



Traffic Impact Study for the Apothevert Dispensary



Prepared for the County of Sonoma

Submitted by
W-Trans

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Project Information

File Number: UPC17-0094

Address: 15499 Arnold Drive, Glen Ellen, CA 95442

APN: 054-130-024

Project Name: Apothevert Dispensary

Applicant Name: Janette Friedman

Property Owner Name: Ergas Properties, LLC

Table of Contents

Executive Summary	1
Introduction.....	2
Transportation Setting.....	4
Capacity Analysis	7
Alternative Modes	18
Access and Circulation.....	19
Parking.....	21
Conclusions and Recommendations.....	22
Study Participants and References.....	23

Figures

1. Study Area, Lane Configurations and Existing Traffic Volumes.....	3
2. Future Traffic Volumes	11
3. Site Plan	12
4. Project and Existing plus Project Traffic Volumes	15
5. Future plus Project Traffic Volumes	17

Tables

1. Collision Rates at the Study Intersections.....	5
2. Bicycle Facility Summary	6
3. Intersection Level of Service Criteria	7
4. Existing Peak Hour Intersection Levels of Service	10
5. Future Peak Hour Intersection Levels of Service	10
6. Trip Generation Summary	13
7. Average of ITE Peak Hour Rates.....	14
8. Trip Distribution Assumptions.....	14
9. Existing and Existing plus Project Peak Hour Intersection Levels of Service	14
10. Future and Future plus Project Peak Hour Intersection Levels of Service	16
11. 95 th Percentile Queues Exceeding Available Storage	16
12. Parking Analysis Summary	21

Appendices

- A. Collision Rate Calculations
- B. Intersection Level of Service Calculations
- C. Turn Lane Warrants
- D. On-Site Circulation Exhibit

Executive Summary

The proposed Apothevert Dispensary would occupy the existing 3,847 square-foot building located at 15499 Arnold Drive. As proposed, the retail portion of the dispensary would occupy 1,891 square-feet and the remaining 1,956 square-feet would be used for administrative and storage space. The dispensary would operate Monday through Saturday from 10:00 a.m. to 7:00 p.m. and would have nine employees on a typical daily basis, with a maximum of five employees on-site at any one time.

Based on standard trip generation rates, the proposed project would be expected to generate an average of 263 net new daily trips, including 36 during the weekday p.m. peak hour and 68 during the weekend p.m. peak hour.

The study area included the intersections of Arnold Drive/Madrone Road and SR 12/Madrone Road, both of which are currently operating acceptably at LOS C overall. Upon adding trips associated with the proposed project, the study intersections would be expected to continue operating acceptably at LOS C overall. Under Future volumes and with project traffic added, both study intersections are still expected to operate acceptably at LOS C or D overall.

Existing stacking space for all turn lanes at both study intersections are adequate to accommodate the maximum projected queue lengths.

Facilities providing access to the site via alternative modes, including pedestrians, bicyclists, and transit riders are adequate and will be improved as plans to expand the bike system are realized. Racks or other structures to provide secure parking for at least four bicycles should be provided as part of the project.

Access to the site is proposed to occur via Arnold Drive for dispensary guests and via Madrone Road for project employees. Sight lines along Arnold Drive and Madrone Road from the project driveways are adequate. Left-turn lanes are not warranted, and therefore not recommended, at the project's driveways on Arnold Drive and Madrone Road.

The south most parking space located in the employee parking lot should be eliminated to provide adequate circulation and access to employees parking in the northwest employee parking space. Additionally, the applicant should provide one tandem parking space to accommodate the maximum number of five employees that will be on-site at any one time.

Introduction

This report presents an analysis of the potential traffic impacts that would be associated with development of a proposed medical cannabis dispensary to be located at 15499 Arnold Drive in the County of Sonoma. The traffic study was completed in accordance with the criteria established by the County of Sonoma, and is consistent with standard traffic engineering techniques. The study presents all the information requested by County staff.

Prelude

The purpose of a traffic impact study is to provide County staff and policy makers with data 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 to mitigate these impacts to a level of insignificance as defined by the County'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 Apothevert Dispensary is a new medical cannabis dispensary that would repurpose the existing 3,847 square foot building at 15499 Arnold Drive from its previous office and residential uses. As proposed, the project would include 1,891 square feet of retail space and 1,956 square feet of storage and administrative space. The retail operation would operate Monday through Saturday between 10:00 a.m. and 7:00 p.m. Nine employees are expected to be at the site on a typical daily basis, with a maximum of five at any one time. The project location is shown in Figure 1.



Traffic Impact Study for the Apothevert Dispensary
Figure 1 – Study Area, Lane Configurations and Existing Traffic Volumes

Transportation Setting

Operational Analysis

Study Area and Periods

The study area consists of the following intersections:

1. Arnold Drive/Madrone Road
2. SR 12/Madrone Road

Operating conditions during the weekday p.m. and weekend peak periods were evaluated as these time periods reflect the highest traffic volumes areawide and for the proposed project. The evening peak hour occurs between 4:00 and 6:00 p.m. and typically reflects the highest level of congestion of the day during the homeward bound commute, while the weekend midday peak occurred between 3:00 and 5:00 p.m.

Study Intersections

Arnold Drive/Madrone Road is a four-legged all-way stop-controlled intersection; the project site is on the northeast corner of the intersection.

SR 12/Madrone Road is a four-legged signalized intersection with protected left-turn phasing on the northbound and southbound SR 12 approaches. The east leg of the intersection is a private driveway to the Hamel Family Winery. There is split phasing for the eastbound Madrone Road and westbound driveway approaches. Marked crosswalks exist at the west and south legs.

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

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, 2013 through December 31, 2017.

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). Calculated collision rates for both study intersections were nearly equal to or lower than the statewide averages indicating that the intersections are generally operating within acceptable safety parameters. The collision rate calculations are provided in Appendix A.

Table 1 – Collision Rates at the Study Intersections

Study Intersection	Number of Collisions (2013-2017)	Calculated Collision Rate (c/mve)	Statewide Average Collision Rate (c/mve)
1. Arnold Drive/Madrone Road	6	0.34	0.32
2. SR 12/Madrone Road	7	0.26	0.50

Note: c/mve = collisions per million vehicles entering; **Bold** text indicates an above-average collision rate.

Because the collision rate for Arnold Drive/Madrone Road was slightly higher than the statewide average, the crashes at this location were reviewed in greater detail. All six of the collisions involved northbound vehicles only, with rear-end and side-swipe crashes being the predominant types and unsafe speed or improper turning being the most common primary collision factors. With an injury rate of 16.7 percent versus a statewide average of 44.7 percent, despite the above-average collision rate there does not appear to be a safety concern.

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 network of sidewalks and curb ramps provides access for pedestrians at the intersection of Arnold Drive/Madrone Road and into the residential neighborhoods near the project site. There are limited pedestrian facilities along SR 12; however, given the rural character of the area along SR 12, very little pedestrian traffic would be expected.

- **Arnold Drive** – Intermittent sidewalk coverage is provided on the east side of Arnold Drive, north of the Arnold Drive/Madrone Road intersection. Lighting is provided by overhead street lights along the west side of Arnold Drive.
- **Madrone Road** – Sidewalks are provided on both sides of Madrone Road between Arnold Drive and Maplewood Drive. There are overhead street lights on the south side of Madrone Road.

Bicycle Facilities

The *Highway Design Manual*, Caltrans, 2017, classifies bikeways into four 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 IV Bikeway** – also known as a separated bikeway, a Class IV Bikeway is for the exclusive use of bicycles and includes a separation between the bikeway and the motor vehicle traffic lane. The separation may include, but is not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking.

In the project area, there are existing Class II bike lanes on Madrone Road. Bicyclists ride in the roadway and on the roadway shoulders along all other streets within the project study area. Table 2 summarizes the existing and planned bicycle facilities in the project vicinity, as contained in the Sonoma County Transportation Authority's *Countywide Bicycle and Pedestrian Master Plan*, 2014.

Table 2 – Bicycle Facility Summary

Status Facility	Class	Length (miles)	Begin Point	End Point
Existing				
Madrone Road	II	0.30	Arnold Dr	Maplewood Dr
Planned				
Agua Caliente	II	0.83	Arnold Dr	SR 12
Arnold Drive	II	3.47	Country Club Dr	Chauvet Rd
Madrone Road	II	0.88	SR 12	Arnold Dr
Sonoma Valley Trail	I	12.64	Agua Caliente Rd	Melita Rd

Source: *Countywide Bicycle and Pedestrian Master Plan*, Sonoma County Transportation Authority, 2014

Transit Facilities

Sonoma County Transit (SCT) provides fixed route bus service in the County of Sonoma. SCT Routes 30 and 38 stops on both sides of Arnold Drive near the project frontage and provide regional service to destinations throughout Sonoma Valley and to San Rafael, respectively. Route 30 operates seven days a week with approximately one-and-a-half hour headways on weekdays between 6:00 a.m. and 9:30 p.m. and approximately 3-hour headways on weekends from 7:30 a.m. to 8:00 p.m. Route 38 provides one trip for the morning commute from Kenwood to San Rafael and a return trip from San Rafael to Kenwood in the evening.

Two to three bicycles can be carried on most SCT buses. Bike rack space is on a first come, first served basis. Additional bicycles are allowed on SCT buses at the discretion of the driver.

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. SCT Paratransit is designed to serve the needs of individuals with disabilities within Santa Rosa and the greater County of Sonoma area.

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 intersections were analyzed using methodologies published in the *Highway Capacity Manual* (HCM), Transportation Research Board, 2010. This source contains 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 study intersection of Arnold Drive/Madrone Road, which has stop signs on all approaches, was analyzed using the “All-Way Stop-Controlled” Intersection methodology from the HCM. This methodology evaluates delay for each approach based on turning movements, opposing and conflicting traffic volumes, and the number of lanes. Average vehicle delay is computed for the intersection, and is then related to a Level of Service.

The signalized study intersection of SR 12/Madrone Road was evaluated using the signalized methodology from the HCM. 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. For purposes of this study, delays were calculated using actual signal timing provided by Caltrans.

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

Table 3 – Intersection Level of Service Criteria

LOS	All-Way Stop-Controlled	Signalized
A	Delay of 0 to 10 seconds. Upon stopping, drivers are immediately able to proceed.	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. Drivers may wait for one or two vehicles to clear the intersection before proceeding from a stop.	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. Drivers will enter a queue of one or two vehicles on the same approach, and wait for vehicle to clear from one or more approaches prior to entering the intersection.	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. Queues of more than two vehicles are encountered on one or more approaches.	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. Longer queues are encountered on more than one approach to the intersection.	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 enter long queues on all approaches.	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, 2010

Traffic Operation Standards

Based on the most recent criteria published by the County of Sonoma in May 2016, the project would have a significant traffic impact if it results in any of the following conditions.

1. **On-site roads and frontage improvements** – Proposed on-site circulation and street frontage would not meet the County's minimum standards for roadway or driveway design, or potentially result in safety hazards, as determined by the County in consultation with a registered Traffic Engineer or Civil Engineer.
2. **Parking** – Proposed on-site parking supply does not meet County standards and does not adequately accommodate parking demand.
3. **Emergency Access** – The project site would have inadequate emergency access.
4. **Alternative Transportation** – The project provides inadequate facilities for alternative transportation modes (e.g., bus turnouts, bicycle racks, pedestrian pathways) and/or the project creates potential conflicts with the County's Complete Streets Policy, other adopted policies, plans, or programs supporting alternative transportation.
5. **Road Hazards** – Road design features that do not meet standards (e.g., sharp curves or skewed intersections) or any perceived incompatible uses (e.g., farm equipment, major bicycle route, rail or pedestrian crossings).
6. **Vehicle Queues** – Project causes or exacerbates 95th percentile turning movement queues exceeding available turn pocket capacity.
7. **Signal Warrants** – The addition of the project's vehicle or pedestrian traffic causes an intersection to meet or exceed Caltrans or CA-MUTCD signal warrant criteria.
8. **Turn Lanes** – The addition of project traffic causes an intersection to meet or exceed criteria for provision of a right or left turn lane on an intersection approach.
9. **Sight Lines** – The project constructs an unsignalized intersection (including driveways) and/or adds traffic to an existing unsignalized intersection approach that does not have adequate sight lines based upon Caltrans criteria for State highway intersections and AASHTO criteria for County roadway intersections.
10. **County Intersection Operations** – The County level of service standard for County intersection operations is to maintain a Level of Service D or better pursuant to General Plan Policy CT-4.2. The project would have a significant traffic impact if the project's traffic would cause an intersection currently operating at an acceptable level of service (LOS D or better) to operate at an unacceptable level (LOS E or worse).

