

HCM Signalized Intersection Capacity Analysis
6: Discovery & Street A

Year 2030 + Project PM

9/24/2013

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	168	1612	75	75	951	98	75	42	75	78	47	218
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.90		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3516		1770	5014		1770	1683		1770	1633	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3516		1770	5014		1770	1683		1770	1633	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	177	1697	79	79	1001	103	79	44	79	82	49	229
RTOR Reduction (vph)	0	2	0	0	8	0	0	62	0	0	169	0
Lane Group Flow (vph)	177	1774	0	79	1096	0	79	61	0	82	109	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	16.2	60.4		11.0	55.2		7.7	11.5		11.1	14.9	
Effective Green, g (s)	16.2	60.4		11.0	55.2		7.7	11.5		11.1	14.9	
Actuated g/C Ratio	0.15	0.55		0.10	0.50		0.07	0.10		0.10	0.14	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	261	1931		177	2516		124	176		179	221	
v/s Ratio Prot	c0.10	c0.50		0.04	0.22		c0.04	0.04		0.05	c0.07	
v/s Ratio Perm												
v/c Ratio	0.68	0.92		0.45	0.44		0.64	0.35		0.46	0.49	
Uniform Delay, d1	44.4	22.6		46.6	17.5		49.8	45.8		46.6	44.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	6.8	8.5		1.8	0.6		10.3	1.2		1.9	1.7	
Delay (s)	51.3	31.1		48.4	18.0		60.1	47.0		48.5	45.8	
Level of Service	D	C		D	B		E	D		D	D	
Approach Delay (s)		32.9			20.0			52.1			46.4	
Approach LOS		C			C			D			D	
Intersection Summary												
HCM Average Control Delay			31.2			HCM Level of Service			C			
HCM Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			110.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			84.5%			ICU Level of Service			E			
Analysis Period (min)			15									
c - Critical Lane Group												

Option C

Queues

Year 2030 + Project PM

5: Discovery & Rush Drive

9/24/2013



Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	1665	361	1021	128	526
v/c Ratio	0.91	0.48	0.26	0.56	0.83
Control Delay	29.9	33.5	3.1	45.4	36.8
Queue Delay	0.0	0.0	0.4	0.0	0.0
Total Delay	29.9	33.5	3.6	45.4	36.8
Queue Length 50th (ft)	448	90	44	69	248
Queue Length 95th (ft)	#630	141	73	119	#424
Intersecting Link Dist (ft)	1853		224	311	
Turn Bay Length (ft)		156			
Base Capacity (vph)	1820	749	3972	315	631
Starvation Cap Reductn	0	0	2292	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.91	0.48	0.61	0.41	0.83

Intersection Summary

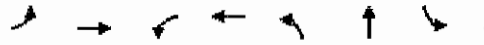
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Option C-

Queues
6: Discovery & Street A

Year 2030 + Project PM

9/24/2013



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SLB	SLT
Lane Group Flow (vph)	177	1776	79	1104	79	123	82	278
v/c Ratio	0.68	0.89	0.48	0.43	0.55	0.54	0.49	0.73
Control Delay	56.9	29.6	56.3	18.9	62.7	30.5	56.3	25.7
Queue Delay	0.3	130.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.2	159.6	56.3	18.9	62.7	30.5	56.3	25.7
Queue Length 50th (ft)	120	547	54	169	54	36	56	55
Queue Length 95th (ft)	183	#913	100	269	105	90	102	138
Internal Link Dist (ft)		224		600		277		880
Turn Bay Length (ft)	161		193				100	
Base Capacity (vph)	370	2000	290	2586	161	305	290	509
Starvation Cap Reductn	26	623	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	1.29	0.27	0.43	0.49	0.40	0.28	0.56

Intersection Summary

95th percentile volume exceeds capacity; queue may be longer.
Queue shown is maximum after two cycles.

