of lanes, Nw (max)			3.50	
<input checked="" type="checkbox"/> If Nw < Nw(max) unconstrained operation		<input type="checkbox"/> if Nw > Nw (max) constrained operation		

Weaving Segment Speed, Density, Level of Service, and Capacity	
Weaving segment speed, S (mi/h)	58.98
Weaving segment density, D (pc/mi/ln)	37.03
Level of service, LOS	E
Capacity of base condition, $c_b$ (pc/h)	9400
Capacity as a 15-minute flow rate, c (veh/h)	9126
Capacity as a full-hour volume, $c_h$ (veh/h)	7940

- Notes**
- a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
  - b. Capacity constrained by basic freeway capacity.
  - c. Capacity occurs under constrained operating conditions.
  - d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
  - e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
  - f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
  - g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
  - h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
  - i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.