Traffic Impact Study for the Zinfandel Estate Subdivision

Prepared for the City of Napa

Submitted by
W-Trans

August 1, 2019

TRAFFIC ENGINEERING
TRANSPORTATION PLANNING
Balancing Functionality and Livability since 1995
w-trans.com

This page intentionally left blank

Table of Contents

This page intentionally left blank

Executive Summary

The proposed Zinfandel Estate project would be located on the south side of El Centro Avenue and would include 53 single-family homes and five accessory dwelling units on 53 lots that would be accessed via a new residential street and a private drive off of Lassen Street. Based on application of standard trip generation rates, the project is anticipated to generate an average of 539 new daily trips, including 42 trips during the a.m. peak hour and 56 trips during the p.m. peak hour.

Peak hour traffic conditions at the nearby intersections of SR 29/Wine Country Avenue and Jefferson Street/ El Centro Avenue were evaluated to determine the potential impacts associated with development of the project under Existing and Future Conditions. Under Existing Conditions, both intersections are operating acceptably at LOS C or better overall during both peak hours and are expected to continue operating at the same levels of service under Existing plus Project Conditions. Upon the addition of project-related traffic to Future volumes, the intersections are expected to continue operating acceptably at LOS C or better overall during both peak hours.

The project would improve access for alternative modes via the provision of a separated sidewalk along the project frontage with El Centro Avenue, consistent with the City's plans for the roadway. Existing transit service is adequate for the anticipated demand and though currently adequate, bicycle facilities will be improved upon completion of the planned projects contained in the *City of Napa Bicycle Plan*.

Sight distance on El Centro Avenue is adequate to accommodate the proposed turning movements at both project access points, and neither intersection would meet left-turn lane warrants. As proposed in the most recent concept site plan on-site circulation is expected to operate acceptably, though it is recommended that stop signs be installed on the Clementina Circle approaches to El Centro Avenue along with crosswalks on the southern legs of the intersections.

Introduction

This report presents an analysis of the potential traffic impacts that would be associated with development of a proposed 53-lot residential subdivision to be located on El Centro Avenue in the City of Napa. The traffic study was completed in accordance with the criteria established by the City of Napa, and is consistent with standard traffic engineering techniques.

Prelude

The purpose of a traffic impact study is to provide City staff and policy makers with data that they can use to make an informed decision regarding the potential traffic impacts of a proposed project, and any associated improvements that would be required in order to mitigate these impacts to a level of insignificance as defined by the City's General Plan or other policies. Vehicular traffic impacts are typically evaluated by determining the number of new trips that the proposed use would be expected to generate, distributing these trips to the surrounding street system based on existing travel patterns or anticipated travel patterns specific to the proposed project, then analyzing the impact the new traffic would be expected to have on critical intersections or roadway segments. Impacts relative to access for pedestrians, bicyclists, and to transit are also addressed.

Project Profile

The proposed project would include development of a 53-lot subdivision on a parcel currently occupied by vineyards and two single-family dwellings, one of which would be removed as part of the project. The project site is located on the south side of El Centro Avenue and west of Moss Lane in the City of Napa. All but three of the 53 total lots would be located on the north side of Salvador Creek, which divides the site, and would be accessed via a proposed residential street called Clementina Circle; the remaining three lots would be located south of the creek and would be accessed via a private drive from Lassen Street.

The project location is shown in Figure 1.

nap139.ai 12/17

Traffic Impact Study for the Zinfandel Estate Subdivision

Figure 1 – Study Area and Lane Configurations

Transportation Setting

Operational Analysis

Study Area and Periods

The study area consists of El Centro Avenue fronting the project and the project access point as well as the following intersections:

1. State Route (SR) 29/Wine Country Avenue
2. Jefferson Street/El Centro Avenue

Operating conditions during the weekday a.m. and p.m. peak periods were evaluated to capture the highest potential impacts for the proposed project as well as the highest volumes on the local transportation network. The morning peak hour occurs between 7:00 and 9:00 a.m. and reflects conditions during the home to work or school commute, while the p.m. peak hour occurs between 4:00 and 6:00 p.m. and typically reflects the highest level of congestion during the homeward bound commute.

Study Intersections

SR 29/Wine Country Avenue is a signalized, four-legged intersection with protected left-turn phasing on both SR 29 approaches, while the eastbound and westbound approaches of Wine Country Avenue have permitted left-turn phasing. A crosswalk with pedestrian phasing is provided on the northern leg and signs are present prohibiting pedestrian crossings of all other legs, directing pedestrians to cross at adjacent intersections.

Jefferson Street/El Centro Avenue is an unsignalized tee-intersection stop-controlled on the eastbound El Centro Avenue approach. An alley way creates a fourth leg to the intersection on the eastern side of Jefferson Street, though it is offset approximately 50 feet south of El Centro Avenue so is actually outside the area that makes up the intersection. Crosswalks are provided on the north and west legs.

The locations of the study intersections and the existing lane configurations and controls are shown in Figure 1.

Study Roadways

El Centro Avenue is a residential street that runs east-west and is bound by Byway East on the west and Big Ranch Road on the east, but is disconnected at Jefferson Street. The segment west of Jefferson Street is approximately one-half mile in length and has a posted speed limit of 30 miles per hour (mph) except for the section adjacent to the El Centro Elementary School where the standard school zone speed limit of 25 mph "when children are present" is posted. The roadway varies in width between 28 and 40 feet depending on whether or not frontage improvements have been made to parcels on the southern side of the street. Street parking is permitted in the westbound direction and in select locations in the eastbound direction.

Collision History

The collision history for the study area was reviewed to determine any trends or patterns that may indicate a safety issue. Collision rates were calculated based on records available from the California Highway Patrol as published in their *Statewide Integrated Traffic Records System (SWITRS)* reports. The most current five-year period available is January 1, 2012 through December 31, 2016.

As presented in Table 1, the calculated collision rates for the study intersections were compared to average collision rates for similar facilities statewide, as indicated in *2014 Collision Data on California State Highways*, California Department of Transportation (Caltrans). The study intersection of SR 29/Wine Country Avenue had a calculated collision rate below the statewide average for similar facilities and there were no reported collisions at Jefferson Street/El Centro Avenue, indicating that there are no readily apparent safety issues at either intersection. The collision rate calculations are provided in Appendix A.

Table 1 – Collision Rates at the Study Intersections

Study Intersection	Number of Collisions (2012-2016)	Calculated Collision Rate (c/mve)	Statewide Average Collision Rate (c/mve)
1. SR 29/Wine Country Ave	12	0.22	0.27
2. Jefferson St/El Centro Ave	0	0.00	0.18

Note: c/mve = collisions per million vehicles entering

Alternative Modes

Pedestrian Facilities

Pedestrian facilities include sidewalks, crosswalks, pedestrian signal phases, curb ramps, curb extensions, and various streetscape amenities such as lighting, benches, etc. In general, a connected sidewalk network is present on the northern side of El Centro Avenue, but it is sporadic on the southern side. Curb ramps and crosswalks at side street approaches are present in the locations that do have sidewalks, but not all are equipped with truncated domes are therefore not compliant with current ADA standards. Lighting is provided by overhead street lights and there is a single crosswalk on El Centro Avenue located just east of Verbena Street.

Bicycle Facilities

The *Highway Design Manual*, Caltrans, 2017, classifies bikeways into three categories:

- **Class I Multi-Use Path** – a completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross flows of motorized traffic minimized.
- **Class II Bike Lane** – a striped and signed lane for one-way bike travel on a street or highway.
- **Class III Bike Route** – signing only for shared use with motor vehicles within the same travel lane on a street or highway.

Class II bike lanes exist on the majority of Jefferson Street and there are plans to provide a Class III bike route on El Centro Avenue. Additionally, a 12.5-mile segment of the Vine Trail is completed and runs parallel to SR 29 between Trancas Street in Napa and Madison Street in Yountville; the trail is located approximately one-quarter mile west of the project site and when completed would provide regional bicycle access between Vallejo and Calistoga. A future Class I trail is also planned along Salvador Creek between Jefferson Street and SR 29 and would connect the project site to the Vine Trail. Table 2 summarizes the existing and planned bicycle facilities in the project vicinity, as contained in the *City of Napa Bicycle Plan*.

Table 2 – Bicycle Facility Summary				
Status **Facility**	**Class**	**Length (miles)**	**Begin Point**	**End Point**
Existing				
Vine Trail	I	12.5	Kennedy Park	Madison St
Jefferson St	II	0.9	El Centro Ave	Rubicon St
Jefferson St	II	0.3	Darling St	Salvador Ave
Planned				
Vine Trail	I	Regional	Vallejo	Calistoga
Salvador Creek Trail	I	0.7	Jefferson St	SR 29
El Centro Ave	III	0.8	SR 29	Heather Lane

Source: *City of Napa Bicycle Plan*, W-Trans, 2012

Transit Facilities

Transit Services in the City of Napa, and throughout Napa County, are provided by Napa Valley Transit (VINE). VINE Route 7 provides service between Salvador Avenue and the Kaiser Permanente medical offices on Claremont Way every day of the week except for Sunday and stops on Byway East just north of El Centro Avenue and on Jefferson Street just south of Maximilian Court. Both stops are roughly one-quarter mile from the project site, which is considered an acceptable walking distance.

Dial-a-ride, also known as paratransit or door-to-door service, is available for those who are unable to independently use the transit system due to a physical or mental disability. VINE Go is VINE's paratransit service and is designed to serve the needs of individuals with disabilities in the cities of Calistoga, St. Helena, Napa, American Canyon, the Town of Yountville and the unincorporated areas of Napa County. Reservations are required and, while can be made the same day of the trip, are recommended to be made in advance.

Capacity Analysis

Intersection Level of Service Methodologies

Level of Service (LOS) is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity using a series of letter designations ranging from A to F. Generally, Level of Service A represents free flow conditions and Level of Service F represents forced flow or breakdown conditions. A unit of measure that indicates a level of delay generally accompanies the LOS designation.

The study intersection of Jefferson Street/El Centro Avenue was analyzed using methodologies published in the *Highway Capacity Manual (HCM)*, Transportation Research Board, 2010, while the intersection of SR 29/Wine Country Avenue was analyzed using the year 2000 version of the same methodology due to the proximity of the Wine Country Avenue/Solano Avenue intersection, which the 2010 version does not have the capability to analyze. Both versions of the HCM contain methodologies for various types of intersection control, all of which are related to a measurement of delay in average number of seconds per vehicle.

The Levels of Service for Jefferson Street/El Centro Avenue, which has side-street stop controls, were analyzed using the "Two-Way Stop-Controlled" intersection capacity method from the HCM 2010. This methodology determines a level of service for each minor turning movement by estimating the level of average delay in seconds per vehicle. Results are presented for individual movements together with the weighted overall average delay for the intersection.

SR 29/Wine Country Avenue was evaluated using the signalized methodology from the HCM 2000. This methodology is based on factors including traffic volumes, green time for each movement, phasing, whether or not the signals are coordinated, truck traffic, and pedestrian activity. Average stopped delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology. Timing sheets were obtained from Caltrans and used in this analysis, though it should be noted that there is a timing study currently ongoing and the signal timing could be modified in the near term.

The ranges of delay associated with the various levels of service are indicated in Table 3.