Option C

University District Specific Plan

San Marcos

On – Site Traffic Study

ATTACHMENT 7

TABLE B

August 14, 2013

San Marcos - University Specific Plan Update

East Side - WITH TARGET OPTION - Queuing Analysis Worksheet - PM Peak Hour

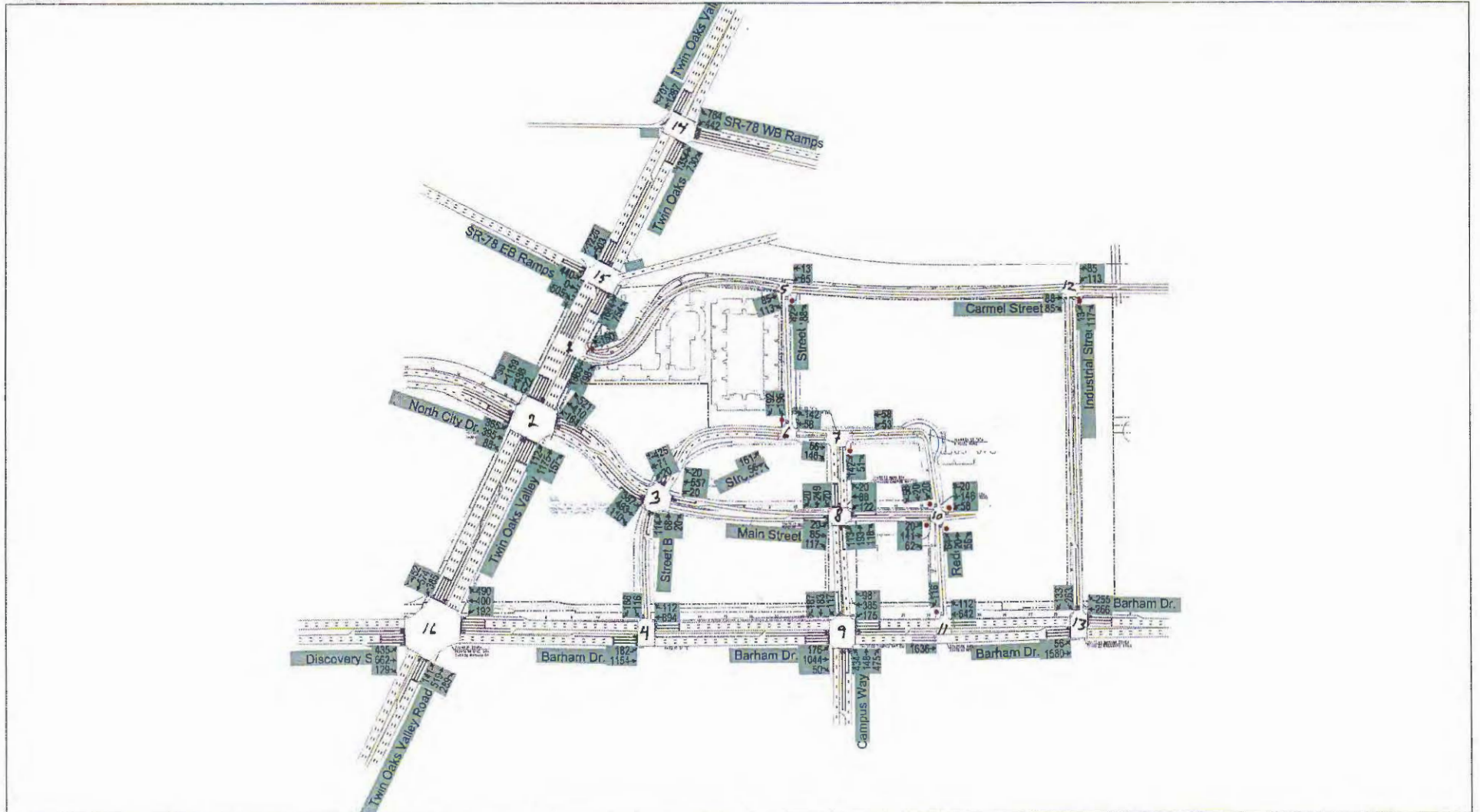
#	INTERSECTION	Control	Eastbound						Westbound						Northbound						Southbound					
			Left		Through		Right		Left		Through		Right		Left		Through		Right		Left		Through		Right	
			95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)
1	Twin Oaks Valley Rd. / Carmel St.	Right In / Out	---	---	---	---	---	---	---	---	---	---	150	Not Limited	---	---	---	---	---	---	---	---	---	---	---	---
2	Twin Oaks Valley Rd. / North City Dr.	Signalized	229	250	172	454	37	200	105	150	293	500	127	200	66	200	314	851	---	---	263	350	331	600	---	---
3	Main Street / Street B	Signalized	189	250	405	507	---	---	36	100	611	969	---	---	146	150	119	468	---	---	35	100	271	590	118	150
4	Barham Drive / Street B	Signalized	210	250	140	770	---	---	---	---	215	710	---	---	---	---	---	---	---	---	96	100	---	---	55	468
5	Carmel Street / Street C	Two-Way Stop	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
6	Street A / Street C	Two-Way Stop	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
7	Street A / Campus Way	Two-Way Stop	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
8	Main Street / Campus Way	Signalized	35	150	128	869	---	---	121	150	78	317	---	---	102	386*	177	390	---	---	35	100	84	244	---	---
9	Barham Dr. / Campus Way	Signalized	85	250	325	710	---	---	105	200	113	330	---	---	217	250	108	294	258	294	162	386*	230	386	---	---
10	Main Street / Redel Road	All-Way Stop	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
11	Barham Dr. / Redel Street	Right In / Out	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	116	200
12	Carmel Street / Industrial Street	Two-Way Stop	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
13	Barham Dr. / Industrial Street	Signalized	59	100	249	455	---	---	---	---	50	282	47	200	---	---	---	---	---	---	146	250	---	---	31	500+

Notes:

* Left Turn lane is trapped.

Volumes
Volumes

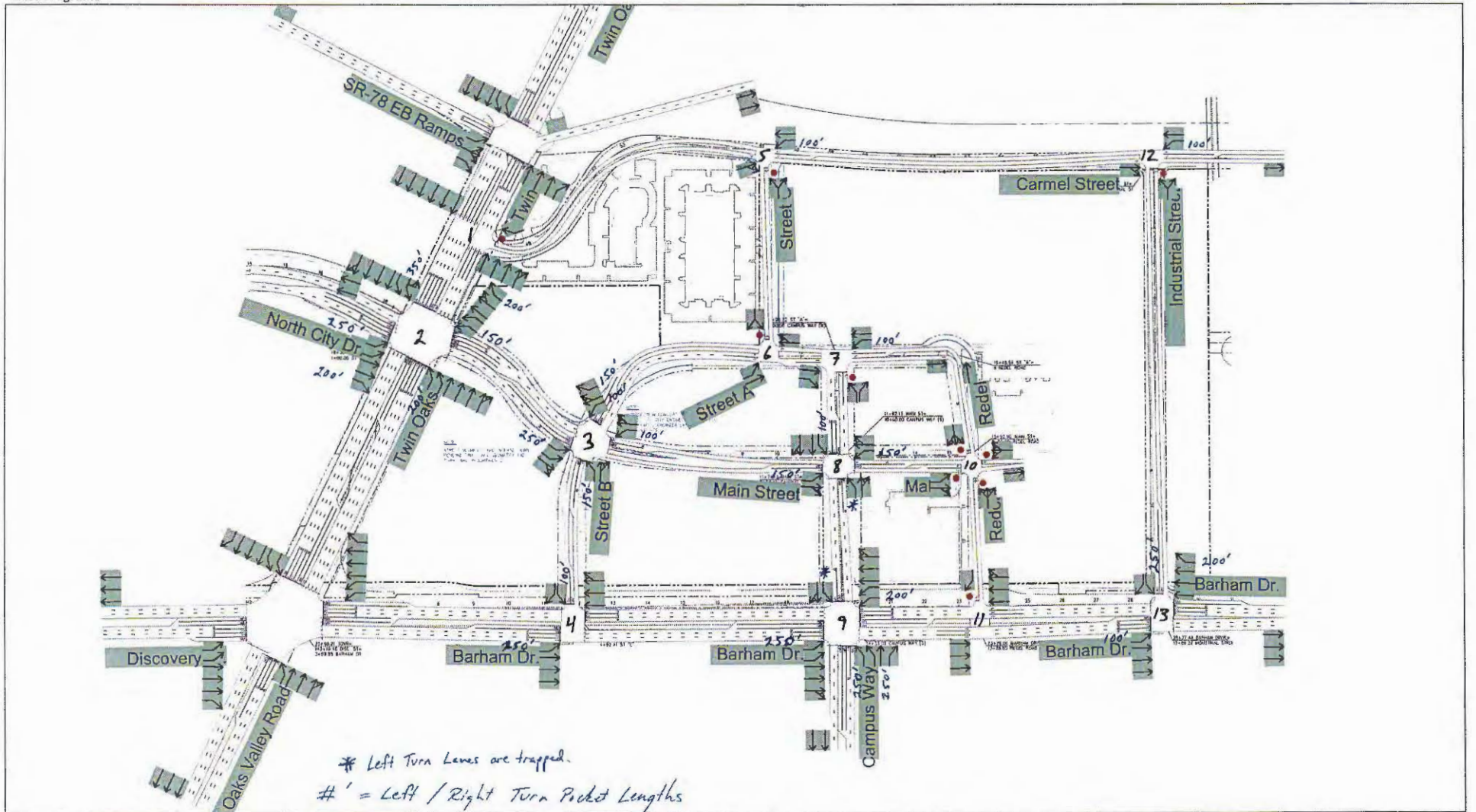
Map - \\Diskstation\projects\000406 University Place San Marcos\HCS\070213_With Target Option - East Side - PM\070213-Year 2030 with Project PM_version G.syn
8/7/2013

