

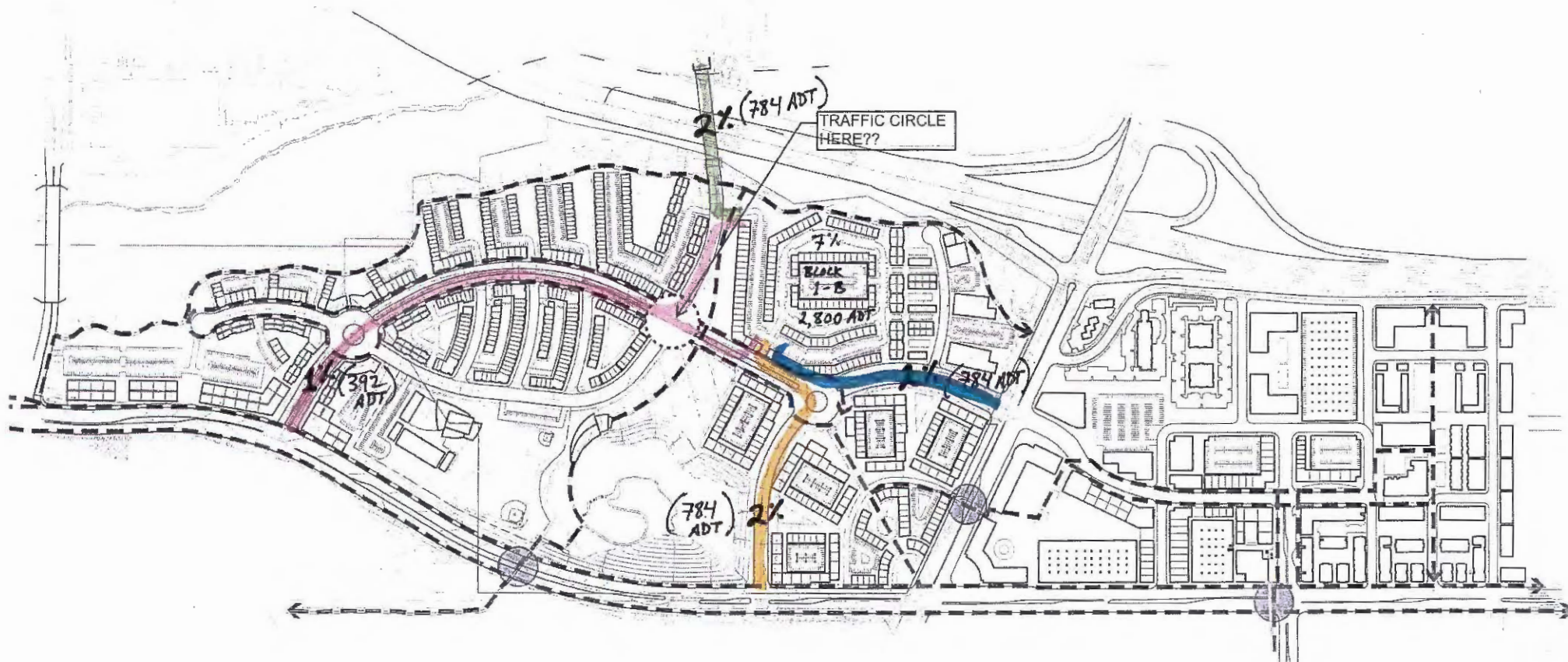


LEGEND

-  Pedestrian Bridge
-  Primary Pedestrian Routes
-  Secondary Pedestrian Routes
-  Multi Use Trail
-  Bicycle Lanes

BLOCK 1-A → 4,890 ADT

B 1/9



LEGEND

-  Pedestrian Bridge
-  Primary Pedestrian Routes
-  Secondary Pedestrian Routes
-  Multi Use Trail
-  Bicycle Lanes

BLOCK 1-B ⇒ 2,800 ADT

B 2/9



LEGEND

-  Pedestrian Bridge
-  Primary Pedestrian Routes
-  Secondary Pedestrian Routes
-  Multi Use Trail
-  Bicycle Lanes

BLOCK 2 → 15,650 ADT

BLOCK 2
15,650 ADT
40%

B 3/4

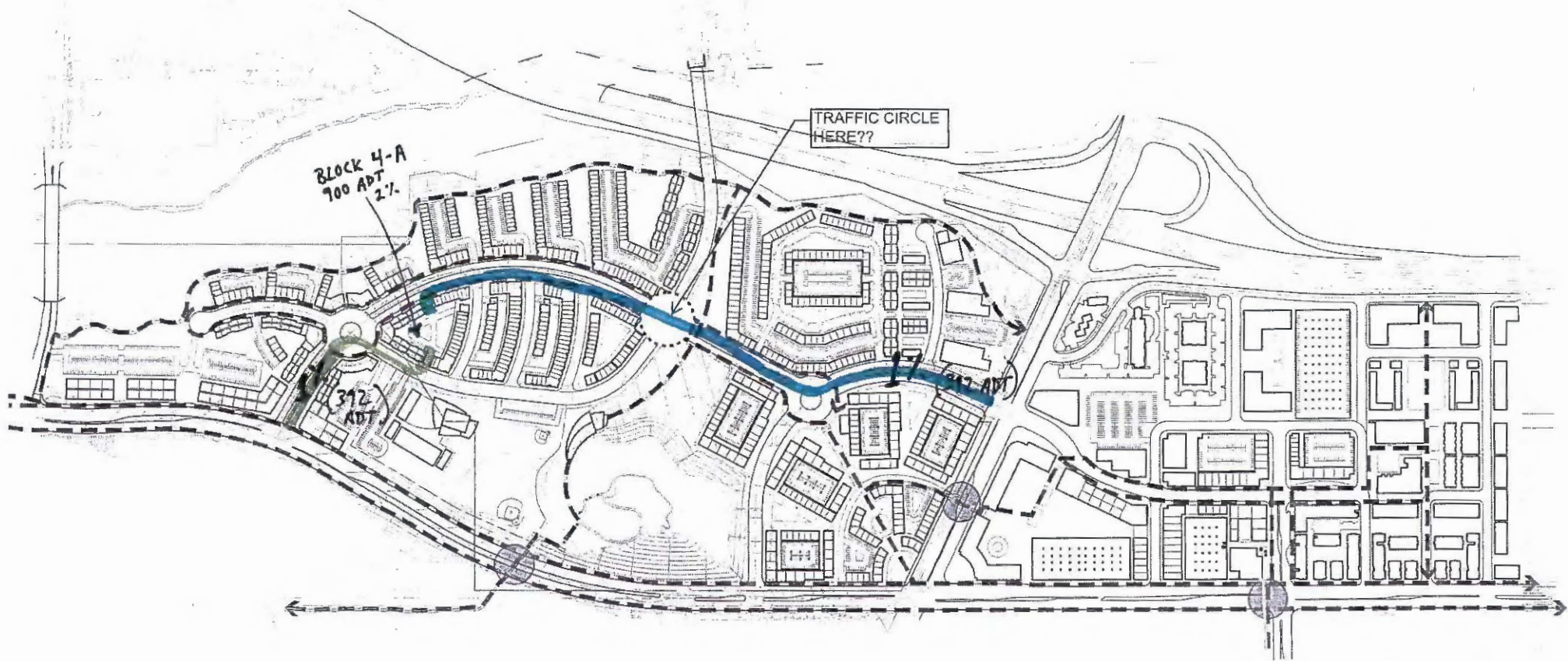


LEGEND

-  Pedestrian Bridge
-  Primary Pedestrian Routes
-  Secondary Pedestrian Routes
-  Multi Use Trail
-  Bicycle Lanes

BLOCK 3 → 1,080 ADT

B 4/9

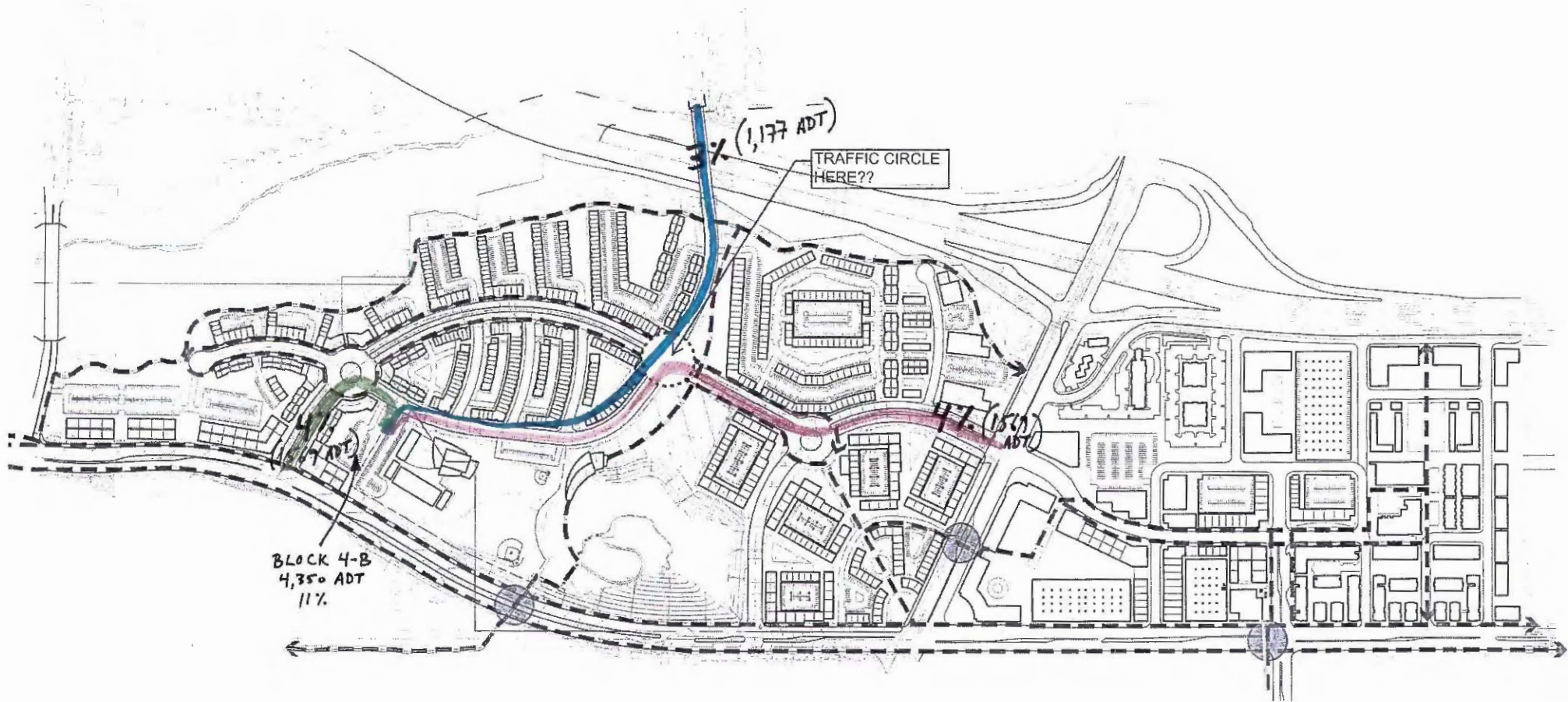


LEGEND

- Pedestrian Bridge
- Primary Pedestrian Routes
- Secondary Pedestrian Routes
- Multi Use Trail
- Bicycle Lanes

BLOCK 4-A $\Rightarrow$ 900 ADT

B 5/9



LEGEND

-  Pedestrian Bridge
-  Primary Pedestrian Routes
-  Secondary Pedestrian Routes
-  Multi Use Trail
-  Bicycle Lanes

BLOCK 4-B ⇒ 4,350 ADT

B 6/9

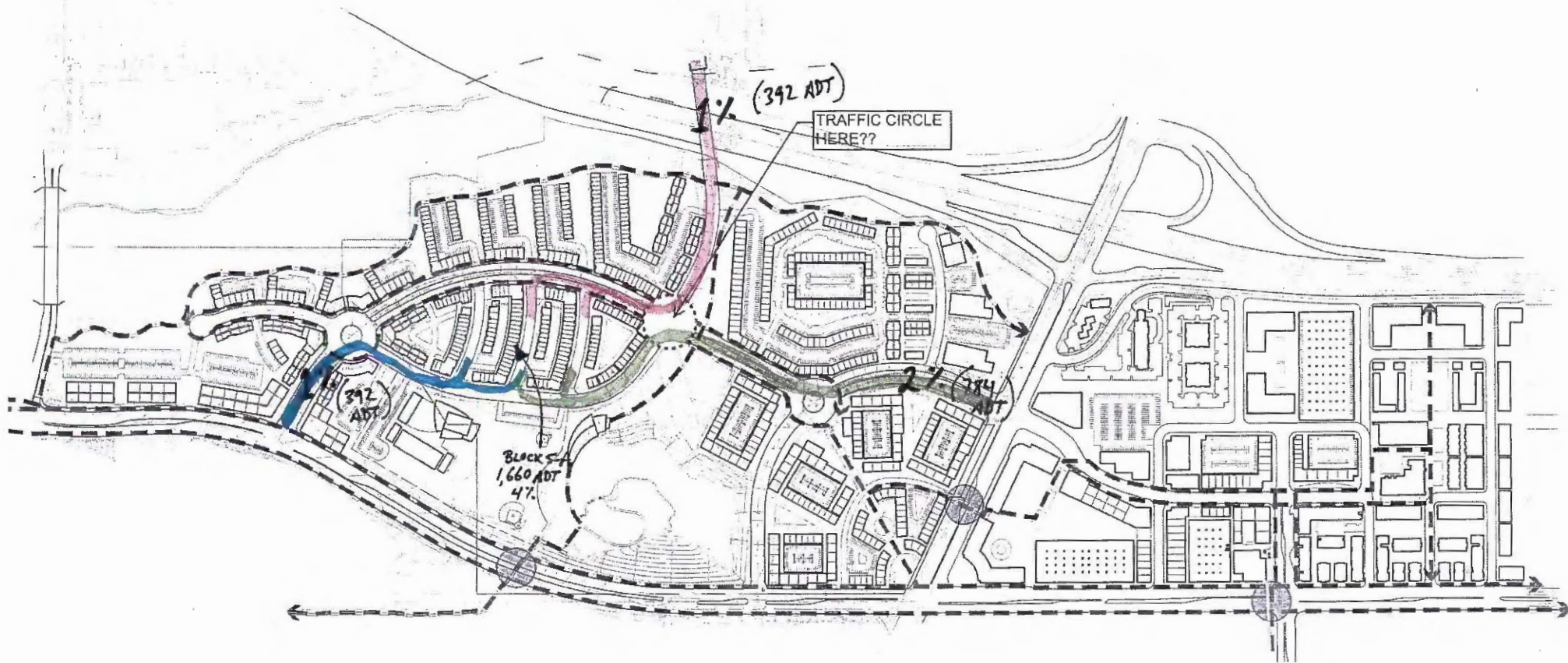


LEGEND

-  Pedestrian Bridge
-  Primary Pedestrian Routes
-  Secondary Pedestrian Routes
-  Multi Use Trail
-  Bicycle Lanes

BLOCK 4-C ⇒ 5,150 ADT

B 7/9

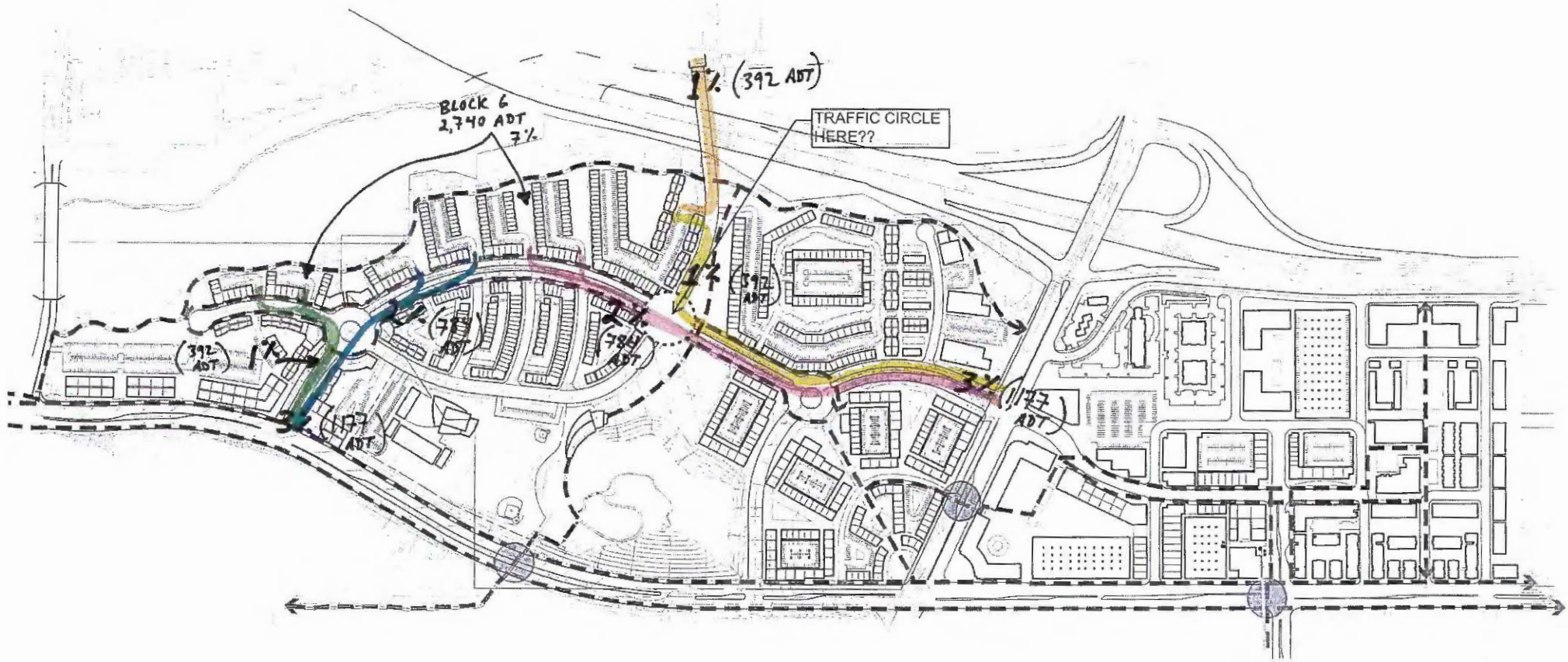


LEGEND

-  Pedestrian Bridge
-  Primary Pedestrian Routes
-  Secondary Pedestrian Routes
-  Multi Use Trail
-  Bicycle Lanes

BLOCK S-A → 1,660 ADT

B 8/9



LEGEND

- Pedestrian Bridge
- Primary Pedestrian Routes
- Secondary Pedestrian Routes
- Multi Use Trail
- Bicycle Lanes