Table 3 – Intersection Level of Service Criteria		
LOS	**Two-Way Stop-Controlled**	**Signalized**
A	Delay of 0 to 10 seconds. Gaps in traffic are readily available for drivers exiting the minor street.	Delay of 0 to 10 seconds. Most vehicles arrive during the green phase, so do not stop at all.
B	Delay of 10 to 15 seconds. Gaps in traffic are somewhat less readily available than with LOS A, but no queuing occurs on the minor street.	Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop.
C	Delay of 15 to 25 seconds. Acceptable gaps in traffic are less frequent, and drivers may approach while another vehicle is already waiting to exit the side street.	Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.
D	Delay of 25 to 35 seconds. There are fewer acceptable gaps in traffic, and drivers may enter a queue of one or two vehicles on the side street.	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.
E	Delay of 35 to 50 seconds. Few acceptable gaps in traffic are available, and longer queues may form on the side street.	Delay of 55 to 80 seconds. Most, if not all, vehicles must stop and drivers consider the delay excessive.
F	Delay of more than 50 seconds. Drivers may wait for long periods before there is an acceptable gap in traffic for exiting the side streets, creating long queues.	Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.

Reference: *Highway Capacity Manual,* Transportation Research Board, 2000

Traffic Operation Standards

City of Napa

The City of Napa established a Level of Service (LOS) Standard of mid-LOS D for signalized intersections in Policy T-2.1 of *Envision Napa 2020: City of Napa General Plan*, and mid-LOS E for unsignalized intersections. This translates to an allowable average delay of 45 seconds at signalized intersections and 42.5 seconds or less for unsignalized intersections.

In *City of Napa Traffic Impact Study Guidelines*, City of Napa, 2004, the City establishes levels of significance for a situation where an intersection operates unacceptably without the influence of a proposed project.

> *When a signalized intersection operates at LOS F (a violation of the General Plan LOS policy) under existing or interim baseline conditions, the addition of more than 50 peak hour project trips contributes to the continuing operational failure at the intersection. The project mitigation should bring the facility to pre-project conditions.*
>
> *When a low-volume movement at an unsignalized intersection has delays that yield LOS E or F, operation may still be considered as acceptable by considering both total delay and LOS; operation may be deemed acceptable if the total delay is less than 4.0 hours for a single lane movement or 5.0 vehicle hours for a multilane movement.*

Caltrans

Caltrans indicates that they endeavor to maintain operation at the transition from LOS C to LOS D.

Existing Conditions

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the weekday a.m. and p.m. peak periods. This condition does not include project-generated traffic

volumes. Volume data for Jefferson Street/El Centro Avenue was collected in December 2016 and traffic counts for SR 29/El Centro Avenue were collected in August 2017.

Peak hour factors (PHF's) were calculated based on the counts and used in the analysis, except where the calculated PHF was less than 0.90, in which case 0.90 was used as a floor to avoid overly conservative results. Additionally, monthly and daily adjustment factors were applied to the counts at both study intersections to reflect volumes anticipated on a typical Thursday in August, as required by the City of Napa *Policy Guidelines: Traffic Impact Analysis for Private Development Review.* The traffic counts and adjustment factors are included in Appendix B.

Intersection Levels of Service

Under Existing Conditions, both study intersections are operating acceptably overall and on the El Centro Avenue approach at LOS C or better during both peak hours. The Existing traffic volumes are shown in Figure 2. A summary of the intersection level of service calculations is contained in Table 4, and copies of the Level of Service calculations for all evaluated scenarios are provided in Appendix C.

Table 4 – Existing Peak Hour Intersection Levels of Service

Study Intersection *Approach*	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
1. SR 29/Wine Country Ave	29.1	C	29.7	C
2. Jefferson St/El Centro Ave	4.9	A	2.8	A
Eastbound (El Centro Ave) Approach	*17.8*	*C*	*12.3*	*B*

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*

It is noted that delay at the intersection of SR 29/Wine Country Avenue is likely higher than projected using the HCM 2000 methodology, which does not take initial queues into account as is done by the HCM 2010 methodology. However, since the comparative change due to the project would likely be of the same magnitude under either methodology, for purposes of determining project impacts, the comparison is valid and adequate.

Future Conditions

Future volumes for the horizon year 2040 were calculated based on output from the *Napa Solano Travel Demand Model*, maintained by the Solano Transportation Authority (STA). Base year (2015) and future (2040) segment volumes for the weekday a.m. and p.m. peak periods were used to calculate growth factors for the study intersections.

The growth factors projected by the model were adjusted to account for the two years of growth that occurred between 2015 and the 2017 existing counts. The existing counts were then multiplied by the growth factor to project likely Future weekday a.m. and p.m. turning movement volumes at the study intersections. Growth factors of 1.24 and 1.10 were calculated for SR 29/Wine Country Avenue and Jefferson Street/El Centro Avenue, respectively, during both peak hours. The growth factor calculations are included in Appendix B.

Intersection Levels of Service

Under the anticipated Future volumes, both study intersections are expected to continue operating acceptably at the same levels of service as under Existing Conditions. Future volumes are shown in Figure 3 and operating conditions are summarized in Table 5.

nap139.ai 12/17

Traffic Impact Study for the Zinfandel Estate Subdivision

Figure 2 – Existing Traffic Volumes

nap139.ai 12/17

Traffic Impact Study for the Zinfandel Estate Subdivision

Figure 3 – Future Traffic Volumes

Table 5 – Future Peak Hour Intersection Levels of Service

Study Intersection *Approach*	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
1. SR 29/Wine Country Ave	31.6	C	33.1	C
2. Jefferson St/El Centro Ave	5.7	A	3.0	A
Eastbound (El Centro Ave) Approach	*21.4*	*C*	*13.1*	*B*

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*

Project Description

The proposed project would result in development of 53 lots with a total of 53 single-family dwellings and five accessory dwelling units (ADUs). The property is currently occupied by vineyards and two single-family dwellings, one of which would be removed as part of the project. The project site is located on the south side of El Centro Avenue between Moss Lane and Hampton Way in the northern part of the City of Napa. Of the 53 total lots, 50 would be located north of Salvador Creek and three would be located south of the creek. The project would also include construction of a new residential street called Clementina Circle that would provide access to the homes north of Salvador Creek; the homes on the south side of the creek would be accessed via a private drive extending east from Lassen Street.

The proposed project site plan is shown in Figure 4.

Trip Generation

The anticipated trip generations for both the existing and proposed uses were estimated using standard rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 10th Edition, 2017. Rates for "Single-Family Detached Housing" (Land Use #210) were applied to the existing single-family home that would be removed and the proposed new homes. It should be noted that although the ADUs could potentially generate fewer trips than the rest of the dwellings, rates for Single-Family Detached Housing were applied to all proposed units to provide a conservative analysis.

The proposed project is expected to generate an average of 548 trips per day, including 43 trips during the a.m. peak hour and 57 trips during the p.m. peak hour. After deducting trips associated with removal of the existing single-family dwelling, the project would be anticipated to generate 539 new trips per day on average, with 42 trips during the morning peak hour and 56 trips during the evening peak hour; these trips represent the net increase in traffic associated with the proposed project compared to existing volumes. These results are summarized in Table 6.

Table 6 – Trip Generation Summary

Land Use	Units	Daily		AM Peak Hour				PM Peak Hour			
		Rate	Trips	Rate	Trips	In	Out	Rate	Trips	In	Out
Existing											
Single-Family Detached Housing	-1 du	9.44	-9	0.74	-1	0	-1	0.99	-1	-1	0
Proposed											
Single-Family Detached Housing	58 du	9.44	548	0.74	43	11	32	0.99	57	36	21
Net New Trips			**539**		**42**	**11**	**31**		**56**	**35**	**21**

Note: du = dwelling unit

Source: RSA+, 7/19 nap139.ai 8/19

Traffic Impact Study for the Zinfandel Estate Subdivision

Figure 4 – Site Plan

Trip Distribution

The pattern used to allocate new project trips to the street network was determined based on familiarity with the area and surrounding region, as well as anticipated origins/destinations for residents of the subdivision. The applied distribution assumptions and resulting trips are shown in Table 7. It should be noted that although some trips to and from SR 29 south of the project site would likely be made via the SR 29/Trower Avenue intersection, it was assumed that these project trips would pass through the study intersection at Wine Country Avenue to provide conservative results.

Table 7 – Trip Distribution Assumptions

Route	Percent	Daily Trips	AM Trips	PM Trips
SR 29 (North)	15%	81	6	8
SR 29 (South)	50%	270	21	28
Jefferson St (North)	5%	27	2	3
Jefferson St (South)	30%	161	13	17
TOTAL	**100%**	**539**	**42**	**56**

It is noted that the following operational and access analysis was prepared based on a previously proposed larger version of the project that included one more lot and resulted in an average of 548 new trips per day including 43 a.m. trips and 57 p.m. trips. The analysis, as presented, reflects the potential impacts associated with the slightly larger project and is therefore conservative.

Intersection Operation

Existing plus Project Conditions

Upon the addition of project-related traffic to existing volumes, the study intersections are expected to continue operating acceptably at the same levels of service as under Existing Conditions. These results are summarized in Table 8 and project traffic volumes are shown in Figure 5.

Table 8 – Existing and Existing plus Project Peak Hour Intersection Levels of Service

Study Intersection *Approach*	Existing Conditions				Existing plus Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. SR 29/Wine Country Ave	29.1	C	29.7	C	30.4	C	30.2	C
2. Jefferson St/El Centro Ave	4.9	A	2.8	A	5.2	A	3.1	A
EB (El Centro Ave) Approach	*17.8*	*C*	*12.3*	*B*	*18.4*	*C*	*12.7*	*B*

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*; EB = Eastbound

Finding – The study intersections are expected to continue operating acceptably at the same Levels of Service upon the addition of project-generated traffic to existing volumes and the project's impact on short-term operation is therefore *less-than-significant*.

nap139.ai 8/18

Traffic Impact Study for the Zinfandel Estate Subdivision

Figure 5 – Project Traffic Volumes and Trip Distribution

Future plus Project Conditions

Upon the addition of project-generated traffic to the anticipated future volumes, the study intersections are expected to continue operating acceptably at the same Levels of Service. The Future plus Project operating conditions are summarized in Table 9.

Table 9 – Future and Future plus Project Peak Hour Intersection Levels of Service

	Study Intersection ***Approach***	**Future Conditions**				**Future plus Project**			
		AM Peak		**PM Peak**		**AM Peak**		**PM Peak**	
		Delay	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
1.	SR 29/Wine Country Ave	31.6	C	33.1	C	33.8	C	32.8	C
2.	Jefferson St/El Centro Ave	5.7	A	3.0	A	6.2	A	3.2	A
	EB (El Centro Ave) Approach	*21.4*	*C*	*13.1*	*B*	*22.6*	*C*	*13.5*	*B*

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*; EB = Eastbound

It should be noted that with the addition of project-related traffic volumes, average delay at SR 29/Wine Country Avenue is projected to decrease slightly during the p.m. peak hour. While this is counter-intuitive, this condition occurs when a project adds trips to movements that are underutilized or have delays that are below the intersection average, resulting in a better balance between approaches and lower overall average delay. The project would add trips predominantly to the northbound right-turn movement at this intersection during the evening peak hour, which has a lower average delay than the intersection as a whole, resulting in a slight reduction in the overall average delay. The conclusion could incorrectly be drawn that the project actually improves operation of the intersection based on this data alone; however, it is more appropriate to conclude that the project trips are expected to make use of excess capacity, so drivers will experience little, if any, change in conditions as a result of the project.

