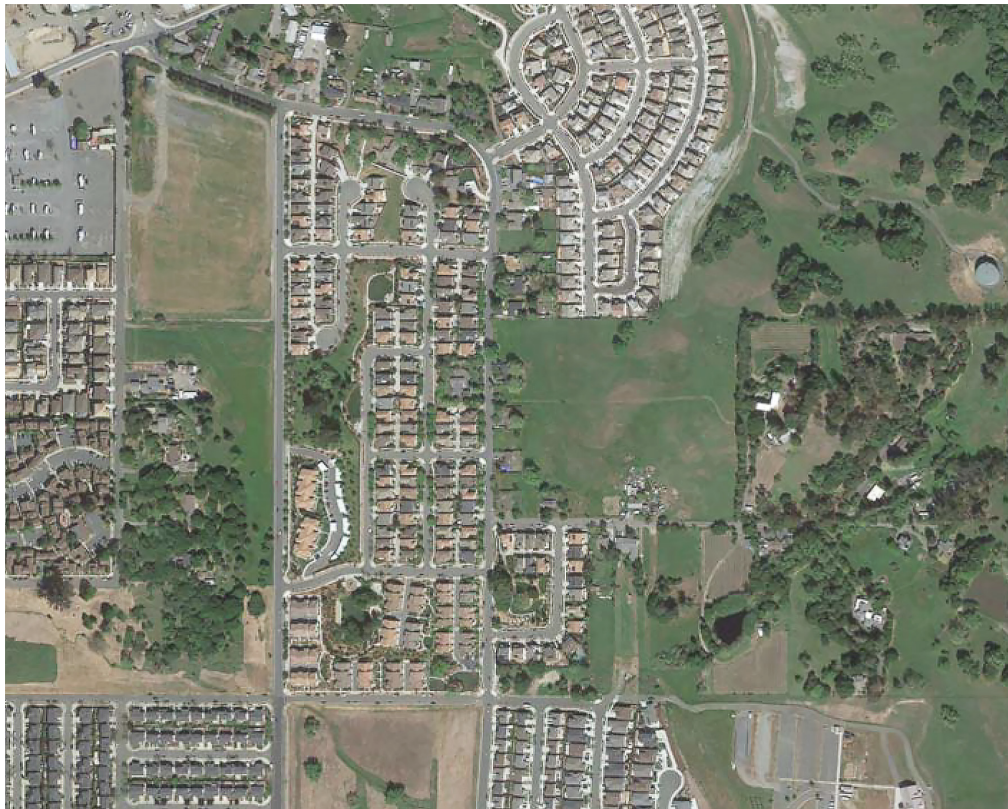




Traffic Impact Study for the Penstemon Place



Prepared for the City of Santa Rosa

Submitted by
W-Trans

January 11, 2018



**TRAFFIC ENGINEERING
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Executive Summary

The proposed Penstemon Place project includes 59 single-family detached dwellings, six of which would have a second unit, to be located on the large undeveloped plot of land south of Verbena Drive and east and north of Linwood Avenue. The project would be expected to generate an average of 602 trips on a daily basis, including 47 during the morning peak hour and 63 during the p.m. peak hour. The six houses existing on site but will be eliminated as part of the project, but to be conservative, no deduction was applied to the trip generation to reflect the replace of these existing units. The peak hour trips related to the construction are expected to be less than what is anticipated for the project upon its occupation.

Project impacts were evaluated at five intersections in the vicinity of the project site. Under the existing conditions and upon the addition of project trips, the intersections are expected to continue operating acceptably. Under future volumes, the Aston Avenue/Linwood Avenue intersection is projected to operate at LOS F during the p.m. peak hour without the project. It is recommended that a separate left-turn/through lane be installed on the northbound approach. With the recommended improvement, the intersection would operate acceptably without and with the project. The project applicant's proportional share of the cost of the recommended improvements is 12.4 percent, or \$27,827. All other intersections are expected to operate at an acceptable level of service under future volumes.

Three access points to the site are proposed: Verbena Drive to the north, Poinsettia Lane from the east, completing the fourth leg of the intersection, and on Linwood Avenue to the south about 180 feet from Hibiscus Drive. An all-way stop-control warrant was performed for the proposed four-legged intersection of Linwood Avenue and Poinsettia Lane. Based on the warrant analysis, all-way stop control is warranted through one of the optional criteria and recommended to improve sight lines.

Facilities for pedestrians and bicyclists include sidewalks on most adjacent street and bike lanes on Brookwood Avenue and Kawana Springs Road. Access for these modes would be acceptable upon construction of sidewalks along the project street frontages. However, the proposed project does not conform to the existing geometry at the intersection of Poinsettia Lane/Linwood Avenue which has bulb-outs on each corner. To maintain conformity, it is recommended that the site plan be updated to include bulb-outs. There are currently no bus routes that service the area and the closest bus stop is 0.8 miles from the propose project site. To improve transit access, the project applicant should request bus service to the neighborhood.

Introduction

This report presents an analysis of the potential traffic impacts that would be associated with development of the Penstemon Place residential project to be located south of Verbena Drive and north and east of Linwood Avenue in the City of Santa Rosa. The traffic study was completed in accordance with the criteria established by the City, reflects a scope of work approved by City staff, and is consistent with standard traffic engineering techniques.

Prelude

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

Project Profile

The proposed project would consist of 59 single family dwellings, six of which would have second detached units. Three access points are proposed for the site; one would connect to Verbena Drive to the north, another would replace the existing driveway on the east leg of the Poinsettia Lane/Linwood Avenue intersection, and the last would connect to Linwood Avenue on the south side of the project boundary about 180 feet east of Hibiscus Drive. There are currently six existing single family dwellings on-site. The project site is shown in Figure 1.



LEGEND

- Study Intersection

Traffic Impact Study for the Penstemon Place Project
Figure 1 – Study Area & Lane Configurations



Transportation Setting

Operational Analysis

Study Area and Periods

The study area consists of the following intersections:

1. Aston Avenue/Meda Avenue
2. Aston Avenue/Linwood Avenue
3. Linwood Avenue/Poinsettia Lane
4. Taylor Mountain Place/Kawana Springs Road
5. Petaluma Hill Road/Kawana Springs Road

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

Study Intersections

Aston Avenue/Meda Avenue is a tee intersection with one lane on each approach. There is stop control on the south leg of Meda Avenue. There are crosswalks on the south and west legs of the intersection. The intersection is directly west of the intersection of Aston Avenue/Linwood Avenue, as described below.

Aston Avenue/Linwood Avenue is a two-way stop-controlled four-legged intersection with stop controls on the north and south legs. The north leg is one of the access points to the fairgrounds. With the exception of the north leg, which has two lanes, all other approaches have single lanes. There are crosswalks on all legs except the west leg. The intersection is directly east of the intersection of Aston Avenue/Meda Avenue.

Linwood Avenue/Poinsettia Lane is a four-legged intersection with stop controls in the east-west direction. Currently, the east leg is a private driveway. While there are no crosswalks at the intersection, there are bulb-outs on the west side.

Taylor Mountain Place/Kawana Springs Road is a stop-controlled intersection with a stop sign on the southbound Taylor Mountain Place approach. Each approach has a single lane. There are no striped crosswalks at the intersection but there are curb ramps on the south and east sides of the intersection.

Petaluma Hill Road/Kawana Springs Road is a signalized four-legged intersection with protected-permitted left-turn phasing on each leg. There is a right-turn overlap in the southbound and eastbound directions. There are crosswalks with pedestrian phasing on the all but the south leg.

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 July 1, 2011 through June 30, 2016.

As presented in Table 1, the calculated collision rates for the study intersections were compared to average collision rates for similar facilities statewide, as indicated in *2013 Collision Data on California State Highways*, California Department of Transportation (Caltrans). Three of the five intersections have collision rates that are less than the statewide average. For the intersections with rates higher than the statewide average, further review was performed, as discussed below. The collision rate calculations are provided in Appendix A.

Table 1 – Collision Rates at the Study Intersections

Study Intersection	Number of Collisions (2011-2016)	Calculated Collision Rate (c/mve)	Statewide Average Collision Rate (c/mve)
1. Aston Ave/Meda Ave	4	0.29	0.18
2. Aston Ave/Linwood Ave	3	0.13	0.15
3. Linwood Ave/Poinsettia Ln	0.0	0	0.15
4. Taylor Mountain Pl/Kawana Springs Rd	0	0	0.18
5. Petaluma Hill Rd/Kawana Springs Rd	19	0.41	0.27

Note: c/mve = collisions per million vehicles entering

The intersections of Aston Avenue/Meda Avenue and Petaluma Hills Road/Kawana Springs Road have collision rates that are slightly higher than the statewide average for similar facilities. At the Aston Avenue intersection, two of the collisions involved hitting an object in the intersection and the other two types were a sideswipe and rear-end. Given the limited number collisions, there is no clear indication of any reason for concern. The higher average can be attributed to the low roadway volume, although not perceived as a concern.

The most common types of collisions that occurred at Petaluma Hills Road/Kawana Springs Road were rear-end, broadside, and head-on, with the primary cause being right-of-way violation. While rear-end collisions are generally common for busy signalized intersections, broadside and head-on collisions are more likely associated with the permitted left-turn phasing that is present on all approaches. It is noted that more than half of the collisions at the intersection occurred where vehicles were traveling on Petaluma Hill Road. Currently the intersection is scheduled to have flashing yellow arrows provided which may reduce the average collision rate at the intersection by indicating to drivers that the left-turn is permitted and not a protected movement.

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, crosswalks, pedestrian signals, and curb ramps provide access for pedestrians in the vicinity of the proposed project site; however, sidewalk gaps, obstacles, and barriers can be found along some of the roadways connecting to the project site. Existing gaps and obstacles along the connecting roadways impact convenient and continuous access for pedestrians and present safety concerns in those locations where appropriate pedestrian infrastructure would address potential conflict points.

- **Linwood Avenue** – Intermittent sidewalk coverage is provided on Linwood Avenue with gaps on one or both sides of the street between Aston Avenue and Taylor Mountain Place/Linwood Avenue. Sidewalks are

provided along frontages of more recently developed properties. Curb ramps exist at developed side street approaches.

- **Kawana Springs Road** – Continuous sidewalks are provided on one or both sides of Kawana Springs Road between Taylor Mountain Place and west of Petaluma Hill Road. There are no sidewalks on the north side for the length of road between Brookwood Avenue and Taylor Mountain Place. Sidewalks do not exist on the south side of the street from Meda Avenue to the west side of the Kawana Springs Road/Petaluma Hill Road intersection. There are acorn street lights on Kawana Springs Road.
- **Taylor Mountain Place** – Continuous sidewalks are provided on one side of Taylor Mountain Place between Tokay Street and Kawana Springs Road. Sidewalks do not exist on the west side of the street where the property has not been developed.

Bicycle Facilities

The *Highway Design Manual*, Caltrans, 2012, classifies bikeways into three categories:

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

Guidance for Class IV Bikeways is provided in *Design Information Bulletin Number 89: Class IV Bikeway Guidance (Separated Bikeways/Cycle Tracks)*, Caltrans, 2015.

- **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, Class II bike lanes exist on one or both sides of Brookwood Avenue between Linwood Avenue and Kawana Springs Road and Kawana Springs Road between Brookwood Avenue and Petaluma Hill Road. Bicyclists ride in the roadway and/or on sidewalks 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 Santa Rosa Bicycle and Pedestrian Master Plan* (2010).

Table 2 – Bicycle Facility Summary

Status Facility	Class	Length (miles)	Begin Point	End Point
Existing				
Colgan Creek Trail	I	0.6	Colgan Ave	Petaluma Hill Rd
Kawana Springs Rd	II	0.5	Petaluma Hill Rd	Brookwood Ave
Kawana Springs Rd (WB)	II	0.5	Santa Rosa Ave	Petaluma Hill Rd
Brookwood Ave	II	0.1	Kawana Springs Rd	Tokay St
Brookwood Ave (NB)	II	0.4	Tokay St	Linwood Ave
Petaluma Hill Rd	II	0.9	Barham Ave-Pressley St	Kawana Springs Rd
Aston Avenue	III	0.4	Hendley St	Brookwood Ave
Planned				
Colgan Creek Trail Ext.	I	0.5	Kawana Springs Rd	City Limits
Kawana Springs Rd (EB)	II	0.5	Santa Rosa Ave	Petaluma Hill Rd
Kawana Springs Rd	II	0.3	Brookwood Ave	Future Famers Ln Ext.
Linwood Ave	II	0.1	Aston Ave	Brookwood Ave
Aston Avenue	II	0.4	Hendley St	Brookwood Ave
Brookwood Ave (SB)	II	0.4	Linwood Ave	Tokay St
Farmers Road Ext.	II	1.9	Bennett Valley Rd	Yolanda Ave

Source: *The Santa Rosa Bicycle and Pedestrian Master Plan, 2010*

Transit Facilities

Santa Rosa CityBus provides fixed route bus service in Santa Rosa. There are two bus routes that have stops within the study area, specifically on Aston Avenue, Petaluma Hill Road and west of the Petaluma Hill Road/Kawana Springs Road intersection. Route 5 provides a 30-minute loop to destinations throughout southeast Santa Rosa from the Downtown Transit Mall, to the Sonoma County Fairgrounds, Santa Rosa Marketplace, and the Santa Rosa Town Center before returning. Route 18 is the Southeast Circulator route providing hourly loop service from the Downtown Transit Mall to the Santa Rosa Market Place, Farmers Lane Plaza, Eastside Transfer Center, and the Flamingo One Stop Shopping Center. These routes provide service on both weekdays and weekends.

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

Santa Rosa Paratransit, a door-to-door service, is available for those who are unable to independently use the transit system due to a physical or mental disability. Santa Rosa Paratransit is designed to serve the needs of individuals with disabilities within the Santa Rosa 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 Levels of Service for the intersections with side-street stop controls, or those which are unsignalized and have one or two approaches stop controlled, were analyzed using the “Two-Way Stop-Controlled” intersection capacity method from the HCM. This methodology determines a level of service for each minor turning movement by estimating the level of average delay in seconds per vehicle. Results are presented for individual movements together with the weighted overall average delay for the intersection.

The study intersections that are currently controlled by a traffic signal, or may be in the future, were 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 optimized signal timing.

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

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

Reference: *Highway Capacity Manual*, Transportation Research Board, 2010

Reporting of Peak Hour Delay

Per the City of Santa Rosa's General Plan policy T-D-1, LOS is calculated based on the average traffic demand over the hour, rather than the peak 15 minutes within the hour. This is particularly relevant in the study area, in that the average delays reported at some of the intersections over the course of an hour are not as long as what would be experienced during the peak 15 minutes during arrival and dismissal periods at the nearby school, Sonoma Academy.

Traffic Operation Standards

The City of Santa Rosa's adopted Level of Service (LOS) Standard is contained in *Santa Rosa General Plan 2035*. Standard TD-1 states that the City will try to maintain a Level of Service (LOS) D or better along all major corridors. Exceptions to meeting this standard are allowed where attainment would result in significant environmental degradation; where topography or environmental impacts make the improvement impossible; or where attainment would ensure loss of an area's unique character.

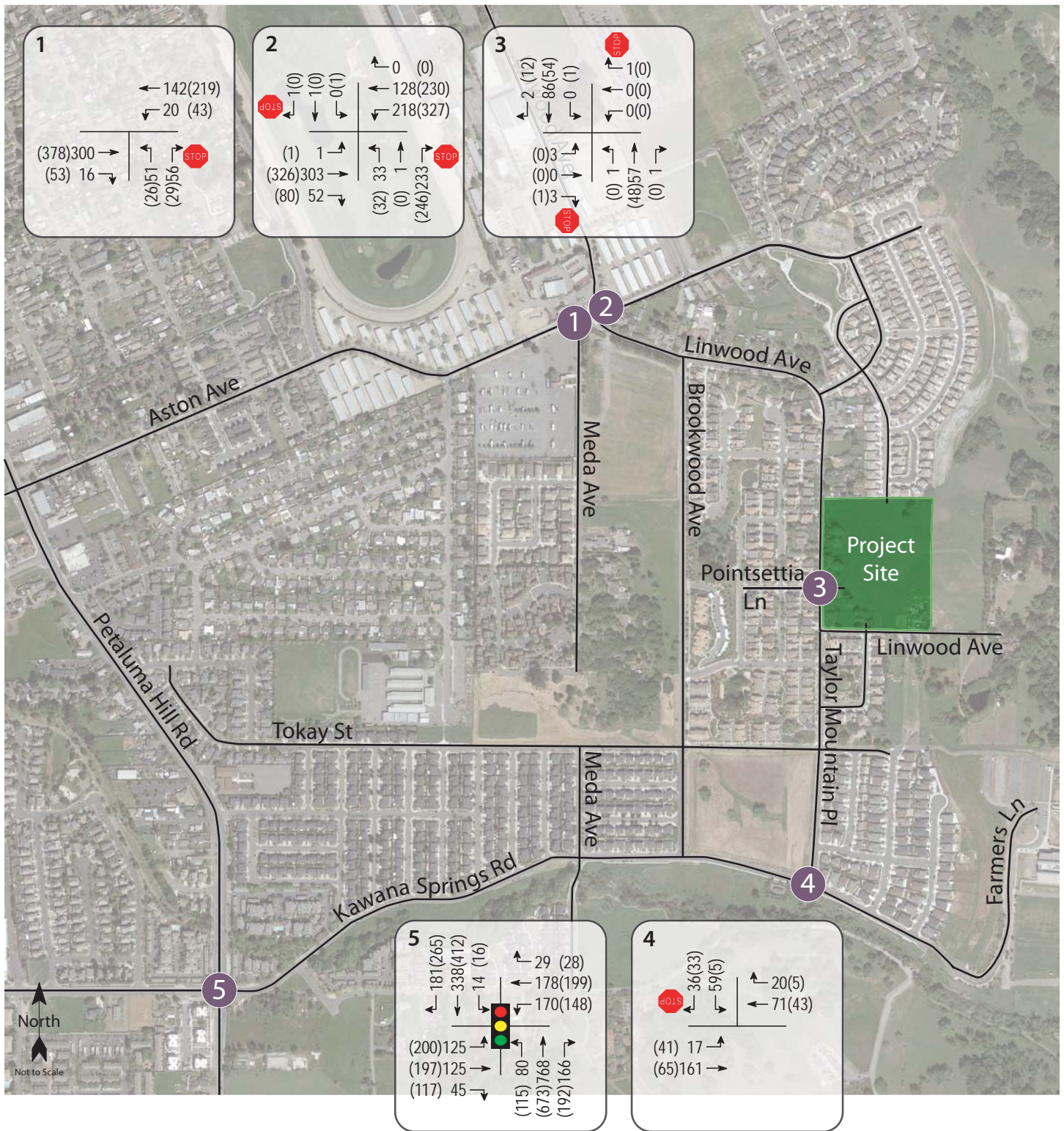
While a corridor level of service is applied by the City in its analysis of the entire City as part of the environmental documentation supporting the General Plan, this type of analysis only provides relevant data when performed on a much longer segment than the one included as the study area for the project. Therefore, although the City's standard does not specify criteria for intersections, for the purposes of this study a minimum operation of LOS D for the overall operation of signalized intersections was applied.

Existing Conditions

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the a.m. and p.m. peak periods. This condition does not include project-generated traffic volumes. Volume data was collected when while local schools were in session.

Intersection Levels of Service

Under existing conditions, the intersections are operating acceptably overall. The existing traffic volumes are shown in Figure 2, a summary of the intersection level of service calculations is contained in Table 4, and copies of the Level of Service calculations are provided in Appendix B.