BLOCK 6 ⇒ 2,740 ADT

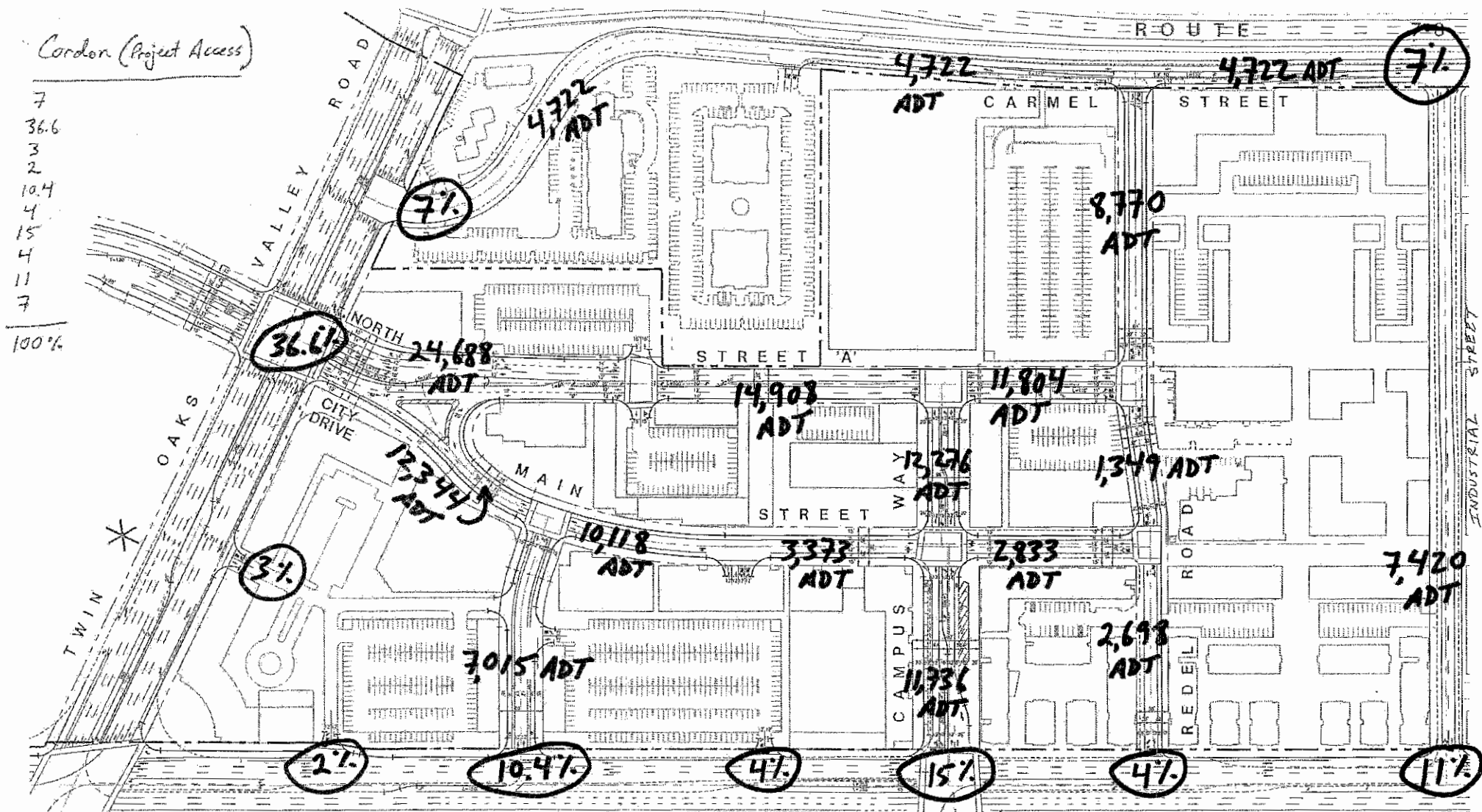
B 9/9

University District Specific Plan

San Marcos

On – Site Traffic Study

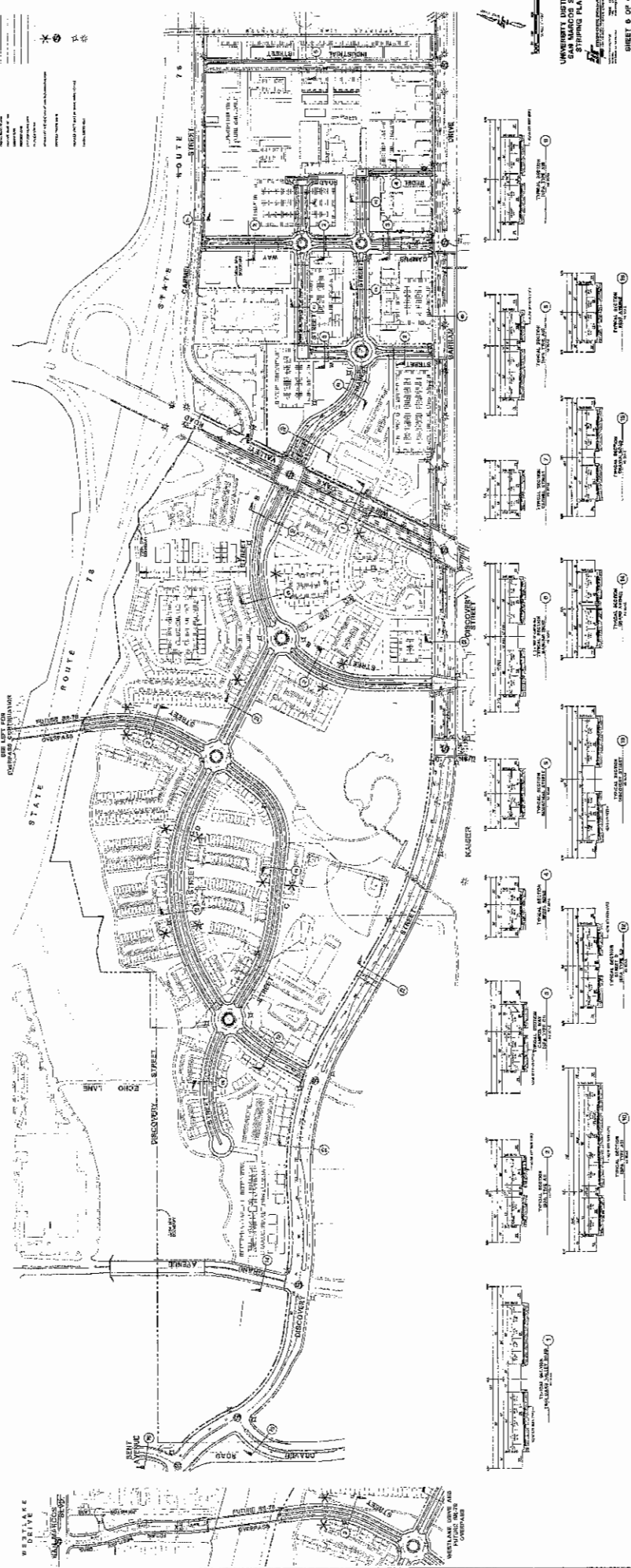
ATTACHMENT 4



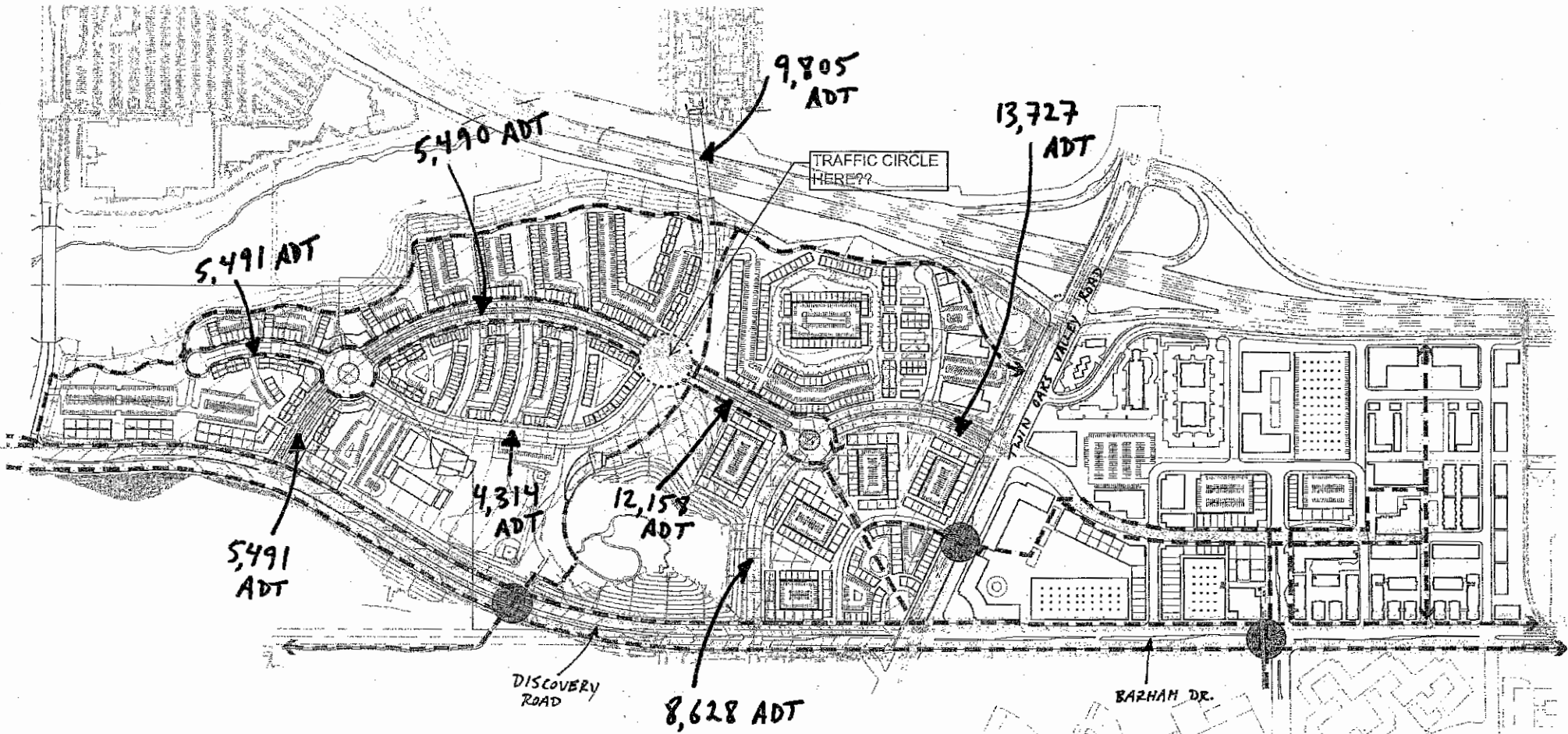
EAST SIDE - WITH TARGET
ADT Volumes + Access Point %

June 19, 2013

UNIVERSITY DISTRICT SAN MARCOS SPECIFIC PLAN AMENDMENT
STRIPING PLAN EXHIBIT



3 f 2



LEGEND

- Pedestrian Bridge
- Primary Pedestrian Routes
- - - Secondary Pedestrian Routes
- - - Multi Use Trail
- - - Bicycle Lanes

Average Daily Traffic (ADT) on West Side

C-1/1

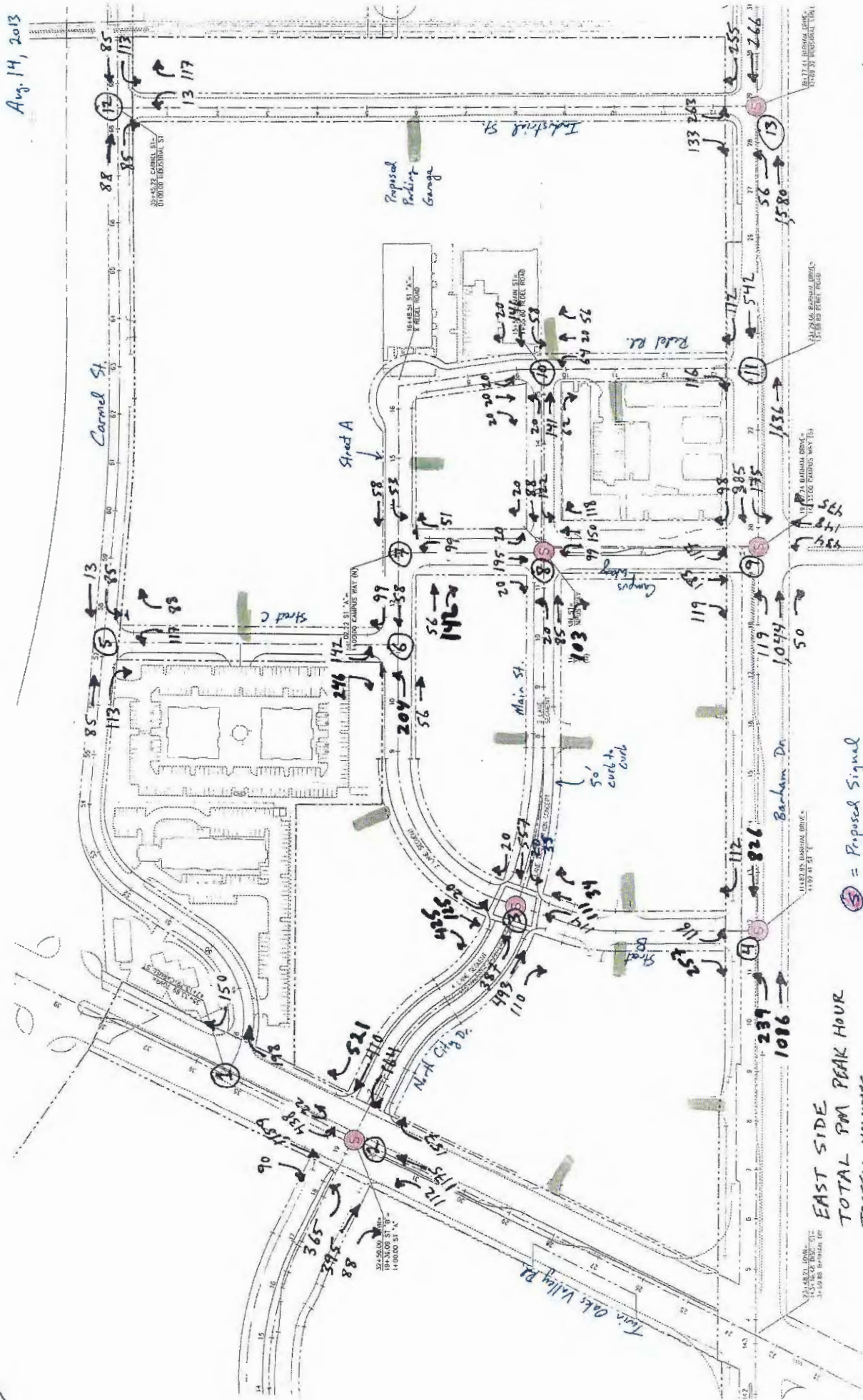
University District Specific Plan

San Marcos

On – Site Traffic Study

ATTACHMENT 5

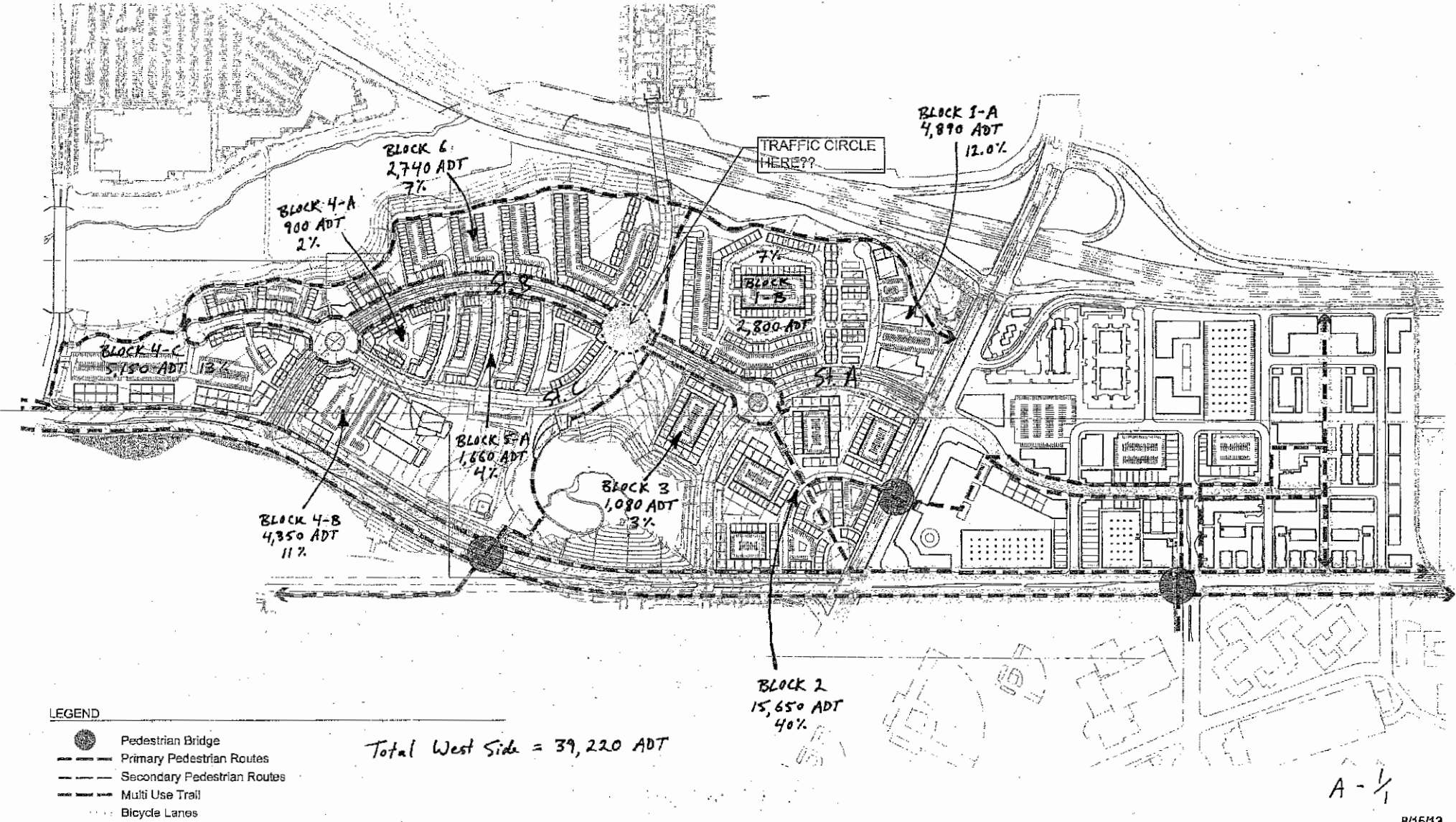
Aug. 14, 2013

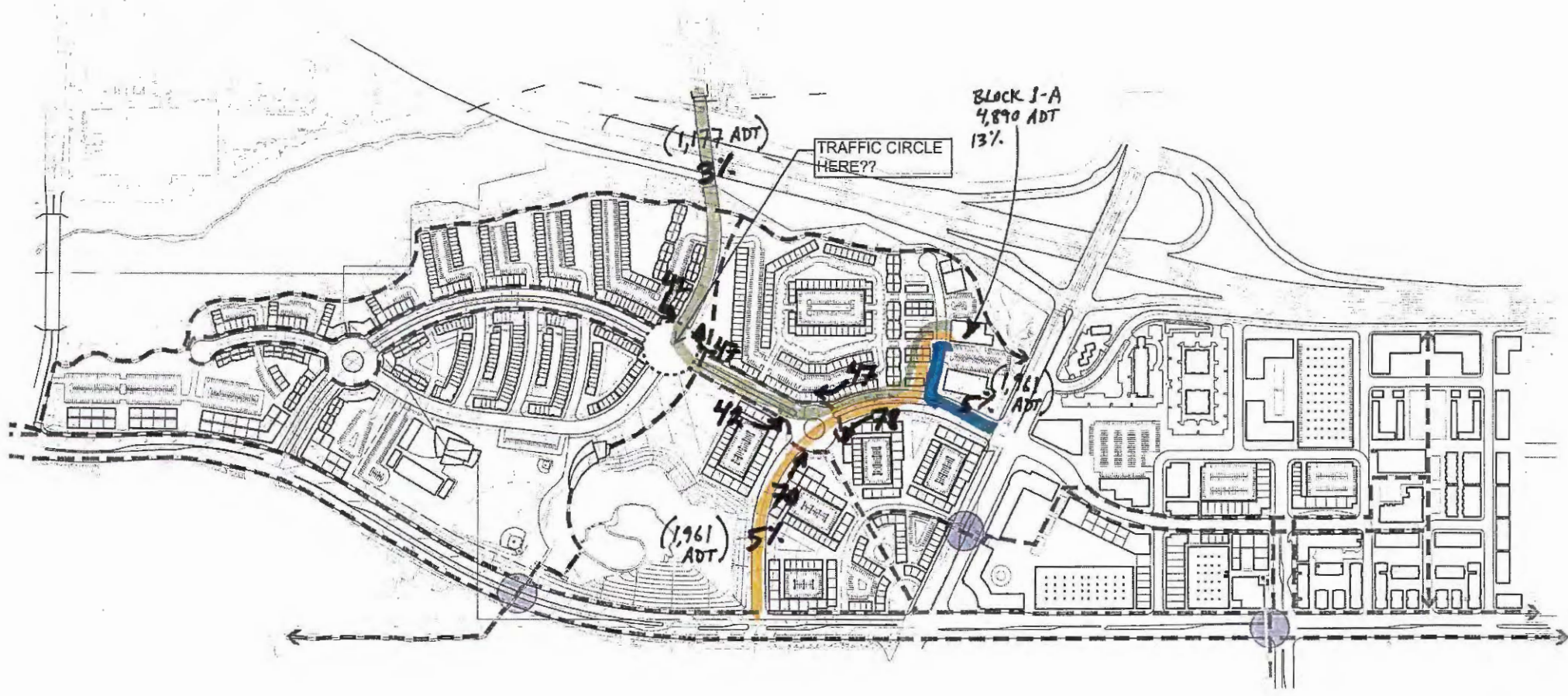


EAST SIDE
TOTAL PM PEAK HOUR
TRAFFIC VOLUMES

Aug. 14, 2013

B-1/3





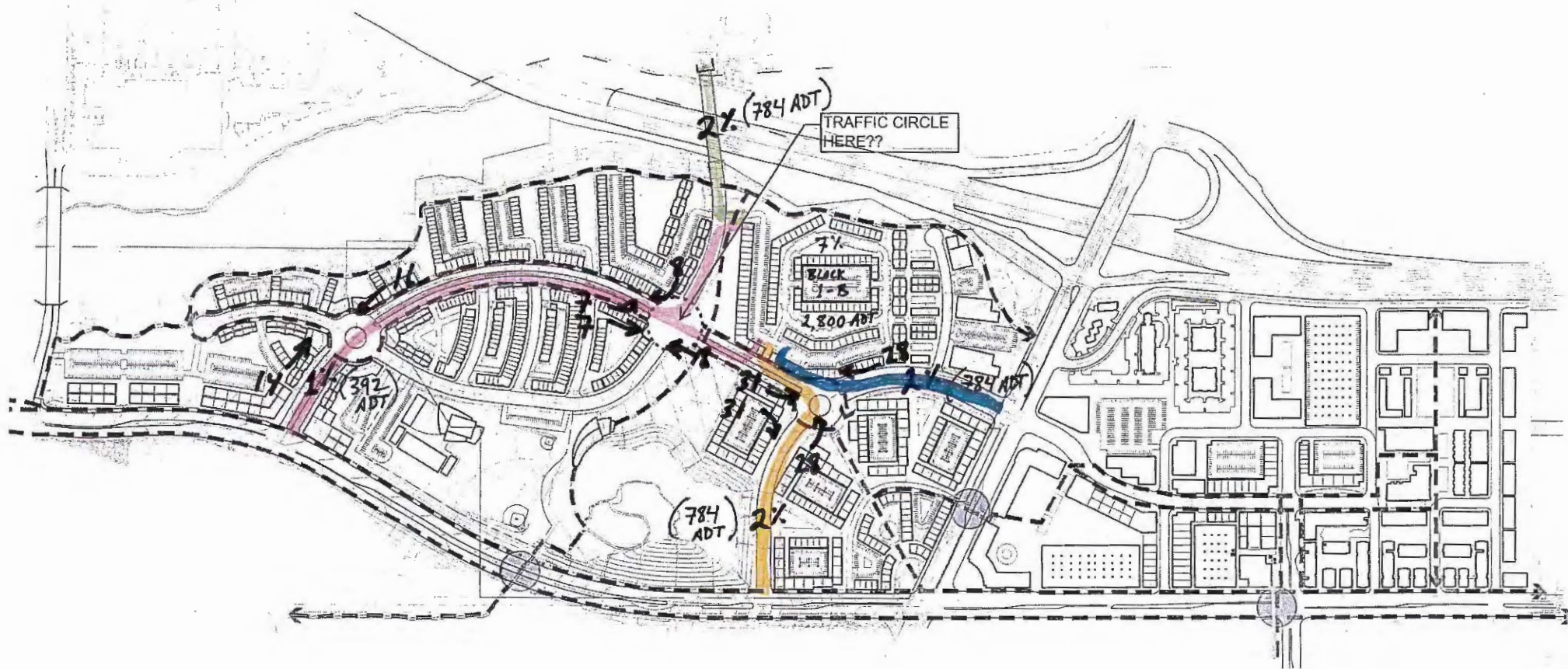
LEGEND

-  Pedestrian Bridge
-  Primary Pedestrian Routes
-  Secondary Pedestrian Routes
-  Multi Use Trail
-  Bicycle Lanes