Finding – The study intersections will continue operating acceptably with project traffic added to Future volumes and at the same Levels of Service as without it; the project's long term impact is therefore *less-than-significant*.

Alternative Modes

Pedestrian Facilities

Given the proximity of the project site to the transit stops located on Byway East and Jefferson Street, it is reasonable to assume that some residents of the subdivision would want to be able to walk to the stops and use the transit service. Additionally, some project residents may wish to walk to El Centro Elementary School which is located on the north side of El Centro Avenue and east of the project site.

Based on the most recent site plan, the project would provide improvements along its entire frontage with El Centro Avenue consistent with the improvements that have already been made and the City's future plans for the roadway. Such improvements include widening El Centro Avenue by approximately 12 feet and providing a separated sidewalk which would improve access for pedestrians and connect the site to the surrounding pedestrian network.

Finding – The project would improve access for pedestrians via frontage improvements and El Centro Avenue would be closer to having a connected sidewalk along its entirety.

Bicycle Facilities

Existing bicycle facilities, including bike lanes on Jefferson Street, together with shared use of minor streets provide adequate access for bicyclists and would be further improved upon completion of the planned improvements outlined in the *City of Napa Bicycle Plan*. The project does not include any components that would potentially interfere with carrying out the planned bicycle projects.

Finding – Bicycle facilities serving the project site are adequate, but access will be improved upon completion of the planned improvements identified in the *City of Napa Bicycle Plan*.

Transit

Existing transit routes are adequate to accommodate project-generated transit trips and the stops are within acceptable walking distance of the site.

Finding – Transit facilities serving the project site are adequate.

Access and Circulation

Site Access

As proposed, a new residential street, Clementina Circle, would form a loop on the south side of El Centro Avenue and provide access to the majority of the lots in the subdivision. The three lots on the southern parcel would be accessed via a private drive extending east from of Lassen Street. Clementina Circle would intersect El Centro Avenue in two places; the western intersection would be opposite Via La Paz and the eastern intersection would be located just east of the existing driveway to the home that would be removed as part of the project.

Finding – As proposed, on-site circulation would be expected to operate acceptably, though the concept site plan does not indicate what controls would be used at the project intersections with El Centro Avenue.

Recommendation – Consistent with other minor street approaches in the project vicinity, the Clementina Circle approaches to El Centro Avenue should be stop-controlled and crosswalks should be provided on the southern legs of both intersections.

Sight Distance

At unsignalized intersections and driveways, a substantially clear line of sight should be maintained between the driver of a vehicle waiting at the crossroad and the driver of an approaching vehicle. Adequate time should be provided for the waiting vehicle to either cross, turn left, or turn right, without requiring the through traffic to radically alter their speed, if feasible.

Sight distances along El Centro Avenue at the proposed intersections with Clementina Circle were evaluated based on sight distance criteria contained in the *Highway Design Manual* published by Caltrans. The recommended sight distances for unsignalized intersections are based on corner sight distance, with approach travel speeds used as the basis for determining the recommended sight distance. Sight distance should be measured from a 3.5-foot height at the location of the driver on the minor road to a 4.25-foot object height in the center of the approaching lane of the major road. Set-back for the driver on the crossroad shall be a minimum of 15 feet, measured from the edge of the traveled way.

For the posted 30-mph speed limit, the recommended corner sight distance is 330 feet. Based on a review of field conditions, sight distance at both of the proposed intersection locations extends more than 400 feet in each direction, which is more than adequate for the posted speed limit.

Finding – Adequate sight distance is available at both proposed intersection locations to accommodate all turns into and out of the subdivision.

Recommendation – To preserve existing sight lines, it is recommended that any vegetation planted along the project frontage with El Centro Avenue be planted and maintained such that foliage is less than three, or more than seven, feet off the ground.

Access Analysis

Left-Turn Lane Warrants

The need for left-turn lanes on El Centro Avenue at the proposed intersections with Clementina Circle were evaluated based on criteria contained in the *Intersection Channelization Design Guide*, National Cooperative Highway Research Program (NCHRP) Report No. 279, Transportation Research Board, 1985, as well as a more recent

update of the methodology developed by the Washington State Department of Transportation. The NCHRP report references a methodology developed by M. D. Harmelink that includes equations that can be applied to expected or actual traffic volumes in order to determine the need for a left-turn pocket based on safety issues.

Based on Future plus Project volumes, which represents worst case conditions, a left-turn lane would not be warranted on El Centro Avenue at either intersection. It should be noted that for the purposes of this evaluation it was assumed that half of the total trips would occur at each of the two access points, though even with all of the trips assigned to enter via one access point a turn lane would still not be warranted. The turn lane warrants analysis sheets are contained in Appendix D.

Finding – A left-turn lane would not be warranted on El Centro Avenue at either of the proposed intersections with Clementina Circle.

Conclusions and Recommendations

Conclusions

- The proposed project is expected to generate an average of 539 new daily vehicle trips, including 42 trips during the morning peak hour and 56 trips during the evening peak hour.
- The study intersections of SR 29/Wine Country Avenue and Jefferson Street/El Centro Avenue are currently operating acceptably at LOS C or better overall and on all minor street approaches during both peak hours. Upon the addition of project-related traffic, both study intersections would continue to operate at the same Levels of Service as without the project.
- Under the anticipated Future volumes, both intersections would be expected to continue operating acceptably, with or without project-generated traffic.
- The project would improve access for alternative modes via the provision of a separated sidewalk along the project frontage with El Centro Avenue. Existing transit service is adequate for the anticipated demand and though currently adequate, bicycle facilities will be improved upon completion of the planned projects contained in the *City of Napa Bicycle Plan*.
- Sight distance on El Centro Avenue is adequate to accommodate the proposed turning movements at both project access points.
- On-site circulation is expected to operate acceptably.
- A left-turn lane would not be warranted at either of the proposed intersections of El Centro Avenue with Clementina Circle.

Recommendations

- The proposed Clementina Circle approaches to El Centro Avenue should be stop-controlled and crosswalks should be provided on the southern legs of both intersections.
- Any new vegetation planted along the project frontage with El Centro Avenue should be planted and maintained such that foliage is less than three, or more than seven, feet off the ground to maintain existing adequate sight lines.

Study Participants and References

Study Participants

Principal in Charge	Dalene J. Whitlock, PE, PTOE
Assistant Engineer	Cameron Nye, EIT, and Kevin Rangel, EIT
Graphics/Formatting	Katia Wolfe

References

2014 Collision Data on California State Highways, California Department of Transportation, 2017

California Manual on Uniform Traffic Control Devices for Streets and Highways, California Department of Transportation, 2014

City of Napa Bicycle Plan, W-Trans, 2012

City of Napa Traffic Impact Study Guidelines, City of Napa, 2004

Envision Napa 2020: City of Napa General Plan, City of Napa, 2011

Guide for the Preparation of Traffic Impact Studies, California Department of Transportation, 2002

Highway Capacity Manual, Transportation Research Board, 2000

Highway Capacity Manual, Transportation Research Board, 2010

Highway Design Manual, 6th Edition, California Department of Transportation, 2017

Intersection Channelization Design Guide, National Cooperative Highway Research Program (NCHRP) Report No. 279, Transportation Research Board, 1985

Napa Municipal Code, Quality Code Publishing, 2017

Policy Guidelines: Traffic Impact Analysis for Private Development Review, City of Napa, 2005

Statewide Integrated Traffic Records System (SWITRS), California Highway Patrol, 2012-2016

Trip Generation Manual, 10th Edition, Institute of Transportation Engineers, 2017

VINE Transit, http://www.ridethevine.com

NAP139

This page intentionally left blank

Appendix A

Collision Rate Calculations

This page intentionally left blank

Intersection Collision Rate Calculations

Zinfandel Estate TIS

Intersection # 1: SR 29 & Wine Country Ave

Date of Count: Tuesday, December 12, 2017

Number of Collisions: 10
Number of Injuries: 5
Number of Fatalities: 0
ADT: 25100
Start Date: January 1, 2012
End Date: December 31, 2016
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{10 \times 1{,}000{,}000}{25{,}100 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.22 c/mve**	**0.0%**	**50.0%**
Statewide Average*	**0.27 c/mve**	**0.4%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 2: Jefferson St & El Centro Ave

Date of Count: Tuesday, December 12, 2017

Number of Collisions: 0
Number of Injuries: 0
Number of Fatalities: 0
ADT: 7300
Start Date: January 1, 2012
End Date: December 31, 2016
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{0 \times 1{,}000{,}000}{7{,}300 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.00 c/mve**	**0.0%**	**0.0%**
Statewide Average*	**0.18 c/mve**	**0.7%**	**36.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

This page intentionally left blank

Appendix B

Traffic Counts, Adjustment Factors, & Growth Factor Calculations

This page intentionally left blank

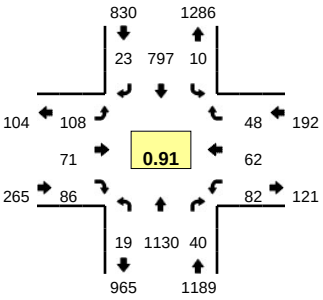
Type of peak hour being reported: Intersection Peak

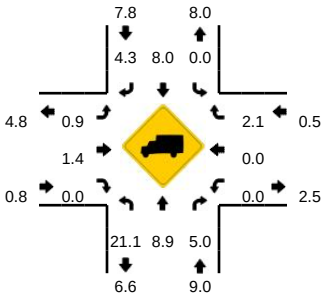
Method for determining peak hour: Total Entering Volume

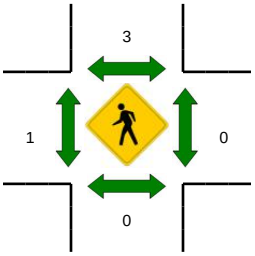
LOCATION: SR 29 -- Wine Country Ave
CITY/STATE: Napa, CA

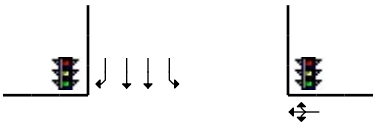
QC JOB #: 14460210
DATE: Tue, Aug 29 2017

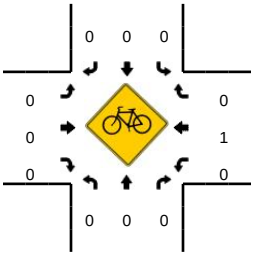
Peak-Hour: 7:35 AM -- 8:35 AM
Peak 15-Min: 7:35 AM -- 7:50 AM

