

LEVEL OF SERVICE DEFINITIONS

LEVEL OF SERVICE	SIGNALIZED INTERSECTIONS	UNSIGNALIZED INTERSECTIONS*
"A"	Uncongested operations, all queues clear in a single-signal cycle. (Average stopped delay less than 10 seconds per vehicle; V/C less than or = 0.60).	Little or no delay. (Average delay of ≤ 10 seconds)
"B"	Uncongested operations, all queues clear in a single cycle. (Average delay of 10-20 seconds; V/C=0.61-0.70).	Short traffic delays. (Average delay of >10 and ≤ 15 secs.)
"C"	Light congestion, occasional backups on critical approaches. (Average delay of 20-35 seconds; V/C=0.71-0.80).	Average traffic delay. (Average delay of >15 and ≤ 25 secs.)
"D"	Significant congestion of critical approaches but intersection functional. Cars required to wait through more than one cycle during short peaks. No long queues formed. (Average delay of 35-55 seconds; V/C=0.81-0.90).	Long traffic delays for some approaches. (Average delay of >25 and ≤ 35 secs.)
"E"	Severe congestion with some long standing queues on critical approaches. Blockage of intersection may occur if traffic signal does not provide for protected turning movements. Traffic queue may block nearby intersection(s) upstream of critical approach(es). (Average delay of 55-80 seconds; V/C=0.91-1.00).	Very long traffic delays for some approaches. (Average delay of >35 and ≤ 50 secs.)
"F"	Total breakdown, stop-and-go operation. (Average delay in excess of 80 seconds; V/C of 1.01 or greater).	Extreme traffic delays for some approaches (intersection may be blocked by external causes--delays >50 seconds).

* Level of Service refers to delays encountered by certain stop sign controlled approaches. Other approaches may operate with little delay.

Source: Transportation Research Board, *Highway Capacity Manual*, 2000.

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information		Site Information	
Analyst	<u>GWN</u>	Jurisdiction/Date	<u>NAPA COUNTY</u> <u>9/21/2009</u>
Agency or Company	<u>GWN</u>	Major Street	<u>SILVERADO TRAIL</u>
Analysis Period/Year	<u>SEPT</u> <u>2009</u>	Minor Street	<u>SINSKEY DRIVEWAY</u>
Comment	<u>EXISTING WEEKDAY PEAK</u>		

Input Data

Lane Configuration	NB			SB			WB			EB		
	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Lane 1 (curb)	TR			T			LR					
Lane 2				L								
Lane 3												
Lane 4												
Lane 5												
Movement												
Volume (veh/h)		317	0	4	797		11		11			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Percent of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		352	0	4	886		12		12			
Flare storage (# of vehs)												
Median storage (# of vehs)							1					
Signal upstream of Movement 2	_____ ft			Movement 5			_____ ft					
Length of study period (h)	_____ 1.00 _____											

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
WB	1	LR	24	426	0.056	0	14.0	B	14.0
	2								B
	3								
EB	1								
	2								
	3								
NB		①							
SB		④	4	1201	0.004	0	8.0	A	

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Analysis Summary

General Information		Site Information	
Analyst	<u>GWN</u>	Jurisdiction/Date	<u>NAPA COUNTY</u> <u>9/21/2009</u>
Agency or Company	<u>GWN</u>	Major Street	<u>SILVERADO TRAIL</u>
Analysis Period/Year	<u>SEPT</u> <u>2009</u>	Minor Street	<u>SINSKEY DRIVEWAY</u>
Comment	<u>EXISTING SATURDAY PEAK</u>		

Input Data

Lane Configuration	NB			SB			WB			EB		
	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Lane 1 (curb)	TR			T			LR					
Lane 2				L								
Lane 3												
Lane 4												
Lane 5												
Movement												
Volume (veh/h)		450	15	14	493		6		13			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Percent of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		500	17	16	548		7		14			
Flare storage (# of vehs)												
Median storage (# of vehs)							1					
Signal upstream of Movement 2	_____ ft			Movement 5			_____ ft					
Length of study period (h)	_____ 1.00 _____											

