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Memorandum

Date: February 16, 2009

Subject:	US 50 EB Weaving Analysis between El Dorado Hills and Silva Valley Ramp Metering Analysis for US 50 EB On-Ramp at Latrobe Road
Reference #:	P07033
From:	Jim Damkowitch & Chirag Safi
CC:	Christine Zdunkiewicz, Caltrans D-3
То:	Paul Hom, El Dorado County DOT

Weaving Analysis

Dowling Associates, Inc. has completed evaluation of a weave section along US 50 EB from El Dorado Hills to Silva Valley. Weaving analysis for 2010 opening year and 2030 design year peak hour volumes was performed using the methodology described in *Highway Capacity Manual* updated in 2000, Transportation Research Board, 3rd Edition, Washington DC.

The lane configuration on mainline US 50 EB was assumed to be consisting of five lanes (an HOV, 2 mixed flow, a truck climbing and an auxiliary lane) for both analysis years. Since vehicles utilizing HOV lane would not perform weaving maneuvers, total mainline volumes were reduced by 11.5% to control for HOV traffic.

Highway Capacity Manual (HCM) Methodology

Table 1 shows the results of weaving analysis. The study weave section is estimated to operate at highly acceptable LOS B or better for the opening year (2010) peak hour traffic volumes. In the design year (2030), the weave section would function at acceptable LOS D or better during both peak hours. With the installation of ramp metering and assuming discharge rate of 900 vehicles per hour (vph), the study weave section is anticipated to operate at the same LOS but with better density during the PM peak hours.

HCS worksheets for weaving analysis are provided in Attachment A.

		HCM Method ¹							
		AMI	Peak	PM F	'eak				
		Density		Density					
Analysis Year	Control	pc/mi/ln	LOS	pc/mi/ln	LOS				
2010	Unmetered	10.43	В	18.56	В				
2030	Unmetered	20.11	С	34.67	D				
2030	Metered ²	19.6	В	30.59	D				
¹ - Based on HCM 2000 Type 'B' Weave Section									
² - Assuming discharge r	ate of 900 vph								

Table 1. Weaving Analysis Results

Highway Design Manual (HDM) Methodology

HDM is insensitive to the ramp design features such as dual off-ramp lanes. It characterizes weave sections as either balanced or unbalanced based on number of lanes upstream and downstream of an off-ramp. Given that this analysis is being applied to a dual off-ramp design, the HCM methodology is considered more appropriate/representative approach for determining operational performance.

Ramp Metering Analysis

Based on the methodology described in Caltrans publication Highway Design Manual (HDM), Sixth Edition, ramp metering analysis was performed for US 50 EB on-ramp at Latrobe for 2030 peak hour conditions. Based on the preliminary concept plan prepared by Quincy Engineering¹, Inc., the on-ramp is estimated to provide storage capacity of 1,000 feet per lane. The EB on-ramp is proposed to accommodate two mixed flow and an HOV lane for US 50 EB on-ramp at Latrobe. The preliminary ramp design is shown in **Figure 1**.

Discharge rate for ramp meters varies from 240 to 900 vph per lane. Since the study ramp consists of two lanes, assumptions must be made about lane utilization. To provide a range, three different scenarios with varying discharge capacities were evaluated. Scenario 'A' studies the most conservative situation where the discharge rate for two-lane on-ramp was assumed to be 900 vph. Scenario 'B' uses both upper and lower limits of discharge, i.e. discharge rate for one lane is assumed to be 900 vph and the second is 240 vph (total of 1140 vph). Scenario 'C' is based on the assumption that both on-ramp lanes would operate at their maximum capacity i.e. 900 vph.

Ramp meter analysis procedure and results for 2030 forecasted peak hour traffic volumes are presented in <u>Table 2</u>. As recommended in HDM, the peak 15-min and 5-min arrival and departure rates were computed and any queue spillback was estimated. Overall, the PM peak hour is more critical than the AM peak hour. Major findings are discussed below:

• Scenario 'A': The arrival rates for peak 15-min traffic volumes during both peak hours were found to be higher than the corresponding discharge rates, which would result in queues. The queue length for peak 15-min volumes during the PM peak hour is estimated to be 2,173 ft which exceeds the storage capacity of 2,000 ft. Therefore, net

¹ Not based on final GAD.

difference of 173 ft i.e.7 vehicles would spillback from the ramp. Hence, this scenario is likely to negatively impact operation of the upstream intersection.