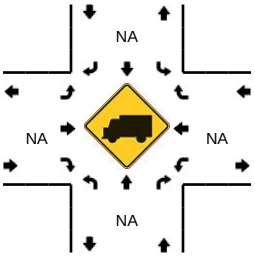


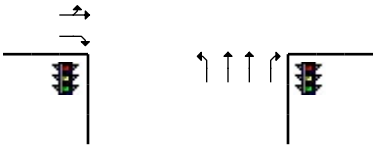


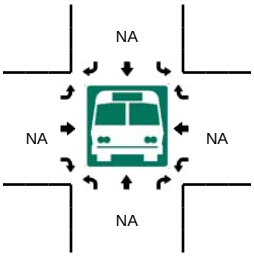












5-Min Count Period Beginning At	SR 29 (Northbound)				SR 29 (Southbound)				Wine Country Ave (Eastbound)				Wine Country Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	2	81	2	0	0	52	1	0	0	0	1	0	4	2	2	0	147	
7:05 AM	2	110	0	1	1	71	0	0	1	1	2	0	3	4	1	0	197	
7:10 AM	1	82	0	0	0	40	0	0	3	2	5	0	6	2	3	0	144	
7:15 AM	2	94	2	0	0	41	0	0	5	1	4	0	6	1	3	0	159	
7:20 AM	4	113	3	0	0	68	1	0	7	7	0	0	4	4	1	0	212	
7:25 AM	3	84	3	0	0	75	2	0	2	2	8	0	2	1	3	0	185	
7:30 AM	0	95	2	0	1	58	3	0	8	2	3	0	6	1	4	0	183	
7:35 AM	0	109	1	0	1	84	1	0	10	5	13	0	9	3	0	0	236	
7:40 AM	2	78	1	0	0	73	3	0	11	5	8	0	10	8	5	0	204	
7:45 AM	1	104	4	0	1	75	1	0	11	13	6	0	6	9	10	0	241	
7:50 AM	2	74	6	0	0	64	2	0	10	8	10	0	12	8	3	0	199	
7:55 AM	2	89	7	0	2	51	1	0	7	8	15	0	9	8	4	0	203	2310
8:00 AM	4	105	4	0	2	76	2	0	8	8	2	0	7	6	5	0	229	2392
8:05 AM	1	94	6	0	0	61	2	0	12	5	5	0	3	2	5	0	196	2391
8:10 AM	0	94	4	0	2	58	0	0	8	6	4	0	6	5	2	0	189	2436
8:15 AM	4	70	4	0	2	70	3	0	9	4	6	0	5	2	3	0	182	2459
8:20 AM	1	109	1	0	0	42	5	0	8	0	7	0	4	4	4	0	185	2432
8:25 AM	1	77	0	0	0	83	1	0	10	4	2	0	10	2	5	0	195	2442
8:30 AM	1	127	2	0	0	60	2	0	4	5	8	0	1	5	2	0	217	2476
8:35 AM	0	60	3	0	1	73	3	0	4	4	9	0	7	5	7	0	176	2416
8:40 AM	2	118	4	0	2	107	3	0	3	2	6	0	6	6	4	0	263	2475
8:45 AM	4	98	3	0	1	53	9	0	9	2	6	0	5	2	3	0	195	2429
8:50 AM	4	63	2	0	1	87	7	0	8	1	9	0	1	7	5	0	195	2425
8:55 AM	3	105	2	0	0	108	2	0	6	10	8	0	6	2	1	0	253	2475

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	12	1164	24	0	8	928	20	0	128	92	108	0	100	80	60	0	2724
Heavy Trucks	0	80	4		0	68	0		0	0	0		0	0	4		156
Pedestrians		0				4				0				0			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/8/2017 1:59 PM

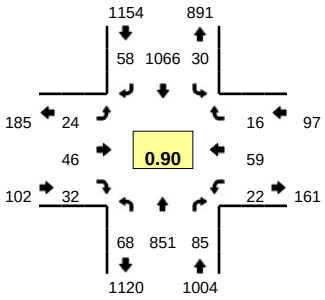
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

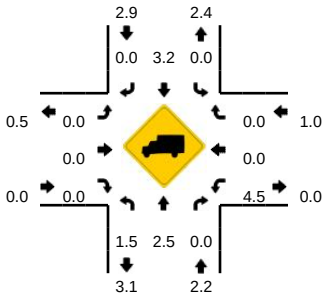
Method for determining peak hour: Total Entering Volume

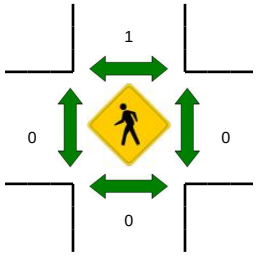
LOCATION: SR 29 -- Wine Country Ave
CITY/STATE: Napa, CA

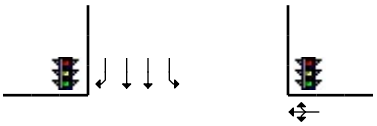
QC JOB #: 14460212
DATE: Tue, Aug 29 2017

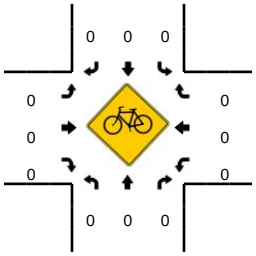


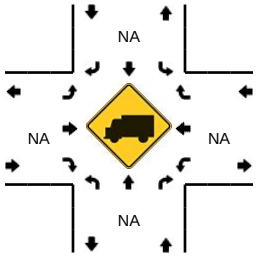
Peak-Hour: 4:55 PM -- 5:55 PM
Peak 15-Min: 5:15 PM -- 5:30 PM

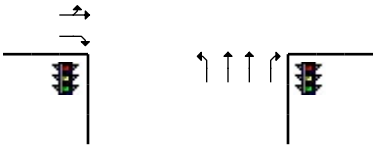


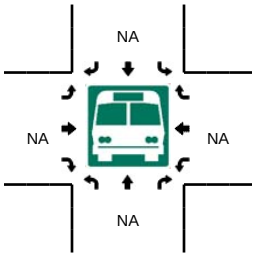












5-Min Count Period Beginning At	SR 29 (Northbound)				SR 29 (Southbound)				Wine Country Ave (Eastbound)				Wine Country Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	6	63	7	0	6	112	11	0	5	2	2	0	0	2	0	0	216	
4:05 PM	4	75	3	0	1	64	3	0	2	4	1	0	2	11	2	0	172	
4:10 PM	7	57	7	0	4	86	10	0	5	2	2	0	1	2	3	0	186	
4:15 PM	3	99	11	0	1	106	2	0	2	2	3	0	1	4	0	0	234	
4:20 PM	13	68	2	0	4	84	2	0	0	6	0	0	1	2	1	0	183	
4:25 PM	1	55	5	0	3	108	7	0	6	9	3	0	1	2	1	0	201	
4:30 PM	6	42	3	0	4	77	7	0	3	5	1	0	1	2	1	0	152	
4:35 PM	4	58	7	0	2	84	4	0	3	3	3	0	1	6	0	0	175	
4:40 PM	2	63	4	0	2	100	7	0	2	1	1	0	1	3	1	0	187	
4:45 PM	6	80	4	0	0	82	4	0	4	2	1	0	0	4	0	0	187	
4:50 PM	4	50	8	0	5	73	6	0	0	2	3	0	2	2	0	0	155	
4:55 PM	9	71	7	0	1	76	6	0	2	5	4	0	0	3	2	0	186	2234
5:00 PM	1	72	8	0	6	113	6	0	2	6	1	0	0	3	3	0	221	2239
5:05 PM	5	70	4	0	0	85	4	0	1	5	3	0	0	7	1	0	185	2252
5:10 PM	5	82	6	0	2	80	3	0	3	4	2	0	3	3	0	0	193	2259
5:15 PM	6	80	13	0	2	99	7	0	1	5	1	0	0	8	0	0	222	2247
5:20 PM	5	60	10	0	4	87	1	0	1	3	6	0	5	10	0	0	192	2256
5:25 PM	6	89	7	0	4	112	9	0	0	1	5	0	1	4	2	0	240	2295
5:30 PM	6	49	6	0	4	80	2	0	2	5	3	0	5	5	1	0	168	2311
5:35 PM	8	78	7	0	2	84	9	0	3	2	1	0	3	4	3	0	204	2340
5:40 PM	1	62	4	0	3	115	5	0	2	4	0	0	2	3	2	0	203	2356
5:45 PM	8	69	6	0	1	73	2	0	2	4	4	0	0	6	2	0	177	2346
5:50 PM	8	69	7	0	1	62	4	0	5	2	2	0	3	3	0	0	166	2357
5:55 PM	0	37	4	0	4	111	3	0	6	4	3	0	4	4	0	0	180	2351

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	68	916	120	0	40	1192	68	0	8	36	48	0	24	88	8	0	2616
Heavy Trucks	0	16	0		0	20	0		0	0	0		0	0	0		36
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/8/2017 1:59 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

National Data and Surveying Services

City of Napa
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Nothing On Bank 2

(323) 782-0090
info@ndsdata.com

File Name : 16-7869-002 Jefferson St & El Centro Ave
Date : 12/7/2016

Unshifted Count = All Vehicles & Uturns

	Jefferson St Southbound					El Centro Ave Westbound					Jefferson St Northbound					El Centro Ave Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturns Total
7:00	0	28	0	0	28	0	0	0	0	0	12	28	0	0	40	0	0	10	0	10	78	0
7:15	0	33	1	0	34	1	0	0	0	1	4	17	0	0	21	1	0	18	0	19	75	0
7:30	0	88	5	0	93	2	0	0	0	2	11	45	1	0	57	5	0	30	0	35	187	0
7:45	0	121	5	0	126	2	2	0	0	4	24	72	0	0	96	4	0	62	0	66	292	0
Total	0	270	11	0	281	5	2	0	0	7	51	162	1	0	214	10	0	120	0	130	632	0
8:00	0	70	3	0	73	1	0	0	0	1	39	66	0	0	105	4	0	30	0	34	213	0
8:15	0	58	2	0	60	0	0	1	0	1	29	46	0	0	75	2	1	37	0	40	176	0
8:30	0	35	1	0	36	0	0	0	0	0	9	32	0	0	41	2	0	15	0	17	94	0
8:45	4	52	1	0	57	0	0	0	0	0	7	31	0	0	38	1	0	14	0	15	110	0
Total	4	215	7	0	226	1	0	1	0	2	84	175	0	0	259	9	1	96	0	106	593	0
13:30	0	55	1	0	56	0	0	0	0	0	12	45	0	0	57	1	0	13	0	14	127	0
13:45	0	50	3	1	54	0	0	0	0	0	16	57	1	1	75	1	0	15	0	16	145	2
14:00	0	49	0	0	49	1	0	0	0	1	10	39	1	0	50	1	0	12	0	13	113	0
14:15	0	57	1	0	58	3	0	0	0	3	11	54	0	0	65	1	0	12	0	13	139	0
Total	0	211	5	1	217	4	0	0	0	4	49	195	2	1	247	4	0	52	0	56	524	2
14:30	0	46	2	0	48	0	0	0	0	0	21	37	2	0	60	0	0	19	0	19	127	0
14:45	0	70	1	0	71	1	0	0	0	1	19	56	0	0	75	0	0	20	0	20	167	0
15:00	0	72	0	0	72	0	0	0	0	0	37	84	3	0	124	1	1	22	0	24	220	0
15:15	0	73	4	0	77	0	0	0	0	0	20	83	0	0	103	1	0	39	0	40	220	0
Total	0	261	7	0	268	1	0	0	0	1	97	260	5	0	362	2	1	100	0	103	734	0
Grand Total	4	957	30	1	992	11	2	1	0	14	281	792	8	1	1082	25	2	368	0	395	2483	2
Apprch %	0.4%	96.5%	3.0%	0.1%		78.6%	14.3%	7.1%	0.0%		26.0%	73.2%	0.7%	0.1%		6.3%	0.5%	93.2%	0.0%			
Total %	0.2%	38.5%	1.2%	0.0%	40.0%	0.4%	0.1%	0.0%	0.0%	0.6%	11.3%	31.9%	0.3%	0.0%	43.6%	1.0%	0.1%	14.8%	0.0%	15.9%	100.0%	

