

Traffic Impact Study for the Penstemon Place



Prepared for the City of Santa Rosa

Submitted by **W-Trans**

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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.

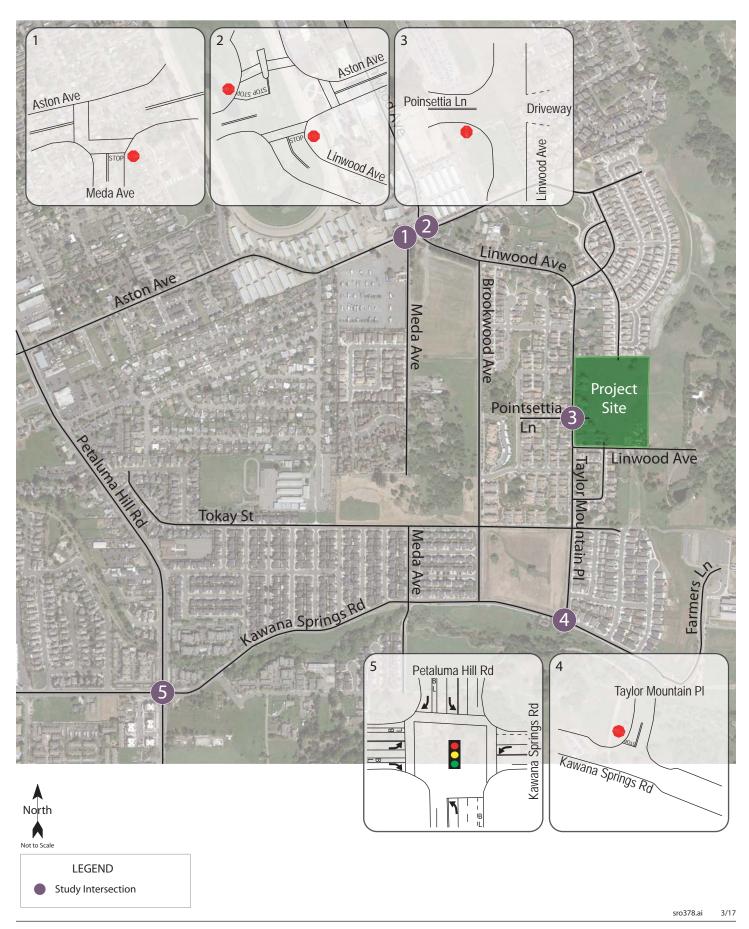
Prelude

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.







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 stripped 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										
Stu	ıdy 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.

Table	3 – Intersection Level of Service Criteria	
LOS	Two-Way Stop-Controlled	Signalized
Α	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.
В	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.
С	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.

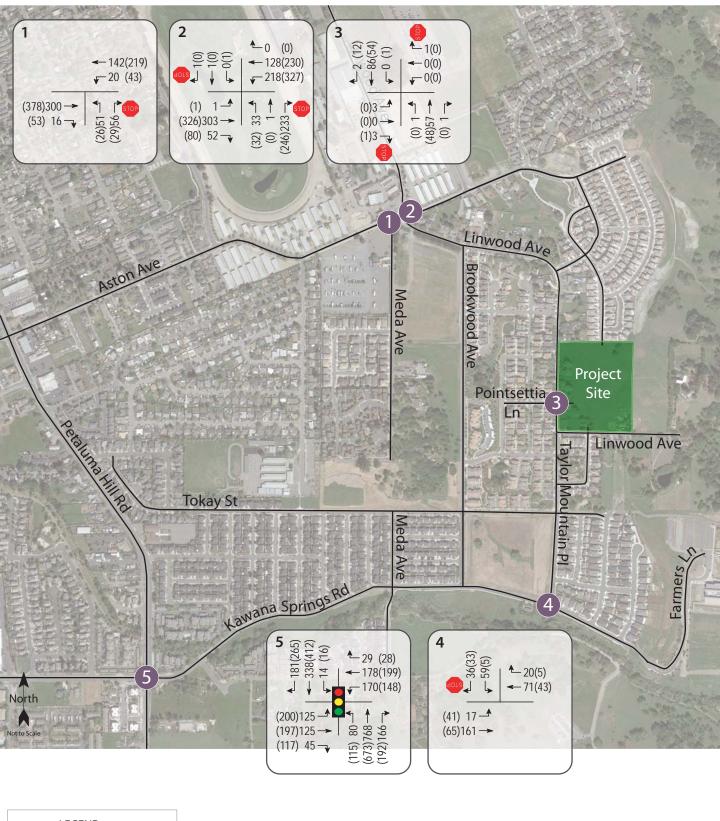
Existing Conditions

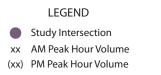
The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the a.m. and p.m. peak periods. This condition does not include project-generated traffic volumes. Volume data was collected when while local schools were in session.

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.