BLOCK 1-A → 4,890 ADT

PM In = 1,398
PM Out = 1,554

B 1/9



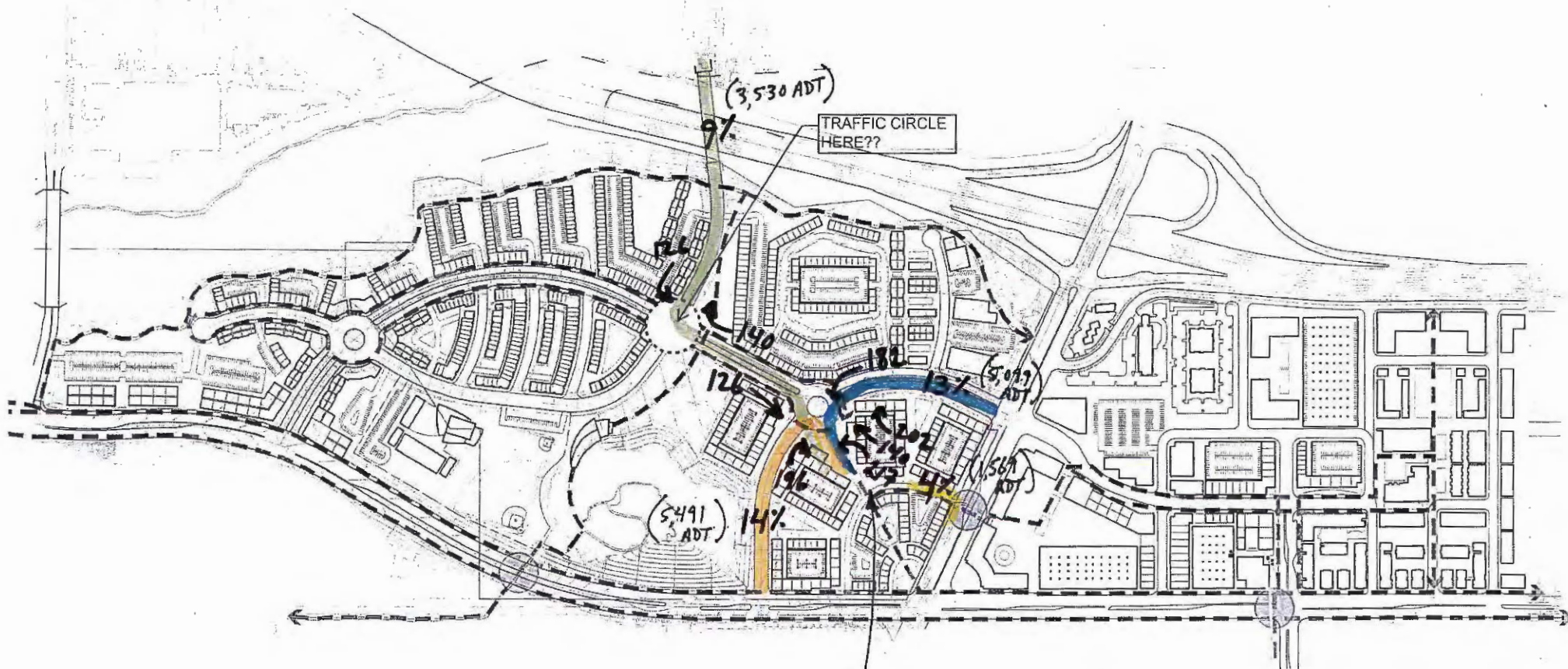
LEGEND

- Pedestrian Bridge
- Primary Pedestrian Routes
- Secondary Pedestrian Routes
- Multi Use Trail
- Bicycle Lanes

BLOCK 1-B $\Rightarrow$ 2,800 ADT

PM In = 1,398
PM Out = 1,554

B 2/9



LEGEND

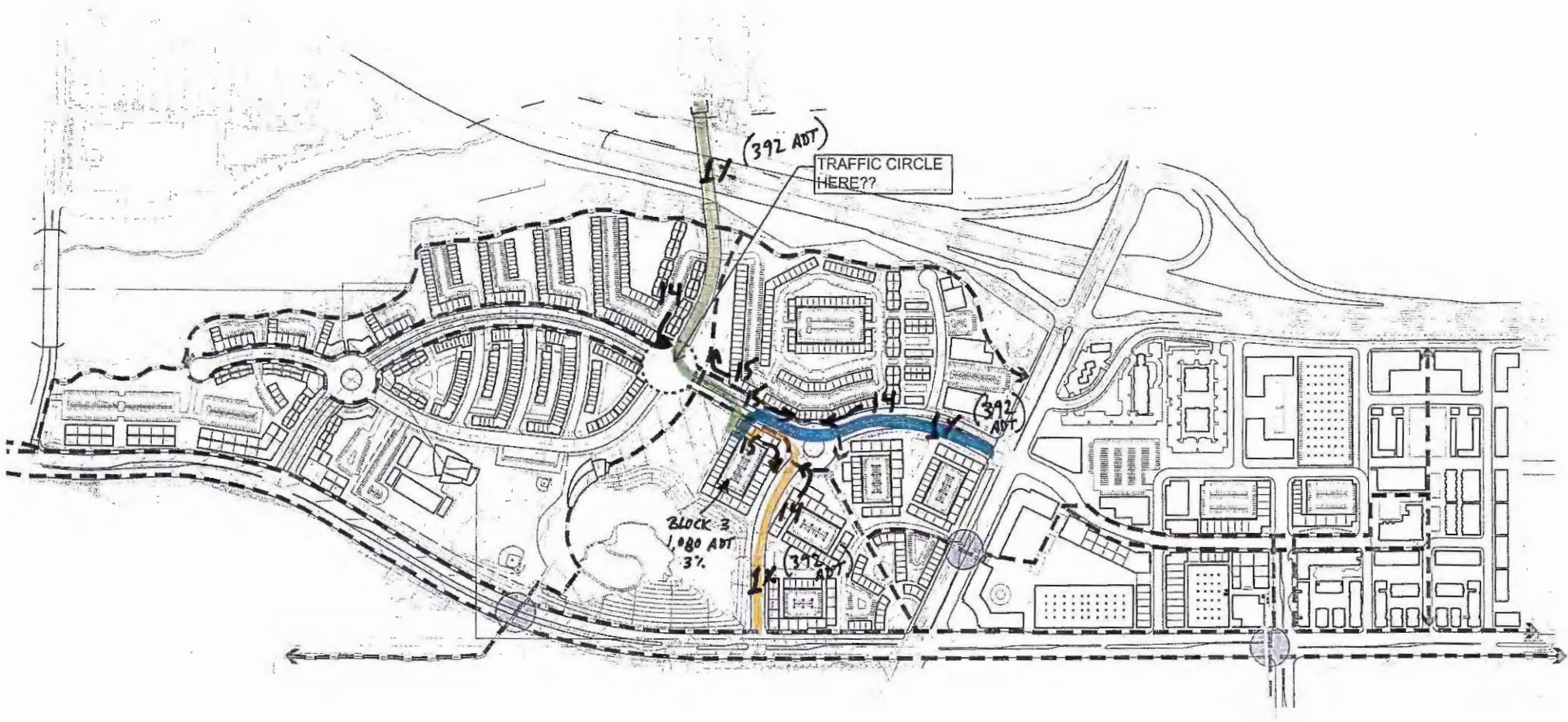
-  Pedestrian Bridge
-  Primary Pedestrian Routes
-  Secondary Pedestrian Routes
-  Multi Use Trail
-  Bicycle Lanes

BLOCK 2 → 15,650 ADT

PM In = 1,398
PM Out = 1,554

BLOCK 2
15,650 ADT
40%

B 3/4



LEGEND

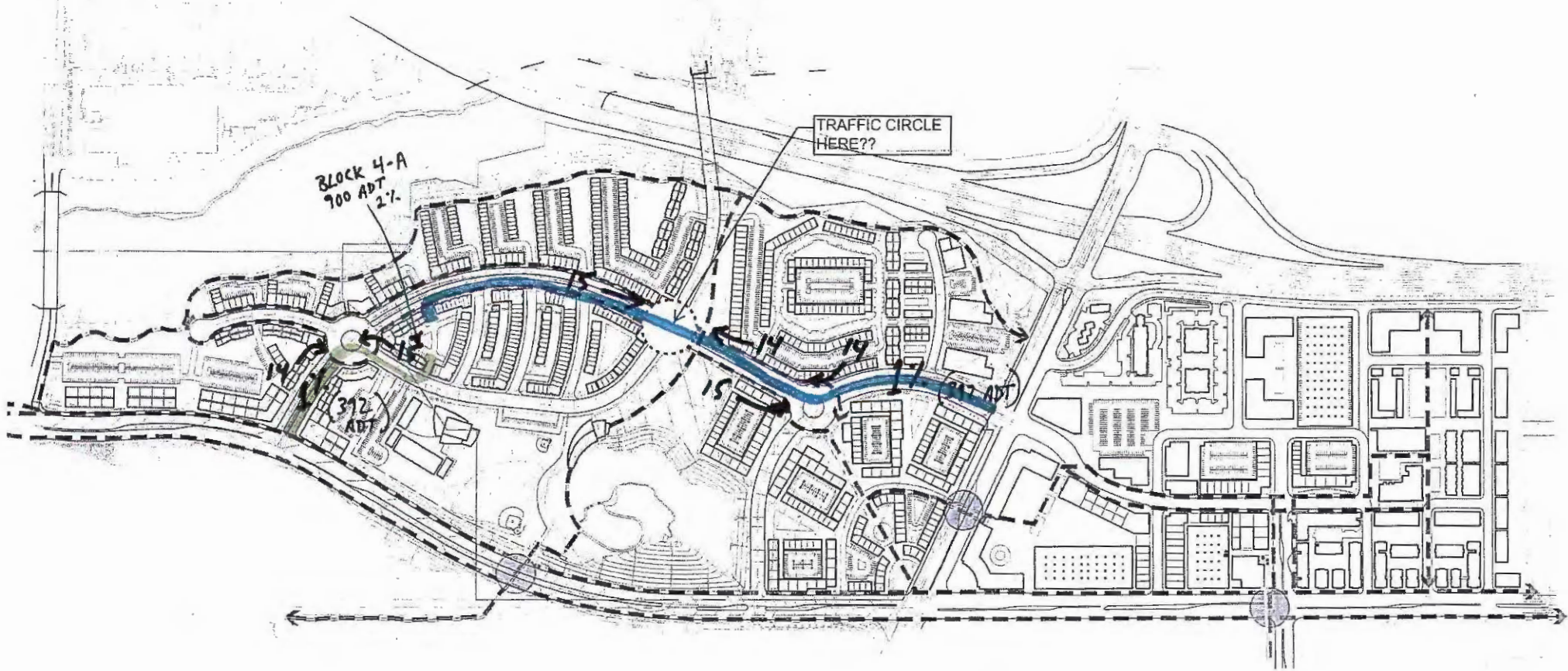
-  Pedestrian Bridge
-  Primary Pedestrian Routes
-  Secondary Pedestrian Routes
-  Multi Use Trail
-  Bicycle Lanes

BLOCK 3 $\Rightarrow$ 1,080 ADT

PM In = 1,398

PM Out = 1,554

B 4/9



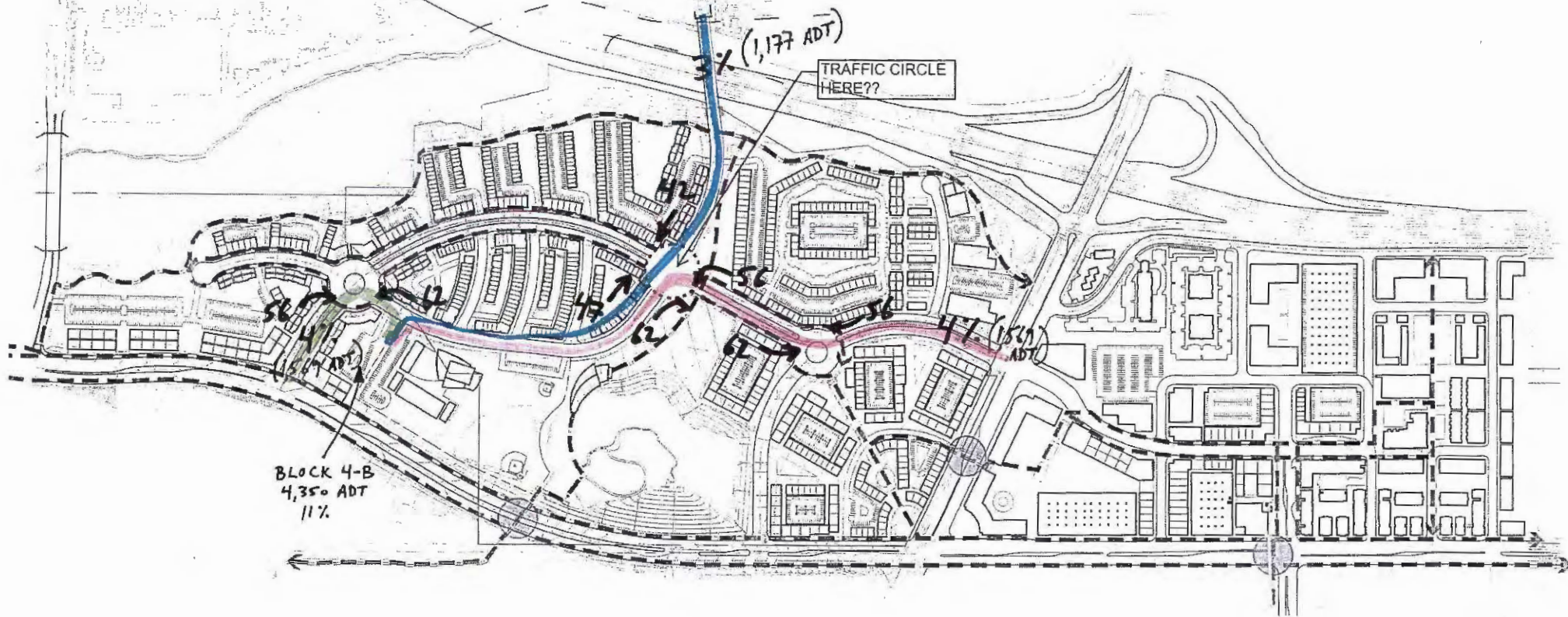
LEGEND

- Pedestrian Bridge
- Primary Pedestrian Routes
- Secondary Pedestrian Routes
- Multi Use Trail
- Bicycle Lanes

BLOCK 4-A ⇒ 900 ADT

PM In = 1,398
PM Out = 1,554

B 5/9



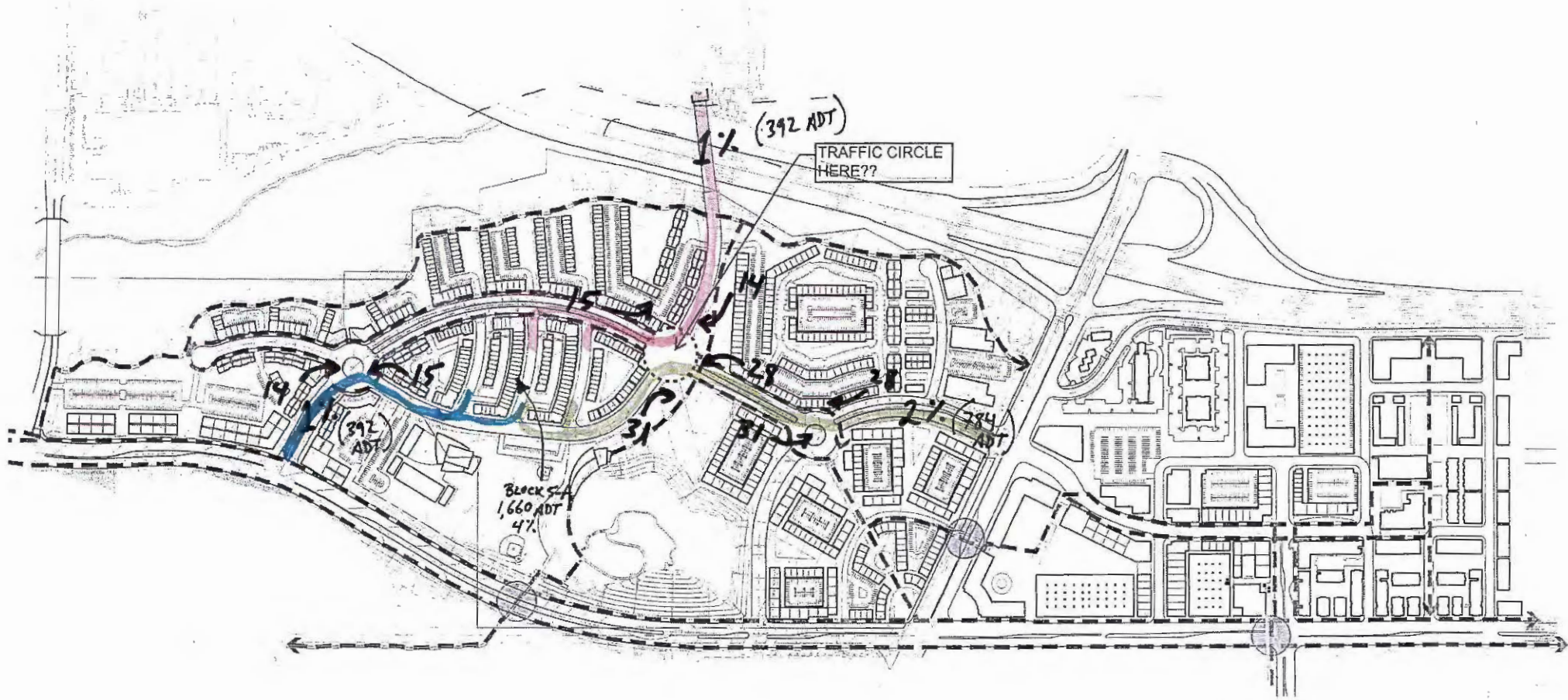
LEGEND

-  Pedestrian Bridge
-  Primary Pedestrian Routes
-  Secondary Pedestrian Routes
-  Multi Use Trail
-  Bicycle Lanes