AM PEAK HOUR	Jefferson St Southbound					El Centro Ave Westbound					Jefferson St Northbound					El Centro Ave Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 07:30 to 08:30																					
Peak Hour For Entire Intersection Begins at 07:30																					
7:30	0	88	5	0	93	2	0	0	0	2	11	45	1	0	57	5	0	30	0	35	187
7:45	0	121	5	0	126	2	2	0	0	4	24	72	0	0	96	4	0	62	0	66	292
8:00	0	70	3	0	73	1	0	0	0	1	39	66	0	0	105	4	0	30	0	34	213
8:15	0	58	2	0	60	0	0	1	0	1	29	46	0	0	75	2	1	37	0	40	176
Total Volume	0	337	15	0	352	5	2	1	0	8	103	229	1	0	333	15	1	159	0	175	868
% App Total	0.0%	95.7%	4.3%	0.0%		62.5%	25.0%	12.5%	0.0%		30.9%	68.8%	0.3%	0.0%		8.6%	0.6%	90.9%	0.0%		
PHF	.000	.696	.750	.000	.698	.625	.250	.250	.000	.500	.660	.795	.250	.000	.793	.750	.250	.641	.000	.663	.743

PM PEAK HOUR	Jefferson St Southbound					El Centro Ave Westbound					Jefferson St Northbound					El Centro Ave Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 14:30 to 15:30																					
Peak Hour For Entire Intersection Begins at 14:30																					
14:30	0	46	2	0	48	0	0	0	0	0	21	37	2	0	60	0	0	19	0	19	127
14:45	0	70	1	0	71	1	0	0	0	1	19	56	0	0	75	0	0	20	0	20	167
15:00	0	72	0	0	72	0	0	0	0	0	37	84	3	0	124	1	1	22	0	24	220
15:15	0	73	4	0	77	0	0	0	0	0	20	83	0	0	103	1	0	39	0	40	220
Total Volume	0	261	7	0	268	1	0	0	0	1	97	260	5	0	362	2	1	100	0	103	734
% App Total	0.0%	97.4%	2.6%	0.0%		100.0%	0.0%	0.0%	0.0%		26.8%	71.8%	1.4%	0.0%		1.9%	1.0%	97.1%	0.0%		
PHF	.000	.894	.438	.000	.870	.250	.000	.000	.000	.250	.655	.774	.417	.000	.730	.500	.250	.641	.000	.644	.834

Quality Counts LLC
City of Napa 2016

Street Name : El Centro Ave
Segment : btwn Byway E & Jefferson St
Location : 38.33515, -122.31824

Site: 13775024
4/26/2016
Tuesday

Daily Volume

Interval Start	WB		EB		Combined	
12:00 AM	0	1	0	1	0	2
12:15 AM	0		0		0	
12:30 AM	0		0		0	
12:45 AM	1		1		2	
1:00 AM	1	2	2	6	3	8
1:15 AM	0		1		1	
1:30 AM	0		1		1	
1:45 AM	1		2		3	
2:00 AM	0	0	0	0	0	0
2:15 AM	0		0		0	
2:30 AM	0		0		0	
2:45 AM	0		0		0	
3:00 AM	0	3	0	3	0	6
3:15 AM	1		2		3	
3:30 AM	1		1		2	
3:45 AM	1		0		1	
4:00 AM	0	4	0	0	0	4
4:15 AM	0		0		0	
4:30 AM	1		0		1	
4:45 AM	3		0		3	
5:00 AM	0	8	1	7	1	15
5:15 AM	1		1		2	
5:30 AM	4		2		6	
5:45 AM	3		3		6	
6:00 AM	1	25	3	19	4	44
6:15 AM	8		3		11	
6:30 AM	8		3		11	
6:45 AM	8		10		18	
7:00 AM	12	53	8	72	20	125
7:15 AM	7		12		19	
7:30 AM	18		20		38	
7:45 AM	16		32		48	
8:00 AM	31	84	32	112	63	196
8:15 AM	32		30		62	
8:30 AM	11		20		31	
8:45 AM	10		30		40	
9:00 AM	9	45	4	45	13	90
9:15 AM	10		7		17	
9:30 AM	8		16		24	
9:45 AM	18		18		36	
10:00 AM	9	38	12	39	21	77
10:15 AM	14		6		20	
10:30 AM	5		12		17	
10:45 AM	10		9		19	
11:00 AM	12	44	7	38	19	82
11:15 AM	12		12		24	
11:30 AM	7		9		16	
11:45 AM	13		10		23	

Interval Start	WB		EB		Combined	
12:00 PM	15	57	13	52	28	109
12:15 PM	16		7		23	
12:30 PM	12		17		29	
12:45 PM	14		15		29	
1:00 PM	8	60	17	55	25	115
1:15 PM	15		14		29	
1:30 PM	13		15		28	
1:45 PM	24		9		33	
2:00 PM	12	90	18	105	30	195
2:15 PM	14		28		42	
2:30 PM	42		29		71	
2:45 PM	22		30		52	
3:00 PM	38	95	24	73	62	168
3:15 PM	26		17		43	
3:30 PM	15		13		28	
3:45 PM	16		19		35	
4:00 PM	16	64	15	77	31	141
4:15 PM	15		22		37	
4:30 PM	15		21		36	
4:45 PM	18		19		37	
5:00 PM	18	70	26	96	44	166
5:15 PM	21		23		44	
5:30 PM	21		23		44	
5:45 PM	10		24		34	
6:00 PM	13	66	14	60	27	126
6:15 PM	22		13		35	
6:30 PM	13		13		26	
6:45 PM	18		20		38	
7:00 PM	13	57	13	56	26	113
7:15 PM	19		20		39	
7:30 PM	14		9		23	
7:45 PM	11		14		25	
8:00 PM	4	20	6	25	10	45
8:15 PM	9		6		15	
8:30 PM	4		5		9	
8:45 PM	3		8		11	
9:00 PM	5	15	4	19	9	34
9:15 PM	7		6		13	
9:30 PM	1		5		6	
9:45 PM	2		4		6	
10:00 PM	3	11	2	9	5	20
10:15 PM	3		6		9	
10:30 PM	1		1		2	
10:45 PM	4		0		4	
11:00 PM	2	5	2	7	4	12
11:15 PM	2		1		3	
11:30 PM	1		2		3	
11:45 PM	0		2		2	

Volume Totals

	WB	EB	Combined
12:00 AM - 12:00 PM			
	307	342	649
	(47.3%)	(52.7%)	
12:00 PM - 12:00 AM			
	610	634	1244
	(49.0%)	(51.0%)	
24 Hours			
	917	976	1893
	(48.4%)	(51.6%)	

Peak Hours

12:00 AM - 12:00 PM

	WB	EB	Combined
Started	7:30 AM	7:30 AM	7:30 AM
Volume	97	114	211
Factor	0.76	0.89	0.84

12:00 PM - 12:00 AM

	WB	EB	Combined
Started	2:30 PM	2:15 PM	2:30 PM
Volume	128	111	228
Factor	0.76	0.93	0.80

Exhibit C: Count Adjustment Factors

Monthly and Daily Factors for Converting Counts
To Average August Thursday Traffic

Day of Week Multiplier

Monday	1.043
Tuesday	1.020
Wednesday	1.010
Thursday	1.000
Friday	0.940

Month of Year Multiplier

January	1.179
February	1.161
March	1.133
April	1.083
May	1.064
June	1.009
July	1.015
August	1.000
September	1.037
October	1.078
November	1.067
December	1.158

Source: Napa Transportation Management Plan (TMP) Traffic Model

GROWTH FACTOR CALCULATIONS

Zinfandel Estate Subdivision TIS

	Int	AM 2015	AM 2040	AM Growth Factor	Adjusted for 2017
1	SR 29/Wine Country	15,332	19,481	1.27	**1.24**
2	Jefferson/El Centro	1,209	1,348	1.11	**1.10**

	Int	PM 2015	PM 2040	PM Growth Factor	Adjusted for 2017
1	SR 29/Wine Country	14,699	18,666	1.27	**1.24**
2	Jefferson/El Centro	1,603	1,769	1.10	**1.10**

Appendix C

Intersection Level of Service Calculations

This page intentionally left blank

HCM Signalized Intersection Capacity Analysis
1: SR 29 & Wine Country Avenue

12/20/2017

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	72	88	84	63	49	19	1153	41	10	813	23
Future Volume (vph)	110	72	88	84	63	49	19	1153	41	10	813	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.97	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1808	1583		1753		1770	3374	1583	1770	3374	1583
Flt Permitted		0.97	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1808	1583		1753		1770	3374	1583	1770	3374	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	121	79	97	92	69	54	21	1267	45	11	893	25
RTOR Reduction (vph)	0	0	81	0	8	0	0	0	20	0	0	12
Lane Group Flow (vph)	0	200	16	0	207	0	21	1267	25	11	893	13
Confl. Peds. (#/hr)	3					3						
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	7%	2%
Turn Type	Split	NA	Perm	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	3		4	4		5	2		1	6	
Permitted Phases			3						2			6
Actuated Green, G (s)		22.8	22.8		21.4		7.3	76.3	76.3	1.6	70.6	70.6
Effective Green, g (s)		22.8	22.8		21.4		7.3	76.3	76.3	1.6	70.6	70.6
Actuated g/C Ratio		0.16	0.16		0.15		0.05	0.54	0.54	0.01	0.50	0.50
Clearance Time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Vehicle Extension (s)		3.0	3.0		3.0		3.0	5.5	5.5	3.0	5.5	5.5
Lane Grp Cap (vph)		294	257		267		92	1838	862	20	1701	798
v/s Ratio Prot		c0.11			c0.12		0.01	c0.38		c0.01	0.26	
v/s Ratio Perm			0.01						0.02			0.01
v/c Ratio		0.68	0.06		0.77		0.23	0.69	0.03	0.55	0.52	0.02
Uniform Delay, d1		55.2	49.6		57.0		63.6	23.2	14.7	68.8	23.4	17.3
Progression Factor		0.35	0.20		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		9.4	0.4		19.4		1.3	2.1	0.1	28.9	1.2	0.0
Delay (s)		28.5	10.1		76.3		64.9	25.4	14.8	97.7	24.6	17.4
Level of Service		C	B		E		E	C	B	F	C	B
Approach Delay (s)		22.5			76.3			25.6			25.2	
Approach LOS		C			E			C			C	

Intersection Summary				
HCM 2000 Control Delay	29.1	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.70			
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.9	
Intersection Capacity Utilization	58.2%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

HCM 2010 TWSC
2: Jefferson St & El Centro Ave

12/20/2017

Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	1	186	6	2	1	120	268	1	0	394	18
Future Vol, veh/h	18	1	186	6	2	1	120	268	1	0	394	18
Conflicting Peds, #/hr	7	0	1	1	0	7	4	0	3	3	0	4
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	20	1	207	7	2	1	133	298	1	0	438	20