If the intersection currently operates or is projected to operate below the County standard, the project's impact is considered significant and cumulatively considerable if it causes the average delay to increase by five seconds or more. The delay will be determined by comparing intersection operations with and without the project's traffic for both the existing baseline and projected future conditions.

The above criterion applies to all controlled intersections except for driveways and minor side streets that have less than 30 vehicle trips per hour per approach or exclusive left turn movement.

11. **County Roadway Operations** – The County level of service standard for County roadway operations is to maintain a Level of Service C pursuant to General Plan Policy CT-4.1; or, for specific roadway segments, the level of service standard adopted in the General Plan Figure CT-3. The project would have a significant traffic

impact if the project's traffic would cause a road currently operating at an acceptable level of service (LOS C or better) to operate at an unacceptable level (LOS D or worse).

If a road segment currently operates or is projected to operate below the County standard, the project's impact is considered significant and cumulatively considerable if it causes the average speed to decrease by 2 mph for a roadway operating at LOS D without the project, 1 mph if existing operation is LOS E, and any reduction in travel speed is significant for a roadway operating at LOS F. The change will be determined by comparing roadway conditions with and without the project's traffic for both the existing baseline and projected future conditions.

12. **State Highways** – Caltrans' general level of service policy on State highways is to maintain the level of service at the transition between LOS C and LOS D. However, level of service goals for specific Caltrans facilities should be taken from transportation planning documents for that facility. A project would have a significant impact if the project traffic would cause the operation of a State highway to operate below LOS C. If a State highway currently operates or is projected to operate below the standard, the project's impact is considered significant and cumulatively considerable if it does not maintain the existing "measure of effectiveness." Measures of effectiveness are: (a) control delay per vehicle for signalized intersections; (b) average control delay per vehicle for unsignalized intersections; (c) average speed for two-lane highways, and (d) density for multi-lane highways.
13. **Mitigation Measures** – In order to reduce project impacts to levels of insignificance, the proposed mitigation measures must result in post-development affected intersections and roadways that have an LOS that is no worse than the County General Plan LOS standard for roadways and intersections, reduce safety impacts to insignificance by bringing the site up to Caltrans or AASHTO design standards, and provide adequate parking and alternative transportation facilities consistent with County plans and policies. The scope of the mitigation measures must reduce the project impacts below the identifiable thresholds mentioned.

The payment of County wide traffic impact fees in and of itself may not be adequate to mitigate a project's local impacts if the existing facilities are already below standard, and the required improvements are not fully funded or programmed to be operational at the time of project completion. The timing of the mitigation measure implementation may require construction of off-site improvements by the developer using a Reimbursement Agreement to pay for any oversized facilities associated with the public share of the improvement pursuant to Section 26-670 of the Sonoma County Code. Traffic impact fees do not address specific impacts related to a particular project. Payment of the traffic impact fee only mitigates or addresses cumulative countywide impacts related to projects that are programmed or listed to be funded by the fees on file with DTPW.

The project's contribution to cumulative impacts must also be addressed in proportion to the project's impact. A proportional fair share contribution to a traffic improvement related to a cumulative impact may be required based on the "Methodology for Calculating Equitable Mitigation Measures" included in Caltrans' *Guide for the Preparation of Traffic Impact Studies*, 2002. Mitigation measures for both project impacts and cumulative impacts must be implemented prior to occurrence of the impact. An analysis of the timing, funding and responsibilities for implementation of mitigation measures should be included in the traffic study.

Existing Conditions

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the weekday and weekend evening peak periods. This condition does not include project-generated traffic volumes. Counts were obtained at the study intersections in November 2017 and May 2018, while local schools were in session.

Intersection Levels of Service

The study intersections are currently operating acceptably at LOS C during both peak periods studied. The existing traffic volumes are shown in Figure 1. A summary of the intersection level of service calculations is contained in Table 4, and copies of the Level of Service calculations are provided in Appendix B.

Table 4 – Existing Peak Hour Intersection Levels of Service

Study Intersection	PM Peak		Weekend Peak	
	Delay	LOS	Delay	LOS
1. Arnold Dr/Madrone Rd	17.8	C	15.5	C
2. SR 12/Madrone Rd	21.2	C	20.4	C

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Future Conditions

Segment volumes for the horizon year of 2040 were obtained from the County's gravity demand model as maintained by the Sonoma County Transportation Authority (SCTA) and translated to turning movement volumes at the study intersection using the "Furness" method. The Furness method is an iterative process that employs existing turn movement data, existing link volumes, and future link volumes to project likely turning future movement volumes at intersections. Because the County's model does not include future volume projections for the weekend peak period, growth rates were calculated from the weekday evening projections and applied to the weekend peak hour counts.

Under the anticipated Future volumes, the study intersections are expected to operate acceptably at LOS C or D during both peak hours. Future volumes are shown in Figure 2 and operating conditions are summarized in Table 5.

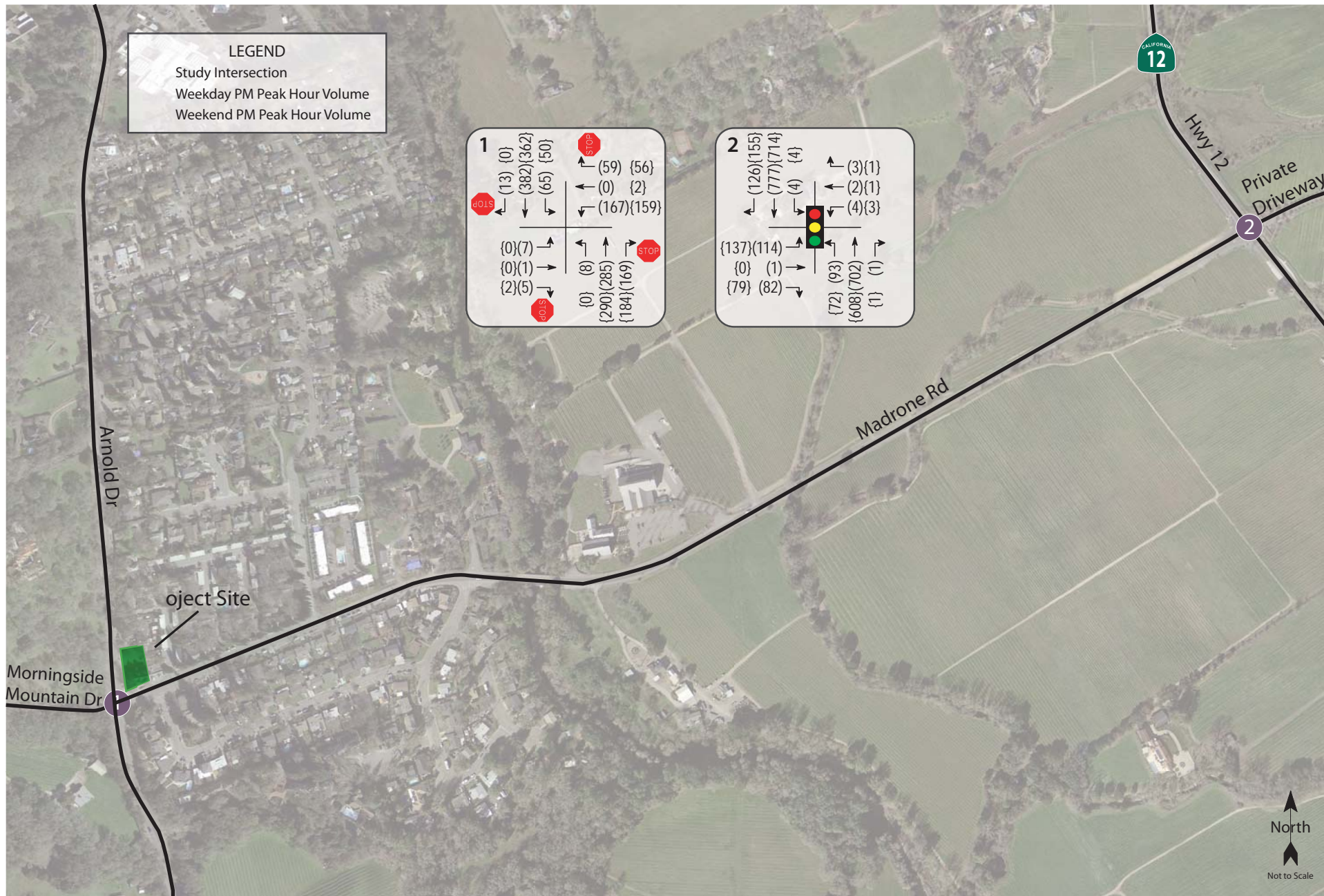
Table 5 – Future Peak Hour Intersection Levels of Service

Study Intersection	PM Peak		Weekend Peak	
	Delay	LOS	Delay	LOS
1. Arnold Dr/Madrone Rd	27.6	D	25.3	D
2. SR 12/Madrone Rd	23.5	C	22.7	C

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

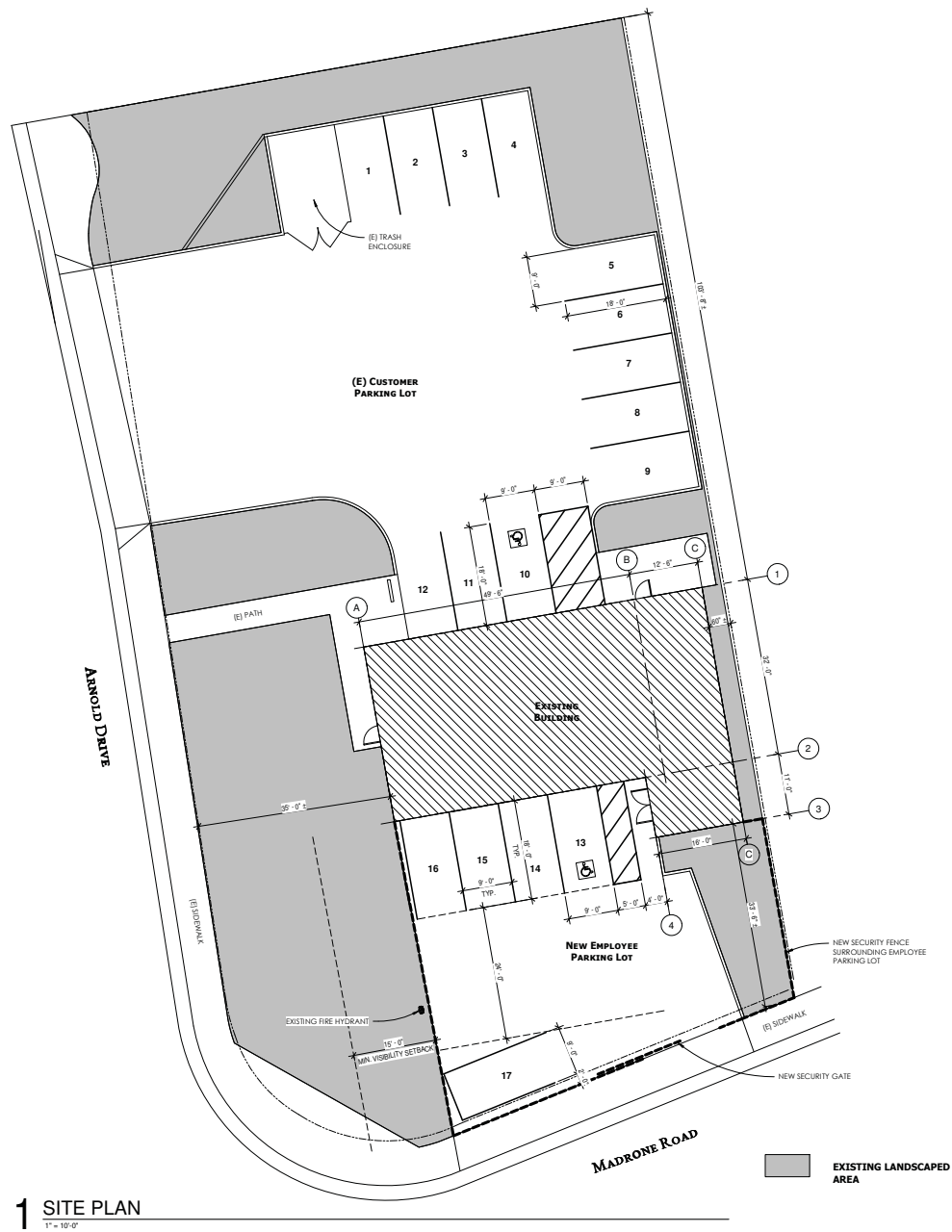
Project Description

The project is a proposed medical cannabis dispensary which will be housed in an existing 3,847 square foot building previously occupied by Globalmed Technologies commercial offices. The existing upper floor of the building includes a small office and a single residential unit that would be converted to storage space upon project completion. The retail portion of the dispensary would occupy 1,891 square feet. The dispensary would operate Monday through Saturday between 10:00 a.m. and 7:00 p.m. Project patrons would access the site via the existing driveway on Arnold Drive. Project employees and vendors would access the site via the existing driveway on Madrone Road. The proposed project site plan is shown in Figure 3.