BLOCK 4-B $\Rightarrow$ 4,350 ADT

PM In = 1,398
PM Out = 1,554

B 6/9



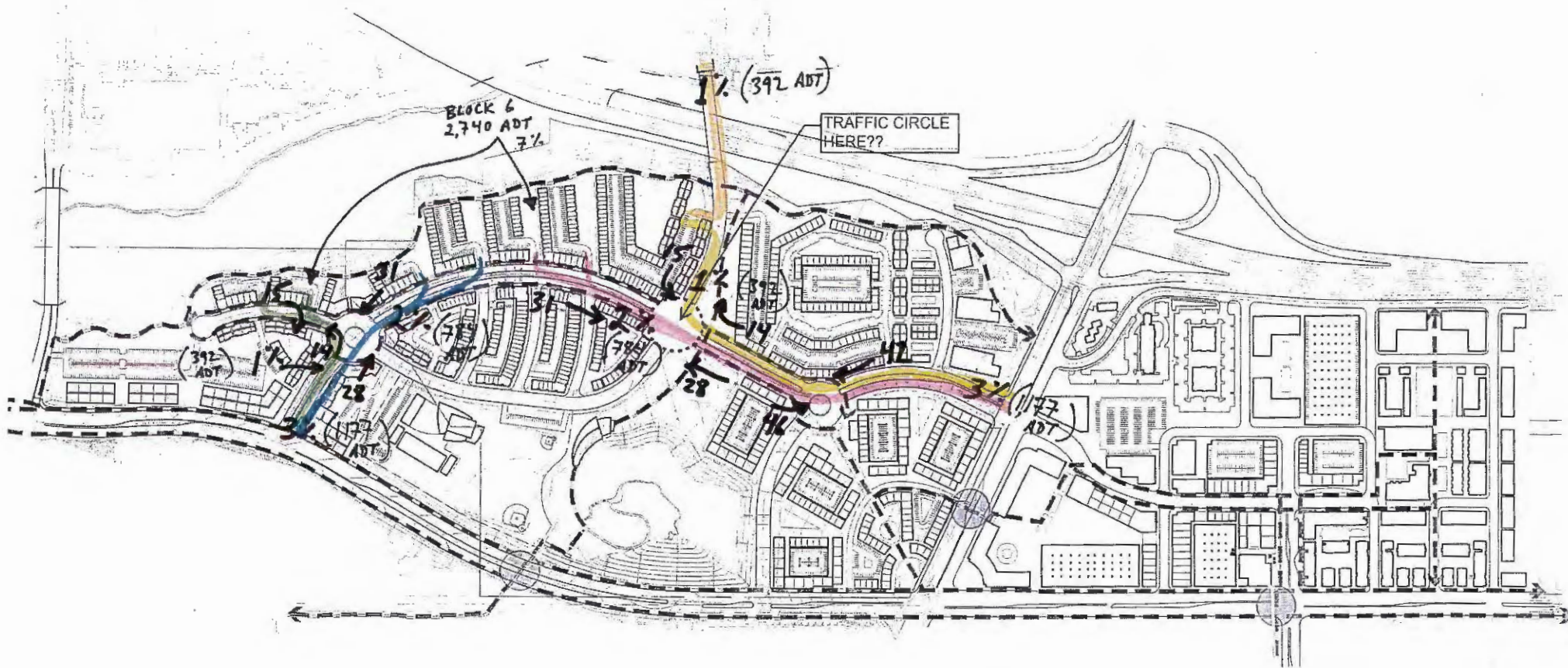
LEGEND

- Pedestrian Bridge
- Primary Pedestrian Routes
- Secondary Pedestrian Routes
- Multi Use Trail
- Bicycle Lanes

BLOCK S-A → 1,660 ADT

PM In = 1,398
PM Out = 1,554

B 8/9



LEGEND

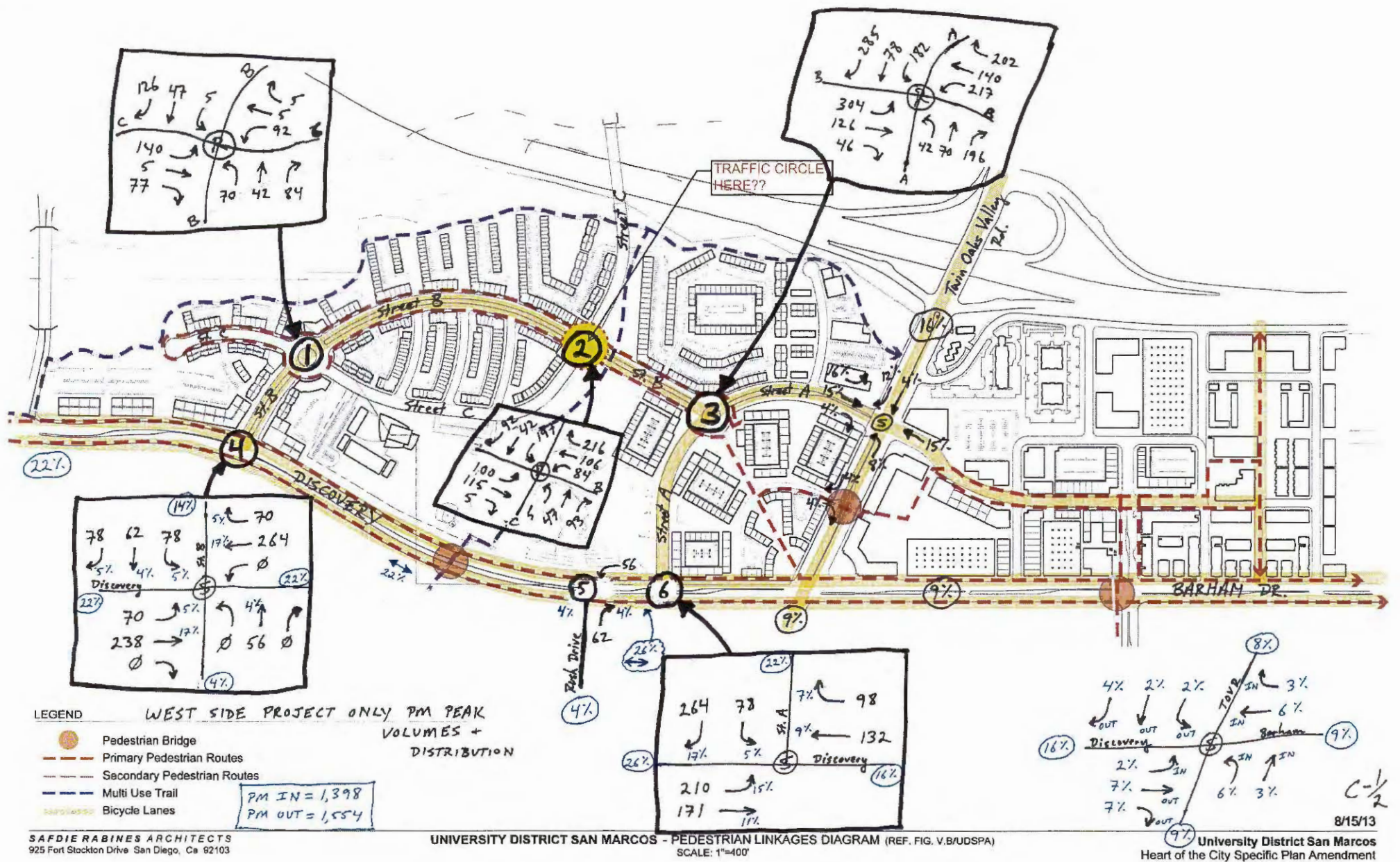
-  Pedestrian Bridge
-  Primary Pedestrian Routes
-  Secondary Pedestrian Routes
-  Multi Use Trail
-  Bicycle Lanes

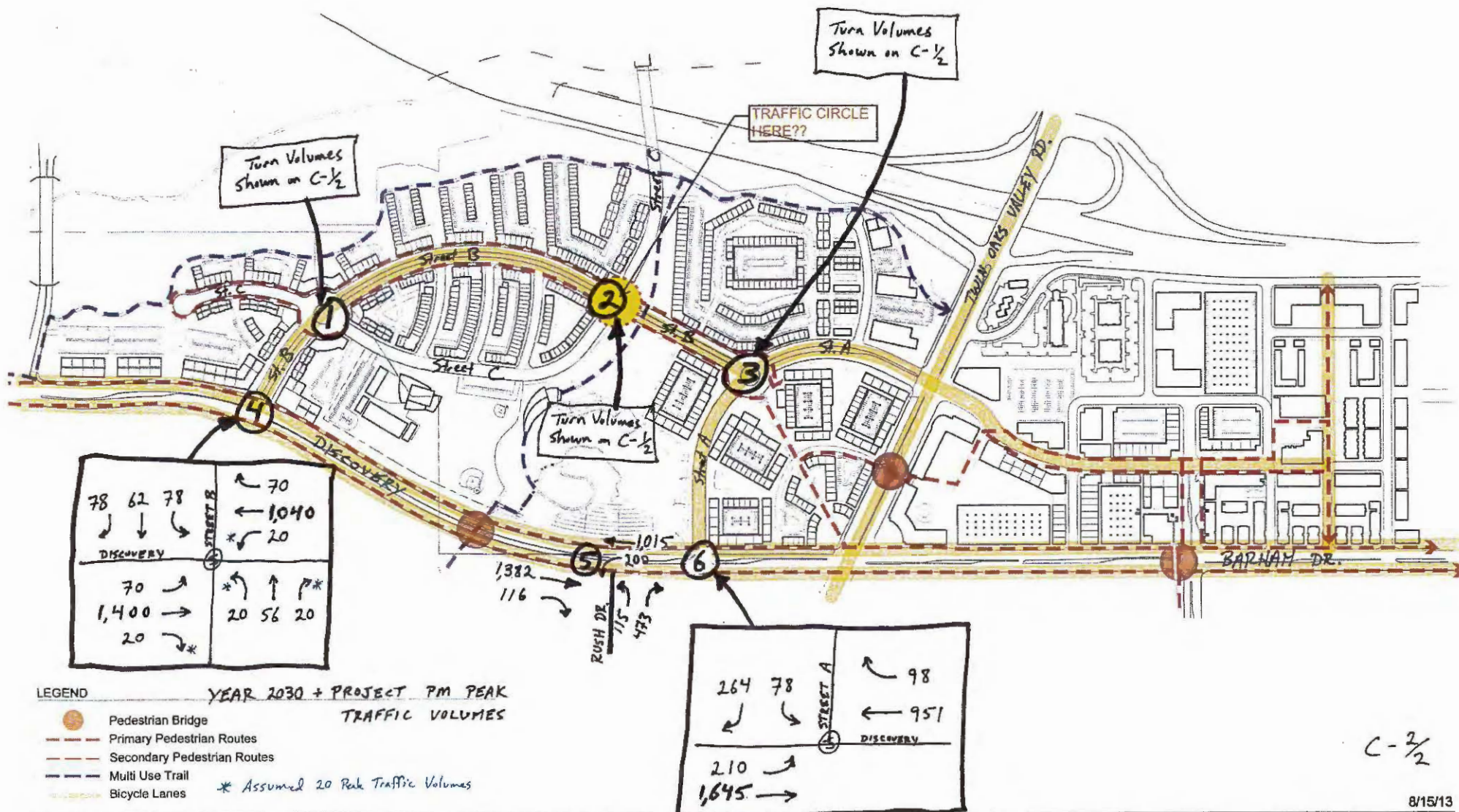
BLOCK 6 $\Rightarrow$ 2,740 ADT

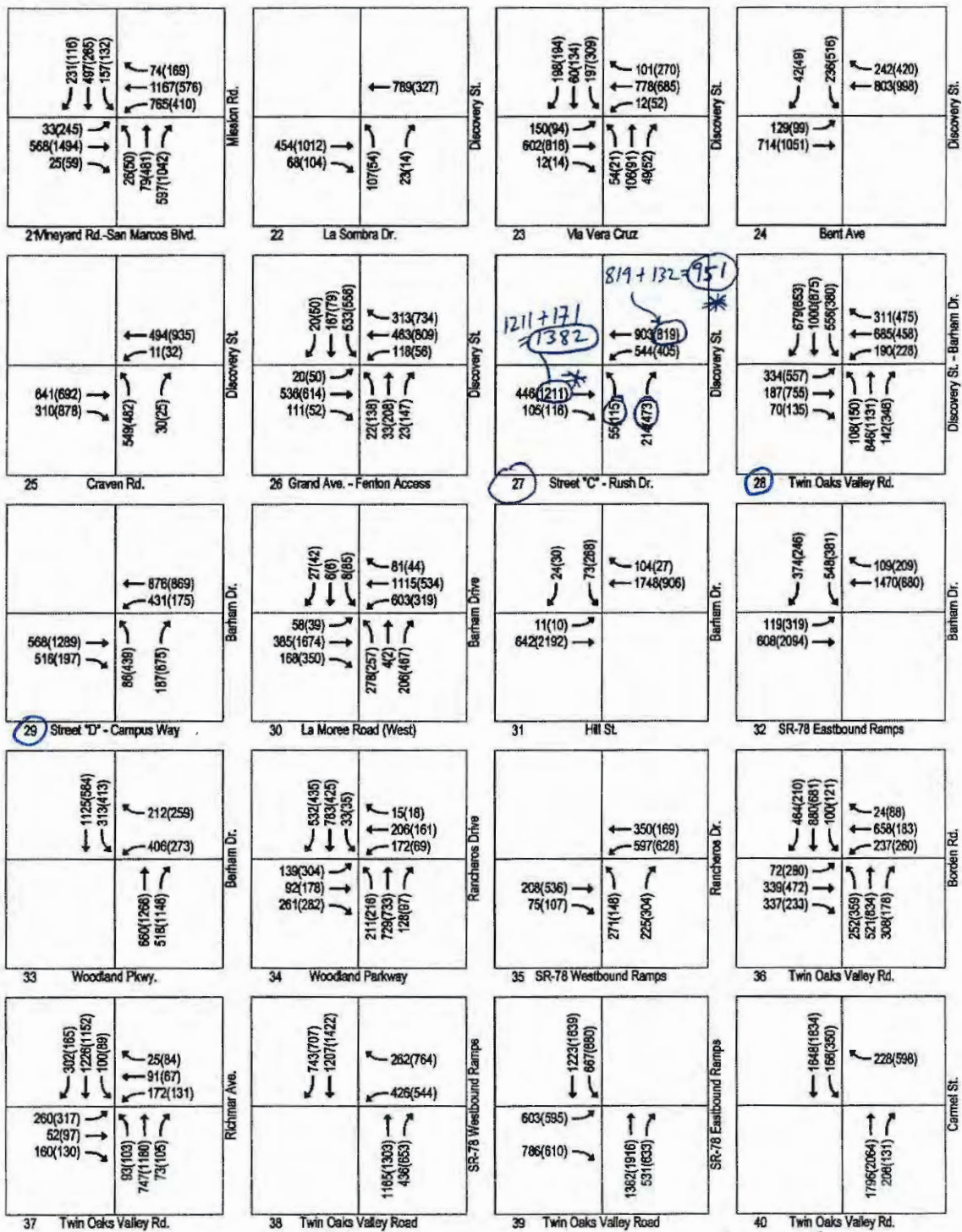
PM In = 1,398

PM Out = 1,554

B 9/9







* WB Thru = 951 PM Peak Hour Traffic at Discovery / Street "A"
 * EB Thru = 1,382 PM Peak Hour Traffic at Discovery / Rush Dr.

LEGEND

XX(XX) AM/PM PEAK HOUR VOLUME

HORIZON YEAR 2030 WITHOUT PROJECT PEAK HOUR INTERSECTION VOLUMES

55-100570 JUNE 2009

Exhibit 13 (page 2 of 3)



RBF

D-1/1

University District Specific Plan

San Marcos

On – Site Traffic Study

ATTACHMENT 6

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	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBL	SBL
Lane Configurations													
Volume (vph)	965	895	88	162	410	521	112	1375	157	22		438	1159
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		1900	1900
Total Lost 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	0.65	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	1583	3433	3208	1441	3433	6295				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	1583	3433	3208	1441	3433	6295				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	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		481	1306
Turn Type	Prot		Perm	Prot		Perm	Prot					Prot	Prot
Protected Phases	5	2		1	6		3	8				7	4
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	0.30	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	467	295	815	366	235	1951				575	2593
v/s Ratio Prot	0.11	0.12		0.05	0.19		0.08	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				0.82	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	48.5	44.7				61.9	26.4
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													

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

Year 2030 + Project PM
8/13/2013

Viewpoint	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

3: Main Street & Street B

Year 2030 + Project PM
8/13/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↙↙	↑		↙	↑		↙	↑		↙	↑	↗
Volume (vph)	387	493	110	20	557	20	114	111	34	20	125	125
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
Lane Util. Factor	0.97	1.00		1.00	1.00		1.00	1.00		1.00	0.95	0.95
Flt	1.00	0.97		1.00	0.99		1.00	0.96		1.00	0.92	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd Flow (prot)	3433	1812		1770	1853		1770	1797		1770	1622	1504
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd Flow (perm)	3433	1812		1770	1853		1770	1797		1770	1622	1504
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)	407	519	116	21	586	21	120	117	36	21	132	132
RTOR Reduction (vph)	0	9	0	0	1	0	0	11	0	0	49	99
Lane Group Flow (vph)	407	626	116	21	606	0	120	142	36	21	246	183
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	3			3			3			3		
Permitted Phases										6		
Actuated Green, G (s)	12.6	44.3		1.5	33.2		8.6	25.2		1.9	18.5	31.1
Effective Green, g (s)	12.6	44.3		1.5	33.2		8.6	25.2		1.9	18.5	31.1
Actuated g/C Ratio	0.14	0.50		0.02	0.37		0.10	0.28		0.02	0.21	0.35
Clearance Time (s)	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
Lane Grp Cap (vph)	487	903		30	632		171	509		38	338	594
v/s Ratio Prot	0.12	0.35		0.01	0.33		0.07	0.08		0.01	0.15	0.04
v/s Ratio Perm												0.08
v/c Ratio	0.84	0.69		0.70	0.88		0.70	0.28		0.55	0.73	0.31
Uniform Delay, d1	37.1	17.1		43.5	25.9		38.9	24.8		43.1	32.9	21.1
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.8	2.3		54.0	11.9		12.3	0.3		16.2	8.0	0.3
Delay (s)	48.9	19.4		97.5	37.9		51.2	25.1		59.3	40.9	21.4
Level of Service	D	B		F	D		D	C		E	D	C
Approach Delay (s)	31.0			39.8			36.5			32.9		
Approach LOS	C			D			D			C		
Intersection Summary												
HCM Average Control Delay			34.1	HCM Level of Service			C					
HCM Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			88.9	Sum of lost time (s)			16.0					
Intersection Capacity Utilization			76.5%	ICU Level of Service			D					
Analysis Period (min)			15									
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: Barham Dr. & Street B

Year 2030 + Project PM
8/13/2013



Movement	EBL	EBT	WBT	WSP	SEB	SEB
Lane Configurations	←	↑↑↑	↑↑↑		←	←
Volume (vph)	239	1086	826	112	116	257
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5		4.5	4.5
Lane Util. Factor	1.00	0.91	0.91		1.00	1.00
Flt. Protected	1.00	1.00	0.98		1.00	0.85
Flt. Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	5085	4995		1770	1583
Flt. Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	5085	4995		1770	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	266	1207	918	124	129	286
RTOR Reduction (vph)	0	0	17	0	0	231
Lane Group Flow (vph)	266	1207	1025	124	129	55
Turn Type	Prot				Perm	
Protected Phases	7		8		6	
Permitted Phases						6
Actuated Green, G (s)	14.6	40.8	21.7		11.8	11.8
Effective Green, g (s)	14.6	40.8	21.7		11.8	11.8
Actuated g/C Ratio	0.24	0.66	0.35		0.19	0.19
Clearance Time (s)	4.5	4.5	4.5		4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	420	3368	1760		339	303
v/s Ratio Prot	0.15	0.22	0.21		0.07	
v/s Ratio Perm						0.03
v/c Ratio	0.63	0.86	0.58		0.38	0.18
Uniform Delay, d1	21.1	4.6	16.3		21.7	20.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.1	0.1	0.5		0.7	0.3
Delay (s)	24.2	4.7	16.8		22.4	21.1
Level of Service	C	A	B		C	C
Approach Delay (s)		8.2	16.8		24.6	
Approach LOS		A	B		C	

Intersection Summary					
HCM Average Control Delay	13.1	HCM Level of Service	B		
HCM Volume to Capacity ratio	0.55				
Actuated Cycle Length (s)	61.6	Sum of lost time (s)	13.5		
Intersection Capacity Utilization	49.4%	ICU Level of Service	A		
Analysis Period (min)	15				
Critical Lane Group					

