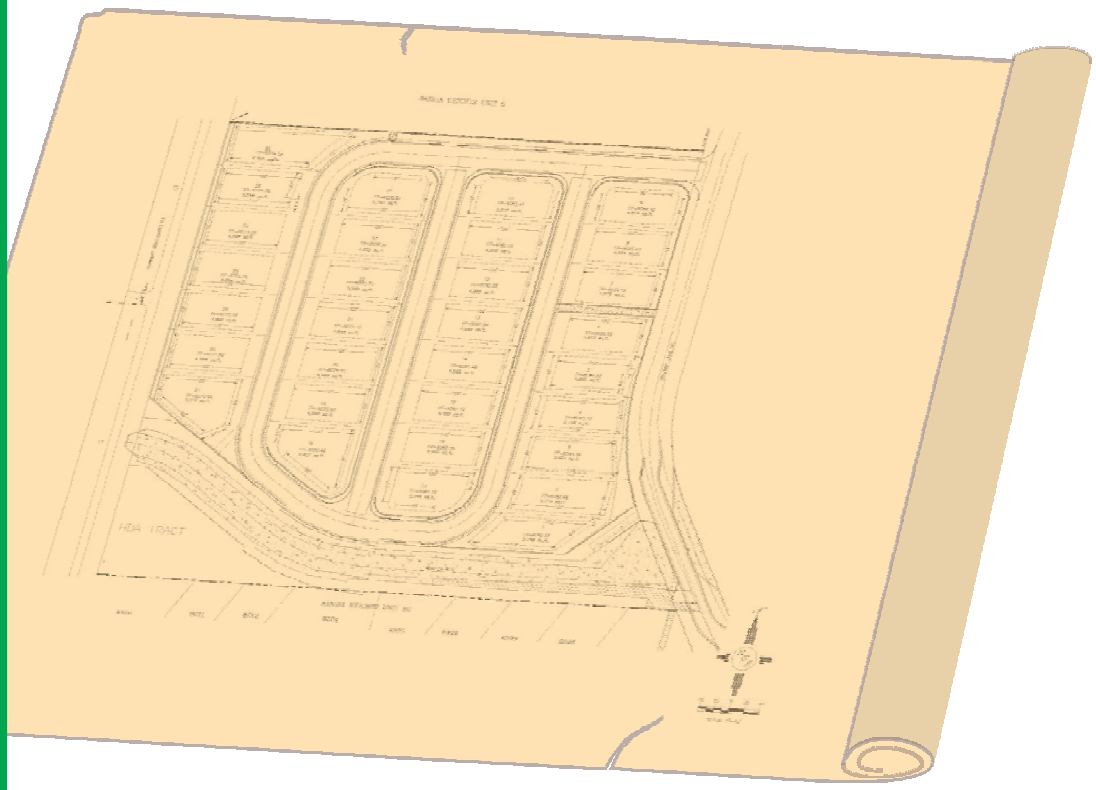
Hawk's Landing

Final

Traffic Impact Analysis



February 3, 2014

Traffic Impact Study

Hawk's Landing

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Acronyms

AASHTO	American Association of State Highway and Transportation Officials
AADT	Annual Average Daily Traffic
AAWDT	Annual Average Weekday Traffic
AMAFCA	Albuquerque Metropolitan Arroyo Flood Control Authority
g/C	Green time per signal Cycle length
HCM	Highway Capacity Manual
HTG	Harwick Transportation Group
ITE	Institute of Transportation Engineers
MRCOG	Mid-Region Council of Governments
mph	Miles per Hour
MTP	Metropolitan Transportation Plan (current document for year 2025)
MUTCD	Manual on Uniform Traffic Control Devices
NMDOT	New Mexico Department of Transportation
pcphpl	Passenger cars per hour per lane
PHF	Peak Hour Factor
SAMM	State Access Management Manual
v/c	Volume to Capacity ratio
vpd	Vehicles per Day
vph	Vehicles per Hour

1.0 INTRODUCTION

This traffic impact study was prepared for the Hawk's Landing residential development located east of Tramway Blvd at the Paseo del Norte intersection (see Appendix A). Hawk's Landing will have 31 single family residences. The purpose of this study was to assess the traffic operations impacts on the surrounding roadway network from this proposed residential development.

The study was conducted following preparation of a scoping report approved by Bernalillo County on October 23, 2013. The report was prepared in accordance with Bernalillo County standards. Based upon the scoping discussions, the study evaluated traffic operations at the following three existing intersections:

1) Tramway Blvd @ San Bernardino Dr — Signalized
2) Tramway Blvd @ Paseo del Norte — Signalized
3) Tramway Blvd @ Live Oak Rd — Signalized

The Build year is assumed to be 2015 when the developer anticipates that all lots will be constructed.

The analyses for this project are limited to the impacted signalized intersections with Tramway Blvd. The site access with Tramway Lane and internal local intersections were not evaluated.

1.1 ROADWAY NETWORK

Tramway Blvd is a north-south, limited access principal arterial. Tramway Blvd is a four-lane divided roadway with a rural roadway section and 8' shoulders with a posted speed limit of 50 mph within the study area. The east side of Tramway Blvd has a non-motorized asphalt trail and the shoulders are designated as NMDOT bicycle facility #556. Tramway Blvd has exclusive left- and right-turn lanes at each intersection.

San Bernardino Dr and Live Oak Rd are two-lane local streets with posted speeds of 25 mph. Each road serves local access and each are signalized at Tramway Blvd.

2.0 TRAFFIC ANALYSIS METHODOLOGY

The *Highway Capacity Manual* (HCM 2010) defines operational measures of effectiveness for all types of roadways and junctions in terms of qualitative levels of service. This study is concerned with levels of service for both signalized and unsignalized intersections, and the barometer for each intersection type is measured in terms of average vehicle control delay. Signalized intersections consider the average control delay for each approaching vehicle. Control delay is the sum of the deceleration, queue, stop, and acceleration delay, computed for each approach movement. The signalized intersection level of service criteria and a brief definition are contained in Table 1.

Table 1
Signalized Intersection Levels of Service

Level of Service	Average Control Delay per Vehicle	Definition
A	≤ 10.0 sec	Very low delay - Free flow
B	10.1 sec to 20.0 sec	Minimal stops, good progression
C	20.1 sec to 35.0 sec	Moderate number of stops
D	35.1 sec to 55.0 sec	Significant stops, some cycle failures
E	55.1 sec to 80.0 sec	High delay, approaching capacity
F	> 80.0 sec	Approach over saturation, excessive delay

The signalized intersection analyses were calculated using Synchro 7.0. This software calculates the level of service for each approach, and may provide optimization for each individual movement. It also provides excellent analyses for signal progression, where required. Synchro 7.0 can produce reports in either Synchro format or *Highway Capacity Manual* (HCM) format. Synchro's standard operational analyses for signalized intersections deviates slightly from the *Highway Capacity Manual* methodology, however, only for very congested intersections do the results diverge. Synchro can calculate both algorithms; therefore, the HCM alternative output format that is fully compatible with the methodology found in the *Highway Capacity Manual* was used. All of the signalized intersection level of service (LOS) outputs for this study were produced in the HCM format.

Unsignalized intersections also utilize control delay; however, its definition differs because of the type of traffic control. Stop controlled intersections may be two-way stop controlled, all-way stop controlled, or roundabouts (yield controlled). Each unsignalized intersection considered herein was two-way stop control, meaning that main street through movements are not considered in the analyses because they should experience no intersection related delay. Unsignalized intersection levels of service are a function of the side street approaches and main street turn levels of service. For this reason, an overall intersection level of service is not calculated such as it is for signalized intersections, and the intersection level of service is typically considered that level of service experienced by the poorest approach LOS. Table 2 contains brief definitions of unsignalized intersection LOS and the control delay values.

Table 2
Unsignalized Intersection Levels of Service

Level of Service	Average Control Delay per Vehicle	Definition
A	≤ 10.0 sec	Little or no delay
B	10.1 sec to 15.0 sec	Short traffic delays
C	15.1 sec to 25.0 sec	Average traffic delays
D	25.1 sec to 35.0 sec	Long traffic delays
E	35.1 sec to 50.0 sec	Very long traffic delays, approaching capacity
F	> 50.0 sec	Over capacity, excessive delay

The unsignalized intersection analyses were evaluated using Synchro 7.0. While this program is primarily a signalized intersection tool, it also performs unsignalized intersection analyses that are consistent with the *Highway Capacity Manual* methodology and the output results are identical to those produced by the McTrans Highway Capacity Software.

Urban areas typically assign an overall level of service (LOS) D as the desirable base condition for signalized intersections. LOS E may be acceptable for certain low volume approaches or movements, especially where a higher level of service may significantly degrade a major movement or where the default is LOS E based upon the intersection cycle length or low approach volumes. LOS D is also the desired approach level of service for urban unsignalized intersections; however, lower service levels may be acceptable for very low volume approaches.

A series of assumptions must be made for all level of service analyses. For this study, the following analysis assumptions were made, applying to existing and forecast analyses:

- Lane Width - Measured in Field (nominally 12 feet)
- Truck Percentage - Assumed 2%
- Existing Peak Hour Factors - Measured in field, applied by approach average
- Forecast Peak Hour Factors: Maintained existing factors
- Saturation Flow Rate - 1900 pcphpl
- Roadway Grades - All analyses assume level grades
- Change Intervals - 4 seconds amber, 1.5 second all red
- Cycle Lengths – 70 second cycles, splits optimized
- Signalized Operations - Actuated-uncoordinated
- Arrival Type - Random on each roadway
- Right-turn-on-Red - Estimated
- Conflicting Pedestrians - None
- Area Type - Non CBD

3.0 TRAFFIC VOLUMES

Daily traffic volumes for study area roadways were obtained from the Mid-Region Council of Governments (MRCOG) 2012 Traffic Flow Map. The average daily traffic flows on study area roadways are summarized in Table 3.

Table 3
2012 Average Daily Traffic Flows for Study Area Roadways

Roadway Segment	Average Daily Traffic (vpd)
Tramway Blvd:	
North of Paseo del Norte	13,300
South of Paseo del Norte	17,000
Paseo del Norte West of Tramway Blvd	11,000

Automated, 48-hour traffic counts were collected on Tramway Ln at the proposed site access from January 28-29, 2014. The average weekday traffic (AWDT) was 106 vehicles per day.

Turning movement counts were collected for the existing study area intersections in October/November 2013 by HTG. The existing AM and PM peak hour turning movement volumes are provided in Table 4.

Table 4
Existing AM and PM Peak Hour Turning Movement Volumes

Intersection	Eastbound			Westbound			Northbound			Southbound		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
AM Peak Hour												
Tramway Blvd @ San Bernardino	35	0	27	29	1	52	36	859	11	13	489	43
Tramway Blvd @ Paseo del Norte	59		181				433	492			351	123
Tramway Blvd @ Live Oak	2	1	75	133	4	26	18	479	19	8	242	1
PM Peak Hour												
Tramway Blvd @ San Bernardino	58	2	47	20	3	20	57	805	35	25	853	63
Tramway Blvd @ Paseo del Norte	160		409				337	587		2	555	127
Tramway Blvd @ Live Oak	0	0	41	100	0	6	61	426	137	12	452	3

The implementation (build out) year for this project is 2015. Traffic growth on the major study area roadway segments from Table 3 were examined for the years 2008 through 2012. Growth rates vary from 0.3% to 1.2% for these segments, with an average growth rate of 0.6%. To be conservative, the background growth rate was assumed to be 1.0%, and this was applied to the existing volumes to forecast the 2015 Baseline volumes. Table 4 contains the 2015 Baseline forecast volumes and please note that all forecast volumes are rounded to the nearest 10 vehicles.

Table 5
2015 Baseline AM and PM Peak Hour Turning Movement Volumes

Intersection	Eastbound			Westbound			Northbound			Southbound		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
AM Peak Hour												
Tramway Blvd @ San Bernardino	40	0	30	30	10	50	40	880	10	10	500	40
Tramway Blvd @ Paseo del Norte	60		180				440	500			360	130
Tramway Blvd @ Live Oak	10	10	80	140	10	30	20	490	20	10	250	10
PM Peak Hour												
Tramway Blvd @ San Bernardino	60	10	50	20	10	20	60	820	40	30	870	60
Tramway Blvd @ Paseo del Norte	160		420				340	600			570	130
Tramway Blvd @ Live Oak	0	0	40	100	0	10	60	430	140	10	460	10

Traffic volume summaries and raw data are provided in Appendix B.

4.0 TRIP GENERATION, DISTRIBUTION AND ASSIGNMENT

4.1 TRIP GENERATION

Trip generation for the analysis assumed that Hawk's Landing will have 31 single family homes. Project trips were generated using the Institute of Transportation Engineers (ITE) *Trip Generation*, 9th Edition. The trip generation data for Hawk's Landing is summarized in Table 6. The trip generation worksheets are provided in Appendix C.

Table 6
Trip Generation - Proposed Land Use

Code	Development	DU	Daily	AM In	AM Out	PM In	PM Out
210	Single Family Detached Housing	31	358	8	23	23	14

Residential trips are most concentrated during the peak commute hours. All residential trips are considered primary trips; therefore, no pass-by trip reduction is applied. The trips in Table 6 were distributed and assigned to the study area network as described in the following sections.

4.2 TRIP DISTRIBUTION

The trip distribution from the site was generated using the 4-hour count data collected. All existing development east of Tramway Blvd in this vicinity is residential; therefore it is assumed that existing travel patterns will mirror future travel patterns from Hawk's Landing. Table 7contains the descriptions and contributing percentages for each access route to/from the proposed development.

Table 7
Trip Distribution Percentages

No.	Description	Percent
1	Tramway Blvd North	10%
2	Tramway Blvd South	67%
3	Paseo del Norte West	23%

The primary access to the site was assumed to be Live Oak Rd because the site access from Tramway Lane is at the north side of the development, making Live Oak Rd the shortest path to Tramway Blvd. All trips were initially assigned to that access. The data yielded approximately 67% of the traffic destined to proceed south on Tramway Blvd, south of San Bernardino Dr. Because over half of the trips are assumed to go south toward Albuquerque's northeast heights, an estimated 40% of those trips were distributed to the San Bernardino Dr intersection to egress the area. It was further assumed that all trips into the development from the south will turn right at San Bernardino Dr rather than proceeding to Live Oak and backtracking to the development.

A trip distribution summary sheet is provided in Appendix C.

4.3 TRIP ASSIGNMENT

The trip assignment was based upon trip percentages for the distribution summarized in Table 7. The new trip assignment is shown below and in Appendix C.

Table 8
Site Trip Assignment

Intersection	Eastbound			Westbound			Northbound			Southbound		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
AM Peak Hour												
Tramway Blvd @ San Bernardino				9					5		6	
Tramway Blvd @ Paseo del Norte	2										6	5
Tramway Blvd @ Live Oak				12		2			2	1		
PM Peak Hour												
Tramway Blvd @ San Bernardino				6					15		4	
Tramway Blvd @ Paseo del Norte	5										4	3
Tramway Blvd @ Live Oak				7		1			5	2		

5.0 TRAFFIC ANALYSES

Traffic analyses were performed for the existing conditions (2013) and the project implementation year (2017) Baseline and Build scenarios. The existing level of service worksheets may be found in Appendix D, the 2017 Baseline worksheets in Appendix E and the 2017 Build worksheets in Appendix F.

Level of service analyses assess the traffic operations at an intersection in terms of vehicle throughput, however, they do not adequately assess the impacts associated with the physical dimensions of turn lanes and the blocking of accesses or upstream intersections by queued vehicles. Queuing analyses were performed for each of the movements at signalized intersections and queue lengths were determined for the 95th percentile value. The queue analyses utilize the Poisson negative exponential random arrival distribution, summed to the 95% levels.

Left-turn lanes are the primary queue concern because they typically have the shortest green time at intersections. The storage length design value for all left-turn lanes is the 95th percentile queue. For these analyses, where a left turn movement operates with less than 15% of the signal cycle's green time (represented by the g/C ratio), the analysis assumes that all vehicles arrive at that left-turn approach with a red indication. In reality, there is frequently a percentage of vehicles that arrive on the green indication and proceed through the left turn without stop delay. If the left turn being analyzed has greater than 15% of the signal cycle green time, the potential for arrival on green increases, and an adjustment for half of that green time is provided in the analysis, reducing the design queue length. This queue adjustment is calculated following generation of the 95th percentile queue length, Q_{95}, utilizing the equation

$$Q_{LT} = Q_{95} * [1.00-(^{g}/_{C})/2]$$

Where Q_{LT} is the left-turn design queue length,
Q_{95} is the base 95th percentile queue length, and
g/C is the green time percentage per cycle for the movement greater than 0.15.