Traffic Impact Study for the Apothevert Dispensary
Figure 2 – Future Traffic Volumes

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Traffic Impact Study for the Apothevert Dispensary
Figure 3 – Site Plan



Trip Generation

The anticipated trip generation for the proposed project was estimated using standard rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 10th Edition, 2017. This publication has a new land use for “marijuana dispensary” (LU# 882), and these rates were applied to the 1,891 square-foot retail portion of the dispensary. It is noted that the daily rate included in the manual is based on a small sample size of four studies; two of the data points are outliers that appear to overestimate the number of daily trips produced by a dispensary of the size of the proposed project. The two outliers were identified as the data points farthest from the fitted line and included one point above the line and another below it. To calculate a rate that appears to more reasonably estimate daily trips, these outliers were removed and the average ratio of daily to evening peak hour trips for the remaining two samples was calculated and applied to the square footage of the proposed dispensary. The published ITE rates for the peak hour were applied with no adjustments.

The trip generation for that portion of the building not dedicated to retail was estimated using standard rates for “General Light Industrial” (LU #110) as it was determined to be most representative of the processing, storage, and receiving space collectively. Because the site is currently occupied by the existing office space and single residential unit, the trip generation of the existing use was considered using rates for “Small Office Building” (LU# 712) and “Multifamily Housing (Low-Rise)” (LU# 220). Based on application of these standard rates, the proposed project is expected to generate 263 net new primary trips per day, including 36 trips during the p.m. peak hour on weekdays, and 68 trips during the p.m. peak hour on Saturdays. These results are summarized in Table 6.

Table 6 – Trip Generation Summary

Land Use	Units	Daily		Weekday PM Peak Hour				Weekend PM Peak Hour			
		Rate	Trips	Rate	Trips	In	Out	Rate	Trips	In	Out
Existing											
Small Office Building	1.891 ksf	16.19	31	2.45	5	1	4	0.40	1	0	1
Multifamily Housing (Low-Rise)	1 du	7.32	7	0.56	1	1	0	0.70	1	0	1
Sub-total			38		6	2	4		2	0	2
Proposed Project											
Marijuana Dispensary	1.891 ksf	154.0*	291	21.83	41	21	20	36.43	69	34	35
Gen'l Light Industrial	1.956 ksf	4.96	10	0.63	1	0	1	0.41	1	0	1
Net Increase in Trips			263		36	19	17		68	34	34

Note: ksf = 1,000 square feet; du = dwelling unit; * = ITE Rate with two outliers removed

It is noted that the daily rate with all data points considered for the dispensary land use estimates 252.7 trips per thousand square-feet. Application of this rate for the 1,891 square-foot dispensary indicates that it would generate 478 trips per day for a net new daily trip generation of 450 trips. However, it was reasonably assumed that this would be an overestimate of the project’s potential trip generation. Given that the project would operate nine hours a day, assuming a ten-hour day to account for employees arriving and departing outside these hours, a trip generation estimate of 478 daily trips would translate to an average of 48 trips per hour. Applying the daily rate with the outliers removed results in an estimate of 291 trips per day, translating to an average of 29 trips per hour, which appears more reasonable as this estimate is closer to the average of 39 trips per hour estimated based on standard rates for the highest four hours of the day. The ITE trip generation rates for the morning and evening peak hours both on the adjacent street system and at the site together with the average rates for these four hours are shown in Table 7.

Table 7 – Average of ITE Peak Hour Rates

Time Period	Average Rate	Peak Hour Trips
AM Peak Hour of Adjacent Street Traffic	10.44	20
AM Peak Hour of Generator	20.88	39
PM Peak Hour of Adjacent Street Traffic	21.83	41
PM Peak Hour of Generator	29.93	57
Average		39

Trip Distribution

The pattern used to allocate new project trips to the street network was developed based on turning movements at the study intersections and are shown in Table 8.

Table 8 – Trip Distribution Assumptions

Route	Percent
From/to the north via Arnold Drive	10
From/to the north via SR12	40
From/to the south via Arnold Drive	25
From/to the south via SR12	25
TOTAL	100

Intersection Operation

Existing plus Project Conditions

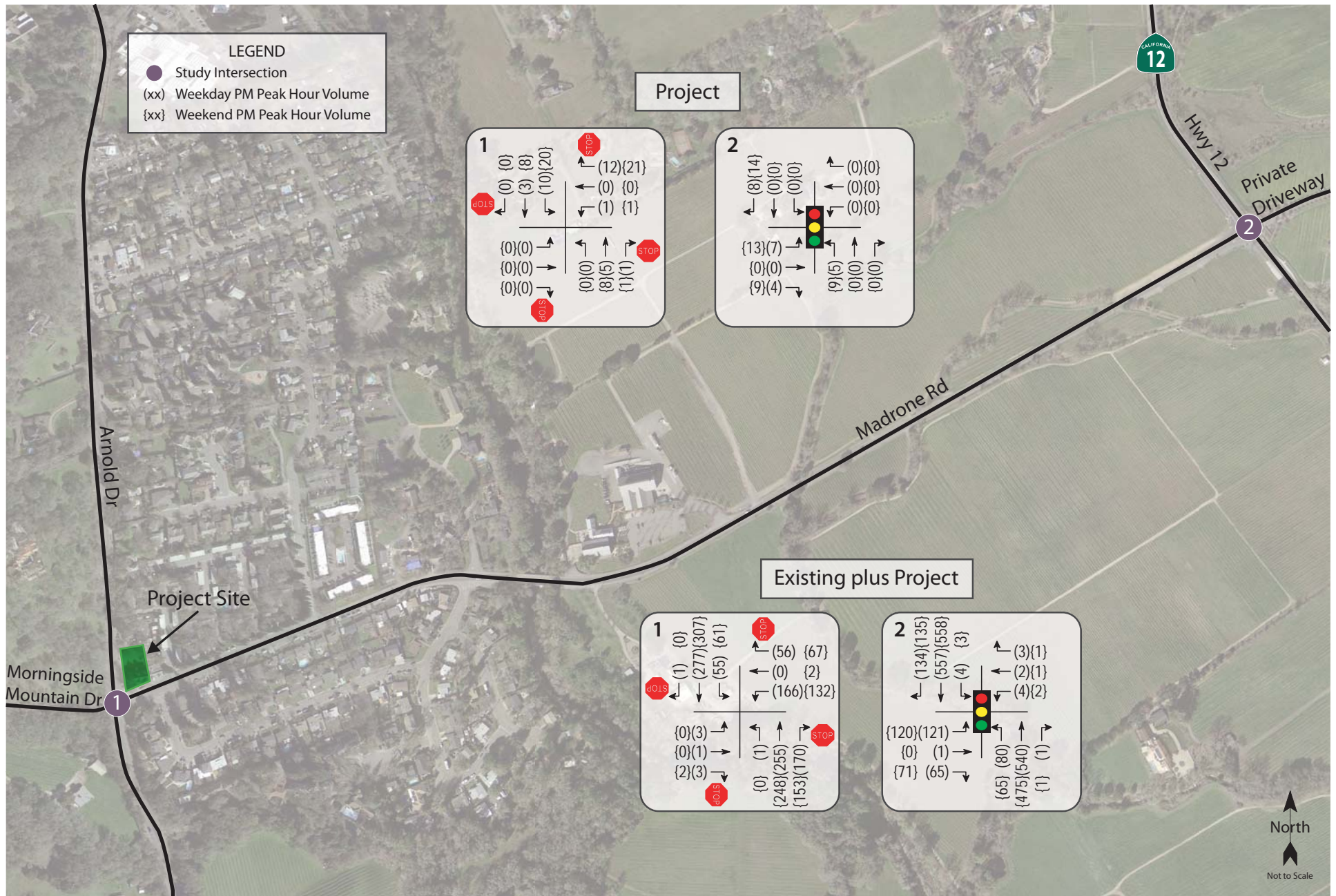
Upon the addition of project-related traffic to the Existing volumes, the study intersections are expected to continue operating acceptably at LOS C. These results are summarized in Table 9. Project and Existing plus Project traffic volumes are shown in Figure 4.

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

Study Intersection	Existing Conditions				Existing plus Project			
	PM Peak		Weekend Peak		PM Peak		Weekend Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. Arnold Dr/Madrone Rd	17.8	C	15.5	C	18.6	C	16.5	C
2. SR 12/Madrone Rd	21.2	C	20.4	C	21.4	C	20.9	C

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Finding – The study intersections are expected to continue operating acceptably with project traffic added to existing volumes, at the same Levels of Service as without it.



Traffic Impact Study for the Apothevert Dispensary
Figure 4 – Project and Existing plus Project Traffic Volumes

Future plus Project Conditions

Upon the addition of project-generated traffic to the anticipated Future volumes, the study intersections are expected to continue operating acceptable at LOS C or D. The Future plus Project operating conditions are summarized in Table 10 and Future plus Project traffic volumes are shown in Figure 5.

Table 10 – Future and Future plus Project Peak Hour Intersection Levels of Service

Study Intersection	Future Conditions				Future plus Project			
	PM Peak		Weekend Peak		PM Peak		Weekend Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. Arnold Dr/Madrone Rd	27.6	D	25.3	D	29.5	D	28.3	D
2. SR 12/Madrone Rd	23.5	C	22.7	C	23.8	C	23.6	C

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Finding – The study intersections are expected to operate at acceptable LOS C or D upon the addition of project-generated traffic to anticipated future volumes.

Queuing

Under each scenario, the projected 95th percentile queues in dedicated turn pockets at the study intersections were determined using Vistro. Summarized in Table 11 are the predicted queue lengths for dedicated turn lanes on the approaches to the two study intersections. It is noted that because the westbound approach to Arnold Drive/Madrone Road has a left-turn pocket that extends east of the Glenwood Drive/Madrone Road intersection, the available stacking space includes the total length of the left-turn pocket.

Table 11 – 95th Percentile Queues Exceeding Available Storage

Study Intersection Approach	Available Storage	95 th Percentile Queues							
		PM Peak Hour				Saturday Peak Hour			
		E	E+P	F	F+P	E	E+P	F	F+P
Arnold Dr/Madrone Rd									
Southbound Left-Turn	90	8	10	12	15	7	10	9	13
Westbound Left-Turn	205	44	45	50	52	30	31	45	46
SR 12/Madrone Rd									
Northbound Left-turn	145	49	53	86	91	36	43	61	69
Southbound Right-turn	300	35	40	38	42	33	41	53	62

Notes: 95th Percentile Queue based on the Vistro operational analysis output; all distances are measured in feet; E = existing conditions; E+P = existing plus project conditions; F = future conditions; F+P = future plus project conditions

Finding – Existing stacking space for all turn lanes at the study intersections are sufficient to accommodate queues with project traffic added. The project does not cause any queues to exceed available storage.



Traffic Impact Study for the Apothevert Dispensary
Figure 5 – Future plus Project Traffic Volumes

Alternative Modes

Pedestrian Facilities

Given the proximity of agricultural land uses and suburban residential uses, it is reasonable to assume that most dispensary visitors and employees will travel to and from the site by private automobile. Therefore, the dispensary is expected to generate little pedestrian travel. Existing sidewalks along both sides of Madrone Road and along the east side of Arnold Drive provide pedestrian connections to people who may wish to access the site from the nearby residential areas. Both the bus stops located on Arnold Drive are served by sidewalks and are located close to the dispensary.