LEGEND

- Study Intersection
- xx AM Peak Hour Volume
- (xx) PM Peak Hour Volume

Traffic Impact Study for the Penstemon Place Project
Figure 2 – Existing Traffic Volumes



Table 4 – Existing Peak Hour Intersection Levels of Service

Study Intersection Approach	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
1. Aston Ave/Meda Ave <i>Northbound (Meda Ave) Approach</i>	2.5 <i>12.1</i>	A <i>B</i>	1.5 <i>13.4</i>	A <i>B</i>
2. Aston Ave/Linwood Ave <i>Northbound (Linwood Ave) Approach</i> <i>Southbound (Fairgrounds) Approach</i>	6.9 <i>17.8</i> <i>15.5</i>	A <i>C</i> <i>C</i>	8.8 <i>28.0</i> <i>68.2</i>	A <i>D</i> <i>F</i>
3. Linwood Ave/Poinsettia Ln <i>Westbound (Private Driveway) Approach</i> <i>Eastbound (Poinsettia Ln) Approach</i>	0.5 <i>8.7</i> <i>9.3</i>	A <i>A</i> <i>A</i>	0.1 <i>0.0</i> <i>8.7</i>	A <i>A</i> <i>A</i>
4. Taylor Mountain Pl/Kawana Springs Rd <i>Southbound (Taylor Mountain Pl) Approach</i>	3.0 <i>10.2</i>	A <i>B</i>	3.4 <i>8.9</i>	A <i>A</i>
5. Petaluma Hill Rd/Kawana Springs Rd	23.1	C	25.1	C

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

The southbound approach to the Aston Avenue/Linwood Avenue intersection is currently operating unacceptably at service level F during the p.m. peak hour but the intersection overall is operating acceptably at service level A.

Average Delay That Does Not Match Expectations

The perception a motorist has of intersection operation as represented by the Level of Service can sometimes be at odds with the calculated values. Based on field observation at the intersection of Petaluma Hill Road/Kawana Springs, the existing evening LOS determined above does not necessarily provide an accurate representation of the perceived delay. One factor that results in a difference between perception and calculated values is that the calculations are based upon a full hour. Motorists can encounter lower service levels and higher delays during the peak of the commute period at the beginning and ending of the typical workday while others can experience light traffic flow a little earlier or later within the same hour. It is therefore common for calculated average delays and associated service levels to be different from the perception some drivers have of how the intersection is operating.

During the evening peak hour, the downstream Petaluma Hill Road/Yolanda Avenue intersection acts as the bottleneck for southbound commuters trying to avoid congestion on US 101. The Petaluma Hill Road queue from that intersection can extend north through the Kawana Springs Road intersection. Based on the counts collected, which included information on the queue, the number of southbound vehicles that were unable to enter the intersection during their respective green time was as low as one vehicle but as high as 21 vehicles; the average number of vehicles from the counts collected was 12 vehicles.

Since the intersection still operates acceptably according to City's standard when the service level is calculated based on the average traffic demand over the hour, with the initial queue included in the analysis, no improvements are recommended.

Future Conditions

Segment volumes for the horizon year of 2040 were obtained from the Sonoma County Transportation Authority's gravity demand model and translated to turning movement volumes at each of the study intersections that were

available using a combination of the “Furness” method and factoring, depending on how the model was configured at each intersection. 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.

For the intersection of Linwood Avenue/Poinsettia Lane, where segment volumes were only available for Linwood Avenue, a growth factor was determined and applied to all the turning movements. Since segments model volumes were not available for Meda Avenue but available for Linwood Avenue at Aston Avenue, the Furness method was applied to the Aston Avenue/Linwood Avenue intersection and using volume balancing and the existing counts, the future volumes were projected for the Aston Avenue/Meda Avenue intersection.

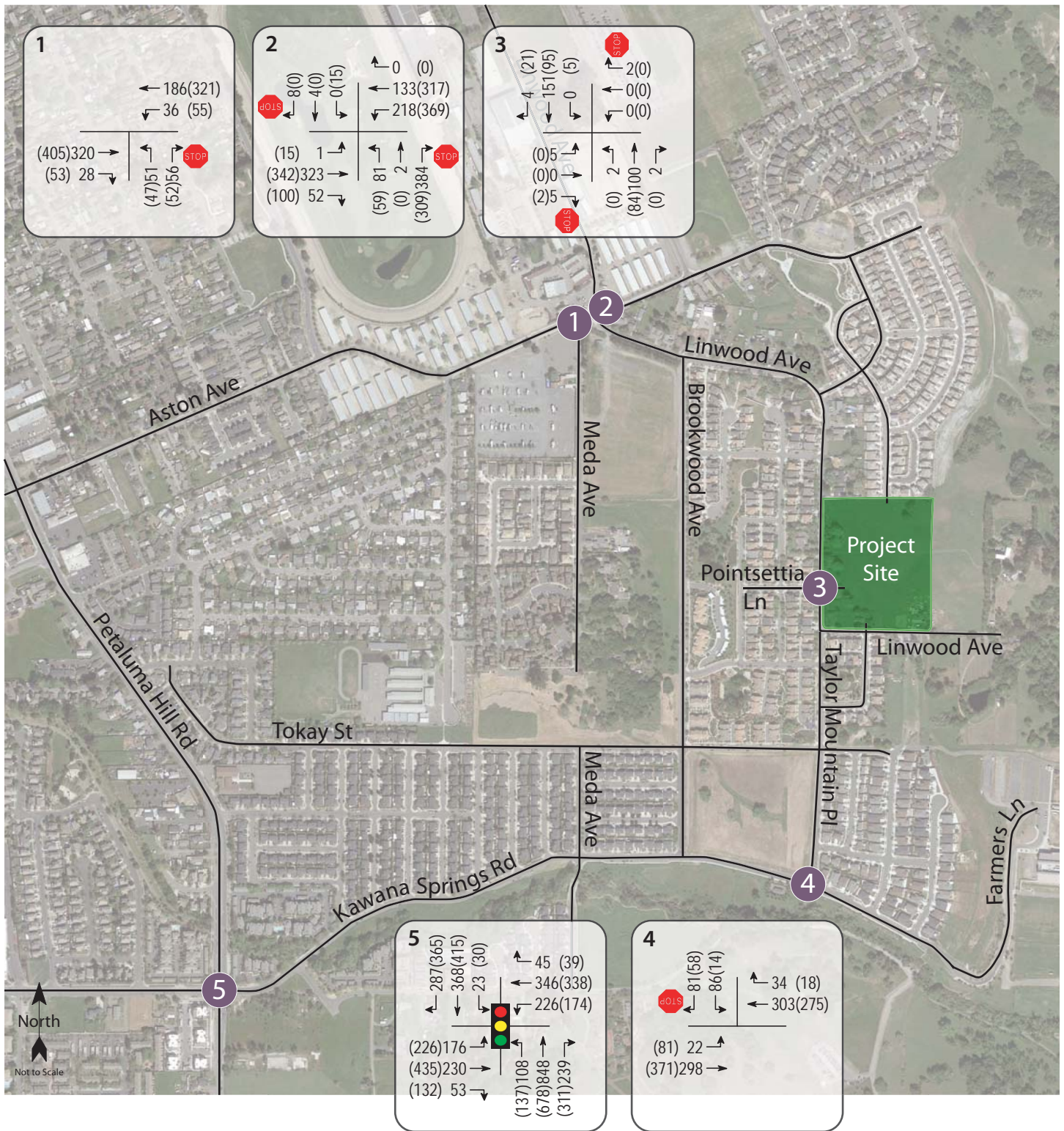
In some instances, the model projected a traffic volume decrease. Decreases are attributable to assumed infrastructure improvements and forecast changes in demographic data throughout the region. Though there are no planned future improvements at the study intersections, the planned Farmers Road extension would be along the east side of the project boundary. The extension provides an additional north-south connection within the City and would likely change the existing traffic circulation pattern. Rather than assume volume decreases, existing counts were maintained as a "floor." This is a common technique used to ensure that the future projections are conservative.

Under the anticipated Future volumes, the study intersections are expected to operate acceptably with the exception of the Aston Avenue/Linwood Avenue intersection, which would be expected to operate at LOS F under anticipated volumes for the p.m. peak hour. Future operating conditions are summarized in Table 5, and Future volumes are shown in Figure 3.

Study Intersection Approach	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
1. Aston Ave/Meda Ave <i>Northbound (Meda Ave) Approach</i>	2.6 <i>13.8</i>	A <i>B</i>	2.4 <i>18.0</i>	A <i>C</i>
2. Aston Ave/Linwood Ave <i>Northbound (Linwood Ave) Approach</i> <i>Southbound (Fairgrounds) Approach</i> Add NB thru-left and right-turn lane	26.3 <i>63.5</i> <i>13.6</i> 9.5	D <i>F</i> <i>B</i> A	52.1 <i>**</i> <i>**</i> 13.3	F <i>F</i> <i>F</i> B
3. Linwood Ave/Poinsettia Ln <i>Westbound (Private Driveway) Approach</i> <i>Eastbound (Poinsettia Ln) Approach</i>	0.5 <i>8.9</i> <i>9.9</i>	A <i>A</i> <i>A</i>	0.1 <i>0.0</i> <i>9.0</i>	A <i>A</i> <i>A</i>
4. Taylor Mountain Pl/Kawana Springs Rd <i>Southbound (Taylor Mountain Pl) Approach</i>	3.3 <i>15.1</i>	A <i>A</i>	1.8 <i>12.1</i>	A <i>B</i>
5. Petaluma Hill Rd/Kawana Springs Rd	27.9	C	29.5	C

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*; ****** = delay greater than 120 seconds; **Bold** text = deficient operation; **Shaded cells** = conditions with recommended improvements; NB = Northbound

The intersection of Aston Avenue/Linwood Avenue is expected to operate unacceptably at LOS F during the p.m. peak hour. It is recommended that a separate right-turn lane be added to the northbound approach. Given the width restriction of Linwood Avenue south of the intersection and the projected volumes, it is assumed that the additional lane would be a left-turn/through lane with about 50 feet of storage length. With this recommended improvement, the intersection is expected to operate acceptably overall at service level A or B.



LEGEND

- Study Intersection
- xx AM Peak Hour Volume
- (xx) PM Peak Hour Volume

Traffic Impact Study for the Penstemon Place Project
Figure 3 – Future Traffic Volumes



Project Description

The project consists of 59 single-family dwellings, six of which would have second detached units. Three access points are proposed from the site. One would connect to Verbena Drive to the north, another would replace the existing driveway on the east leg of the Poinsettia Lane/Linwood Avenue intersection, and the last would connect to Linwood Avenue on the south side of the project boundary about 180 feet east of Hibiscus Drive. On the site, there are currently six existing single-family dwellings that will be torn down as part of the project. The proposed project site plan is shown in Figure 4.

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*, 9th Edition, 2012 for “Single Family Detached Housing” (ITE LU 210). “Apartment” (Land Use #220) was used to project the anticipated trips generated by the six second-unit dwellings as the description most closely matches the project description and daily trip generation for this land use is the most conservative of the various multiple-family dwelling categories.

The expected trip generation potential for the proposed project is indicated in Table 6 and includes an average of 602 trips per day, including 47 trips during the a.m. peak hour and 63 during the p.m. peak hour. To be conservative, the six existing homes that will be razed to make way for the proposed project were not included in the analysis. These new trips represent the increase in traffic associated with the project compared to existing volumes.

Table 6 – Trip Generation Summary

Land Use	Units	Daily		AM Peak Hour				PM Peak Hour			
		Rate	Trips	Rate	Trips	In	Out	Rate	Trips	In	Out
Existing											
Single Family Dwelling	59 du	9.52	562	0.75	44	11	33	1.00	59	37	22
Apartment	6 du	6.65	40	0.51	3	1	2	0.62	4	2	2
Total			602		47	12	35		63	39	24

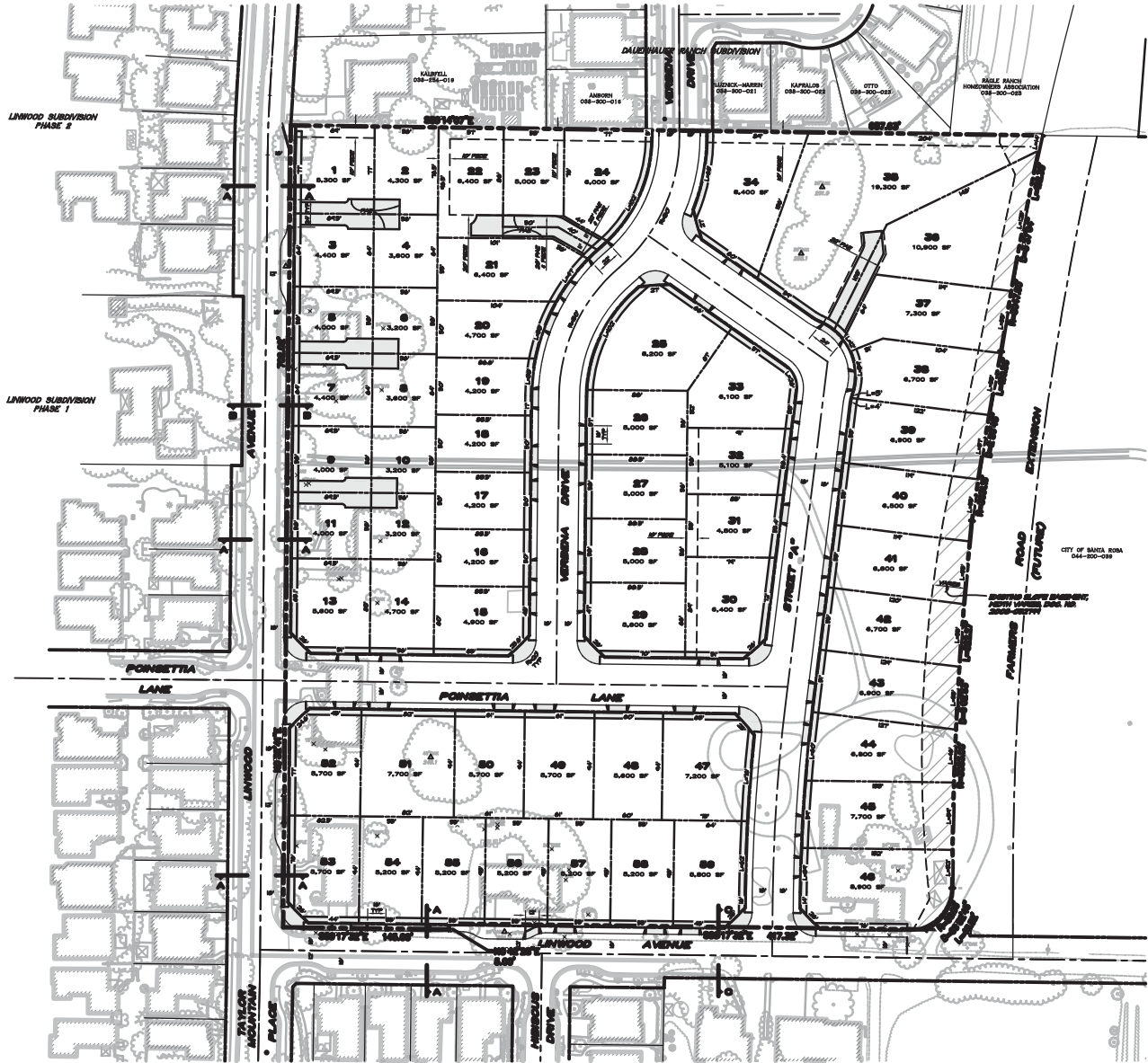
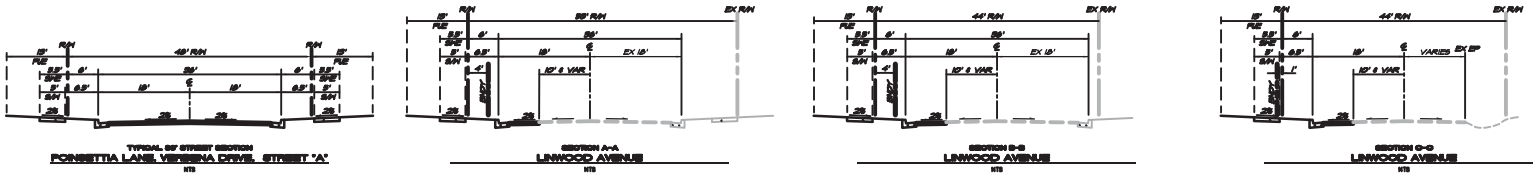
Note: du = dwelling unit

Construction Traffic

The project would temporarily result in an increase in truck trips through the study area due to typical construction activities associated with the single-family dwellings. Per the City’s general notes, construction hours are limited from 7 a.m., the start of the morning peak period, to 7 p.m., after the evening peak period for traffic. Generally, construction workers arrive at the site early so that work can start promptly at seven, and leave in the evening after the full time allotted. Therefore, the vehicles into and out of the site during the peak traffic periods would be trucks, though it is expected that most truck trips would happen outside of the morning and evening peak periods. It is understood that the highest frequency of trucks into and out of the site would be during the grading process. It is anticipated that during any one morning or evening peak hour, there would be most four truck trips, split between inbound out outbound, less than what is expected to be generated by the proposed project during and either peak hour.

Trip Distribution

The pattern used to allocate new project trips to the street network was determined by reviewing existing turning movement counts at the study intersections. The applied distribution assumptions and resulting trips are shown in Table 7.