Right-turn lanes have less restrictive green times than left-turn lanes because of right-turns-on-red, allowing vehicles to turn during numerous cycle phases. Standard right-turn queues are calculated to determine the 95th percentile queue length, Q_{95}, for designing a right turn lane length. The right-turn queues were analyzed for the 95th percentile value, and were adjusted similarly to left turns using the equation

$$Q_{RT} = Q_{95} * [1.00-(^{g}/_{C})/2]$$

Where Q_{RT} is the right-turn design queue length,
Q_{95} is the base 95th percentile queue length, and
g/C is the green time percentage per cycle for the movement.

Through movement queues are calculated where there is concern that the through movement may block either a left- or right-turn lane, or an upstream access or side street. This is calculated for through and through-right movements. The 95th percentile queue is calculated, with an adjustment for arrival on red, using the following equation:

$$Q_{Th} = Q_{95} * [1.00-(^{g}/_{C})]$$

Where Q_{Th} is the through movement design queue length,

Q_{95} is the base 95th percentile queue length, and
g/C is the green time percentage per cycle for the movement.

Unsignalized intersections with 2-way stop control were assessed for queue length using the methodology described in the Highway Capacity Manual, Chapter 19. The analysis uses HCM Equation 19-68, with the methodology described on page 19-30. The Synchro program utilizes this equation to generate 95th percentile queue lengths for each unsignalized approach, and these results have been included with the level of service results. All design queue lengths are rounded to the nearest 25' and are in units of feet.

All signalized intersection queue worksheets may be found in Appendix G.

5.1 EXISTING CONDITION

Traffic analyses were performed for the existing condition (2013) using the intersection volumes from Table 4. All analyses were conducted using Synchro 7.0 and the results produced using the *Highway Capacity Manual* methodology. Table 9 contains the signalized intersection measures of effectiveness (MOEs) including the level of service [LOS], average control delay by approach [Delay], the approach volume to capacity (v/c) ratio [Ave v/c], and the design queue [Queue] for each approach. The existing condition analyses evaluated actuated-coordinated signals with a 70 second base cycle length. Table 9 notes the storage lane length of exclusive turn lanes at study area intersections. The existing level of service worksheets for the existing condition may be found in Appendix D.

Table 9
Existing Signalized Intersection Measures of Effectiveness

Intersection/Approach	AM Peak Hour				PM Peak Hour			
	LOS	Delay (sec)	Ave v/c	Queue (ft)	LOS	Delay (sec)	Ave v/c	Queue (ft)
Tramway @ San Bernardino	**A**	**10 s**	**0.43**		**B**	**13 s**	**0.44**	
EB LT-Th	C	31 s	0.34	50’	C	33 s	0.52	75’
(50’) EB RT	C	29 s	0.02	50’	C	27 s	0.04	75’
WB LT-Th	C	31 s	0.27	50’	C	28 s	0.19	50’
(100’) WB RT	C	29 s	0.04	75’	C	27 s	0.02	50’
(250’) NB LT	A	3 s	0.08	50’	A	5 s	0.16	75’
NB Th	A	7 s	0.44	125’	A	8 s	0.42	125’
(425’) NB RT	A	4 s	0.01	25’	A	6 s	0.02	50’
(250’) SB LT	A	8 s	0.05	25’	B	10 s	0.07	50’
SB Th	A	9 s	0.30	75’	B	15 s	0.45	150’
(250’) SB RT	B	14 s	0.04	75’	C	21 s	0.04	75’

Table 9 (Continued)
Existing Signalized Intersection Measures of Effectiveness

Intersection/Approach		AM Peak Hour				PM Peak Hour			
		LOS	Delay (sec)	Ave v/c	Queue (ft)	LOS	Delay (sec)	Ave v/c	Queue (ft)
Tramway @ Paseo del Norte		**A**	**7 s**	**0.58**		**A**	**9 s**	**0.57**	
	EB LT	C	31 s	0.43	75'	C	29 s	0.57	150'
	EB RT	A	0 s	0.16	100'	A	0 s	0.28	175'
(200')	NB LT	B	11 s	0.62	225'	B	16 s	0.60	200'
	NB Th	A	3 s	0.21	50'	A	5 s	0.26	75'
	SB Th	A	9 s	0.24	75'	B	11 s	0.40	125'
(600' +)	SB RT	A	0 s	0.09	75'	A	0 s	0.09	75'
Tramway @ Live Oak		**B**	**14 s**	**0.34**		**B**	**11 s**	**0.33**	
	EB LT-Th	C	23 s	0.01	25'	A	0 s	0.00	0'
(100')	EB RT	C	23 s	0.07	100'	C	24 s	0.05	50'
	WB LT-Th	C	30 s	0.62	125'	C	30 s	0.59	100'
(150')	WB RT	C	23 s	0.02	50'	C	23 s	0.01	25'
(275')	NB LT	A	7 s	0.04	25'	A	3 s	0.12	75'
	NB Th	B	10 s	0.30	100'	A	6 s	0.24	75'
(275')	NB RT	A	10 s	0.01	50'	A	9 s	0.11	125'
(250')	SB LT	A	7 s	0.02	25'	A	8 s	0.02	25'
	SB Th	A	9 s	0.17	75'	A	10 s	0.25	100'
(250')	SB RT	A	8 s	0.00	0'	A	8 s	0.00	25'

The existing condition signalized intersection analyses indicate that good operations currently exist at each study area signalized intersection during both the AM and PM peak periods. No deficiencies were noted.

5.2 2015 BASELINE SCENARIO

Traffic analyses were performed for the 2015 Baseline scenario using the intersection volumes from Table 5. All analyses were conducted using Synchro 7.0 and the results produced using the *Highway Capacity Manual* methodology. Table 10 contains the signalized intersection measures of effectiveness (MOEs) including the level of service [LOS], average control delay by approach [Delay], the approach volume to capacity (v/c) ratio [Ave v/c], and the design queue [Queue] for each approach. The 2015 Baseline analyses evaluated actuated-coordinated signals with a 70 second base cycle length at each Tramway Blvd intersection. Table 10 identifies the storage lane length of existing turn lanes at study area intersections, as well as trap lanes. The existing level of service worksheets for the 2015 Baseline scenario may be found in Appendix E.

Table 10
2015 Baseline Signalized Intersection Measures of Effectiveness

Intersection/Approach		AM Peak Hour				PM Peak Hour			
		LOS	Delay (sec)	Ave v/c	Queue (ft)	LOS	Delay (sec)	Ave v/c	Queue (ft)
Tramway @ San Bernardino		**A**	**10 s**	**0.44**		**B**	**14 s**	**0.46**	
	EB LT-Th	C	31 s	0.38	50'	C	32 s	0.55	75'
(50')	EB RT	C	29 s	0.02	50'	C	27 s	0.04	75'
	WB LT-Th	C	31 s	0.32	50'	C	28 s	0.22	50'
(100')	WB RT	C	29 s	0.04	75'	C	27 s	0.02	50'
(250')	NB LT	A	3 s	0.09	50'	A	5 s	0.18	75'
	NB Th	A	7 s	0.46	125'	A	8 s	0.43	125'
(425')	NB RT	A	4 s	0.01	25'	A	6 s	0.03	50'
(250')	SB LT	A	9 s	0.04	25'	B	11 s	0.09	50'
	SB Th	A	9 s	0.31	75'	B	16 s	0.47	150'
(250')	SB RT	B	14 s	0.03	50'	C	21 s	0.04	75'
Tramway @ Paseo del Norte		**A**	**7 s**	**0.59**		**A**	**9 s**	**0.58**	
	EB LT	C	31 s	0.43	75'	C	29 s	0.57	150'
	EB RT	A	0 s	0.16	100'	A	1 s	0.29	175'
(200')	NB LT	B	11 s	0.63	225'	B	17 s	0.61	200'
	NB Th	A	4 s	0.22	50'	A	5 s	0.27	75'
	SB Th	A	9 s	0.25	100'	B	11 s	0.41	125'
(600' +)	SB RT	A	0 s	0.09	75'	A	0 s	0.09	75'
Tramway @ Live Oak		**B**	**14 s**	**0.36**		**B**	**11 s**	**0.33**	
	EB LT-Th	C	22 s	0.09	50'	A	0 s	0.00	0'
(100')	EB RT	C	22 s	0.07	100'	C	24 s	0.04	50'
	WB LT-Th	C	31 s	0.65	125'	C	30 s	0.59	100'
(150')	WB RT	C	22 s	0.02	50'	C	23 s	0.01	25'
(275')	NB LT	A	7 s	0.04	50'	A	3 s	0.12	75'
	NB Th	B	10 s	0.32	100'	A	6 s	0.25	75'
(275')	NB RT	A	9 s	0.02	50'	A	9 s	0.11	125'
(250')	SB LT	A	8 s	0.03	25'	A	8 s	0.02	25'
	SB Th	A	9 s	0.18	75'	A	10 s	0.26	100'
(250')	SB RT	A	8 s	0.01	25'	A	8 s	0.01	25'

The 2015 Baseline scenario signalized intersection analyses indicate that good operations currently exist at each study area signalized intersection during both the AM and PM peak periods. No deficiencies were noted for the 2015 Baseline scenario.

5.3 2015 BUILD SCENARIO

Traffic analyses were performed for the 2015 Build scenario using the intersection volumes from Table 5 plus Table 8. No network changes were anticipated or incorporated into the analyses. All analyses were conducted using Synchro 7.0 and the results produced using the *Highway Capacity Manual* methodology. Table 11 contains the signalized intersection measures of effectiveness (MOEs) including the level of service [LOS], average control delay

by approach [Delay], the approach volume to capacity (v/c) ratio [Ave v/c], and the design queue [Queue] for each approach. The 2015 Build scenario analyses evaluated actuated-coordinated signals with a 70 second base cycle lengths at each Tramway Blvd intersection. Table 11 identifies the storage lane length of existing turn lanes at study area intersections, as well as trap lanes. The existing level of service worksheets for the 2015 Build scenario may be found in Appendix F.

Table 11
2015 Build Signalized Intersection Measures of Effectiveness

Intersection/Approach		AM Peak Hour				PM Peak Hour			
		LOS	Delay (sec)	Ave v/c	Queue (ft)	LOS	Delay (sec)	Ave v/c	Queue (ft)
Tramway @ San Bernardino		**A**	**10 s**	**0.45**		**B**	**14 s**	**0.46**	
	EB LT-Th	C	31 s	0.38	50’	C	32 s	0.55	75’
(50’)	EB RT	C	28 s	0.02	50’	C	27 s	0.04	75’
	WB LT-Th	C	31 s	0.40	75’	C	28 s	0.27	50’
(100’)	WB RT	C	29 s	0.04	75’	C	27 s	0.02	50’
(250’)	NB LT	A	3 s	0.09	50’	A	5 s	0.18	75’
	NB Th	A	7 s	0.46	125’	A	8 s	0.43	125’
(425’)	NB RT	A	4 s	0.01	25’	A	6 s	0.04	75’
(250’)	SB LT	A	8 s	0.04	25’	B	11 s	0.09	50’
	SB Th	A	10 s	0.31	75’	B	16 s	0.47	150’
(250’)	SB RT	B	14 s	0.03	50’	C	21 s	0.04	75’
Tramway @ Paseo del Norte		**A**	**7 s**	**0.59**		**A**	**9 s**	**0.59**	
	EB LT	C	31 s	0.44	75’	C	30 s	0.58	150’
	EB RT	A	0 s	0.16	100’	A	1 s	0.29	175’
(200’)	NB LT	B	11 s	0.63	225’	B	17 s	0.61	200’
	NB Th	A	4 s	0.22	75’	A	5 s	0.27	75’
	SB Th	A	10 s	0.26	100’	B	11 s	0.42	125’
(600’ +)	SB RT	A	0 s	0.10	75’	A	0 s	0.09	75’
Tramway @ Live Oak		**B**	**15 s**	**0.38**		**B**	**11 s**	**0.34**	
	EB LT-Th	C	22 s	0.08	50’	A	0 s	0.00	0’
(100’)	EB RT	C	22 s	0.07	100’	C	23 s	0.04	50’
	WB LT-Th	C	30 s	0.67	125’	C	30 s	0.61	125’
(150’)	WB RT	C	21s	0.02	50’	C	23 s	0.01	25’
(275’)	NB LT	A	7 s	0.04	50’	A	3 s	0.12	75’
	NB Th	B	11 s	0.32	100’	A	6 s	0.25	75’
(275’)	NB RT	A	10 s	0.02	50’	A	9 s	0.11	125’
(250’)	SB LT	A	8 s	0.03	25’	A	8 s	0.02	25’
	SB Th	A	10 s	0.19	75’	A	10 s	0.26	100’
(250’)	SB RT	A	9 s	0.01	25’	A	8 s	0.01	25’

The 2015 Build scenario signalized intersection analyses indicate that good operations will continue at each study area signalized intersection during both the AM and PM peak periods. No deficiencies were identified.

5.4 NON-MOTORIZED TRANSPORTATION

Tramway Blvd is a busy transportation corridor for non-motorized user. There is a non-motorized trail along the east side of the road from Central Ave to Tramway Rd, and the trail is nominally 12' wide within the study area. Cyclists also frequent both of Tramway's nominal 8'+ wide shoulders as bicycle lanes. The NMDOT has signed Tramway Blvd as bicycle route 556. An excerpt from the MRCOG Bernalillo County has installed a permanent count station for bicyclists northbound at Paseo del Norte to quantify on-street usage.

Bernalillo County developed the *Pedestrian and Bicyclist Safety Action Plan* in 2012. The Plan identifies projects countywide to improve pedestrian and bicyclist safety. One of the routes identified for improvements is Tramway Lane from Modesto Rd to San Bernardino Rd, and Hawk's Landing is located along this route. The Plan identifies the need for sidewalks, crosswalks and lighting along this corridor to enhance pedestrian safety. This development should coordinate with the County to determine pedestrian improvements along the Tramway Lane frontage.

6.0 FINDINGS AND RECOMMENDATIONS

6.1 FINDINGS AND CONSIDERATIONS

Construction of Hawk's Landing will have no measurable impact upon the roadway network. All intersections operate at LOS A or B, and will continue those operations through the 2015 Build scenario. This area of the Albuquerque is mostly developed; therefore, it is anticipated that excellent operations will continue for the foreseeable future.

The south side of the property contains an AMAFCA drainage facility. Given the trail along Tramway Blvd and the proposed pedestrian improvements along Tramway Lane, it may be prudent to provide a connection between these non-motorized facilities within the AMAFCA right-of-way. A gravel trail may best match the development within South Sandia Heights which discourages non-native landscaping and amenities. The need for a trail should be determined jointly by Bernalillo County, the NMDOT and AMAFCA.

6.2 RECOMMENDATIONS

The following traffic engineering recommendations are made for Hawk's Landing. No improvements are required at the external study area intersections.

1. The Hawk's Landing access road (unnamed on the site plan) should have a stop sign and stop bar at the intersection with Tramway Lane. The stop sign and stop bar shall be per the MUTCD and Bernalillo County standards.
2. Non-motorized improvements should be negotiated with Bernalillo County per the 2012 *Pedestrian and Bicyclist Safety Action Plan* for Tramway Ln frontage. The County should first identify the required improvements, and identify if these improvements will be constructed along each side of Tramway Lane, or just one side. If the improvements will be located along the east side of Tramway Lane only, Hawk's Landing will not be directly impacted. (The county indicates that there are to be improvements along the west side of Tramway Ln, and the design requirements should be negotiated with Bernalillo County.)
3. All non-motorized facilities within the development shall be consistent with ADA standards. This includes sidewalk, curb ramps and driveway cuts.