Finding – Pedestrian facilities serving the project site are adequate.

Bicycle Facilities

Existing roadway shoulders and shared use of local streets along with the planned future bicycle facilities, including the future Sonoma Valley Trail paralleling SR 12, will provide adequate access for bicyclists.

Bicycle Storage

The project should provide bicycle parking consistent with the requirements outlined in Article 86 of the County of Sonoma Code of Ordinances, which states that one bicycle parking space should be provided for every five required automobile parking spaces. With a proposed supply of 17 total vehicle parking spaces for normal daily visitation and operation, parking for four bicycles is needed. The project plans include bicycle parking near the front entrance for guests and in the back area for employees, but do not indicate how many spaces are to be provided.

Finding – Bicycle facilities are adequate to serve the expected demand, and would be improved upon installation of the planned future bicycle facilities.

Recommendation – Parking to secure at least four bicycles should be provided on-site.

Transit

Existing transit routes are adequate to accommodate project-generated transit trips. Existing stops are located within 200 feet of the site.

Finding – Transit facilities serving the project site are adequate.

Access and Circulation

Site Access

The dispensary will be accessed via the two existing driveways on Arnold Drive and Madrone Road. There would be a dedicated parking lot for patients on the north side of the property that would be accessed via the Arnold Road driveway. The parking lot south of the building would be dedicated for employee and vendor parking and would be accessed via the driveway on Madrone Road.

Sight Distance

At driveways, a substantially clear line of sight should be maintained between the driver of a vehicle waiting on the driveway and the driver of an approaching vehicle. Sight distances along Arnold Drive and Madrone Road at the project driveways were evaluated based on stopping sight distance criteria contained in *A Policy on Geometric Design on Highways and Streets* published by American Association of State Highway and Transportation Officials (AASHTO). Because Madrone Road and Arnold Drive are generally straight and flat near the project site, sight distances were measured based on aerial photography available on Google Earth. It is noted both project driveways are located near the all-way stop-controlled intersection of Arnold Drive and Madrone Road; therefore, it is reasonable to assume that vehicle speeds on both streets will be lower than the posted limits as vehicles will be stopping at the intersection, which is within about 100 feet of each driveway.

Based on a posted speed limit of 25 mph on Madrone Road, the minimum stopping sight distance needed is 155 feet. Sight lines at the driveway on Madrone Road extend west to the all-way stop-controlled intersection of Arnold Drive/Madrone Road and while this is only about 100 feet from the driveway, speeds would be less than 25 mph as drivers stop and then turn into eastbound Madrone Road, so the available sight lines are adequate. Looking west along Madrone Road sight lines are clear for more than 400 feet, which would be adequate for travel speeds of up to 45 mph, which is substantially higher than the posted speed limit as well as the actual speeds of drivers approaching a stop-controlled intersection.

Stopping sight distance at the Arnold Drive access was evaluated based on a 35-mph posted speed limit. From the requisite 15-foot setback, drivers exiting the project driveway on Arnold Drive have clear sight lines that extend past the Arnold Drive/Madrone Road intersection to the south, which at about 130 feet is less than the required amount for the speed limit but is adequate for the actual speed of traffic coming out of the stop-controlled intersection. To the north, sight lines extend up to 250 feet north along Arnold Drive, which is adequate for drivers approaching at the posted speed limit of 35 mph. Again, because of the proximity to a stop-controlled intersection, drivers will typically be traveling at speeds below the posted speed limit.

Finding – Sight distances from the project driveways on Arnold Drive and Madrone Road are adequate.

Access Analysis

Left-Turn Lane Warrants

The need for left-turn lanes on Arnold Drive and Madrone Road at the project driveways 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 to determine the need for a left-turn pocket based on safety issues. Future plus Project weekday evening peak hour volumes as well as safety criteria were evaluated. Based on these conditions, which are

representative of the highest number of project-generated trips and therefore worst-case conditions, a left-turn lane is not warranted on Arnold Drive or Madrone Road at the project driveways. A copy of the warrant analysis is provided in Appendix C.

On-Site Circulation

The AutoTURN application of AutoCAD was used to evaluate the adequacy of on-site passenger vehicle access for the proposed parking layout. The results are provided in Appendix C.

Finding – The parking lot as designed includes a parking space on the southwest corner that blocks access to parking spaces in the northwest corner of the employee lot.

Recommendation – The applicant should eliminate the southwest parking space in the employee lot to provide adequate access for employees parking in the northwest space.

Parking

The project was analyzed to determine whether the proposed parking supply would be sufficient to meet the County's zoning requirements. The project plan shows a supply of 17 parking spaces, including 11 guest, one van accessible, and five employee spaces. One space in the employee lot would need to be eliminated to provide adequate circulation for that lot, resulting in a supply of 16 spaces. The proposed project would include two shifts per day. The maximum shift would occur from 10:00 a.m. to 3:30 p.m., during which there would be four employees including one management, two sales, and one receptionist. One cleaning employee would also be scheduled during this shift, but would only come in for one hour.

Parking supply requirements for the County of Sonoma are based on the County's Code of Ordinances, Article 86 Section 26-86-010, Required Parking. The proposed project would be required to provide 16 spaces. With an anticipated supply of 16 spaces, the project's supply would meet the County's Requirement. It is noted that the four employee spaces would account for the parking demand generated by the remaining 1,956 square feet of the building used for processing, storage, and receiving space collectively. A summary of the County's parking requirements is shown in Table 12.

Table 12 – Parking Analysis Summary

Land Use	Units	Supply (spaces)	City Requirements	
			Rate	Spaces Required
Medical cannabis dispensary	1.891 ksf	12 Guest, 4 Employee	2 spaces, including at least 1 van-accessible space; plus 1 additional space for every 200 square feet of gross floor area, plus 1 additional space for each employee on maximum shift; but in no case less than 5 off-street parking spaces	12 Guest, 4 Employee
Total		16		16

Notes: du = dwelling unit; ksf = 1,000 square feet

Finding – The parking supply as proposed is adequate to meet the County's requirements. It is noted that one cleaning employee will be on-site for one hour a day; therefore, the maximum number of employees on-site during the maximum shift would be five during the hour the janitorial employee is scheduled.

Recommendation – It is recommended that the applicant provide one tandem parking space in the employee lot to accommodate the cleaning employee.

Conclusions and Recommendations

Conclusions

- The proposed project is expected to generate an average of 263 net new trips per day, including 36 weekday p.m. peak hour trips and 68 trips during the p.m. peak hour on weekends.
- Under Existing conditions, the study intersections operate acceptably at LOS C during both peak periods and they would be expected to continue operating at these service levels with the addition of project traffic.
- Under anticipated future volumes, the study intersections are expected to continue operating acceptably at LOS C or D overall during both peak hours and upon the addition of project.
- Projected queue lengths are less than the available stacking space at both study intersections under all volume scenarios.
- Existing Class II bike lanes on Madrone Road and planned future bicycle facilities would provide adequate access to the site.
- While few transit trips to and from the site are expected, the available transit facilities are adequate to serve those that may occur.
- Sight distances on Arnold Drive and Madrone Road at the project driveways are adequate.
- Left-turn lanes are not warranted on Arnold Drive or Madrone Road at the project driveways.
- The proposed parking supply is adequate to meet County requirements.

Recommendations

- Secure parking facilities for at least four bicycles should be provided on-site.
- The parking space on the south side of the employee parking lot should be eliminated to provide adequate site circulation and access to the parking space in the northwest corner of the lot.
- The applicant should provide one tandem parking stall to accommodate the janitorial employee that will be on-site for one hour per day.

Study Participants and References

Study Participants

Principal in Charge	Dalene J. Whitlock, PE, PTOE
Assistant Engineer	Kevin Rangel, EIT
Graphics/Editing/Formatting	Alex Scrobonia
Report Review	Dalene J. Whitlock, PE, PTOE

References

2014 Collision Data on California State Highways, California Department of Transportation, 2017
A Policy on Geometric Design of Highways and Streets, 6th Edition, American Association of State Highway and Transportation Officials, 2011
California Manual on Uniform Traffic Control Devices for Streets and Highways, California Department of Transportation, 2014
Countywide Bicycle and Pedestrian Master Plan, Sonoma County Transportation Authority, 2014
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Communications

Jamgochian, Chet "Re: Memorandum of Assumptions for the 15499 Arnold Drive Traffic Study (UPC17-0094)." Memorandum to Crystal Acker. April 30, 2018. Email.
Jamgochian, Chet "Re: Apothevert Dispensary (UPC17-0094); 15499 Arnold Dr, Glen Ellen." Message to Crystal Acker. May 2, 2018. Email.

SOX644



Appendix A

Collision Rate Calculations

Intersection Collision Rate Calculations

Apothevert Dispensary TIS

Intersection # 1: Arnold & Madrone Road
Date of Count: Saturday, January 00, 1900

Number of Collisions: 6
Number of Injuries: 1
Number of Fatalities: 0
ADT: 9600
Start Date: January 1, 2013
End Date: December 31, 2017
Number of Years: 5

Intersection Type: Four-Legged
Control Type: 4 Way Stop
Area: Suburban

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

$$\text{collision rate} = \frac{6}{9,600} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.34 c/mve	0.0%	16.7%
Statewide Average*	0.32 c/mve	0.4%	44.7%

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: SR 12 & Madrone Road
Date of Count: Saturday, January 00, 1900

Number of Collisions: 7
Number of Injuries: 3
Number of Fatalities: 0
ADT: 14900
Start Date: January 1, 2013
End Date: December 31, 2017
Number of Years: 5

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

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

$$\text{collision rate} = \frac{7}{14,900} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.26 c/mve	0.0%	42.9%
Statewide Average*	0.50 c/mve	0.8%	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

Appendix B

Intersection Level of Service Calculations

Intersection Level Of Service Report
Intersection 1: Arnold Drive/Madrone Road

Control Type:	All-way stop	Delay (sec / veh):	17.8
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.742

Intersection Setup

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	0	0	0	0	1	0	0
Pocket Length [ft]	60.00	100.00	100.00	70.00	100.00	100.00	100.00	100.00	100.00	190.00	100.00	100.00
Speed [mph]	35.00			45.00			25.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Base Volume Input [veh/h]	1	250	169	45	274	1	3	1	3	165	0	44
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	1	250	169	45	274	1	3	1	3	165	0	44
Peak Hour Factor	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	71	48	13	78	0	1	0	1	47	0	13
Total Analysis Volume [veh/h]	1	284	192	51	311	1	3	1	3	188	0	50
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings**Lanes**

Capacity per Entry Lane [veh/h]	562	641	550	596	491	494	593
Degree of Utilization, x	0.00	0.74	0.09	0.52	0.01	0.38	0.08


Movement, Approach, & Intersection Results

95th-Percentile Queue Length [v/t]	0.01	6.55	0.31	3.03	0.04	1.76	0.28
95th-Percentile Queue Length [ft]	0.13	163.84	7.63	75.83	1.08	44.04	6.88
Approach Delay [s/veh]	22.65		14.43		10.43	13.33	
Approach LOS	C		B		B	B	
Intersection Delay [s/veh]	17.78						
Intersection LOS	C						

Intersection Level Of Service Report
Intersection 2: SR 12/Madrone Rd

Control Type:	Signalized	Delay (sec / veh):	21.2
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.664

Intersection Setup

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	0	0	0	0	0	0
Pocket Length [ft]	120.00	100.00	100.00	120.00	100.00	270.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	50.00			50.00			30.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			No			Yes			No		