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1016	1011	443	1111	1010	308	442	0	0	-	-	0
Stage 1	442	442	-	568	568	-	-	-	-	-	-	-
Stage 2	574	569	-	543	442	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	216	240	615	186	240	732	1118	-	-	0	-	-
Stage 1	594	576	-	508	506	-	-	-	-	0	-	-
Stage 2	504	506	-	524	576	-	-	-	-	0	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	189	204	612	109	204	726	1117	-	-	-	-	-
Mov Cap-2 Maneuver	189	204	-	109	204	-	-	-	-	-	-	-
Stage 1	507	574	-	434	433	-	-	-	-	-	-	-
Stage 2	427	433	-	346	574	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	17.8	33.6	2.7	0
HCM LOS	C	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBT	SBR
Capacity (veh/h)	1117	-	-	507	136	-	-
HCM Lane V/C Ratio	0.119	-	-	0.449	0.074	-	-
HCM Control Delay (s)	8.7	0	-	17.8	33.6	-	-
HCM Lane LOS	A	A	-	C	D	-	-
HCM 95th %tile Q(veh)	0.4	-	-	2.3	0.2	-	-

HCM Signalized Intersection Capacity Analysis
1: SR 29 & Wine Country Avenue

12/20/2017

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	47	33	22	60	16	69	868	87	31	1087	59
Future Volume (vph)	24	47	33	22	60	16	69	868	87	31	1087	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1831	1583		1797		1770	3374	1583	1770	3374	1583
Flt Permitted		0.98	1.00		0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1831	1583		1797		1770	3374	1583	1770	3374	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	27	52	37	24	67	18	77	964	97	34	1208	66
RTOR Reduction (vph)	0	0	31	0	5	0	0	0	44	0	0	33
Lane Group Flow (vph)	0	79	6	0	104	0	77	964	53	34	1208	33
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	7%	2%
Turn Type	Split	NA	Perm	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	3		4	4		5	2		1	6	
Permitted Phases			3						2			6
Actuated Green, G (s)		21.4	21.4		21.4		9.9	74.2	74.2	5.1	69.4	69.4
Effective Green, g (s)		21.4	21.4		21.4		9.9	74.2	74.2	5.1	69.4	69.4
Actuated g/C Ratio		0.15	0.15		0.15		0.07	0.53	0.53	0.04	0.50	0.50
Clearance Time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Vehicle Extension (s)		3.0	3.0		3.0		3.0	5.5	5.5	3.0	5.5	5.5
Lane Grp Cap (vph)		279	241		274		125	1788	838	64	1672	784
v/s Ratio Prot		c0.04			c0.06		c0.04	0.29		0.02	c0.36	
v/s Ratio Perm			0.00						0.03			0.02
v/c Ratio		0.28	0.02		0.38		0.62	0.54	0.06	0.53	0.72	0.04
Uniform Delay, d1		52.5	50.4		53.3		63.2	21.6	16.0	66.3	27.7	18.2
Progression Factor		0.37	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		1.8	0.1		4.0		8.7	1.2	0.1	8.2	2.7	0.1
Delay (s)		21.2	50.5		57.3		71.9	22.8	16.1	74.5	30.5	18.3
Level of Service		C	D		E		E	C	B	E	C	B
Approach Delay (s)		30.6			57.3			25.6			31.0	
Approach LOS		C			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	29.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.9
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM 2010 TWSC
2: Jefferson St & El Centro Ave

12/20/2017

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	1	117	1	0	0	113	304	6	0	305	8
Future Vol, veh/h	2	1	117	1	0	0	113	304	6	0	305	8
Conflicting Peds, #/hr	31	0	0	0	0	31	30	0	18	18	0	30
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	1	130	1	0	0	126	338	7	0	339	9

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	992	983	369	1014	979	390	369	0	0	-	-	0
Stage 1	369	369	-	610	610	-	-	-	-	-	-	-
Stage 2	623	614	-	404	369	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	225	249	677	217	250	658	1190	-	-	0	-	-
Stage 1	651	621	-	482	485	-	-	-	-	0	-	-
Stage 2	474	483	-	623	621	-	-	-	-	0	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	192	208	660	154	209	631	1190	-	-	-	-	-
Mov Cap-2 Maneuver	192	208	-	154	209	-	-	-	-	-	-	-
Stage 1	552	605	-	413	415	-	-	-	-	-	-	-
Stage 2	401	413	-	499	605	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.3	28.5	2.2	0
HCM LOS	B	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBT	SBR
Capacity (veh/h)	1190	-	-	623	154	-	-
HCM Lane V/C Ratio	0.106	-	-	0.214	0.007	-	-
HCM Control Delay (s)	8.4	0	-	12.3	28.5	-	-
HCM Lane LOS	A	A	-	B	D	-	-
HCM 95th %tile Q(veh)	0.4	-	-	0.8	0	-	-

HCM Signalized Intersection Capacity Analysis
1: SR 29 & Wine Country Avenue

12/20/2017

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	72	88	84	63	49	19	1153	41	10	813	23
Future Volume (vph)	110	72	88	84	63	49	19	1153	41	10	813	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.97	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1808	1583		1753		1770	3374	1583	1770	3374	1583
Flt Permitted		0.97	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1808	1583		1753		1770	3374	1583	1770	3374	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	124%	124%	124%	124%	124%	124%	124%	124%	124%	124%	124%	124%
Adj. Flow (vph)	136	89	109	104	78	61	24	1430	51	12	1008	29
RTOR Reduction (vph)	0	0	92	0	8	0	0	0	23	0	0	14
Lane Group Flow (vph)	0	225	17	0	235	0	24	1430	28	12	1008	15
Confl. Peds. (#/hr)	3					3						
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	7%	2%
Turn Type	Split	NA	Perm	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	3		4	4		5	2		1	6	
Permitted Phases			3						2			6
Actuated Green, G (s)		21.4	21.4		21.4		7.5	77.7	77.7	1.6	71.8	71.8
Effective Green, g (s)		21.4	21.4		21.4		7.5	77.7	77.7	1.6	71.8	71.8
Actuated g/C Ratio		0.15	0.15		0.15		0.05	0.56	0.56	0.01	0.51	0.51
Clearance Time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Vehicle Extension (s)		3.0	3.0		3.0		3.0	5.5	5.5	3.0	5.5	5.5
Lane Grp Cap (vph)		276	241		267		94	1872	878	20	1730	811
v/s Ratio Prot		c0.12			c0.13		0.01	c0.42		c0.01	0.30	
v/s Ratio Perm			0.01						0.02			0.01
v/c Ratio		0.82	0.07		0.88		0.26	0.76	0.03	0.60	0.58	0.02
Uniform Delay, d1		57.4	50.8		58.0		63.6	24.1	14.1	68.9	23.7	16.8
Progression Factor		0.34	0.15		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		17.3	0.4		31.1		1.4	3.0	0.1	40.2	1.4	0.0
Delay (s)		36.6	8.0		89.1		65.0	27.1	14.2	109.1	25.1	16.8
Level of Service		D	A		F		E	C	B	F	C	B
Approach Delay (s)		27.3			89.1			27.3			25.9	
Approach LOS		C			F			C			C	

Intersection Summary			
HCM 2000 Control Delay	31.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.9
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM 2010 TWSC
2: Jefferson St & El Centro Ave

12/20/2017

Intersection	
Int Delay, s/veh	5.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	1	186	6	2	1	120	268	1	0	394	18
Future Vol, veh/h	18	1	186	6	2	1	120	268	1	0	394	18
Conflicting Peds, #/hr	7	0	1	1	0	7	4	0	3	3	0	4
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	1	227	7	2	1	147	328	1	0	482	22

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1116	1111	487	1222	1111	338	486	0	0	-	-	0
Stage 1	486	486	-	625	625	-	-	-	-	-	-	-
Stage 2	630	625	-	597	486	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	185	209	581	156	209	704	1077	-	-	0	-	-
Stage 1	563	551	-	473	477	-	-	-	-	0	-	-
Stage 2	470	477	-	490	551	-	-	-	-	0	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	158	173	579	82	173	698	1076	-	-	-	-	-
Mov Cap-2 Maneuver	158	173	-	82	173	-	-	-	-	-	-	-
Stage 1	467	549	-	393	396	-	-	-	-	-	-	-
Stage 2	386	396	-	297	549	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	21.4	43.7	2.7	0
HCM LOS	C	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBT	SBR
Capacity (veh/h)	1076	-	-	465	104	-	-
HCM Lane V/C Ratio	0.136	-	-	0.539	0.106	-	-
HCM Control Delay (s)	8.9	0	-	21.4	43.7	-	-
HCM Lane LOS	A	A	-	C	E	-	-
HCM 95th %tile Q(veh)	0.5	-	-	3.1	0.3	-	-

HCM Signalized Intersection Capacity Analysis
1: SR 29 & Wine Country Avenue

12/20/2017

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	47	33	22	60	16	69	868	87	31	1087	59
Future Volume (vph)	24	47	33	22	60	16	69	868	87	31	1087	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1832	1583		1797		1770	3374	1583	1770	3374	1583
Flt Permitted		0.98	1.00		0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1832	1583		1797		1770	3374	1583	1770	3374	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	124%	124%	124%	124%	124%	124%	124%	124%	124%	124%	124%	124%
Adj. Flow (vph)	30	58	41	27	74	20	86	1076	108	38	1348	73
RTOR Reduction (vph)	0	0	35	0	5	0	0	0	42	0	0	36
Lane Group Flow (vph)	0	88	6	0	116	0	86	1076	66	38	1348	37
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	7%	2%
Turn Type	Split	NA	Perm	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	3		4	4		5	2		1	6	
Permitted Phases			3						2			6
Actuated Green, G (s)		21.4	21.4		21.4		10.2	76.1	76.1	3.2	69.1	69.1
Effective Green, g (s)		21.4	21.4		21.4		10.2	76.1	76.1	3.2	69.1	69.1
Actuated g/C Ratio		0.15	0.15		0.15		0.07	0.54	0.54	0.02	0.49	0.49
Clearance Time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Vehicle Extension (s)		3.0	3.0		3.0		3.0	5.5	5.5	3.0	5.5	5.5
Lane Grp Cap (vph)		280	241		274		128	1834	860	40	1665	781
v/s Ratio Prot		c0.05			c0.06		c0.05	0.32		c0.02	c0.40	
v/s Ratio Perm			0.00						0.04			0.02
v/c Ratio		0.31	0.03		0.42		0.67	0.59	0.08	0.95	0.81	0.05
Uniform Delay, d1		52.8	50.4		53.7		63.3	21.4	15.2	68.3	29.9	18.4
Progression Factor		0.36	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.1	0.1		4.7		13.0	1.4	0.2	121.1	4.4	0.1
Delay (s)		21.4	50.6		58.4		76.3	22.8	15.4	189.4	34.3	18.5
Level of Service		C	D		E		E	C	B	F	C	B
Approach Delay (s)		30.7			58.4			25.8			37.5	
Approach LOS		C			E			C			D	

Intersection Summary			
HCM 2000 Control Delay	33.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.9
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM 2010 TWSC
2: Jefferson St & El Centro Ave