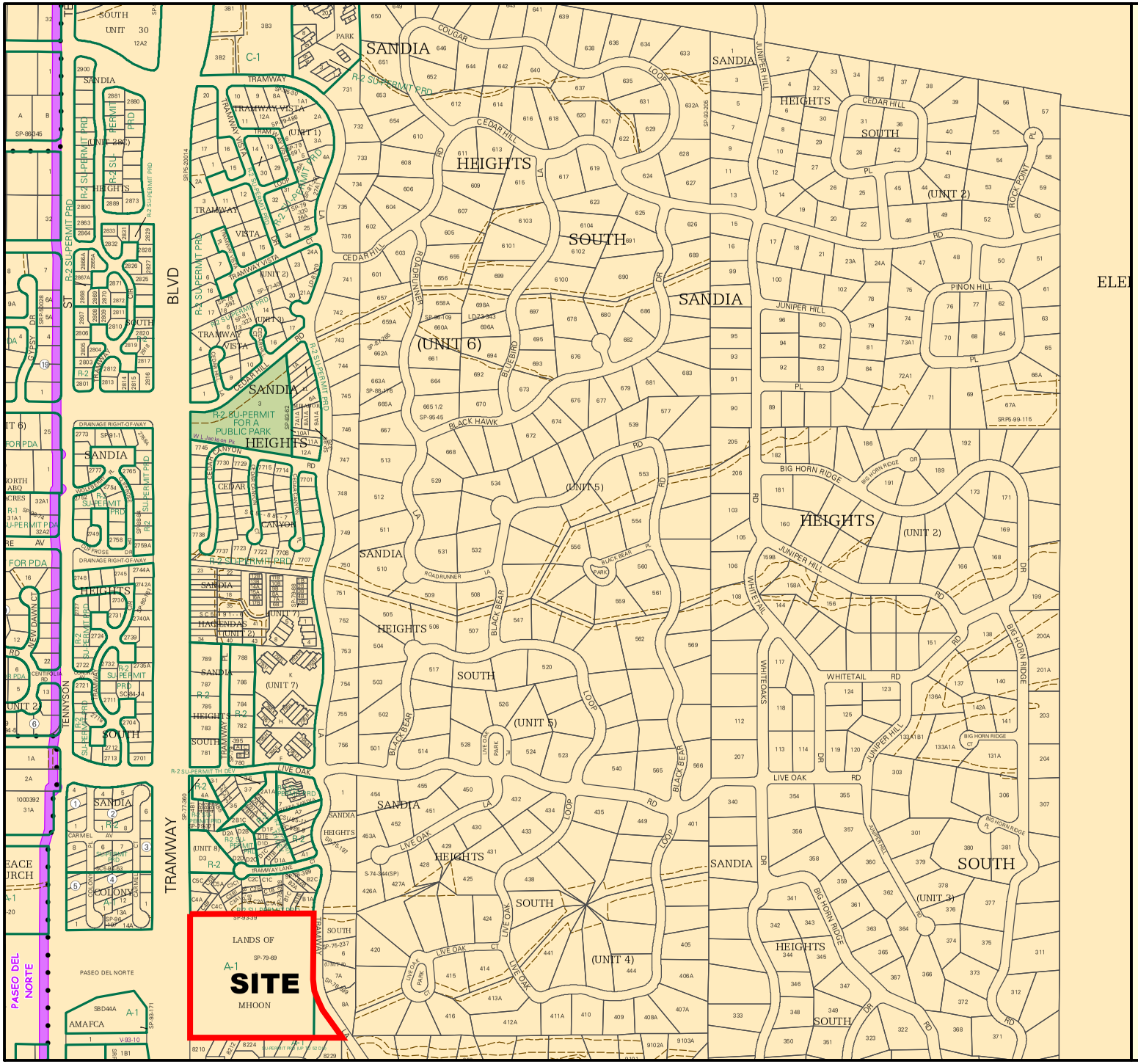
Appendices

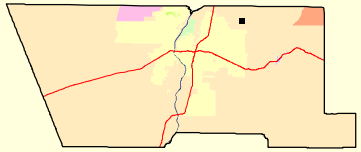
Appendix A	Vicinity Maps and Site Drawing
Appendix B	Traffic Volume Summary Sheets
Appendix C	Trip Generation, Distribution, and Assignments
Appendix D	Existing Condition Level of Service Analyses
Appendix E	2015 Baseline Level of Service Analyses
Appendix F	2015 Build Level of Service Analyses
Appendix G	Queuing Summary Sheets

Appendix A

Vicinity Maps and Site Drawing

Zone Atlas Page C-23-Z
Site Plan on Aerial
Site Plan
Bicycle Map Excerpt
Pedestrian and Bicyclist Safety Action Plan Excerpt





LEGAL DESCRIPTION

T11N

R4E

SEC 14

UNIFORM PROPERTY CODE

1-023-064

N

250 0 250 500 750 1,000

Feet

Map amended through February 2007

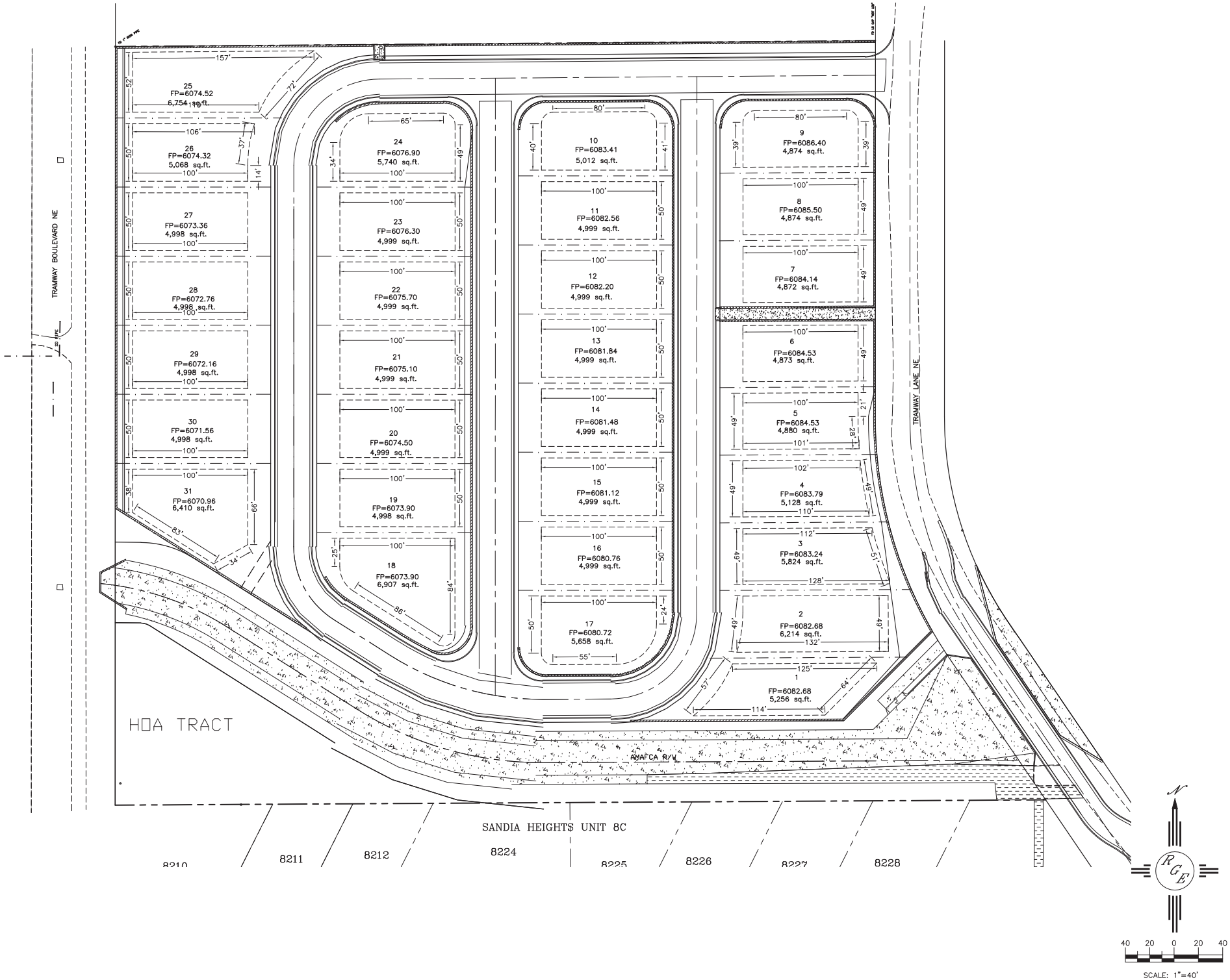
PUBLIC WORKS DIVISION
GIS PROGRAM

This information is for reference only. Bernalillo County assumes no liability for errors associated with the use of these data. Users are solely responsible for confirming data accuracy when necessary. Source data are from Bernalillo County and the City of Albuquerque. For current information visit www.bernco.gov.

C-23-Z

Site Plan
on Aerial Base

SANDIA HEIGHTS UNIT 8



This map was excerpted from the MRCOG Long Range Bikeway System map dated 4/15/2011.

Bikeway System Map

Exhibit 30: Bernalillo County Pedestrian and Bicycle Facility Projects - Northeast Area (continued)						
Facility	**Type**	**Description**	**Connectivity**	**Funding**	**Cost**	**Source**
Alameda Blvd. Corridor (East)*	Sidewalks, Bike Lane, Crosswalks, MU Trail, Lighting	Ventura St. to Eubank Blvd. to Lowell		STP-U, CMAQ	$5,950,000	MTP
Eubank Blvd. Corridor	Sidewalks, Bike Lane, Crosswalks, MU Trail, Lighting	Paseo del Norte to Alameda Blvd.		**Funded in TIP**		
Paseo del Norte Corridor Frontage Road	Sidewalks on south side, Bike Lanes, Crosswalks, Lighting	Eubank Blvd. to Tramway Blvd.	Equestrian Park	STP-U, CMAQ	$ 244,350	BC
Tennyson St.	Sidewalk connections to Tramway; bridge over S. Dom. Baca Arroyo	San Antonio to Modesto Ave.		GO Bonds	$ 493,980	BC
Lowell St.	Sidewalks, MU Trail	Del Rey to PDN	Equestrian Park	GO Bonds	$ 276,240	BC
Tramway Ln.	Sidewalks crosswalk, lighting	Modesto Ave. to San Bernardino Ave.	Open Space/ Park	GO Bonds	$ 446,400	BC
La Cueva Arroyo Trail (AMAFCA)	Multi-Use Trail	Follows Signal Ave. to Lowell St.		STP-E	$ 695,000	MTP
S. Domingo Baca Arroyo (AMAFCA)	Multi Use Trail	Follows Pino Ave. Holbrook to Tramway	Equestrian Park	GO Bonds	$ 295,496	BC
Total GO Bond Projects Only					***$ 18,106,146***	
Total GO Bond/MTP Projects					***$105,961,562***	

Notes: Highlighted cells indicate those projects listed in the MTP and using federal funding.

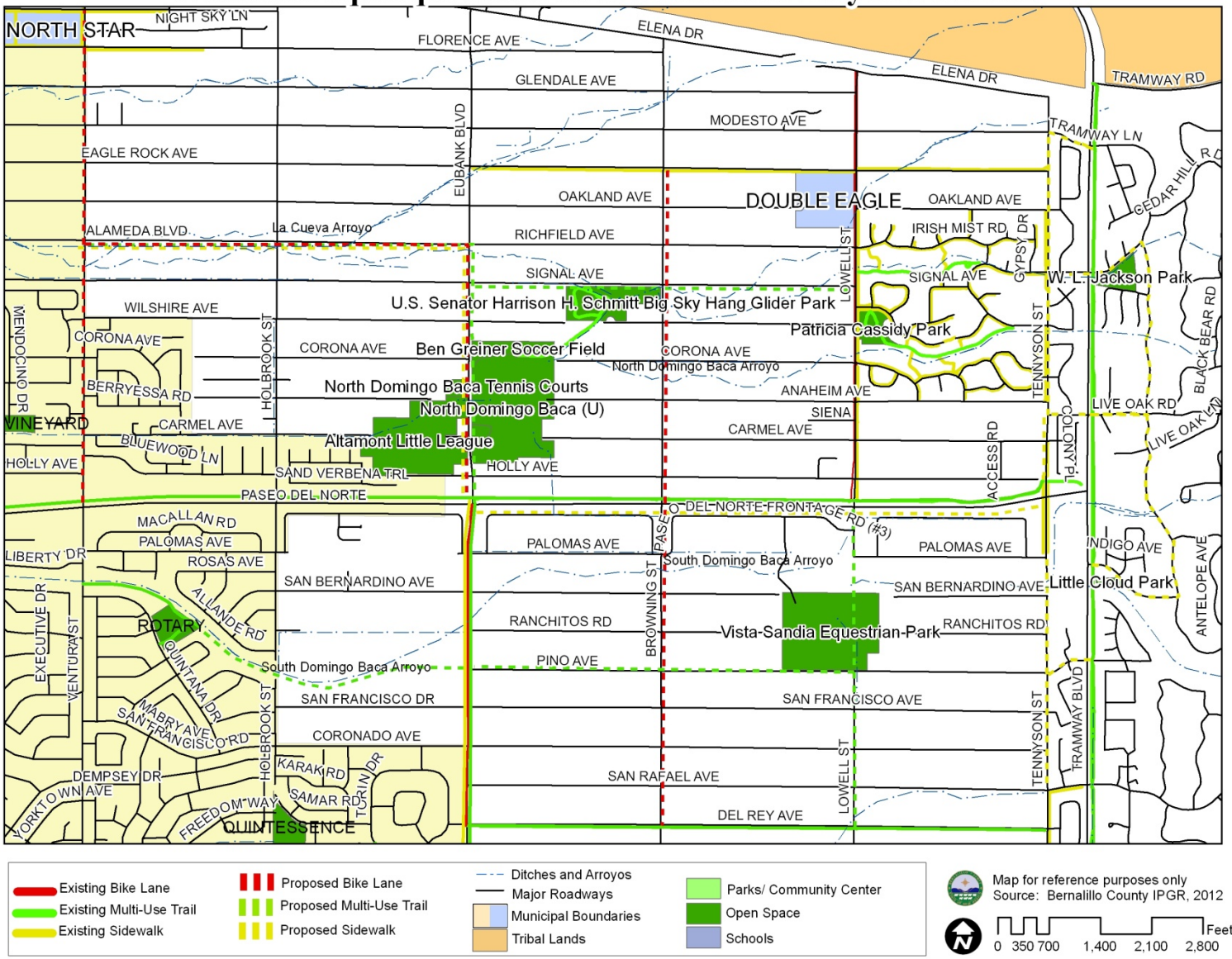
MTP costs are per MRCOG; County costs for sidewalks do not include curb and gutter

Agency Jurisdiction:
AMAFCA – Albuquerque-Metropolitan Flood Control Authority
MRGCD – Middle Rio Grande Conservancy District
NMDOT – New Mexico Department of Transportation
BC – Bernalillo County

Abbreviations:
MTP – 2035 Metropolitan Transportation Plan. Projects included in the plan are eligible for federal funding
TIP – 6 year Transportation Improvement Plan programs projects

Funding Sources:
STP-U – Urban Surface Transportation Prog
STP-E – Surface Transportation Enhancement
HSIP – Highway Safety Improvement Program
GO Bonds – County General Obligation Bonds
SRTS – Safe Routes to School
CMAQ – Congestion Mitigation and Air Quality

North Albuquerque Acres Area Pedestrian-Bicycle Facilities



Appendix B

Traffic Volume Summary Sheets

Hawk's Landing - Existing Vols

AM Peak	Eastbound			Westbound			Northbound			Southbound			
Intersection	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**Sum**
Tramway @ San Bernardino	35	0	27	29	1	52	36	859	11	13	489	43	**1595**
Tramway @ Paseo Del Norte	59		181				433	492			351	123	**1639**
Tramway @ Live Oak	2	1	75	133	4	26	18	479	19	8	242	1	**1008**
													0
													0
													0
													0
													0

PM Peak	Eastbound			Westbound			Northbound			Southbound			
Intersection	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**Sum**
Tramway @ San Bernardino	58	2	47	20	3	20	57	805	35	25	853	63	**1988**
Tramway @ Paseo Del Norte	160		409				337	587			555	127	**2175**
Tramway @ Live Oak	0	0	41	100	0	6	61	426	137	12	452	3	**1238**
													0
													0
													0
													0
													0