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Ta	Table 4 – Existing Peak Hour Intersection Levels of Service								
Study Intersection		AM I	Peak	PM Peak					
	Approach	Delay	LOS	Delay	LOS				
1.	Aston Ave/Meda Ave	2.5	Α	1.5	Α				
	Northbound (Meda Ave) Approach	12.1	В	13.4	В				
2.	Aston Ave/Linwood Ave	6.9	Α	8.8	Α				
	Northbound (Linwood Ave) Approach	17.8	С	28.0	D				
	Southbound (Fairgrounds) Approach	15.5	С	68.2	F				
3.	Linwood Ave/Poinsettia Ln	0.5	Α	0.1	А				
	Westbound (Private Driveway) Approach	8.7	Α	0.0	Α				
	Eastbound (Poinsettia Ln) Approach	9.3	Α	8.7	Α				
4.	Taylor Mountain Pl/Kawana Springs Rd	3.0	Α	3.4	А				
	Southbound (Taylor Mountain Pl) Approach	10.2	В	8.9	Α				
5.	Petaluma Hill Rd/Kawana Springs Rd	23.1	С	25.1	С				

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.

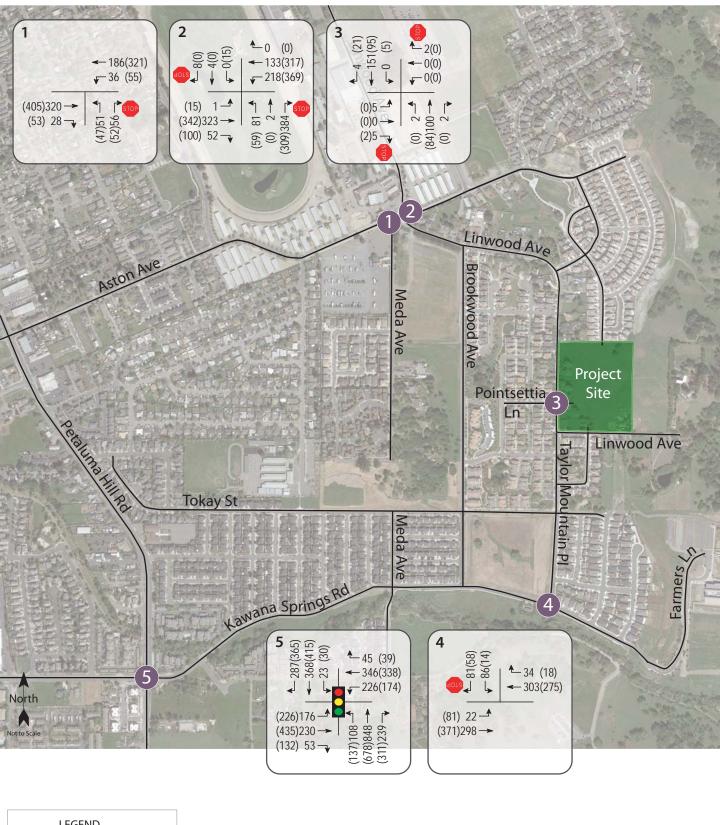
Under the anticipated Future volumes, the study intersections are expected to operate acceptably with the exception of the Aston Avenue/Linwood Avenue intersection, which would be expected to operate at LOS F under anticipated volumes for the p.m. peak hour. Future operating conditions are summarized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

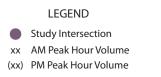
Ta	Table 5 – Future Peak Hour Intersection Levels of Service								
Stu	udy Intersection	AM F	Peak	PM F	Peak				
	Approach	Delay	LOS	Delay	LOS				
1.	Aston Ave/Meda Ave	2.6	Α	2.4	Α				
	Northbound (Meda Ave) Approach	13.8	В	18.0	С				
2.	Aston Ave/Linwood Ave	26.3	D	52.1	F				
	Northbound (Linwood Ave) Approach	63.5	F	**	F				
	Southbound (Fairgrounds) Approach	13.6	В	**	F				
	Add NB thru-left and right-turn lane	9.5	Α	13.3	В				
3.	Linwood Ave/Poinsettia Ln	0.5	Α	0.1	Α				
	Westbound (Private Driveway) Approach	8.9	Α	0.0	Α				
	Eastbound (Poinsettia Ln) Approach	9.9	Α	9.0	Α				
4.	Taylor Mountain Pl/Kawana Springs Rd	3.3	Α	1.8	Α				
	Southbound (Taylor Mountain Pl) Approach	15.1	Α	12.1	В				
5.	Petaluma Hill Rd/Kawana Springs Rd	27.9	С	29.5	С				

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.







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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	Da	Daily AM Peak Hour		PM Peak Hour						
		Rate	Trips	Rate	Trips	ln	Out	Rate	Trips	ln	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.







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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