- Scenario 'B': The assumed discharge rate and calculated arrival rate would not result in queues during the AM peak hour. The estimated queue length during the PM peak hour was 673 ft which could be easily accommodated by the proposed storage length of ramp. In this case, ramp metering operation will not impede that of upstream intersection.
- Scenario 'C': The assumed discharge rate and calculated arrival rate will not result in any queues during both peak hours. Discharge rate in this case is higher than the arrival rate. The higher discharge rate assumed under this scenario will possibly create greater turbulence on the mainline.
- In case of queues spillback, left-turn movement towards the study on-ramp of the upstream intersection will have major impact than the right-turn movement.
- Downstream merge and mainline sections affect/limit the discharge capacities of the ramp. This analysis assumed that the freeway would have sufficient capacity to accommodate ramp meter discharge of up to 1,800 vph.

Conclusion

Based on the HCS weaving analysis and with the unmetered on-ramp, US 50 EB section from EI Dorado Hills to Silva Valley section is projected to operate at acceptable LOS B or better for the opening year (2010) and at LOS D or better for the design year (2030) peak hour traffic volumes. It was determined that this weave section would continue to operate at the same LOS during the PM peak hour if it's metered with discharge rate of 900 vph. In addition, the weave section would continue to operate at the same LOS D during the PM peak hour if the discharge rate of meter was kept as low as 500 mph. Therefore, metering at US 50 EB on-ramp at Latrobe is not anticipated to change operation of the weave section during the study peak hours.

Ramp metering analysis for US 50 EB on-ramp at Latrobe reveals that under Scenario 'A' (combined discharge rate is 900 vph) the arrival rate would produce queues that may exceed the available storage capacity during the PM peak hour. Under Scenario 'B' where capacity of one lane is fully utilized while the second is minimally used, queues will exist but are not shown to exceed the available storage length. Under Scenario 'C', the departure rate will be higher than the arrival rate, and therefore, queues will not be present.

For more comprehensive and detailed analysis of the effect of metering on weave section, ramps and intersection queue spillback operations, micro-simulation is the most appropriate approach.



Figure 1. US 50 EB Interchange with El Dorado Hills/Latrobe

	Seen		Seen	aria IDI	Scenario 'C'				
Description	AM Book	ITIO A	AM Book	ITIO D	AM Book	ITIO C			
	Alli Peak	PIN Peak	AIVI Peak	PIVI Peak	Alli Peak	PINI Peak			
Arrival Kate:	069	1 207	069	4 207	060	4 207			
	900	1,231	900	1,231	900	1,231			
Adjusted Traffic Volumes	00 <i>1</i>	1,140	857	1,140	001	1,140			
Number of Un-Kamp Lanes				2					
Peak Hour Factor (PHF)		T 1.040	0.2	92		1.0.10			
Flow Rate (vph)	931	1,248	931	1,248	931	1,248			
Average Arrival Rate (vps)	0.26	0.35	0.26	0.35	0.26	0.35			
Peak 15-min Arrival Rate	233	312	233	312	233	312			
Peak 5-min Arrival Rate	78	104	78	104	78	104			
Discharge Rate:		<u> </u>	<u> '</u>						
Maximum Capacity or Discharge Rate (vph) °	900	900	1,140	1,140	1,800	1,800			
Average Discharge Rate (vps)	0.25	0.25	0.32	0.32	0.50	0.50			
Peak 15-min Discharge Rate	225	225	285	285	450	450			
Peak 5-min Discharge Rate	75	75	95	95	150	150			
Results:			[<u> </u>						
Average Car Length (ft)			2	25					
Approx. Storage Length (ft per lane) ⁴	Γ	1,000							
Approx Total Storage Capacity (ft)			2,0	000					
Residual Peak 15-min Queue Length (veh) ⁵	8	87	0	27	0	0			
Residual Peak 15-min Queue Length (ft)	195	2,173	0	673	0	0			
Resultant Peak 15-min Queue Spillback (ft) ⁶	0	173	0	0	0	0			
Resultant Peak 15-min Queue Spillback (veh)	0	7	0	0	0	0			
Residual Peak 5-min Queue Length (veh) ⁵	3	29	0	9	0	0			
Residual Peak 5-min Queue Length (ft)	65	724	0	224	0	0			
Resultant Peak 5-min Queue Spillback (ft) 6	0	0	0	0	0	0			
Resultant Peak 5-min Queue Spillback (veh)	0	0	0	0	0	0			
¹ - Forecasted traffic volumes were reduced by 11.5% to exclu	ude HOV-lane	traffic	·	·	· · · · · ·				
² - Computed as traffic volumes divided by a PHF									
³ - Based on Highway Design Manual (HDM), Sixth Edition.									
⁴ - Based on the preliminary concept plan prepared by Quincy	y Engineering, I	Inc.							
⁵ - Difference of corresponding arrival rate and departure rate	÷								
⁶ - Queues in feet exceeding the available storage capacity									