Hawk's Landing - 2015 Baseline Vols

AM Peak	**Eastbound**			**Westbound**			**Northbound**			**Southbound**			
Intersection	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**Sum**
Tramway @ San Bernardino	40	0	30	30	10	50	40	880	10	10	500	40	**1640**
Tramway @ Paseo Del Norte	60	0	180	0	0	0	440	500	0	0	360	130	**1670**
Tramway @ Live Oak	10	10	80	140	10	30	20	490	20	10	250	10	**1080**
	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	0	0	0	0	0	0	0	0	0	0	0	0	**0**
													0
													0
													0

PM Peak	**Eastbound**			**Westbound**			**Northbound**			**Southbound**			
Intersection	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**Sum**
Tramway @ San Bernardino	60	10	50	20	10	20	60	820	40	30	870	60	**2050**
Tramway @ Paseo Del Norte	160	0	420	0	0	0	340	600	0	0	570	130	**2220**
Tramway @ Live Oak	0	0	40	100	0	10	60	430	140	10	460	10	**1260**
	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	0	0	0	0	0	0	0	0	0	0	0	0	**0**
													0
													0
													0

Annual Growth Rate	1.0%
Years of Background Growth	2

Hawk's Landing - 2015 Build Vols

AM Peak	Eastbound			Westbound			Northbound			Southbound			
Intersection	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	Sum
Tramway @ San Bernardino	40	0	30	39	10	50	40	880	15	10	506	40	**1660**
Tramway @ Paseo Del Norte	62	0	180	0	0	0	440	500	0	0	366	135	**1683**
Tramway @ Live Oak	10	10	80	152	10	32	20	490	22	11	250	10	**1097**
	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	0	0	0	0	0	0	0	0	0	0	0	0	**0**
													0
													0
													0

PM Peak	Eastbound			Westbound			Northbound			Southbound			
Intersection	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	Sum
Tramway @ San Bernardino	60	10	50	26	10	20	60	820	55	30	874	60	**2075**
Tramway @ Paseo Del Norte	165	0	420	0	0	0	340	600	0	0	574	133	**2232**
Tramway @ Live Oak	0	0	40	107	0	11	60	430	145	12	460	10	**1275**
	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	0	0	0	0	0	0	0	0	0	0	0	0	**0**
													0
													0
													0

Annual Growth Rate	2.0%
Years of Background Growth	2

Harwick Transportation Group

1440 Camino Cerrito SE
Albuquerque, NM 87123

Counter: RC

File Name : San Bernardino
Site Code : 10162013
Start Date : 10/16/2013
Page No : 1

Groups Printed- Cars - Trucks - Buses

	San Bernardino Eastbound				San Bernardino Westbound				Tramway Blvd Northbound				Tramway Blvd Southbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	3	0	5	8	11	0	11	22	4	166	1	171	1	84	4	89	290
07:15 AM	5	0	1	6	10	0	10	20	9	215	3	227	1	110	7	118	371
07:30 AM	10	0	9	19	5	0	18	23	6	232	1	239	3	107	9	119	400
07:45 AM	9	0	8	17	9	0	12	21	17	251	1	269	5	155	19	179	486
Total	27	0	23	50	35	0	51	86	36	864	6	906	10	456	39	505	1547
08:00 AM	11	0	9	20	5	1	12	18	4	161	6	171	4	117	8	129	338
08:15 AM	5	0	10	15	8	0	4	12	5	170	2	177	5	121	8	134	338
08:30 AM	3	0	7	10	4	0	10	14	6	151	2	159	6	112	9	127	310
08:45 AM	7	1	13	21	7	3	3	13	5	158	3	166	1	115	10	126	326
Total	26	1	39	66	24	4	29	57	20	640	13	673	16	465	35	516	1312
*** BREAK ***																	
04:00 PM	7	1	10	18	2	0	5	7	15	142	13	170	4	159	9	172	367
04:15 PM	11	0	9	20	5	1	2	8	14	149	8	171	7	166	13	186	385
04:30 PM	13	3	13	29	9	1	5	15	18	148	3	169	10	152	20	182	395
04:45 PM	12	0	7	19	1	0	4	5	13	225	10	248	4	198	10	212	484
Total	43	4	39	86	17	2	16	35	60	664	34	758	25	675	52	752	1631
05:00 PM	16	0	9	25	6	3	5	14	9	173	6	188	4	203	12	219	446
05:15 PM	10	2	14	26	6	0	5	11	12	203	13	228	6	233	19	258	523
05:30 PM	20	0	17	37	7	0	6	13	23	204	6	233	11	219	22	252	535
05:45 PM	11	0	19	30	7	0	6	13	13	149	6	168	5	157	20	182	393
Total	57	2	59	118	26	3	22	51	57	729	31	817	26	812	73	911	1897
Grand Total	153	7	160	320	102	9	118	229	173	2897	84	3154	77	2408	199	2684	6387
Apprch %	47.8	2.2	50		44.5	3.9	51.5		5.5	91.9	2.7		2.9	89.7	7.4		
Total %	2.4	0.1	2.5	5	1.6	0.1	1.8	3.6	2.7	45.4	1.3	49.4	1.2	37.7	3.1	42	
Cars	152	7	160	319	102	9	114	225	172	2894	84	3150	77	2397	198	2672	6366
% Cars	99.3	100	100	99.7	100	100	96.6	98.3	99.4	99.9	100	99.9	100	99.5	99.5	99.6	99.7
Trucks	0	0	0	0	0	0	0	0	0	1	0	1	0	2	1	3	4
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.5	0.1	0.1
Buses	1	0	0	1	0	0	4	4	1	2	0	3	0	9	0	9	17
% Buses	0.7	0	0	0.3	0	0	3.4	1.7	0.6	0.1	0	0.1	0	0.4	0	0.3	0.3

Harwick Transportation Group

1440 Camino Cerrito SE
Albuquerque, NM 87123

Counter: RC

File Name : San Bernardino
Site Code : 10162013
Start Date : 10/16/2013
Page No : 2

	San Bernardino Eastbound				San Bernardino Westbound				Tramway Blvd Northbound				Tramway Blvd Southbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	5	0	1	6	10	0	10	20	9	215	3	227	1	110	7	118	371
07:30 AM	10	0	9	19	5	0	18	23	6	232	1	239	3	107	9	119	400
07:45 AM	9	0	8	17	9	0	12	21	17	251	1	269	5	155	19	179	486
08:00 AM	11	0	9	20	5	1	12	18	4	161	6	171	4	117	8	129	338
Total Volume	35	0	27	62	29	1	52	82	36	859	11	906	13	489	43	545	1595
% App. Total	56.5	0	43.5		35.4	1.2	63.4		4	94.8	1.2		2.4	89.7	7.9		
PHF	.795	.000	.750	.775	.725	.250	.722	.891	.529	.856	.458	.842	.650	.789	.566	.761	.820
Cars	34	0	27	61	29	1	48	78	35	858	11	904	13	483	43	539	1582
% Cars	97.1	0	100	98.4	100	100	92.3	95.1	97.2	99.9	100	99.8	100	98.8	100	98.9	99.2
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0.2	0.1
Buses	1	0	0	1	0	0	4	4	1	1	0	2	0	5	0	5	12
% Buses	2.9	0	0	1.6	0	0	7.7	4.9	2.8	0.1	0	0.2	0	1.0	0	0.9	0.8
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	12	0	7	19	1	0	4	5	13	225	10	248	4	198	10	212	484
05:00 PM	16	0	9	25	6	3	5	14	9	173	6	188	4	203	12	219	446
05:15 PM	10	2	14	26	6	0	5	11	12	203	13	228	6	233	19	258	523
05:30 PM	20	0	17	37	7	0	6	13	23	204	6	233	11	219	22	252	535
Total Volume	58	2	47	107	20	3	20	43	57	805	35	897	25	853	63	941	1988
% App. Total	54.2	1.9	43.9		46.5	7	46.5		6.4	89.7	3.9		2.7	90.6	6.7		
PHF	.725	.250	.691	.723	.714	.250	.833	.768	.620	.894	.673	.904	.568	.915	.716	.912	.929
Cars	58	2	47	107	20	3	20	43	57	804	35	896	25	853	63	941	1987
% Cars	100	100	100	100	100	100	100	100	100	99.9	100	99.9	100	100	100	100	99.9
Trucks	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1
% Trucks	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Harwick Transportation Group

1440 Camino Cerrito SE
Albuquerque, NM 87123

Counter: RC

File Name : PDN
Site Code : 10172013
Start Date : 10/17/2013
Page No : 1

Groups Printed- Cars - Trucks - Buses

	Paseo del Norte Eastbound				Westbound				Tramway Blvd Northbound				Tramway Blvd Southbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	8	0	25	33	0	0	0	0	101	81	0	182	0	82	29	111	326
07:15 AM	12	0	34	46	0	0	0	0	99	117	0	216	0	66	36	102	364
07:30 AM	12	0	35	47	0	0	0	0	121	139	0	260	0	102	35	137	444
07:45 AM	14	0	68	82	0	0	0	0	130	116	0	246	0	102	29	131	459
Total	46	0	162	208	0	0	0	0	451	453	0	904	0	352	129	481	1593
08:00 AM	21	0	44	65	0	0	0	0	83	120	0	203	0	81	23	104	372
08:15 AM	23	0	33	56	0	0	0	0	99	81	0	180	0	63	28	91	327
08:30 AM	9	1	56	66	0	0	0	0	71	73	0	144	0	65	35	100	310
08:45 AM	24	0	59	83	0	0	0	0	64	56	0	120	0	46	29	75	278
Total	77	1	192	270	0	0	0	0	317	330	0	647	0	255	115	370	1287
*** BREAK ***																	
04:00 PM	46	0	109	155	0	0	0	0	76	117	0	193	0	104	30	134	482
04:15 PM	42	0	94	136	0	0	0	0	97	120	0	217	0	96	27	123	476
04:30 PM	34	0	83	117	0	0	0	0	83	108	0	191	0	100	29	129	437
04:45 PM	38	0	126	164	0	0	0	0	86	128	0	214	0	97	28	125	503
Total	160	0	412	572	0	0	0	0	342	473	0	815	0	397	114	511	1898
05:00 PM	49	0	106	155	0	0	0	0	84	162	0	246	1	141	44	186	587
05:15 PM	38	0	105	143	0	0	0	0	89	150	0	239	0	152	26	178	560
05:30 PM	35	0	84	119	0	0	0	0	83	133	0	216	0	140	34	174	509
05:45 PM	38	0	114	152	0	0	0	0	81	142	0	223	1	122	23	146	521
Total	160	0	409	569	0	0	0	0	337	587	0	924	2	555	127	684	2177
Grand Total	443	1	1175	1619	0	0	0	0	1447	1843	0	3290	2	1559	485	2046	6955
Apprch %	27.4	0.1	72.6		0	0	0		44	56	0		0.1	76.2	23.7		
Total %	6.4	0	16.9	23.3	0	0	0	0	20.8	26.5	0	47.3	0	22.4	7	29.4	
Cars	442	1	1170	1613	0	0	0	0	1443	1838	0	3281	2	1554	482	2038	6932
% Cars	99.8	100	99.6	99.6	0	0	0	0	99.7	99.7	0	99.7	100	99.7	99.4	99.6	99.7
Trucks	1	0	1	2	0	0	0	0	1	0	0	1	0	0	1	1	4
% Trucks	0.2	0	0.1	0.1	0	0	0	0	0.1	0	0	0	0	0	0.2	0	0.1
Buses	0	0	4	4	0	0	0	0	3	5	0	8	0	5	2	7	19
% Buses	0	0	0.3	0.2	0	0	0	0	0.2	0.3	0	0.2	0	0.3	0.4	0.3	0.3

Harwick Transportation Group

1440 Camino Cerrito SE
Albuquerque, NM 87123

Counter: RC

File Name : PDN
Site Code : 10172013
Start Date : 10/17/2013
Page No : 2

	Paseo del Norte Eastbound				Westbound				Tramway Blvd Northbound				Tramway Blvd Southbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	12	0	34	46	0	0	0	0	99	117	0	216	0	66	36	102	364
07:30 AM	12	0	35	47	0	0	0	0	121	139	0	260	0	102	35	137	444
07:45 AM	14	0	68	82	0	0	0	0	130	116	0	246	0	102	29	131	459
08:00 AM	21	0	44	65	0	0	0	0	83	120	0	203	0	81	23	104	372
Total Volume	59	0	181	240	0	0	0	0	433	492	0	925	0	351	123	474	1639
% App. Total	24.6	0	75.4		0	0	0		46.8	53.2	0		0	74.1	25.9		
PHF	.702	.000	.665	.732	.000	.000	.000	.000	.833	.885	.000	.889	.000	.860	.854	.865	.893
Cars	59	0	178	237	0	0	0	0	429	489	0	918	0	349	121	470	1625
% Cars	100	0	98.3	98.8	0	0	0	0	99.1	99.4	0	99.2	0	99.4	98.4	99.2	99.1
Trucks	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	2
% Trucks	0	0	0	0	0	0	0	0	0.2	0	0	0.1	0	0	0.8	0.2	0.1
Buses	0	0	3	3	0	0	0	0	3	3	0	6	0	2	1	3	12
% Buses	0	0	1.7	1.3	0	0	0	0	0.7	0.6	0	0.6	0	0.6	0.8	0.6	0.7
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	49	0	106	155	0	0	0	0	84	162	0	246	1	141	44	186	587
05:15 PM	38	0	105	143	0	0	0	0	89	150	0	239	0	152	26	178	560
05:30 PM	35	0	84	119	0	0	0	0	83	133	0	216	0	140	34	174	509
05:45 PM	38	0	114	152	0	0	0	0	81	142	0	223	1	122	23	146	521
Total Volume	160	0	409	569	0	0	0	0	337	587	0	924	2	555	127	684	2177
% App. Total	28.1	0	71.9		0	0	0		36.5	63.5	0		0.3	81.1	18.6		
PHF	.816	.000	.897	.918	.000	.000	.000	.000	.947	.906	.000	.939	.500	.913	.722	.919	.927
Cars	160	0	409	569	0	0	0	0	337	587	0	924	2	555	127	684	2177
% Cars	100	0	100	100	0	0	0	0	100	100	0	100	100	100	100	100	100
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Harwick Transportation Group

1440 Camino Cerrito SE
Albuquerque, NM 87123

Counter: RC

File Name : Live Oak and Tramway
Site Code : 11212013
Start Date : 11/21/2013
Page No : 1

Groups Printed- Cars - Trucks - Buses

	Live Oak Eastbound				Live Oak Westbound				Tramway Blvd Northbound				Tramway Blvd Southbound				
Start Time				App. Total				App. Total				App. Total				App. Total	Int. Total
07:00 AM	1	0	15	16	28	1	6	35	2	102	1	105	0	47	1	48	204
07:15 AM	0	0	19	19	37	0	6	43	4	105	4	113	1	48	0	49	224
07:30 AM	0	0	27	27	39	2	9	50	5	129	6	140	3	66	0	69	286
07:45 AM	1	1	14	16	29	1	5	35	7	143	8	158	4	81	0	85	294
Total	2	1	75	78	133	4	26	163	18	479	19	516	8	242	1	251	1008
08:00 AM	1	1	21	23	22	0	4	26	2	82	12	96	0	46	0	46	191
08:15 AM	0	0	14	14	23	0	4	27	3	87	14	104	0	53	0	53	198
08:30 AM	3	0	15	18	34	0	3	37	2	73	9	84	0	61	0	61	200
08:45 AM	1	0	20	21	34	1	0	35	12	71	14	97	3	66	0	69	222
Total	5	1	70	76	113	1	11	125	19	313	49	381	3	226	0	229	811
*** BREAK ***																	
04:00 PM	0	0	3	3	11	0	1	12	10	96	37	143	2	116	2	120	278
04:15 PM	2	0	12	14	27	0	1	28	7	78	33	118	3	110	2	115	275
04:30 PM	1	0	9	10	23	0	2	25	10	89	33	132	1	97	0	98	265
04:45 PM	0	0	7	7	19	0	1	20	7	89	40	136	3	116	0	119	282
Total	3	0	31	34	80	0	5	85	34	352	143	529	9	439	4	452	1100
05:00 PM	0	0	18	18	40	0	1	41	14	99	27	140	5	105	1	111	310
05:15 PM	0	0	9	9	20	0	1	21	21	118	31	170	2	119	0	121	321
05:30 PM	0	0	7	7	21	0	3	24	19	120	39	178	2	112	2	116	325
05:45 PM	1	1	7	9	16	0	1	17	14	78	35	127	4	87	2	93	246
Total	1	1	41	43	97	0	6	103	68	415	132	615	13	423	5	441	1202
Grand Total	11	3	217	231	423	5	48	476	139	1559	343	2041	33	1330	10	1373	4121
Apprch %	4.8	1.3	93.9		88.9	1.1	10.1		6.8	76.4	16.8		2.4	96.9	0.7		
Total %	0.3	0.1	5.3	5.6	10.3	0.1	1.2	11.6	3.4	37.8	8.3	49.5	0.8	32.3	0.2	33.3	
Cars	11	2	213	226	422	5	47	474	136	1556	343	2035	33	1327	10	1370	4105
% Cars	100	66.7	98.2	97.8	99.8	100	97.9	99.6	97.8	99.8	100	99.7	100	99.8	100	99.8	99.6
Trucks	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2
% Trucks	0	33.3	0	0.4	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0
Buses	0	0	4	4	1	0	1	2	3	3	0	6	0	2	0	2	14
% Buses	0	0	1.8	1.7	0.2	0	2.1	0.4	2.2	0.2	0	0.3	0	0.2	0	0.1	0.3