HCM Unsignalized Intersection Capacity Analysis 5: Carmel Street & Street C

Year 2030 + Project PM
8/13/2013

Volume	EBT	EBR	WBT	WBR	NBT	NBR				
Lane Configurations										
Volume (veh/h)	85	113	85	13	42	88				
Sign Control	Free		Free		Stop					
Grade	0%		0%		0%					
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				
Hourly flow rate (vph)	92	123	92	14	46	98				
Pedestrians										
Lane Width (ft)										
Walking Speed (ft/s)										
Percent Blockage										
Right turn flare (veh)										
Median type	None		None							
Median storage (veh)										
Upstream signal (ft)										
pX, platoon unblocked										
vC, conflicting volume			215		353	154				
vC1, stage 1 conf vol										
vC2, stage 2 conf vol										
vCu, unblocked vol			215		353	154				
tC, single (s)			4.1		6.4	16.2				
tC, 2 stage (s)										
tC (s)			2.2		3.6	3.3				
pD queue free %			93		92	89				
cM capacity (veh/h)			1355		601	892				
Direction Lane#	EB L	WB L	WB R	EB R						
Volume Total	215	92	14	46						
Volume Left	0	92	0	46						
Volume Right	123	0	0	98						
cSH	1700	1355	1700	771						
Volume to Capacity	0.13	0.07	0.01	0.18						
Queue Length 95th (ft)	0	5	0	17						
Control Delay (s)	0.0	7.9	0.0	10.7						
Lane LOS	A		B							
Approach Delay (s)	0.0	6.8		10.7						
Approach LOS			B							
Intersection Summary										
Average Delay	4.8									
Intersection Capacity Utilization	33.8%			ICU Level of Service		A				
Analysis Period (min)	15									

HCM Unsignalized Intersection Capacity Analysis

6: Street A & Street C

Year 2030 + Project PM
8/13/2013



Approach	EBL	EBT	WBT	WBR	SEB	SEB
Lane Configurations	←	↑	↑	↑	↓	↓
Volume (Veh/h)	284	56	58	99	142	246
Sign Control		Free	Free		Stop	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	222	61	63	108	154	267
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)		670				
pX, platoon unblocked						
vC, conflicting volume	171				621	117
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	171				621	117
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
lP (s)	2.2				3.5	3.3
p0 queue free %	84				59	71
cM capacity (veh/h)	1407				680	935
Direction Lane #	EBL	EBT	WBT	SEB		
Volume Total	222	61	171	422		
Volume Left	222	0	0	154		
Volume Right	0	0	108	267		
cSH	1407	1700	1700	609		
Volume to Capacity	0.16	0.04	0.10	0.69		
Queue Length 95th (ft)	14	0	0	137		
Control Delay (s)	8.0	0.0	0.0	23.1		
Lane LOS	A			C		
Approach Delay (s)	6.3		0.0	23.1		
Approach LOS				C		
Intersection Summary						
Average Delay			13.2			
Intersection Capacity Utilization			58.4%			
Analysis Period (min)			15			
ICU Level of Service					A	

HCM Unsignalized Intersection Capacity Analysis

7: Street A & Campus Way

Year 2030 + Project PM
8/13/2013

	→	↘	↙	←	↖	↗
Approach	EBT	EBP	WBT	WBL	NBT	NBP
Lane Configurations	↑	↑	↑	↑	↑	↑
Volume (veh/h)	66	142	53	58	99	51
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	61	154	58	63	108	55
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (ft)	875					
pX, platoon unblocked						
vC, conflicting volume			215		239	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			215		239	
tC, single (s)			4.1		6.4	
tC, 2 stage (s)						
tE (s)			2.2		3.5	
p0 queue free %			96		85	
cM capacity (veh/h)			1355		717	
	1004					
Direction Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total	61	154	58	63	108	55
Volume Left	0	0	58	0	108	0
Volume Right	0	154	0	63	0	55
cSH	1700	1700	1355	1700	717	1004
Volume to Capacity	0.04	0.09	0.04	0.04	0.15	0.06
Queue Length 95th (ft)	0	0	3	0	13	4
Control Delay (s)	0.0	0.0	7.8	0.0	10.9	8.8
Lane LOS			A		B	A
Approach Delay (s)	0.0		8.7		10.2	
Approach LOS					B	
Intersection Summary						
Average Delay	4.2					
Intersection Capacity Utilization	2.8%					
Analysis Period (min)	15					
	ICU Level of Service					
	A					

HCM Signalized Intersection Capacity Analysis 8: Main Street & Campus Way

Year 2030 + Project PM
8/13/2013

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	85	103	122	88	20	99	150	118	20	195	20
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	1.00		1.00	1.00		1.00	1.00		1.00	0.95	
Flt Protected	1.00	0.92		1.00	0.97		1.00	0.93		1.00	0.99	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd Flow (prot)	1770	1710		1770	1812		1770	1740		1770	3490	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd Flow (perm)	1770	1710		1770	1812		1770	1740		1770	3490	
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)	22	94	114	136	98	22	110	167	131	22	217	22
RTOR Reduction (vph)	0	51	0	0	10	0	0	30	0	0	8	0
Lane Group Flow (vph)	22	157	0	136	110	30	110	268	0	22	231	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		5	6		5	8		7	4	
Permitted Phases												
Actuated Green, G (s)	0.6	14.1		7.7	21.2		7.1	20.7		0.6	14.2	
Effective Green, g (s)	0.6	14.1		7.7	21.2		7.1	20.7		0.6	14.2	
Actuated G/C Ratio	0.01	0.24		0.13	0.36		0.12	0.35		0.01	0.24	
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)	18	408		231	650		213	609		18	839	
V/C Ratio Prot	0.01	0.09		0.08	0.06		0.06	0.15		0.01	0.07	
V/C Ratio Perm												
V/C Ratio	1.22	0.38		0.59	0.17		0.52	0.44		1.22	0.27	
Uniform Delay, d1	29.2	18.9		24.2	12.9		24.4	14.7		29.2	18.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	289.8	0.6		3.8	0.1		2.1	0.5		289.8	0.2	
Delay (s)	319.0	19.5		28.0	13.1		26.5	15.3		319.0	18.4	
Level of Service	F	B		C	B		C	B		F	B	
Approach Delay (s)		48.1			21.0			18.3			43.8	
Approach LOS		D			C			B			D	
Intersection Summary												
HCM Average Control Delay	30.6			HCM Level of Service			C					
HCM Volume to Capacity ratio	0.45											
Actuated Cycle Length (s)	59.1			Sum of lost time (s)			12.0					
Intersection Capacity Utilization	49.3%			100 Level of Service			A					
Analysis Period (min)	15											
6 Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

9: Barham Dr. & Campus Way

Year 2030 + Project PM
8/13/2013

Movements	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	 			 			 			 			
Volume (vph)	119	1044	50	175	385	98	434	148	475	117	183	119	
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		
Lane Util. Factor	0.97	0.91		0.97	0.91		0.97	1.00	1.00	1.00	1.00		
Flt	1.00	0.99		1.00	0.97		1.00	1.00	0.85	1.00	0.94		
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00		
Satd. Flow (prot)	3433	5050		3433	4930		3433	1863	1583	1770	1753		
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00		
Satd. Flow (perm)	3433	5050		3433	4930		3433	1863	1583	1770	1753		
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)	132	1160	56	194	428	109	482	164	528	130	203	132	
RTOR Reduction (vph)	0	6	0	0	48	0	0	0	167	0	29	0	
Lane Grp Flow (vph)	182	1210	0	194	439	0	482	164	361	130	306	0	
Turn Type	Prot			Prot			Prot			Perm		Prot	
Protected Phases	5		2	1		6	3		8	7		4	
Permitted Phases	8												
Actuated Green, G (s)	7.5		23.7	7.1		23.3	14.5		25.1	25.1		8.7	19.3
Effective Green, g (s)	7.5		23.7	7.1		23.3	14.5		25.1	25.1		8.7	19.3
Actuated g/C Ratio	0.09		0.29	0.09		0.29	0.18		0.31	0.31		0.11	0.24
Clearance Time (s)	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
Lane Grp Cap (vph)	319		1485	302		1425	618		580	493		191	420
v/s Ratio Prot	0.04		0.24	0.06		0.10	0.14		0.09			0.07	0.17
v/s Ratio Perm	0.23												
v/c Ratio	0.41		0.82	0.64		0.34	0.78		0.28	0.73		0.68	0.73
Uniform Delay, d1	34.5		26.4	35.5		22.6	31.5		21.0	24.7		34.6	28.2
Progression Factor	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.9		3.6	4.6		0.1	6.2		0.3	5.5		9.6	6.2
Delay (s)	35.3		30.0	40.1		22.8	37.7		21.2	30.3		44.2	34.5
Level of Service	D		C	D		C	D		C	C		D	C
Approach Delay (s)			30.5			27.4			32.1			37.2	
Approach LOS			C			C			C			D	
Intersection Summary													
HCM Average Control Delay	31.2			HCM Level of Service			C						
HCM Volume to Capacity ratio	0.70												
Actuated Cycle Length (s)	80.6			Sum of lost time (s)			8.0						
Intersection Capacity Utilization	68.9%			ICU Level of Service			C						
Analysis Period (min)	15												
6 Critical Lane Group													

HCM Unsignalized Intersection Capacity Analysis 10: Main Street & Redel Road

Year 2030 + Project PM
8/13/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop				Stop
Volume (vph)	20	141	62	58	146	20	64	20	56	20	20	58
Peak Hour Factor	0.90	0.92	0.90	0.92	0.92	0.92	0.90	0.90	0.92	0.92	0.90	0.90
Hourly flow rate (vph)	22	153	69	63	159	22	71	22	61	22	22	64
Direction Lane #	EB 1	EB 2	WB 1	NB 1	SB 1							
Volume Total (vph)	22	222	243	154	108							
Volume Left (vph)	22	0	63	71	22							
Volume Right (vph)	0	69	22	61	64							
Red (s)	0.53	0.18	0.03	0.11	0.28							
Departure Headway (s)	6.0	5.3	5.1	5.2	5.1							
Degree Utilization x	0.04	0.33	0.34	0.22	0.15							
Capacity (veh/h)	562	645	668	619	626							
Control Delay (s)	8.0	9.6	10.7	9.7	9.0							
Approach Delay (s)	9.5		10.7	9.7	9.0							
Approach LOS	A		B	A	A							
Intersection Summary												
Delay	9.9											
HCM Level of Service	A											
Intersection Capacity Utilization	48.0%											
ICU Level of Service	A											
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis

11: Barham Dr. & Redel Road

Year 2030 + Project PM
8/13/2013



Volume	EB	EB	WB	WB	SB	SB	
Lane Configurations	↑↑↑	↑↑↑				↑	
Volume (veh/h)	0	1636	542	112	0	116	
Sign Control	Free	Free			Stop		
Grade		0%	0%		0%		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	0	1818	602	124	0	129	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type		None	None				
Median storage (veh)							
Upstream signal (ft)		410	538				
pX, platoon unblocked					0.79		
vC, conflicting volume	727				1270	263	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	727				408	263	
IC, single (s)	4.1				6.8	6.9	
IC, 2 stage (s)							
IC (s)	2.2				3.5	3.3	
p0 queue free %	100				100	82	
CM capacity (veh/h)	372				451	736	
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1
Volume Total	606	606	606	241	241	245	129
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	124	129
cSH	1700	1700	1700	1700	1700	1700	736
Volume to Capacity	0.36	0.36	0.36	0.14	0.14	0.14	0.18
Queue Length 95th (ft)	0	0	0	0	0	0	16
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	10.9
Lane LOS							B
Approach Delay (s)	0.0			0.0			10.9
Approach LOS							B
Intersection Summary							
Average Delay	0.5						
Intersection Capacity Utilization	34.9%						
ICU Level of Service	A						
Analysis Period (min)	15						

HCM Unsignalized Intersection Capacity Analysis 12: Carmel Street & Industrial Street

Year 2030 + Project PM
8/13/2013



Movement	EBL	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	88	85	123	86	13	117
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	96	92	123	92	14	127
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			188		480	122
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			188		480	142
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
f (s)			2.2		3.5	3.3
p0 queue free %			91		97	86
cM capacity (veh/h)			1386		496	903
Direction Lane #						
	EB L	EB R	WB L	WB R	NB L	NB R
Volume Total	188	123	92	141		
Volume Left	0	123	0	14		
Volume Right	92	0	0	127		
cSH	1700	1386	1700	837		
Volume to Capacity	0.11	0.09	0.05	0.17		
Queue Length 95th (ft)	0	7	0	15		
Control Delay (s)	0.0	7.8	0.0	10.2		
Lane LOS		A		B		
Approach Delay (s)	0.0	4.6		10.2		
Approach LOS				B		
Intersection Summary						
Average Delay	4.4					
Intersection Capacity Utilization	34.0%			ICU Level of Service		A
Analysis Period (min)	15					

HCM Signalized Intersection Capacity Analysis 13: Barham Dr. & Industrial Street

Year 2030 + Project PM

8/13/2013



Movement	EBL	EBT	WBL	WBR	SBL	SBR	
Lane Configurations							
Volume (vph)	56	1580	266	255	262	133	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.91	0.91	1.00	1.00	1.00	
Flt Protected	1.00	1.00	1.00	0.85	1.00	0.85	
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00	
Satd Flow (prot)	1770	5085	5085	1583	1770	1583	
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00	
Satd Flow (perm)	1770	5085	5085	1583	1770	1583	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	
Adj Flow (vph)	62	1756	296	283	292	148	
RTOR Reduction (vph)	0	0	0	158	0	108	
Lane Group Flow (vph)	62	1756	296	125	292	240	
Turn Type	Prot			Perm		Perm	
Protected Phases	4	8		6			
Permitted Phases				8		6	
Actuated Green, G (s)	3.6	32.7	24.6	24.6	15.1	15.1	
Effective Green, g (s)	3.6	32.7	24.6	24.6	15.1	15.1	
Actuated g/C Ratio	0.06	0.59	0.44	0.44	0.27	0.27	
Clearance Time (s)	4.5	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	
Lane Grp Cap (vph)	114	2980	2242	698	479	428	
v/s Ratio Prot	0.04	0.85	0.06		0.17		
v/s Ratio Perm				0.08		0.03	
V/C Ratio	0.54	0.59	0.13	0.18	0.61	0.09	
Uniform Delay, d1	25.3	7.3	9.3	9.5	17.8	15.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.2	0.3	0.0	0.1	2.2	0.1	
Delay (s)	30.5	7.6	9.3	9.6	20.0	15.3	
Level of Service	C	A	A	A	B	B	
Approach Delay (s)		8.4	9.4		8.4		
Approach LOS		A	A		B		
Intersection Summary							
HCM Average Control Delay			10.2	HCM Level of Service			B
HCM Volume to Capacity ratio			0.60				
Actuated Cycle Length (s)			55.8	Sum of lost time (s)			8.0
Intersection Capacity Utilization			51.8%	ICU Level of Service			A
Analysis Period (min)			15				
c - Critical Lane Group							

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

Year 2030 + Project PM

8/13/2013

	EBL	EB	EBR	WB	WB	WBR	NBL	NBT	NBR	SEB	SE	SEB
Lane Configurations												
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 Protected				1.00		0.85		1.00	0.85		1.00	0.85
Flt Permitted				0.95		1.00		1.00	1.00		1.00	1.00
Satd Flow (ppl)				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	1504	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	1504	811	0	1430	741
Turn Type				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		0.88		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	
Approach LOS		A			D			A			B	
Intersection Summary												
HCM Average Control Delay				17.2								
HCM Volume-to-Capacity ratio				0.66								
Actuated Cycle Length (s)				120.0								
Intersection Capacity Utilization				61.1%								
Analysis Period (min)				15								
Critical Lane Group												

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

Year 2030 + Project PM

8/13/2013

Move	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NET	NBR	SEB	SEB	SEB
Lane Configurations												
Volume (vph)	440	0	505	0	0	0	0	1624	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	6.0	4.2	5.3	
Lane Util. Factor	0.95	0.91	0.95					0.91	1.00	0.97	0.91	
PHF	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	1696	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	1696	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	551	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	844	559	1362	0
Turn Type	Split		Perm						custom		Prot	
Protected Phases	4							2			6	
Permitted Phases			4						24			
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						0.36		0.16	0.27	
v/s Ratio Perm			0.20						0.53			
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					36.9	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												

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	SEB	SEB	SEB	
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
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	4818			3433	5085	1583
Satd Flow (perm)	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00			0.95	1.00	1.00
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	736	148	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	736	148	213	444	318	157	322	0		428	638	237
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm		Prot		Perm
Protected Phases	7	1		3	8		5	2			1	6	
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			1.37	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			57.6	30.3	33.0
Level of Service	E	C	C	E	D	E	E	D			E	C	D
Approach Delay (s)		42.0			50.3			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			69.2%			ICU Level of Service					C		
Analysis Period (min)			15										
or Critical Lane Group													

SIDRA INTERSECTION

Output Tables

UC San Marcos

2 Lane Roundabout

Main Street at Street B

150 ft Diameter

Run Information

* Basic Parameters:

Intersection Type: Roundabout
 Driving on the right-hand side of the road
 Input data specified in US units
 Model Defaults: US HCM (US)
 Peak Flow Period (for performance): 15 minutes
 Unit time (for volumes): 60 minutes.
 Delay definition: Control delay
 Geometric delay included
 HCM Delay Model option selected
 HCM Queue Model option selected
 Level of Service based on: Delay (HCM method)
 Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds, negotiation radius or negotiation speed data in the Definitions & Path Data dialog.

Table R.1 - Roundabout Gap Acceptance Parameters

UC San Marcos

Main Street at Street B

Intersection ID: 3 PM

Roundabout

Turn Lane No.	Lane Type	Circulating/Exiting Stream					Critical Gap		Follow-up Headway (s)
		Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bach Headway (s)	Drop Bunched	Hdwy (s)	Dist (ft)	

West: North City Drive

Environment Factor: 1.20 Entry/Circulating Flow Adjustment: Medium

Left	1 Subdominant	183	19.6	563.4	2.00	0.200	4.17	119.6	2.56
Thru	1 Subdominant	183	19.6	563.4	2.00	0.200	4.17	119.5	2.56
	2 Dominant	183	19.6	563.4	2.00	0.200	4.01	115.0	2.46
Right	2 Dominant	183	19.6	563.4	2.00	0.200	4.01	115.0	2.46

South: Street B

Environment Factor: 1.20 Entry/Circulating Flow Adjustment: Medium									
Left	1 Subdominant	1000	19.2	101.3	1.10	0.491	3.52	99.0	2.49
Thru	1 Subdominant	1000	19.2	101.3	1.10	0.491	3.52	98.9	2.49
	2 Dominant	1000	19.2	101.3	1.10	0.491	3.22	90.7	2.28
Right	2 Dominant	1000	19.2	101.3	1.10	0.491	3.22	90.8	2.28

East: Main Street									
Environment Factor: 1.20 Entry/Circulating Flow Adjustment: Medium									
Left	1 Subdominant	680	18.5	143.9	1.65	0.500	3.76	102.2	2.54
Thru	1 Subdominant	680	18.5	143.9	1.65	0.500	3.76	102.1	2.54
	2 Dominant	680	18.5	143.9	1.65	0.500	3.56	96.7	2.40
Right	2 Dominant	680	18.5	143.9	1.65	0.500	3.56	96.8	2.40

North: Street A									
Environment Factor: 1.20 Entry/Circulating Flow Adjustment: Medium									
Left	1 Subdominant	768	19.7	135.1	1.17	0.422	4.60	132.6	3.15
Thru	1 Subdominant	768	19.7	135.1	1.17	0.422	4.60	132.5	3.15
Right	2 Dominant	768	19.7	135.1	1.17	0.422	3.46	99.7	2.37

Priority sharing is implied for some movements (Follow-up Headway plus Intra-bunch Headway is larger than the Critical Gap). The O-D Factor (Table R.0) allows for priority sharing and priority emphasis.

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table S.3 - Intersection Parameters

UC San Marcos
Main Street at Street B
Intersection ID: 3 PM
Roundabout

Intersection Level of Service	=	A
Worst movement Level of Service	=	A
Average intersection delay (s/pers)	=	3.0
Largest average movement delay (s)	=	5.8
Largest back of queue, 95% (ft)	=	121
Performance Index	=	25.81
Degree of saturation (highest)	=	0.568
Practical Spare Capacity (lowest)	=	50 %
Effective intersection capacity, (veh/h)	=	4731
Total vehicle flow (veh/h)	=	2687
Total person flow (pers/h)	=	3224
Total vehicle delay (veh-h/h)	=	2.20
Total person delay (pers-h/h)	=	2.65
Total effective vehicle stops (veh/h)	=	1360
Total effective person stops (pers/h)	=	1632
Total vehicle travel (veh-mi/h)	=	181.3
Total cost (\$/h)	=	163.77
Total fuel (gal/h)	=	10.9
Total CO2 (kg/h)	=	103.62

Table S.6 - Intersection Performance

UC San Marcos
Main Street at Street B
Intersection ID: 3 PM
Roundabout

Total Flow (veh/h)	Deg. Satn x	Total Delay (veh-h/h)	Total Delay (pers-h/h)	Aver. Delay (sec)	Prop. Queued	Eff. Stop Rate	Longest Queue (ft)	Perf. Index	Aver. Speed (mph)
West: North City Drive									
1100	0.456	0.49	0.58	1.6	0.45	0.25	97	9.21	16.6
South: Street B									
288	0.198	0.30	0.36	3.8	0.64	0.59	28	2.92	14.9
East: Main Street									
665	0.397	0.65	0.78	3.5	0.68	0.61	71	6.62	14.5
North: Street A									
634	0.568	0.77	0.92	4.4	0.73	0.80	121	7.06	12.9
ALL VEHICLES:									
2687	0.568	2.20	2.65	3.0	0.59	0.51	121	25.81	15.3
INTERSECTION (persons):									
3224	0.568		2.65	3.0	0.59	0.51		25.81	15.3

Queue values in this table are 95% back of queue (feet).