Table 2. Ramp Metering Analysis Procedure and Results

vph - vehicles per hour, vps - vehicles per second

Attachment A HCS Weaving Analysis Worksheets

			FREEWA	Y WEAV	ING WOR	KSHEE	Т			
Genera	l Informat	ion			Site Information					
Analyst CS Agency/Company Dowling Associates, I Date Performed 1/09 Analysis Time Period AM Peak Hour			Inc.	Freeway/Dir of TravelUS 50 EBWeaving Seg LocationEl Dorado Hills/Silva VJurisdictionEl Dorado CountyAnalysis Year2010			a Valley			
Inputs										
Freeway free-flow speed, S _{FF} (mi/h) Weaving number of lanes, N Weaving seg length, L (ft) Terrain		65 4 215 Gra	0 de	Weaving type Volume ratio, VR Weaving ratio, R			A 0.46 0.25			
Conver	sions to p	oc/h Und	er Base C	ondition	S					
(pc/h)	V	PHF	Truck %	RV %	Ε _Τ	E _R	f _{HV}	fp	V	
V _{o1}	1173	1.00	6	0	2.0	2.5	0.943	1.00	1243	
V ₀₂	41	1.00	6	0	2.0	2.5	0.943	1.00	43	
V _{w1}	785	1.00	6	0	2.0	2.5	0.943	1.00	832	
V_{w2}	261	1.00	6	0	2.0	2.5	0.943	1.00	276	
V				1108	V _{nv}		1	1	1286	
V	_				TIW				2394	
Weavin	a and Nor	n-Weavir	na Speeds							
Tearm	g and no		Unconstr	ained			Cons	trained		
		Weaving	g (i = w)	Non-Weaving (i = nw) Weav		ng (i = w) Non-Weaving		ving (= nw)		
a (Exhibit 2	4-6)				0.3		35 0.0020		020	
b (Exhibit 2	4-6)				2.		20 4.0		00	
c (Exhibit 2	4-6)				0.9		97 1.		.30	
d (Exhibit 2	4-6)					0	<u>80 0.</u>		75	
Weaving intens	sity factor, Wi on-weaving				0.8		86 ().12	
speeds, Si (mi/	h)					44	.54	4 64.19		
Number of Maximum r	lanes required f number of lanes	for unconstra s, Nw (max)	ined operation,	Nw	1.98 1.40		<i>/ / / /</i>			
	If Nw < Nw	(max) uncons	strained operat	ion		If Nw > N	w (max) consti	rained operati	on	
weavin	g Segmer	nt Speed	, Density,		Service,	and Ca	bacity			
weaving se	egment speed,	S (mi/h)		53.31						
weaving se	egment density,	D (pc/mi/in)		11.23						
Level of sei	rvice, LOS	(")		В						
Capacity of	base condition	, c _b (pc/h)		7557						
Capacity as	s a 15-minute fl	ow rate, c (ve	h/h)	7129						
Capacity as	s a full-hour volu	ume, c _h (veh/	h)	7129						
Notes a. Weaving Junctions". b. Capacity c. Capacity d. Three-lan such cases. e. Four-lane such cases. f. Capacity c g. Five-lane cases	segments longer constrained by b occurs under cor e Type A segme Type A segmen constrained by m Type A segment	than 2500 ft. a asic freeway c Istrained opera nts do not opera ts do not opera aximum allowa is do not opera	are treated as is apacity. ting conditions. rate well at volu ate well at volur able weaving flow te well at volurm	olated merge a me ratios grea ne ratios great w rate: 2,800 p e ratios greate	and diverge area tter than 0.45. Po er than 0.35. Poo pc/h (Type A), 4, er than 0.20. Poo	or operation or operation or operations 000 (Type B) r operations	rocedures of C s and some loc and some loca , 3,500 (Type C and some local	hapter 25, "Rar al queuing are I queuing are e ;). queuing are ex	nps and Ramp expected in xpected in xpected in such	
h. Type B w cases. i. Type C we	eaving segments aving segments	do not operat	e well at volume e well at volume	ratios greater	than 0.80. Poor than 0.50. Poor	operations a	nd some local ond some local o	queuing are exp	pected in such	
cases.										