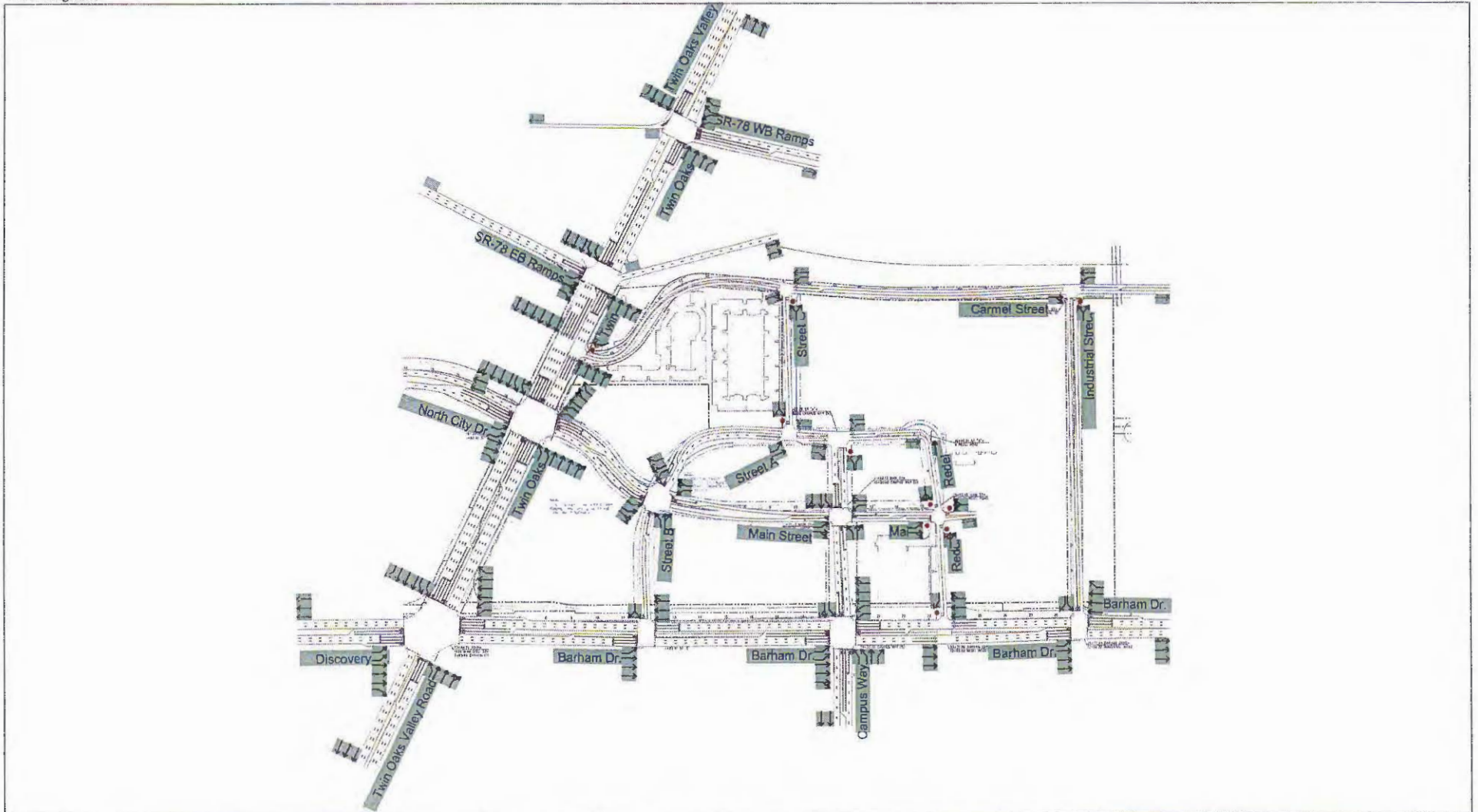


Baseline

\\Diskstation\projects\000406 University Place San Marcos\HCS\070213_With Target Option - East Side - PM\070213-Year 2030 with Project PM_version G.syn

B - 2/3





Queues
2: North City Dr. & Twin Oaks Valley Rd.

Year 2030 + Project PM
8/13/2013



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	384	416	93	173	673	307	118	1402	484	1315
v/c Ratio	0.86	0.40	0.17	0.59	0.77	0.56	0.50	0.73	0.84	0.51
Control Delay	69.8	34.4	6.4	61.3	42.4	12.0	52.7	45.2	64.8	27.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Total Delay	69.8	34.4	6.4	61.3	42.4	12.0	52.7	45.3	64.8	27.0
Queue Length 50th (ft)	151	135	0	167	235	38	46	240	179	155
Queue Length 95th (ft)	#229	172	37	105	293	127	m66	314	#263	331
Internal Link Dist (ft)		454			507			851		249
Turn Bay Length (ft)	225		200	150		200	200		350	
Base Capacity (vph)	458	1180	590	315	1005	602	241	1971	591	2603
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	12	0	61	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.84	0.35	0.16	0.65	0.67	0.51	0.49	0.73	0.82	0.51

Intersection Summary

- # 95th percentile volume exceeds capacity, queue may be longer.
- Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Queues

Year 2030 + Project PM

3: Main Street & Street B

8/13/2013



Lane Group	EB	WB	NB	SB
Lane Group Flow (vph)	407	635	21	607
v/c Ratio	0.79	0.66	0.24	0.90
Control Delay	48.4	19.4	48.8	43.6
Queue Delay	0.0	0.5	0.0	0.0
Total Delay	48.4	20.0	48.8	43.6
Queue Length 50th (ft)	117	217	12	312
Queue Length 95th (ft)	#189	405	36	#511
Internal Link Dist (ft)	507	669	466	590
Turn Bay Length (ft)	250	100	150	100
Base Capacity (vph)	540	1003	86	763
Starvation Cap Reductn	0	110	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.75	0.71	0.24	0.80

Intersection Summary

95th percentile volume exceeds capacity; queue may be longer.

Queue shown is maximum after two cycles.