Source: McIntosh Development, LLC

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Traffic Impact Study for the Penstemon Place Project
Figure 4 – Site Plan



Table 7 – Trip Distribution Assumptions

Route	Percent
North to Brookwood Ave	25%
To/From US 101 North	30%
To/From US 101 South	30%
To/From South on Petaluma Hill Rd	15%
TOTAL	100%

Intersection Operation

Existing plus Project Conditions

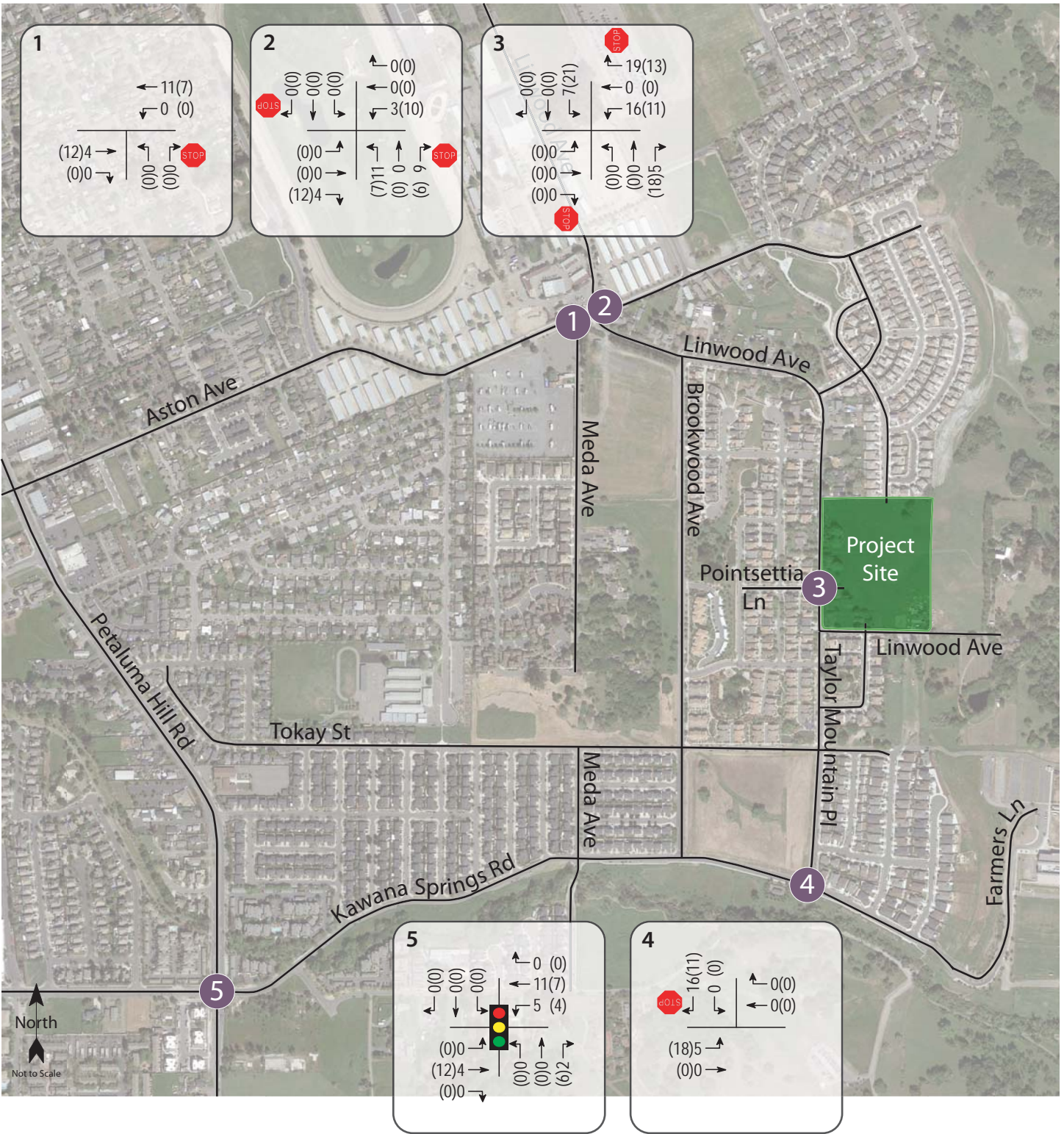
Upon the addition of project-related traffic to the Existing volumes, the study intersections are expected to continue to operate acceptably, generally at the same levels of service. Existing plus Project level of service results are summarized in Table 8, and Project traffic volumes are shown in Figure 5

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

Study Intersection Approach	Existing Conditions				Existing plus Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. Aston Ave/Meda Ave <i>Northbound (Meda Ave) Approach</i>	2.5	A	1.5	A	2.4	A	1.4	A
	<i>12.1</i>	<i>B</i>	<i>13.4</i>	<i>B</i>	<i>12.2</i>	<i>B</i>	<i>13.5</i>	<i>B</i>
2. Aston Ave/Linwood Ave <i>Northbound (Linwood Ave) Approach</i>	6.9	A	8.8	A	7.9	A	10.9	B
	<i>17.8</i>	<i>C</i>	<i>28.0</i>	<i>D</i>	<i>20.5</i>	<i>C</i>	<i>36.9</i>	<i>E</i>
	<i>15.5</i>	<i>C</i>	<i>68.2</i>	<i>F</i>	<i>15.7</i>	<i>C</i>	<i>72.9</i>	<i>F</i>
3. Linwood Ave/Poinsettia Ln <i>Westbound (Private Driveway) Approach</i>	0.5	A	0.1	A	2.2	A	2.2	A
	<i>8.7</i>	<i>A</i>	<i>0.0</i>	<i>A</i>	<i>9.3</i>	<i>A</i>	<i>9.2</i>	<i>A</i>
	<i>9.3</i>	<i>A</i>	<i>8.7</i>	<i>A</i>	<i>9.4</i>	<i>A</i>	<i>8.7</i>	<i>A</i>
4. Taylor Mountain Pl/Kawana Springs Rd <i>Southbound (Taylor Mountain Pl) Approach</i>	3.0	A	3.4	A	3.4	A	4.0	A
	<i>10.2</i>	<i>B</i>	<i>8.9</i>	<i>A</i>	<i>10.2</i>	<i>B</i>	<i>9.0</i>	<i>A</i>
5. Petaluma Hill Rd/Kawana Springs Rd	23.1	C	25.1	C	23.2	C	25.2	C

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

It should be noted that with the addition of project-related traffic volumes, average overall delay at the intersection of Aston Avenue/Meda Avenue decreases during both peak hours. While this is counter-intuitive, this condition occurs when a project adds trips to movements that are currently underutilized or have delays that are below the intersection average, resulting in a better balance between approaches and lower overall average delay. The project adds traffic predominantly to the through movement, which has an average delay that is lower than the average for the intersection as a whole, resulting in a slight reduction in the overall average delay. The conclusion could incorrectly be drawn that the project actually improves operation based on this data alone; however, it is more appropriate to conclude that the project trips are expected to make use of excess capacity, so drivers will experience little, if any, change in conditions as a result of the project. It is further noted that delay increases slightly on the side-street movement, which is consistent with expectation.



LEGEND

- Study Intersection
- xx AM Peak Hour Volume
- (xx) PM Peak Hour Volume

Traffic Impact Study for the Penstemon Place Project
Figure 5 – Project Traffic Volumes



Finding – The study intersections are expected to continue operating at acceptable service levels upon the addition of project-generated traffic.

Future plus Project Conditions

Upon the addition of project-generated traffic to the anticipated Future volumes, four of the five study intersections are expected to operate acceptably. With the improvements recommended for the intersection of Aston Avenue/Linwood Avenue to achieve acceptable operation under future volumes, the intersection is expected to operate acceptably overall upon the addition of project-generated trips. The Future plus Project operating conditions are summarized in Table 9.

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

Study Intersection <i>Approach</i>	Future Conditions				Future plus Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. Aston Ave/Meda Ave <i>Northbound (Meda Ave) Approach</i>	2.6	A	2.4	A	2.6	A	2.2	A
	<i>13.8</i>	<i>B</i>	<i>18.0</i>	<i>C</i>	14.0	B	16.7	C
2. Aston Ave/Linwood Ave <i>Northbound (Linwood Ave) Approach</i>	26.3	D	52.1	F	34.0	D	70.4	F
<i>Southbound (Fairgrounds) Approach</i>	63.5	F	**	F	83.3	F	**	F
Add NB right-turn lane	9.5	A	13.3	B	10.0	B	16.2	C
3. Linwood Ave/Poinsettia Ln <i>Westbound (Private Driveway) Approach</i>	0.5	A	0.1	A	1.6	A	1.6	A
<i>Eastbound (Poinsettia Ln) Approach</i>	8.9	A	0.0	A	9.9	A	9.7	A
	9.9	A	9.0	A	10.2	B	9.0	A
4. Taylor Mountain Pl/Kawana Springs Rd <i>Southbound (Taylor Mountain Pl) Approach</i>	3.3	A	1.8	A	3.7	A	2.1	A
	15.1	A	12.1	B	15.8	C	12.2	B
5. Petaluma Hill Rd/Kawana Springs Rd	27.9	C	29.5	C	28.2	C	29.8	C

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*; ** = delay greater than 120 seconds; **Bold** text = deficient operation; **Shaded cells** = conditions with recommended improvements; NB = Northbound

Similar to existing conditions, under the future scenario with the addition of project-related traffic volumes, average delay at the intersection of Aston Avenue/Meda Avenue would be expected to decrease during the p.m. peak hour. Again, the project adds traffic predominantly to the through movement, which has an average delay that is lower than the average for the intersection as a whole, resulting in a slight reduction in the overall average delay.

The intersection of Aston Avenue/Linwood Avenue is projected to continue operating at an unacceptable level during the p.m. peak hour with the addition of project trips. With the recommended improvement to add a storage lane for the northbound left-turn/through movements, the intersection would operate acceptably overall.

Proportional Share

The proportional share of the improvement cost applicable to the Penstemon Place project was determined for the intersection of Aston Avenue/Linwood Avenue using the methodology published by Caltrans in their *Guide for Preparation of Traffic Impact Studies*. The equitable proportion is determined as the ratio between the number of project trips at an intersection and the expected increase in traffic between existing conditions and future

conditions. For the purpose of this analysis, the cost to widen Linwood Avenue in order to add a left turn lane was estimated to be \$225,000.

Penstemon Place project's equitable share of the improvement is 12.4 percent, or \$27,827. The proportional share calculations are provided in Appendix C.

Finding – Four of the five study intersections will continue operating acceptably with project traffic added. The intersection of Aston Avenue/Linwood Avenue would operate unacceptably at LOS F during the p.m. peak hour with or without the project.

Recommendation – To achieve acceptable operation under Future plus Project volumes at Aston Avenue/Linwood Avenue, it is recommended that the northbound approach be reconfigured for a northbound left-turn/through storage lane and a right-turn lane. The project applicant should pay a proportional share of the cost to improve the intersection, calculated as \$27,827.

Alternative Modes

Pedestrian Facilities

Given the proximity of schools, parks, and chopping centers surrounding the site, it is reasonable to assume that some project patrons and employees will want to walk, bicycle, and/or use transit to reach the project site.

Project Site – Sidewalks do not exist currently exist along the project frontage, but per the site plan, are proposed. Within the project site, sidewalks are recommended along the street frontages, including the connection to existing sidewalks on Verbena Drive to the north. At the intersection of Poinsettia Lane/Linwood Avenue, there are existing bulb-outs on the westerly side of the intersection but none proposed on the project site, the east side of the intersection. The proposed project should conform to the design of the existing pedestrian facilities.

Finding – Pedestrian facilities serving the project site would be inadequate upon completion of sidewalks along all street frontages as part of the project.

Recommendation – It is recommended that the proposed project's site plan be modified to include bulb-outs on east side of the Poinsettia Lane/Linwood Avenue intersection.

Bicycle Facilities

Existing bicycle facilities, including bike lanes on portions of Brookwood Avenue and Kawana Springs Road, together with shared use of minor streets provide adequate access for bicyclists.

Finding – Bicycle facilities serving the project site are adequate.

Transit

Existing transit routes are not adequate to accommodate project-generated transit trips since the existing stops are not within acceptable walking distance of the site.

Finding – Transit facilities serving the project site are not inadequate.

Recommendation – It is recommended that the applicant request that Santa Rosa CityBus add service to the neighborhood.

Access and Circulation

Site Access

As proposed there would be three access points for the project. To the north, the project would connect with the existing Verbena Drive. To the south, "Street A" would intersect Linwood Avenue about 180 feet east of the Hibiscus Drive/Linwood Avenue intersection. Along the western project boundary, access to the site would be through a newly developed east leg to the Linwood Avenue/Poinsettia Lane intersection. The intersection would have four approaches and following the existing control, would have stop-control in the east-west direction.

All-way Stop Control Warrants

All-way Stop Warrants (For Residential Streets)

Generally, warrants for all-way stop controlled intersections are based on guidelines contained in the *California Manual on Uniform Traffic Control Devices* (CA-MUTCD). The warrants includes the following issues in considering need for all-way stop controls.

- excessive volume
- high number of collisions
- limited visibility
- excessive speeds
- crossing residential collectors
- residential frontage

An intersection meeting any one of the criteria is considered a candidate for an all-way stop sign installation.

Based on the counts collected at the intersection of Linwood Avenue/Poinsettia Lane, the volumes are not high enough to warrant all-way stop-control, even with the 80 percent reduction for the combination warrant. As mentioned in the collision history, there were no reported collisions at the intersection. A brief radar survey indicated an 85th percentile speed of 29 mph, which is less than what the warrant classifies as "excessive speeds." However, there is limited visibility from the west leg of Poinsettia Lane to the north and south due to the on-street parking. The criteria calls for at least 150 feet of visibility, but based on field measurements, there is only 90 feet to the north and 115 feet to the south.

Since one of the optional criteria, limited visibility, for an all-way stop control was satisfied, such controls are warranted. The limited visibility at the intersection is a result of the existing parking. Given that all-way stop controls would address the sight distance issue and also provide a measure of traffic calming for the residential neighborhood, implementation of all-way stops is recommended in lieu of restricting parking near the intersection to improve sight lines. A copy of the All-Way Stop-Control Warrant is provided in Appendix D.

Conclusions and Recommendations

Conclusions

- The proposed project is expected to generate an average of 602 trips per day, including 47 trips during the a.m. peak hour and 63 during the p.m. peak hour.
- Under existing conditions, with and without the project, the study intersections are expected to operate acceptably per the City's standards. The southbound approach to the intersection of Aston Avenue/Linwood Avenue operates at LOS F but the intersection as a whole operates at LOS A or B.
- With and without the proposed project under future conditions, the intersection of Aston Avenue/ Linwood Avenue is expected to operate unacceptably. By reconfiguring the northbound approach to include a left-turn/through and exclusive right-turn lane, the intersection would be expected to operate acceptably.
- Proposed pedestrian facilities, including construction of new sidewalks along all street frontages at the project site, and existing bicycle facilities are adequate.
- The transit facilities serving the site are inadequate.
- All-way stop-control is warranted at Linwood Avenue/Poinsettia Lane, with one optional criteria satisfied, and additional right-of-way controls would be appropriate given the residential setting and to address sight distance constraints.

Recommendations

- To achieve acceptable operation under Future conditions at Aston Avenue/Linwood Avenue, it is recommended that the northbound approach be reconfigured for separate northbound left-turn/through and right-turn lanes.
- The project applicant should pay its proportional share of the cost to widen Linwood Avenue at the Aston Avenue intersection, calculated as 12.4 percent, or \$27,827 of the estimated cost of \$225,000 for the project.
- The applicant should request that Santa Rosa CityBus add service to the neighborhood.
- There is limited sight distance for eastbound vehicles on Poinsettia Avenue so installation of all-way stop-controls is recommended.

Study Participants and References

Study Participants

Principal in Charge	Dalene J. Whitlock, PE, PTOE
Assistant Engineer	Briana Byrne, EIT
Graphics	Hannah Yung
Editing/Formatting	Angela McCoy

References

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- California Manual on Uniform Traffic Control Devices for Streets and Highways*, California Department of Transportation, 2014
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SRO378



Appendix A

Collision Rate Calculations

Intersection Collision Rate Calculations

SRO378 McIntosh Homes Project

Intersection # 1: Aston Avenue & Meda Avenue

Date of Count: Thursday, February 23, 2017

Number of Collisions: 4
Number of Injuries: 2
Number of Fatalities: 0
ADT: 7500
Start Date: July 1, 2011
End Date: June 30, 2016
Number of Years: 5

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

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

$$\text{collision rate} = \frac{4}{7,500} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.29 c/mve	0.0%	50.0%
Statewide Average*	0.18 c/mve	0.7%	36.4%

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

Intersection # 2: Aston Ave & Linwood Ave

Date of Count: Thursday, February 23, 2017

Number of Collisions: 3
Number of Injuries: 1
Number of Fatalities: 0
ADT: 12400
Start Date: July 1, 2011
End Date: June 30, 2016
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Stop & Yield Controls
Area: Urban

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

$$\text{collision rate} = \frac{3}{12,400} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.13 c/mve	0.0%	33.3%
Statewide Average*	0.15 c/mve	1.0%	41.9%

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

Intersection Collision Rate Calculaions

SRO378 McIntosh Homes Project

Intersection # 3: Linwood Avenue & Poinsettia Lane

Date of Count: Thursday, February 23, 2017

Number of Collisions: 0
Number of Injuries: 0
Number of Fatalities: 0
ADT: 1200
Start Date: July 1, 2011
End Date: June 30, 2016
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Stop & Yield Controls
Area: Urban

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

$$\text{collision rate} = \frac{0}{1,200} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.00 c/mve	0.0%	0.0%
Statewide Average*	0.15 c/mve	1.0%	41.9%

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

Intersection # 4: Taylor Mountain Place & Kawana Springs Road

Date of Count: Thursday, February 23, 2017

Number of Collisions: 0
Number of Injuries: 0
Number of Fatalities: 0
ADT: 1900
Start Date: July 1, 2011
End Date: June 30, 2016
Number of Years: 5

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

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

$$\text{collision rate} = \frac{0}{1,900} \times \frac{1,000,000}{365 \times 5}$$

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

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

Intersection Collision Rate Calculations

SRO378 McIntosh Homes Project

Intersection # 5: Petaluma Hill Road & Kawana Springs Road

Date of Count: Thursday, February 23, 2017

Number of Collisions: 19

Number of Injuries: 9

Number of Fatalities: 0

ADT: 25600

Start Date: July 1, 2011

End Date: June 30, 2016

Number of Years: 5

Intersection Type: Four-Legged

Control Type: Signals

Area: Urban

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

$$\text{collision rate} = \frac{19}{25,600} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.41 c/mve	0.0%	47.4%
Statewide Average*	0.27 c/mve	0.4%	41.9%

ADT = average daily total vehicles entering intersection

c/mve = collisions per million vehicles entering intersection

* 2013 Collision Data on California State Highways, Caltrans

Appendix B

Intersection Level of Service Calculations

HCM 2010 TWSC

1: Meda Ave & Aston Ave

03/22/2017

Intersection									
Int Delay, s/veh 2.5									
Movement	EBT	EBR	WBL	WBT	NBL	NBR			
Lane Configurations									
Traffic Vol, veh/h	300	16	20	142	51	56			
Future Vol, veh/h	300	16	20	142	51	56			
Conflicting Peds, #/hr	0	0	0	0	4	4			
Sign Control	Free	Free	Free	Free	Stop	Stop			
RT Channelized	-	None	-	None	-	None			
Storage Length	-	-	-	-	0	-			
Veh in Median Storage, #	0	-	-	0	0	-			
Grade, %	0	-	-	0	0	-			
Peak Hour Factor	100	100	100	100	100	100			
Heavy Vehicles, %	2	2	2	2	2	2			
Mvmt Flow	300	16	20	142	51	56			
Major/Minor	Major1	Major2	Minor1						
Conflicting Flow All	0	0	316	0	494	312			
Stage 1	-	-	-	-	308	-			
Stage 2	-	-	-	-	186	-			
Critical Hdwy	-	-	4.12	-	6.42	6.22			
Critical Hdwy Sig 1	-	-	-	-	5.42	-			
Critical Hdwy Sig 2	-	-	-	-	5.42	-			
Follow-up Hdwy	-	-	2.218	-	3.518	3.318			
Pot Cap-1 Maneuver	-	-	1244	-	535	728			
Stage 1	-	-	-	-	745	-			
Stage 2	-	-	-	-	846	-			
Platoon blocked, %	-	-	-	-	-	-			
Mov Cap-1 Maneuver	-	-	1239	-	523	725			
Mov Cap-2 Maneuver	-	-	-	-	523	-			
Stage 1	-	-	-	-	745	-			
Stage 2	-	-	-	-	828	-			
Approach	EB	WB	NB						
HCM Control Delay, s	0	1	12.1						
HCM LOS			B						
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT				
Capacity (veh/h)	612	-	-	1239	-				
HCM Lane V/C Ratio	0.175	-	-	0.016	-				
HCM Control Delay (s)	12.1	-	-	8	0				
HCM Lane LOS	B	-	-	A	A				
HCM 95th %ile Q(veh)	0.6	-	-	0	-				