			FREEWA	Y WEAV	ING WOR	KSHEE	Т			
General Information					Site Information					
AnalystCSAgency/CompanyDowling Associates, IDate Performed1/09Analysis Time PeriodPM Peak Hour			Inc.	Freeway/Dir of TravelUS 50 EBWeaving Seg LocationEl Dorado HillJurisdictionEl Dorado CoAnalysis Year2010) EB rado Hills/Silv rado County	ls/Silva Valley ounty		
Inputs					1					
Freeway free-flow speed, S FF (mi/h)6Weaving number of lanes, N4Weaving seg length, L (ft)2TerrainG		65 4 215 Gra	Weaving type Volume ratio, od Weaving ratio ade		pe io, VR tio, R		A 0.39 0.31			
Conver	sions to p	c/h Und	er Base C	ondition	IS					
(pc/h)	V	PHF	Truck %	RV %	Ε _Τ	E _R	f _{HV}	fp	V	
V _{o1}	2263	1.00	6	0	2.0	2.5	0.943	1.00	2398	
V _{o2}	55	1.00	6	0	2.0	2.5	0.943	1.00	58	
V _{w1}	1036	1.00	6	0	2.0	2.5	0.943	1.00	1098	
V _{w2}	470	1.00	6	0	2.0	2.5	0.943	1.00	498	
V _w	1	•	•	1596	V _{nw}				2456	
V	-								4052	
Weavin	g and Nor	n-Weavir	ng Speeds	6						
			Unconstr	ained	ed		Constrained			
a (Euclidia)	4 ()	Weaving	g (i = w)	Non-Weaving (i = nw)		Weaving (i = w)		Non-Wea	Non-Weaving (= nw)	
a (Exhibit 2) h (Exhibit 2)	4-6) 4-6)					2.20		4.00		
c (Exhibit 2	4-6)					0.	0.97		1.30	
d (Exhibit 2	4-6)			ļ	0.		80 0.7		75	
Weaving intens	ity factor, Wi	ļ			1.		29 0.		.19	
speeds, Si (mi/	h)					39	.01	61.10		
Number of I Maximum n	anes required f umber of lanes	for unconstrai ;, Nw (max) (max) uncons	ned operation, strained operat	Nw	1.88 1.40	if Nw > N	v (max) const	rained operati	on	
Weavin	g Segmer	nt Speed	, Density,	Level of	f Service,	and Cap	Dacity		-	
Weaving se	gment speed, S	S (mi/h)	<u> </u>	49.96		<u> </u>	ž			
Weaving se	gment density,	D (pc/mi/ln)		20.28						
Level of ser	vice, LOS			С						
Capacity of	base condition	, c _b (pc/h)		7557						
Capacity as	a 15-minute flo	ow rate, c (ve	h/h)	7129						
Capacity as	a full-hour volu	ume, c _h (veh/	h)	7129						
Notes										
 a. Weaving s Junctions". b. Capacity of c. Capacity of d. Three-land such cases. e. Four-lane such cases. f. Capacity of g. Five-lane cases. h. Type B we cases 	segments longer constrained by ba occurs under con e Type A segmen Type A segment onstrained by ma Type A segment eaving segments	than 2500 ft. a asic freeway c istrained opera nts do not opera ts do not opera aximum allowa s do not operat	are treated as is apacity. titing conditions. rate well at volur ate well at volur ble weaving flov te well at volume e well at volume	olated merge me ratios great ne ratios great w rate: 2,800 p e ratios greate e ratios greate	and diverge area ater than 0.45. Po er than 0.35. Poo pc/h (Type A), 4, er than 0.20. Poo r than 0.80. Poor	as using the p por operations or operations 000 (Type B) or operations a	rocedures of C s and some loc and some loca , 3,500 (Type C and some local nd some local	hapter 25, "Rai al queuing are l queuing are e c). queuing are ex queuing are ex	mps and Ramp expected in xpected in xpected in such pected in such	
i. Type C we cases.	aving segments	do not operate	e well at volume	ratios greater	than 0.50. Poor	operations ar	nd some local o	queuing are exp	ected in such	