12/20/2017

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	1	117	1	0	0	113	304	6	0	305	8
Future Vol, veh/h	2	1	117	1	0	0	113	304	6	0	305	8
Conflicting Peds, #/hr	31	0	0	0	0	31	30	0	18	18	0	30
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	1	143	1	0	0	138	372	7	0	373	10

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1085	1076	403	1114	1072	424	403	0	0	-	-	0
Stage 1	403	403	-	669	669	-	-	-	-	-	-	-
Stage 2	682	673	-	445	403	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	194	219	647	185	220	630	1156	-	-	0	-	-
Stage 1	624	600	-	447	456	-	-	-	-	0	-	-
Stage 2	440	454	-	592	600	-	-	-	-	0	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	163	179	631	124	179	605	1156	-	-	-	-	-
Mov Cap-2 Maneuver	163	179	-	124	179	-	-	-	-	-	-	-
Stage 1	517	585	-	374	381	-	-	-	-	-	-	-
Stage 2	364	380	-	457	585	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.1	34.3	2.3	0
HCM LOS	B	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBT	SBR
Capacity (veh/h)	1156	-	-	590	124	-	-
HCM Lane V/C Ratio	0.119	-	-	0.249	0.01	-	-
HCM Control Delay (s)	8.5	0	-	13.1	34.3	-	-
HCM Lane LOS	A	A	-	B	D	-	-
HCM 95th %tile Q(veh)	0.4	-	-	1	0	-	-

HCM Signalized Intersection Capacity Analysis
1: SR 29 & Wine Country Avenue

12/03/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	72	88	100	63	54	19	1153	46	11	813	23
Future Volume (vph)	110	72	88	100	63	54	19	1153	46	11	813	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.97	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1808	1583		1751		1770	3374	1583	1770	3374	1583
Flt Permitted		0.97	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1808	1583		1751		1770	3374	1583	1770	3374	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	121	79	97	110	69	59	21	1267	51	12	893	25
RTOR Reduction (vph)	0	0	81	0	8	0	0	0	23	0	0	12
Lane Group Flow (vph)	0	200	16	0	230	0	21	1267	28	12	893	13
Confl. Peds. (#/hr)	3					3						
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	7%	2%
Turn Type	Split	NA	Perm	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	3		4	4		5	2		1	6	
Permitted Phases			3						2			6
Actuated Green, G (s)		22.8	22.8		21.4		7.3	76.3	76.3	1.6	70.6	70.6
Effective Green, g (s)		22.8	22.8		21.4		7.3	76.3	76.3	1.6	70.6	70.6
Actuated g/C Ratio		0.16	0.16		0.15		0.05	0.54	0.54	0.01	0.50	0.50
Clearance Time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Vehicle Extension (s)		3.0	3.0		3.0		3.0	5.5	5.5	3.0	5.5	5.5
Lane Grp Cap (vph)		294	257		267		92	1838	862	20	1701	798
v/s Ratio Prot		c0.11			c0.13		0.01	c0.38		c0.01	0.26	
v/s Ratio Perm			0.01						0.02			0.01
v/c Ratio		0.68	0.06		0.86		0.23	0.69	0.03	0.60	0.52	0.02
Uniform Delay, d1		55.2	49.6		57.8		63.6	23.2	14.8	68.9	23.4	17.3
Progression Factor		0.35	0.20		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		9.4	0.4		28.5		1.3	2.1	0.1	40.2	1.2	0.0
Delay (s)		28.5	10.1		86.3		64.9	25.4	14.8	109.1	24.6	17.4
Level of Service		C	B		F		E	C	B	F	C	B
Approach Delay (s)		22.5			86.3			25.6			25.5	
Approach LOS		C			F			C			C	

Intersection Summary			
HCM 2000 Control Delay	30.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.9
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM 2010 TWSC
2: Jefferson St & El Centro Ave

12/03/2018

Intersection	
Int Delay, s/veh	5.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	1	196	6	2	1	123	268	1	0	394	19
Future Vol, veh/h	19	1	196	6	2	1	123	268	1	0	394	19
Conflicting Peds, #/hr	7	0	1	1	0	7	4	0	3	3	0	4
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	1	218	7	2	1	137	298	1	0	438	21

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1023	1018	443	1135	1039	309	463	0	0	-	-	0
Stage 1	442	442	-	576	576	-	-	-	-	-	-	-
Stage 2	581	576	-	559	463	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	214	237	615	179	231	731	1098	-	-	0	-	-
Stage 1	594	576	-	503	502	-	-	-	-	0	-	-
Stage 2	499	502	-	513	564	-	-	-	-	0	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	186	201	612	101	195	725	1094	-	-	-	-	-
Mov Cap-2 Maneuver	186	201	-	101	195	-	-	-	-	-	-	-
Stage 1	503	574	-	427	426	-	-	-	-	-	-	-
Stage 2	419	426	-	330	562	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	18.4	35.8	2.7	0
HCM LOS	C	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBT	SBR
Capacity (veh/h)	1094	-	-	505	127	-	-
HCM Lane V/C Ratio	0.125	-	-	0.475	0.079	-	-
HCM Control Delay (s)	8.8	0	-	18.4	35.8	-	-
HCM Lane LOS	A	A	-	C	E	-	-
HCM 95th %tile Q(veh)	0.4	-	-	2.5	0.3	-	-

HCM Signalized Intersection Capacity Analysis
1: SR 29 & Wine Country Avenue

12/03/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	47	33	33	60	19	69	868	105	36	1087	59
Future Volume (vph)	24	47	33	33	60	19	69	868	105	36	1087	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1831	1583		1790		1770	3374	1583	1770	3374	1583
Flt Permitted		0.98	1.00		0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1831	1583		1790		1770	3374	1583	1770	3374	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	27	52	37	37	67	21	77	964	117	40	1208	66
RTOR Reduction (vph)	0	0	31	0	5	0	0	0	44	0	0	33
Lane Group Flow (vph)	0	79	6	0	120	0	77	964	73	40	1208	33
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	7%	2%
Turn Type	Split	NA	Perm	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	3		4	4		5	2		1	6	
Permitted Phases			3						2			6
Actuated Green, G (s)		21.4	21.4		21.4		9.9	74.5	74.5	4.8	69.4	69.4
Effective Green, g (s)		21.4	21.4		21.4		9.9	74.5	74.5	4.8	69.4	69.4
Actuated g/C Ratio		0.15	0.15		0.15		0.07	0.53	0.53	0.03	0.50	0.50
Clearance Time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Vehicle Extension (s)		3.0	3.0		3.0		3.0	5.5	5.5	3.0	5.5	5.5
Lane Grp Cap (vph)		279	241		273		125	1795	842	60	1672	784
v/s Ratio Prot		c0.04			c0.07		c0.04	0.29		0.02	c0.36	
v/s Ratio Perm			0.00						0.05			0.02
v/c Ratio		0.28	0.02		0.44		0.62	0.54	0.09	0.67	0.72	0.04
Uniform Delay, d1		52.5	50.4		53.9		63.2	21.5	16.1	66.8	27.7	18.2
Progression Factor		0.37	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		1.8	0.1		5.1		8.7	1.2	0.2	24.5	2.7	0.1
Delay (s)		21.2	50.5		58.9		71.9	22.6	16.3	91.4	30.5	18.3
Level of Service		C	D		E		E	C	B	F	C	B
Approach Delay (s)		30.6			58.9			25.2			31.7	
Approach LOS		C			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	30.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.9
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM 2010 TWSC
2: Jefferson St & El Centro Ave

12/03/2018

Intersection	
Int Delay, s/veh	3.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	1	123	1	0	0	124	304	6	0	305	10
Future Vol, veh/h	3	1	123	1	0	0	124	304	6	0	305	10
Conflicting Peds, #/hr	31	0	0	0	0	31	30	0	18	18	0	30
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	1	137	1	0	0	138	338	7	0	339	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1018	1008	369	1050	1016	391	380	0	0	-	-	0
Stage 1	369	369	-	636	636	-	-	-	-	-	-	-
Stage 2	649	639	-	414	380	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	216	240	677	205	238	658	1178	-	-	0	-	-
Stage 1	651	621	-	466	472	-	-	-	-	0	-	-
Stage 2	458	470	-	616	614	-	-	-	-	0	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	182	196	660	141	194	631	1149	-	-	-	-	-
Mov Cap-2 Maneuver	182	196	-	141	194	-	-	-	-	-	-	-
Stage 1	540	605	-	391	396	-	-	-	-	-	-	-
Stage 2	380	394	-	488	599	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.7	30.7	2.4	0
HCM LOS	B	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBT	SBR
Capacity (veh/h)	1149	-	-	611	141	-	-
HCM Lane V/C Ratio	0.12	-	-	0.231	0.008	-	-
HCM Control Delay (s)	8.6	0	-	12.7	30.7	-	-
HCM Lane LOS	A	A	-	B	D	-	-
HCM 95th %tile Q(veh)	0.4	-	-	0.9	0	-	-

HCM Signalized Intersection Capacity Analysis
1: SR 29 & Wine Country Avenue

12/03/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	72	88	100	63	54	19	1153	46	11	813	23
Future Volume (vph)	110	72	88	100	63	54	19	1153	46	11	813	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.97	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1808	1583		1751		1770	3374	1583	1770	3374	1583
Flt Permitted		0.97	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1808	1583		1751		1770	3374	1583	1770	3374	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	124%	124%	124%	124%	124%	124%	124%	124%	124%	124%	124%	124%
Adj. Flow (vph)	136	89	109	124	78	67	24	1430	57	14	1008	29
RTOR Reduction (vph)	0	0	92	0	8	0	0	0	25	0	0	14
Lane Group Flow (vph)	0	225	17	0	261	0	24	1430	32	14	1008	15
Confl. Peds. (#/hr)	3					3						
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	7%	2%
Turn Type	Split	NA	Perm	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	3		4	4		5	2		1	6	
Permitted Phases			3						2			6
Actuated Green, G (s)		21.4	21.4		21.4		7.5	77.7	77.7	1.6	71.8	71.8
Effective Green, g (s)		21.4	21.4		21.4		7.5	77.7	77.7	1.6	71.8	71.8
Actuated g/C Ratio		0.15	0.15		0.15		0.05	0.56	0.56	0.01	0.51	0.51
Clearance Time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Vehicle Extension (s)		3.0	3.0		3.0		3.0	5.5	5.5	3.0	5.5	5.5
Lane Grp Cap (vph)		276	241		267		94	1872	878	20	1730	811
v/s Ratio Prot		c0.12			c0.15		0.01	c0.42		c0.01	0.30	
v/s Ratio Perm			0.01						0.02			0.01
v/c Ratio		0.82	0.07		0.98		0.26	0.76	0.04	0.70	0.58	0.02
Uniform Delay, d1		57.4	50.8		59.0		63.6	24.1	14.1	69.0	23.7	16.8
Progression Factor		0.34	0.15		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		17.3	0.4		49.2		1.4	3.0	0.1	71.8	1.4	0.0
Delay (s)		36.6	8.0		108.3		65.0	27.1	14.2	140.8	25.1	16.8
Level of Service		D	A		F		E	C	B	F	C	B
Approach Delay (s)		27.3			108.3			27.2			26.4	
Approach LOS		C			F			C			C	

Intersection Summary			
HCM 2000 Control Delay	33.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.9
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM 2010 TWSC
2: Jefferson St & El Centro Ave