Volumes

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Base Volume Input [veh/h]	75	540	1	4	557	126	114	1	61	4	2	3
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	44	0	0	41	0	0	3
Total Hourly Volume [veh/h]	75	540	1	4	557	82	114	1	20	4	2	0
Peak Hour Factor	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	20	141	0	1	145	21	30	0	5	1	1	0
Total Analysis Volume [veh/h]	78	563	1	4	580	85	119	1	21	4	2	0
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	120
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Last time [s]	23.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Split	Split	Split	Split	Split	Split
Signal group	1	6	0	5	2	0	0	4	0	0	3	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	11	15	0	11	15	0	0	12	0	0	12	0
Maximum Green [s]	25	80	0	25	80	0	0	25	0	0	25	0
Amber [s]	5.2	5.2	0.0	5.2	5.2	0.0	0.0	4.8	0.0	0.0	4.1	0.0
All red [s]	1.0	1.0	0.0	1.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	32	86	0	31	86	0	0	31	0	0	30	0
Vehicle Extension [s]	3.0	3.0	0.0	3.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	0	0	0	7	0	0	7	0	0	0	0
Pedestrian Clearance [s]	0	0	0	0	30	0	0	20	0	0	0	0
Rest In Walk	No			No				No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	4.2	4.2	0.0	4.2	4.2	0.0	0.0	3.8	0.0	0.0	3.1	0.0
Minimum Recall	No	Yes		No	Yes			No			No	
Maximum Recall	No	No		No	No			No			No	
Pedestrian Recall	No	No		No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	L	C	R	C	C
C, Cycle Length [s]	68	68	68	68	68	68	68
L, Total Lost Time per Cycle [s]	6.20	6.20	6.20	6.20	6.20	5.80	5.10
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	4.20	4.20	4.20	4.20	4.20	3.80	3.10
g_i, Effective Green Time [s]	9	31	1	24	24	11	1
g / C, Green / Cycle	0.13	0.46	0.01	0.35	0.35	0.16	0.02
(v / s)_l Volume / Saturation Flow Rate	0.04	0.30	0.00	0.31	0.05	0.08	0.00
s, saturation flow rate [veh/h]	1774	1862	1774	1863	1583	1743	1803
c, Capacity [veh/h]	222	861	21	651	553	286	35
d1, Uniform Delay [s]	27.27	14.11	33.32	20.94	15.24	25.88	32.88
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.95	0.85	4.23	4.49	0.13	1.31	2.36
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.35	0.65	0.19	0.89	0.15	0.49	0.17
d, Delay for Lane Group [s/veh]	28.21	14.96	37.55	25.42	15.36	27.19	35.23
Lane Group LOS	C	B	D	C	B	C	D
Critical Lane Group	Yes	No	No	Yes	No	Yes	Yes
50th-Percentile Queue Length [veh/ln]	1.10	5.36	0.08	7.98	0.78	2.08	0.12
50th-Percentile Queue Length [ft/ln]	27.44	133.91	2.11	199.41	19.59	52.09	2.95
95th-Percentile Queue Length [veh/ln]	1.98	9.15	0.15	12.61	1.41	3.75	0.21
95th-Percentile Queue Length [ft/ln]	49.39	228.80	3.80	315.20	35.27	93.76	5.32

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	28.21	14.96	14.96	37.55	25.42	15.36	27.19	27.19	27.19	35.23	35.23	35.23
Movement LOS	C	B	B	D	C	B	C	C	C	D	D	D
d_A, Approach Delay [s/veh]	16.57			24.22			27.19			35.23		
Approach LOS	B			C			C			D		
d_I, Intersection Delay [s/veh]	21.18											
Intersection LOS	C											
Intersection V/C	0.664											

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 1: Arnold Drive/Madrone Road

Control Type:	All-way stop	Delay (sec / veh):	15.5
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.666

Intersection Setup

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	0	0	0	0	1	0	0
Pocket Length [ft]	60.00	100.00	100.00	70.00	100.00	100.00	100.00	100.00	100.00	190.00	100.00	100.00
Speed [mph]	35.00			45.00			25.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Base Volume Input [veh/h]	0	240	152	41	299	0	0	0	2	131	2	46
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	240	152	41	299	0	0	0	2	131	2	46
Peak Hour Factor	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	67	43	12	84	0	0	0	1	37	1	13
Total Analysis Volume [veh/h]	0	270	171	46	336	0	0	0	2	147	2	52
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings**Lanes**

Capacity per Entry Lane [veh/h]	631	662	575	625	542	502	601
Degree of Utilization, x	0.00	0.67	0.08	0.54	0.00	0.29	0.09


Movement, Approach, & Intersection Results

95th-Percentile Queue Length [v/t]	0.00	5.05	0.26	3.21	0.01	1.21	0.29
95th-Percentile Queue Length [ft]	0.00	126.36	6.50	80.16	0.28	30.29	7.37
Approach Delay [s/veh]	18.28		14.31		9.66	11.88	
Approach LOS	C		B		A	B	
Intersection Delay [s/veh]	15.53						
Intersection LOS	C						

Intersection Level Of Service Report
Intersection 2: SR 12/Madrone Rd

Control Type:	Signalized	Delay (sec / veh):	20.4
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.663

Intersection Setup

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	0	0	0	0	0	0
Pocket Length [ft]	120.00	100.00	100.00	120.00	100.00	270.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	50.00			50.00			30.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			No			Yes			No		

Volumes

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Base Volume Input [veh/h]	56	475	1	3	558	121	107	0	62	2	1	1
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	40	0	0	36	0	0	0
Total Hourly Volume [veh/h]	56	475	1	3	558	81	107	0	26	2	1	1
Peak Hour Factor	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	15	125	0	1	147	21	28	0	7	1	0	0
Total Analysis Volume [veh/h]	59	500	1	3	587	85	113	0	27	2	1	1
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	120
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	23.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Split	Split	Split	Split	Split	Split
Signal group	1	6	0	5	2	0	0	4	0	0	3	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	11	15	0	11	15	0	0	12	0	0	12	0
Maximum Green [s]	25	80	0	25	80	0	0	25	0	0	25	0
Amber [s]	5.2	5.2	0.0	5.2	5.2	0.0	0.0	4.8	0.0	0.0	4.1	0.0
All red [s]	1.0	1.0	0.0	1.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	32	86	0	31	86	0	0	31	0	0	30	0
Vehicle Extension [s]	3.0	3.0	0.0	3.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	0	0	0	7	0	0	7	0	0	0	0
Pedestrian Clearance [s]	0	0	0	0	30	0	0	20	0	0	0	0
Rest In Walk	No			No				No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	4.2	4.2	0.0	4.2	4.2	0.0	0.0	3.8	0.0	0.0	3.1	0.0
Minimum Recall	No	Yes		No	Yes			No			No	
Maximum Recall	No	No		No	No			No			No	
Pedestrian Recall	No	No		No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	L	C	R	C	C
C, Cycle Length [s]	66	66	66	66	66	66	66
L, Total Lost Time per Cycle [s]	6.20	6.20	6.20	6.20	6.20	5.80	5.10
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	4.20	4.20	4.20	4.20	4.20	3.80	3.10
g_i, Effective Green Time [s]	7	30	1	23	23	11	1
g / C, Green / Cycle	0.11	0.46	0.01	0.35	0.35	0.17	0.01
(v / s)_l Volume / Saturation Flow Rate	0.03	0.27	0.00	0.32	0.05	0.08	0.00
s, saturation flow rate [veh/h]	1774	1862	1774	1863	1583	1734	1742
c, Capacity [veh/h]	197	850	16	660	561	292	23
d1, Uniform Delay [s]	26.97	13.34	32.44	20.07	14.52	24.82	32.20
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.84	0.66	5.46	4.34	0.12	1.22	3.62
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.30	0.59	0.19	0.89	0.15	0.48	0.18
d, Delay for Lane Group [s/veh]	27.81	13.99	37.90	24.40	14.65	26.04	35.82
Lane Group LOS	C	B	D	C	B	C	D
Critical Lane Group	Yes	No	No	Yes	No	Yes	Yes
50th-Percentile Queue Length [veh/ln]	0.81	4.38	0.07	7.67	0.74	1.98	0.08
50th-Percentile Queue Length [ft/ln]	20.18	109.46	1.69	191.81	18.50	49.41	2.11
95th-Percentile Queue Length [veh/ln]	1.45	7.81	0.12	12.21	1.33	3.56	0.15
95th-Percentile Queue Length [ft/ln]	36.33	195.25	3.04	305.37	33.30	88.94	3.81

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	27.81	13.99	13.99	37.90	24.40	14.65	26.04	26.04	26.04	35.82	35.82	35.82
Movement LOS	C	B	B	D	C	B	C	C	C	D	D	D
d_A, Approach Delay [s/veh]	15.45			23.24			26.04			35.82		
Approach LOS	B			C			C			D		
d_I, Intersection Delay [s/veh]	20.39											
Intersection LOS	C											
Intersection V/C	0.663											

Sequence


Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 1: Arnold Drive/Madrone Road

Control Type:	All-way stop	Delay (sec / veh):	27.6
Analysis Method:	HCM 2010	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.870

Intersection Setup

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	0	0	0	0	1	0	0
Pocket Length [ft]	60.00	100.00	100.00	70.00	100.00	100.00	100.00	100.00	100.00	190.00	100.00	100.00
Speed [mph]	35.00			45.00			25.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Base Volume Input [veh/h]	8	285	169	65	382	13	7	1	5	167	0	59
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	8	285	169	65	382	13	7	1	5	167	0	59
Peak Hour Factor	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	2	81	48	18	109	4	2	0	1	47	0	17
Total Analysis Volume [veh/h]	9	324	192	74	434	15	8	1	6	190	0	67
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings**Lanes**

Capacity per Entry Lane [veh/h]	526	593	526	570	441	457	541
Degree of Utilization, x	0.02	0.87	0.14	0.79	0.03	0.42	0.12


Movement, Approach, & Intersection Results

95th-Percentile Queue Length [v/t]	0.05	9.92	0.49	7.46	0.11	2.01	0.42
95th-Percentile Queue Length [ft]	1.30	247.92	12.18	186.53	2.64	50.37	10.54
Approach Delay [s/veh]	35.99		25.98		11.46	14.57	
Approach LOS	E		D		B		B
Intersection Delay [s/veh]	27.58						
Intersection LOS	D						

Intersection Level Of Service Report
Intersection 2: SR 12/Madrone Rd

Control Type:	Signalized	Delay (sec / veh):	23.5
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.798

Intersection Setup

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	0	0	0	0	0	0
Pocket Length [ft]	120.00	100.00	100.00	120.00	100.00	270.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	50.00			50.00			30.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			No			Yes			No		

Volumes

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Base Volume Input [veh/h]	93	702	1	4	777	126	114	1	82	4	2	3
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	44	0	0	41	0	0	3
Total Hourly Volume [veh/h]	93	702	1	4	777	82	114	1	41	4	2	0
Peak Hour Factor	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	24	183	0	1	202	21	30	0	11	1	1	0
Total Analysis Volume [veh/h]	97	731	1	4	809	85	119	1	43	4	2	0
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	120
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	23.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Split	Split	Split	Split	Split	Split
Signal group	1	6	0	5	2	0	0	4	0	0	3	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	11	15	0	11	15	0	0	12	0	0	12	0
Maximum Green [s]	25	80	0	25	80	0	0	25	0	0	25	0
Amber [s]	5.2	5.2	0.0	5.2	5.2	0.0	0.0	4.8	0.0	0.0	4.1	0.0
All red [s]	1.0	1.0	0.0	1.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	32	86	0	31	86	0	0	31	0	0	30	0
Vehicle Extension [s]	3.0	3.0	0.0	3.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	0	0	0	7	0	0	7	0	0	0	0
Pedestrian Clearance [s]	0	0	0	0	30	0	0	20	0	0	0	0
Rest In Walk	No			No				No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	4.2	4.2	0.0	4.2	4.2	0.0	0.0	3.8	0.0	0.0	3.1	0.0
Minimum Recall	No	Yes		No	Yes			No			No	
Maximum Recall	No	No		No	No			No			No	
Pedestrian Recall	No	No		No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	L	C	R	C	C
C, Cycle Length [s]	87	87	87	87	87	87	87
L, Total Lost Time per Cycle [s]	6.20	6.20	6.20	6.20	6.20	5.80	5.10
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	4.20	4.20	4.20	4.20	4.20	3.80	3.10
g_i, Effective Green Time [s]	10	49	1	40	40	12	2
g / C, Green / Cycle	0.11	0.57	0.01	0.46	0.46	0.14	0.02
(v / s)_l Volume / Saturation Flow Rate	0.05	0.39	0.00	0.43	0.05	0.09	0.00
s, saturation flow rate [veh/h]	1774	1862	1774	1863	1583	1720	1803
c, Capacity [veh/h]	203	1055	21	864	735	233	34
d1, Uniform Delay [s]	36.12	13.47	42.62	22.11	13.22	35.97	42.06
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.74	0.83	4.39	5.52	0.07	3.81	2.47
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.48	0.69	0.19	0.94	0.12	0.70	0.18
d, Delay for Lane Group [s/veh]	37.86	14.30	47.01	27.62	13.29	39.78	44.53
Lane Group LOS	D	B	D	C	B	D	D
Critical Lane Group	Yes	No	No	Yes	No	Yes	Yes
50th-Percentile Queue Length [veh/ln]	1.91	8.30	0.11	14.43	0.84	3.49	0.15
50th-Percentile Queue Length [ft/ln]	47.63	207.61	2.65	360.84	20.94	87.25	3.75
95th-Percentile Queue Length [veh/ln]	3.43	13.03	0.19	20.66	1.51	6.28	0.27
95th-Percentile Queue Length [ft/ln]	85.73	325.76	4.77	516.60	37.69	157.04	6.75