Harwick Transportation Group

1440 Camino Cerrito SE
Albuquerque, NM 87123

File Name : Live Oak and Tramway
Site Code : 11212013
Start Date : 11/21/2013
Page No : 2

	Live Oak Eastbound				Live Oak Westbound				Tramway Blvd Northbound				Tramway Blvd Southbound				
Start Time				App. Total				App. Total				App. Total				App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 12:30 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	1	0	15	16	28	1	6	35	2	102	1	105	0	47	1	48	204
07:15 AM	0	0	19	19	37	0	6	43	4	105	4	113	1	48	0	49	224
07:30 AM	0	0	27	27	39	2	9	50	5	129	6	140	3	66	0	69	286
07:45 AM	1	1	14	16	29	1	5	35	7	143	8	158	4	81	0	85	294
Total Volume	2	1	75	78	133	4	26	163	18	479	19	516	8	242	1	251	1008
% App. Total	2.6	1.3	96.2		81.6	2.5	16		3.5	92.8	3.7		3.2	96.4	0.4		
PHF	.500	.250	.694	.722	.853	.500	.722	.815	.643	.837	.594	.816	.500	.747	.250	.738	.857
Cars	2	1	73	76	133	4	25	162	15	477	19	511	8	242	1	251	1000
% Cars	100	100	97.3	97.4	100	100	96.2	99.4	83.3	99.6	100	99.0	100	100	100	100	99.2
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buses	0	0	2	2	0	0	1	1	3	2	0	5	0	0	0	0	8
% Buses	0	0	2.7	2.6	0	0	3.8	0.6	16.7	0.4	0	1.0	0	0	0	0	0.8
Peak Hour Analysis From 12:45 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	0	0	7	7	19	0	1	20	7	89	40	136	3	116	0	119	282
05:00 PM	0	0	18	18	40	0	1	41	14	99	27	140	5	105	1	111	310
05:15 PM	0	0	9	9	20	0	1	21	21	118	31	170	2	119	0	121	321
05:30 PM	0	0	7	7	21	0	3	24	19	120	39	178	2	112	2	116	325
Total Volume	0	0	41	41	100	0	6	106	61	426	137	624	12	452	3	467	1238
% App. Total	0	0	100		94.3	0	5.7		9.8	68.3	22		2.6	96.8	0.6		
PHF	.000	.000	.569	.569	.625	.000	.500	.646	.726	.888	.856	.876	.600	.950	.375	.965	.952
Cars	0	0	41	41	100	0	6	106	61	426	137	624	12	451	3	466	1237
% Cars	0	0	100	100	100	0	100	100	100	100	100	100	100	99.8	100	99.8	99.9
Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
% Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0.2	0.1
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Basic Volume Report: TRAMWAY LN

Station ID : TRAMWAY LN
Info Line 1 :
Info Line 2 :
GPS Lat/Lon :
DB File : TRAMWAY LN.DB

Last Connected Device Type : Apollo
Version Number : 1.51
Serial Number : 13253
Number of Lanes : 2
Posted Speed Limit : 20.0 mph

Lane #1 Configuration

#	Dir.	Information	Volume Mode	Volume Sensors	Divide By 2	Comment
1.		Northbound	Directional^	Axle	Yes	

Lane #1 Basic Volume Data From: 00:00 - 01/28/2014 To: 23:59 - 01/29/2014

Date	Time	:00	:15	:30	:45	Total
01/28/14	00:00	0	0	0	0	0
Tue	01:00	0	0	0	0	0
	02:00	0	0	0	0	0
	03:00	0	0	0	0	0
	04:00	0	1	0	0	1
	05:00	0	0	0	2	2
	06:00	0	1	0	0	1
	07:00	0	0	1	0	1
	08:00	0	1	0	0	1
	09:00	1	0	1	1	3
	10:00	0	0	1	0	1
	11:00	1	1	1	1	4
	12:00	1	0	0	1	2
	13:00	1	0	1	0	2
	14:00	1	1	1	1	4
	15:00	1	1	2	0	4
	16:00	4	1	0	0	5
	17:00	0	1	0	0	1
	18:00	1	1	1	0	3
	19:00	0	1	1	1	3
	20:00	2	0	1	1	4
	21:00	0	0	0	0	0
	22:00	0	0	0	0	0
	23:00	0	0	0	0	0
Day Total :						42

AM Total :	14 (33.3%)	Peak AM Hour :	11:00 =	4 (9.5%)	Peak AM Factor : 0.500	Average Period :	0.4
PM Total :	28 (66.7%)	Peak PM Hour :	15:15 =	7 (16.7%)	Peak PM Factor : 0.438	Average Hour :	1.8

Date	Time	:00	:15	:30	:45	Total
01/29/14	00:00	0	0	0	0	0
Wed	01:00	0	0	0	0	0
	02:00	0	0	0	0	0
	03:00	0	0	0	0	0
	04:00	0	0	1	0	1
	05:00	0	0	0	0	0
	06:00	0	1	0	0	1
	07:00	0	2	0	0	2
	08:00	0	0	0	0	0
	09:00	1	0	4	0	5
	10:00	1	1	1	1	4
	11:00	3	0	3	6	12
	12:00	2	0	1	0	3
	13:00	0	2	1	1	4
	14:00	1	1	1	2	5
	15:00	2	1	3	1	7
	16:00	0	2	0	0	2
	17:00	1	1	1	1	4
	18:00	1	0	1	2	4
	19:00	2	0	1	0	3
	20:00	1	0	0	0	1
	21:00	0	1	0	0	1
	22:00	0	0	0	0	0
	23:00	0	0	0	0	0
Day Total :						59

AM Total :	25 (42.4%)	Peak AM Hour :	11:00 =	12 (20.3%)	Peak AM Factor : 0.500	Average Period :	0.6
PM Total :	34 (57.6%)	Peak PM Hour :	14:45 =	8 (13.6%)	Peak PM Factor : 0.667	Average Hour :	2.5

Lane #2 Configuration

#	Dir.	Information	Volume Mode	Volume Sensors	Divide By 2	Comment
2.		Southbound	Directional^	Axle	Yes	

Lane #2 Basic Volume Data From: 00:00 - 01/28/2014 To: 23:59 - 01/29/2014

Date	Time	:00	:15	:30	:45	Total
01/28/14	00:00	0	0	0	0	0
Tue	01:00	0	0	0	0	0
	02:00	0	0	0	0	0
	03:00	0	0	0	0	0
	04:00	0	0	0	0	0
	05:00	0	0	0	0	0
	06:00	0	2	0	0	2
	07:00	0	3	2	2	7
	08:00	1	0	1	2	4
	09:00	0	1	0	1	2
	10:00	2	1	2	3	8
	11:00	0	1	1	0	2
	12:00	2	0	0	2	4
	13:00	1	0	1	1	3
	14:00	4	1	2	1	8
	15:00	4	0	1	1	6
	16:00	0	1	0	1	2
	17:00	2	0	1	0	3
	18:00	1	0	0	0	1
	19:00	0	2	0	1	3
	20:00	0	1	0	0	1
	21:00	0	0	1	0	1
	22:00	0	0	0	0	0
	23:00	0	0	0	0	0
Day Total :						57

AM Total :	25 (43.9%)	Peak AM Hour :	07:15 =	8 (14.0%)	Peak AM Factor :	0.667	Average Period : 0.6
PM Total :	32 (56.1%)	Peak PM Hour :	13:45 =	8 (14.0%)	Peak PM Factor :	0.500	Average Hour : 2.4

Date	Time	:00	:15	:30	:45	Total
01/29/14	00:00	0	0	0	0	0
Wed	01:00	0	0	0	0	0
	02:00	0	0	0	0	0
	03:00	0	0	0	0	0
	04:00	0	0	0	0	0
	05:00	0	0	0	0	0
	06:00	0	0	0	0	0
	07:00	1	1	1	1	4
	08:00	2	1	1	1	5
	09:00	1	0	6	0	7
	10:00	3	0	0	2	5
	11:00	1	1	3	0	5
	12:00	2	1	2	0	5
	13:00	2	1	2	0	5
	14:00	1	1	0	1	3
	15:00	2	0	1	2	5
	16:00	1	0	0	0	1
	17:00	2	0	1	0	3
	18:00	0	0	1	1	2
	19:00	0	1	0	1	2
	20:00	0	0	0	0	0
	21:00	0	0	1	0	1
	22:00	0	0	0	0	0
	23:00	0	0	0	0	0
Day Total :						53

AM Total :	26 (49.1%)	Peak AM Hour : 09:15 =	9 (17.0%)	Peak AM Factor : 0.375	Average Period :	0.6
PM Total :	27 (50.9%)	Peak PM Hour : 12:00 =	5 (9.4%)	Peak PM Factor : 0.625	Average Hour :	2.2

Basic Volume Summary: TRAMWAY LN

Grand Total For Data From: 00:00 - 01/28/2014 To: 23:59 - 01/29/2014

Lane	Total Count		# Of Days	ADT	Avg. Period	Avg. Hour	AM Total & Percent	PM Total & Percent
#1.	101	(47.9%)	2.00	51	0.5	2.1	39 (38.6%)	62 (61.4%)
#2.	110	(52.1%)	2.00	55	0.6	2.3	51 (46.4%)	59 (53.6%)
ALL	211		2.00	106	1.1	4.4	90 (42.7%)	121 (57.3%)

Lane	Peak AM Hour		Date	Peak AM Factor	Peak PM Hour		Date	Peak PM Factor
#1.	11:00 =	12	01/29/2014	0.500	14:45 =	8	01/29/2014	0.667
#2.	09:15 =	9	01/29/2014	0.375	13:45 =	8	01/28/2014	0.500

Hawk's Landing - Growth Rate

No.	Roadway Segments	2008	2009	2010	2011	2012	m	b	R2	Annual Rate
1	Tramay South of Paseo	16900	16700	17300	17000	17000	50	16830	0.13	0.3%
2	Tramway North of Paseo	12400	13500	13600	13300	13300	160	12740	0.28	1.2%
3	PdN West of Tramway	11000	10800	11200	11000	11000	20	10940	0.05	0.2%
	Summary	**40300**	**41000**	**42100**	**41300**	**41300**	**230**	**40510**	**0.31**	**0.6%**

Appendix C

Trip Generation, Distribution and Assignments

Trip Generation Worksheet
Trip Distribution (by Intersection Approach)
Trip Assignment (by Intersection Approach)

Trip Generation Worksheet

Land Use: **Single Family Detached Housing** **210**

Trip Generation Units:	1	Dwelling Unit
Project Units:	31	

Trip Generation Equations:

Average Vehicle Trip End on a Weekday

Ln(T) = 0.92 Ln(X) + 2.72	
Enter	50%
Exit	50%

Peak Hour of Adjacent St, Traffic 7 to 9 AM

T = 0.70 (X) + 9.74	
Enter	25%
Exit	75%

Peak Hour of Adjacent St Traffic, 4 to 6 PM

Ln(T) = 0.90 Ln(X) + 0.51	
Enter	63%
Exit	37%

Daily Trips	**358**
Enter	179
Exit	179
AM Peak Trips	**31**
Enter	8
Exit	23
PM Peak Trips	**37**
Enter	23
Exit	14

Trip Generation based upon ITE *Trip Generation* , 9th Edition.

Hawk's Landing - Distribution

AM Peak	**Eastbound**			**Westbound**			**Northbound**			**Southbound**			
Intersection	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**Sum**
Tramway @ San Bernardino				**0.400**					0.670		**0.270**		**1.34**
Tramway @ Paseo Del Norte	0.230										**0.270**	**0.230**	**0.73**
Tramway @ Live Oak				**0.500**		**0.100**			0.230	0.100			**0.93**
													0
													0
													0
													0
													0

PM Peak	**Eastbound**			**Westbound**			**Northbound**			**Southbound**			
Intersection	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**Sum**
Tramway @ San Bernardino				**0.400**					0.670		**0.270**		**1.34**
Tramway @ Paseo Del Norte	0.230										**0.270**	**0.230**	**0.73**
Tramway @ Live Oak				**0.500**		**0.100**			0.230	0.100			**0.93**
													0
													0
													0
													0
													0

Bold Text is Exiting Trips

Hawk's Landing - Assignment

AM Peak	**Eastbound**			**Westbound**			**Northbound**			**Southbound**			
Intersection	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**Sum**
Tramway @ San Bernardino	0	0	0	**9**	0	0	0	0	5	0	**6**	0	**20**
Tramway @ Paseo Del Norte	2	0	0	0	0	0	0	0	0	0	**6**	**5**	**13**
Tramway @ Live Oak	0	0	0	**12**	0	**2**	0	0	2	1	0	0	**17**
													0
													0
													0
													0
													0
AM Trips	**In**	8	**Out**	23									

PM Peak	**Eastbound**			**Westbound**			**Northbound**			**Southbound**			
Intersection	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**LT**	**TH**	**RT**	**Sum**
Tramway @ San Bernardino	0	0	0	**6**	0	0	0	0	15	0	**4**	0	**25**
Tramway @ Paseo Del Norte	5	0	0	0	0	0	0	0	0	0	**4**	**3**	**12**
Tramway @ Live Oak	0	0	0	**7**	0	**1**	0	0	5	2	0	0	**15**
													0
													0
													0
													0
													0
PM Trips	**In**	23	**Out**	14									

Appendix D

Existing Condition Level of Service Analyses

Level of Service Analysis	Pages
AM Existing Condition - Signalized	3
PM Existing Condition - Signalized	3