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
WB	1	LR	21	479	0.044	0	12.9	B	12.9
	2								B
	3								
EB	1								
	2								
	3								
NB	①								
SB	④		16	1044	0.015	0	8.5	A	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information		Site Information	
Analyst	<u>GWN</u>	Jurisdiction/Date	<u>NAPA COUNTY</u> <u>9/22/2009</u>
Agency or Company	<u>GWN</u>	Major Street	<u>SILVERADO TRAIL</u>
Analysis Period/Year	<u>SEPT</u> <u>2009</u>	Minor Street	<u>SINSKEY DRIVEWAY</u>
Comment	<u>EXISTING WEEKDAY PEAK + □□PROJECT</u>		

Input Data

Lane Configuration	NB			SB			WB			EB		
Lane 1 (curb)	TR			T			LR					
Lane 2				L								
Lane 3												
Lane 4												
Lane 5												
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		317	0	6	797		17		17			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Percent of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		352	0	7	886		19		19			
Flare storage (# of vehs)												
Median storage (# of vehs)							1					
Signal upstream of Movement 2	_____ ft			Movement 5			_____ ft					
Length of study period (h)	<u>1.00</u>											

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
WB	1	LR	38	424	0.090	0	14.3	B	14.3
	2								B
	3								
EB	1								
	2								
	3								
NB	①								
SB	④		7	1201	0.006	0	8.0	A	

CHAPTER 17 - TWSC - UNSIGNALIZED INTERSECTIONS WORKSHEET

Analysis Summary

General Information

Site Information

Analyst <u>GWN</u>	Jurisdiction/Date <u>NAPA COUNTY</u> <u>9/22/2009</u>
Agency or Company <u>GWN</u>	Major Street <u>SILVERADO TRAIL</u>
Analysis Period/Year. <u>SEPT</u> <u>2009</u>	Minor Street <u>SINSKEY DRIVEWAY</u>
Comment <u>EXISTING SATURDAY PEAK + □□PROJECT</u>	

Input Data

Lane Configuration	NB			SB			WB			EB		
Lane 1 (curb)	TR			T			LR					
Lane 2				L								
Lane 3												
Lane 4												
Lane 5												
	NB			SB			WB			EB		
Movement	1 (LT)	2 (TH)	3 (RT)	4 (LT)	5 (TH)	6 (RT)	7 (LT)	8 (TH)	9 (RT)	10 (LT)	11 (TH)	12 (RT)
Volume (veh/h)		450	19	18	493		8		16			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Percent of heavy vehicles, HV		3	3	3	3		3		3			
Flow rate		500	21	20	548		9		18			
Flare storage (# of vehs)												
Median storage (# of vehs)							1					
Signal upstream of Movement 2 _____ ft							Signal upstream of Movement 5 _____ ft					
Length of study period (h)	1.00											

Output Data

	Lane	Movement	Flow Rate (veh/h)	Capacity (veh/h)	v/c	Queue Length (veh)	Control Delay (s)	LOS	Approach Delay and LOS
WB	1	LR	27	476	0.057	0	13.0	B	13.0
	2								
	3								B
EB	1								
	2								
	3								
	NB	①							
	SB	④	20	1040	0.019	0	8.5	A	

RADAR SPEED SURVEY

OMNI-MEANS LTD.

Silverado Trail near Sinskey Winery Access

DATE: 9/17/09 Thurs TIME START: 4:00 pm TIME END: 6:00 pm WEATHER: Clear ROAD TYPE: 2 lanes

DIRECTION: Southbound

SPEED LIMIT: 55 mph

OBSERVER: GWN Assoc's.