HCM 2010 TWSC

1: Meda Ave & Aston Ave

03/22/2017

Intersection									
Int Delay, s/veh 1.5									
Movement	EBT	EBR	WBL	WBT	NBL	NBR			
Lane Configurations									
Traffic Vol, veh/h	378	53	43	219	26	29			
Future Vol, veh/h	378	53	43	219	26	29			
Conflicting Peds, #/hr	0	0	0	0	1	1			
Sign Control	Free	Free	Free	Free	Stop	Stop			
RT Channelized	-	None	-	None	-	None			
Storage Length	-	-	-	-	0	-			
Veh in Median Storage, #	0	-	-	0	0	-			
Grade, %	0	-	-	0	0	-			
Peak Hour Factor	100	100	100	100	100	100			
Heavy Vehicles, %	2	2	2	2	2	2			
Mvmt Flow	378	53	43	219	26	29			
Major/Minor	Major1	Major2	Minor1						
Conflicting Flow All	0	0	431	0	711	406			
Stage 1	-	-	-	-	405	-			
Stage 2	-	-	-	-	306	-			
Critical Hdwy	-	-	4.12	-	6.42	6.22			
Critical Hdwy Sig 1	-	-	-	-	5.42	-			
Critical Hdwy Sig 2	-	-	-	-	5.42	-			
Follow-up Hdwy	-	-	2.218	-	3.518	3.318			
Pot Cap-1 Maneuver	-	-	1129	-	400	645			
Stage 1	-	-	-	-	673	-			
Stage 2	-	-	-	-	747	-			
Platoon blocked, %	-	-	-	-	-	-			
Mov Cap-1 Maneuver	-	-	1128	-	382	644			
Mov Cap-2 Maneuver	-	-	-	-	382	-			
Stage 1	-	-	-	-	673	-			
Stage 2	-	-	-	-	714	-			
Approach	EB	WB	NB						
HCM Control Delay, s	0	1.4	13.4						
HCM LOS			B						
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT				
Capacity (veh/h)	486	-	-	1128	-				
HCM Lane V/C Ratio	0.113	-	-	0.038	-				
HCM Control Delay (s)	13.4	-	-	8.3	0				
HCM Lane LOS	B	-	-	A	A				
HCM 95th %ile Q(veh)	0.4	-	-	0.1	-				

HCM 2010 TWSC
2: Linwood Ave & Aston Ave

03/22/2017

Intersection													
Int Delay, s/veh 6.9													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Vol, veh/h	1	303	52	218	128	0	33	1	233	0	1	1	
Future Vol, veh/h	1	303	52	218	128	0	33	1	233	0	1	1	
Conflicting Peds, #/hr	0	0	4	4	0	4	4	0	4	0	0	0	
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	55
Veh in Median Storage, #	-	0	-	0	-	0	-	0	-	-	0	-	-
Grade, %	-	0	-	0	-	0	-	0	-	-	0	-	0
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	1	303	52	218	128	0	33	1	233	0	1	1	

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	132	0	0	904
Stage 1	-	-	-	335
Stage 2	-	-	-	569
Critical Hdwy	4.12	-	-	7.12
Critical Hdwy Sig 1	-	-	-	6.12
Critical Hdwy Sig 2	-	-	-	6.12
Follow-up Hdwy	2.218	-	-	3.518
Pot Cap-1 Maneuver	1453	-	-	258
Stage 1	-	-	-	679
Stage 2	-	-	-	507
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1447	-	-	216
Mov Cap-2 Maneuver	-	-	-	216
Stage 1	-	-	-	676
Stage 2	-	-	-	405

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	5.5	17.8	15.5
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	545	1447	-	-	1195	-	-	214	906
HCM Lane V/C Ratio	0.49	0.001	-	-	0.182	-	-	0.005	0.001
HCM Control Delay (s)	17.8	7.5	0	8.7	0	21.9	9	-	-
HCM Lane LOS	C	A	A	A	A	C	A	-	-
HCM 95th %ile Q(veh)	2.7	0	-	0.7	-	0	0	-	-

HCM 2010 TWSC
2: Linwood Ave & Aston Ave

03/22/2017

Intersection													
Int Delay, s/veh 8.8													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Vol, veh/h	1	326	80	327	230	0	32	0	246	1	0	0	
Future Vol, veh/h	1	326	80	327	230	0	32	0	246	1	0	0	
Conflicting Peds, #/hr	0	0	1	1	0	0	1	0	1	0	0	0	
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	55
Veh in Median Storage, #	-	0	-	0	-	0	-	0	-	-	0	-	-
Grade, %	-	0	-	0	-	0	-	0	-	-	0	-	0
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	1	326	80	327	230	0	32	0	246	1	0	0	

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	230	0	0	1254
Stage 1	-	-	-	369
Stage 2	-	-	-	885
Critical Hdwy	4.12	-	-	7.12
Critical Hdwy Sig 1	-	-	-	6.12
Critical Hdwy Sig 2	-	-	-	6.12
Follow-up Hdwy	2.218	-	-	3.518
Pot Cap-1 Maneuver	1338	-	-	149
Stage 1	-	-	-	651
Stage 2	-	-	-	340
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1337	-	-	111
Mov Cap-2 Maneuver	-	-	-	111
Stage 1	-	-	-	650
Stage 2	-	-	-	229

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	5.5	28	68.2
HCM LOS			D	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	426	1337	-	-	1151	-	-	58	-
HCM Lane V/C Ratio	0.653	0.001	-	-	0.284	-	-	0.017	-
HCM Control Delay (s)	28	7.7	0	9.4	0	68.2	0	-	-
HCM Lane LOS	D	A	A	A	A	F	A	-	-
HCM 95th %ile Q(veh)	4.5	0	-	1.2	-	0.1	-	-	-

HCM 2010 TWSC
3: Linwood Ave & Poinsettia Ln/Private Driveway

03/22/2017

Intersection		0.5											
Int Delay, s/veh													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Vol, veh/h	3	0	3	0	0	1	1	57	1	0	86	2	
Future Vol, veh/h	3	0	3	0	0	1	1	57	1	0	86	2	
Conflicting Peds, #/hr	7	0	11	4	0	0	11	0	4	0	0	7	
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-	
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	3	0	3	0	0	1	1	57	1	0	86	2	

Major/Minor	Minor2	Minor1	Major1	Major2								
Conflicting Flow All	165	162	109	164	163	69	99	0	0	62	0	0
Stage 1	98	98	-	64	64	-	-	-	-	-	-	-
Stage 2	67	64	-	100	99	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Sig 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Sig 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	800	730	945	801	729	994	1494	-	-	1541	-	-
Stage 1	908	814	-	947	842	-	-	-	-	-	-	-
Stage 2	943	842	-	906	813	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	785	719	925	786	718	984	1478	-	-	1531	-	-
Mov Cap-2 Maneuver	898	805	-	786	718	-	-	-	-	-	-	-
Stage 1	935	838	-	894	804	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.3	8.7	0.1	0
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Capacity (veh/h)	1478	-	-	849	984	1531	-	-	-	-	-	-	-	-	-
HCM Lane V/C Ratio	0.001	-	-	0.007	0.001	-	-	-	-	-	-	-	-	-	-
HCM Control Delay (s)	7.4	0	-	9.3	8.7	0	-	-	-	-	-	-	-	-	-
HCM Lane LOS	A	A	-	A	A	A	-	-	-	-	-	-	-	-	-
HCM 95th %ile Q(veh)	0	-	-	0	0	0	-	-	-	-	-	-	-	-	-

HCM 2010 TWSC
3: Linwood Ave & Poinsettia Ln/Private Driveway

03/22/2017

Intersection		0.1											
Int Delay, s/veh													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Vol, veh/h	0	0	1	0	0	0	0	48	0	1	54	12	
Future Vol, veh/h	0	0	1	0	0	0	0	48	0	1	54	12	
Conflicting Peds, #/hr	8	0	9	3	0	2	9	0	3	2	0	8	
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-	
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	0	0	1	0	0	0	0	48	0	1	54	12	

Major/Minor	Minor2	Minor1	Major1	Major2								
Conflicting Flow All	127	122	78	123	128	59	75	0	0	51	0	0
Stage 1	71	71	-	51	51	-	-	-	-	-	-	-
Stage 2	56	51	-	72	77	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Sig 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Sig 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	846	768	983	852	763	1007	1524	-	-	1555	-	-
Stage 1	939	836	-	962	852	-	-	-	-	-	-	-
Stage 2	956	852	-	938	831	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	832	758	966	841	754	996	1511	-	-	1543	-	-
Mov Cap-2 Maneuver	931	828	-	841	754	-	-	-	-	-	-	-
Stage 1	949	850	-	928	823	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8.7	0	0	0.1
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Capacity (veh/h)	1511	-	-	966	-	1543	-	-	-	-	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	0.001	-	0.001	-	-	-	-	-	-	-	-	-
HCM Control Delay (s)	0	-	-	8.7	0	7.3	0	-	-	-	-	-	-	-	-
HCM Lane LOS	A	A	-	A	A	A	-	-	-	-	-	-	-	-	-
HCM 95th %ile Q(veh)	0	-	-	0	0	0	-	-	-	-	-	-	-	-	-

HCM 2010 TWSC

4: Kawana Springs Rd & Taylor Mountain PI

03/22/2017

Intersection		3					
Int Delay, s/veh		3.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations	17	161	71	20	59	36	
Traffic Vol, veh/h	17	161	71	20	59	36	
Future Vol, veh/h	1	0	0	0	1	1	
Conflicting Peds, #/hr	Free	Free	Free	Free	Stop	Stop	
Sign Control	-	None	-	None	-	None	
RT Channelized	-	-	-	-	0	-	
Storage Length	-	-	-	-	-	-	
Veh in Median Storage, #	-	0	-	-	-	-	
Grade, %	-	0	-	-	-	-	
Peak Hour Factor	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	17	161	71	20	59	36	
Major/Minor	Major1		Major2		Minor2		
Conflicting Flow All	92	0	-	0	278	83	
Stage 1	-	-	-	-	82	-	
Stage 2	-	-	-	-	196	-	
Critical Hdwy	4.12	-	-	-	6.42	6.22	
Critical Hdwy Sig 1	-	-	-	-	5.42	-	
Critical Hdwy Sig 2	-	-	-	-	5.42	-	
Follow-up Hdwy	2.218	-	-	-	3.518	3.318	
Pot Cap-1 Maneuver	1503	-	-	-	712	976	
Stage 1	-	-	-	-	941	-	
Stage 2	-	-	-	-	837	-	
Platoon blocked, %	-	-	-	-	-	-	
Mov Cap-1 Maneuver	1502	-	-	-	702	974	
Mov Cap-2 Maneuver	-	-	-	-	702	-	
Stage 1	-	-	-	-	940	-	
Stage 2	-	-	-	-	826	-	
Approach	EB		WB		SB		
HCM Control Delay, s	0.7	-	0	-	10.2	B	
HCM LOS							
Minor Lane/Major Mvmt	EBL		WBT		WBR	SBL	
Capacity (veh/h)	1502	-	-	-	785	-	
HCM Lane V/C Ratio	0.011	-	-	-	0.121	-	
HCM Control Delay (s)	7.4	0	-	-	10.2	-	
HCM Lane LOS	A	A	-	-	B	-	
HCM 95th %ile Q(veh)	0	-	-	-	0.4	-	

HCM 2010 TWSC

4: Kawana Springs Rd & Taylor Mountain PI

03/22/2017

Intersection		3.4					
Int Delay, s/veh		3.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations	41	65	43	5	5	33	
Traffic Vol, veh/h	41	65	43	5	5	33	
Future Vol, veh/h	6	0	0	1	1	6	
Conflicting Peds, #/hr	Free	Free	Free	Free	Stop	Stop	
Sign Control	-	None	-	None	-	None	
RT Channelized	-	-	-	-	0	-	
Storage Length	-	-	-	-	-	-	
Veh in Median Storage, #	-	0	-	-	-	-	
Grade, %	-	0	-	-	-	-	
Peak Hour Factor	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	41	65	43	5	5	33	
Major/Minor	Major1		Major2		Minor2		
Conflicting Flow All	54	0	-	0	200	58	
Stage 1	-	-	-	-	52	-	
Stage 2	-	-	-	-	148	-	
Critical Hdwy	4.12	-	-	-	6.42	6.22	
Critical Hdwy Sig 1	-	-	-	-	5.42	-	
Critical Hdwy Sig 2	-	-	-	-	5.42	-	
Follow-up Hdwy	2.218	-	-	-	3.518	3.318	
Pot Cap-1 Maneuver	1551	-	-	-	789	1008	
Stage 1	-	-	-	-	970	-	
Stage 2	-	-	-	-	880	-	
Platoon blocked, %	-	-	-	-	-	-	
Mov Cap-1 Maneuver	1542	-	-	-	758	997	
Mov Cap-2 Maneuver	-	-	-	-	758	-	
Stage 1	-	-	-	-	964	-	
Stage 2	-	-	-	-	850	-	
Approach	EB		WB		SB		
HCM Control Delay, s	2.9	-	0	-	8.9	A	
HCM LOS							
Minor Lane/Major Mvmt	EBL		WBT		WBR	SBL	
Capacity (veh/h)	1542	-	-	-	957	-	
HCM Lane V/C Ratio	0.027	-	-	-	0.04	-	
HCM Control Delay (s)	7.4	0	-	-	8.9	-	
HCM Lane LOS	A	A	-	-	A	-	
HCM 95th %ile Q(veh)	0.1	-	-	-	0.1	-	

HCM 2010 Signalized Intersection Summary
5: Petaluma Hill Rd & Kawana Springs Rd

03/22/2017

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	←	←	←	←	←	←	←	←	←	←	←
Traffic Volume (veh/h)	125	125	45	170	178	29	80	768	166	14	338	181
Future Volume (veh/h)	125	125	45	170	178	29	80	768	166	14	338	181
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped/Bike Adj(A_pbT)	1.00	0.99	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.99	1.00	0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	125	125	5	170	178	18	80	768	139	14	338	109
Adj No. of Lanes	1	1	1	1	1	1	1	2	0	1	1	1
Peak Hour 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
Percent Heavy Veh. %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	439	527	524	504	499	51	466	1446	262	287	846	818
Arrive On Green	0.07	0.28	0.28	0.08	0.30	0.30	0.05	0.48	0.48	0.02	0.45	0.45
Sat Flow, veh/h	1774	1863	1575	1774	1662	168	1774	2984	540	1774	1863	1569
Grip Volume(V), veh/h	125	125	5	170	0	196	80	455	452	14	338	109
Grip Sat Flow(s), veh/h/ln	1774	1863	1575	1774	0	1830	1774	1770	1754	1774	1863	1569
Q Serve(g.s), s	5.4	5.7	0.2	7.3	0.0	9.2	2.5	19.6	19.6	0.5	13.3	3.9
Cycle Q Clear(g.c), s	5.4	5.7	0.2	7.3	0.0	9.2	2.5	19.6	19.6	0.5	13.3	3.9
Prop In Lane	1.00	1.00	1.00	1.00	0.09	1.00	0.09	1.00	0.31	1.00	1.00	1.00
Lane Grp Cap(c), veh/h	439	527	524	504	0	550	466	858	850	287	846	818
V/C Ratio(X)	0.28	0.24	0.01	0.34	0.00	0.36	0.17	0.53	0.53	0.05	0.40	0.13
Avail Cap(c,a), veh/h	514	527	524	548	0	550	571	858	850	446	846	818
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.3	30.3	24.6	23.9	0.0	30.1	14.3	19.7	19.7	16.6	20.0	13.6
Incr Delay (d2), s/veh	0.1	1.1	0.0	0.1	0.0	1.8	0.1	2.3	2.4	0.0	1.4	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOf(50%),veh/ln	2.7	3.1	0.1	3.5	0.0	5.0	1.2	10.2	10.1	0.2	7.2	1.8
LnGrp Delay(d),s/veh	25.5	31.4	24.6	24.1	0.0	31.9	14.4	22.0	22.0	16.7	21.4	13.9
LnGrp LOS	C	C	C	C	C	C	B	C	C	C	B	C
Approach Vol, veh/h	255			366			987			461		
Approach Delay, s/veh	28.3			28.3			21.4			19.5		
Approach LOS	C			C			C			B		
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	12.3	35.0	8.5	54.2	10.3	37.0	5.1	57.6				
Change Period (Y+Rb), s	3.0	3.9	3.0	*4.3	3.0	3.9	3.0	4.3				
Max Green Setting (Gmax), s	12.0	31.1	12.0	*4.1	12.0	31.1	12.0	40.7				
Max O Clear Time (g_c+H1), s	9.3	7.7	4.5	15.3	7.4	11.2	2.5	21.6				
GreenExt Time (p_c), s	0.1	1.9	0.0	6.0	0.1	1.8	0.0	5.6				
Intersection Summary												
HCM 2010 Ctrl Delay	23.1			23.1			21.4			19.5		
HCM 2010 LOS	C			C			C			B		
Notes												

HCM 2010 Signalized Intersection Summary
5: Petaluma Hill Rd & Kawana Springs Rd

03/22/2017

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	←	←	←	←	←	←	←	←	←	←	←
Traffic Volume (veh/h)	200	197	117	148	199	28	115	673	192	16	412	265
Future Volume (veh/h)	200	197	117	148	199	28	115	673	192	16	412	265
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped/Bike Adj(A_pbT)	0.99	0.99	1.00	0.97	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	200	197	64	148	199	24	115	673	173	16	412	138
Adj No. of Lanes	1	1	1	1	1	1	1	2	0	1	1	1
Peak Hour 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
Percent Heavy Veh. %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	497	633	626	495	522	63	326	1172	301	264	719	745
Arrive On Green	0.09	0.34	0.34	0.07	0.32	0.32	0.06	0.42	0.42	0.02	0.39	0.39
Sat Flow, veh/h	1774	1863	1574	1774	1626	196	1774	2776	713	1774	1863	1546
Grip Volume(V), veh/h	200	197	64	148	0	223	115	429	417	16	412	138
Grip Sat Flow(s), veh/h/ln	1774	1863	1574	1774	0	1822	1774	1770	1719	1774	1863	1546
Q Serve(g.s), s	7.3	7.8	2.6	5.5	0.0	9.5	3.7	18.5	18.5	0.5	17.4	5.1
Cycle Q Clear(g.c), s	7.3	7.8	2.6	5.5	0.0	9.5	3.7	18.5	18.5	0.5	17.4	5.1
Prop In Lane	1.00	1.00	1.00	1.00	0.11	1.00	0.41	1.00	1.00	1.00	1.00	1.00
Lane Grp Cap(c), veh/h	497	633	626	495	0	585	326	747	726	264	719	745
V/C Ratio(X)	0.40	0.31	0.10	0.30	0.00	0.38	0.35	0.57	0.57	0.06	0.57	0.19
Avail Cap(c,a), veh/h	526	633	626	558	0	585	465	747	726	438	719	745
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.4	24.4	18.9	20.1	0.0	26.3	18.5	22.0	22.1	18.8	25.2	14.9
Incr Delay (d2), s/veh	0.2	1.3	0.3	0.1	0.0	1.9	0.2	3.2	3.3	0.0	3.3	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOf(50%),veh/ln	3.5	4.2	1.2	2.7	0.0	5.1	1.8	9.6	9.4	0.3	12.2	2.3
LnGrp Delay(d),s/veh	19.6	25.6	19.2	20.3	0.0	28.2	18.8	25.2	25.4	18.9	33.2	15.4
LnGrp LOS	B	C	B	C	C	C	B	C	C	C	B	C
Approach Vol, veh/h	461			371			961			566		
Approach Delay, s/veh	22.1			25.0			24.5			28.5		
Approach LOS	C			C			C			C		
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	10.4	37.9	8.8	42.9	12.3	36.0	5.2	46.5				
Change Period (Y+Rb), s	3.0	3.9	3.0	*4.3	3.0	3.9	3.0	4.3				
Max Green Setting (Gmax), s	11.0	32.1	12.0	*3.1	11.0	32.1	12.0	30.7				
Max O Clear Time (g_c+H1), s	7.5	9.8	5.7	19.4	9.3	11.5	2.5	20.5				
GreenExt Time (p_c), s	0.1	2.7	0.1	4.6	0.1	2.6	0.0	4.3				
Intersection Summary												
HCM 2010 Ctrl Delay	25.1			25.1			25.1			25.1		
HCM 2010 LOS	C			C			C			C		
Notes												