12/03/2018

Intersection	
Int Delay, s/veh	6.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	1	196	6	2	1	123	268	1	0	394	19
Future Vol, veh/h	19	1	196	6	2	1	123	268	1	0	394	19
Conflicting Peds, #/hr	7	0	1	1	0	7	4	0	3	3	0	4
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	23	1	240	7	2	1	150	328	1	0	482	23

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1123	1118	487	1247	1141	339	509	0	0	-	-	0
Stage 1	486	486	-	632	632	-	-	-	-	-	-	-
Stage 2	637	632	-	615	509	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	183	207	581	150	201	703	1056	-	-	0	-	-
Stage 1	563	551	-	468	474	-	-	-	-	0	-	-
Stage 2	465	474	-	479	538	-	-	-	-	0	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	155	170	579	76	165	697	1052	-	-	-	-	-
Mov Cap-2 Maneuver	155	170	-	76	165	-	-	-	-	-	-	-
Stage 1	463	549	-	386	391	-	-	-	-	-	-	-
Stage 2	379	391	-	280	536	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	22.6	46.8	2.8	0
HCM LOS	C	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBT	SBR
Capacity (veh/h)	1052	-	-	463	97	-	-
HCM Lane V/C Ratio	0.143	-	-	0.57	0.113	-	-
HCM Control Delay (s)	9	0	-	22.6	46.8	-	-
HCM Lane LOS	A	A	-	C	E	-	-
HCM 95th %tile Q(veh)	0.5	-	-	3.5	0.4	-	-

HCM Signalized Intersection Capacity Analysis
1: SR 29 & Wine Country Avenue

12/03/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	24	47	33	33	60	19	69	868	105	36	1087	59
Future Volume (vph)	24	47	33	33	60	19	69	868	105	36	1087	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1832	1583		1789		1770	3374	1583	1770	3374	1583
Flt Permitted		0.98	1.00		0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1832	1583		1789		1770	3374	1583	1770	3374	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	124%	124%	124%	124%	124%	124%	124%	124%	124%	124%	124%	124%
Adj. Flow (vph)	30	58	41	41	74	24	86	1076	130	45	1348	73
RTOR Reduction (vph)	0	0	35	0	5	0	0	0	45	0	0	36
Lane Group Flow (vph)	0	88	6	0	134	0	86	1076	85	45	1348	37
Confl. Peds. (#/hr)	1					1						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	7%	2%
Turn Type	Split	NA	Perm	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	3		4	4		5	2		1	6	
Permitted Phases			3						2			6
Actuated Green, G (s)		21.4	21.4		21.4		10.2	72.9	72.9	6.4	69.1	69.1
Effective Green, g (s)		21.4	21.4		21.4		10.2	72.9	72.9	6.4	69.1	69.1
Actuated g/C Ratio		0.15	0.15		0.15		0.07	0.52	0.52	0.05	0.49	0.49
Clearance Time (s)		4.6	4.6		4.6		3.0	5.7	5.7	3.0	5.7	5.7
Vehicle Extension (s)		3.0	3.0		3.0		3.0	5.5	5.5	3.0	5.5	5.5
Lane Grp Cap (vph)		280	241		273		128	1756	824	80	1665	781
v/s Ratio Prot		c0.05			c0.07		c0.05	0.32		0.03	c0.40	
v/s Ratio Perm			0.00						0.05			0.02
v/c Ratio		0.31	0.03		0.49		0.67	0.61	0.10	0.56	0.81	0.05
Uniform Delay, d1		52.8	50.4		54.3		63.3	23.6	17.0	65.4	29.9	18.4
Progression Factor		0.36	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.1	0.1		6.2		13.0	1.6	0.3	8.8	4.4	0.1
Delay (s)		21.4	50.6		60.5		76.3	25.2	17.3	74.2	34.3	18.5
Level of Service		C	D		E		E	C	B	E	C	B
Approach Delay (s)		30.7			60.5			27.8			34.7	
Approach LOS		C			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	32.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.9
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM 2010 TWSC
2: Jefferson St & El Centro Ave

12/03/2018

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	1	123	1	0	0	124	304	6	0	305	10
Future Vol, veh/h	3	1	123	1	0	0	124	304	6	0	305	10
Conflicting Peds, #/hr	31	0	0	0	0	31	30	0	18	18	0	30
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	1	150	1	0	0	152	372	7	0	373	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1114	1104	403	1153	1113	425	415	0	0	-	-	0
Stage 1	403	403	-	698	698	-	-	-	-	-	-	-
Stage 2	711	701	-	455	415	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	185	211	647	174	208	629	1144	-	-	0	-	-
Stage 1	624	600	-	431	442	-	-	-	-	0	-	-
Stage 2	424	441	-	585	592	-	-	-	-	0	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	152	168	631	113	165	604	1115	-	-	-	-	-
Mov Cap-2 Maneuver	152	168	-	113	165	-	-	-	-	-	-	-
Stage 1	503	585	-	351	360	-	-	-	-	-	-	-
Stage 2	342	359	-	445	577	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13.5	37.2	2.5	0
HCM LOS	B	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBT	SBR
Capacity (veh/h)	1115	-	-	576	113	-	-
HCM Lane V/C Ratio	0.136	-	-	0.269	0.011	-	-
HCM Control Delay (s)	8.7	0	-	13.5	37.2	-	-
HCM Lane LOS	A	A	-	B	E	-	-
HCM 95th %tile Q(veh)	0.5	-	-	1.1	0	-	-

Appendix D

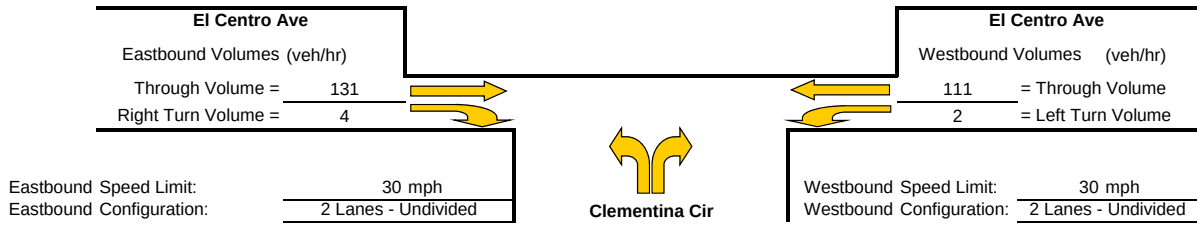
Turn-Lane Warrants

This page intentionally left blank

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: El Centro Ave/Clementina Circle
Study Scenario: AM Future plus Project

Direction of Analysis Street: East/West
Cross Street Intersects: From the South



Eastbound Speed Limit: 30 mph
Eastbound Configuration: 2 Lanes - Undivided

Westbound Speed Limit: 30 mph
Westbound Configuration: 2 Lanes - Undivided

Eastbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold	AV =	1020.1
Advancing Volume	Va =	135
If AV<Va then warrant is met		No

Right Turn Lane Warranted: **NO**

Eastbound Right Turn Taper Warrants
(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

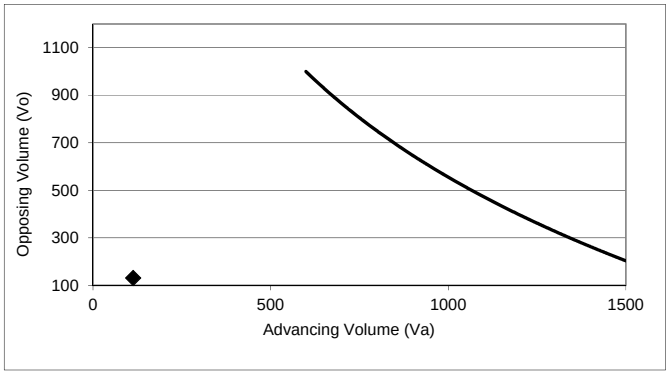
Advancing Volume Threshold	AV =	-
Advancing Volume	Va =	135
If AV<Va then warrant is met		-

Right Turn Taper Warranted: **NO**

Westbound Left Turn Lane Warrants

Percentage Left Turns	%lt	1.8 %
Advancing Volume Threshold	AV	1630 veh/hr

If AV<Va then warrant is met



◆ Study Intersection
Two lane roadway warrant threshold for: 30 mph
Turn lane warranted if point falls to right of warrant threshold line

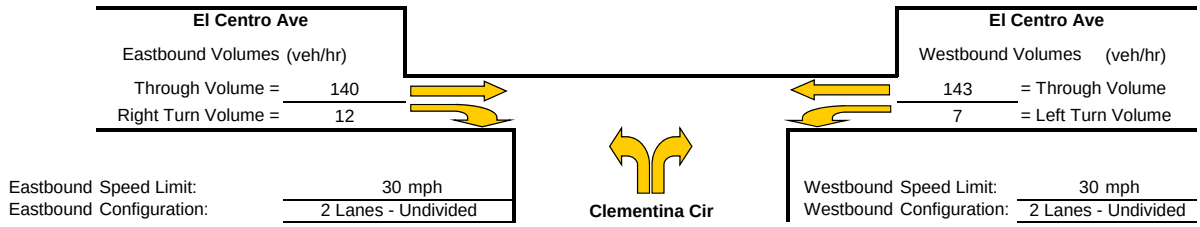
Left Turn Lane Warranted: **NO**

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements* , January 1997.
The right turn lane and taper analysis is based on work conducted by Cottrell in 1981.
The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: El Centro Ave/Clementina Circle
Study Scenario: PM Future plus Project

Direction of Analysis Street: East/West
Cross Street Intersects: From the South



Eastbound Speed Limit: 30 mph
Eastbound Configuration: 2 Lanes - Undivided

Westbound Speed Limit: 30 mph
Westbound Configuration: 2 Lanes - Undivided

Eastbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold	AV =	960.1
Advancing Volume	Va =	152
If AV<Va then warrant is met		No

Right Turn Lane Warranted: **NO**

Eastbound Right Turn Taper Warrants
(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

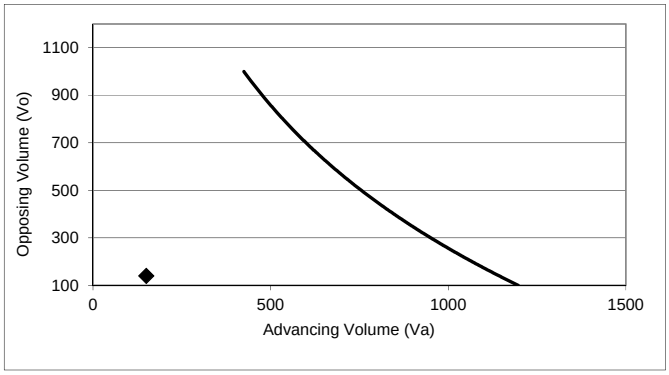
Advancing Volume Threshold	AV =	-
Advancing Volume	Va =	152
If AV<Va then warrant is met		-

Right Turn Taper Warranted: **NO**

Westbound Left Turn Lane Warrants

Percentage Left Turns	%lt	4.7 %
Advancing Volume Threshold	AV	1143 veh/hr

If AV<Va then warrant is met



◆ Study Intersection
Two lane roadway warrant threshold for: 30 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: **NO**

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements* , January 1997.
The right turn lane and taper analysis is based on work conducted by Cottrell in 1981.
The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.