Queues
4: Barham Dr. & Street B

Year 2030 + Project PM

8/13/2013



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	266	1207	1042	129	286
V/c Ratio	0.64	0.36	0.60	0.38	0.54
Control Delay	31.3	5.7	19.1	26.9	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	31.3	5.7	19.1	26.9	7.5
Queue Length 50th (ft)	87	53	106	43	0
Queue Length 95th (ft)	210	140	215	96	55
Internal Link Dist (ft)		770	710	466	
Turn Bay Length (ft)	250			100	
Base Capacity (vph)	535	4193	2256	914	956
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced V/c Ratio	0.45	0.29	0.46	0.14	0.80
Intersection Summary					

Queues
8: Main Street & Campus Way

Year 2030 + Project PM
8/13/2013



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT	SBL
Lane Group Flow (vph)	22	208	136	120	110	298	22	239
V/C Ratio	0.11	0.49	0.38	0.17	0.38	0.43	0.11	0.31
Control Delay	33.0	20.6	28.3	12.4	28.4	14.9	33.0	22.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.0	20.6	28.3	12.4	28.4	14.9	33.0	22.4
Queue Length 50th (ft)	7	40	39	19	32	53	7	34
Queue Length 95th (ft)	35	128	121	76	102	177	35	84
Internal Link Dist (ft)		669		317		386		244
Turn Bay Length (ft)	150		150				100	
Base Capacity (vph)	202	949	606	1221	565	1046	202	1598
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced V/C Ratio	0.11	0.22	0.22	0.10	0.19	0.28	0.11	0.15

Intersection Summary

Queues
9: Barham Dr. & Campus Way

Year 2030 + Project PM
8/13/2013



Lane Group	EBL	EBT	WBL	WBT	NBL	NET	NBR	SBL	SBR
Lane Group Flow (vph)	132	1216	194	537	482	164	528	130	335
V/C Ratio	0.41	0.82	0.64	0.37	0.78	0.28	0.80	0.68	0.75
Control Delay	40.4	32.9	48.6	21.8	43.1	22.0	23.4	56.0	35.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.4	32.9	48.6	21.8	43.1	22.0	23.4	56.0	35.9
Queue Length 50th (ft)	32	206	50	68	120	62	133	64	141
Queue Length 95th (ft)	65	#325	#105	113	#217	108	258	#162	230
Internal Link Dist (ft)		710		330		294			386
Turn Bay Length (ft)	255		200		250			175	
Base Capacity (vph)	344	522	301	1474	645	793	813	199	639
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced W/C Ratio	0.38	0.80	0.64	0.38	0.76	0.21	0.65	0.65	0.52

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer
Queue shown is maximum after two cycles.

Queues
13: Barham Dr. & Industrial Street

Year 2030 + Project PM
8/13/2013



Lane Group	EBL	EBT	WBT	WBF	SEB	SEB
Lane Group Flow (vph)	62	1756	296	283	292	148
v/c Ratio	0.29	0.61	0.13	0.32	0.59	0.27
Control Delay	29.1	9.8	11.7	3.6	22.3	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.1	9.8	11.7	3.6	22.3	4.5
Queue Length 50th (ft)	19	10	21	0	86	10
Queue Length 95th (ft)	59	249	50	47	146	31
Internal Link Dist (ft)		458	282		1282	
Turn Bay Length (ft)	100			200	250	
Base Capacity (vph)	227	3226	2314	874	874	938
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.64	0.13	0.32	0.30	0.13