CALIBRATION TEST: Yes

SPEED	FREQUENCY	ACUM %	PERCENTAGE BREAKDOWN																	
			0	10	20	30	40	50	60	70	80	90	100							
41	1	1.0	1*																	
42	0	1.0	1*																	
43	2	3.0	1***																	
44	5	8.0	1****5***																	
45	11	19.0	1****5****1****5****																	
46	8	27.0	1****5****1****5****2****5**																	
47	8	35.0	1****5****1****5****2****5****3****5																	
48	16	51.0	1****5****1****5****2****5****3****5****4****5****5*																	
49	13	64.0	1****5****1****5****2****5****3****5****4****5****5****6****																	
50	10	74.0	1****5****1****5****2****5****3****5****4****5****5****6****7****																	
51	9	83.0	1****5****1****5****2****5****3****5****4****5****5****6****7****8****																	
52	5	88.0	1****5****1****5****2****5****3****5****4****5****5****6****7****8****9****																	
53	3	91.0	1****5****1****5****2****5****3****5****4****5****5****6****7****8****9****																	
54	5	96.0	1****5****1****5****2****5****3****5****4****5****5****6****7****8****9****																	
55	1	97.0	1****5****1****5****2****5****3****5****4****5****5****6****7****8****9****																	
56	0	97.0	1****5****1****5****2****5****3****5****4****5****5****6****7****8****9****																	
57	1	98.0	1****5****1****5****2****5****3****5****4****5****5****6****7****8****9****																	
58	1	99.0	1****5****1****5****2****5****3****5****4****5****5****6****7****8****9****																	
59	0	99.0	1****5****1****5****2****5****3****5****4****5****5****6****7****8****9****																	
60	0	99.0	1****5****1****5****2****5****3****5****4****5****5****6****7****8****9****																	
61	1	100.0	1****5****1****5****2****5****3****5****4****5****5****6****7****8****9****																	

100

AVERAGE SPEED = 48.7
 50th PERCENTILE = 47.9
 85th PERCENTILE = 51.4
 90th PERCENTILE = 52.6
 95th PERCENTILE = 53.8

PACE = 44 - 53
 % IN PACE = 88
 VEHICLES IN PACE = 88

SAMPLE VARIANCE = 11.48485
 STANDARD DEVIATION = 3.38893
 RANGE 1*S = 69
 RANGE 2*S = 96
 RANGE 3*S = 99

RADAR SPEED SURVEY

OMNI-MEANS LTD.

Silverado Trail near Sinskey Winery Access

DATE: 9/17/09 Thurs. TIME START: 4:00 pm TIME END: 6:00 pm WEATHER: Clear ROAD TYPE: 2 lanes

DIRECTION: Northbound

SPEED LIMIT: 55 mph

OBSERVER: GWN Assocs.

CALIBRATION TEST: Yes

SPEED	FREQUENCY	ACUM %	PERCENTAGE BREAKDOWN
43	3	3.0	***
44	3	6.0	****5*
45	4	10.0	*****1
46	9	19.0	*****1*****5****
47	15	34.0	*****1*****5****2****5****3****
48	15	49.0	*****1*****5****2****5****3****5****4****5****
49	13	62.0	*****1*****5****2****5****3****5****4****5****5****6**
50	13	75.0	*****1*****5****2****5****3****5****4****5****5****6****7****5
51	7	82.0	*****1*****5****2****5****3****5****4****5****5****6****7****8**
52	10	92.0	*****1*****5****2****5****3****5****4****5****5****6****7****8****9**
53	4	96.0	*****1*****5****2****5****3****5****4****5****5****6****7****8****9****5*
54	3	99.0	*****1*****5****2****5****3****5****4****5****5****6****7****8****9****5****
55	0	99.0	*****1*****5****2****5****3****5****4****5****5****6****7****8****9****5****
56	0	99.0	*****1*****5****2****5****3****5****4****5****5****6****7****8****9****5****
57	1	100.0	*****1*****5****2****5****3****5****4****5****5****6****7****8****9****5****0

100

AVERAGE SPEED = 48.7
 50th PERCENTILE = 48
 85th PERCENTILE = 51.3
 90th PERCENTILE = 51.8
 95th PERCENTILE = 52.7

PACE = 44 - 53
 % IN PACE = 93
 VEHICLES IN PACE = 93

SAMPLE VARIANCE = 7.381471
 STANDARD DEVIATION = 2.716886
 RANGE 1*S = 63
 RANGE 2*S = 96
 RANGE 3*S = 99

RADAR SPEED SURVEY

OMNI-MEANS LTD.