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	37.86	14.30	14.30	47.01	27.62	13.29	39.78	39.78	39.78	44.53	44.53	44.53
Movement LOS	D	B	B	D	C	B	D	D	D	D	D	D
d_A, Approach Delay [s/veh]	17.05				26.35		39.78				44.53	
Approach LOS	B				C		D				D	
d_I, Intersection Delay [s/veh]	23.50											
Intersection LOS	C											
Intersection V/C	0.798											

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 1: Arnold Drive/Madrone Road

Control Type:	All-way stop	Delay (sec / veh):	25.3
Analysis Method:	HCM 2010	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.864

Intersection Setup

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	⌂			⌂			+			⌂		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	0	0	0	0	1	0	0
Pocket Length [ft]	60.00	100.00	100.00	70.00	100.00	100.00	100.00	100.00	100.00	190.00	100.00	100.00
Speed [mph]	35.00			45.00			25.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Base Volume Input [veh/h]	0	240	152	41	299	0	0	0	2	131	2	46
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	290	184	50	362	0	0	0	2	159	2	56
Peak Hour Factor	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	81	52	14	102	0	0	0	1	45	1	16
Total Analysis Volume [veh/h]	0	326	207	56	407	0	0	0	2	179	2	63
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings**Lanes**

Capacity per Entry Lane [veh/h]	589	617	537	581	480	465	551
Degree of Utilization, x	0.00	0.86	0.10	0.70	0.00	0.38	0.12



Movement, Approach, & Intersection Results

95th-Percentile Queue Length [v/t]	0.00	9.84	0.35	5.58	0.01	1.79	0.40
95th-Percentile Queue Length [ft]	0.00	245.97	8.68	139.59	0.31	44.69	9.97
Approach Delay [s/veh]	34.57		20.66		10.54	13.84	
Approach LOS	D		C		B		B
Intersection Delay [s/veh]	25.27						
Intersection LOS	D						

Intersection Level Of Service Report
Intersection 2: SR 12/Madrone Rd

Control Type:	Signalized	Delay (sec / veh):	22.7
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.782

Intersection Setup

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	0	0	0	0	0	0
Pocket Length [ft]	120.00	100.00	100.00	120.00	100.00	270.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	50.00			50.00			30.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			No			Yes			No		

Volumes

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Base Volume Input [veh/h]	56	475	1	3	558	121	107	0	62	2	1	1
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	40	0	0	36	0	0	0
Total Hourly Volume [veh/h]	72	608	1	4	714	115	137	0	43	3	1	1
Peak Hour Factor	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	19	160	0	1	188	30	36	0	11	1	0	0
Total Analysis Volume [veh/h]	76	640	1	4	752	121	144	0	45	3	1	1
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	120
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	23.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Split	Split	Split	Split	Split	Split
Signal group	1	6	0	5	2	0	0	4	0	0	3	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	11	15	0	11	15	0	0	12	0	0	12	0
Maximum Green [s]	25	80	0	25	80	0	0	25	0	0	25	0
Amber [s]	5.2	5.2	0.0	5.2	5.2	0.0	0.0	4.8	0.0	0.0	4.1	0.0
All red [s]	1.0	1.0	0.0	1.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	32	86	0	31	86	0	0	31	0	0	30	0
Vehicle Extension [s]	3.0	3.0	0.0	3.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	0	0	0	7	0	0	7	0	0	0	0
Pedestrian Clearance [s]	0	0	0	0	30	0	0	20	0	0	0	0
Rest In Walk	No			No				No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	4.2	4.2	0.0	4.2	4.2	0.0	0.0	3.8	0.0	0.0	3.1	0.0
Minimum Recall	No	Yes		No	Yes			No			No	
Maximum Recall	No	No		No	No			No			No	
Pedestrian Recall	No	No		No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	L	C	R	C	C
C, Cycle Length [s]	81	81	81	81	81	81	81
L, Total Lost Time per Cycle [s]	6.20	6.20	6.20	6.20	6.20	5.80	5.10
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	4.20	4.20	4.20	4.20	4.20	3.80	3.10
g_i, Effective Green Time [s]	9	43	1	35	35	12	1
g / C, Green / Cycle	0.11	0.54	0.01	0.44	0.44	0.15	0.02
(v / s)_l Volume / Saturation Flow Rate	0.04	0.34	0.00	0.40	0.08	0.11	0.00
s, saturation flow rate [veh/h]	1774	1862	1774	1863	1583	1725	1749
c, Capacity [veh/h]	198	1000	21	814	692	253	28
d1, Uniform Delay [s]	33.26	13.20	39.49	21.46	13.86	33.00	39.19
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.21	0.69	4.33	5.07	0.12	4.37	3.04
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.38	0.64	0.19	0.92	0.17	0.75	0.18
d, Delay for Lane Group [s/veh]	34.47	13.89	43.83	26.53	13.98	37.37	42.23
Lane Group LOS	C	B	D	C	B	D	D
Critical Lane Group	Yes	No	No	Yes	No	Yes	Yes
50th-Percentile Queue Length [veh/ln]	1.34	6.63	0.10	12.28	1.18	3.75	0.12
50th-Percentile Queue Length [ft/ln]	33.62	165.71	2.47	306.89	29.48	93.75	3.02
95th-Percentile Queue Length [veh/ln]	2.42	10.85	0.18	18.02	2.12	6.75	0.22
95th-Percentile Queue Length [ft/ln]	60.51	271.27	4.44	450.54	53.06	168.76	5.43

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	34.47	13.89	13.89	43.83	26.53	13.98	37.37	37.37	37.37	42.23	42.23	42.23
Movement LOS	C	B	B	D	C	B	D	D	D	D	D	D
d_A, Approach Delay [s/veh]	16.07			24.88			37.37			42.23		
Approach LOS	B			C			D			D		
d_I, Intersection Delay [s/veh]	22.72											
Intersection LOS	C											
Intersection V/C	0.782											

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 1: Arnold Drive/Madrone Road

Control Type:	All-way stop	Delay (sec / veh):	18.6
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.764

Intersection Setup

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	0	0	0	0	1	0	0
Pocket Length [ft]	60.00	100.00	100.00	70.00	100.00	100.00	100.00	100.00	100.00	190.00	100.00	100.00
Speed [mph]	35.00			45.00			25.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Base Volume Input [veh/h]	1	250	169	45	274	1	3	1	3	165	0	44
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	5	1	10	3	0	0	0	0	1	0	12
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	1	255	170	55	277	1	3	1	3	166	0	56
Peak Hour Factor	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	72	48	16	79	0	1	0	1	47	0	16
Total Analysis Volume [veh/h]	1	290	193	63	315	1	3	1	3	189	0	64
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings**Lanes**

Capacity per Entry Lane [veh/h]	556	633	543	589	484	490	587
Degree of Utilization, x	0.00	0.76	0.12	0.54	0.01	0.39	0.11

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [v/t]	0.01	7.05	0.39	3.18	0.04	1.80	0.37
95th-Percentile Queue Length [ft]	0.14	176.13	9.77	79.39	1.10	45.04	9.14
Approach Delay [s/veh]	24.37		14.75		10.55		13.34
Approach LOS	C		B		B		B
Intersection Delay [s/veh]	18.55						
Intersection LOS	C						

Intersection Level Of Service Report
Intersection 2: SR 12/Madrone Rd

Control Type:	Signalized	Delay (sec / veh):	21.4
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.675

Intersection Setup

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	0	0	0	0	0	0
Pocket Length [ft]	120.00	100.00	100.00	120.00	100.00	270.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	50.00			50.00			30.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			No			Yes			No		

Volumes

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Base Volume Input [veh/h]	75	540	1	4	557	126	114	1	61	4	2	3
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	5	0	0	0	0	8	7	0	4	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	44	0	0	41	0	0	3
Total Hourly Volume [veh/h]	80	540	1	4	557	90	121	1	24	4	2	0
Peak Hour Factor	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	21	141	0	1	145	23	32	0	6	1	1	0
Total Analysis Volume [veh/h]	83	563	1	4	580	94	126	1	25	4	2	0
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	120
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	23.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Split	Split	Split	Split	Split	Split
Signal group	1	6	0	5	2	0	0	4	0	0	3	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	11	15	0	11	15	0	0	12	0	0	12	0
Maximum Green [s]	25	80	0	25	80	0	0	25	0	0	25	0
Amber [s]	5.2	5.2	0.0	5.2	5.2	0.0	0.0	4.8	0.0	0.0	4.1	0.0
All red [s]	1.0	1.0	0.0	1.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	32	86	0	31	86	0	0	31	0	0	30	0
Vehicle Extension [s]	3.0	3.0	0.0	3.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	0	0	0	7	0	0	7	0	0	0	0
Pedestrian Clearance [s]	0	0	0	0	30	0	0	20	0	0	0	0
Rest In Walk	No			No				No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	4.2	4.2	0.0	4.2	4.2	0.0	0.0	3.8	0.0	0.0	3.1	0.0
Minimum Recall	No	Yes		No	Yes			No			No	
Maximum Recall	No	No		No	No			No			No	
Pedestrian Recall	No	No		No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	L	C	R	C	C
C, Cycle Length [s]	69	69	69	69	69	69	69
L, Total Lost Time per Cycle [s]	6.20	6.20	6.20	6.20	6.20	5.80	5.10
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	4.20	4.20	4.20	4.20	4.20	3.80	3.10
g_i, Effective Green Time [s]	9	32	1	24	24	11	1
g / C, Green / Cycle	0.13	0.46	0.01	0.35	0.35	0.17	0.02
(v / s)_l Volume / Saturation Flow Rate	0.05	0.30	0.00	0.31	0.06	0.09	0.00
s, saturation flow rate [veh/h]	1774	1862	1774	1863	1583	1740	1803
c, Capacity [veh/h]	227	866	21	650	553	287	34
d1, Uniform Delay [s]	27.45	14.12	33.65	21.15	15.48	26.26	33.20
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.99	0.83	4.24	4.51	0.14	1.51	2.36
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.37	0.65	0.19	0.89	0.17	0.53	0.17
d, Delay for Lane Group [s/veh]	28.44	14.96	37.88	25.66	15.63	27.77	35.56
Lane Group LOS	C	B	D	C	B	C	D
Critical Lane Group	Yes	No	No	Yes	No	Yes	Yes
50th-Percentile Queue Length [veh/ln]	1.18	5.40	0.09	8.08	0.88	2.29	0.12
50th-Percentile Queue Length [ft/ln]	29.53	134.92	2.13	202.09	22.12	57.30	2.98
95th-Percentile Queue Length [veh/ln]	2.13	9.21	0.15	12.75	1.59	4.13	0.21
95th-Percentile Queue Length [ft/ln]	53.15	230.16	3.84	318.65	39.81	103.14	5.37

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	28.44	14.96	14.96	37.88	25.66	15.63	27.77	27.77	27.77	35.56	35.56	35.56
Movement LOS	C	B	B	D	C	B	C	C	C	D	D	D
d_A, Approach Delay [s/veh]	16.69			24.34			27.77			35.56		
Approach LOS	B			C			C			D		
d_I, Intersection Delay [s/veh]	21.40											
Intersection LOS	C											
Intersection V/C	0.675											

Sequence


Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 1: Arnold Drive/Madrone Road

Control Type:	All-way stop	Delay (sec / veh):	16.5
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.699