			FREEWA	Y WEAV		KSHEE	Т			
Genera	I Informat	ion		Site Information						
Analyst Agency/Co Date Perfor Analysis Tir	mpany med me Period	CS DAI 2/13/2 AM P	2009 eak		Freeway/Dir of Travel US 50 EB Weaving Seg Location El Dorado Hills/Silva Valley Jurisdiction El Dorado County Analysis Year 2030			a Valley		
Inputs										
Freeway fre Weaving nu Weaving se Terrain	Freeway free-flow speed, S _{FF} (mi/h) 65 Weaving number of lanes, N 4 Weaving seg length, L (ft) 21 Terrain Gr		65 4 215 Gra	Weaving type Volume ratio, 50 Weaving ratio ade		e , VR o, R		B 0.38 0.42		
Conver	sions to p	oc/h Unde	er Base C	ondition	s	r		r	.	
(pc/h)	V	PHF	Truck %	RV %	Ε _Τ	E _R	f _{HV}	fp	V	
V _{o1}	2506	1.00	6	0	2.0	2.5	0.943	1.00	2656	
V _{o2}	48	1.00	6	0	2.0	2.5	0.943	1.00	50	
V _{w1}	920	1.00	6	0	2.0	2.5	0.943	1.00	975	
V _{w2}	675	1.00	6	0	2.0	2.5	0.943	1.00	715	
V _w				1690	V _{nw}		•	•	2706	
V				L		1			4396	
Weavin	g and Nor	n-Weavin	g Speeds	6						
			Unconstr	ained			Cons	trained		
- (Euclidia)	4.()	Weaving	<u> (i = W)</u>	Non-Weaving (i = nw)		Weavir	ng (i = w)	Non-Weav	/ing (= nw)	
a (Exhibit 2 h (Exhibit 2	4-6) 4-6)	0.0	3 1	6.00						
c (Exhibit 2	4-6)	0.7)	1.00						
d (Exhibit 2	4-6)	0.5)	0.50						
Weaving intens	sity factor, Wi	0.4	7	0.33						
speeds, Si (mi/	h)	52.3	0	56.24						
Number of Maximum r Weavin	lanes required for the second	for unconstrai , Nw (max) (max) uncons	ned operation, trained operat	ion	1.57 3.50	if Nw > Nv	v (max) constr Dacity	rained operati	on	
Weaving se	egment speed, S	S (mi/h)	<u> </u>	54.65			<u></u>			
Weaving se	egment density,	D (pc/mi/ln)		20.11						
Level of se	rvice, LOS			С						
Capacity of	base condition	, c _h (pc/h)		8253						
Capacity as	s a 15-minute flo	ow rate, c (ve	h/h)	7786						
Capacity as	s a full-hour volu	ume, c _h (veh/ł	ו)	7786						
Notes										
a. Weaving : Junctions". b. Capacity of d. Three-lan such cases. e. Four-lane such cases. f. Capacity of g. Five-lane cases. h. Type B w cases. i. Type C we	segments longer constrained by b occurs under cor e Type A segme Type A segment constrained by m Type A segment eaving segments eaving segments	than 2500 ft. a asic freeway c: istrained opera nts do not opera ts do not opera aximum allowa s do not operate do not operate	re treated as is apacity. ting conditions. ate well at volun te well at volun ble weaving flor te well at volume well at volume	olated merge a me ratios grea ne ratios greate w rate: 2,800 p le ratios greate e ratios greater ratios greater	and diverge area ter than 0.45. P er than 0.35. Po w/h (Type A), 4, er than 0.20. Poo than 0.80. Poo than 0.50. Poor	as using the p oor operations or operations ,000 (Type B), or operations a r operations ar	rocedures of C s and some loca and some local 3,500 (Type C and some local nd some local q nd some local q	hapter 25, "Rar al queuing are l queuing are e). queuing are exp queuing are exp ueuing are exp	nps and Ramp expected in xpected in such pected in such ected in such	