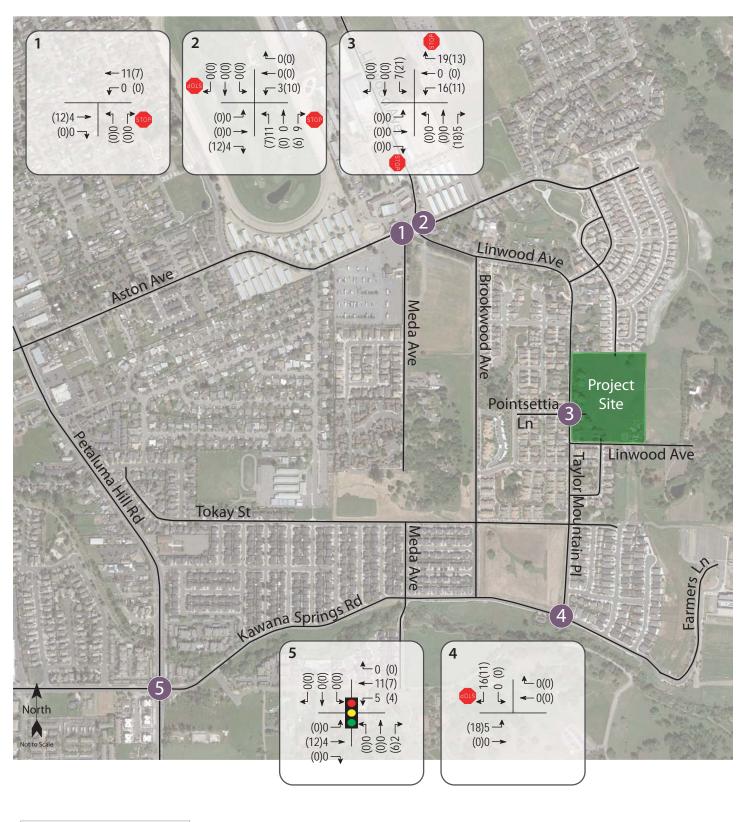
Upon the addition of project-related traffic to the Existing volumes, the study intersections are expected to continue to operate acceptably, generally at the same levels of service. Existing plus Project level of service results are summarized in Table 8, and Project traffic volumes are shown in Figure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

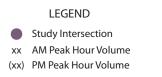
Tal	Table 8 – Existing and Existing plus Project Peak Hour Intersection Levels of Service										
Study Intersection			isting (Conditio	ns	Exi	Existing plus Project				
	Approach	AM F	Peak	PM F	eak	AM F	Peak	PM P	eak		
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS		
1.	Aston Ave/Meda Ave	2.5	Α	1.5	Α	2.4	Α	1.4	Α		
	Northbound (Meda Ave) Approach	12.1	В	13.4	В	12.2	В	13.5	В		
2.	Aston Ave/Linwood Ave	6.9	Α	8.8	Α	7.9	Α	10.9	В		
	Northbound (Linwood Ave) Approach	17.8	C	28.0	D	20.5	C	36.9	Ε		
	Southbound (Fairgrounds) Approach	15.5	C	68.2	F	15.7	C	72.9	F		
3.	Linwood Ave/Poinsettia Ln	0.5	Α	0.1	Α	2.2	Α	2.2	Α		
	Westbound (Private Driveway) Approach	8.7	Α	0.0	Α	9.3	Α	9.2	Α		
	Eastbound (Poinsettia Ln) Approach	9.3	Α	8.7	Α	9.4	Α	8.7	Α		
4.	Taylor Mountain Pl/Kawana Springs Rd	3.0	Α	3.4	Α	3.4	Α	4.0	Α		
	Southbound (Taylor Mountain Pl) Approach	10.2	В	8.9	Α	10.2	В	9.0	Α		
5.	Petaluma Hill Rd/Kawana Springs Rd	23.1	C	25.1	С	23.2	С	25.2	С		

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.







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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.

Tal	Table 9 – Future and Future plus Project Peak Hour Levels of Service									
Study Intersection			uture C	ondition	ıs	Fu	Future plus Project			
	Approach	AM F	Peak	PM F	Peak AM Peak PM Peal		eak PM F			
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	
1.	Aston Ave/Meda Ave	2.6	Α	2.4	Α	2.6	Α	2.2	Α	
	Northbound (Meda Ave) Approach	13.8	В	18.0	C	14.0	В	16.7	C	
2.	Aston Ave/Linwood Ave	26.3	D	52.1	F	34.0	D	70.4	F	
	Northbound (Linwood Ave) Approach	63.5	F	**	F	83.3	F	**	F	
	Southbound (Fairgrounds) Approach	13.6	В	**	F	14.0	В	**	F	
	Add NB right-turn lane	9.5	Α	13.3	В	10.0	В	16.2	С	
3.	Linwood Ave/Poinsettia Ln	0.5	Α	0.1	Α	1.6	Α	1.6	Α	
	Westbound (Private Driveway) Approach	8.9	Α	0.0	Α	9.9	Α	9.7	Α	
	Eastbound (Poinsettia Ln) Approach	9.9	Α	9.0	Α	10.2	В	9.0	Α	
4.	Taylor Mountain Pl/Kawana Springs Rd	3.3	Α	1.8	Α	3.7	Α	2.1	Α	
	Southbound (Taylor Mountain Pl) Approach	15.1	Α	12.1	В	15.8	С	12.2	В	
5.	Petaluma Hill Rd/Kawana Springs Rd	27.9	C	29.5	C	28.2	С	29.8	С	

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 stopcontrols is recommended.