Silverado Trail near Sinskey Winery Access

DATE: 9/19/09 Sat. TIME START: 1:00 pm TIME END: 3:00 pm WEATHER: Clear ROAD TYPE: 2 lanes

DIRECTION: Northbound SPEED LIMIT: 55 mph OBSERVER: GWN Assocs. CALIBRATION TEST: Yes

SPEED	FREQUENCY	ACUM %	PERCENTAGE BREAKDOWN
36	1	1.0	!*
37	0	1.0	!*
38	0	1.0	!*
39	1	2.0	!***
40	1	3.0	!****
41	3	6.0	!****5*
42	2	8.0	!****5***
43	9	17.0	!****5****!****5**
44	5	22.0	!****5****!****5****2**
45	15	37.0	!****5****!****5****2****5****3****5**
46	14	51.0	!****5****!****5****2****5****3****5****4****5****5*
47	16	67.0	!****5****!****5****2****5****3****5****4****5****5****6****5**
48	17	84.0	!****5****!****5****2****5****3****5****4****5****5****6****5****7****5****8****
49	9	93.0	!****5****!****5****2****5****3****5****4****5****5****6****5****7****5****8****9****
50	6	99.0	!****5****!****5****2****5****3****5****4****5****5****6****5****7****5****8****9****5****
51	0	99.0	!****5****!****5****2****5****3****5****4****5****5****6****5****7****5****8****9****5****
52	0	99.0	!****5****!****5****2****5****3****5****4****5****5****6****5****7****5****8****9****5****
53	0	99.0	!****5****!****5****2****5****3****5****4****5****5****6****5****7****5****8****9****5****
54	1	100.0	!****5****!****5****2****5****3****5****4****5****5****6****5****7****5****8****9****5****0

100

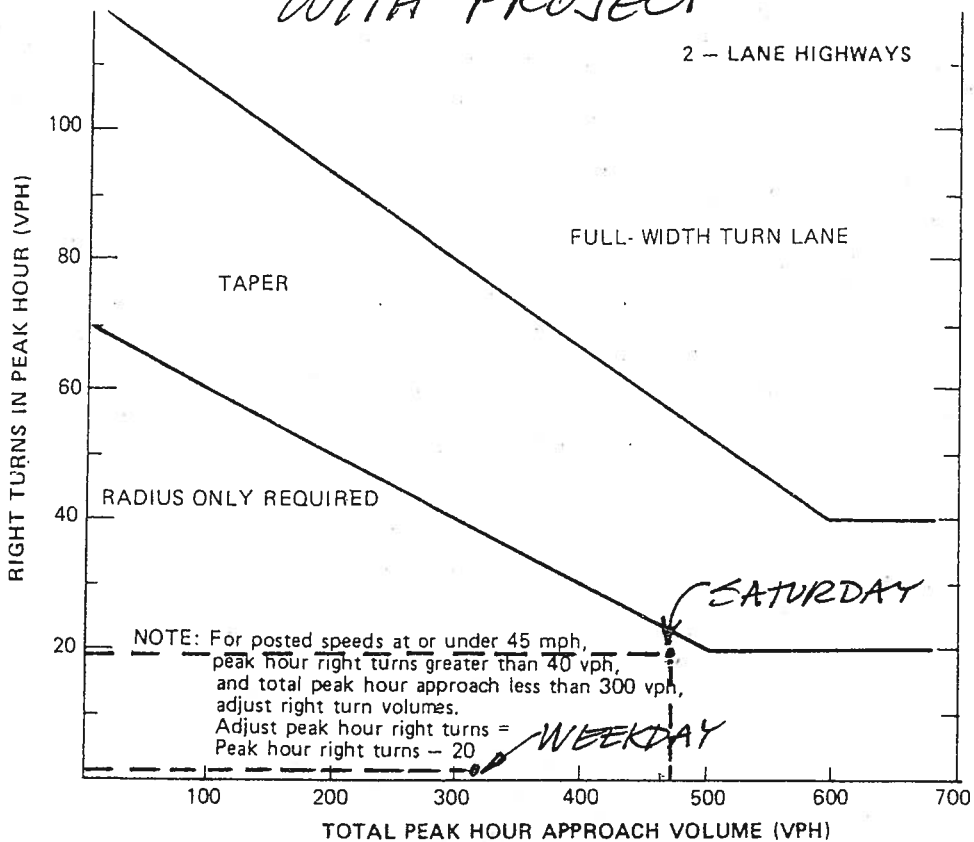
AVERAGE SPEED = 46.1
 50th PERCENTILE = 45.9
 85th PERCENTILE = 48.1
 90th PERCENTILE = 48.6
 95th PERCENTILE = 49.3