Intersection Setup

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	0	0	0	0	1	0	0
Pocket Length [ft]	60.00	100.00	100.00	70.00	100.00	100.00	100.00	100.00	100.00	190.00	100.00	100.00
Speed [mph]	35.00			45.00			25.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Base Volume Input [veh/h]	0	240	152	41	299	0	0	0	2	131	2	46
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	8	1	20	8	0	0	0	0	1	0	21
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	248	153	61	307	0	0	0	2	132	2	67
Peak Hour Factor	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	70	43	17	86	0	0	0	1	37	1	19
Total Analysis Volume [veh/h]	0	279	172	69	345	0	0	0	2	148	2	75
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings**Lanes**

Capacity per Entry Lane [veh/h]	616	645	564	612	527	493	589
Degree of Utilization, x	0.00	0.70	0.12	0.56	0.00	0.30	0.13

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [v/t]	0.00	5.65	0.42	3.50	0.01	1.25	0.45
95th-Percentile Queue Length [ft]	0.00	141.29	10.39	87.58	0.29	31.29	11.19
Approach Delay [s/veh]	20.19		14.90		9.86		11.95
Approach LOS	C		B		A		B
Intersection Delay [s/veh]	16.47						
Intersection LOS	C						

Intersection Level Of Service Report
Intersection 2: SR 12/Madrone Rd

Control Type:	Signalized	Delay (sec / veh):	20.9
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.683

Intersection Setup

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	0	0	0	0	0	0
Pocket Length [ft]	120.00	100.00	100.00	120.00	100.00	270.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	50.00			50.00			30.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			No			Yes			No		

Volumes

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Base Volume Input [veh/h]	56	475	1	3	558	121	107	0	62	2	1	1
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	9	0	0	0	0	14	13	0	9	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	40	0	0	36	0	0	0
Total Hourly Volume [veh/h]	65	475	1	3	558	95	120	0	35	2	1	1
Peak Hour Factor	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	17	125	0	1	147	25	32	0	9	1	0	0
Total Analysis Volume [veh/h]	68	500	1	3	587	100	126	0	37	2	1	1
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	120
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	23.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Split	Split	Split	Split	Split	Split
Signal group	1	6	0	5	2	0	0	4	0	0	3	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	11	15	0	11	15	0	0	12	0	0	12	0
Maximum Green [s]	25	80	0	25	80	0	0	25	0	0	25	0
Amber [s]	5.2	5.2	0.0	5.2	5.2	0.0	0.0	4.8	0.0	0.0	4.1	0.0
All red [s]	1.0	1.0	0.0	1.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	32	86	0	31	86	0	0	31	0	0	30	0
Vehicle Extension [s]	3.0	3.0	0.0	3.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	0	0	0	7	0	0	7	0	0	0	0
Pedestrian Clearance [s]	0	0	0	0	30	0	0	20	0	0	0	0
Rest In Walk	No			No				No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	4.2	4.2	0.0	4.2	4.2	0.0	0.0	3.8	0.0	0.0	3.1	0.0
Minimum Recall	No	Yes		No	Yes			No			No	
Maximum Recall	No	No		No	No			No			No	
Pedestrian Recall	No	No		No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	L	C	R	C	C
C, Cycle Length [s]	67	67	67	67	67	67	67
L, Total Lost Time per Cycle [s]	6.20	6.20	6.20	6.20	6.20	5.80	5.10
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	4.20	4.20	4.20	4.20	4.20	3.80	3.10
g_i, Effective Green Time [s]	8	31	1	24	24	11	1
g / C, Green / Cycle	0.12	0.46	0.01	0.35	0.35	0.17	0.01
(v / s)_l Volume / Saturation Flow Rate	0.04	0.27	0.00	0.32	0.06	0.09	0.00
s, saturation flow rate [veh/h]	1774	1862	1774	1863	1583	1727	1742
c, Capacity [veh/h]	209	862	16	659	560	293	23
d1, Uniform Delay [s]	27.29	13.32	33.19	20.57	15.03	25.69	32.95
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.89	0.62	5.48	4.40	0.15	1.65	3.63
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.32	0.58	0.19	0.89	0.18	0.56	0.18
d, Delay for Lane Group [s/veh]	28.18	13.94	38.67	24.96	15.19	27.34	36.58
Lane Group LOS	C	B	D	C	B	C	D
Critical Lane Group	Yes	No	No	Yes	No	Yes	Yes
50th-Percentile Queue Length [veh/ln]	0.95	4.45	0.07	7.93	0.91	2.41	0.09
50th-Percentile Queue Length [ft/ln]	23.78	111.17	1.72	198.17	22.76	60.30	2.16
95th-Percentile Queue Length [veh/ln]	1.71	7.90	0.12	12.54	1.64	4.34	0.16
95th-Percentile Queue Length [ft/ln]	42.80	197.62	3.10	313.60	40.97	108.54	3.88

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	28.18	13.94	13.94	38.67	24.96	15.19	27.34	27.34	27.34	36.58	36.58	36.58
Movement LOS	C	B	B	D	C	B	C	C	C	D	D	D
d_A, Approach Delay [s/veh]	15.64			23.61			27.34			36.58		
Approach LOS	B			C			C			D		
d_I, Intersection Delay [s/veh]	20.89											
Intersection LOS	C											
Intersection V/C	0.683											

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 1: Arnold Drive/Madrone Road

Control Type:	All-way stop	Delay (sec / veh):	29.5
Analysis Method:	HCM 2010	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.895

Intersection Setup

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	0	0	0	0	1	0	0
Pocket Length [ft]	60.00	100.00	100.00	70.00	100.00	100.00	100.00	100.00	100.00	190.00	100.00	100.00
Speed [mph]	35.00			45.00			25.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Base Volume Input [veh/h]	8	285	169	65	382	13	7	1	5	167	0	59
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	5	1	10	3	0	0	0	0	1	0	12
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	8	290	170	75	385	13	7	1	5	168	0	71
Peak Hour Factor	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800	0.8800
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	2	82	48	21	109	4	2	0	1	48	0	20
Total Analysis Volume [veh/h]	9	330	193	85	438	15	8	1	6	191	0	81
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings**Lanes**

Capacity per Entry Lane [veh/h]	519	584	520	562	433	453	535
Degree of Utilization, x	0.02	0.90	0.16	0.81	0.03	0.42	0.15

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [v/t]	0.05	10.70	0.58	7.87	0.11	2.06	0.53
95th-Percentile Queue Length [ft]	1.32	267.38	14.52	196.87	2.68	51.51	13.26
Approach Delay [s/veh]	39.91		27.32		11.60	14.64	
Approach LOS	E		D		B		B
Intersection Delay [s/veh]	29.54						
Intersection LOS	D						

Intersection Level Of Service Report
Intersection 2: SR 12/Madrone Rd

Control Type:	Signalized	Delay (sec / veh):	23.8
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.809

Intersection Setup

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	0	0	0	0	0	0
Pocket Length [ft]	120.00	100.00	100.00	120.00	100.00	270.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	50.00			50.00			30.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			No			Yes			No		

Volumes

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Base Volume Input [veh/h]	93	702	1	4	777	126	114	1	82	4	2	3
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	5	0	0	0	0	8	7	0	4	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	44	0	0	41	0	0	3
Total Hourly Volume [veh/h]	98	702	1	4	777	90	121	1	45	4	2	0
Peak Hour Factor	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	26	183	0	1	202	23	32	0	12	1	1	0
Total Analysis Volume [veh/h]	102	731	1	4	809	94	126	1	47	4	2	0
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	120
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	23.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Split	Split	Split	Split	Split	Split
Signal group	1	6	0	5	2	0	0	4	0	0	3	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	11	15	0	11	15	0	0	12	0	0	12	0
Maximum Green [s]	25	80	0	25	80	0	0	25	0	0	25	0
Amber [s]	5.2	5.2	0.0	5.2	5.2	0.0	0.0	4.8	0.0	0.0	4.1	0.0
All red [s]	1.0	1.0	0.0	1.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	32	86	0	31	86	0	0	31	0	0	30	0
Vehicle Extension [s]	3.0	3.0	0.0	3.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	0	0	0	7	0	0	7	0	0	0	0
Pedestrian Clearance [s]	0	0	0	0	30	0	0	20	0	0	0	0
Rest In Walk	No			No				No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	4.2	4.2	0.0	4.2	4.2	0.0	0.0	3.8	0.0	0.0	3.1	0.0
Minimum Recall	No	Yes		No	Yes			No			No	
Maximum Recall	No	No		No	No			No			No	
Pedestrian Recall	No	No		No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	L	C	R	C	C
C, Cycle Length [s]	87	87	87	87	87	87	87
L, Total Lost Time per Cycle [s]	6.20	6.20	6.20	6.20	6.20	5.80	5.10
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	4.20	4.20	4.20	4.20	4.20	3.80	3.10
g_i, Effective Green Time [s]	10	50	1	41	41	12	2
g / C, Green / Cycle	0.12	0.57	0.01	0.46	0.46	0.14	0.02
(v / s)_l Volume / Saturation Flow Rate	0.06	0.39	0.00	0.43	0.06	0.10	0.00
s, saturation flow rate [veh/h]	1774	1862	1774	1863	1583	1719	1803
c, Capacity [veh/h]	205	1057	21	865	735	233	34
d1, Uniform Delay [s]	36.31	13.46	42.81	22.20	13.35	36.39	42.25
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.87	0.82	4.38	5.49	0.08	4.77	2.46
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.50	0.69	0.19	0.94	0.13	0.75	0.18
d, Delay for Lane Group [s/veh]	38.19	14.28	47.19	27.69	13.43	41.16	44.72
Lane Group LOS	D	B	D	C	B	D	D
Critical Lane Group	Yes	No	No	Yes	No	Yes	Yes
50th-Percentile Queue Length [veh/ln]	2.02	8.33	0.11	14.51	0.94	3.81	0.15
50th-Percentile Queue Length [ft/ln]	50.50	208.17	2.66	362.67	23.43	95.33	3.76
95th-Percentile Queue Length [veh/ln]	3.64	13.06	0.19	20.75	1.69	6.86	0.27
95th-Percentile Queue Length [ft/ln]	90.89	326.48	4.78	518.83	42.18	171.60	6.77

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	38.19	14.28	14.28	47.19	27.69	13.43	41.16	41.16	41.16	44.72	44.72	44.72
Movement LOS	D	B	B	D	C	B	D	D	D	D	D	D
d_A, Approach Delay [s/veh]	17.20				26.30		41.16				44.72	
Approach LOS	B				C		D				D	
d_I, Intersection Delay [s/veh]							23.75					
Intersection LOS	C											
Intersection V/C	0.809											

Sequence


Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 1: Arnold Drive/Madrone Road

Control Type:	All-way stop	Delay (sec / veh):	28.3
Analysis Method:	HCM 2010	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.904

Intersection Setup

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	0	0	0	0	1	0	0
Pocket Length [ft]	60.00	100.00	100.00	70.00	100.00	100.00	100.00	100.00	100.00	190.00	100.00	100.00
Speed [mph]	35.00			45.00			25.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Arnold Drive			Arnold Drive			Madrone Road			Madrone Road		
Base Volume Input [veh/h]	0	240	152	41	299	0	0	0	2	131	2	46
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	8	1	20	8	0	0	0	0	1	0	21
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	298	185	70	370	0	0	0	2	160	2	77
Peak Hour Factor	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900	0.8900
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	84	52	20	104	0	0	0	1	45	1	22
Total Analysis Volume [veh/h]	0	335	208	79	416	0	0	0	2	180	2	87
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings**Lanes**

Capacity per Entry Lane [veh/h]	574	601	527	568	465	458	541
Degree of Utilization, x	0.00	0.90	0.15	0.73	0.00	0.39	0.16


Movement, Approach, & Intersection Results

95th-Percentile Queue Length [v/t]	0.00	11.13	0.52	6.18	0.01	1.85	0.58
95th-Percentile Queue Length [ft]	0.00	278.19	13.12	154.40	0.32	46.18	14.62
Approach Delay [s/veh]	41.07		22.17		10.77	13.95	
Approach LOS	E		C		B		B
Intersection Delay [s/veh]	28.31						
Intersection LOS	D						

Intersection Level Of Service Report
Intersection 2: SR 12/Madrone Rd

Control Type:	Signalized	Delay (sec / veh):	23.6
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.804

Intersection Setup

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	1	0	0	0	0	0	0
Pocket Length [ft]	120.00	100.00	100.00	120.00	100.00	270.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	50.00			50.00			30.00			25.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			No			Yes			No		