Study Participants and References

Study Participants

Principal in Charge Dalene J. Whitlock, PE, PTOE

Assistant EngineerBriana Byrne, EITGraphicsHannah YungEditing/FormattingAngela McCoy

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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

Number of Collisions x 1 Million

ADT x 365 Days per Year x Number of Years

 Study Intersection Statewide Average*
 Collision Rate | Fatality Rate | Injury Rate |
 Injury Rate |

 0.29
 c/mve | 0.0% |
 50.0% |

 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

collision rate = Number of Collisions x 1 Million
ADT x 365 Days per Year x Number of Years

collision rate = $\frac{3}{12,400} \times \frac{1,000,000}{x}$

Injury Rate

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

collision rate = Number of Collisions x 1 Million

ADT x 365 Days per Year x Number of Years

collision rate = 0 x 1,000,000 1,200 x 365 x 5

 Study Intersection Statewide Average*
 Collision Rate | Fatality Rate | Injury Rate |
 Injury Rate |

 0.00 c/mve | 0.0% | 0.0% |
 0.0% |

 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: July 1, 2011 End Date: June 30, 2016 Number of Years: 5

Intersection Type: Tee

Control Type: Stop & Yield Controls

Area: Urban

collision rate = Number of Collisions x 1 Million

ADT x 365 Days per Year x Number of Years

 Study Intersection Statewide Average*
 Collision Rate | Fatality Rate | Injury Rate |
 Injury Rate |

 0.00 c/mve | 0.0% |
 0.0% |
 0.0% |

 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 Calculaions

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

collision rate = Number of Collisions x 1 Million

ADT x 365 Days per Year x Number of Years

collision rate = $\frac{19}{25,600} \times \frac{1,000,000}{x}$

 Study Intersection Statewide Average*
 Collision Rate | Fatality Rate | Injury Rate |
 Injury Rate |

 0.41
 c/mve | 0.0% | 47.4% |

 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

1 2							
7.5							
	EBT	EBR	WBL	L WBT	NBL	NBR	
ane Configurations	£			4	>		
raffic Vol, veh/h	300	16	2	-	51	26	
-uture Vol, veh/h	300	16	2	20 142	51	26	
Conflicting Peds, #/hr	0	0		0 0	4	4	
	Free	Free	Free	e Free	Stop	Stop	
RT Channelized	•	None		- None		None	
Storage Length	•				0		
Veh in Median Storage, #	0			0 -	0		
	0	٠		0	0		
Peak Hour Factor	100	100	100	=	100	100	
Heavy Vehicles, %	2	2		2 2	2	2	
	300	16	2	20 142	51	26	
	Major1		Major2	2	Minor1		
Conflicting Flow All	0	0	316	0 9	494	312	
					308		
	•				186		
	•	٠	4.12	2 -	6.42	6.22	
Critical Hdwy Stg 1	•				5.42		
Critical Hdwy Stg 2	•	ì			5.42		
Follow-up Hdwy			2.218		3.518	3.318	
Pot Cap-1 Maneuver			1244	4 -	535	728	
	•				745		
	1	·		1	846		
Platoon blocked, %	•						
Mov Cap-1 Maneuver	•	,	1239	- 6	523	725	
Mov Cap-2 Maneuver	•	,			523		
	•				745		
	•	٠			828		
	EB		WB	В	NB		
HCM Control Delay, s	0			_	12.1		
					Ω		
Minor Lane/Major Mvmt NBLn1	EBT	EBR V	WBL WBT	F			
Capacity (veh/h) 612		,	1239				
HCM Lane V/C Ratio 0.175		- 0	- 0.016	ı.			
(6	•			0			
			٧	A			
4CM 95th %tile O(veh) 0.6		٠	C				

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HCM 2010 TWSC 1: Meda Ave & Aston Ave

03/22/2017

03/22/2017

Int Delay, s/veh 1.5								
Movement	8	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations		æ,			€4	*		
Traffic Vol, veh/h	3.	378	23	43	219	26	29	
Future Vol, veh/h	3.	78	23	43	219	26	29	
Conflicting Peds, #/hr		0	0	0	0	-	—	
Sign Control	Ē	Free	Free	Free	Free	Stop	Stop	
RT Channelized		-	None		None		None	
Storage Length				ľ		0		
Veh in Median Storage, #		0			0	0		
Grade, %		0		ľ	0	0		
Peak Hour Factor	1	100	100	100	100	100	100	
Heavy Vehicles, %		7	2	2	2	2	2	
Mvmt Flow	3.	378	53	43	219	26	29	
Major/Minor	Major1	7		Major2		Minor1		
Conflicting Flow All		0	0	431	0	711	406	
Stage 1						405		
Stage 2		,				306		
Critical Hdwy		i	ř	4.12	·	6.42	6.22	
Critical Hdwy Stg 1						5.42		
Critical Hdwy Stg 2		ï	ì		,	5.42		
Follow-up Hdwy				2.218		3.518	3.318	
Pot Cap-1 Maneuver		ï		1129		400	645	
Stage 1		ï	·	•	·	673		
Stage 2		ï	·	•		747		
Platoon blocked, %		,						
Mov Cap-1 Maneuver		ï	ì	1128		382	644	
Mov Cap-2 Maneuver						382		
Stage 1		ï		•		673		
Stage 2				•	ı	714		
Approach	E	EB		WB		NB		
HCM Control Delay, s		0		1.4		13.4		
HCM LOS						В		
Minor Lane/Major Mvmt		EBT	EBR WBL	3L WBT				
Capacity (veh/h)	486	į.	- 1128	- 83				
HCM Lane V/C Ratio	0.113		- 0.038					
HCM Control Delay (s)	13.4	ï		8.3 0				
HCM Lane LOS	ω							
HCM 95th %tile Q(veh)	0.4		0 -	0.1				