HCM 2010 TWSC

1: Meda Ave & Aston Ave

03/23/2017

Intersection									
Int Delay, s/veh 2.6									
Movement	EBT	EBR	WBL	WBT	NBL	NBR			
Lane Configurations									
Traffic Vol, veh/h	320	28	36	186	51	56			
Future Vol, veh/h	320	28	36	186	51	56			
Conflicting Peds, #/hr	0	0	0	0	4	4			
Sign Control	Free	Free	Free	Free	Stop	Stop			
RT Channelized	-	None	-	None	-	None			
Storage Length	-	-	-	-	0	-			
Veh in Median Storage, #	0	-	-	0	0	-			
Grade, %	0	-	-	0	0	-			
Peak Hour Factor	100	100	100	100	100	100			
Heavy Vehicles, %	2	2	2	2	2	2			
Mvmt Flow	320	28	36	186	51	56			
Major/Minor	Major1		Major2		Minor1				
Conflicting Flow All	0	0	348	0	596	338			
Stage 1	-	-	-	-	334	-			
Stage 2	-	-	-	-	262	-			
Critical Hdwy	-	-	4.12	-	7.12	6.22			
Critical Hdwy Sig 1	-	-	-	-	6.12	-			
Critical Hdwy Sig 2	-	-	-	-	6.12	-			
Follow-up Hdwy	-	-	2.218	-	3.518	3.318			
Pot Cap-1 Maneuver	-	-	1211	-	415	704			
Stage 1	-	-	-	-	680	-			
Stage 2	-	-	-	-	743	-			
Platoon blocked, %	-	-	-	-	-	-			
Mov Cap-1 Maneuver	-	-	1206	-	403	701			
Mov Cap-2 Maneuver	-	-	-	-	403	-			
Stage 1	-	-	-	-	680	-			
Stage 2	-	-	-	-	716	-			
Approach	EB	EB	WB	WB	NB	NB			
HCM Control Delay, s	0	0	1.3	1.3	13.8	13.8			
HCM LOS					B	B			
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	NBLn1			
Capacity (veh/h)	518	-	-	1206	-	-			
HCM Lane V/C Ratio	0.207	-	-	0.03	-	-			
HCM Control Delay (s)	13.8	-	-	8.1	0	-			
HCM Lane LOS	B	-	-	A	A	-			
HCM 95th %ile Q(veh)	0.8	-	-	0.1	-	-			

HCM 2010 TWSC

1: Meda Ave & Aston Ave

03/23/2017

Intersection									
Int Delay, s/veh 2.4									
Movement	EBT	EBR	WBL	WBT	NBL	NBR			
Lane Configurations									
Traffic Vol, veh/h	405	53	55	321	47	52			
Future Vol, veh/h	405	53	55	321	47	52			
Conflicting Peds, #/hr	0	0	0	0	1	1			
Sign Control	Free	Free	Free	Free	Stop	Stop			
RT Channelized	-	None	-	None	-	None			
Storage Length	-	-	-	-	0	-			
Veh in Median Storage, #	0	-	-	0	0	-			
Grade, %	0	-	-	0	0	-			
Peak Hour Factor	100	100	100	100	100	100			
Heavy Vehicles, %	2	2	2	2	2	2			
Mvmt Flow	405	53	55	321	47	52			
Major/Minor	Major1		Major2		Minor1				
Conflicting Flow All	0	0	458	0	864	433			
Stage 1	-	-	-	-	432	-			
Stage 2	-	-	-	-	432	-			
Critical Hdwy	-	-	4.12	-	7.12	6.22			
Critical Hdwy Sig 1	-	-	-	-	6.12	-			
Critical Hdwy Sig 2	-	-	-	-	6.12	-			
Follow-up Hdwy	-	-	2.218	-	3.518	3.318			
Pot Cap-1 Maneuver	-	-	1103	-	274	623			
Stage 1	-	-	-	-	602	-			
Stage 2	-	-	-	-	602	-			
Platoon blocked, %	-	-	-	-	-	-			
Mov Cap-1 Maneuver	-	-	1102	-	261	622			
Mov Cap-2 Maneuver	-	-	-	-	261	-			
Stage 1	-	-	-	-	602	-			
Stage 2	-	-	-	-	565	-			
Approach	EB	EB	WB	WB	NB	NB			
HCM Control Delay, s	0	0	1.2	1.2	18	18			
HCM LOS					C	C			
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	NBLn1			
Capacity (veh/h)	375	-	-	1102	-	-			
HCM Lane V/C Ratio	0.264	-	-	0.05	-	-			
HCM Control Delay (s)	18	-	-	8.4	0	-			
HCM Lane LOS	C	-	-	A	A	-			
HCM 95th %ile Q(veh)	1	-	-	0.2	-	-			

HCM 2010 TWSC

2: Linwood Ave & Aston Ave

03/23/2017

Intersection		26.3											
Int Delay, s/veh		52.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	1	323	52	218	133	0	81	2	384	0	4	8	
Traffic Vol, veh/h	1	323	52	218	133	0	81	2	384	0	4	8	
Future Vol, veh/h	0	0	4	4	0	4	4	0	4	0	0	0	
Conflicting Peds, #/hr	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
Sign Control	-	-	None	-	-	None	-	-	None	-	-	None	
RT Channelized	-	-	-	-	-	-	-	-	-	-	-	-	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	55	
Veh in Median Storage, #	-	0	-	0	-	0	-	0	-	-	-	0	
Grade, %	-	0	-	0	-	0	-	0	-	-	-	0	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	1	323	52	218	133	0	81	2	384	0	4	8	

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	137	0	0	930
Stage 1	-	-	-	355
Stage 2	-	-	-	575
Critical Hdwy	4.12	-	-	7.12
Critical Hdwy Sig 1	-	-	-	6.12
Critical Hdwy Sig 2	-	-	-	6.12
Follow-up Hdwy	2.218	-	-	3.518
Pot Cap-1 Maneuver	1447	-	-	248
Stage 1	-	-	-	662
Stage 2	-	-	-	503
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1441	-	-	203
Mov Cap-2 Maneuver	-	-	-	659
Stage 1	-	-	-	393
Stage 2	-	-	-	226

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	5.4	63.5	13.6
HCM LOS	-	-	F	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	481	1441	-	-	1175	-	-	205	900
HCM Lane V/C Ratio	0.971	0.001	-	-	0.186	-	-	0.02	0.009
HCM Control Delay (s)	63.5	7.5	0	-	8.8	0	-	22.9	9
HCM Lane LOS	F	A	A	A	A	A	A	C	A
HCM 95th %ile Q(veh)	12.4	0	-	-	0.7	-	-	0.11	0

HCM 2010 TWSC

2: Linwood Ave & Aston Ave

03/23/2017

Intersection		52.1											
Int Delay, s/veh		52.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	15	342	100	369	317	0	59	0	309	15	0	0	
Traffic Vol, veh/h	15	342	100	369	317	0	59	0	309	15	0	0	
Future Vol, veh/h	0	0	1	0	0	0	1	0	1	0	0	0	
Conflicting Peds, #/hr	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
Sign Control	-	-	None	-	-	None	-	-	None	-	-	None	
RT Channelized	-	-	-	-	-	-	-	-	-	-	-	-	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	55	
Veh in Median Storage, #	-	0	-	0	-	0	-	0	-	-	-	0	
Grade, %	-	0	-	0	-	0	-	0	-	-	-	0	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	15	342	100	369	317	0	59	0	309	15	0	0	

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	317	0	0	1479
Stage 1	-	-	-	423
Stage 2	-	-	-	1056
Critical Hdwy	4.12	-	-	7.12
Critical Hdwy Sig 1	-	-	-	6.12
Critical Hdwy Sig 2	-	-	-	6.12
Follow-up Hdwy	2.218	-	-	3.518
Pot Cap-1 Maneuver	1243	-	-	104
Stage 1	-	-	-	609
Stage 2	-	-	-	272
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1242	-	-	71
Mov Cap-2 Maneuver	-	-	-	71
Stage 1	-	-	-	599
Stage 2	-	-	-	163

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	5.3	196.9	222.2
HCM LOS	-	-	F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	282	1242	-	-	1116	-	-	29	-
HCM Lane V/C Ratio	1.305	0.012	-	-	0.331	-	-	0.517	-
HCM Control Delay (s)	196.9	7.9	0	-	9.8	0	-	222.2	0
HCM Lane LOS	F	A	A	A	A	A	A	F	A
HCM 95th %ile Q(veh)	18.3	0	-	-	1.5	-	-	1.7	-

HCM 2010 TWSC
2: Linwood Ave & Aston Ave

03/24/2017

Intersection													
Int Delay, s/veh													9.5
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↔ ↘ ↙												
Traffic Vol, veh/h	1	323	52	218	133	0	81	2	384	0	4	8	
Future Vol, veh/h	1	323	52	218	133	0	81	2	384	0	4	8	
Conflicting Peds, #/hr	0	0	4	4	0	4	4	0	4	0	0	0	
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	-	50	-	0	-	-	55	
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	0	
Grade, %	-	0	-	-	0	-	-	0	-	-	-	0	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	1	323	52	218	133	0	81	2	384	0	4	8	

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	137	0	0	930
Stage 1	-	-	-	355
Stage 2	-	-	-	575
Critical Hdwy	4.12	-	-	7.12
Critical Hdwy Sig 1	-	-	-	6.12
Critical Hdwy Sig 2	-	-	-	6.12
Follow-up Hdwy	2.218	-	-	3.518
Pot Cap-1 Maneuver	1447	-	-	248
Stage 1	-	-	-	662
Stage 2	-	-	-	503
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1441	-	-	203
Mov Cap-2 Maneuver	-	-	-	659
Stage 1	-	-	-	393
Stage 2	-	-	-	287

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	5.4	20	13.6
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	NBLn1	SBLn2
Capacity (veh/h)	203	682	1441	-	-	1175	-	-	205	900
HCM Lane V/C Ratio	0.409	0.563	0.001	-	-	0.186	-	-	0.02	0.009
HCM Control Delay (s)	34.5	16.9	7.5	0	8.8	0	22.9	9	-	-
HCM Lane LOS	D	C	A	A	A	A	C	A	-	-
HCM 95th %ile Q(veh)	1.8	3.5	0	-	0.7	-	0.1	0	-	-

HCM 2010 TWSC
2: Linwood Ave & Aston Ave

03/24/2017

Intersection													
Int Delay, s/veh													13.3
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↔ ↘ ↙												
Traffic Vol, veh/h	15	342	100	369	317	0	59	0	309	15	0	0	
Future Vol, veh/h	15	342	100	369	317	0	59	0	309	15	0	0	
Conflicting Peds, #/hr	0	0	1	0	0	0	1	0	1	0	0	0	
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	-	50	-	0	-	-	55	
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	0	
Grade, %	-	0	-	-	0	-	-	0	-	-	-	0	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	15	342	100	369	317	0	59	0	309	15	0	0	

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	317	0	0	1479
Stage 1	-	-	-	423
Stage 2	-	-	-	1056
Critical Hdwy	4.12	-	-	7.12
Critical Hdwy Sig 1	-	-	-	6.12
Critical Hdwy Sig 2	-	-	-	6.12
Follow-up Hdwy	2.218	-	-	3.518
Pot Cap-1 Maneuver	1243	-	-	104
Stage 1	-	-	-	609
Stage 2	-	-	-	272
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1242	-	-	71
Mov Cap-2 Maneuver	-	-	-	599
Stage 1	-	-	-	163
Stage 2	-	-	-	181

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	5.3	38.6	157.3
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	NBLn1	SBLn2
Capacity (veh/h)	71	654	1242	-	-	1116	-	-	37	-
HCM Lane V/C Ratio	0.831	0.472	0.012	-	-	0.331	-	-	0.405	-
HCM Control Delay (s)	160.5	15.3	7.9	0	9.8	0	157.3	0	-	-
HCM Lane LOS	F	C	A	A	A	A	A	A	F	A
HCM 95th %ile Q(veh)	4	2.5	0	-	1.5	-	1.4	-	-	-

HCM 2010 TWSC
3: Linwood Ave & Poinsettia Ln/Private Driveway

03/23/2017

Intersection													
Int Delay, s/veh													
0.5													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Vol, veh/h	5	0	5	0	0	2	2	100	2	2	0	151	4
Future Vol, veh/h	5	0	5	0	0	2	2	100	2	0	151	4	4
Conflicting Peds, #/hr	7	0	11	4	0	0	11	0	4	0	0	0	7
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	-
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	0	5	0	0	2	2	100	2	2	0	151	4

Major/Minor	Minor2	Minor1	Major1	Major2
Conflicting Flow All	277	274	175	276
Stage 1	164	164	109	109
Stage 2	113	110	167	166
Critical Hdwy	7.12	6.52	6.22	7.12
Critical Hdwy Sig 1	6.12	5.52	-	6.12
Critical Hdwy Sig 2	6.12	5.52	-	6.12
Follow-up Hdwy	3.518	4.018	3.318	3.518
Pot Cap-1 Maneuver	675	633	868	676
Stage 1	838	762	-	896
Stage 2	892	804	-	835
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	661	623	850	661
Mov Cap-2 Maneuver	661	623	661	622
Stage 1	828	754	-	891
Stage 2	882	799	-	821

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.9	8.9	0.1	0
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Capacity (veh/h)	1397	-	-	744	931	1475	-	-	-	-	-	-	-	-	-
HCM Lane V/C Ratio	0.001	-	-	0.013	0.002	-	-	-	-	-	-	-	-	-	-
HCM Control Delay (s)	7.6	0	-	9.9	8.9	0	-	-	-	-	-	-	-	-	-
HCM Lane LOS	A	A	-	A	A	A	-	-	-	-	-	-	-	-	-
HCM 95th %ile Q(veh)	0	-	-	0	0	0	-	-	-	-	-	-	-	-	-

HCM 2010 TWSC
3: Linwood Ave & Poinsettia Ln/Private Driveway

03/23/2017

Intersection													
Int Delay, s/veh													
0.1													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Vol, veh/h	0	0	2	0	0	0	0	84	0	2	95	21	21
Future Vol, veh/h	0	0	2	0	0	0	0	84	0	2	95	21	21
Conflicting Peds, #/hr	8	0	9	3	0	2	9	0	3	2	0	8	8
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	-
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	2	0	0	0	0	84	0	2	95	21	21

Major/Minor	Minor2	Minor1	Major1	Major2
Conflicting Flow All	211	206	124	207
Stage 1	119	119	-	87
Stage 2	92	87	-	120
Critical Hdwy	7.12	6.52	6.22	7.12
Critical Hdwy Sig 1	6.12	5.52	-	6.12
Critical Hdwy Sig 2	6.12	5.52	-	6.12
Follow-up Hdwy	3.518	4.018	3.318	3.518
Pot Cap-1 Maneuver	746	691	927	751
Stage 1	885	797	-	921
Stage 2	915	823	-	884
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	733	682	911	740
Mov Cap-2 Maneuver	733	682	740	674
Stage 1	877	789	-	918
Stage 2	908	821	-	874

Approach	EB	WB	NB	SB
HCM Control Delay, s	9	0	0	0.1
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Capacity (veh/h)	1449	-	-	911	-	1498	-	-	-	-	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	0.002	-	0.001	-	-	-	-	-	-	-	-	-
HCM Control Delay (s)	0	-	-	9	0	7.4	-	-	-	-	-	-	-	-	-
HCM Lane LOS	A	A	-	A	A	A	-	-	-	-	-	-	-	-	-
HCM 95th %ile Q(veh)	0	-	-	0	-	0	-	-	-	-	-	-	-	-	-

HCM 2010 TWSC

4: Kawana Springs Rd & Taylor Mountain PI

03/23/2017

Intersection									
Int Delay, s/veh 3.3									
Movement	EBL	EBT	WBT	WBR	SBL	SBR			
Lane Configurations									
Traffic Vol, veh/h	22	298	303	34	86	81			
Future Vol, veh/h	22	298	303	34	86	81			
Conflicting Peds, #/hr	1	0	0	0	1	1			
Sign Control	Free	Free	Free	Free	Stop	Stop			
RT Channelized	-	None	-	None	-	None			
Storage Length	-	-	-	-	0	-			
Veh in Median Storage, #	-	0	0	-	0	-			
Grade, %	-	0	-	-	0	-			
Peak Hour Factor	100	100	100	100	100	100			
Heavy Vehicles, %	2	2	2	2	2	2			
Mvmt Flow	22	298	303	34	86	81			
Major/Minor	Major1	Major2	Minor2						
Conflicting Flow All	338	0	0	664	322				
Stage 1	-	-	321						
Stage 2	-	-	343						
Critical Hdwy	4.12	-	6.42	6.22					
Critical Hdwy Sig 1	-	-	5.42						
Critical Hdwy Sig 2	-	-	5.42						
Follow-up Hdwy	2.218	-	3.518	3.318					
Pot Cap-1 Maneuver	1221	-	426	719					
Stage 1	-	-	735						
Stage 2	-	-	719						
Platoon blocked, %	-	-	-						
Mov Cap-1 Maneuver	1220	-	416	718					
Mov Cap-2 Maneuver	-	-	416						
Stage 1	-	-	734						
Stage 2	-	-	703						
Approach	EB	WB	SB						
HCM Control Delay, s	0.6	0	15.1						
HCM LOS			C						
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBL	SBR			
Capacity (veh/h)	1220	-	-	523					
HCM Lane V/C Ratio	0.018	-	-	0.319					
HCM Control Delay (s)	8	0	-	15.1					
HCM Lane LOS	A	A	-	C					
HCM 95th %ile Q(veh)	0.1	-	-	1.4					

HCM 2010 TWSC

4: Kawana Springs Rd & Taylor Mountain PI

03/23/2017

Intersection									
Int Delay, s/veh 1.8									
Movement	EBL	EBT	WBT	WBR	SBL	SBR			
Lane Configurations									
Traffic Vol, veh/h	81	371	275	18	14	58			
Future Vol, veh/h	81	371	275	18	14	58			
Conflicting Peds, #/hr	6	0	0	1	1	6			
Sign Control	Free	Free	Free	Free	Stop	Stop			
RT Channelized	-	None	-	None	-	None			
Storage Length	-	-	-	-	0	-			
Veh in Median Storage, #	-	0	0	-	0	-			
Grade, %	-	0	-	-	0	-			
Peak Hour Factor	100	100	100	100	100	100			
Heavy Vehicles, %	2	2	2	2	2	2			
Mvmt Flow	81	371	275	18	14	58			
Major/Minor	Major1	Major2	Minor2						
Conflicting Flow All	299	0	0	824	296				
Stage 1	-	-	290						
Stage 2	-	-	534						
Critical Hdwy	4.12	-	6.42	6.22					
Critical Hdwy Sig 1	-	-	5.42						
Critical Hdwy Sig 2	-	-	5.42						
Follow-up Hdwy	2.218	-	3.518	3.318					
Pot Cap-1 Maneuver	1262	-	343	743					
Stage 1	-	-	759						
Stage 2	-	-	588						
Platoon blocked, %	-	-	-						
Mov Cap-1 Maneuver	1255	-	312	735					
Mov Cap-2 Maneuver	-	-	312						
Stage 1	-	-	755						
Stage 2	-	-	537						
Approach	EB	WB	SB						
HCM Control Delay, s	1.4	0	12.1						
HCM LOS			B						
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBL	SBR			
Capacity (veh/h)	1255	-	-	582					
HCM Lane V/C Ratio	0.065	-	-	0.124					
HCM Control Delay (s)	8.1	0	-	12.1					
HCM Lane LOS	A	A	-	B					
HCM 95th %ile Q(veh)	0.2	-	-	0.4					