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Genera	l Informat	ion		Site Information						
Analyst Agency/Col Date Perfor Analysis Tir	mpany med ne Period	CS DAI 2/13/2 AM P	2009 eak		Freeway/Dir of TravelUS 50 EBWeaving Seg LocationEl Dorado Hills/Silva ValleyJurisdictionEl Dorado CountyAnalysis Year2030			a Valley		
Inputs										
Freeway fre Weaving nu Weaving se Terrain	ee-flow speed, s imber of lanes, ig length, L (ft)	S _{FF} (mi/h) N	65 4 215 Gra	Weaving type Volume ratio, 0 Weaving ratio de		e , VR o, R		B 0.38 0.44		
Conver	sions to p	oc/h Unde	er Base C	ondition	S		1	1	1	
(pc/h)	V	PHF	Truck %	RV %	Ε _Τ	E _R	f _{HV}	fp	V	
V _{o1}	2503	1.00	6	0	2.0	2.5	0.943	1.00	2653	
V _{o2}	45	1.00	6	0	2.0	2.5	0.943	1.00	47	
V _{w1}	855	1.00	6	0	2.0	2.5	0.943	1.00	906	
V _{w2}	678	1.00	6	0	2.0	2.5	0.943	1.00	718	
V _w		•		1624	V _{nw}		•	•	2700	
V	-								4324	
Weavin	g and Nor	n-Weavin	g Speeds	3						
	Y		Unconstr	ained		Constrained				
		Weaving	(i = W)	Non-Weaving (i = nw)		Weavir	ng (i = w)	Non-Weav	/ing (= nw)	
a (Exhibit 2	4-6) 4-6)	0.0	3	0.0020				<u> </u>		
c (Exhibit 2	4-0) 4-6)	0.7)	0.00 1.00						
d (Exhibit 2	4-6)	0.5)	0.50				1		
Weaving intens	ity factor, Wi	0.4	6	0.3	32			ļ		
Weaving and n speeds, Si (mi/	on-weaving h)	52.6	0	56.80						
Number of Maximum n	anes required f umber of lanes If Nw < Nw	for unconstrai s, Nw (max) (max) uncons	ned operation, trained operat	Nw ion	1.53 3.50	if Nw > Nv	v (max) const	rained operation	on	
Weaving se	g Segmen	<u>n Speeu</u> S (mi/h)	Density,	55 15	Service,	anu cap	Jacity			
Weaving se	ament density.	D (pc/mi/ln)		19.60						
Level of ser	vice, LOS			B						
Capacity of	base condition	, c _h (pc/h)		8310						
Capacity as	a 15-minute flo	ow rate, c (ve	h/h)	7840						
Capacity as	a full-hour volu	ume, c _h (veh/l) 1)	7840						
Notes				J						
a. Weaving s Junctions". b. Capacity of d. Three-lam such cases. e. Four-lane such cases. f. Capacity of g. Five-lane g. Five-lane cases. h. Type B we cases. i. Type C we cases	segments longer constrained by b boccurs under cor e Type A segme Type A segment onstrained by m Type A segment eaving segments aving segments	than 2500 ft. a asic freeway c astrained opera nts do not opera ts do not opera aximum allowa is do not operate do not operate	re treated as is apacity. ting conditions. ate well at volur te well at volur ble weaving flov te well at volurme well at volurme	olated merge a me ratios grea ne ratios greate w rate: 2,800 p e ratios greate ratios greater ratios greater	and diverge area ter than 0.45. P er than 0.35. Po ic/h (Type A), 4, ir than 0.20. Poo than 0.80. Poo than 0.50. Poor	as using the p oor operations or operations 000 (Type B), or operations a r operations ar	rocedures of C s and some loc and some loca 3,500 (Type C and some local nd some local o	hapter 25, "Rar al queuing are e l queuing are e). queuing are exp queuing are exp	nps and Ramp expected in xpected in spected in such pected in such ected in such	