Penslemon Homes Traffic Impact Study 03/20/2017 PM Existing

HCM 2010 TWSC 2: Linwood Ave & Aston Ave

HCM 2010 TWSC 2: Linwood Ave & Aston Ave

03/22/2017

03/22/2017

Intersection													
Int Delay, s/veh 6.9	6												
Movement	EBL	EBT	EBR	_	WBL \	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4				4			4			₩	*
Traffic Vol, veh/h	_	303	25		218	128	0	33	-	233	0	-	_
Future Vol, veh/h	_	303	25		218	128	0	33	~	233	0	-	τ-
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		٠	٠	None			None			None
Storage Length		'				٠							22
Veh in Median Storage, #		0				0		,	0		٠	0	
Grade, %		0			٠	0			0			0	ľ
Peak Hour Factor	100	100	100		100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2		7	7	2	2	2	2	2	2	2
Mvmt Flow	_	303	25		218	128	0	33	_	233	0	_	_
Major/Minor	Major1			Ma	Major2			Minor1			Minor2		
Conflicting Flow All	132	0	0		359	0	0	904	903	337	1020	929	136
Stage 1	•	•	٠			٠		335	335		268	268	
Stage 2	'	'			٠	٠		269	268		452	361	ľ
Critical Hdwy	4.12	•	٠	`	4.12	•		7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1		ľ			٠	•		6.12	5.52		6.12	5.52	ľ
Critical Hdwy Stg 2		•	٠		٠	٠		6.12	5.52		6.12	5.52	ľ
Follow-up Hdwy	2.218			2	2.218	٠		3.518	4.018	3.318	3.518		3.318
Pot Cap-1 Maneuver	1453	•		_	1200	٠		258	277	705	215	268	913
Stage 1	•	•	,			٠	,	619	643	,	208	206	
Stage 2					٠	٠		207	206		287	626	
Platoon blocked, %		•				٠							
Mov Cap-1 Maneuver	1447	•	ì	_	1195	٠		216	221	700	120	214	906
Mov Cap-2 Maneuver		•				٠		216	221		120	214	
Stage 1		•			٠	٠		9/9	640		206	405	
Stage 2	•	•	٠		٠	•		405	405		389	623	
Approach	EB				WB			NB			SB		
HCM Control Delay, s	0				5.5			17.8			15.5		
HCM LOS								ပ			O		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT E	EBR V	WBL \	WBT	WBR SBLn1 SBLn2	SBLn2					
Capacity (veh/h)	545	1447		,	1195	1	- 214	906					
HCM Lane V/C Ratio	0.49	Ö		- 0	0.182	•	- 0.005	0.001					
HCM Control Delay (s)	17.8	7.5	0		8.7	0	- 21.9	6					
HCM Lane LOS	S	A	A		A	A		A					
HCM 95th %tile Q(veh)	2.7	0			0.7	1	0 -	0					

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Intersection														
Int Delay, s/veh	8.8													
Movement	EBL	EBT		EBR	>	WBL V	WBT	WBR	NBI	- NBT	NBR	SBL	SBT	SBR
Lane Configurations		4					4			4			¥	¥c_
Traffic Vol, veh/h		1 326		80	m	327	230	0	33		246	_	0	0
Future Vol, veh/h		326		8	(C)	327	230	0	32	0	246	_	0	0
Conflicting Peds, #/hr		0	_				0	0		0		0	0	0
Sign Control	Free	e Free	Free	96	ᇤ	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized		i	- None	ne Pie			7	None			None			None
Storage Length							٠				٠		•	22
Veh in Median Storage, #		٠	_				0			0 .	٠		0	,
Grade, %		0					0			0			0	'
Peak Hour Factor	100	001 (100		100	100	100	100	100	100	100	100	100
Heavy Vehicles, %		2	01	2		7	7	2	2	2	2	2	2	2
Mvmt Flow		1 326		80	(C)	327	230	0	32	0	246	_	0	0
Major/Minor	Major1				Major2	or2			Minor1			Minor2		
Conflicting Flow All	230	0 (_	0	4	407	0	0	1254	1253	368	1376	1293	231
Stage 1				ì		ì	1	÷	369		•	884	884	
Stage 2		ĺ				,	٠	,	882			492		,
Critical Hdwy	4.12	~		í	4	4.12	1	ř	7.12	6.52	6.22	7.12		6.22
Critical Hdwy Stg 1		ĺ					٠		6.12		٠	6.12		•
Critical Hdwy Stg 2		ĺ		ì		ï	1	ì	6.12	5.52	•	6.12	5.52	•
Follow-up Hdwy	2.218	· ~			2.2	2.218	٠		3.518	4	3	3.518	4	3.318
Pot Cap-1 Maneuver	1338	· ~		ï	=	1152	٠	·	149		677	122		808
Stage 1		Ì					٠	·	651		•	340		1
Stage 2		Ì		í		ï	1	í	340	363	•	558	296	
Platoon blocked, %							٠							
Mov Cap-1 Maneuver	1337			ï	11	1151	٠		111		9/9	58		807
Mov Cap-2 Maneuver							٠		111		•	58		1
Stage 1				ï		÷	٠	·	920		•	340		
Stage 2									229	9 242		354	295	1
Approach	EB	~			_	WB			NB	~		SB		
HCM Control Delay, s		0				5.5			28	~		68.2		
HCMLOS									٥			ш.		
Minor Lane/Major Mvmt	NBLn1	I EBI	EBT		EBR WBL		WBT	WBR SB	WBR SBLn1 SBLn2	01				
Capacity (veh/h)	426	5 1337	_	,	-	1151			28					
HCM Lane V/C Ratio	0.653	3 0.001			- 0.2	0.284	٠	- 0						
HCM Control Delay (s)	28	7	_	0	,	9.4	0	-	68.2 (0				
HCM Lane LOS		D		Ø		⋖	Ø		H H	_				
HCM 95th %tile Q(veh)	4.5	0		,		1.2	٠	·	0.1					