Intersection Summary

TABLE

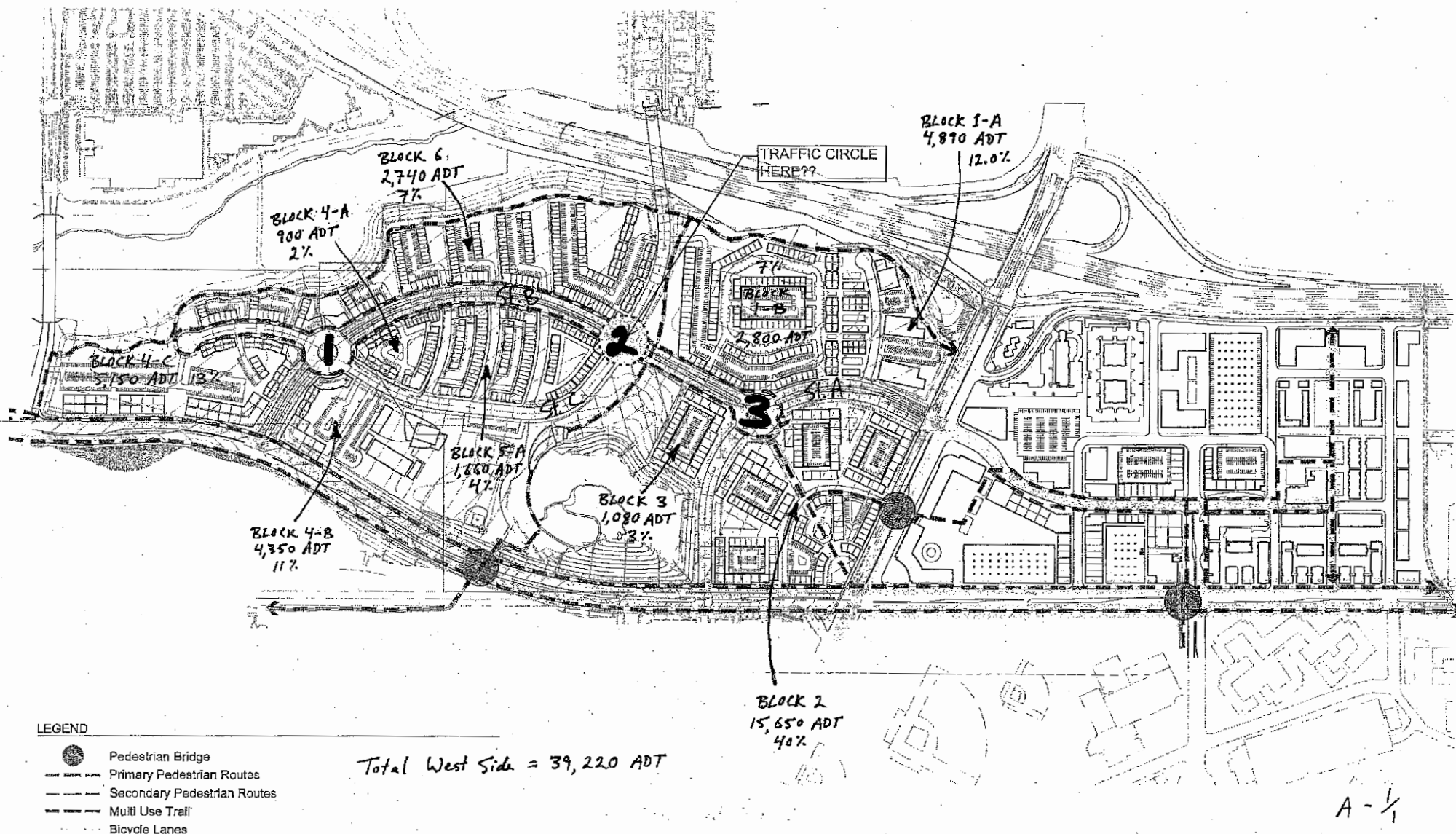
September 11, 2013

San Marcos - University Specific Plan Update

WEST SIDE - Queuing Analysis Worksheet - PM Peak Hour

San Marcos - University Specific Plan Update																																		
WEST SIDE - Queuing Analysis Worksheet - PM Peak Hour																																		
#	INTERSECTION	Control	Eastbound								Westbound								Northbound								Southbound							
			Left		Through		Right		Left		Through		Right		Left		Through		Right		Left		Through		Right									
			95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)	95th % Queue Per Lane (ft)	Storage Length Per Lane (ft)								
1	Street B / Street C	Roundabout	--	--	41	650	--	--	--	--	20	500	--	--	--	--	37	550	--	--	--	--	33	1400	--	--								
2	Street C / Street B	Roundabout	--	--	52	1400	--	--	--	--	87	600	--	--	--	--	35	500	--	--	--	--	73	500	--	--								
3	Street A / Street B	Roundabout	--	--	238	600	--	--	--	--	313	300	--	--	--	--	144	900	--	--	--	--	300	600	--	--								
4	Discovery / Street B	Signalized	88	150	535	831	--	--	37	150	288	282	--	--	--	--	71	221	--	--	--	--	116	150	97	489	--	--						
5	Discovery / Rush Dr.	Signalized	--	--	518	1353	--	--	210	250	141	250	--	--	117	311	--	--	--	--	--	--	--	--	--	--	--							
6	Discovery / Street A	Signalized	191	250	356	250	--	--	--	--	360	600	--	--	--	--	--	--	--	--	--	--	82	100	--	--	--	--						

Notes:



(veh/h)	x	(veh-h/h)	(pers-h/h)	(sec)	Rate		(ft)	(mph)	
West: Street C									
242	0.225	0.19	0.23	2.9	0.38	0.35	41	3.17	17.7
South: Street B									
214	0.202	0.13	0.15	2.1	0.39	0.28	37	2.40	17.7
East: Street C									
112	0.119	0.13	0.16	4.3	0.45	0.49	20	1.50	16.9
North: Street B									
194	0.188	0.07	0.08	1.3	0.40	0.21	33	3.50	19.1
ALL VEHICLES:									
762	0.225	0.52	0.63	2.5	0.40	0.32	41	10.57	18.1
INTERSECTION {persons}:									
914	0.225		0.63	2.5	0.40	0.32		10.57	18.1
Queue values in this table are 95% back of queue (feet).									

Table S.7 - Lane Performance

UC San Marcos
West Side Roundabout Analysis
Intersection ID: Int 1
Roundabout

Lane No.	Dem Flow (veh/h)	Cap (veh/h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Q u e u e 95% Back (veh)	(ft)	Lane Length (ft)
West: Street C								
1 LTR	242	1078	0.224	2.9	0.35	1.6	41.3	650.0
South: Street B								
1 LTR	214	1060	0.202	2.1	0.28	1.4	36.9	550.0
East: Street C								
1 LTR	112	943	0.119	4.3	0.49	0.8	19.9	500.0
North: Street B								
1 LTR	194	1033	0.188	1.3	0.21	1.3	33.2	1400.0

Table S.10 - Movement Capacity and Performance Summary

UC San Marcos
West Side Roundabout Analysis
Intersection ID: Int 1
Roundabout

Mov ID	Mov Type	Dem Flow (veh/h)	Total Cap. (veh/h)	Lane Util	Deg. Satn	Aver. Delay	Eff. Stop Rate	95% Back of Queue	Perf. Index
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(veh/h)	x	(veh-h/h)	(pers-h/h)	(sec)	Rate	(ft)	(mph)		
West: Street B									
240	0.273	0.26	0.31	3.8	0.58	0.51	51	5.24	18.5
South: Street C									
158	0.194	0.14	0.16	3.1	0.60	0.47	35	1.91	17.1
East: Street B									
441	0.397	0.23	0.27	1.9	0.46	0.28	87	5.14	17.8
North: Street C									
360	0.351	0.33	0.40	3.3	0.50	0.43	73	4.55	17.0
ALL VEHICLES:									
1199	0.397	0.95	1.14	2.9	0.52	0.39	87	16.85	17.8
INTERSECTION (persons):									
1439	0.397		1.14	2.9	0.52	0.39		16.85	17.8
Queue values in this table are 95% back of queue (feet).									

Table S.7 - Lane Performance

UC San Marcos
West Side Roundabout Analysis
Intersection ID: Int 2
Roundabout

Lane No.	Dem Flow (veh/h)	Cap (veh/h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Queue 95% Back (vehs)	Queue (ft)	Lane Length (ft)
West: Street B								
1 LTR	240	882	0.272	3.8	0.51	2.0	51.5	1400.0
South: Street C								
1 LTR	158	813	0.194	3.1	0.47	1.4	34.9	500.0
East: Street B								
1 LTR	441	1113	0.396	1.9	0.28	3.4	86.9	600.0
North: Street C								
1 LTR	360	1027	0.351	3.3	0.43	2.9	73.0	500.0

Table S.10 - Movement Capacity and Performance Summary

UC San Marcos
West Side Roundabout Analysis
Intersection ID: Int 2
Roundabout

Mov ID	Mov Type	Dem Flow (veh/h)	Total Cap. (veh/h)	Lane Util	Deg. Satn	Aver. Delay	Eff. Stop Rate	Queue 95% Back of Queue	Perf. Index
--------	----------	------------------	--------------------	-----------	-----------	-------------	----------------	-------------------------	-------------

(veh/h)	x	(veh-h/h)	{pers-h/h}	(sec)	Rate	(ft)	(mph)		
West: Street B									
518	0.714	1.72	2.07	12.0	0.93	1.16	250	12.44	14.0
South: Street A									
336	0.555	0.85	1.02	9.1	0.90	0.97	149	7.88	15.9
East: Street B									
607	0.791	2.11	2.53	12.5	0.99	1.23	331	13.51	11.3
North: Street A									
593	0.775	1.85	2.22	11.2	0.99	1.16	316	15.37	14.9
ALL VEHICLES:									
2054	0.791	6.53	7.83	11.4	0.96	1.15	331	49.19	14.1
INTERSECTION (persons):									
2465	0.791		7.83	11.4	0.96	1.15		49.19	14.1
Queue values in this table are 95% back of queue (feet).									