HCM 2010 Signalized Intersection Summary
5: Petaluma Hill Rd & Kawana Springs Rd

03/23/2017

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	
Traffic Volume (veh/h)	176	230	53	226	346	45	108	848	239	23	368	287	
Future Volume (veh/h)	176	230	53	226	346	45	108	848	239	23	368	287	
Number	5	2	12	1	6	16	3	8	18	7	4	14	
Initial Q (Obs), veh	0	0	0	0	0	0	0	0	0	0	0	0	
Ped/Bike Adj(A, pbT)	1.00	0.99	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.99	1.00	0.99	
Parking Buses, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	
Adj Flow Rate, veh/h	176	230	13	226	346	34	108	848	212	23	368	215	
Adj No. of Lanes	1	1	1	1	1	1	0	1	2	0	1	1	
Peak Hour 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	
Percent Heavy Veh. %	2	2	2	2	2	2	2	2	2	2	2	2	
Cap. veh/h	339	527	528	459	502	49	398	1270	317	229	800	813	
Arrive On Green	0.09	0.28	0.28	0.11	0.30	0.30	0.05	0.45	0.45	0.45	0.43	0.43	
Sat Flow, veh/h	1774	1863	1575	1774	1667	164	1774	2794	698	1774	1863	1569	
Grip Volume(V), veh/h	176	230	13	226	0	380	108	537	523	23	368	215	
Grip Sat Flow(s), veh/h/ln	1774	1863	1575	1774	0	1830	1774	1770	1722	1774	1863	1569	
Q Serve(g.s.), s	7.6	11.1	0.6	9.7	0.0	20.1	3.6	26.1	26.2	0.8	15.4	8.4	
Cycle Q Clear(g.c.), s	7.6	11.1	0.6	9.7	0.0	20.1	3.6	26.1	26.2	0.8	15.4	8.4	
Prop In Lane	1.00	1.00	1.00	1.00	0.09	1.00	0.41	1.00	1.00	1.00	1.00	1.00	
Lane Grp Cap(c), veh/h	339	527	528	459	0	551	398	804	783	229	800	813	
V/C Ratio(X)	0.52	0.44	0.02	0.49	0.00	0.69	0.27	0.67	0.67	0.10	0.46	0.26	
Avail Cap(c.a), veh/h	377	527	528	464	0	551	498	804	783	374	800	813	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Upstream Filter(l)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Uniform Delay (d), s/veh	26.0	32.3	24.5	23.7	0.0	33.9	16.3	23.5	23.5	19.0	22.3	14.9	
Incr Delay (d2), s/veh	0.5	2.6	0.1	0.3	0.0	6.9	0.1	4.4	4.5	0.1	1.9	0.8	
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOf(50%), veh/ln	3.7	6.1	0.3	4.7	0.0	11.2	1.7	13.7	13.3	0.4	8.4	3.8	
LnGrp Delay(d), s/veh	26.5	34.9	24.6	24.0	0.0	40.8	16.4	27.9	28.0	19.1	24.2	15.7	
LnGrp LOS	C	C	C	C	D	B	C	C	C	B	C	B	
Approach Vol, veh/h	419												
Approach Delay, s/veh	31.0												
Approach LOS	C												
Timer	1	2	3	4	5	6	7	8					8
Assigned Phs	1	2	3	4	5	6	7	8					8
Phs Duration (G+Y+Rc), s	14.7	35.0	8.8	51.6	12.6	37.0	6.0	54.3					4.3
Change Period (Y+Rc), s	3.0	3.9	3.0	*4.3	3.0	3.9	3.0	4.3					4.3
Max Green Setting (Gmax), s	12.0	31.1	12.0	*4.1	12.0	31.1	12.0	40.7					30.7
Max Q Clear Time (g.c+H1), s	11.7	13.1	5.6	17.4	9.6	22.1	2.8	28.2					25.7
GreenExt Time (p.c.), s	0.0	3.6	0.1	7.4	0.1	2.5	0.0	5.7					3.0
Intersection Summary													
HCM 2010 Ctrl Delay	27.9												
HCM 2010 LOS	C												
Notes													

HCM 2010 Signalized Intersection Summary
5: Petaluma Hill Rd & Kawana Springs Rd

03/23/2017

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	
Traffic Volume (veh/h)	226	435	132	174	338	39	137	678	311	30	415	365	
Future Volume (veh/h)	226	435	132	174	338	39	137	678	311	30	415	365	
Number	5	2	12	1	6	16	3	8	18	7	4	14	
Initial Q (Obs), veh	0	0	0	0	0	0	0	0	0	0	0	0	
Ped/Bike Adj(A, pbT)	1.00	0.99	1.00	0.97	1.00	0.97	1.00	0.98	1.00	0.98	1.00	0.98	
Parking Buses, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	
Adj Flow Rate, veh/h	226	435	79	174	338	35	137	678	292	30	415	238	
Adj No. of Lanes	1	1	1	1	1	1	0	1	2	0	1	1	
Peak Hour 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	
Percent Heavy Veh. %	2	2	2	2	2	2	2	2	2	2	2	2	
Cap. veh/h	402	632	637	344	531	55	307	958	412	226	687	733	
Arrive On Green	0.10	0.34	0.34	0.08	0.32	0.32	0.06	0.40	0.40	0.40	0.03	0.37	
Sat Flow, veh/h	1774	1863	1574	1774	1656	171	1774	2394	1031	1774	1863	1545	
Grip Volume(V), veh/h	226	435	79	174	0	373	137	501	469	30	415	238	
Grip Sat Flow(s), veh/h/ln	1774	1863	1574	1774	0	1827	1774	1770	1655	1774	1863	1545	
Q Serve(g.s.), s	8.3	20.1	3.1	6.5	0.0	17.4	4.6	23.7	23.7	1.0	18.1	9.6	
Cycle Q Clear(g.c.), s	8.3	20.1	3.1	6.5	0.0	17.4	4.6	23.7	23.7	1.0	18.1	9.6	
Prop In Lane	1.00	1.00	1.00	1.00	0.09	1.00	0.62	1.00	1.00	1.00	1.00	1.00	
Lane Grp Cap(c), veh/h	402	632	637	344	0	586	307	708	662	226	687	733	
V/C Ratio(X)	0.56	0.69	0.12	0.51	0.00	0.64	0.45	0.71	0.71	0.13	0.60	0.32	
Avail Cap(c.a), veh/h	414	632	637	389	0	586	431	708	662	379	687	733	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Upstream Filter(l)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Uniform Delay (d), s/veh	20.6	28.5	18.7	21.7	0.0	29.0	19.5	25.1	25.1	20.4	26.7	16.5	
Incr Delay (d2), s/veh	0.9	6.0	0.4	0.4	0.0	5.2	0.4	5.9	6.3	0.1	3.9	1.2	
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOf(50%), veh/ln	4.1	11.3	1.4	3.1	0.0	9.7	2.2	12.7	12.0	0.5	12.7	4.3	
LnGrp Delay(d), s/veh	21.6	34.5	19.1	22.1	0.0	34.2	19.9	31.0	31.4	20.5	36.1	17.7	
LnGrp LOS	C	C	C	B	C	C	B	C	C	C	C	D	
Approach Vol, veh/h	740												
Approach Delay, s/veh	28.9												
Approach LOS	C												
Timer	1	2	3	4	5	6	7	8					8
Assigned Phs	1	2	3	4	5	6	7	8					8
Phs Duration (G+Y+Rc), s	11.5	37.8	9.5	41.2	13.3	36.0	6.4	44.3					4.3
Change Period (Y+Rc), s	3.0	3.9	3.0	*4.3	3.0	3.9	3.0	4.3					4.3
Max Green Setting (Gmax), s	11.0	32.1	12.0	*3.1	11.0	32.1	12.0	30.7					30.7
Max Q Clear Time (g.c+H1), s	8.5	22.1	6.6	20.1	10.3	19.4	3.0	25.7					25.7
GreenExt Time (p.c.), s	0.1	3.8	0.1	5.2	0.0	4.4	0.0	3.0					3.0
Intersection Summary													
HCM 2010 Ctrl Delay	29.5												
HCM 2010 LOS	C												
Notes													

HCM 2010 TWSC

1: Meda Ave & Aston Ave

03/24/2017

Intersection									
Int Delay, s/veh 2.4									
Movement	EBT	EBR	WBL	WBT	NBL	NBR			
Lane Configurations									
Traffic Vol, veh/h	304	16	20	153	51	56			
Future Vol, veh/h	304	16	20	153	51	56			
Conflicting Peds, #/hr	0	0	0	0	4	4			
Sign Control	Free	Free	Free	Free	Stop	Stop			
RT Channelized	-	None	-	None	-	None			
Storage Length	-	-	-	-	0	-			
Veh in Median Storage, #	0	-	0	-	0	-			
Grade, %	0	-	-	0	0	-			
Peak Hour Factor	100	100	100	100	100	100			
Heavy Vehicles, %	2	2	2	2	2	2			
Mvmt Flow	304	16	20	153	51	56			
Major/Minor	Major1	Major2	Minor1						
Conflicting Flow All	0	0	320	0	509	316			
Stage 1	-	-	-	-	312	-			
Stage 2	-	-	-	-	197	-			
Critical Hdwy	-	-	4.12	-	6.42	6.22			
Critical Hdwy Sig 1	-	-	-	-	5.42	-			
Critical Hdwy Sig 2	-	-	-	-	5.42	-			
Follow-up Hdwy	-	-	2.218	-	3.518	3.318			
Pot Cap-1 Maneuver	-	-	1240	-	524	724			
Stage 1	-	-	-	-	742	-			
Stage 2	-	-	-	-	836	-			
Platoon blocked, %	-	-	-	-	-	-			
Mov Cap-1 Maneuver	-	-	1235	-	513	721			
Mov Cap-2 Maneuver	-	-	-	-	513	-			
Stage 1	-	-	-	-	742	-			
Stage 2	-	-	-	-	818	-			
Approach	EB	WB	NB						
HCM Control Delay, s	0	0.9	12.2						
HCM LOS			B						
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT				
Capacity (veh/h)	604	-	-	1235	-				
HCM Lane V/C Ratio	0.177	-	-	0.016	-				
HCM Control Delay (s)	12.2	-	-	8	0				
HCM Lane LOS	B	-	-	A	A				
HCM 95th %ile Q(veh)	0.6	-	-	0	-				

HCM 2010 TWSC

1: Meda Ave & Aston Ave

03/24/2017

Intersection									
Int Delay, s/veh 1.4									
Movement	EBT	EBR	WBL	WBT	NBL	NBR			
Lane Configurations									
Traffic Vol, veh/h	390	53	43	226	26	29			
Future Vol, veh/h	390	53	43	226	26	29			
Conflicting Peds, #/hr	0	0	0	0	1	1			
Sign Control	Free	Free	Free	Free	Stop	Stop			
RT Channelized	-	None	-	None	-	None			
Storage Length	-	-	-	-	0	-			
Veh in Median Storage, #	0	-	0	-	0	-			
Grade, %	0	-	-	0	0	-			
Peak Hour Factor	100	100	100	100	100	100			
Heavy Vehicles, %	2	2	2	2	2	2			
Mvmt Flow	390	53	43	226	26	29			
Major/Minor	Major1	Major2	Minor1						
Conflicting Flow All	0	0	443	0	730	418			
Stage 1	-	-	-	-	417	-			
Stage 2	-	-	-	-	313	-			
Critical Hdwy	-	-	4.12	-	6.42	6.22			
Critical Hdwy Sig 1	-	-	-	-	5.42	-			
Critical Hdwy Sig 2	-	-	-	-	5.42	-			
Follow-up Hdwy	-	-	2.218	-	3.518	3.318			
Pot Cap-1 Maneuver	-	-	1117	-	389	635			
Stage 1	-	-	-	-	665	-			
Stage 2	-	-	-	-	741	-			
Platoon blocked, %	-	-	-	-	-	-			
Mov Cap-1 Maneuver	-	-	1116	-	372	634			
Mov Cap-2 Maneuver	-	-	-	-	372	-			
Stage 1	-	-	-	-	665	-			
Stage 2	-	-	-	-	708	-			
Approach	EB	WB	NB						
HCM Control Delay, s	0	1.3	13.5						
HCM LOS			B						
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT				
Capacity (veh/h)	476	-	-	1116	-				
HCM Lane V/C Ratio	0.116	-	-	0.039	-				
HCM Control Delay (s)	13.5	-	-	8.4	0				
HCM Lane LOS	B	-	-	A	A				
HCM 95th %ile Q(veh)	0.4	-	-	0.1	-				

HCM 2010 TWSC
2: Linwood Ave & Aston Ave

03/24/2017

Intersection		7.9											
Int Delay, s/veh		7.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	1	303	56	221	128	0	44	1	242	0	1	1	
Traffic Vol, veh/h	1	303	56	221	128	0	44	1	242	0	1	1	
Future Vol, veh/h	0	0	4	4	0	4	4	0	4	0	0	0	
Conflicting Peds, #/hr	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	
Sign Control	-	-	None	-	-	None	-	-	None	-	-	None	
RT Channelized	-	-	-	-	-	-	-	-	-	-	-	-	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	55	
Veh in Median Storage, #	-	0	-	0	-	0	-	0	-	-	-	0	
Grade, %	-	0	-	0	-	0	-	0	-	-	-	0	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	1	303	56	221	128	0	44	1	242	0	1	1	

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	132	0	0	363
Stage 1	-	-	-	337
Stage 2	-	-	-	575
Critical Hdwy	4.12	-	-	7.12
Critical Hdwy Sig 1	-	-	-	6.12
Critical Hdwy Sig 2	-	-	-	6.12
Follow-up Hdwy	2.218	-	-	3.518
Pot Cap-1 Maneuver	1453	-	-	255
Stage 1	-	-	-	677
Stage 2	-	-	-	503
Platoon blocked, %	-	-	-	503
Mov Cap-1 Maneuver	1447	-	-	213
Mov Cap-2 Maneuver	-	-	-	213
Stage 1	-	-	-	674
Stage 2	-	-	-	399
Approach	EB	WB	NB	SB
HCM Control Delay, s	0	5.5	20.5	15.7
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	NBLn2	SBLn1	SBLn2
Capacity (veh/h)	514	1447	-	-	1191	-	-	209	906	-
HCM Lane V/C Ratio	0.588	0.001	-	-	0.186	-	-	0.005	0.001	-
HCM Control Delay (s)	20.5	7.5	0	-	8.7	0	-	22.3	9	-
HCM Lane LOS	C	A	A	A	A	A	A	C	A	A
HCM 95th %ile Q(veh)	3.4	0	-	-	0.7	-	-	0	0	-

HCM 2010 TWSC
2: Linwood Ave & Aston Ave

03/24/2017

Intersection		10.9											
Int Delay, s/veh		10.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	1	326	92	337	230	0	39	0	252	1	0	0	
Traffic Vol, veh/h	1	326	92	337	230	0	39	0	252	1	0	0	
Future Vol, veh/h	0	0	1	1	0	0	1	0	1	0	0	0	
Conflicting Peds, #/hr	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	
Sign Control	-	-	None	-	-	None	-	-	None	-	-	None	
RT Channelized	-	-	-	-	-	-	-	-	-	-	-	-	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	55	
Veh in Median Storage, #	-	0	-	0	-	0	-	0	-	-	-	0	
Grade, %	-	0	-	0	-	0	-	0	-	-	-	0	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	1	326	92	337	230	0	39	0	252	1	0	0	

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	230	0	0	419
Stage 1	-	-	-	375
Stage 2	-	-	-	905
Critical Hdwy	4.12	-	-	7.12
Critical Hdwy Sig 1	-	-	-	6.12
Critical Hdwy Sig 2	-	-	-	6.12
Follow-up Hdwy	2.218	-	-	3.518
Pot Cap-1 Maneuver	1338	-	-	143
Stage 1	-	-	-	646
Stage 2	-	-	-	331
Platoon blocked, %	-	-	-	331
Mov Cap-1 Maneuver	1337	-	-	105
Mov Cap-2 Maneuver	-	-	-	105
Stage 1	-	-	-	645
Stage 2	-	-	-	219
Approach	EB	WB	NB	SB
HCM Control Delay, s	0	5.6	36.9	72.9
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	390	1337	-	-	1139	-	-	54	-
HCM Lane V/C Ratio	0.746	0.001	-	-	0.296	-	-	0.019	-
HCM Control Delay (s)	36.9	7.7	0	-	9.5	0	-	72.9	0
HCM Lane LOS	E	A	A	A	A	A	A	F	A
HCM 95th %ile Q(veh)	6	0	-	-	1.2	-	-	0.1	-

HCM 2010 TWSC
3: Linwood Ave & Poinsettia Ln/Private Driveway

03/24/2017

Intersection													
Int Delay, s/veh 2.2													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Vol, veh/h	3	0	3	16	0	20	1	57	6	7	86	2	
Future Vol, veh/h	3	0	3	16	0	20	1	57	6	7	86	2	
Conflicting Peds, #/hr	7	0	11	4	0	0	11	0	4	0	0	7	
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-	
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	3	0	3	16	0	20	1	57	6	7	86	2	

Major/Minor	Minor2	Minor1	Major1	Major2								
Conflicting Flow All	191	181	109	180	179	71	99	0	0	67	0	0
Stage 1	112	112	-	66	66	-	-	-	-	-	-	-
Stage 2	79	69	-	114	113	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Sig 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Sig 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	769	713	945	782	715	991	1494	-	-	1535	-	-
Stage 1	893	803	-	945	840	-	-	-	-	-	-	-
Stage 2	930	837	-	891	802	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	737	699	925	765	701	981	1478	-	-	1525	-	-
Mov Cap-2 Maneuver	883	791	-	765	701	-	-	-	-	-	-	-
Stage 1	883	791	-	940	836	-	-	-	-	-	-	-
Stage 2	904	833	-	874	790	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.4	9.3	0.1	0.5
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Capacity (veh/h)	1478	-	-	820	872	1525	-	-	-	-	-	-	-	-	-
HCM Lane V/C Ratio	0.001	-	-	0.007	0.041	0.005	-	-	-	-	-	-	-	-	-
HCM Control Delay (s)	7.4	0	-	9.4	9.3	7.4	0	-	-	-	-	-	-	-	-
HCM Lane LOS	A	A	-	A	A	A	A	-	-	-	-	-	-	-	-
HCM 95th %ile Q(veh)	0	-	-	0	0.1	0	-	-	-	-	-	-	-	-	-

HCM 2010 TWSC
3: Linwood Ave & Poinsettia Ln/Private Driveway

03/24/2017

Intersection													
Int Delay, s/veh 2.2													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Vol, veh/h	0	0	1	11	0	13	0	48	18	22	54	12	
Future Vol, veh/h	0	0	1	11	0	13	0	48	18	22	54	12	
Conflicting Peds, #/hr	8	0	9	3	0	2	9	0	3	2	0	8	
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-	
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	0	0	1	11	0	13	0	48	18	22	54	12	

Major/Minor	Minor2	Minor1	Major1	Major2								
Conflicting Flow All	185	182	78	174	179	68	75	0	0	69	0	0
Stage 1	113	113	-	60	60	-	-	-	-	-	-	-
Stage 2	72	69	-	114	119	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Sig 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Sig 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	776	712	983	789	715	995	1524	-	-	1532	-	-
Stage 1	892	802	-	951	845	-	-	-	-	-	-	-
Stage 2	938	837	-	891	797	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	745	693	966	770	696	985	1511	-	-	1520	-	-
Mov Cap-2 Maneuver	884	783	-	770	696	-	-	-	-	-	-	-
Stage 1	884	783	-	948	843	-	-	-	-	-	-	-
Stage 2	919	835	-	869	778	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8.7	9.2	0	1.9
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Capacity (veh/h)	1511	-	-	966	873	1520	-	-	-	-	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	0.001	0.027	0.014	-	-	-	-	-	-	-	-	-
HCM Control Delay (s)	0	-	-	8.7	9.2	7.4	0	-	-	-	-	-	-	-	-
HCM Lane LOS	A	A	-	A	A	A	A	-	-	-	-	-	-	-	-
HCM 95th %ile Q(veh)	0	-	-	0	0.1	0	-	-	-	-	-	-	-	-	-