Penstemon Homes Traffic Impact Study 03/20/2017 PM Existing

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

Intersection												
Int Delay, s/veh 0.5												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Vol, veh/h	က	0	co	0	0	-	_	27	-	0	98	2
Future Vol, veh/h	c	0	e	0	0	-	_	27	-	0	98	2
Conflicting Peds, #/hr	7	0	=	4	0	0	=	0	4	0	0	7
Sign Control	Stop	Stop Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	1	1	None	•	1	None	•	1	None	•	1	None
Storage Length	٠	٠		•	•			٠			٠	٠
Veh in Median Storage, #	•	0		•	0		•	0			0	
Grade, %	٠	0		٠	0		٠	0		٠	0	٠
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	7	2	2	2	2	2	2	2
Mvmt Flow	3	0	3	0	0	-	-	27	-	0	98	2

Major/Minor	Minor2			Minor1			Major1	_		Major2		
Conflicting Flow All	165	162	109	164	163	69	6	0 66	0	62	0	0
Stage 1	86	86	٠	64		٠					•	
Stage 2	19	94	٠	100	66 (٠			'		٠	
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	2 -	•	4.12	٠	
Critical Hdwy Stg 1	6.12	5.52		6.12	5.52	٠					٠	
Critical Hdwy Stg 2	6.12	5.52	٠	6.12	2 5.52	•			•	•	٠	
Follow-up Hdwy	3.518	4.018 3	3.318	3.518	3 4.018	3.318	2.218			2.218	٠	
Pot Cap-1 Maneuver	800	730	945	801	729	994	1494	4	•	1541	٠	
Stage 1	806	814	٠	947	7 842	٠			'		٠	
Stage 2	943	842	٠	906	5 813	•			•	•	٠	
Platoon blocked, %								ľ	'		٠	
Mov Cap-1 Maneuver	785	719	925	786		984	1478	. 8	,	1531	٠	
Mov Cap-2 Maneuver	785	719		786	5 718	٠			'		٠	
Stage 1	868	802	٠	942		٠			•		٠	
Stage 2	935	838	٠	894	1 804	٠				'	٠	
Approach	EB			WB	~~		NB	ω.		SB		
HCM Control Delay, s	9.3			8.7	_		0.1	_		0		
HCM LOS	A			A	_							
Minor Lane/Major Mvmt	NBL	NBT	NBR EF	NBT NBR EBLn1WBLn1 SBL	SBL	SBT	SBR					
Capacity (veh/h)	1478	1	•	849 984	1531							
HCM Lane V/C Ratio	0.001		0 -	0.007 0.001	_	٠						
HCM Control Delay (s)	7.4	0	•	9.3 8.7	0 /	1						
HCM Lane LOS	A	A	٠	A	۱ A	•	,					
HCM 95th %tile Q(veh)	0		٠	0	0 (٠						

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

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Intersection												
Int Delay, s/veh 0.1	_											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Vol, veh/h	0	0	-	0	0	0	0	48	0	<u></u>	24	12
Future Vol, veh/h	0	0	-	0	0	0	0	48	0	-	24	12
Conflicting Peds, #/hr	∞	0	6	co		2	6	0	33	2	0	∞
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized			None	'	. '	None	•	•	None	٠	•	None
Storage Length	ľ	•	٠	ľ		•		•		•	•	
Veh in Median Storage, #		0	1		0	1		0		٠	0	•
Grade, %	ľ	0	٠	ľ	0	1	ľ	0		•	0	ľ
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	7	2
Mvmt Flow	0	0		0	0	0	0	48	0	-	24	12
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	127	122	78	123	128	26	75	0	0	21	0	0
Stage 1	71	71	٠	51	21	•	•	•		•	٠	
Stage 2	29	21	٠	72	77	1	1	•		•	1	•
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	•		4.12	1	,
Critical Hdwy Stg 1	6.12	5.52	٠	6.12		٠	,	•			٠	٠
Critical Hdwy Stg 2	6.12	5.52	•	6.12		•	,	•		•	•	•
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	•		2.218	٠	٠
Pot Cap-1 Maneuver	846	768	983	852		1007	1524	•		1555	1	
Stage 1	939	836		962		1	•	•		•	•	•
Stage 2	926	852	1	938	831	1		1	·	•	1	,
Platoon blocked, %								•			٠	•
Mov Cap-1 Maneuver	832	758	996	841	754	966	1511	•		1543	•	•
Mov Cap-2 Maneuver	832	758	٠	841		٠	•	•		•	٠	٠
Stage 1	931	828	i.	959		1		•		•	1	
Stage 2	949	820	٠	928	823	٠	'	•		٠	٠	1
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 E	NBR EBLn1WBLn1	SBL	SBT	SBR					
Capacity (veh/h)	1511		1	- 996	1543							
HCM Lane V/C Ratio			-	0.001	0.001	•						
HCM Control Delay (s)	0	1	•		7	0						
HCM Lane LOS	A	•	٠	A		A						
HCM 95th %tile Q(veh)	0			0	0							