Volumes

Name	SR 12			SR 12			Madrone Road			Winery Driveway		
Base Volume Input [veh/h]	56	475	1	3	558	121	107	0	62	2	1	1
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	9	0	0	0	0	14	13	0	9	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	0	0	40	0	0	36	0	0	0
Total Hourly Volume [veh/h]	81	608	1	4	714	129	150	0	52	3	1	1
Peak Hour Factor	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	21	160	0	1	188	34	39	0	14	1	0	0
Total Analysis Volume [veh/h]	85	640	1	4	752	136	158	0	55	3	1	1
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	120
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	23.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Split	Split	Split	Split	Split	Split
Signal group	1	6	0	5	2	0	0	4	0	0	3	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	11	15	0	11	15	0	0	12	0	0	12	0
Maximum Green [s]	25	80	0	25	80	0	0	25	0	0	25	0
Amber [s]	5.2	5.2	0.0	5.2	5.2	0.0	0.0	4.8	0.0	0.0	4.1	0.0
All red [s]	1.0	1.0	0.0	1.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	32	86	0	31	86	0	0	31	0	0	30	0
Vehicle Extension [s]	3.0	3.0	0.0	3.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	0	0	0	7	0	0	7	0	0	0	0
Pedestrian Clearance [s]	0	0	0	0	30	0	0	20	0	0	0	0
Rest In Walk	No			No				No			No	
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	4.2	4.2	0.0	4.2	4.2	0.0	0.0	3.8	0.0	0.0	3.1	0.0
Minimum Recall	No	Yes		No	Yes			No			No	
Maximum Recall	No	No		No	No			No			No	
Pedestrian Recall	No	No		No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	L	C	R	C	C
C, Cycle Length [s]	82	82	82	82	82	82	82
L, Total Lost Time per Cycle [s]	6.20	6.20	6.20	6.20	6.20	5.80	5.10
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	4.20	4.20	4.20	4.20	4.20	3.80	3.10
g_i, Effective Green Time [s]	9	44	1	36	36	12	1
g / C, Green / Cycle	0.11	0.54	0.01	0.44	0.44	0.15	0.02
(v / s)_l Volume / Saturation Flow Rate	0.05	0.34	0.00	0.40	0.09	0.12	0.00
s, saturation flow rate [veh/h]	1774	1862	1774	1863	1583	1721	1749
c, Capacity [veh/h]	204	1005	21	813	691	256	28
d1, Uniform Delay [s]	33.80	13.27	40.21	21.87	14.26	33.95	39.90
k, delay calibration	0.11	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.36	0.68	4.37	5.10	0.14	6.83	3.06
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.42	0.64	0.19	0.92	0.20	0.83	0.18
d, Delay for Lane Group [s/veh]	35.16	13.95	44.58	26.96	14.40	40.78	42.96
Lane Group LOS	D	B	D	C	B	D	D
Critical Lane Group	Yes	No	No	Yes	No	Yes	Yes
50th-Percentile Queue Length [veh/ln]	1.54	6.74	0.10	12.57	1.37	4.50	0.12
50th-Percentile Queue Length [ft/ln]	38.47	168.46	2.51	314.18	34.33	112.51	3.07
95th-Percentile Queue Length [veh/ln]	2.77	11.00	0.18	18.38	2.47	7.98	0.22
95th-Percentile Queue Length [ft/ln]	69.25	274.88	4.52	459.53	61.79	199.49	5.52

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	35.16	13.95	13.95	44.58	26.96	14.40	40.78	40.78	40.78	42.96	42.96	42.96
Movement LOS	D	B	B	D	C	B	D	D	D	D	D	D
d_A, Approach Delay [s/veh]	16.43			25.13			40.78			42.96		
Approach LOS	B			C			D			D		
d_I, Intersection Delay [s/veh]	23.55											
Intersection LOS	C											
Intersection V/C	0.804											

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Appendix C

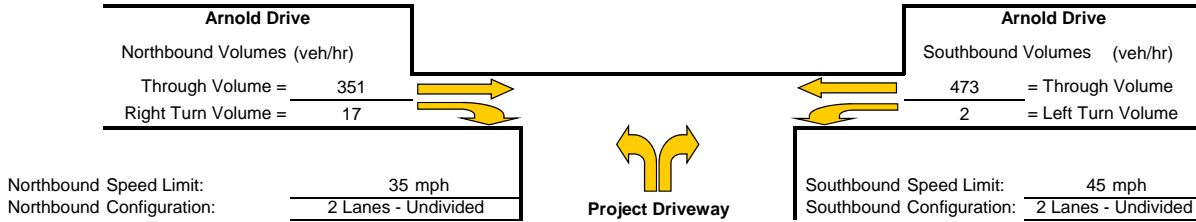
Turn Lane Warrants

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Arnold Drive and Project Driveway
Study Scenario: Weekday PM Future plus Project

Direction of Analysis Street: North/South

Cross Street Intersects: From the East



Northbound 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 = 922.6
Advancing Volume Va = 368
If AV < Va then warrant is met No

Right Turn Lane Warranted: NO

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

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

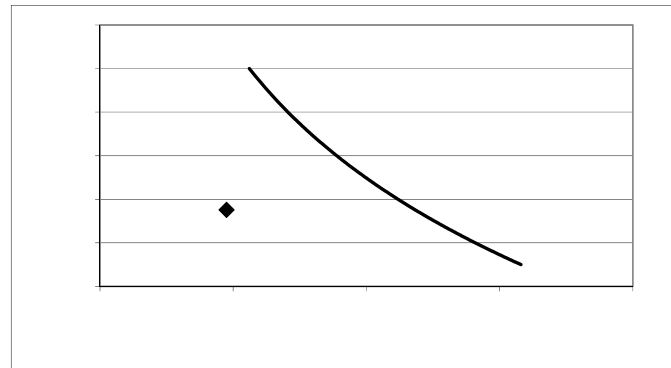
2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV = -
Advancing Volume Va = 368
If AV < Va then warrant is met -

Right Turn Taper Warranted: NO

Southbound Left Turn Lane Warrants

Percentage Left Turns %lt 0.4 %
Advancing Volume Threshold AV 1183 veh/hr
If AV < Va then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 45 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.

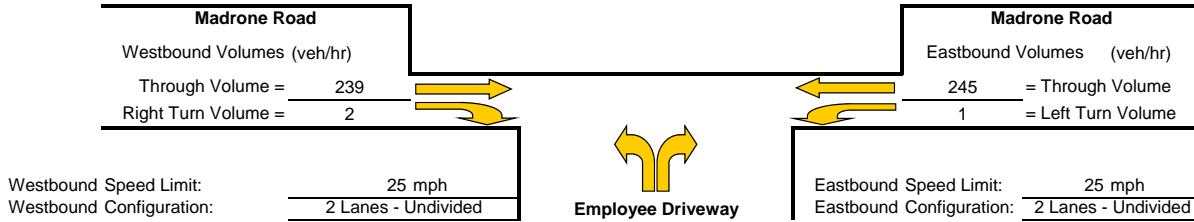
The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Madrone Road and Employee Driveway
Study Scenario: Weekday PM Future plus Project

Direction of Analysis Street: East/West

Cross Street Intersects: From the North



Westbound 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 = 1035.1
Advancing Volume Va = 241
If $AV < Va$ then warrant is met No

Right Turn Lane Warranted: NO

Westbound 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 = 241
If $AV < Va$ then warrant is met -

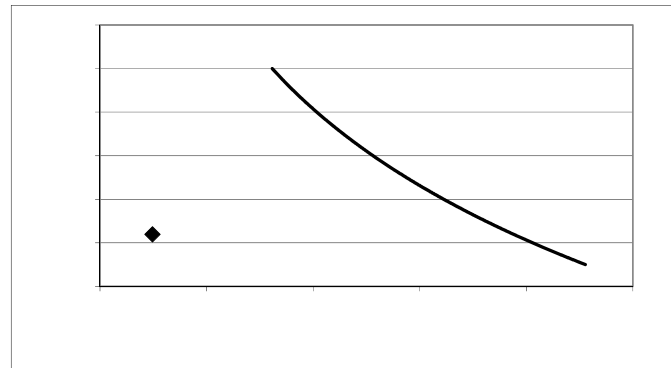
Right Turn Taper Warranted: NO

Eastbound Left Turn Lane Warrants

Percentage Left Turns %lt 0.4 %

Advancing Volume Threshold AV 1940 veh/hr

If $AV < Va$ then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 25 mph

Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

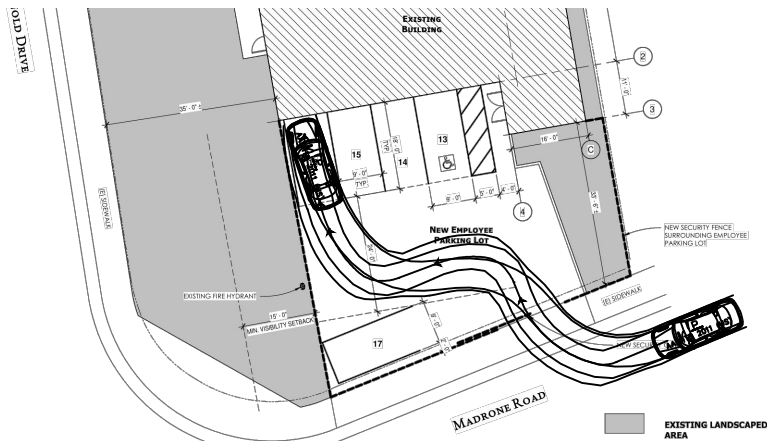
Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements*, January 1997.

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.

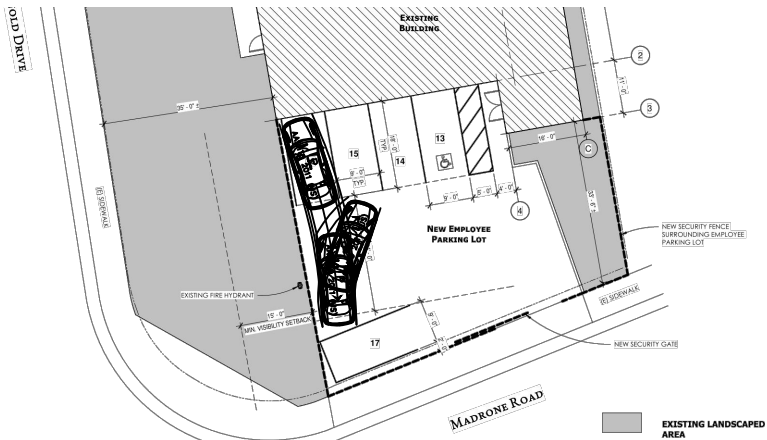
Appendix D

On-Site Circulation Exhibit

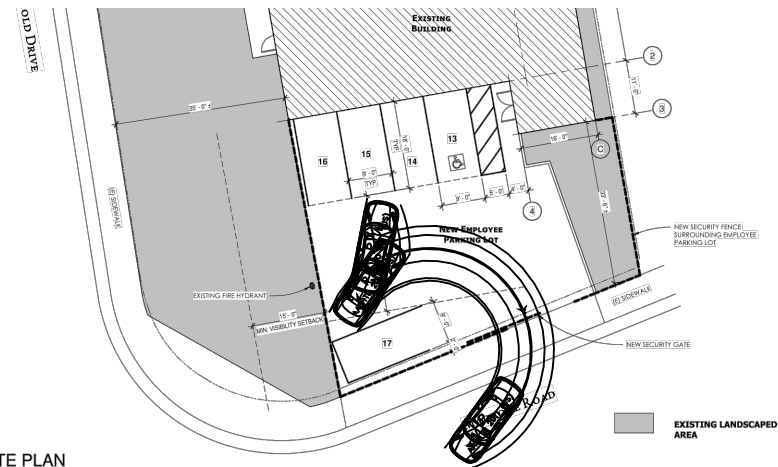


1 SITE PLAN
1" = 10'-0"

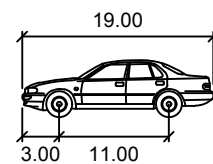
Inbound from Madrone Road Driveway



1 SITE PLAN
1" = 10'-0"



1 SITE PLAN
1" = 10'-0"



P

	feet
Width	: 7.00
Track	: 6.00
Lock to Lock Time	: 6.0
Steering Angle	: 31.6

Outbound from Employee Parking Lot