			FREEWA	Y WEAV		KSHEE	Г			
Genera	l Informat	ion		Site Information						
Analyst Agency/Co Date Perfor Analysis Tir	mpany med me Period	CS DAI 2/13/2 PM Pe	009 eak		Freeway/Dir of TravelUS 50 EBWeaving Seg LocationEI Dorado Hills/Silva VallJurisdictionEl Dorado CountyAnalysis Year2030			a Valley		
Inputs										
Freeway fre Weaving nu Weaving se Terrain	Freeway free-flow speed, S _{FF} (mi/h) 65 Weaving number of lanes, N 4 Weaving seg length, L (ft) 21 Terrain Gr		65 4 215 Gra	Weaving type Volume ratio, 0 Weaving ratio ade		e , VR o, R		B 0.29 0.39		
Conver	sions to p	c/h Unde	er Base C	ondition	S					
(pc/h)	V	PHF	Truck %	RV %	Ε _Τ	E _R	f _{HV}	fp	V	
V _{o1}	4905	1.00	6	0	2.0	2.5	0.943	1.00	5199	
V _{o2}	65	1.00	6	0	2.0	2.5	0.943	1.00	68	
V _{w1}	1232	1.00	6	0	2.0	2.5	0.943	1.00	1305	
V _{w2}	797	1.00	6	0	2.0	2.5	0.943	1.00	844	
V _w				2149	V _{nw}		R		5267	
V					•	1			7416	
Weavin	g and No	n-Weavin	g Speeds	6						
			Unconstr	ained			Constrained			
a (Eyhihit a	1 6)	Weaving	(i = W)	Non-Weaving (i = nw)		Weavir	ng (i = w)	Non-Weav	/ing (= nw)	
b (Exhibit 2	4-0) 4-6)	2.20)	6.00						
c (Exhibit 2	4-6)	0.70)	1.00						
d (Exhibit 2	4-6)	0.50)	0.50						
Weaving intens	sity factor, Wi	0.59)	0.37		ļ				
speeds, Si (mi/	h)	49.6	8	55.20						
Number of Maximum r	lanes required f number of lanes M If Nw < Nw	for unconstrai s, Nw (max) (max) uncons	ned operation, trained operat	ion	1.19 3.50	if Nw > Nv	v (max) consti	rained operation	on	
Weavin	g Segmer	nt Speed,	Density,	Level of	Service,	and Cap	acity			
Weaving se	egment speed, S	S (mi/h)		53.48						
Weaving se	egment density,	D (pc/mi/ln)		34.67						
Level of Sel	NICE, LUS	c (nc/h)								
Capacity of	Dase conultion	, c _b (pc/n)	2/b)	8859						
Capacity as	s a full-hour volu	ume c (veh/k))	0300						
Notos		ame, e _h (ven/i	1)	8338						
a. Weaving : Junctions". b. Capacity of c. Capacity of d. Three-lan such cases. f. Capacity of g. Five-lane cases. h. Type B w cases. i. Type C we	segments longer constrained by b occurs under cor e Type A segmen Type A segmen constrained by m Type A segment eaving segments eaving segments	than 2500 ft. a asic freeway ca istrained opera nts do not opera ts do not opera aximum allowa s do not operate do not operate	re treated as is apacity. ting conditions. ate well at volun te well at volun ble weaving flo te well at volume well at volume	olated merge a me ratios great ne ratios greate w rate: 2,800 p e ratios greate e ratios greater ratios greater	and diverge area ter than 0.45. P er than 0.35. Po c/h (Type A), 4, r than 0.20. Poo than 0.80. Poo than 0.50. Poor	as using the provide the provided to the provi	rocedures of C and some loca and some local 3,500 (Type C and some local nd some local q d some local q	hapter 25, "Rar al queuing are e l queuing are e), queuing are ex queuing are exp jueuing are exp	nps and Ramp expected in xpected in spected in such pected in such ected in such	