Table S.7 - Lane Performance

UC San Marcos
West Side Roundabout Analysis
Intersection ID: Int 3
Roundabout (150 ft. Dia)

Lane No.	Dem Flow (veh/h)	Cap (veh/h)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	Queue 95% Back (vehs)	Queue (ft)	Lane Length (ft)
West: Street B								
1 LTR	518	726	0.714	12.0	1.16	9.8	250.3	600.0
South: Street A								
1 LTR	336	605	0.555	9.1	0.97	5.9	149.3	900.0
East: Street B								
1 LTR	607	769	0.789	12.5	1.23	13.0	331.3	300.0
North: Street A								
1 LTR	593	766	0.774	11.2	1.16	12.4	316.0	800.0

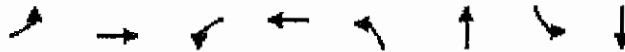
Table S.10 - Movement Capacity and Performance Summary

UC San Marcos
West Side Roundabout Analysis
Intersection ID: Int 3
Roundabout

Mov ID	Mov Typ	Dem Flow (veh/h)	Total Cap. (veh/h)	Lane Util	Deg. Satn	Aver. Delay	Eff. Stop Rate	95% Back of Queue	Perf. Index
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Queues
4: Discovery & Street B

Year 2030+Project PM
9/8/2013



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	78	1578	22	1234	22	84	87	156
V/c Ratio	0.40	0.76	0.20	0.70	0.16	0.32	0.47	0.38
Control Delay	41.6	16.3	43.0	18.3	40.5	29.1	45.8	20.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.6	16.3	43.0	18.3	40.5	29.1	45.8	20.8
Queue Length 50th (ft)	34	222	10	229	10	29	39	33
Queue Length 95th (ft)	88	#535	37	380	36	71	#116	97
Internal Link Dist (ft)		831		1853		221		489
Turn Bay Length (ft)	150		150				150	
Base Capacity (vph)	223	2367	111	2189	139	519	195	581
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced V/c Ratio	0.35	0.67	0.20	0.56	0.16	0.16	0.45	0.27

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
5: Discovery & Rush Drive

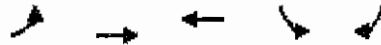
Year 2030+Project PM
9/8/2013



Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	1665	222	1128	128	526
V/C Ratio	0.90	0.66	0.42	0.53	0.87
Control Delay	26.3	42.6	4.1	41.7	40.3
Queue Delay	0.0	0.0	1.2	0.0	0.0
Total Delay	26.3	42.6	5.3	41.7	40.3
Queue Length 50th (ft)	383	108	80	63	244
Queue Length 95th (ft)	#618	#210	141	117	#418
Internal Link Dist (ft)	1853		224	311	
Turn Bay Length (ft)		250			
Base Capacity (vph)	1876	344	2752	387	609
Starvation Cap Reductn	0	0	1306	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced V/C Ratio	0.89	0.65	0.78	0.33	0.86

Intersection Summary

95th percentile volume exceeds capacity queue may be longer
Queue shown is maximum after two cycles.



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	233	1828	1166	87	293
v/c Ratio	0.61	0.71	0.74	0.33	0.61
Control Delay	34.0	7.4	19.2	32.5	10.1
Queue Delay	0.1	0.6	0.0	0.0	0.0
Total Delay	34.1	8.0	19.2	32.5	10.1
Queue Length 50th (ft)	86	152	188	33	0
Queue Length 95th (ft)	191	356	360	82	65
Internal Link Dist (ft)		224	600	880	
Turn Bay Length (ft)	250			100	
Base Capacity (vph)	558	3128	2095	558	699
Starvation Cap Reductn	19	810	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.43	0.79	0.56	0.16	0.42
Intersection Summary					

University District Specific Plan

San Marcos

On – Site Traffic Study

ATTACHMENT 8

TABLE A

**Updated Year 2030 with Project Intersection Levels of Service
University District Specific Plan - San Marcos**

August 14, 2013

Number	Intersection	Control	PM Peak Hour	
			Delay	LOS
1	Twin Oaks Valley Road / Carmel Street	Right In / Right Out	0.46*	A*
2	Twin Oaks Valley Road / North City Drive	Signalized (With U-turns)	42.3	D
3	Main Street / Street "B"	Signalized	34.1	C
4	Barham Drive / Street "B"	Signalized	13.1	B
5	Carmel Street / Street "C"	Two-Way Stop	4.8	A
6	Street "A" / Street "C"	Two-Way Stop	13.2	B
7	Street "A" / Campus Way	Two-Way Stop	4.2	A
8	Main Street / Campus Way	Signalized	30.6	C
9	Barham Dr. / Campus Way	Signalized	31.2	C
10	Main Street / Redel Road	All Way Stop	9.9	A
11	Barham Drive / Redel Road	Right In / Right Out	10.9	B
12	Carmel Street / Industrial Street	Two-Way Stop	4.4	A
13	Barham Dr. / Industrial Street	Signalized	10.2	B
14	Twin Oaks Valley Road / SR-78 WB Ramps	Signalized	17.2	B
15	Twin Oaks Valley Road / SR-78 EB Ramps	Signalized	28.3	C
16	Twin Oaks Valley Road / Barham Dr/Discovery	Signalized	45.3	D

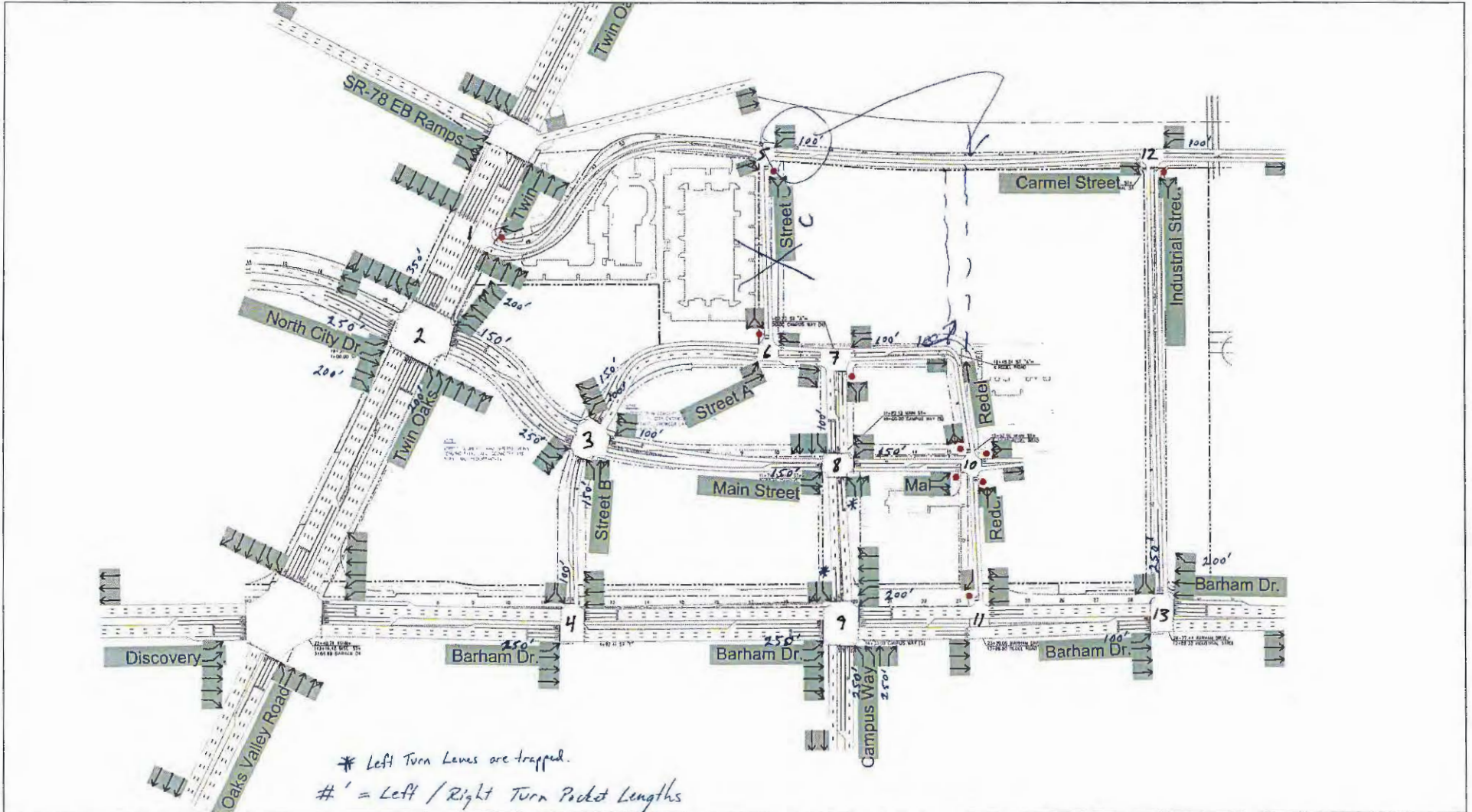
Notes:

LOS = Level of Service

* Intersection Capacity Utilization Calculation

Cycle Length analyzed on Twin Oaks Valley Road is 120 seconds.

Highlighted delays changed slightly from previous analysis dated 8/7/2013 based on RBF's comments.



HCM Signalized Intersection Capacity Analysis 2: North City Dr. & Twin Oaks Valley Rd.

Year 2030 + Project PM
8/13/2013

Movement	FBI	FBI	FBR	WBI	WBI	WBR	NBI	NBI	NBR	SBU	SBI	SBI
Lane Configurations												
Volume (vph)	365	395	88	164	410	521	112	1175	157	22	438	1159
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Los time (s)	4.0	4.5	4.5	4.0	4.0	4.0	4.0	4.5			4.0	4.5
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91	0.91	0.97	0.86			0.97	0.86
Flt Protected	1.00	1.00	0.85	1.00	0.95	0.85	1.00	0.98			1.00	0.99
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd Flow (prot)	3433	3539	1588	3433	3208	1441	3433	5295			3433	6338
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00
Satd Flow (perm)	3433	3539	1588	3433	3208	1441	3433	5295			3433	6338
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj Flow (vph)	384	416	93	173	432	548	118	1287	165	23	461	1220
RTOR Reduction (vph)	0	0	66	0	60	186	0	19	0	0	0	9
Lane Group Flow (vph)	384	416	27	173	613	121	118	1383	0	0	484	1306
Turn Type	Prot		Perm	Prot		Perm	Prot				Prot	Prot
Protected Phases	5	3	2	5	3	2	3	3				
Permitted Phases			2			6						
Actuated Green, G (s)	15.7	35.4	35.4	10.3	30.5	30.5	8.2	37.2			20.1	49.1
Effective Green, g (s)	15.7	35.4	35.4	10.3	30.5	30.5	8.2	37.2			20.1	49.1
Actuated g/C Ratio	0.13	0.39	0.30	0.09	0.25	0.25	0.07	0.31			0.17	0.41
Clearance Time (s)	4.0	4.5	4.5	4.0	4.0	4.0	4.0	4.5			4.0	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	449	1044	487	295	815	366	235	1951			575	2593
v/s Ratio Prot	0.11	0.42		0.05	0.19		0.03	0.22			0.14	0.21
v/s Ratio Perm			0.02			0.08						
v/c Ratio	0.86	0.40	0.06	0.59	0.75	0.33	0.50	0.71			0.84	0.50
Uniform Delay, d1	51.0	33.8	30.3	52.8	41.3	36.4	53.9	36.6			48.4	26.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.18			1.08	0.98
Incremental Delay, d2	14.7	0.3	0.1	3.0	4.0	0.5	1.1	1.5			9.6	0.6
Delay (s)	65.7	34.0	30.4	55.8	45.2	37.0	55.0	38.1			58.0	27.0
Level of Service	E	C	C	E	D	D	D	D			E	C
Approach Delay (s)		47.3			44.6			45.0				35.9
Approach LOS		D			D			D				D
Intersection Summary												
HCM Average Control Delay	42.3			HCM Level of Service			D					
HCM Volume to Capacity Ratio	0.77											
Actuated Cycle Length (s)	120.0			Sum of lost time (s)			16.5					
Intersection Capacity Utilization	78.4%			ICU Level of Service			D					
Analysis Period (min)	15											
Critical Lane Group												

Waveshift	SBR
Lane Configurations	
Volume (vph)	90
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Flt Protected	
Satd Flow (prot)	
Flt Permitted	
Satd Flow (perm)	
Peak-hour factor, PHF	0.95
Adj Flow (vph)	95
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM Signalized Intersection Capacity Analysis 16: Discovery St. & Twin Oaks Valley Road