PACE = 41 - 50
 % IN PACE = 96
 VEHICLES IN PACE = 96

SAMPLE VARIANCE = 7.391888
 STANDARD DEVIATION = 2.718803
 RANGE 1*S = 67
 RANGE 2*S = 96
 RANGE 3*S = 99

RIGHT TURN LANE WARRANTS WITH PROJECT

DRIVEWAY VOLUME



NORTHBOUND SILVERADO TRAIL

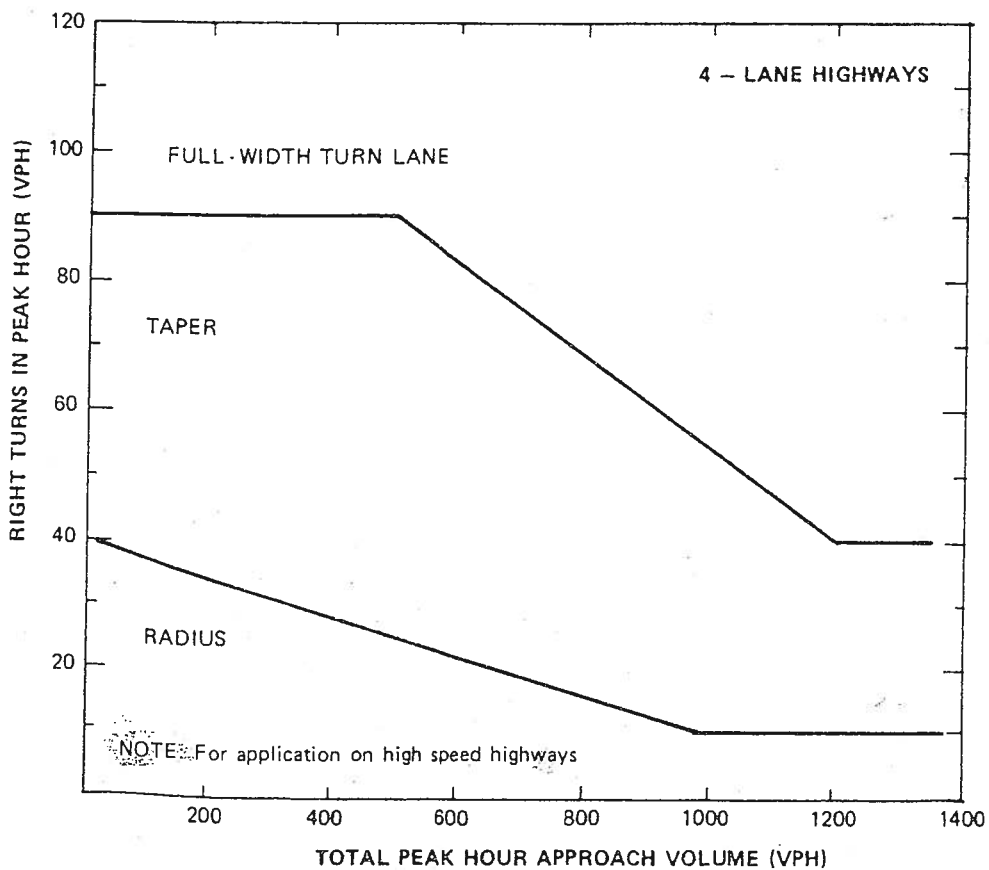


Figure 4-23. Traffic volume guidelines for design of right-turn lanes. (Source: Ref. 4-11)