Penstemon Homes Traffic Impact Study 03/20/2017 PM Existing

HCM 2010 TWSC 4: Kawana Springs Rd & Taylor Mountain Pl

Intersection									
Int Delay, s/veh	23								
Movement	EBL	EBT			WBT	WBT WBR	SBL	SBR	
Lane Configurations		₹			2		>		
Traffic Vol, veh/h	17	161			71		29	36	
Future Vol, veh/h	17	161			71	20	29	36	
Conflicting Peds, #/hr		0			0		- -		
Sign Control	Free	Free			Free	Free	Stop	Stop	
RT Channelized		None				None	. •	None	
Storage Length		'			ľ	'	0		
Veh in Median Storage, #	•	0			0	,	0		
Grade, %		0			0		0		
Peak Hour Factor	100	100			100	=	100	100	
Heavy Vehicles, %	2	2			2		2	2	
Mvmt Flow	17	161			71	20	29	36	
Major/Minor	Major1				Major2		Minor2		
Conflicting Flow All	92	0				0	278	83	
Stage 1						•	82		
Stage 2		•			ľ	'	196		
Critical Hdwy	4.12	1			•	•	6.42	6.22	
Critical Hdwy Stg 1					·	•	5.42		
Critical Hdwy Stg 2	•					•	5.42		
Follow-up Hdwy	2.218	•					3.518	3.318	
Pot Cap-1 Maneuver	1503	1				•	712	926	
Stage 1	•	1				•	941		
Stage 2	•	1				•	837		
Platoon blocked, %		•							
Mov Cap-1 Maneuver	1502	1				•	702	974	
Mov Cap-2 Maneuver		•					702		
Stage 1		1				•	940		
Stage 2	1	1			·		826		
Approach	EB				WB		SB		
HCM Control Delay, s	0.7				0		10.2		
HCM LOS							a		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR SBLn1	-n1				
Capacity (veh/h)	1502	1	•		785				
HCM Lane V/C Ratio	0.011		٠	- 0.121	121				
HCM Control Delay (s)	7.4	0	•	,	10.2				
HCM Lane LOS	⋖	⋖	٠		В				
HCM 95th %tile Q(veh)	0		٠		0.4				

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HCM 2010 TWSC

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acitococia								
Int Dolay chok	Į							
Movement	EBL	EBT	V	WBT	WBR	SBL	SBR	
Lane Configurations		₩		÷		×		
Traffic Vol, veh/h	41	65		43	2	വ	33	
Future Vol, veh/h	41	65		43	2	2	33	
Conflicting Peds, #/hr	9	0		0	-	-	9	
Sign Control	Free	Free		Free	Free	Stop	Stop	
RT Channelized	•	None		7	None	. •	None	
Storage Length	ľ			٠		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		7	2	2	2	
Mvmt Flow	41	92		43	2	2	33	
Major/Minor	Major1		Ma	Major2		Minor2		
Conflicting Flow All	54	0			0	200	58	
Stage 1	•			•		52		
Stage 2				٠		148		
Critical Hdwy	4.12			1		6.42	6.22	
Critical Hdwy Stg 1				٠		5.42		
Critical Hdwy Stg 2	•			٠		5.42		
Follow-up Hdwy	2.218			٠		3.518	3.318	
Pot Cap-1 Maneuver	1551			1	·	789	1008	
Stage 1				٠		970		
Stage 2	•			1		880		
Platoon blocked, %								
Mov Cap-1 Maneuver	1542			٠		758	266	
Mov Cap-2 Maneuver	•			٠		758		
Stage 1	•			•		964		
Stage 2	•			٠		820		
Approach	EB			WB		SB		
HCM Control Delay, s	2.9			0		8.9		
HCM LOS						A		
	Ē	H	2000	П				
MINOT Lane/Major MVIII	EBL	EBI WBI W	/BK SBLIII					
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	V	Α	∀ ;					
HCM 95th %tile Q(veh)	0.1		- 0.1					