HCM 2010 TWSC

4: Kawana Springs Rd & Taylor Mountain PI

03/24/2017

Intersection		4		3.4	
Int Delay, s/veh		4		3.4	
Movement	EBL	EBT	WBT	WBR	SBR
Lane Configurations					
Traffic Vol, veh/h	22	161	71	20	52
Future Vol, veh/h	22	161	71	20	52
Conflicting Peds, #/hr	1	0	0	0	1
Sign Control	Free	Free	Free	Free	Stop
RT Channelized	-	None	-	None	None
Storage Length	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0
Grade, %	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2
Mvmt Flow	22	161	71	20	52
Major/Minor					
Conflicting Flow All	Major1		Major2		Minor2
Stage 1	92	0	-	0	288
Stage 2	-	-	-	-	82
Critical Hdwy	4.12	-	-	-	206
Critical Hdwy Sig 1	-	-	-	-	6.42
Critical Hdwy Sig 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1503	-	-	-	702
Stage 1	-	-	-	-	941
Stage 2	-	-	-	-	829
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	1502	-	-	-	689
Mov Cap-2 Maneuver	-	-	-	-	689
Stage 1	-	-	-	-	940
Stage 2	-	-	-	-	815
Approach					
EBL	EB	WB	WB	SB	SB
HCM Control Delay, s	0.9	0	0	10.2	10.2
HCM LOS					B
Minor Lane/Major Mvmt					
Capacity (veh/h)	EBL	EBT	WBT	WBR	SBR
HCM Lane V/C Ratio	1502	-	-	-	798
HCM Control Delay (s)	0.015	-	-	-	0.139
HCM Lane LOS	A	A	A	A	B
HCM 95th %ile Q(veh)	0	-	-	-	0.5

HCM 2010 TWSC

4: Kawana Springs Rd & Taylor Mountain PI

03/24/2017

Intersection		4		4	
Int Delay, s/veh		4		4	
Movement	EBL	EBT	WBT	WBR	SBR
Lane Configurations					
Traffic Vol, veh/h	59	65	43	5	44
Future Vol, veh/h	59	65	43	5	44
Conflicting Peds, #/hr	6	0	0	1	6
Sign Control	Free	Free	Free	Free	Stop
RT Channelized	-	None	-	None	None
Storage Length	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0
Grade, %	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2
Mvmt Flow	59	65	43	5	44
Major/Minor					
Conflicting Flow All	Major1		Major2		Minor2
Stage 1	54	0	-	0	236
Stage 2	-	-	-	-	52
Critical Hdwy	4.12	-	-	-	184
Critical Hdwy Sig 1	-	-	-	-	6.42
Critical Hdwy Sig 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1551	-	-	-	752
Stage 1	-	-	-	-	970
Stage 2	-	-	-	-	848
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	1542	-	-	-	714
Mov Cap-2 Maneuver	-	-	-	-	714
Stage 1	-	-	-	-	964
Stage 2	-	-	-	-	809
Approach					
EBL	EB	WB	WB	SB	SB
HCM Control Delay, s	3.5	0	0	9	9
HCM LOS					A
Minor Lane/Major Mvmt					
Capacity (veh/h)	EBL	EBT	WBT	WBR	SBR
HCM Lane V/C Ratio	1542	-	-	-	958
HCM Control Delay (s)	0.038	-	-	-	0.051
HCM Lane LOS	A	A	A	A	A
HCM 95th %ile Q(veh)	0.1	-	-	-	0.2

HCM 2010 Signalized Intersection Summary
5: Petaluma Hill Rd & Kawana Springs Rd

03/24/2017

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	→	→	→	←	←	←	←	←	←	←	←	←
Traffic Volume (veh/h)	125	129	45	175	189	29	80	768	168	14	338	181
Future Volume (veh/h)	125	129	45	175	189	29	80	768	168	14	338	181
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A, pbT)	1.00	0.99	1.00	0.98	1.00	0.98	1.00	1.00	0.98	1.00	0.99	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	125	129	5	175	189	18	80	768	141	14	338	109
Adj No. of Lanes	1	1	1	1	1	1	0	1	2	0	1	1
Peak Hour 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
Percent Heavy Veh. %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	432	527	524	504	506	48	464	1437	264	284	842	815
Arrive On Green	0.07	0.28	0.28	0.09	0.30	0.30	0.05	0.48	0.48	0.02	0.45	0.45
Sat Flow, veh/h	1774	1863	1575	1774	1672	159	1774	2976	546	1774	1863	1569
Grip Volume(V), veh/h	125	129	5	175	0	207	80	457	452	14	338	109
Grip Sat Flow(s), veh/h/ln	1774	1863	1575	1774	0	1831	1774	1770	1753	1774	1863	1569
Q Serve(g.s), s	5.4	5.9	0.2	7.5	0.0	9.8	2.5	19.8	19.8	0.5	13.4	4.0
Cycle Q Clear(g.c), s	5.4	5.9	0.2	7.5	0.0	9.8	2.5	19.8	19.8	0.5	13.4	4.0
Prop In Lane	1.00	1.00	1.00	1.00	1.00	0.09	1.00	0.31	1.00	1.00	1.00	1.00
Lane Grp Cap(c), veh/h	432	527	524	504	0	554	464	855	847	284	842	815
V/C Ratio(X)	0.29	0.24	0.01	0.35	0.00	0.37	0.17	0.53	0.53	0.05	0.40	0.13
Avail Cap(c.a), veh/h	508	527	524	545	0	554	569	855	847	444	842	815
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.3	30.4	24.6	23.8	0.0	30.2	14.4	19.8	19.8	16.8	20.2	13.7
Incr Delay (d2), s/veh	0.1	1.1	0.0	0.2	0.0	1.9	0.1	2.4	2.4	0.0	1.4	0.3
Initial O Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOf(50%),veh/ln	2.7	3.2	0.1	3.6	0.0	5.2	1.2	10.2	10.1	0.2	7.2	1.8
LnGrp Delay(d),s/veh	25.5	31.5	24.6	23.9	0.0	32.1	14.5	22.2	22.2	16.8	21.6	14.0
LnGrp LOS	C	C	C	C	C	C	C	C	C	C	C	B
Approach Vol, veh/h	259	285	382	382	382	989	216	19.7				
Approach Delay, s/veh	28.5	32.5	28.3	28.3	28.3	21.6	19.7					
Approach LOS	C	C	C	C	C	C	B					
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	12.5	35.0	8.5	54.0	10.3	37.2	5.1	57.4				
Change Period (Y+Rc), s	3.0	3.9	3.0	*4.3	3.0	3.9	3.0	4.3				
Max Green Setting (Gmax), s	12.0	31.1	12.0	*4.1	12.0	31.1	12.0	40.7				
Max O Clear Time (g.c+H1), s	9.5	7.9	4.5	15.4	7.4	11.8	2.5	21.8				
GreenExt Time (p.c), s	0.1	2.0	0.0	6.1	0.1	1.8	0.0	5.6				
Intersection Summary												
HCM 2010 Ctrl Delay	23.3											
HCM 2010 LOS	C											
Notes												

HCM 2010 Signalized Intersection Summary
5: Petaluma Hill Rd & Kawana Springs Rd

03/24/2017

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	→	→	→	←	←	←	←	←	←	←	←	←
Traffic Volume (veh/h)	200	209	117	152	206	28	115	673	198	16	412	265
Future Volume (veh/h)	200	209	117	152	206	28	115	673	198	16	412	265
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A, pbT)	0.99	0.99	1.00	0.97	1.00	0.97	1.00	1.00	0.98	1.00	0.98	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	200	209	64	152	206	24	115	673	179	16	412	138
Adj No. of Lanes	1	1	1	1	1	1	0	1	2	0	1	1
Peak Hour 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
Percent Heavy Veh. %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	492	631	624	487	524	61	326	1162	309	262	719	745
Arrive On Green	0.09	0.34	0.34	0.08	0.32	0.32	0.06	0.42	0.42	0.02	0.39	0.39
Sat Flow, veh/h	1774	1863	1574	1774	1633	190	1774	2753	732	1774	1863	1546
Grip Volume(V), veh/h	200	209	64	152	0	230	115	432	420	16	412	138
Grip Sat Flow(s), veh/h/ln	1774	1863	1574	1774	0	1823	1774	1770	1715	1774	1863	1546
Q Serve(g.s), s	7.3	8.4	2.6	5.7	0.0	9.8	3.7	18.7	18.7	0.5	17.4	5.1
Cycle Q Clear(g.c), s	7.3	8.4	2.6	5.7	0.0	9.8	3.7	18.7	18.7	0.5	17.4	5.1
Prop In Lane	1.00	1.00	1.00	1.00	1.00	0.10	1.00	0.43	1.00	1.00	1.00	1.00
Lane Grp Cap(c), veh/h	492	631	624	487	0	585	326	747	724	262	719	745
V/C Ratio(X)	0.41	0.33	0.10	0.31	0.00	0.39	0.35	0.58	0.58	0.06	0.57	0.19
Avail Cap(c.a), veh/h	521	631	624	547	0	585	465	747	724	436	719	745
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.5	24.6	19.0	20.1	0.0	26.4	18.5	22.1	22.1	18.9	25.2	14.9
Incr Delay (d2), s/veh	0.2	1.4	0.3	0.1	0.0	2.0	0.2	3.3	3.4	0.0	3.3	0.5
Initial O Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOf(50%),veh/ln	3.6	4.5	1.2	2.8	0.0	5.2	1.8	9.8	9.5	0.3	12.2	2.3
LnGrp Delay(d),s/veh	19.7	26.0	19.3	20.3	0.0	28.4	18.8	25.4	25.5	18.9	33.2	15.4
LnGrp LOS	B	C	C	C	C	C	C	C	C	C	C	B
Approach Vol, veh/h	473	473	382	382	382	967	246	28.5				
Approach Delay, s/veh	22.5	22.5	25.1	25.1	25.1	24.6	28.5					
Approach LOS	C	C	C	C	C	C	B					
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	10.6	37.8	8.8	42.9	12.4	36.0	5.2	46.5				
Change Period (Y+Rc), s	3.0	3.9	3.0	*4.3	3.0	3.9	3.0	4.3				
Max Green Setting (Gmax), s	11.0	32.1	12.0	*3.1	11.0	32.1	12.0	30.7				
Max O Clear Time (g.c+H1), s	7.7	10.4	5.7	19.4	9.3	11.8	2.5	20.7				
GreenExt Time (p.c), s	0.1	2.8	0.1	4.7	0.1	2.7	0.0	4.3				
Intersection Summary												
HCM 2010 Ctrl Delay	25.2											
HCM 2010 LOS	C											
Notes												

HCM 2010 TWSC

1: Meda Ave & Aston Ave

03/24/2017

Intersection									
Int Delay, s/veh 2.6									
Movement	EBT	EBR	WBL	WBT	NBL	NBR			
Lane Configurations									
Traffic Vol, veh/h	332	28	36	193	51	56			
Future Vol, veh/h	332	28	36	193	51	56			
Conflicting Peds, #/hr	0	0	0	0	4	4			
Sign Control	Free	Free	Free	Free	Stop	Stop			
RT Channelized	-	None	-	None	-	None			
Storage Length	-	-	-	-	0	-			
Veh in Median Storage, #	0	-	-	0	0	-			
Grade, %	0	-	-	0	0	-			
Peak Hour Factor	100	100	100	100	100	100			
Heavy Vehicles, %	2	2	2	2	2	2			
Mvmt Flow	332	28	36	193	51	56			
Major/Minor	Major1		Major2		Minor1				
Conflicting Flow All	0	0	360	0	615	350			
Stage 1	-	-	-	-	346	-			
Stage 2	-	-	-	-	269	-			
Critical Hdwy	-	-	4.12	-	7.12	6.22			
Critical Hdwy Sig 1	-	-	-	-	6.12	-			
Critical Hdwy Sig 2	-	-	-	-	6.12	-			
Follow-up Hdwy	-	-	2.218	-	3.518	3.318			
Pot Cap-1 Maneuver	-	-	1199	-	403	693			
Stage 1	-	-	-	-	670	-			
Stage 2	-	-	-	-	737	-			
Platoon blocked, %	-	-	-	-	-	-			
Mov Cap-1 Maneuver	-	-	1194	-	391	690			
Mov Cap-2 Maneuver	-	-	-	-	391	-			
Stage 1	-	-	-	-	670	-			
Stage 2	-	-	-	-	709	-			
Approach	EB	EB	WB	WB	NB	NB			
HCM Control Delay, s	0	0	1.3	1.3	14	14			
HCM LOS					B	B			
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	NBLn1			
Capacity (veh/h)	506	-	-	1194	-	-			
HCM Lane V/C Ratio	0.211	-	-	0.03	-	-			
HCM Control Delay (s)	14	-	-	8.1	0	-			
HCM Lane LOS	B	-	-	A	A	-			
HCM 95th %ile Q(veh)	0.8	-	-	0.1	-	-			

HCM 2010 TWSC

1: Meda Ave & Aston Ave

03/24/2017

Intersection									
Int Delay, s/veh 2.2									
Movement	EBT	EBR	WBL	WBT	NBL	NBR			
Lane Configurations									
Traffic Vol, veh/h	417	53	55	328	47	52			
Future Vol, veh/h	417	53	55	328	47	52			
Conflicting Peds, #/hr	0	0	0	0	1	1			
Sign Control	Free	Free	Free	Free	Stop	Stop			
RT Channelized	-	None	-	None	-	None			
Storage Length	-	-	-	-	0	-			
Veh in Median Storage, #	0	-	-	0	0	-			
Grade, %	0	-	-	0	0	-			
Peak Hour Factor	100	100	100	100	100	100			
Heavy Vehicles, %	2	2	2	2	2	2			
Mvmt Flow	417	53	55	328	47	52			
Major/Minor	Major1		Major2		Minor1				
Conflicting Flow All	0	0	470	0	883	445			
Stage 1	-	-	-	-	444	-			
Stage 2	-	-	-	-	439	-			
Critical Hdwy	-	-	4.12	-	6.42	6.22			
Critical Hdwy Sig 1	-	-	-	-	5.42	-			
Critical Hdwy Sig 2	-	-	-	-	5.42	-			
Follow-up Hdwy	-	-	2.218	-	3.518	3.318			
Pot Cap-1 Maneuver	-	-	1092	-	316	613			
Stage 1	-	-	-	-	646	-			
Stage 2	-	-	-	-	650	-			
Platoon blocked, %	-	-	-	-	-	-			
Mov Cap-1 Maneuver	-	-	1091	-	296	612			
Mov Cap-2 Maneuver	-	-	-	-	296	-			
Stage 1	-	-	-	-	646	-			
Stage 2	-	-	-	-	609	-			
Approach	EB	EB	WB	WB	NB	NB			
HCM Control Delay, s	0	0	1.2	1.2	16.7	16.7			
HCM LOS					C	C			
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	NBLn1			
Capacity (veh/h)	406	-	-	1091	-	-			
HCM Lane V/C Ratio	0.244	-	-	0.05	-	-			
HCM Control Delay (s)	16.7	-	-	8.5	0	-			
HCM Lane LOS	C	-	-	A	A	-			
HCM 95th %ile Q(veh)	0.9	-	-	0.2	-	-			

HCM 2010 TWSC

2: Linwood Ave & Aston Ave

03/24/2017

Intersection													
Int Delay, s/veh 34													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↔ ↗ ↘												
Traffic Vol, veh/h	1	323	64	228	133	0	88	2	390	0	4	8	
Future Vol, veh/h	1	323	64	228	133	0	88	2	390	0	4	8	
Conflicting Peds, #/hr	0	0	4	4	0	4	4	0	4	0	0	0	
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	55
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	1	323	64	228	133	0	88	2	390	0	4	8	

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	137	0	0	956
Stage 1	-	-	-	361
Stage 2	-	-	-	595
Critical Hdwy	4.12	-	-	7.12
Critical Hdwy Sig 1	-	-	-	6.12
Critical Hdwy Sig 2	-	-	-	6.12
Follow-up Hdwy	2.218	-	-	3.518
Pot Cap-1 Maneuver	1447	-	-	238
Stage 1	-	-	-	657
Stage 2	-	-	-	491
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1441	-	-	193
Mov Cap-2 Maneuver	-	-	-	193
Stage 1	-	-	-	654
Stage 2	-	-	-	378

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	5.6	83.3	14
HCM LOS			F	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	461	1441	-	-	1164	-	-	194	900
HCM Lane V/C Ratio	1.041	0.001	-	-	0.196	-	-	0.021	0.009
HCM Control Delay (s)	83.3	7.5	0	-	8.8	0	-	23.9	0
HCM Lane LOS	F	A	A	A	A	A	A	C	A
HCM 95th %ile Q(veh)	14.7	0	-	-	0.7	-	-	0.1	0

HCM 2010 TWSC

2: Linwood Ave & Aston Ave

03/24/2017

Intersection													
Int Delay, s/veh 70.4													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	↔ ↗ ↘												
Traffic Vol, veh/h	15	342	112	379	317	0	66	0	315	15	0	0	
Future Vol, veh/h	15	342	112	379	317	0	66	0	315	15	0	0	
Conflicting Peds, #/hr	0	0	1	1	0	0	1	0	1	0	0	0	
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	55
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	15	342	112	379	317	0	66	0	315	15	0	0	

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	317	0	0	1505
Stage 1	-	-	-	429
Stage 2	-	-	-	1076
Critical Hdwy	4.12	-	-	7.12
Critical Hdwy Sig 1	-	-	-	6.12
Critical Hdwy Sig 2	-	-	-	6.12
Follow-up Hdwy	2.218	-	-	3.518
Pot Cap-1 Maneuver	1243	-	-	100
Stage 1	-	-	-	604
Stage 2	-	-	-	266
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1242	-	-	67
Mov Cap-2 Maneuver	-	-	-	67
Stage 1	-	-	-	594
Stage 2	-	-	-	155

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	5.4	267.8	260.4
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	259	1242	-	-	1105	-	-	26	-
HCM Lane V/C Ratio	1.471	0.012	-	-	0.343	-	-	0.577	-
HCM Control Delay (s)	267.8	7.9	0	-	9.9	0	-	260.4	0
HCM Lane LOS	F	A	A	A	A	A	A	F	A
HCM 95th %ile Q(veh)	21.8	0	-	-	1.5	-	-	1.8	-

HCM 2010 TWSC

2: Linwood Ave & Aston Ave

03/24/2017

Intersection		10											
Int Delay, s/veh		10											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	1	323	64	228	133	0	88	2	390	0	4	8	
Traffic Vol, veh/h	1	323	64	228	133	0	88	2	390	0	4	8	
Future Vol, veh/h	0	0	4	4	0	4	4	0	4	0	0	0	
Conflicting Peds, #/hr	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
Sign Control	-	-	None	-	-	None	-	-	None	-	-	None	
RT Channelized	-	-	-	-	-	-	50	-	0	-	-	55	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	
Veh in Median Storage, #	-	-	-	-	-	-	-	-	-	-	-	-	
Grade, %	-	-	-	-	-	-	-	-	-	-	-	-	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	1	323	64	228	133	0	88	2	390	0	4	8	

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	137	0	0	956
Stage 1	-	-	-	361
Stage 2	-	-	-	593
Critical Hdwy	4.12	-	-	7.12
Critical Hdwy Sig 1	-	-	-	6.12
Critical Hdwy Sig 2	-	-	-	6.12
Follow-up Hdwy	2.218	-	-	3.518
Pot Cap-1 Maneuver	1447	-	-	238
Stage 1	-	-	-	657
Stage 2	-	-	-	493
Platoon blocked, %	-	-	-	491
Mov Cap-1 Maneuver	1441	-	-	193
Mov Cap-2 Maneuver	-	-	-	202
Stage 1	-	-	-	677
Stage 2	-	-	-	83