			FREEWA	Y WEAV		KSHEE	Г				
Genera	I Informat	ion			Site Information						
Analyst Agency/Cor Date Perfor Analysis Tir	npany med ne Period	CS DAI 2/13/2 PM P	2009 eak		Freeway/Dir of TravelUS 50 EBWeaving Seg LocationEl Dorado Hills/Silva VaJurisdictionEl Dorado CountyAnalysis Year2030			a Valley			
Inputs											
Freeway fre Weaving nu Weaving se Terrain	e-flow speed, s imber of lanes, g length, L (ft)	S _{FF} (mi/h) N	65 4 215 Gra	Weaving type Volume ratio, 50 Weaving ratic ade		e , VR o, R		B 0.25 0.49			
Conver	sions to p	oc/h Unde	er Base C	ondition	S	r	.	1			
(pc/h)	V	PHF	Truck %	RV %	Ε _Τ	E _R	f _{HV}	fp	V		
V _{o1}	4887	1.00	6	0	2.0	2.5	0.943	1.00	5180		
V _{o2}	45	1.00	6	0	2.0	2.5	0.943	1.00	47		
V _{w1}	855	1.00	6	0	2.0	2.5	0.943	1.00	906		
V _{w2}	817	1.00	6	0	2.0	2.5	0.943	1.00	866		
V _w		•		1772	V _{nw}		•	•	5227		
V	1			L		1			6999		
Weavin	g and Noi	n-Weavin	g Speeds	6							
			Unconstr	ained		Constrained					
		Weaving	(i = w)	Non-Weaving (i = nw)		Weavir	ng (i = w)	Non-Weav	/ing (= nw)		
a (Exhibit 2)	4-6) 4-6)	0.0	3	0.0020				<u> </u>			
c (Exhibit 24	4-6) 4-6)	0.7)	8.00 1.00							
d (Exhibit 2	4-6)	0.5)	0.50				1			
Weaving intens	ity factor, Wi	0.5	3	0.29							
Weaving and no speeds, Si (mi/l	on-weaving า)	51.0	0	57.56							
Number of I Maximum n	anes required f umber of lanes	for unconstrai s, Nw (max) (max) uncons	ned operation, trained operat	Nw	1.02 3.50	if Nw > Nv	v (max) const	rained operation	on		
Weavin	g Segmer	nt Speed,	Density,	Level of	Service,	and Cap	acity				
Weaving se	gment speed,	$\frac{S(mi/h)}{D(mi/h)}$		55.74							
weaving se	gment density,	D (pc/mi/in)		31.39							
Consoity of	VICE, LUS	(nc/h)		D 0070							
Capacity of	Dase condition	i, c _b (pc/ii)	- /b)	9079							
Capacity as		umo c (voh/	1/11 <i>)</i>	0000							
		unie, c _h (ven/i	1)	6000							
a. Weaving s Junctions". b. Capacity of c. Capacity of d. Three-lane such cases. f. Capacity of g. Five-lane cases. h. Type B we cases. i. Type C we	segments longer constrained by b occurs under cor a Type A segmen Type A segmen onstrained by m Type A segment eaving segments aving segments	than 2500 ft. a asic freeway ca astrained opera nts do not opera ts do not opera aximum allowa ts do not operate do not operate	re treated as is apacity. ting conditions. ate well at volur te well at volur ble weaving flor te well at volume well at volume	olated merge a me ratios grea ne ratios greate w rate: 2,800 p e ratios greate e ratios greater ratios greater	and diverge area ter than 0.45. P er than 0.35. Po c/h (Type A), 4, ir than 0.20. Poo than 0.80. Poo than 0.50. Poor	as using the p oor operations or operations 000 (Type B), or operations a r operations ar	rocedures of C and some loca 3,500 (Type C and some local nd some local d some local d some local	hapter 25, "Rar al queuing are e l queuing are e). queuing are ex queuing are exp queuing are exp	nps and Ramp expected in xpected in xpected in such pected in such ected in such		