Table S.7 - Lane Performance

UC San Marcos
Main Street at Street B
Intersection ID: 3 PM
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 (vehs)	Lane Length (ft)
West: North City Drive							
1 LT	538	1180	0.456	2.2	0.33	3.8	580.0
2 TR	562	1233	0.456	1.0	0.17	3.8	580.0
South: Street B							
1 LT	135	680	0.198	4.7	0.69	1.1	550.0
2 TR	153	773	0.198	2.9	0.50	1.1	550.0
East: Main Street							
1 LT	320	810	0.395	3.7	0.65	2.8	750.0
2 TR	345	872	0.395	3.3	0.58	2.8	750.0
North: Street A							
1 LT	162	546	0.297	4.5	0.68	1.6	670.0
2 R	472	831	0.568	4.3	0.85	4.7	670.0

Table S.10 - Movement Capacity and Performance Summary

UC San Marcos
Main Street at Street B
Intersection ID: 3 PM
Roundabout

Mov ID	Mov Typ	Dem Flow (veh/h)	Total Cap. (veh/h)	Lane Util (%)	Deg. Satn x	Aver. Delay (sec)	Eff. Stop Rate	95% Back of Queue (veh)	Perf. Index
West: North City Drive									
5L	L	430	943	100	0.456	2.5	0.37	3.8	4.46
2T	T	548	1202	100	0.456	1.0	0.17	3.8	3.99
2R	R	122	268	100	0.455	1.0	0.17	3.8	0.76
South: Street B									
3L	L	127	641	100	0.198	4.8	0.70	1.1	1.55
8T	T	123	621	100	0.198	2.9	0.50	1.1	1.08
8R	R	38	192	100	0.198	2.9	0.50	1.1	0.29
East: Main Street									
1L	L	23	58	100	0.397	5.1	0.74	2.8	0.29
6T	T	619	1566	100	0.395	3.5	0.61	2.8	6.13
6R	R	23	58	100	0.397	3.3	0.58	2.8	0.20
North: Street A									
7L	L	23	78	52	0.295	5.8	0.74	1.6	0.31
4T	T	139	469	52	0.296	4.3	0.67	1.6	1.53
4R	R	472	831	100	0.568*	4.3	0.85	4.7	5.22

* Maximum degree of saturation

Table S.12A - Fuel Consumption, Emissions and Cost (TOTAL)

UC San Marcos
Main Street at Street B
Intersection ID: 3 PM
Roundabout

Mov ID	Fuel Total gal/h	Cost Total \$/h	HC Total kg/h	CO Total kg/h	NOX Total kg/h	CO2 Total kg/h
INTERSECTION:	10.9	163.77	0.188	8.26	0.210	103.6

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel (\$/US gal)	=	2.400
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income (\$/h)	=	19.00
Time value factor	=	0.40
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

Table S.14 - Summary of Input and Output Data

UC San Marcos
Main Street at Street B
Intersection ID: 3 PM
Roundabout

Lane No.	Demand Flow (veh/h)				%HV	Adj. Basic	Eff (secs)	Grn Sat	Deg Aver.	Longest Delay	Shrt Queue
	L	T	R	Tot		Satf.	1st	2nd	x	(sec)	(ft)
West: North City Drive											
1 LT	430	108		538	2			0.456	2.2	96	580
2 TR		440	122	562	2			0.456	1.0	97	580
	430	548	122	1100	2			0.456	1.6	97	
South: Street B											
1 LT	127	8		135	2			0.198	4.7	27	550
2 TR		115	38	153	2			0.198	2.9	28	550
	127	123	38	288	2			0.198	3.8	28	
East: Main Street											
1 LT	23	297		320	2			0.395	3.7	70	750
2 TR		322	23	345	2			0.395	3.3	71	750
	23	619	23	665	2			0.395	3.5	71	
North: Street A											
1 LT	23	139		162	2			0.297	4.5	42	670
2 R			472	472	2			0.568	4.3	121	670
	23	139	472	634	2			0.568	4.4	121	
ALL VEHICLES											
				Total	%			Max	Aver.	Max	
				Flow	HV			X	Delay	Queue	
				2687	2			0.568	3.0	121	

Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - Capacity and Level of Service

UC San Marcos
Main Street at Street B
Intersection ID: 3 PM
Roundabout

Mov ID	Mov Typ	Total Flow (veh/h)	Total Cap. (veh/h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	Queue (ft)
--------	---------	--------------------	--------------------	--------------------	-------------------	-----	-------------------------------	------------

West: North City Drive							
5L L	430	943	0.456	2.5	A	3.8	96
2T T	548	1202	0.456	1.0	A	3.8	97
2R R	122	268	0.455	1.0	A	3.8	97

South: Street B							
3L L	127	641	0.198	4.8	A	1.1	27
8T T	123	621	0.198	2.9	A	1.1	28
8R R	38	192	0.198	2.9	A	1.1	28

East: Main Street							
1L L	23	58	0.397	5.1	A	2.8	70
6T T	619	1566	0.395	3.5	A	2.8	71
6R R	23	58	0.397	3.3	A	2.8	71

North: Street A							
7L L	23	78	0.295	5.8	A	1.6	42
4T T	139	469	0.296	4.3	A	1.6	42
4R R	472	831	0.568*	4.3	A	4.7	121

ALL VEHICLES:	2687		0.568	3.0	A	4.7	121

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.

For the criteria, refer to the "Level of Service" topic in the SIDRA Output Guide or the Output section of the on-line help.

* Maximum v/c ratio, or critical green periods

" Movement Level of service has been determined using adjacent lane v/c ratio rather than short lane v/c ratio (v/c=1.0)



SIDRA SOLUTIONS

Site: 2 lane Roundabout

\\Diskstation\projects\000406 University Place San Marcos\HCS\081313_Roundabout Analysis\Street B at Main St PM.aap
Processed Aug 13, 2013 02:02:54PM

A1444, Unregistered, Small Office

Produced by SIDRA Intersection 3.1.061208.34

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Street A

North City Drive

Street B

Main St

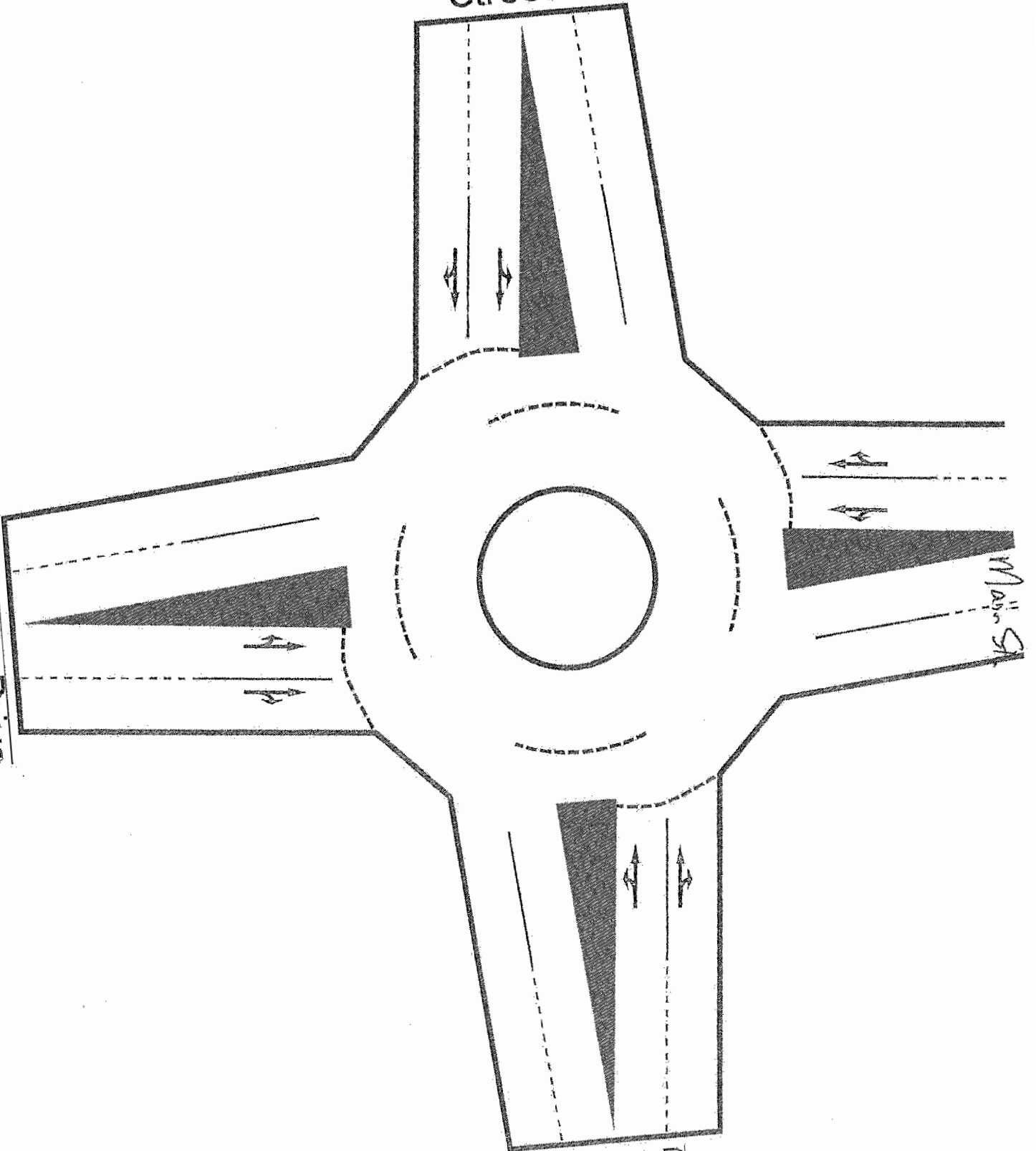


TABLE B

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

West Side Analysis

September 11, 2013

Number	Intersection	Control	PM Peak Hour	
			Delay	LOS
1	Street "B" / Street "C"	1 Lane Roundabout	2.5	A
2	Street "C" / Street "B"	1 Lane Roundabout	2.9	A
3	Street "A" / Street "B"	1 Lane Roundabout	10.6	B
4	Discovery / Street "B"	Signalized	19.3	B
5	Discovery / Rush Dr.	Signalized	20.7	C
6	Discovery / Street "A"	Signalized	12.7	B

Notes:

LOS = Level of Service

Cycle Length analyzed on Discovery is 90 seconds.

HCM Signalized Intersection Capacity Analysis 4: Discovery & Street B

Year 2030+Project PM
9/8/2013

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	1400	20	20	1040	70	20	56	20	78	62	78
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	0.95		1.00	1.00		1.00	1.00	
Flt	1.00	1.00		1.00	0.99		1.00	0.96		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd Flow (prot)	1770	3532		1770	3506		1770	1790		1770	1707	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd Flow (perm)	1770	3532		1770	3506		1770	1790		1770	1707	
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)	78	1556	22	22	1156	78	22	62	22	87	69	87
RTOR Reduction (vph)	0	1	0	0	5	0	0	15	0	0	52	0
Lane Group Flow (vph)	78	1577	0	22	1229	0	22	69	0	87	104	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	5.7	41.2		1.3	36.8		1.6	11.1		5.1	14.6	
Effective Green, g (s)	5.7	41.2		1.3	36.8		1.6	11.1		5.1	14.6	
Actuated g/C Ratio	0.08	0.55		0.02	0.49		0.02	0.15		0.07	0.20	
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)	135	1948		31	1727		38	266		121	334	
v/s Ratio Prot	0.04	0.45		0.01	0.35		0.01	0.04		0.05	0.06	
v/s Ratio Perm												
v/c Ratio	0.58	0.81		0.71	0.71		0.58	0.26		0.72	0.31	
Uniform Delay, d1	33.3	13.6		36.5	14.8		36.2	28.2		34.1	25.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.9	2.6		54.2	1.4		19.6	0.5		18.4	0.5	
Delay (s)	39.2	16.2		90.7	16.2		55.8	28.7		52.5	26.3	
Level of Service	D	B		F	B		E	C		D	C	
Approach Delay (s)	17.3			17.5			34.3			35.7		
Approach LOS	B			B			C			D		
Intersection Summary												
HCM Average Control Delay	19.3			HCM Level of Service			B ⁺					
HCM Volume to Capacity ratio	0.67											
Actuated Cycle Length (s)	74.7			Sum of lost time (s)			12.0					
Intersection Capacity Utilization	67.4%			ICU Level of Service			C					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis 5: Discovery & Rush Drive

Year 2030+Project PM
9/8/2013

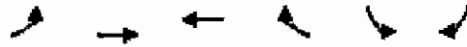
						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↵	↑↑	↵	↵
Volume (vph)	1382	116	200	1015	115	473
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Flt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3498		1770	3539	1770	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3498		1770	3539	1770	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1536	129	222	1128	126	526
RTOR Reduction (vph)	7	0	0	0	0	10
Lane Group Flow (vph)	1656	0	222	1128	126	516
Turn Type			Prot			pm+ov
Protected Phases	4		3	8	2	3
Permitted Phases						2
Actuated Green, G (s)	43.6		15.7	63.3	11.2	26.9
Effective Green, g (s)	43.6		15.7	63.3	11.2	26.9
Actuated g/C Ratio	0.53		0.19	0.77	0.14	0.33
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1849		337	2715	240	593
v/s Ratio Prot	0.47		0.13	0.32	0.07	0.17
v/s Ratio Perm						0.16
v/c Ratio	0.90		0.66	0.42	0.53	0.87
Uniform Delay, d1	17.4		30.9	3.3	33.2	26.2
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	6.2		4.6	0.1	2.3	12.9
Delay (s)	23.6		35.5	3.4	35.5	39.1
Level of Service	C		D	A	D	D
Approach Delay (s)	23.6			8.7	38.4	
Approach LOS	C			A	D	
Intersection Summary						
HCM Average Control Delay	20.7		HCM Level of Service		C	
HCM Volume to Capacity ratio	0.89					
Actuated Cycle Length (s)	82.5		Sum of lost time (s)		8.0	
Intersection Capacity Utilization	77.8%		IGU Level of Service		D	
Analysis Period (min)	15					
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

6: Discovery & Street A

Year 2030+Project PM

9/8/2013



Movement	EBL	EBT	WBT	WBL	SBL	SBR
Lane Configurations	↰	↱	↱	↰	↰	↱
Volume (vph)	210	1645	951	98	78	264
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Flt. Protected	1.00	1.00	0.99		1.00	0.85
Flt. Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3539	3490		1770	1583
Satd. Flow (perm)	1770	3539	3490		1770	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	233	1828	1057	109	87	293
RTOR Reduction (vph)	0	0	8	0	0	250
Lane Group Flow (vph)	233	1828	1158	0	87	43
Turn Type	Prot				Perm	
Protected Phases	7	4	8		6	
Permitted Phases						6
Actuated Green, G (s)	14.4	48.8	30.4		9.9	9.9
Effective Green, g (s)	14.4	48.8	30.4		9.9	9.9
Actuated g/C Ratio	0.22	0.73	0.46		0.15	0.15
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	382	2589	1591		263	235
v/s Ratio Prot	0.13	0.52	0.33		0.05	
v/s Ratio Perm						0.03
v/c Ratio	0.61	0.71	0.73		0.33	0.19
Uniform Delay, d1	23.6	5.0	14.8		25.4	24.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.8	0.9	1.7		0.7	0.4
Delay (s)	26.4	5.9	16.5		26.2	25.3
Level of Service	C	A	B		C	C
Approach Delay (s)		8.2	16.5		25.5	
Approach LOS		A	B		C	

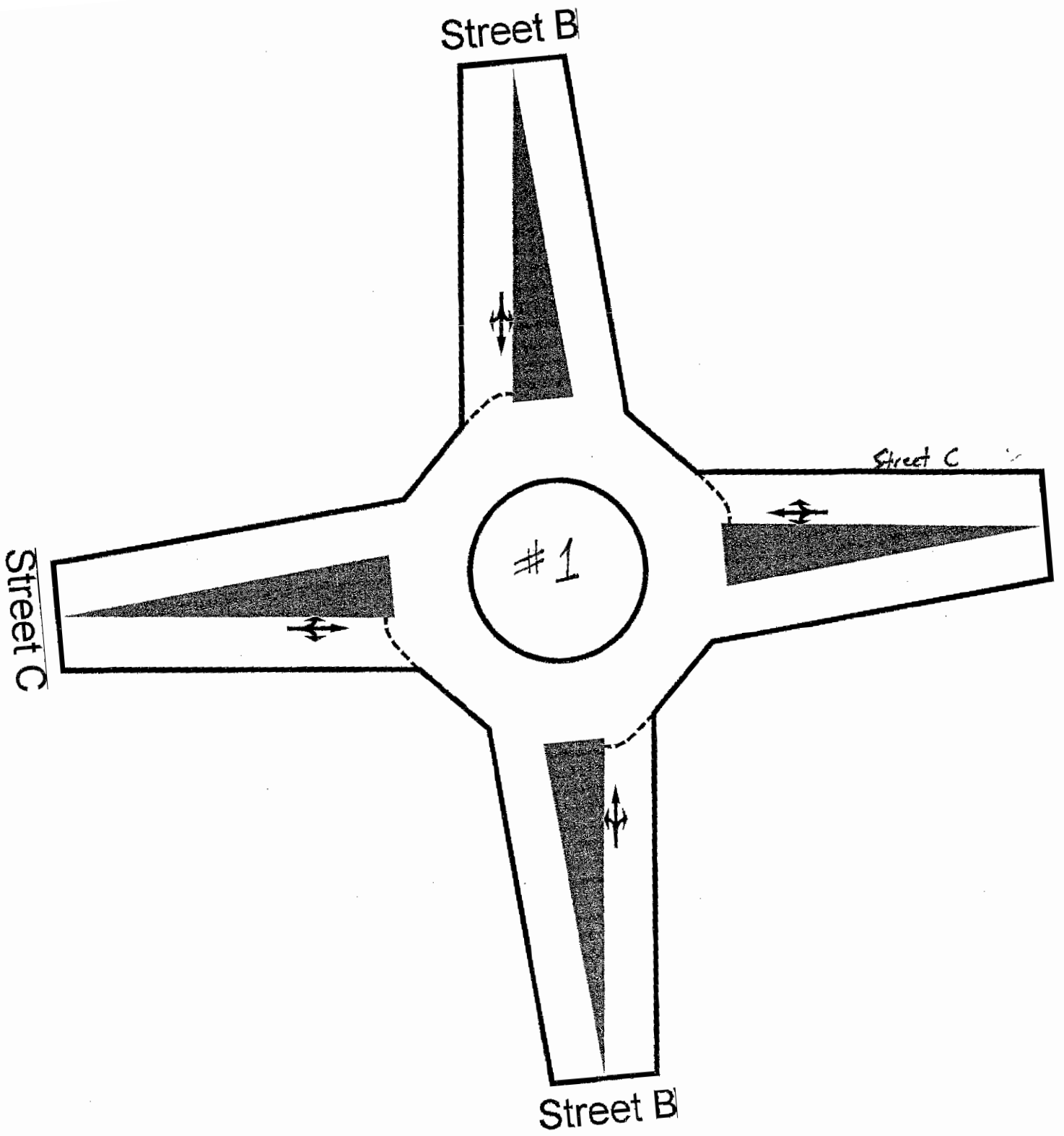
Intersection Summary					
HCM Average Control Delay		12.7	HCM Level of Service		B
HCM Volume to Capacity ratio		0.64			
Actuated Cycle Length (s)		66.7	Sum of lost time (s)		8.0
Intersection Capacity Utilization		56.5%	ICU Level of Service		B
Analysis Period (min)		15			
Critical Lane Group					

Street B

Street C

Street C

Street B



SIDRA INTERSECTION

Output Tables

UC San Marcos

1 Lane Roundabout

West Side Roundabout Analysis

Run Information

Int. #1

* Basic Parameters:

Intersection Type: Roundabout
 Driving on the right-hand side of the road
 Input data specified in US units
 Model Defaults: US HCM (US)
 Peak Flow Period (for performance): 15 minutes
 Unit time (for volumes): 60 minutes.
 Delay definition: Control delay
 Geometric delay included
 HCM Delay Model option selected
 HCM Queue Model option selected
 Level of Service based on: Delay (HCM method)
 Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds, negotiation radius or negotiation speed data in the Definitions & Path Data dialog.