Year 2030 + Project PM

8/13/2013

														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Volume (vph)	435	662	129	192	400	490	141	519	289	385	574	452		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	1.00	0.91		0.97	0.91	1.00		
Flt Protected	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85		
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		
Satd Flow (prot)	3433	5085	1583	3433	5085	1583	1770	4813		3433	5085	1583		
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00		
Satd Flow (perm)	3433	5085	1583	3433	5085	1583	1770	4813		3433	5085	1583		
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90		
Adj Flow (vph)	483	733	143	213	444	544	157	577	321	428	638	502		
RTOR Reduction (vph)	0	0	98	0	0	226	0	76	0	0	0	265		
Lane Group Flow (vph)	483	733	143	213	444	544	157	577	321	428	638	502		
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm		
Protected Phases	7			3			5			1				
Permitted Phases			4			8						6		
Actuated Green, G (s)	20.1	37.6	37.6	11.4	28.9	28.9	14.1	36.6		18.4	40.9	40.9		
Effective Green, g (s)	20.1	37.6	37.6	11.4	28.9	28.9	14.1	36.6		18.4	40.9	40.9		
Actuated g/C Ratio	0.17	0.31	0.31	0.10	0.24	0.24	0.12	0.30		0.15	0.34	0.34		
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		
Lane Grp Cap (vph)	575	1593	496	328	1225	381	208	1468		526	1733	540		
V/s Ratio Prot	0.14	0.14		0.06	0.09		0.09	0.17		0.12	0.13			
V/s Ratio Perm			0.03			0.20						0.15		
V/c Ratio	0.84	0.46	0.09	0.65	0.36	0.83	0.75	0.56		0.81	0.37	0.44		
Uniform Delay, d1	48.4	33.1	29.1	52.4	37.9	43.3	51.3	35.0		49.1	29.8	30.7		
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.37	0.86	1.57		
Incremental Delay, d2	10.7	0.2	0.1	4.6	0.2	14.5	14.4	1.5		8.5	0.5	2.3		
Delay (s)	59.0	33.3	29.2	57.0	38.1	57.7	65.7	36.5		57.9	30.3	33.0		
Level of Service	E	C	C	E	D	E	E	D		E	C	D		
Approach Delay (s)		42.0			60.3			40.8			47.4			
Approach LOS		D			D			D			D			
Intersection Summary														
HCM Average Control Delay						45.3	HCM Level of Service					D		
HCM Volume to Capacity ratio						0.73								
Actuated Cycle Length (s)						120.0	Sum of lost time (s)					16.0		
Intersection Capacity Utilization						89.2%	ICU Level of Service					C		
Analysis Period (min)	15													
of Critical Lane Group	5													

HCM Signalized Intersection Capacity Analysis 14: SR-78 WB Ramps & Twin Oaks Valley Rd.

Year 2030 + Project PM

8/13/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBR	SBR
												
Lane Configurations				TT		TT		TTT	T		TTT	T
Volume (vph)	0	0	0	442	0	764	0	1354	730	0	1287	707
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.6		4.6		5.3	5.3		5.3	5.3
Lane Util. Factor				0.97		0.88		0.91	1.00		0.91	1.00
Flt				1.00		0.85		1.00	0.85		1.00	0.85
Flt Protected				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				3433		2787		5085	1583		5085	1583
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				3433		2787		5085	1583		5085	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	491	0	849	0	1501	811	0	1430	786
RTOR Reduction (vph)	0	0	0	0	0	23	0	0	0	0	0	345
Lane Group Flow (vph)	0	0	0	491	0	826	0	1604	811	0	1430	1411
Turn Type				custom		custom		custom				Perm
Protected Phases								2				6
Permitted Phases				8		8			2 8			6
Actuated Green, G (s)				42.7		42.7		67.4	120.0		67.4	67.4
Effective Green, g (s)				42.7		42.7		67.4	115.4		67.4	67.4
Actuated g/C Ratio				0.36		0.36		0.56	0.96		0.56	0.56
Clearance Time (s)				4.6		4.6		5.3			5.3	5.3
Vehicle Extension (s)				3.0		3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				1222		992		2856	1522		2856	889
v/s Ratio Prot								0.30			0.28	
v/s Ratio Perm				0.14		0.30			0.51			0.28
v/c Ratio				0.40		0.83		0.53	0.53		0.50	0.50
Uniform Delay, d1				29.1		35.4		16.4	0.2		16.0	16.0
Progression Factor				1.00		1.00		0.52	1.00		1.00	1.00
Incremental Delay, d2				0.2		6.1		0.4	0.2		0.6	2.0
Delay (s)				29.3		41.5		16.9	0.4		16.7	18.0
Level of Service				C		D		A	A		B	B
Approach Delay (s)		0.0			37.0			5.9			17.1	17.1
Approach LOS		A			D			A			B	B
Intersection Summary												
HCM Average Control Delay	17.2			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.66											
Actuated Cycle Length (s)	120.0			Sum of lost time (s)			9.9					
Intersection Capacity Utilization	61.1%			ICU Level of Service			B					
Analysis Period (min)	15											
c - Critical Lane Group												

HCM Signalized Intersection Capacity Analysis 15: SR-78 EB Ramps & Twin Oaks Valley Rd.

Year 2030 + Project PM

8/13/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	440	0	505	0	0	0	0	1644	754	503	1226	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.6	4.6	4.6					5.3	5.3	4.2	5.3	
Lane Util. Factor	0.95	0.91	0.95					0.91	1.00	0.97	0.91	
Eff.	1.00	0.90	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.98	1.00					1.00	1.00	0.95	1.00	
Satd Flow (prot)	1681	1506	1504					5085	1583	3433	5085	
Flt Permitted	0.95	0.98	1.00					1.00	1.00	0.95	1.00	
Satd Flow (perm)	1681	1506	1504					5085	1583	3433	5085	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj Flow (vph)	489	0	561	0	0	0	0	1827	838	559	1362	0
RTOR Reduction (vph)	0	39	39	0	0	0	0	0	4	0	0	0
Lane Group Flow (vph)	362	312	298	0	0	0	0	1827	884	559	1362	0
Turn Type	Split		Perm						custom		Prot	
Protected Phases	4	4						2			6	
Permitted Phases			4						2 4			
Actuated Green, G (s)	34.2	34.2	34.2					49.9	89.4	21.8	75.9	
Effective Green, g (s)	34.2	34.2	34.2					49.9	89.4	21.8	75.9	
Actuated g/C Ratio	0.29	0.29	0.29					0.42	0.74	0.18	0.63	
Clearance Time (s)	4.6	4.6	4.6					5.3		4.2	5.3	
Vehicle Extension (s)	3.0	3.0	3.0					3.0		3.0	3.0	
Lane Grp Cap (vph)	479	429	429					2115	1179	624	3216	
v/s Ratio Prot	0.22	0.21						c0.36		c0.16	0.27	
v/s Ratio Perm			0.20						c0.53			
v/c Ratio	0.76	0.73	0.69					0.86	0.71	0.90	0.42	
Uniform Delay, d1	39.1	38.7	38.2					32.0	8.2	48.0	11.1	
Progression Factor	1.00	1.00	1.00					0.80	0.44	1.26	0.76	
Incremental Delay, d2	6.7	6.0	4.8					4.4	1.7	14.2	0.4	
Delay (s)	45.8	44.7	43.0					26.9	5.3	74.7	8.7	
Level of Service	D	D	D					C	A	E	A	
Approach Delay (s)		44.5		0.0				22.2			27.9	
Approach LOS		D		A				C			C	
Intersection Summary												
HCM Average Control Delay			28.3	HCM Level of Service				C				
HCM Volume to Capacity Ratio			0.80									
Actuated Cycle Length (s)			120.0	Sum of lost time (s)				9.5				
Intersection Capacity Utilization			90.1%	ICU Level of Service				E				
Analysis Period (min)			15									
Critical Lane Group												

University District Specific Plan

San Marcos

On – Site Traffic Study

ATTACHMENT 9