HCM Signalized Intersection Capacity Analysis
1: San Bernardino & Tramway Blvd

11/23/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	0	27	29	1	52	36	859	11	13	489	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.95	1.00		0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1770	1583		1777	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.73	1.00		0.70	1.00	0.38	1.00	1.00	0.27	1.00	1.00
Satd. Flow (perm)		1369	1583		1303	1583	703	3539	1583	494	3539	1583
Peak-hour factor, PHF	0.78	0.78	0.78	0.89	0.89	0.89	0.84	0.84	0.84	0.76	0.76	0.76
Adj. Flow (vph)	45	0	35	33	1	58	43	1023	13	17	643	57
RTOR Reduction (vph)	0	0	32	0	0	52	0	0	5	0	0	22
Lane Group Flow (vph)	0	45	3	0	34	6	43	1023	8	17	643	35
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		6.7	6.7		6.7	6.7	49.4	45.6	45.6	44.2	43.0	43.0
Effective Green, g (s)		6.7	6.7		6.7	6.7	49.4	45.6	45.6	44.2	43.0	43.0
Actuated g/C Ratio		0.10	0.10		0.10	0.10	0.71	0.65	0.65	0.63	0.61	0.61
Clearance Time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
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)		131	152		125	152	554	2305	1031	334	2174	972
v/s Ratio Prot							c0.00	c0.29		0.00	0.18	
v/s Ratio Perm		c0.03	0.00		0.03	0.00	0.05		0.01	0.03		0.02
v/c Ratio		0.34	0.02		0.27	0.04	0.08	0.44	0.01	0.05	0.30	0.04
Uniform Delay, d1		29.6	28.7		29.4	28.7	3.2	6.0	4.3	4.8	6.4	5.3
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.70	1.40	2.61
Incremental Delay, d2		1.6	0.1		1.2	0.1	0.1	0.6	0.0	0.1	0.3	0.1
Delay (s)		31.2	28.7		30.6	28.8	3.3	6.6	4.3	8.3	9.3	14.0
Level of Service		C	C		C	C	A	A	A	A	A	B
Approach Delay (s)		30.1			29.5			6.4			9.6	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	9.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	59	181	433	492	351	123
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	4.0	5.5	5.5	5.5	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.44	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	822	3539	3539	1583
Peak-hour factor, PHF	0.73	0.73	0.89	0.89	0.87	0.87
Adj. Flow (vph)	81	248	487	553	403	141
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	81	248	487	553	403	141
Turn Type		Free	pm+pt			Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	7.4	70.0	51.6	51.6	33.0	70.0
Effective Green, g (s)	7.4	70.0	51.6	51.6	33.0	70.0
Actuated g/C Ratio	0.11	1.00	0.74	0.74	0.47	1.00
Clearance Time (s)	5.5		5.5	5.5	5.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	187	1583	783	2609	1668	1583
v/s Ratio Prot	c0.05		c0.12	0.16	0.11	
v/s Ratio Perm		0.16	c0.34			0.09
v/c Ratio	0.43	0.16	0.62	0.21	0.24	0.09
Uniform Delay, d1	29.3	0.0	3.8	2.9	11.0	0.0
Progression Factor	1.00	1.00	2.38	1.14	0.80	1.00
Incremental Delay, d2	1.6	0.2	1.5	0.2	0.3	0.1
Delay (s)	30.9	0.2	10.5	3.4	9.2	0.1
Level of Service	C	A	B	A	A	A
Approach Delay (s)	7.8			6.7	6.8	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	6.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	50.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	1	75	133	4	26	18	479	19	8	242	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1795	1583		1777	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.83	1.00		0.73	1.00	0.54	1.00	1.00	0.43	1.00	1.00
Satd. Flow (perm)		1541	1583		1360	1583	997	3539	1583	804	3539	1583
Peak-hour factor, PHF	0.72	0.72	0.72	0.82	0.82	0.82	0.82	0.82	0.82	0.74	0.74	0.74
Adj. Flow (vph)	3	1	104	162	5	32	22	584	23	11	327	1
RTOR Reduction (vph)	0	0	83	0	0	26	0	0	10	0	0	0
Lane Group Flow (vph)	0	4	21	0	167	6	22	584	13	11	327	1
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		13.8	13.8		13.8	13.8	41.0	38.5	38.5	38.4	37.2	37.2
Effective Green, g (s)		13.8	13.8		13.8	13.8	41.0	38.5	38.5	38.4	37.2	37.2
Actuated g/C Ratio		0.20	0.20		0.20	0.20	0.59	0.55	0.55	0.55	0.53	0.53
Clearance Time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
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)		304	312		268	312	612	1946	871	458	1881	841
v/s Ratio Prot							c0.00	c0.17		0.00	0.09	
v/s Ratio Perm		0.00	0.01		c0.12	0.00	0.02		0.01	0.01		0.00
v/c Ratio		0.01	0.07		0.62	0.02	0.04	0.30	0.01	0.02	0.17	0.00
Uniform Delay, d1		22.6	22.9		25.7	22.7	6.1	8.5	7.1	7.2	8.5	7.7
Progression Factor		1.00	1.00		1.00	1.00	1.10	1.17	1.33	1.00	1.00	1.00
Incremental Delay, d2		0.0	0.1		4.5	0.0	0.0	0.4	0.0	0.0	0.2	0.0
Delay (s)		22.6	22.9		30.2	22.7	6.7	10.3	9.5	7.2	8.7	7.7
Level of Service		C	C		C	C	A	B	A	A	A	A
Approach Delay (s)		22.9			29.0			10.1			8.6	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM Average Control Delay	13.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
1: San Bernardino & Tramway Blvd

11/23/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	58	2	47	20	3	20	57	805	35	25	853	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.95	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1777	1583		1785	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.71	1.00		0.70	1.00	0.25	1.00	1.00	0.30	1.00	1.00
Satd. Flow (perm)		1326	1583		1296	1583	473	3539	1583	554	3539	1583
Peak-hour factor, PHF	0.72	0.72	0.72	0.77	0.77	0.77	0.90	0.90	0.90	0.91	0.91	0.91
Adj. Flow (vph)	81	3	65	26	4	26	63	894	39	27	937	69
RTOR Reduction (vph)	0	0	57	0	0	23	0	0	15	0	0	29
Lane Group Flow (vph)	0	84	8	0	30	3	63	894	24	27	937	40
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		8.6	8.6		8.6	8.6	46.5	42.4	42.4	43.3	40.8	40.8
Effective Green, g (s)		8.6	8.6		8.6	8.6	46.5	42.4	42.4	43.3	40.8	40.8
Actuated g/C Ratio		0.12	0.12		0.12	0.12	0.66	0.61	0.61	0.62	0.58	0.58
Clearance Time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
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)		163	194		159	194	390	2144	959	386	2063	923
v/s Ratio Prot							c0.01	0.25		0.00	c0.26	
v/s Ratio Perm		c0.06	0.01		0.02	0.00	0.10		0.01	0.04		0.03
v/c Ratio		0.52	0.04		0.19	0.02	0.16	0.42	0.02	0.07	0.45	0.04
Uniform Delay, d1		28.7	27.1		27.6	27.0	4.5	7.3	5.5	5.2	8.3	6.2
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.93	1.73	3.30
Incremental Delay, d2		2.7	0.1		0.6	0.0	0.2	0.6	0.0	0.1	0.7	0.1
Delay (s)		31.5	27.2		28.1	27.0	4.7	7.9	5.6	10.1	15.0	20.7
Level of Service		C	C		C	C	A	A	A	B	B	C
Approach Delay (s)		29.6			27.6			7.6			15.3	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	13.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	50.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	160	409	337	587	555	127
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	4.0	5.5	5.5	5.5	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.32	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	594	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.94	0.94	0.92	0.92
Adj. Flow (vph)	174	445	359	624	603	138
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	174	445	359	624	603	138
Turn Type		Free	pm+pt			Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	12.0	70.0	47.0	47.0	29.5	70.0
Effective Green, g (s)	12.0	70.0	47.0	47.0	29.5	70.0
Actuated g/C Ratio	0.17	1.00	0.67	0.67	0.42	1.00
Clearance Time (s)	5.5		5.5	5.5	5.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	303	1583	600	2376	1491	1583
v/s Ratio Prot	c0.10		c0.10	0.18	0.17	
v/s Ratio Perm		0.28	c0.30			0.09
v/c Ratio	0.57	0.28	0.60	0.26	0.40	0.09
Uniform Delay, d1	26.7	0.0	5.7	4.6	14.1	0.0
Progression Factor	1.00	1.00	2.53	0.96	0.74	1.00
Incremental Delay, d2	2.6	0.4	1.5	0.3	0.8	0.1
Delay (s)	29.3	0.4	16.0	4.7	11.3	0.1
Level of Service	C	A	B	A	B	A
Approach Delay (s)	8.5			8.8	9.2	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	8.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: Live Oak & Tramway Blvd

11/23/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	41	100	0	6	61	426	137	12	452	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lane Util. Factor			1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected			1.00		0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)			1583		1770	1583	1770	3539	1583	1770	3539	1583
Flt Permitted			1.00		0.76	1.00	0.45	1.00	1.00	0.48	1.00	1.00
Satd. Flow (perm)			1583		1410	1583	831	3539	1583	887	3539	1583
Peak-hour factor, PHF	0.57	0.57	0.57	0.65	0.65	0.65	0.88	0.88	0.80	0.97	0.97	0.97
Adj. Flow (vph)	0	0	72	154	0	9	69	484	171	12	466	3
RTOR Reduction (vph)	0	0	59	0	0	7	0	0	75	0	0	1
Lane Group Flow (vph)	0	0	13	0	154	2	69	484	96	12	466	2
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)			12.9		12.9	12.9	43.7	39.4	39.4	37.5	36.3	36.3
Effective Green, g (s)			12.9		12.9	12.9	43.7	39.4	39.4	37.5	36.3	36.3
Actuated g/C Ratio			0.18		0.18	0.18	0.62	0.56	0.56	0.54	0.52	0.52
Clearance Time (s)			5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
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)			292		260	292	576	1992	891	490	1835	821
v/s Ratio Prot							c0.01	c0.14		0.00	0.13	
v/s Ratio Perm			0.01		c0.11	0.00	0.07		0.06	0.01		0.00
v/c Ratio			0.05		0.59	0.01	0.12	0.24	0.11	0.02	0.25	0.00
Uniform Delay, d1			23.5		26.1	23.3	5.2	7.7	7.1	7.6	9.3	8.1
Progression Factor			1.00		1.00	1.00	0.53	0.72	1.27	1.00	1.00	1.00
Incremental Delay, d2			0.1		3.6	0.0	0.1	0.3	0.2	0.0	0.3	0.0
Delay (s)			23.5		29.7	23.3	2.8	5.9	9.3	7.6	9.7	8.1
Level of Service			C		C	C	A	A	A	A	A	A
Approach Delay (s)		23.5			29.4			6.4			9.6	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	10.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	35.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Appendix E

2015 Baseline Level of Service Analyses

Level of Service Analysis	Pages
AM 2015 Baseline Condition - Signalized	3
PM 2015 Baseline Condition - Signalized	3

HCM Signalized Intersection Capacity Analysis
1: San Bernardino & Tramway Blvd

11/23/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	0	30	30	10	50	40	880	10	10	500	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.95	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1770	1583		1795	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.73	1.00		0.75	1.00	0.37	1.00	1.00	0.26	1.00	1.00
Satd. Flow (perm)		1356	1583		1388	1583	687	3539	1583	477	3539	1583
Peak-hour factor, PHF	0.78	0.78	0.78	0.89	0.89	0.89	0.84	0.84	0.84	0.76	0.76	0.76
Adj. Flow (vph)	51	0	38	34	11	56	48	1048	12	13	658	53
RTOR Reduction (vph)	0	0	34	0	0	50	0	0	4	0	0	21
Lane Group Flow (vph)	0	51	4	0	45	6	48	1048	8	13	658	32
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		7.0	7.0		7.0	7.0	49.2	45.3	45.3	43.8	42.6	42.6
Effective Green, g (s)		7.0	7.0		7.0	7.0	49.2	45.3	45.3	43.8	42.6	42.6
Actuated g/C Ratio		0.10	0.10		0.10	0.10	0.70	0.65	0.65	0.63	0.61	0.61
Clearance Time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
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)		136	158		139	158	543	2290	1024	321	2154	963
v/s Ratio Prot							c0.00	c0.30		0.00	0.19	
v/s Ratio Perm		c0.04	0.00		0.03	0.00	0.06		0.00	0.02		0.02
v/c Ratio		0.38	0.02		0.32	0.04	0.09	0.46	0.01	0.04	0.31	0.03
Uniform Delay, d1		29.5	28.4		29.3	28.5	3.3	6.2	4.4	5.0	6.6	5.5
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.68	1.38	2.50
Incremental Delay, d2		1.7	0.1		1.4	0.1	0.1	0.7	0.0	0.1	0.4	0.1
Delay (s)		31.2	28.5		30.7	28.5	3.4	6.9	4.4	8.5	9.4	13.7
Level of Service		C	C		C	C	A	A	A	A	A	B
Approach Delay (s)		30.0			29.5			6.7			9.7	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	9.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	50.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	60	180	440	500	360	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	4.0	5.5	5.5	5.5	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.44	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	812	3539	3539	1583
Peak-hour factor, PHF	0.73	0.73	0.89	0.89	0.87	0.87
Adj. Flow (vph)	82	247	494	562	414	149
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	82	247	494	562	414	149
Turn Type		Free	pm+pt			Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	7.5	70.0	51.5	51.5	32.6	70.0
Effective Green, g (s)	7.5	70.0	51.5	51.5	32.6	70.0
Actuated g/C Ratio	0.11	1.00	0.74	0.74	0.47	1.00
Clearance Time (s)	5.5		5.5	5.5	5.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	190	1583	781	2604	1648	1583
v/s Ratio Prot	c0.05		c0.12	0.16	0.12	
v/s Ratio Perm		0.16	c0.34			0.09
v/c Ratio	0.43	0.16	0.63	0.22	0.25	0.09
Uniform Delay, d1	29.3	0.0	3.8	2.9	11.3	0.0
Progression Factor	1.00	1.00	2.43	1.19	0.80	1.00
Incremental Delay, d2	1.6	0.2	1.6	0.2	0.4	0.1
Delay (s)	30.8	0.2	10.9	3.6	9.4	0.1
Level of Service	C	A	B	A	A	A
Approach Delay (s)	7.8			7.0	6.9	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	7.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: Live Oak & Tramway Blvd

11/23/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	10	80	140	10	30	20	490	20	10	250	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1817	1583		1780	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.83	1.00		0.72	1.00	0.53	1.00	1.00	0.42	1.00	1.00
Satd. Flow (perm)		1541	1583		1340	1583	986	3539	1583	792	3539	1583
Peak-hour factor, PHF	0.72	0.72	0.72	0.82	0.82	0.82	0.82	0.82	0.82	0.74	0.74	0.74
Adj. Flow (vph)	14	14	111	171	12	37	24	598	24	14	338	14
RTOR Reduction (vph)	0	0	88	0	0	29	0	0	11	0	0	7
Lane Group Flow (vph)	0	28	23	0	183	8	24	598	13	14	338	7
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		14.7	14.7		14.7	14.7	40.1	37.5	37.5	37.5	36.2	36.2
Effective Green, g (s)		14.7	14.7		14.7	14.7	40.1	37.5	37.5	37.5	36.2	36.2
Actuated g/C Ratio		0.21	0.21		0.21	0.21	0.57	0.54	0.54	0.54	0.52	0.52
Clearance Time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
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)		324	332		281	332	594	1896	848	442	1830	819
v/s Ratio Prot							c0.00	c0.17		0.00	0.10	
v/s Ratio Perm		0.02	0.01		c0.14	0.00	0.02		0.01	0.02		0.00
v/c Ratio		0.09	0.07		0.65	0.02	0.04	0.32	0.02	0.03	0.18	0.01
Uniform Delay, d1		22.2	22.2		25.3	22.0	6.5	9.1	7.6	7.6	9.0	8.2
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.10	1.20	1.00	1.00	1.00
Incremental Delay, d2		0.1	0.1		5.3	0.0	0.0	0.4	0.0	0.0	0.2	0.0
Delay (s)		22.4	22.3		30.6	22.0	6.5	10.4	9.2	7.6	9.2	8.2
Level of Service		C	C		C	C	A	B	A	A	A	A
Approach Delay (s)		22.3			29.2			10.2			9.1	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	40.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
1: San Bernardino & Tramway Blvd