Table R.1 - Roundabout Gap Acceptance Parameters

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

Turn	Lane No.	Lane Type	---- Circulating/Exiting Stream ---				Critical Gap		
			Flow Rate	Aver Speed	Aver In-Bnch Dist	Prop Headway Bunched	Hdwy (s)	Dist (ft)	Foll-up Headway (s)
			(pcu/h)	(mph)	(ft)	(s)			
West: Street C									
Environment Factor: 1.20			Entry/Circulating Flow Adjustment: Medium						
Left	1	Dominant	157	17.3	582.8	2.00	0.173	5.33	135.0
Thru	1	Dominant	157	17.3	582.8	2.00	0.173	5.95	150.7
Right	1	Dominant	157	17.3	582.8	2.00	0.173	5.33	135.0

South: Street B
 Environment Factor: 1.20 Entry/Circulating Flow Adjustment: Medium

Left	1	Dominant	163	16.1	521.2	2.00	0.180	5.37	126.7	2.80
Thru	1	Dominant	163	16.1	521.2	2.00	0.180	5.36	126.7	2.80
Right	1	Dominant	163	16.1	521.2	2.00	0.180	5.36	126.7	2.80

East: Street C

Environment Factor: 1.20 Entry/Circulating Flow Adjustment: Medium

Left	1	Dominant	274	16.6	320.6	2.00	0.283	5.22	127.4	2.78
Thru	1	Dominant	274	16.6	320.6	2.00	0.283	5.83	142.3	3.11
Right	1	Dominant	274	16.6	320.6	2.00	0.283	5.83	142.3	3.11

North: Street B

Environment Factor: 1.20 Entry/Circulating Flow Adjustment: Medium

Left	1	Dominant	182	16.1	467.7	2.00	0.198	6.00	141.5	3.15
Thru	1	Dominant	182	16.1	467.7	2.00	0.198	5.37	126.7	2.82
Right	1	Dominant	182	16.1	467.7	2.00	0.198	5.37	126.7	2.82

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table S.3 - Intersection Parameters

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

Intersection Level of Service	=	A
Worst movement Level of Service	=	A
Average intersection delay (s/pers)	=	2.5
Largest average movement delay (s)	=	4.6
Largest back of queue, 95% (ft)	=	41
Performance Index	=	10.57
Degree of saturation (highest)	=	0.225
Practical Spare Capacity (lowest)	=	278 %
Effective intersection capacity, (veh/h)	=	3393
Total vehicle flow (veh/h)	=	762
Total person flow (pers/h)	=	914
Total vehicle delay (veh-h/h)	=	0.52
Total person delay (pers-h/h)	=	0.63
Total effective vehicle stops (veh/h)	=	242
Total effective person stops (pers/h)	=	291
Total vehicle travel (veh-mi/h)	=	141.5
Total cost (\$/h)	=	102.63
Total fuel (gal/h)	=	6.2
Total CO2 (kg/h)	=	59.03

Table S.6 - Intersection Performance

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

Total Flow	Deg. Satn	Total Delay	Total Delay	Aver. Delay	Prop. Queued	Eff. Stop	Longest Queue	Perf. Index	Aver. Speed
------------	-----------	-------------	-------------	-------------	--------------	-----------	---------------	-------------	-------------

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

	/h)	/h)	(%)	x	(sec)		(veh)	
West: Street C								
5L L	152	677	100	0.225*	4.0	0.46	1.6	2.22
2T T	6	27	100	0.222	1.0	0.18	1.6	0.07
2R R	84	374	100	0.225*	1.0	0.18	1.6	0.88
South: Street B								
3L L	77	382	100	0.202	4.0	0.46	1.4	1.06
8T T	46	228	100	0.202	1.1	0.18	1.4	0.46
8R R	91	451	100	0.202	1.1	0.18	1.4	0.87
East: Street C								
1L L	100	842	100	0.119	4.6	0.51	0.8	1.37
6T T	6	51	100	0.118	1.7	0.29	0.8	0.07
6R R	6	51	100	0.118	1.7	0.29	0.8	0.06
North: Street B								
7L L	6	32	100	0.188	4.1	0.48	1.3	0.13
4T T	51	272	100	0.188	1.2	0.21	1.3	0.93
4R R	137	730	100	0.188	1.2	0.21	1.3	2.44

* Maximum degree of saturation

Table S.12A - Fuel Consumption, Emissions and Cost (TOTAL)

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

Mov	Fuel	Cost	HC	CO	NOX	CO2
ID	Total	Total	Total	Total	Total	Total
	gal/h	\$/h	kg/h	kg/h	kg/h	kg/h
INTERSECTION:	6.2	102.63	0.098	3.27	0.093	59.0

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel (\$/US gal)	=	2.400
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income (\$/h)	=	19.00
Time value factor	=	0.40
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

Table S.14 - Summary of Input and Output Data

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

Roundabout

Lane No.	Demand Flow (veh/h)				%HV	Adj. Eff Grn Basic (secs)		Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
	L	T	R	Tot		Satf. 1st	2nd				
West: Street C											
1 LTR	152	6	84	242	2			0.224	2.9	41	650
	152	6	84	242	2			0.224	2.9	41	
South: Street B											
1 LTR	77	46	91	214	2			0.202	2.1	37	550
	77	46	91	214	2			0.202	2.1	37	
East: Street C											
1 LTR	100	6	6	112	4			0.119	4.3	20	500
	100	6	6	112	4			0.119	4.3	20	
North: Street B											
1 LTR	6	51	137	194	3			0.188	1.3	33	1400
	6	51	137	194	3			0.188	1.3	33	
ALL VEHICLES				Total Flow	% HV			Max X	Aver. Delay	Max Queue	
				762	3			0.225	2.5	41	

Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - Capacity and Level of Service

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

Mov ID	Mov Typ	Total Flow (veh/h)	Total Cap. (veh/h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	Queue (ft)
West: Street C								
5L L		152	677	0.225*	4.0	A	1.6	41
2T T		6	27	0.222	1.0	A	1.6	41
2R R		84	374	0.225*	1.0	A	1.6	41
South: Street B								
3L L		77	382	0.202	4.0	A	1.4	37
8T T		46	228	0.202	1.1	A	1.4	37
8R R		91	451	0.202	1.1	A	1.4	37
East: Street C								
1L L		100	842	0.119	4.6	A	0.8	20
6T T		6	51	0.118	1.7	A	0.8	20
6R R		6	51	0.118	1.7	A	0.8	20
North: Street B								

7L L	6	32	0.188	4.1	A	1.3	33
4T T	51	272	0.188	1.2	A	1.3	33
4R R	137	730	0.188	1.2	A	1.3	33
ALL VEHICLES:	762		0.225	2.5	A	1.6	41

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.

For the criteria, refer to the "Level of Service" topic in the SIDRA Output Guide or the Output section of the on-line help.

- * Maximum v/c ratio, or critical green periods
- " Movement Level of service has been determined using adjacent lane v/c ratio rather than short lane v/c ratio (v/c=1.0)



SIDRA SOLUTIONS

Site: Intersection 1

Processed Sep 06, 2013 10:00:07PM

A1444, Unregistered, Small Office

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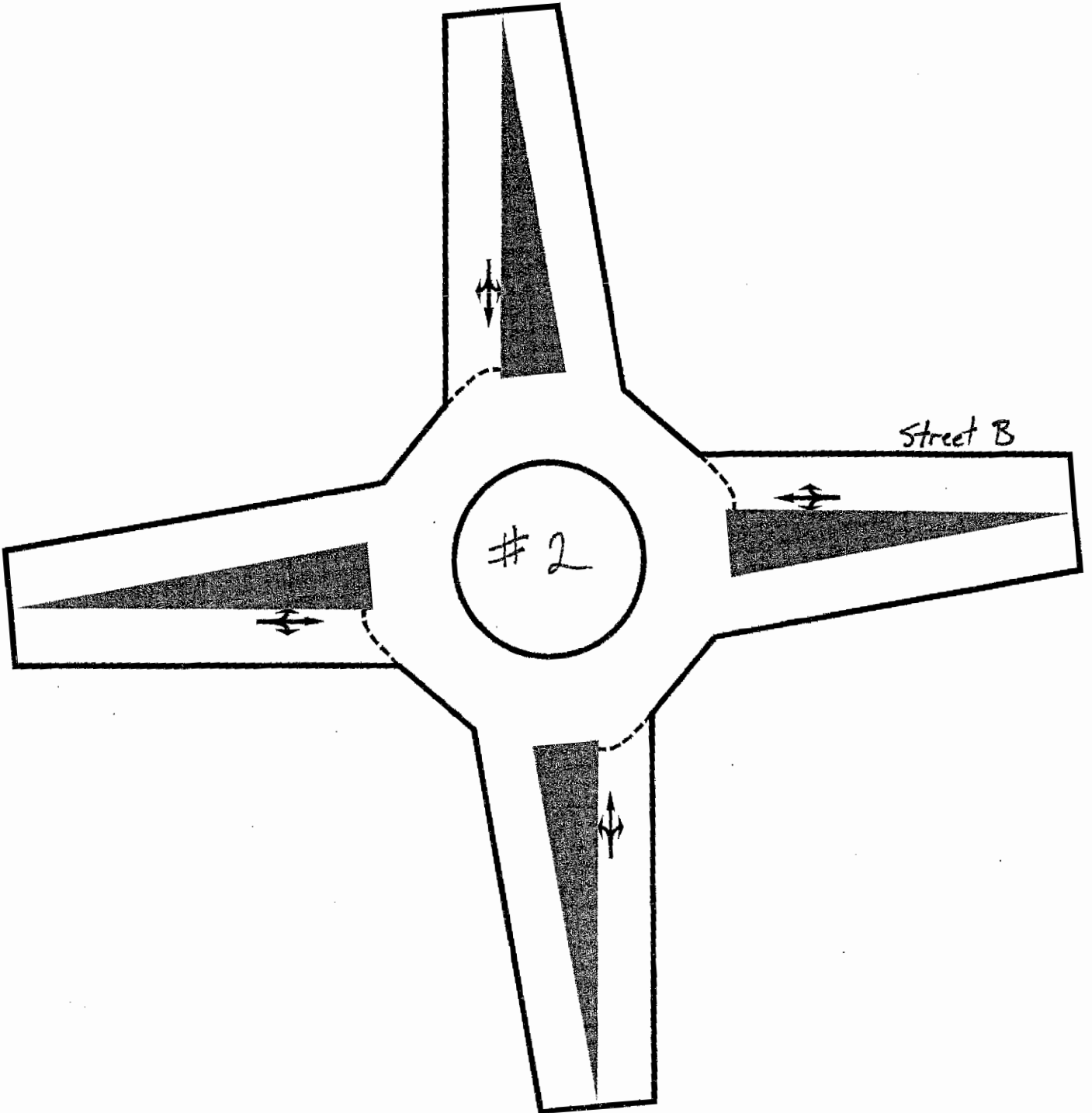
Street C

Street B

Street B

Street C

2



SIDRA INTERSECTION

Output Tables

UC San Marcos

1 Lane Roundabout

West Side Roundabout Analysis

Run Information

Int. # 2

* Basic Parameters:
 Intersection Type: Roundabout
 Driving on the right-hand side of the road
 Input data specified in US units
 Model Defaults: US HCM (US)
 Peak Flow Period (for performance): 15 minutes
 Unit time (for volumes): 60 minutes.
 Delay definition: Control delay
 Geometric delay included
 HCM Delay Model option selected
 HCM Queue Model option selected
 Level of Service based on: Delay (HCM method)
 Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds, negotiation radius or negotiation speed data in the Definitions & Path Data dialog.

Table R.1 - Roundabout Gap Acceptance Parameters

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

Turn Lane No.	Lane Type	---- Circulating/Exiting Stream ---					Critical Gap		Foll-up Headway (s)
		Flow Rate (pcu/h)	Aver Speed (mph)	Aver In-Bnch Dist (ft)	Prop Headway (s)	Bunched	Hdwy (s)	Dist (ft)	
West: Street B									
Environment Factor: 1.20		Entry/Circulating Flow Adjustment: Medium							
Left	1 Dominant	351	16.5	247.9	2.00	0.348	5.10	123.3	2.75
Thru	1 Dominant	351	16.5	247.9	2.00	0.348	5.10	123.3	2.75
Right	1 Dominant	351	16.5	247.9	2.00	0.348	5.70	137.7	3.08

South: Street C
 Environment Factor: 1.20 Entry/Circulating Flow Adjustment: Medium

Left	1 Dominant	448	17.1	201.4	2.00	0.422	5.53	138.7	3.04
Thru	1 Dominant	448	17.1	201.4	2.00	0.422	4.95	124.2	2.72
Right	1 Dominant	448	17.1	201.4	2.00	0.422	4.95	124.2	2.72

East: Street B

Environment Factor: 1.20 Entry/Circulating Flow Adjustment: Medium

Left	1 Dominant	165	17.2	549.9	2.00	0.182	5.13	129.6	2.68
Thru	1 Dominant	165	17.2	549.9	2.00	0.182	5.13	129.6	2.68
Right	1 Dominant	165	17.2	549.9	2.00	0.182	5.13	129.6	2.68

North: Street C

Environment Factor: 1.20 Entry/Circulating Flow Adjustment: Medium

Left	1 Dominant	212	18.2	452.2	2.00	0.227	5.21	138.6	2.74
Thru	1 Dominant	212	18.2	452.2	2.00	0.227	5.21	138.6	2.74
Right	1 Dominant	212	18.2	452.2	2.00	0.227	5.21	138.6	2.74

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table S.3 - Intersection Parameters

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

Intersection Level of Service	=	A
Worst movement Level of Service	=	A
Average intersection delay (s/pers)	=	2.9
Largest average movement delay (s)	=	6.0
Largest back of queue, 95% (ft)	=	87
Performance Index	=	16.85
Degree of saturation (highest)	=	0.397
Practical Spare Capacity (lowest)	=	114 %
Effective intersection capacity, (veh/h)	=	3024
Total vehicle flow (veh/h)	=	1199
Total person flow (pers/h)	=	1439
Total vehicle delay (veh-h/h)	=	0.95
Total person delay (pers-h/h)	=	1.14
Total effective vehicle stops (veh/h)	=	472
Total effective person stops (pers/h)	=	566
Total vehicle travel (veh-mi/h)	=	203.5
Total cost (\$/h)	=	151.76
Total fuel (gal/h)	=	9.3
Total CO2 (kg/h)	=	88.52

Table S.6 - Intersection Performance

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

Total Flow	Deg. Satn	Total Delay	Total Delay	Aver. Delay	Prop. Queued	Eff. Stop	Longest Queue	Perf. Index	Aver. Speed
------------	-----------	-------------	-------------	-------------	--------------	-----------	---------------	-------------	-------------

(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) (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	95% Back of Queue	Perf. Index
--------	----------	------------------	--------------------	-----------	-----------	-------------	----------------	-------------------	-------------

	/h)	/h)	(%)	x	(sec)		(veh)	
West: Street B								
5L L	109	400	100	0.273	5.4	0.61	2.0	2.57
2T T	125	459	100	0.272	2.5	0.43	2.0	2.56
2R R	6	22	100	0.273	2.5	0.43	2.0	0.12
South: Street C								
3L L	6	31	100	0.194	6.0	0.65	1.4	0.09
8T T	51	263	100	0.194	3.0	0.49	1.4	0.63
8R R	101	520	100	0.194	3.0	0.45	1.4	1.18
East: Street B								
1L L	91	230	100	0.396	4.2	0.49	3.4	1.35
6T T	115	290	100	0.397*	1.3	0.22	3.4	1.28
6R R	235	593	100	0.396	1.3	0.22	3.4	2.51
North: Street C								
7L L	214	610	100	0.351	4.5	0.53	2.9	3.04
4T T	46	131	100	0.351	1.6	0.27	2.9	0.49
4R R	100	285	100	0.351	1.6	0.27	2.9	1.02

* Maximum degree of saturation

Table S.12A - Fuel Consumption, Emissions and Cost (TOTAL)

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

Mov	Fuel	Cost	HC	CO	NOX	CO2
ID	Total	Total	Total	Total	Total	Total
	gal/h	\$/h	kg/h	kg/h	kg/h	kg/h
INTERSECTION;	9.3	151.76	0.149	5.23	0.145	88.5

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel (\$/US gal)	=	2.400
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income (\$/h)	=	19.00
Time value factor	=	0.40
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

Table S.14 - Summary of Input and Output Data

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

Roundabout

Lane No.	Demand Flow (veh/h)				%HV	Adj. Eff Grn Basic (secs)		Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
	L	T	R	Tot		Satf. 1st	2nd				
West: Street B											
1 LTR	109	125	6	240	2			0.272	3.8	51	1400
	109	125	6	240	2			0.272	3.8	51	
South: Street C											
1 LTR	6	51	101	158	3			0.194	3.1	35	500
	6	51	101	158	3			0.194	3.1	35	
East: Street B											
1 LTR	91	115	235	441	2			0.396	1.9	87	600
	91	115	235	441	2			0.396	1.9	87	
North: Street C											
1 LTR	214	46	100	360	2			0.351	3.3	73	500
	214	46	100	360	2			0.351	3.3	73	
=====											
ALL VEHICLES				Total Flow	% HV			Max X	Aver. Delay	Max Queue	
				1199	2			0.397	2.9	87	

Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - Capacity and Level of Service

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

Mov ID	Mov Typ	Total Flow (veh/h)	Total Cap. (veh/h)	Deg. cf Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	Queue (ft)
West: Street B								
5L	L	109	400	0.273	5.4	A	2.0	51
2T	T	125	459	0.272	2.5	A	2.0	51
2R	R	6	22	0.273	2.5	A	2.0	51
South: Street C								
3L	L	6	31	0.194	6.0	A	1.4	35
8T	T	51	263	0.194	3.0	A	1.4	35
8R	R	101	520	0.194	3.0	A	1.4	35
East: Street B								
1L	L	91	230	0.396	4.2	A	3.4	87
6T	T	115	290	0.397*	1.3	A	3.4	87
6R	R	235	593	0.396	1.3	A	3.4	87
North: Street C								

7L L	214	610	0.351	4.5	A	2.9	73
4T T	46	131	0.351	1.6	A	2.9	73
4R R	100	285	0.351	1.6	A	2.9	73
ALL VEHICLES:	1199		0.397	2.9	A	3.4	87

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.

For the criteria, refer to the "Level of Service" topic in the SIDRA Output Guide or the Output section of the on-line help.

* Maximum v/c ratio, or critical green periods



SIDRA SOLUTIONS

Site: Intersection 2

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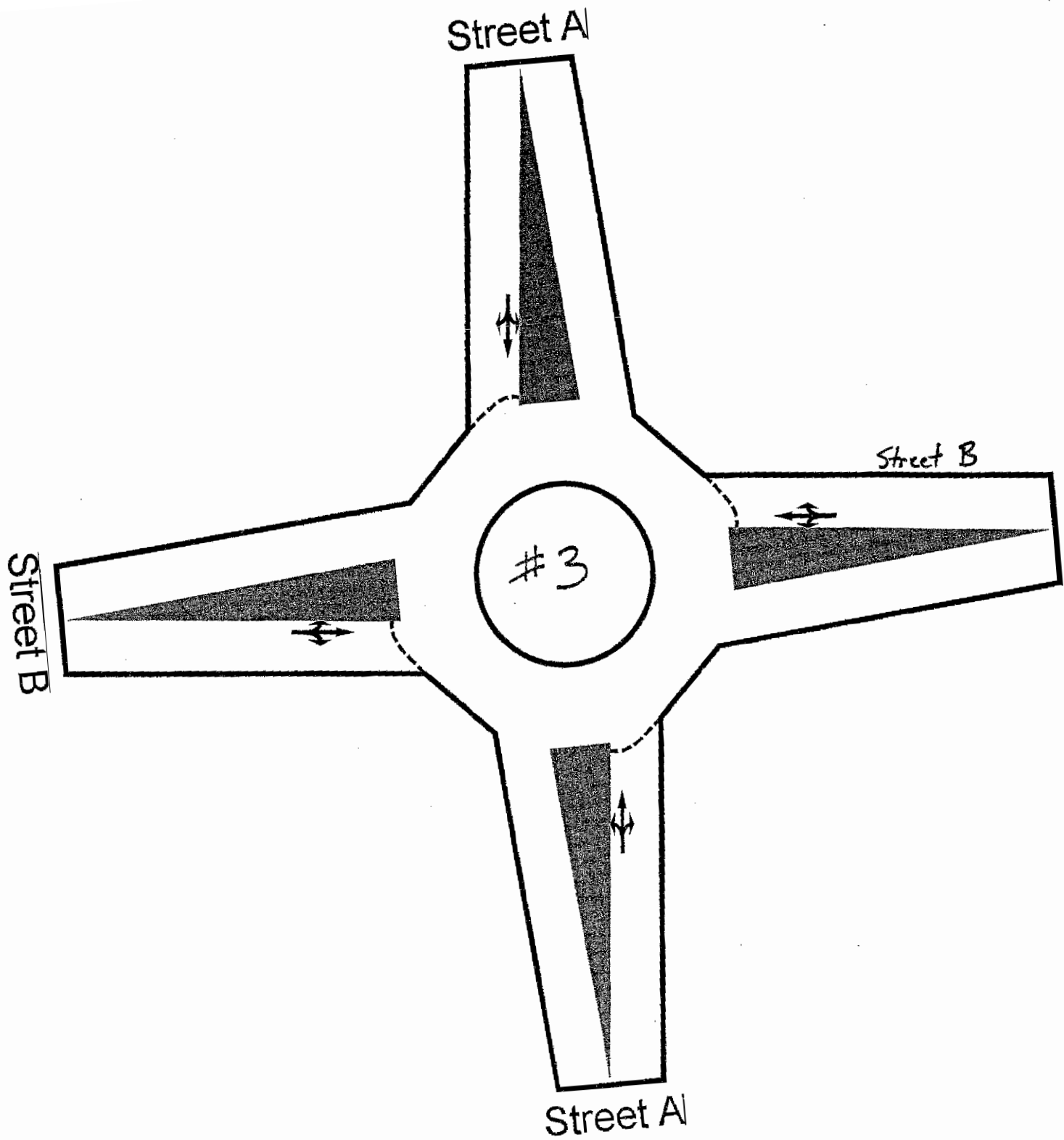
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SIDRA INTERSECTION

Output Tables

UC San Marcos

1 Lane Roundabout

West Side Roundabout Analysis

Run Information

Int. #3

* Basic Parameters:

Intersection Type: Roundabout
 Driving on the right-hand side of the road
 Input data specified in US units
 Model Defaults: US HCM (US)
 Peak Flow Period (for performance): 15 minutes
 Unit time (for volumes): 60 minutes.
 Delay definition: Control delay
 Geometric delay included
 HCM Delay Model option selected
 HCM Queue Model option selected
 Level of Service based on: Delay (HCM method)
 Queue definition: Back of queue, 95th Percentile

Geometric delay is less than 2 seconds for some movements. The negotiation speed may be too high or the approach and exit speeds may be too low for given geometric design (e.g. for a large roundabout). Check Tables D.0, D.1 and D.4 for geometric delay data including negotiation speeds. If necessary, specify appropriate values of approach and exit speeds, negotiation radius or negotiation speed data in the Definitions & Path Data dialog.