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	5.6	21.4	14
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	NBLn1	NBLn2	SBLn1	SBLn2
Capacity (veh/h)	193	677	1441	-	-	1164	-	-	194	900	-	-
HCM Lane V/C Ratio	0.466	0.576	0.001	-	-	0.196	-	-	0.021	0.009	-	-
HCM Control Delay (s)	39	17.3	7.5	0	8.8	0	23.9	9	-	-	-	-
HCM Lane LOS	E	C	A	A	A	A	A	A	C	A	-	-
HCM 95th %ile Q(veh)	2.2	3.7	0	-	0.7	-	-	-	0.1	0	-	-

HCM 2010 TWSC

2: Linwood Ave & Aston Ave

03/24/2017

Intersection		16.2											
Int Delay, s/veh		16.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	15	342	112	379	317	0	66	0	315	15	0	0	
Traffic Vol, veh/h	15	342	112	379	317	0	66	0	315	15	0	0	
Future Vol, veh/h	0	0	1	1	0	0	1	0	1	0	0	0	
Conflicting Peds, #/hr	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
Sign Control	-	-	None	-	-	None	-	-	None	-	-	None	
RT Channelized	-	-	-	-	-	-	50	-	0	-	-	55	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	
Veh in Median Storage, #	-	-	-	-	-	-	-	-	-	-	-	-	
Grade, %	-	-	-	-	-	-	-	-	-	-	-	-	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	15	342	112	379	317	0	66	0	315	15	0	0	

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	317	0	0	1505
Stage 1	-	-	-	429
Stage 2	-	-	-	1076
Critical Hdwy	4.12	-	-	7.12
Critical Hdwy Sig 1	-	-	-	6.12
Critical Hdwy Sig 2	-	-	-	6.12
Follow-up Hdwy	2.218	-	-	3.518
Pot Cap-1 Maneuver	1243	-	-	100
Stage 1	-	-	-	604
Stage 2	-	-	-	266
Platoon blocked, %	-	-	-	266
Mov Cap-1 Maneuver	1242	-	-	67
Mov Cap-2 Maneuver	-	-	-	69
Stage 1	-	-	-	649
Stage 2	-	-	-	34

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	5.4	49.3	177.1
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	NBLn1	NBLn2	SBLn1	SBLn2
Capacity (veh/h)	67	649	1242	-	-	1105	-	-	34	-	-	-
HCM Lane V/C Ratio	0.985	0.485	0.012	-	-	0.343	-	-	0.441	-	-	-
HCM Control Delay (s)	209.7	15.7	7.9	0	9.9	0	177.1	0	-	-	-	-
HCM Lane LOS	F	C	A	A	A	A	A	A	F	A	-	-
HCM 95th %ile Q(veh)	4.9	2.7	0	-	1.5	-	-	-	1.5	-	-	-

HCM 2010 TWSC
3: Linwood Ave & Poinsettia Ln/Private Driveway

03/24/2017

Intersection													
Int Delay, s/veh 1.6													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Vol, veh/h	5	0	5	11	0	15	2	100	20	21	151	4	
Future Vol, veh/h	5	0	5	11	0	15	2	100	20	21	151	4	
Conflicting Peds, #/hr	7	0	11	4	0	0	11	0	4	0	0	7	
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	0	
Grade, %	-	0	-	-	0	-	-	0	-	-	-	0	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	5	0	5	11	0	15	2	100	20	21	151	4	

Major/Minor	Minor2	Minor1	Major1	Major2
Conflicting Flow All	335	327	326	121
Stage 1	206	118	118	-
Stage 2	129	209	208	-
Critical Hdwy	7.12	6.52	6.22	4.12
Critical Hdwy Sig 1	6.12	5.52	6.12	5.52
Critical Hdwy Sig 2	6.12	5.52	6.12	5.52
Follow-up Hdwy	3.518	4.018	3.318	2.218
Pot Cap-1 Maneuver	619	586	868	626
Stage 1	796	731	887	798
Stage 2	875	790	793	730
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	590	567	850	605
Mov Cap-2 Maneuver	590	567	850	605
Stage 1	786	712	882	793
Stage 2	853	785	768	711

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.2	9.9	0.1	0.9
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Capacity (veh/h)	1397	-	-	697	754	1453	-	-	-	-	-	-	-	-	-
HCM Lane V/C Ratio	0.001	-	-	0.014	0.034	0.014	-	-	-	-	-	-	-	-	-
HCM Control Delay (s)	7.6	0	0	10.2	9.9	7.5	0	0	0	0	0	0	0	0	0
HCM Lane LOS	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A
HCM 95th %ile Q(veh)	0	-	-	0	0.1	0	-	-	-	-	-	-	-	-	-

HCM 2010 TWSC
3: Linwood Ave & Poinsettia Ln/Private Driveway

03/24/2017

Intersection													
Int Delay, s/veh 1.6													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Vol, veh/h	0	0	2	11	0	13	0	84	18	23	95	21	
Future Vol, veh/h	0	0	2	11	0	13	0	84	18	23	95	21	
Conflicting Peds, #/hr	8	0	9	3	0	2	9	0	3	2	0	8	
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	-	0	
Grade, %	-	0	-	-	0	-	-	0	-	-	-	0	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2	
Mvmt Flow	0	0	2	11	0	13	0	84	18	23	95	21	

Major/Minor	Minor2	Minor1	Major1	Major2
Conflicting Flow All	269	266	124	258
Stage 1	161	161	-	96
Stage 2	108	105	-	162
Critical Hdwy	7.12	6.52	6.22	4.12
Critical Hdwy Sig 1	6.12	5.52	6.12	5.52
Critical Hdwy Sig 2	6.12	5.52	6.12	5.52
Follow-up Hdwy	3.518	4.018	3.318	2.218
Pot Cap-1 Maneuver	684	640	927	695
Stage 1	841	765	-	911
Stage 2	897	808	-	840
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	655	622	911	677
Mov Cap-2 Maneuver	655	622	911	677
Stage 1	834	746	-	908
Stage 2	878	806	-	817

Approach	EB	WB	NB	SB
HCM Control Delay, s	9	9.7	0	1.2
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Capacity (veh/h)	1449	-	-	911	798	1475	-	-	-	-	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	0.002	0.03	0.016	-	-	-	-	-	-	-	-	-
HCM Control Delay (s)	0	-	0	9.7	7.5	0	0	0	0	0	0	0	0	0	0
HCM Lane LOS	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A
HCM 95th %ile Q(veh)	0	-	-	0	0.1	0	-	-	-	-	-	-	-	-	-

HCM 2010 TWSC

4: Kawana Springs Rd & Taylor Mountain PI

03/24/2017

Intersection									
Int Delay, s/veh 3.7									
Movement	EBL	EBT	WBT	WBR	SBL	SBR			
Lane Configurations									
Traffic Vol, veh/h	40	298	303	34	86	92			
Future Vol, veh/h	40	298	303	34	86	92			
Conflicting Peds, #/hr	1	0	0	0	1	1			
Sign Control	Free	Free	Free	Free	Stop	Stop			
RT Channelized	-	None	-	None	-	None			
Storage Length	-	-	-	-	0	-			
Veh in Median Storage, #	-	0	0	-	0	-			
Grade, %	-	0	-	-	0	-			
Peak Hour Factor	100	100	100	100	100	100			
Heavy Vehicles, %	2	2	2	2	2	2			
Mvmt Flow	40	298	303	34	86	92			
Major/Minor	Major1	Major2	Minor2						
Conflicting Flow All	338	0	700	322					
Stage 1	-	-	321	-					
Stage 2	-	-	379	-					
Critical Hdwy	4.12	-	6.42	6.22					
Critical Hdwy Sig 1	-	-	5.42	-					
Critical Hdwy Sig 2	-	-	5.42	-					
Follow-up Hdwy	2.218	-	3.518	3.318					
Pot Cap-1 Maneuver	1221	-	405	719					
Stage 1	-	-	735	-					
Stage 2	-	-	692	-					
Platoon blocked, %	-	-	-	-					
Mov Cap-1 Maneuver	1220	-	388	718					
Mov Cap-2 Maneuver	-	-	388	-					
Stage 1	-	-	734	-					
Stage 2	-	-	664	-					
Approach	EB	WB	SB						
HCM Control Delay, s	1	0	15.8	C					
HCM LOS									
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBL	SBR			
Capacity (veh/h)	1220	-	-	509					
HCM Lane V/C Ratio	0.033	-	-	0.35					
HCM Control Delay (s)	8.1	0	-	15.8					
HCM Lane LOS	A	A	-	C					
HCM 95th %ile Q(veh)	0.1	-	-	1.6					

HCM 2010 TWSC

4: Kawana Springs Rd & Taylor Mountain PI

03/24/2017

Intersection									
Int Delay, s/veh 2.1									
Movement	EBL	EBT	WBT	WBR	SBL	SBR			
Lane Configurations									
Traffic Vol, veh/h	99	371	275	18	14	69			
Future Vol, veh/h	99	371	275	18	14	69			
Conflicting Peds, #/hr	6	0	0	1	1	6			
Sign Control	Free	Free	Free	Free	Stop	Stop			
RT Channelized	-	None	-	None	-	None			
Storage Length	-	-	-	-	0	-			
Veh in Median Storage, #	-	0	0	-	0	-			
Grade, %	-	0	-	-	0	-			
Peak Hour Factor	100	100	100	100	100	100			
Heavy Vehicles, %	2	2	2	2	2	2			
Mvmt Flow	99	371	275	18	14	69			
Major/Minor	Major1	Major2	Minor2						
Conflicting Flow All	299	0	860	296					
Stage 1	-	-	290	-					
Stage 2	-	-	570	-					
Critical Hdwy	4.12	-	6.42	6.22					
Critical Hdwy Sig 1	-	-	5.42	-					
Critical Hdwy Sig 2	-	-	5.42	-					
Follow-up Hdwy	2.218	-	3.518	3.318					
Pot Cap-1 Maneuver	1262	-	326	743					
Stage 1	-	-	759	-					
Stage 2	-	-	566	-					
Platoon blocked, %	-	-	-	-					
Mov Cap-1 Maneuver	1255	-	290	735					
Mov Cap-2 Maneuver	-	-	290	-					
Stage 1	-	-	755	-					
Stage 2	-	-	507	-					
Approach	EB	WB	SB						
HCM Control Delay, s	1.7	0	12.2	B					
HCM LOS									
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBL	SBR			
Capacity (veh/h)	1255	-	-	584					
HCM Lane V/C Ratio	0.079	-	-	0.142					
HCM Control Delay (s)	8.1	0	-	12.2					
HCM Lane LOS	A	A	-	B					
HCM 95th %ile Q(veh)	0.3	-	-	0.5					

HCM 2010 Signalized Intersection Summary
5: Petaluma Hill Rd & Kawana Springs Rd

03/24/2017

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	176	242	53	230	353	45	108	848	245	23	368	287
Future Volume (veh/h)	176	242	53	230	353	45	108	848	245	23	368	287
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped/Bike Adj (A_pbT)	1.00	0.99	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	176	242	13	230	353	34	108	848	218	23	368	215
Adj No. of Lanes	1	1	1	1	1	1	0	1	2	0	1	1
Peak Hour 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
Percent Heavy Veh. %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	335	527	528	452	505	49	397	1258	323	226	798	810
Arrive On Green	0.09	0.28	0.28	0.11	0.30	0.30	0.05	0.45	0.45	0.03	0.43	0.43
Sat Flow, veh/h	1774	1863	1575	1774	1670	161	1774	2775	713	1774	1863	1569
Grip Volume (V), veh/h	176	242	13	230	0	387	108	541	525	23	368	215
Grip Sat Flow (S), veh/h/ln	1774	1863	1575	1774	0	1831	1774	1770	1719	1774	1863	1569
Q Serve (g, s), s	7.6	11.8	0.6	9.8	0.0	20.6	3.6	26.5	26.5	0.8	15.5	8.5
Cycle Q Clear (g, c), s	7.6	11.8	0.6	9.8	0.0	20.6	3.6	26.5	26.5	0.8	15.5	8.5
Prop In Lane	1.00	1.00	1.00	1.00	0.09	1.00	1.00	0.41	1.00	1.00	1.00	1.00
Lane Grp Cap (c), veh/h	335	527	528	452	0	554	397	802	779	226	798	810
V/C Ratio (X)	0.52	0.46	0.02	0.51	0.00	0.70	0.27	0.67	0.67	0.10	0.46	0.27
Avail Cap (c, a), veh/h	373	527	528	455	0	554	497	802	779	371	798	810
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter (f)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.1	32.5	24.5	23.6	0.0	33.9	16.4	23.7	23.7	19.2	22.4	14.9
Incr Delay (d2), s/veh	0.5	2.9	0.1	0.4	0.0	7.2	0.1	4.5	4.6	0.1	1.9	0.8
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfJ(50%), veh/ln	3.7	6.5	0.3	4.8	0.0	11.5	1.8	13.9	13.6	0.4	8.4	3.8
LnGrp Delay (d) s/veh	26.5	35.4	24.6	24.0	0.0	41.1	16.5	28.2	28.3	19.3	24.3	15.7
LnGrp LOS	C	D	C	C	D	B	C	C	C	B	C	B
Approach Vol, veh/h	431											
Approach Delay, s/veh	31.5											
Approach LOS	C											
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	14.8	35.0	8.8	51.4	12.6	37.2	6.0	54.2				
Change Period (Y+Rb), s	3.0	3.9	3.0	* 4.3	3.0	3.9	3.0	4.3				
Max Green Setting (Gmax), s	12.0	31.1	12.0	* 4.1	12.0	31.1	12.0	40.7				
Max Q Clear Time (g, c+H), s	11.8	13.8	5.6	17.5	9.6	22.6	2.8	28.5				
Green Ext Time (g, c), s	0.0	3.7	0.1	7.5	0.1	2.5	0.0	5.6				
Intersection Summary												
HCM 2010 Ctrl Delay	28.2											
HCM 2010 LOS	C											
Notes												

HCM 2010 Signalized Intersection Summary
5: Petaluma Hill Rd & Kawana Springs Rd

03/24/2017

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	226	447	132	178	345	39	137	678	317	30	415	365
Future Volume (veh/h)	226	447	132	178	345	39	137	678	317	30	415	365
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	12
Ped/Bike Adj (A_pbT)	1.00	0.99	1.00	0.97	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	226	447	79	178	345	35	137	678	298	30	415	238
Adj No. of Lanes	1	1	1	1	1	1	0	1	2	0	1	1
Peak Hour 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
Percent Heavy Veh. %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	397	630	635	337	533	54	307	951	418	224	687	733
Arrive On Green	0.10	0.34	0.34	0.09	0.32	0.32	0.06	0.40	0.40	0.03	0.37	0.37
Sat Flow, veh/h	1774	1863	1574	1774	1659	168	1774	2377	1045	1774	1863	1545
Grip Volume (V), veh/h	226	447	79	178	0	380	137	505	471	30	415	238
Grip Sat Flow (S), veh/h/ln	1774	1863	1574	1774	0	1828	1774	1770	1652	1774	1863	1545
Q Serve (g, s), s	8.3	20.9	3.2	6.6	0.0	17.8	4.6	23.9	23.9	1.0	18.1	9.6
Cycle Q Clear (g, c), s	8.3	20.9	3.2	6.6	0.0	17.8	4.6	23.9	23.9	1.0	18.1	9.6
Prop In Lane	1.00	1.00	1.00	1.00	0.09	1.00	1.00	0.63	1.00	1.00	1.00	1.00
Lane Grp Cap (c), veh/h	397	630	635	337	0	587	307	708	661	224	687	733
V/C Ratio (X)	0.57	0.71	0.12	0.53	0.00	0.65	0.45	0.71	0.71	0.13	0.60	0.32
Avail Cap (c, a), veh/h	409	630	635	380	0	587	431	708	661	377	687	733
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter (f)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.8	28.8	18.8	21.9	0.0	29.1	19.5	25.2	25.2	20.4	26.7	16.5
Incr Delay (d2), s/veh	1.1	6.7	0.4	0.5	0.0	5.5	0.4	6.0	6.5	0.1	3.9	1.2
Initial Q Delay (d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfJ(50%), veh/ln	4.1	11.8	1.4	3.2	0.0	9.9	2.3	12.8	12.0	0.5	12.8	4.3
LnGrp Delay (d) s/veh	21.8	35.5	19.2	22.3	0.0	34.6	19.9	31.2	31.6	20.5	36.1	17.7
LnGrp LOS	C	D	B	C	C	C	B	C	C	C	D	B
Approach Vol, veh/h	752											
Approach Delay, s/veh	29.7											
Approach LOS	C											
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	11.6	37.7	9.5	41.2	13.3	36.0	6.4	44.3				
Change Period (Y+Rb), s	3.0	3.9	3.0	* 4.3	3.0	3.9	3.0	4.3				
Max Green Setting (Gmax), s	11.0	32.1	12.0	* 3.1	11.0	32.1	12.0	30.7				
Max Q Clear Time (g, c+H), s	8.6	22.9	6.6	20.1	10.3	19.8	3.0	25.9				
Green Ext Time (g, c), s	0.1	3.7	0.1	5.2	0.0	4.4	0.0	2.9				
Intersection Summary												
HCM 2010 Ctrl Delay	29.8											
HCM 2010 LOS	C											
Notes												

Appendix C

Proportional Share Calculations



Equitable Share Calculations Aston Avenue/Linwood Avenue

		Total Volume Entering the Intersection of	
		Penstemon Place	
		PM	
	PM		
Project Trips (T)	35	Existing	1243
		Future Year	1526

Description of Project Improvement:

Widen Linwood Avenue to add a 100 foot left turn lane. It was assumed that widening would occur on the west side of the roadway as the City currently has the right of way.

Calculation of Project Share

$$P = T / (TB - TE)$$

where:

P = Equitable Share

T = Project trips during the affected peak hour

TB = Build-out volumes

TE = Existing volumes

T	35
TB	1526
TE	1243
P	12.4%

Total Estimated Cost of Improvement \$225,000

Equitable Share Contribution **\$27,827**

Equitable Share (per Caltrans "Guide for the Preparation of Traffic Impact Studies")

Appendix D

All-Way Stop-Control Warrant

**All Way Stop Control (AWSC) Warrant Criteria
from California MUTCD (adopted 2012)**



MAJOR Street Name: Linwood Ave
MINOR Street Name: Poinsettia Ln
City of Santa Rosa

Prepared By: BKB
Date: 1.9.2018

Intersection may be a candidate for an AWSC (aka a Multi-Way Stop sign installation) if any one of these criteria are met.

Traffic Signal Warranted

No A Where a traffic signal is warranted, the AWSC is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the signal.

No B **Collisions**
There been at least 5 collisions, of a type that could be correctable through STOP installation, within the last 12 months. Such correctable collisions include right-turn, left-turn, and right-angle collisions.

Minimum Volumes

C1 The vehicular volume entering the intersection from the MAJOR street approaches (total of both) averages at least 300 vehicles per hour for any 8 hours of any average day,

AND

No C2 The combined vehicular, ped, and bicycle volumes entering the intersection from the MINOR street approaches (total of both) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 sec/vehicle during the highest one hour.

OR

No C3 If the 85th-percentile approach speed of the MAJOR street traffic >40 mph, the minimum vehicular volume warrants are 70 percent of the above values.

Combination Warrant

No D Where no single criterion is satisfied (A, B, C1, C2 or C3), but where 80 percent of B and C1 and C2 are met.

Options

Other criteria that may be considered in an engineering study include:

No A. The need to control left-turn conflicts

No B. The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes

Yes C. (Visibility) Locations where a road user, after stopping, cannot see conflicting traffic and is not able to reasonably safely negotiate the intersection unless conflicting cross traffic is also required to stop,

No D. An intersection of 2 residential neighborhood collector (through) streets of similar design and operating characteristics where AWSC would improve traffic operational characteristics of the intersection.

The All-Way Stop Control Warrant has been met