11/23/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	10	50	20	10	20	60	820	40	30	870	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1786	1583		1803	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.73	1.00		0.74	1.00	0.24	1.00	1.00	0.29	1.00	1.00
Satd. Flow (perm)		1358	1583		1380	1583	456	3539	1583	538	3539	1583
Peak-hour factor, PHF	0.72	0.72	0.72	0.77	0.77	0.77	0.90	0.90	0.90	0.91	0.91	0.91
Adj. Flow (vph)	83	14	69	26	13	26	67	911	44	33	956	66
RTOR Reduction (vph)	0	0	60	0	0	23	0	0	18	0	0	28
Lane Group Flow (vph)	0	97	9	0	39	3	67	911	26	33	956	38
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		9.1	9.1		9.1	9.1	46.0	41.9	41.9	42.8	40.3	40.3
Effective Green, g (s)		9.1	9.1		9.1	9.1	46.0	41.9	41.9	42.8	40.3	40.3
Actuated g/C Ratio		0.13	0.13		0.13	0.13	0.66	0.60	0.60	0.61	0.58	0.58
Clearance Time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
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)		177	206		179	206	377	2118	948	373	2037	911
v/s Ratio Prot							c0.01	0.26		0.00	c0.27	
v/s Ratio Perm		c0.07	0.01		0.03	0.00	0.11		0.02	0.05		0.02
v/c Ratio		0.55	0.04		0.22	0.02	0.18	0.43	0.03	0.09	0.47	0.04
Uniform Delay, d1		28.5	26.6		27.3	26.5	4.7	7.6	5.7	5.5	8.6	6.5
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.91	1.74	3.26
Incremental Delay, d2		3.4	0.1		0.6	0.0	0.2	0.6	0.1	0.1	0.7	0.1
Delay (s)		32.0	26.7		27.9	26.6	5.0	8.2	5.8	10.5	15.7	21.1
Level of Service		C	C		C	C	A	A	A	B	B	C
Approach Delay (s)		29.8			27.4			7.9			15.9	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	160	420	340	600	570	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	4.0	5.5	5.5	5.5	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.31	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	579	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.94	0.94	0.92	0.92
Adj. Flow (vph)	174	457	362	638	620	141
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	174	457	362	638	620	141
Turn Type		Free	pm+pt			Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	12.0	70.0	47.0	47.0	29.6	70.0
Effective Green, g (s)	12.0	70.0	47.0	47.0	29.6	70.0
Actuated g/C Ratio	0.17	1.00	0.67	0.67	0.42	1.00
Clearance Time (s)	5.5		5.5	5.5	5.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	303	1583	591	2376	1496	1583
v/s Ratio Prot	c0.10		c0.10	0.18	0.18	
v/s Ratio Perm		0.29	c0.31			0.09
v/c Ratio	0.57	0.29	0.61	0.27	0.41	0.09
Uniform Delay, d1	26.7	0.0	5.8	4.6	14.1	0.0
Progression Factor	1.00	1.00	2.59	0.96	0.74	1.00
Incremental Delay, d2	2.6	0.5	1.8	0.3	0.8	0.1
Delay (s)	29.3	0.5	16.8	4.7	11.3	0.1
Level of Service	C	A	B	A	B	A
Approach Delay (s)	8.4			9.1	9.2	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	9.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	40	100	0	10	60	430	140	10	460	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lane Util. Factor			1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected			1.00		0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)			1583		1770	1583	1770	3539	1583	1770	3539	1583
Flt Permitted			1.00		0.76	1.00	0.44	1.00	1.00	0.47	1.00	1.00
Satd. Flow (perm)			1583		1410	1583	825	3539	1583	882	3539	1583
Peak-hour factor, PHF	0.57	0.57	0.57	0.65	0.65	0.65	0.88	0.88	0.80	0.97	0.97	0.97
Adj. Flow (vph)	0	0	70	154	0	15	68	489	175	10	474	10
RTOR Reduction (vph)	0	0	57	0	0	12	0	0	77	0	0	5
Lane Group Flow (vph)	0	0	13	0	154	3	68	489	99	10	474	5
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)			12.9		12.9	12.9	43.7	39.4	39.4	37.5	36.3	36.3
Effective Green, g (s)			12.9		12.9	12.9	43.7	39.4	39.4	37.5	36.3	36.3
Actuated g/C Ratio			0.18		0.18	0.18	0.62	0.56	0.56	0.54	0.52	0.52
Clearance Time (s)			5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
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)			292		260	292	573	1992	891	488	1835	821
v/s Ratio Prot							c0.01	c0.14		0.00	0.13	
v/s Ratio Perm			0.01		c0.11	0.00	0.07		0.06	0.01		0.00
v/c Ratio			0.04		0.59	0.01	0.12	0.25	0.11	0.02	0.26	0.01
Uniform Delay, d1			23.5		26.1	23.3	5.2	7.8	7.1	7.6	9.4	8.1
Progression Factor			1.00		1.00	1.00	0.49	0.69	1.23	1.00	1.00	1.00
Incremental Delay, d2			0.1		3.6	0.0	0.1	0.3	0.2	0.0	0.3	0.0
Delay (s)			23.5		29.7	23.3	2.6	5.6	9.0	7.6	9.7	8.2
Level of Service			C		C	C	A	A	A	A	A	A
Approach Delay (s)		23.5			29.2			6.1			9.6	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	10.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	35.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Appendix F

2015 Build Level of Service Analyses

Level of Service Analysis	Pages
AM 2015 Build Condition - Signalized	3
PM 2015 Build Condition - Signalized	3

HCM Signalized Intersection Capacity Analysis
1: San Bernardino & Tramway Blvd

11/23/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	0	30	39	10	50	40	880	15	10	506	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.95	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1770	1583		1791	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.72	1.00		0.73	1.00	0.36	1.00	1.00	0.26	1.00	1.00
Satd. Flow (perm)		1343	1583		1368	1583	679	3539	1583	476	3539	1583
Peak-hour factor, PHF	0.78	0.78	0.78	0.89	0.89	0.89	0.84	0.84	0.84	0.76	0.76	0.76
Adj. Flow (vph)	51	0	38	44	11	56	48	1048	18	13	666	53
RTOR Reduction (vph)	0	0	34	0	0	50	0	0	6	0	0	21
Lane Group Flow (vph)	0	51	4	0	55	6	48	1048	12	13	666	32
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		7.1	7.1		7.1	7.1	49.1	45.2	45.2	43.7	42.5	42.5
Effective Green, g (s)		7.1	7.1		7.1	7.1	49.1	45.2	45.2	43.7	42.5	42.5
Actuated g/C Ratio		0.10	0.10		0.10	0.10	0.70	0.65	0.65	0.62	0.61	0.61
Clearance Time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
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)		136	161		139	161	537	2285	1022	319	2149	961
v/s Ratio Prot							c0.00	c0.30		0.00	0.19	
v/s Ratio Perm		0.04	0.00		c0.04	0.00	0.06		0.01	0.02		0.02
v/c Ratio		0.38	0.02		0.40	0.04	0.09	0.46	0.01	0.04	0.31	0.03
Uniform Delay, d1		29.4	28.3		29.4	28.4	3.3	6.2	4.4	5.0	6.7	5.5
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.64	1.37	2.45
Incremental Delay, d2		1.7	0.1		1.9	0.1	0.1	0.7	0.0	0.1	0.4	0.1
Delay (s)		31.1	28.4		31.3	28.5	3.4	6.9	4.4	8.3	9.5	13.6
Level of Service		C	C		C	C	A	A	A	A	A	B
Approach Delay (s)		30.0			29.9			6.7			9.8	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	10.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	50.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	62	180	440	500	366	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	4.0	5.5	5.5	5.5	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.43	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	806	3539	3539	1583
Peak-hour factor, PHF	0.73	0.73	0.89	0.89	0.87	0.87
Adj. Flow (vph)	85	247	494	562	421	155
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	85	247	494	562	421	155
Turn Type		Free	pm+pt			Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	7.6	70.0	51.4	51.4	32.4	70.0
Effective Green, g (s)	7.6	70.0	51.4	51.4	32.4	70.0
Actuated g/C Ratio	0.11	1.00	0.73	0.73	0.46	1.00
Clearance Time (s)	5.5		5.5	5.5	5.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	192	1583	778	2599	1638	1583
v/s Ratio Prot	c0.05		c0.12	0.16	0.12	
v/s Ratio Perm		0.16	c0.34			0.10
v/c Ratio	0.44	0.16	0.63	0.22	0.26	0.10
Uniform Delay, d1	29.2	0.0	3.9	2.9	11.5	0.0
Progression Factor	1.00	1.00	2.44	1.19	0.79	1.00
Incremental Delay, d2	1.6	0.2	1.6	0.2	0.4	0.1
Delay (s)	30.8	0.2	11.1	3.7	9.5	0.1
Level of Service	C	A	B	A	A	A
Approach Delay (s)	8.1			7.1	6.9	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	7.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	10	80	152	10	32	20	490	22	11	250	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1817	1583		1779	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.83	1.00		0.72	1.00	0.53	1.00	1.00	0.42	1.00	1.00
Satd. Flow (perm)		1541	1583		1339	1583	988	3539	1583	786	3539	1583
Peak-hour factor, PHF	0.72	0.72	0.72	0.82	0.82	0.82	0.82	0.82	0.82	0.74	0.74	0.74
Adj. Flow (vph)	14	14	111	185	12	39	24	598	27	15	338	14
RTOR Reduction (vph)	0	0	86	0	0	30	0	0	13	0	0	7
Lane Group Flow (vph)	0	28	25	0	197	9	24	598	14	15	338	7
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		15.5	15.5		15.5	15.5	39.2	36.8	36.8	36.8	35.6	35.6
Effective Green, g (s)		15.5	15.5		15.5	15.5	39.2	36.8	36.8	36.8	35.6	35.6
Actuated g/C Ratio		0.22	0.22		0.22	0.22	0.56	0.53	0.53	0.53	0.51	0.51
Clearance Time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
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)		341	351		296	351	580	1861	832	430	1800	805
v/s Ratio Prot							c0.00	c0.17		0.00	0.10	
v/s Ratio Perm		0.02	0.02		c0.15	0.01	0.02		0.01	0.02		0.00
v/c Ratio		0.08	0.07		0.67	0.02	0.04	0.32	0.02	0.03	0.19	0.01
Uniform Delay, d1		21.6	21.6		24.9	21.3	6.9	9.5	7.9	7.9	9.3	8.5
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.09	1.22	1.00	1.00	1.00
Incremental Delay, d2		0.1	0.1		5.6	0.0	0.0	0.5	0.0	0.0	0.2	0.0
Delay (s)		21.7	21.6		30.4	21.4	6.9	10.8	9.7	8.0	9.6	8.5
Level of Service		C	C		C	C	A	B	A	A	A	A
Approach Delay (s)		21.7			28.9			10.6			9.5	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM Average Control Delay	14.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	41.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
1: San Bernardino & Tramway Blvd

11/23/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	10	50	26	10	20	60	820	55	30	874	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1786	1583		1798	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.72	1.00		0.72	1.00	0.24	1.00	1.00	0.29	1.00	1.00
Satd. Flow (perm)		1348	1583		1350	1583	454	3539	1583	538	3539	1583
Peak-hour factor, PHF	0.72	0.72	0.72	0.77	0.77	0.77	0.90	0.90	0.90	0.91	0.91	0.91
Adj. Flow (vph)	83	14	69	34	13	26	67	911	61	33	960	66
RTOR Reduction (vph)	0	0	60	0	0	23	0	0	24	0	0	28
Lane Group Flow (vph)	0	97	9	0	47	3	67	911	37	33	960	38
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)		9.1	9.1		9.1	9.1	46.0	41.9	41.9	42.8	40.3	40.3
Effective Green, g (s)		9.1	9.1		9.1	9.1	46.0	41.9	41.9	42.8	40.3	40.3
Actuated g/C Ratio		0.13	0.13		0.13	0.13	0.66	0.60	0.60	0.61	0.58	0.58
Clearance Time (s)		5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
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)		175	206		176	206	375	2118	948	373	2037	911
v/s Ratio Prot							c0.01	0.26		0.00	c0.27	
v/s Ratio Perm		c0.07	0.01		0.03	0.00	0.11		0.02	0.05		0.02
v/c Ratio		0.55	0.04		0.27	0.02	0.18	0.43	0.04	0.09	0.47	0.04
Uniform Delay, d1		28.5	26.6		27.4	26.5	4.8	7.6	5.8	5.5	8.6	6.5
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.91	1.74	3.26
Incremental Delay, d2		3.8	0.1		0.8	0.0	0.2	0.6	0.1	0.1	0.7	0.1
Delay (s)		32.3	26.7		28.3	26.6	5.0	8.2	5.8	10.5	15.8	21.1
Level of Service		C	C		C	C	A	A	A	B	B	C
Approach Delay (s)		30.0			27.7			7.9			16.0	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	165	420	340	600	574	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	4.0	5.5	5.5	5.5	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.31	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	573	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.94	0.94	0.92	0.92
Adj. Flow (vph)	179	457	362	638	624	145
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	179	457	362	638	624	145
Turn Type		Free	pm+pt			Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	12.1	70.0	46.9	46.9	29.4	70.0
Effective Green, g (s)	12.1	70.0	46.9	46.9	29.4	70.0
Actuated g/C Ratio	0.17	1.00	0.67	0.67	0.42	1.00
Clearance Time (s)	5.5		5.5	5.5	5.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	306	1583	589	2371	1486	1583
v/s Ratio Prot	c0.10		c0.11	0.18	0.18	
v/s Ratio Perm		0.29	c0.31			0.09
v/c Ratio	0.58	0.29	0.61	0.27	0.42	0.09
Uniform Delay, d1	26.6	0.0	5.9	4.6	14.3	0.0
Progression Factor	1.00	1.00	2.60	0.96	0.74	1.00
Incremental Delay, d2	2.8	0.5	1.8	0.3	0.9	0.1
Delay (s)	29.5	0.5	17.1	4.7	11.4	0.1
Level of Service	C	A	B	A	B	A
Approach Delay (s)	8.6			9.2	9.3	
Approach LOS	A			A	A	

Intersection Summary			
HCM Average Control Delay	9.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: Live Oak & Tramway Blvd

11/23/2013

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	40	107	0	11	60	430	145	12	460	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lane Util. Factor			1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected			1.00		0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)			1583		1770	1583	1770	3539	1583	1770	3539	1583
Flt Permitted			1.00		0.76	1.00	0.44	1.00	1.00	0.47	1.00	1.00
Satd. Flow (perm)			1583		1410	1583	824	3539	1583	882	3539	1583
Peak-hour factor, PHF	0.57	0.57	0.57	0.65	0.65	0.65	0.88	0.88	0.80	0.97	0.97	0.97
Adj. Flow (vph)	0	0	70	165	0	17	68	489	181	12	474	10
RTOR Reduction (vph)	0	0	57	0	0	14	0	0	80	0	0	5
Lane Group Flow (vph)	0	0	13	0	165	3	68	489	101	12	474	5
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)			13.4		13.4	13.4	43.2	38.9	38.9	37.0	35.8	35.8
Effective Green, g (s)			13.4		13.4	13.4	43.2	38.9	38.9	37.0	35.8	35.8
Actuated g/C Ratio			0.19		0.19	0.19	0.62	0.56	0.56	0.53	0.51	0.51
Clearance Time (s)			5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
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)			303		270	303	567	1967	880	481	1810	810
v/s Ratio Prot							c0.01	c0.14		0.00	0.13	
v/s Ratio Perm			0.01		c0.12	0.00	0.07		0.06	0.01		0.00
v/c Ratio			0.04		0.61	0.01	0.12	0.25	0.11	0.02	0.26	0.01
Uniform Delay, d1			23.1		25.9	22.9	5.4	8.0	7.4	7.8	9.6	8.4
Progression Factor			1.00		1.00	1.00	0.50	0.69	1.25	1.00	1.00	1.00
Incremental Delay, d2			0.1		4.1	0.0	0.1	0.3	0.3	0.0	0.4	0.0
Delay (s)			23.1		30.0	22.9	2.8	5.8	9.4	7.9	10.0	8.4
Level of Service			C		C	C	A	A	A	A	A	A
Approach Delay (s)		23.1			29.3			6.4			9.9	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	11.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	35.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Appendix G

Queuing Summary Sheets

Intersection Approach Queue Calculator

Intersection: San Bernardino | AM (Period) | 2013 (Year) | Existing (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT			70		25	51.4	0.0					
EB Th	35	0.1	70	1	25	51.4	0.7				**2**	**50**
EB RT	27	0.1	70	1	25	51.4	0.5			**2**		**50**
WB LT			70		25	51.4	0.0					
WB Th	30	0.1	70	1	25	51.4	0.6				**2**	**50**
WB RT	52	0.1	70	1	25	51.4	1.0			**3**		**75**
NB LT	36	0.71	70	1	25	51.4	0.7	**2**	**2**			**50**
NB Th	859	0.65	70	2	25	51.4	16.7				**5**	**125**
NB RT	11	0.65	70	1	25	51.4	0.2			**1**		**25**
SB LT	13	0.63	70	1	25	51.4	0.3	**1**	**1**			**25**
SB Th	489	0.61	70	2	25	51.4	9.5				**3**	**75**
SB RT	43	0.61	70	1	25	51.4	0.8			**3**		**75**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: Paseo Del Norte | AM (Period) | 2013 (Year) | Existing (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT	59	0.11	70	1	25	51.4	1.1	**3**	**3**			**75**
EB Th			70		25	51.4	0.0					
EB RT	181	1	70	1	25	51.4	3.5			**4**		**100**
WB LT			70		25	51.4	0.0					
WB Th			70		25	51.4	0.0					
WB RT			70		25	51.4	0.0					
NB LT	433	0.74	70	1	25	51.4	8.4	**9**	**9**			**225**
NB Th	492	0.74	70	2	25	51.4	9.6				**2**	**50**
NB RT			70		25	51.4	0.0					
SB LT			70		25	51.4	0.0					
SB Th	351	0.47	70	2	25	51.4	6.8				**3**	**75**
SB RT	123	1	70	1	25	51.4	2.4			**3**		**75**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: Live Oak | AM (Period) | 2013 (Year) | Existing (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT			70		25	51.4	0.0					
EB Th	3	0.2	70	1	25	51.4	0.1				**1**	**25**
EB RT	75	0.2	70	1	25	51.4	1.5			**4**		**100**
WB LT			70		25	51.4	0.0					
WB Th	137	0.2	70	1	25	51.4	2.7				**5**	**125**
WB RT	26	0.2	70	1	25	51.4	0.5			**2**		**50**
NB LT	18	0.59	70	1	25	51.4	0.4	**1**	**1**			**25**
NB Th	479	0.55	70	2	25	51.4	9.3				**4**	**100**
NB RT	19	0.55	70	1	25	51.4	0.4			**2**		**50**
SB LT	8	0.55	70	1	25	51.4	0.2	**1**	**1**			**25**
SB Th	242	0.53	70	2	25	51.4	4.7				**3**	**75**
SB RT	1	0.53	70	1	25	51.4	0.0			**#N/A**		**#N/A**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection:	San Bernardino	PM	2013	Existing
		Period	Year	Scenario