Table R.1 - Roundabout Gap Acceptance Parameters

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

Turn	Lane No.	Lane Type	---- Circulating/Exiting Stream ---					Critical Gap		
			Flow Rate (pcu/h)	Aver Speed (mph)	Aver Dist (ft)	In-Bnch Headway (s)	Prop Bunched	Hdwy (s)	Dist (ft)	Follow-up Headway (s)
West: Street B										
Environment Factor: 1.20			Entry/Circulating			Flow Adjustment: Medium				
Left	1	Dominant	519	16.6	169.2	2.00	0.471	4.85	118.3	2.69
Thru	1	Dominant	519	16.6	169.2	2.00	0.471	4.85	118.3	2.69
Right	1	Dominant	519	16.6	169.2	2.00	0.471	4.85	118.3	2.69

South: Street A
 Environment Factor: 1.20 Entry/Circulating Flow Adjustment: Medium

Left	1 Dominant	665	16.8	133.3	2.00	0.563	4.65	114.6	2.64
Thru	1 Dominant	665	16.8	133.3	2.00	0.563	4.65	114.6	2.64
Right	1 Dominant	665	16.8	133.3	2.00	0.563	4.65	114.6	2.64

East: Street B

Environment Factor: 1.20 Entry/Circulating Flow Adjustment: Medium

Left	1 Dominant	452	16.6	194.3	2.00	0.425	4.92	120.0	2.70
Thru	1 Dominant	452	16.6	194.3	2.00	0.425	4.92	120.0	2.70
Right	1 Dominant	452	16.6	194.3	2.00	0.425	4.92	120.0	2.70

North: Street A

Environment Factor: 1.20 Entry/Circulating Flow Adjustment: Medium

Left	1 Dominant	434	17.4	211.5	2.00	0.411	4.94	125.9	2.70
Thru	1 Dominant	434	17.4	211.5	2.00	0.411	4.94	125.9	2.70
Right	1 Dominant	434	17.4	211.5	2.00	0.411	4.94	125.8	2.70

Dist (Distance): Spacing, i.e. distance between the front ends of two successive vehicles across all lanes in the circulating or exiting stream

Table S.3 - Intersection Parameters

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

Intersection Level of Service	=	B
Worst movement Level of Service	=	B
Average intersection delay (s/pers)	=	10.6
Largest average movement delay (s)	=	13.3
Largest back of queue, 95% (ft)	=	313
Performance Index	=	47.54
Degree of saturation (highest)	=	0.772
Practical Spare Capacity (lowest)	=	10 %
Effective intersection capacity, (veh/h)	=	2662
Total vehicle flow (veh/h)	=	2054
Total person flow (pers/h)	=	2465
Total vehicle delay (veh-h/h)	=	6.05
Total person delay (pers-h/h)	=	7.26
Total effective vehicle stops (veh/h)	=	2274
Total effective person stops (pers/h)	=	2728
Total vehicle travel (veh-mi/h)	=	312.2
Total cost (\$/h)	=	291.03
Total fuel (gal/h)	=	18.2
Total CO2 (kg/h)	=	172.35

Table S.6 - Intersection Performance

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

Total Flow	Deg. Satn	Total Delay	Total Delay	Aver. Delay	Prop. Queued	Eff. Stop	Longest Queue	Perf. Index	Avar. Speed
------------	-----------	-------------	-------------	-------------	--------------	-----------	---------------	-------------	-------------

(veh/h)	x	(veh-h/h)	(pers-h/h)	(sec)	Rate	(ft)	(mph)		
West: Street B									
518	0.697	1.61	1.93	11.2	0.92	1.12	238	12.07	14.3
South: Street A									
336	0.542	0.80	0.96	8.6	0.89	0.95	144	7.72	16.1
East: Street B									
607	0.772	1.94	2.32	11.5	0.97	1.18	313	12.92	11.8
North: Street A									
593	0.759	1.70	2.04	10.3	0.97	1.11	299	14.84	15.2
ALL VEHICLES:									
2054	0.772	6.05	7.26	10.6	0.94	1.11	313	47.54	14.4
INTERSECTION (persons):									
2465	0.772		7.26	10.6	0.94	1.11		47.54	14.4
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

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 (vehs)	Lane Length (ft)
West: Street B							
1 LTR	518	744	0.697	11.2	1.12	9.4 238.2	600.0
South: Street A							
1 LTR	336	622	0.541	8.6	0.95	5.6 143.6	900.0
East: Street B							
1 LTR	607	787	0.772	11.5	1.18	12.3 312.9	300.0
North: Street A							
1 LTR	593	784	0.756	10.3	1.11	11.8 299.0	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
--------	---------	------------------	--------------------	-----------	-----------	-------------	----------------	-------------------	-------------

	/h)	/h)	(%)	x	(sec)		(veh)	
West: Street B								
5L L	331	475	100	0.697	12.2	1.14	9.4	8.01
2T T	137	197	100	0.695	9.3	1.11	9.4	3.01
2R R	50	72	100	0.694	9.3	1.03	9.4	1.05
South: Street A								
3L L	46	85	100	0.541	11.1	1.04	5.6	1.18
8T T	77	142	100	0.542	8.2	1.00	5.6	1.79
8R R	213	394	100	0.541	8.2	0.91	5.6	4.75
East: Street B								
1L L	236	306	100	0.771	13.3	1.21	12.3	5.41
6T T	152	197	100	0.772*	10.3	1.20	12.3	3.16
6R R	219	284	100	0.771	10.3	1.12	12.3	4.35
North: Street A								
7L L	198	262	100	0.756	12.3	1.16	11.8	5.33
4T T	85	112	100	0.759	9.4	1.15	11.8	2.11
4R R	310	410	100	0.756	9.4	1.07	11.8	7.40

* Maximum degree of saturation

Table S.12A - Fuel Consumption, Emissions and Cost (TOTAL)

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

Mov	Fuel	Cost	HC	CO	NOX	CO2
ID	Total	Total	Total	Total	Total	Total
	gal/h	\$/h	kg/h	kg/h	kg/h	kg/h
INTERSECTION:	18.2	291.03	0.310	12.30	0.322	172.3

PARAMETERS USED IN COST CALCULATIONS

Pump price of fuel (\$/US gal)	=	2.400
Fuel resource cost factor	=	0.70
Ratio of running cost to fuel cost	=	3.0
Average income (\$/h)	=	19.00
Time value factor	=	0.40
Light vehicle mass (1000 lb)	=	3.1
Heavy vehicle mass (1000 lb)	=	24.0
Light vehicle idle fuel rate (US gal/h)	=	0.360
Heavy vehicle idle fuel rate (US gal/h)	=	0.530

Table S.14 - Summary of Input and Output Data

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

Roundabout

Lane No.	Demand Flow (veh/h)				#HV	Adj. Basic Satf.	Eff Grn (secs) 1st 2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (ft)	Shrt Lane (ft)
	L	T	R	Tot							
West: Street B											
1 LTR	331	137	50	518	2			0.697	11.2	238	600
	331	137	50	518	2			0.697	11.2	238	
South: Street A											
1 LTR	46	77	213	336	2			0.541	8.6	144	900
	46	77	213	336	2			0.541	8.6	144	
East: Street B											
1 LTR	236	152	219	607	2			0.772	11.5	313	300
	236	152	219	607	2			0.772	11.5	313	
North: Street A											
1 LTR	198	85	310	593	2			0.756	10.3	299	800
	198	85	310	593	2			0.756	10.3	299	
ALL VEHICLES				Total Flow	# HV			Max X	Aver. Delay	Max Queue	
				2054	2			0.772	10.6	313	

Peak flow period = 15 minutes.

Queue values in this table are 95% back of queue (feet).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Table S.15 - Capacity and Level of Service

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

Mov ID	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS	Longest Queue 95% Back (vehs)	Queue (ft)
West: Street B								
5L L		331	475	0.697	12.2	B	9.4	238
2T T		137	197	0.695	9.3	A	9.4	238
2R R		50	72	0.694	9.3	A	9.4	238
South: Street A								
3L L		46	85	0.541	11.1	B	5.6	144
9T T		77	142	0.542	8.2	A	5.6	144
8R R		213	394	0.541	8.2	A	5.6	144
East: Street B								
1L L		236	306	0.771	13.3	B	12.3	313
6T T		152	197	0.772*	10.3	B	12.3	313
6R R		219	284	0.771	10.3	B	12.3	313
North: Street A								

7L L	198	262	0.756	12.3	B	11.8	299
4T T	85	112	0.759	9.4	A	11.8	299
4R R	310	410	0.756	9.4	A	11.8	299
ALL VEHICLES:	2054		0.772	10.6	B	12.3	313

Level of Service calculations are based on average control delay including geometric delay (HCM criteria), independent of the current delay definition used.

For the criteria, refer to the "Level of Service" topic in the SIDRA Output Guide or the Output section of the on-line help.

- * Maximum v/c ratio, or critical green periods
- " Movement Level of service has been determined using adjacent lane v/c ratio rather than short lane v/c ratio (v/c=1.0)



SIDRA SOLUTIONS

Site: Intersection 3

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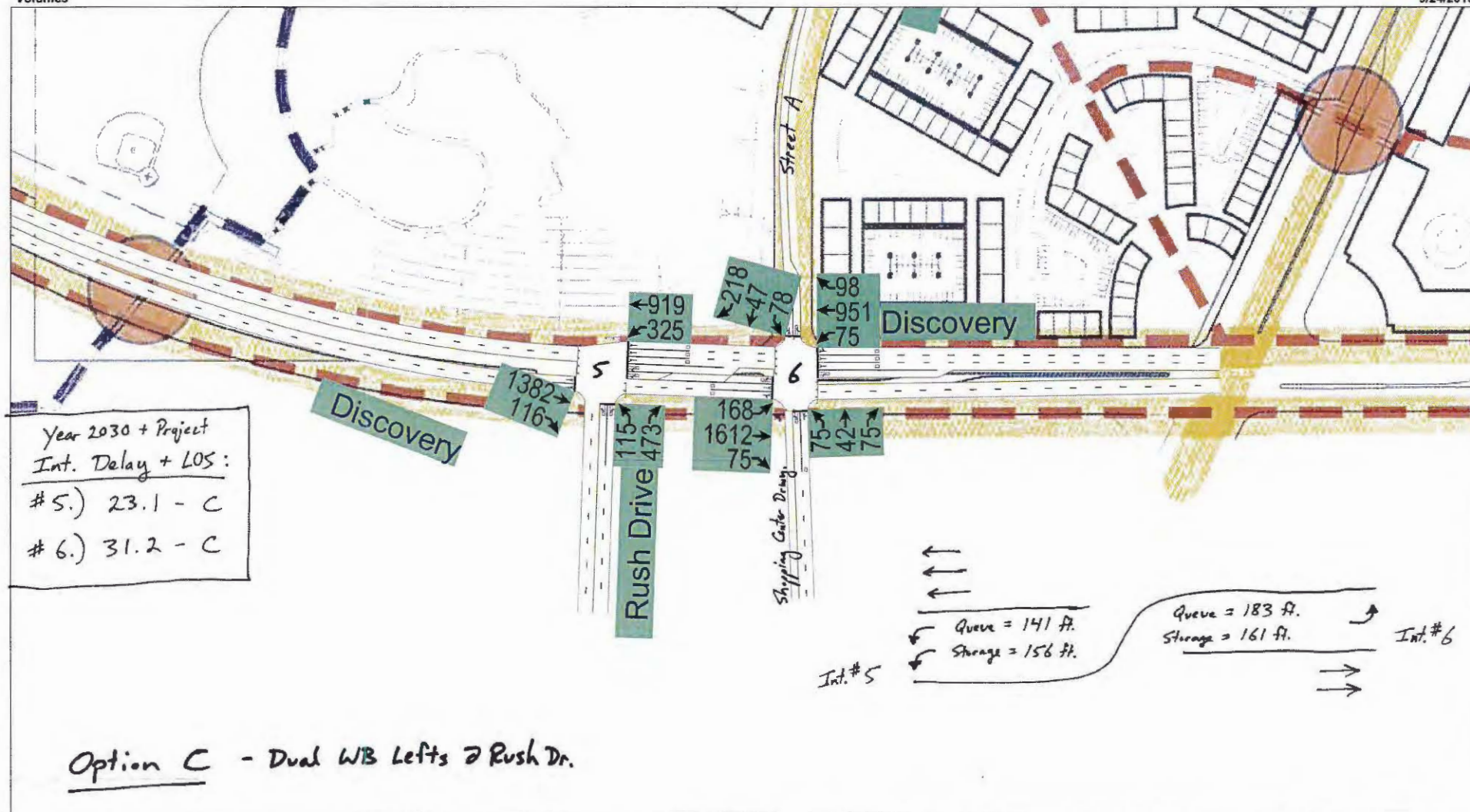
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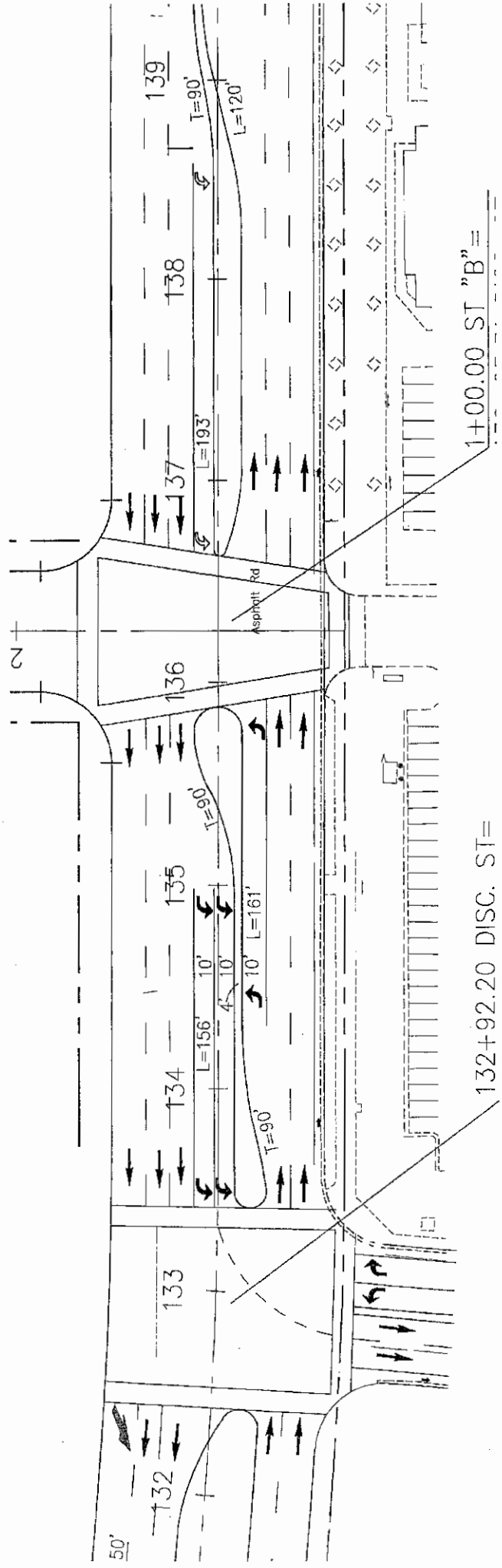
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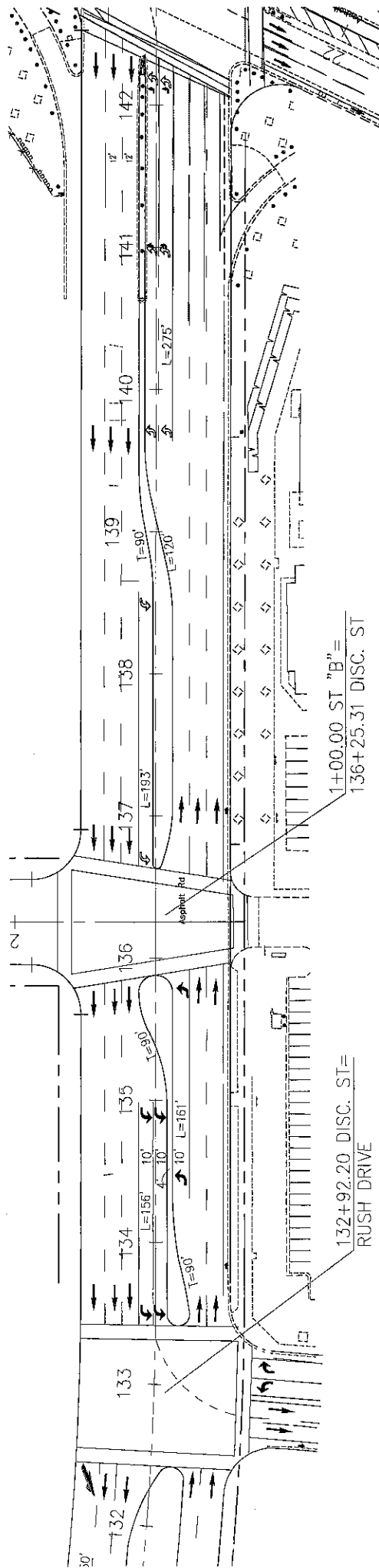


Baseline

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OPTION C



HCM Signalized Intersection Capacity Analysis
5: Discovery & Rush Drive

Year 2030 + Project PM

9/24/2013

Movement	EBL	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖↗	↑↑↑	↖	↗
Volume (vph)	1382	116	325	919	115	473
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.95		0.97	0.91	1.00	1.00
Flt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3498		3433	5085	1770	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3498		3433	5085	1770	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1536	129	361	1021	128	526
RTOR Reduction (vph)	7	0	0	0	0	10
Lane Group Flow (vph)	1658	0	361	1021	128	516
Turn Type			Prot		pm+ov	
Protected Phases	2		1	6	8	1
Permitted Phases						8
Actuated Green, G (s)	46.7		19.6	70.3	11.7	31.3
Effective Green, g (s)	46.7		19.6	70.3	11.7	31.3
Actuated g/C Ratio	0.52		0.22	0.78	0.13	0.35
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1815		748	3972	230	621
v/s Ratio Prot	60.47		0.11	0.20	0.07	60.18
v/s Ratio Perm						0.14
v/c Ratio	0.91		0.48	0.26	0.56	0.83
Uniform Delay, d1	19.8		30.8	2.7	36.7	26.9
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	8.6		0.5	0.2	2.9	9.2
Delay (s)	28.4		31.3	2.9	39.6	36.1
Level of Service	C		C	A	D	D
Approach Delay (s)	28.4			10.3	36.8	
Approach LOS	C			B	D	
Intersection Summary						
HCM Average Control Delay	23.1		HCM Level of Service		C	
HCM Volume to Capacity ratio	0.88					
Actuated Cycle Length (s)	90.0		Sum of lost time (s)		8.0	
Intersection Capacity Utilization	77.8%		ICU Level of Service		D	
Analysis Period (min)	15					
c Critical Lane Group						

Option C