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT			70		25	51.4	0.0					
EB Th	60	0.12	70	1	25	51.4	1.2				**3**	**75**
EB RT	47	0.12	70	1	25	51.4	0.9			**3**		**75**
WB LT			70		25	51.4	0.0					
WB Th	23	0.12	70	1	25	51.4	0.4				**2**	**50**
WB RT	20	0.12	70	1	25	51.4	0.4			**2**		**50**
NB LT	57	0.66	70	1	25	51.4	1.1	**3**	**3**			**75**
NB Th	805	0.61	70	2	25	51.4	15.7				**5**	**125**
NB RT	35	0.61	70	1	25	51.4	0.7			**2**		**50**
SB LT	25	0.62	70	1	25	51.4	0.5	**2**	**2**			**50**
SB Th	853	0.58	70	2	25	51.4	16.6				**6**	**150**
SB RT	63	0.58	70	1	25	51.4	1.2			**3**		**75**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: Paseo Del Norte | PM (Period) | 2013 (Year) | Existing (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT	160	0.17	70	1	25	51.4	3.1	**6**	**6**			**150**
EB Th			70		25	51.4	0.0					
EB RT	409	1	70	1	25	51.4	8.0			**7**		**175**
WB LT			70		25	51.4	0.0					
WB Th			70		25	51.4	0.0					
WB RT			70		25	51.4	0.0					
NB LT	337	0.67	70	1	25	51.4	6.6	**8**	**8**			**200**
NB Th	587	0.67	70	2	25	51.4	11.4				**3**	**75**
NB RT			70		25	51.4	0.0					
SB LT			70		25	51.4	0.0					
SB Th	550	0.42	70	2	25	51.4	10.7				**5**	**125**
SB RT	127	1	70	1	25	51.4	2.5			**3**		**75**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: Live Oak | PM (Period) | 2013 (Year) | Existing (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT			70		25	51.4	0.0					
EB Th	0	0.18	70	1	25	51.4	0.0				**#N/A**	**#N/A**
EB RT	41	0.18	70	1	25	51.4	0.8			**2**		**50**
WB LT			70		25	51.4	0.0					
WB Th	100	0.18	70	1	25	51.4	1.9				**4**	**100**
WB RT	6	0.18	70	1	25	51.4	0.1			**1**		**25**
NB LT	61	0.62	70	1	25	51.4	1.2	**3**	**3**			**75**
NB Th	426	0.56	70	2	25	51.4	8.3				**3**	**75**
NB RT	137	0.56	70	1	25	51.4	2.7			**5**		**125**
SB LT	12	0.54	70	1	25	51.4	0.2	**1**	**1**			**25**
SB Th	452	0.52	70	2	25	51.4	8.8				**4**	**100**
SB RT	3	0.52	70	1	25	51.4	0.1			**1**		**25**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: San Bernardino | AM (Period) | 2015 (Year) | Baseline (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT			70		25	51.4	0.0					
EB Th	40	0.1	70	1	25	51.4	0.8				**2**	**50**
EB RT	30	0.1	70	1	25	51.4	0.6			**2**		**50**
WB LT			70		25	51.4	0.0					
WB Th	40	0.1	70	1	25	51.4	0.8				**2**	**50**
WB RT	50	0.1	70	1	25	51.4	1.0			**3**		**75**
NB LT	40	0.7	70	1	25	51.4	0.8	**2**	**2**			**50**
NB Th	880	0.65	70	2	25	51.4	17.1				**5**	**125**
NB RT	10	0.65	70	1	25	51.4	0.2			**1**		**25**
SB LT	10	0.63	70	1	25	51.4	0.2	**1**	**1**			**25**
SB Th	500	0.61	70	2	25	51.4	9.7				**3**	**75**
SB RT	40	0.61	70	1	25	51.4	0.8			**2**		**50**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: Paseo Del Norte | AM (Period) | 2015 (Year) | Baseline (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT	60	0.11	70	1	25	51.4	1.2	**3**	**3**			**75**
EB Th			70		25	51.4	0.0					
EB RT	180	1	70	1	25	51.4	3.5			**4**		**100**
WB LT			70		25	51.4	0.0					
WB Th			70		25	51.4	0.0					
WB RT			70		25	51.4	0.0					
NB LT	440	0.74	70	1	25	51.4	8.6	**9**	**9**			**225**
NB Th	500	0.74	70	2	25	51.4	9.7				**2**	**50**
NB RT			70		25	51.4	0.0					
SB LT			70		25	51.4	0.0					
SB Th	360	0.47	70	2	25	51.4	7.0				**4**	**100**
SB RT	130	1	70	1	25	51.4	2.5			**3**		**75**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: Live Oak | AM (Period) | 2015 (Year) | Baseline (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT			70		25	51.4	0.0					
EB Th	20	0.21	70	1	25	51.4	0.4				**2**	**50**
EB RT	80	0.21	70	1	25	51.4	1.6			**4**		**100**
WB LT			70		25	51.4	0.0					
WB Th	150	0.21	70	1	25	51.4	2.9				**5**	**125**
WB RT	30	0.21	70	1	25	51.4	0.6			**2**		**50**
NB LT	20	0.57	70	1	25	51.4	0.4	**2**	**2**			**50**
NB Th	490	0.54	70	2	25	51.4	9.5				**4**	**100**
NB RT	20	0.54	70	1	25	51.4	0.4			**2**		**50**
SB LT	10	0.54	70	1	25	51.4	0.2	**1**	**1**			**25**
SB Th	250	0.52	70	2	25	51.4	4.9				**3**	**75**
SB RT	10	0.52	70	1	25	51.4	0.2			**1**		**25**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: San Bernardino | PM (Period) | 2015 (Year) | Baseline (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT			70		25	51.4	0.0					
EB Th	70	0.13	70	1	25	51.4	1.4				**3**	**75**
EB RT	50	0.13	70	1	25	51.4	1.0			**3**		**75**
WB LT			70		25	51.4	0.0					
WB Th	30	0.13	70	1	25	51.4	0.6				**2**	**50**
WB RT	20	0.13	70	1	25	51.4	0.4			**2**		**50**
NB LT	60	0.66	70	1	25	51.4	1.2	**3**	**3**			**75**
NB Th	820	0.6	70	2	25	51.4	15.9				**5**	**125**
NB RT	40	0.6	70	1	25	51.4	0.8			**2**		**50**
SB LT	30	0.61	70	1	25	51.4	0.6	**2**	**2**			**50**
SB Th	870	0.58	70	2	25	51.4	16.9				**6**	**150**
SB RT	60	0.58	70	1	25	51.4	1.2			**3**		**75**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: Paseo Del Norte | PM (Period) | 2015 (Year) | Baseline (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT	160	0.17	70	1	25	51.4	3.1	**6**	**6**			**150**
EB Th			70		25	51.4	0.0					
EB RT	420	1	70	1	25	51.4	8.2			**7**		**175**
WB LT			70		25	51.4	0.0					
WB Th			70		25	51.4	0.0					
WB RT			70		25	51.4	0.0					
NB LT	340	0.67	70	1	25	51.4	6.6	**8**	**8**			**200**
NB Th	600	0.67	70	2	25	51.4	11.7				**3**	**75**
NB RT			70		25	51.4	0.0					
SB LT			70		25	51.4	0.0					
SB Th	570	0.42	70	2	25	51.4	11.1				**5**	**125**
SB RT	130	1	70	1	25	51.4	2.5			**3**		**75**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: Live Oak | PM (Period) | 2015 (Year) | Baseline (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT			70		25	51.4	0.0					
EB Th	0	0.18	70	1	25	51.4	0.0				**#N/A**	**#N/A**
EB RT	40	0.18	70	1	25	51.4	0.8			**2**		**50**
WB LT			70		25	51.4	0.0					
WB Th	100	0.18	70	1	25	51.4	1.9				**4**	**100**
WB RT	10	0.18	70	1	25	51.4	0.2			**1**		**25**
NB LT	60	0.62	70	1	25	51.4	1.2	**3**	**3**			**75**
NB Th	430	0.56	70	2	25	51.4	8.4				**3**	**75**
NB RT	140	0.56	70	1	25	51.4	2.7			**5**		**125**
SB LT	10	0.54	70	1	25	51.4	0.2	**1**	**1**			**25**
SB Th	460	0.52	70	2	25	51.4	8.9				**4**	**100**
SB RT	10	0.52	70	1	25	51.4	0.2			**1**		**25**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: San Bernardino | AM (Period) | 2015 (Year) | Build (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT			70		25	51.4	0.0					
EB Th	40	0.1	70	1	25	51.4	0.8				**2**	**50**
EB RT	30	0.1	70	1	25	51.4	0.6			**2**		**50**
WB LT			70		25	51.4	0.0					
WB Th	49	0.1	70	1	25	51.4	1.0				**3**	**75**
WB RT	50	0.1	70	1	25	51.4	1.0			**3**		**75**
NB LT	40	0.7	70	1	25	51.4	0.8	**2**	**2**			**50**
NB Th	880	0.65	70	2	25	51.4	17.1				**5**	**125**
NB RT	15	0.65	70	1	25	51.4	0.3			**1**		**25**
SB LT	10	0.62	70	1	25	51.4	0.2	**1**	**1**			**25**
SB Th	506	0.61	70	2	25	51.4	9.8				**3**	**75**
SB RT	40	0.61	70	1	25	51.4	0.8			**2**		**50**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: Paseo Del Norte | AM (Period) | 2015 (Year) | Build (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT	62	0.11	70	1	25	51.4	1.2	**3**	**3**			**75**
EB Th			70		25	51.4	0.0					
EB RT	180	1	70	1	25	51.4	3.5			**4**		**100**
WB LT			70		25	51.4	0.0					
WB Th			70		25	51.4	0.0					
WB RT			70		25	51.4	0.0					
NB LT	440	0.73	70	1	25	51.4	8.6	**9**	**9**			**225**
NB Th	500	0.73	70	2	25	51.4	9.7				**3**	**75**
NB RT			70		25	51.4	0.0					
SB LT			70		25	51.4	0.0					
SB Th	366	0.46	70	2	25	51.4	7.1				**4**	**100**
SB RT	135	1	70	1	25	51.4	2.6			**3**		**75**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: Live Oak | AM (Period) | 2015 (Year) | Build (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT			70		25	51.4	0.0					
EB Th	20	0.22	70	1	25	51.4	0.4				**2**	**50**
EB RT	80	0.22	70	1	25	51.4	1.6			**4**		**100**
WB LT			70		25	51.4	0.0					
WB Th	162	0.22	70	1	25	51.4	3.2				**5**	**125**
WB RT	32	0.22	70	1	25	51.4	0.6			**2**		**50**
NB LT	20	0.56	70	1	25	51.4	0.4	**2**	**2**			**50**
NB Th	490	0.53	70	2	25	51.4	9.5				**4**	**100**
NB RT	22	0.53	70	1	25	51.4	0.4			**2**		**50**
SB LT	11	0.53	70	1	25	51.4	0.2	**1**	**1**			**25**
SB Th	250	0.51	70	2	25	51.4	4.9				**3**	**75**
SB RT	10	0.51	70	1	25	51.4	0.2			**1**		**25**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: San Bernardino | PM (Period) | 2015 (Year) | Build (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT			70		25	51.4	0.0					
EB Th	70	0.13	70	1	25	51.4	1.4				**3**	**75**
EB RT	50	0.13	70	1	25	51.4	1.0			**3**		**75**
WB LT			70		25	51.4	0.0					
WB Th	36	0.13	70	1	25	51.4	0.7				**2**	**50**
WB RT	20	0.13	70	1	25	51.4	0.4			**2**		**50**
NB LT	60	0.66	70	1	25	51.4	1.2	**3**	**3**			**75**
NB Th	820	0.6	70	2	25	51.4	15.9				**5**	**125**
NB RT	55	0.6	70	1	25	51.4	1.1			**3**		**75**
SB LT	30	0.61	70	1	25	51.4	0.6	**2**	**2**			**50**
SB Th	874	0.58	70	2	25	51.4	17.0				**6**	**150**
SB RT	60	0.58	70	1	25	51.4	1.2			**3**		**75**

All queues calculated to 95th percentile value assuming random arrival.

Intersection Approach Queue Calculator

Intersection: Paseo Del Norte | PM (Period) | 2015 (Year) | Build (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT	165	0.17	70	1	25	51.4	3.2	**6**	**6**			**150**
EB Th			70		25	51.4	0.0					
EB RT	420	1	70	1	25	51.4	8.2			**7**		**175**
WB LT			70		25	51.4	0.0					
WB Th			70		25	51.4	0.0					
WB RT			70		25	51.4	0.0					
NB LT	340	0.67	70	1	25	51.4	6.6	**8**	**8**			**200**
NB Th	600	0.67	70	2	25	51.4	11.7				**3**	**75**
NB RT			70		25	51.4	0.0					
SB LT			70		25	51.4	0.0					
SB Th	574	0.42	70	2	25	51.4	11.2				**5**	**125**
SB RT	133	1	70	1	25	51.4	2.6			**3**		**75**

All queues calculated to 95th percentile value assuming random arrival.

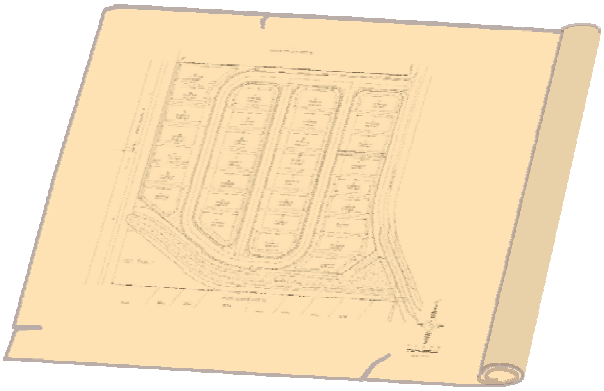
Intersection Approach Queue Calculator

Intersection: Live Oak | PM (Period) | 2015 (Year) | Build (Scenario)

Approach	Volume	g/c Ratio	Cycle Length	Lanes	Vehicle Length	Cycle/Hr	Arrival Per Cycle	Single LT	Dual LT	RT Lane	Through	Design Length
EB LT			70		25	51.4	0.0					
EB Th	0	0.19	70	1	25	51.4	0.0				**#N/A**	**#N/A**
EB RT	40	0.19	70	1	25	51.4	0.8			**2**		**50**
WB LT			70		25	51.4	0.0					
WB Th	107	0.19	70	1	25	51.4	2.1				**5**	**125**
WB RT	11	0.19	70	1	25	51.4	0.2			**1**		**25**
NB LT	60	0.62	70	1	25	51.4	1.2	**3**	**3**			**75**
NB Th	430	0.56	70	2	25	51.4	8.4				**3**	**75**
NB RT	145	0.56	70	1	25	51.4	2.8			**5**		**125**
SB LT	12	0.53	70	1	25	51.4	0.2	**1**	**1**			**25**
SB Th	460	0.51	70	2	25	51.4	8.9				**4**	**100**
SB RT	10	0.51	70	1	25	51.4	0.2			**1**		**25**

All queues calculated to 95th percentile value assuming random arrival.

Traffic Impact Analysis



Hawk's Landing

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