Penslemon Homes Traffic Impact Study 03/20/2017 PM Existing

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

	•	†	~	>	ţ	1	•	-	*	٠	-	*
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	-	*	¥.	K	£3		K	₩		K	*	¥.
Traffic Volume (veh/h)	125	125	45	170	178	29	80	768	166	14	338	181
Future Volume (veh/h)	125	125	42	170	178	29	80	292	166	14	338	181
Number	വ	2	12	- 0	9	16	m (∞ α	<u>8</u>	_	4 (4
Initial Q (Qb), ven	0 6	0	0 8	0 0	0	0 00	0 0	0	0 00	0 6	0	0 00
Ped-Bike Adj(A_pb1)	8.5	00	0.93	1.00	5	0.98	00.1	5	0.98	9.5	5	0.99
Paiking bus, Auj	00.1	1000	00.1	1000	1.00	0001	1.00	0.1	0001	00.1	1.00	00.1
Adj Sat Flow, ven/r/lin	125	125	1863	170	178	1800	803	768	139	14	338	109
Adj No. of Lanes	-	-	· —	-	-	0	- 8	2	0	-	-	5
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	466	21	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
Grp Volume(v), veh/h	125	125	2	170	0	196	80	455	452	14	338	109
Grp Sat Flow(s),veh/h/ln	1774	1863	1575	1774	0	1830	1774	1770	1754	1774	1863	1569
O 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	2.7	0.5	7.3	0.0	9.5	2.5	19.6	19.6	0.2	13.3	3.9
Prop In Lane	00.1		00.1	00.1	c	0.00	00.1	C C	0.31	0.1	ì	1.00
Lane Gip Cap(c), Venin	439	170	524	500	0 0	000	400	828	820	/87	840	213
V/C Katio(X) Avail Cap(c a) vab/h	0.28	D.24 527	0.01	U.34 FAR	0.00	0.36	U.I./	0.53	0.53	0.05	0.40	0.13
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(I)	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	- -	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 BackOfO(50%),veh/ln	2.7	3.7	0.1	3.5	0.0	2.0	1.2	10.2	10.1	0.2	7.2	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
Lughtus	د	טונ	د	ر	, , ,	ر	В	ی ا	ر	В	ی ا	9
Approach Vol, ven/n Approach Delay s/veh		28.3			300			71 4			19 5	
Approach LOS		O			O			O			Ω	
Timer		2	က	4	2	9	7	00				
Assigned Phs	-	2	3	4	2	9	7	ω				
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+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	. 41	12.0	31.1	12.0	40.7				
Max Q Clear Time (g_c+IT), s Green Ext Time (p_c), s	0.1	1.9	0.0	6.0	0.1	1.8	0.0	5.6				
Inforcoction Summary												
HICE SECTION SUMMING			1,00									
HCM 2010 Cfri Delay			73.1									
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HCM 2010 Signalized Intersection Summary 5: Petaluma Hill Rd & Kawana Springs Rd

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	je-	+	¥	¥	Ť,		×	₩		je-	+	W.
Traffic Volume (veh/h)	200	197	117	148	199	78	115	673	192	16	412	265
Future Volume (veh/h)	200	197	117	148	199	78	115	673	192	16	412	265
Number	2	2	12	—	9	16	3	00	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	12	0
Ped-Bike Adj(A_pbT)	0.99		0.99	1.00		0.97	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/In	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	200	197	64	148	199	24	115	673	173	16	412	138
Adj No. of Lanes	-	-	-	-	-	0	_	2	0	_	-	_
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	979	495	522	63	326	1172	301	264	719	745
Arrive On Green	0.09	0.34	0.34	0.07	0.32	0.32	90.0	0.42	0.45	0.05	0.39	0.39
Sat Flow, veh/h	1774	1863	1574	1774	1626	196	1774	2776	713	1774	1863	1546
Grp Volume(v), veh/h	200	197	64	148	0	223	115	429	417	16	412	138
Grp Sat Flow(s),veh/h/In	1774	1863	1574	1774	0	1822	1774	1770	1719	1774	1863	1546
Q Serve(g_s), s	7.3	7.8	5.6	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	5.6	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		0.11	1.00		0.41	1.00		1.00
Lane Grp Cap(c), veh/h	497	633	979	495	0	282	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	90.0	0.57	0.19
Avail Cap(c_a), veh/h	526	633	979	228	0	282	465	747	726	438	719	745
HCM Platoon Ratio	1.00	1.00	1.00	0.6	1.00	0.0	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	00.	00:1	00.1	0.0	0.00	00.5	00.1	00.1	00.1	00.1	00.1	1.00
Uniform Delay (g), Swen	4.4	1.2	0.3	70.1	0.0	10	0.2	22.0	1.77	20.00	72.7	4.9
Inci Delay (uz.), sweri	0.2	ر ا	0.0	- 6	0.0	7. 0	7.0	3.2	5.5	0.0	5.5	0.0
Initial Q Detay(us),s/ven	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.4.	0.0
Alle BackOlc(50.76), Vell/III	10.6	25.4	10.2	200	0.0	000	0. 0	25.7	7.4	10.0	22.7	15.4
Ingral OS	2	0.02	7:Y	C.0.2	9.	20.2	2 2	20.2	F. C.	<u>.</u>	3.55	2
Approach Vol veh/h	٥	141	٥		371		٥	0,41		٥	2 2	
Approach Delay, s/veh		22.1			25.0			24.5			28.5	
Approach LOS		O			S			O			S	
Timer	-	2	cc	4	22	9	7	00				
Assigned Phs	-	2	₀	4	2	9	7	∞				
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+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	* 31	11.0	32.1	12.0	30.7				
Max O Clear Time (g_c+I1), s	7.5	8.6	2.7	19.4	9.3	11.5	2.5	20.5				
Green Ext 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									
HCM 2010 LOS			ပ									

Penstemon Homes Traffic Impact Study 03/20/2017 PM Existing

HCM 2010 TWSC 1: Meda Ave & Aston Ave

Intersection							
Int Delay, s/veh 2.6							
Movement	EBT	EBR	WBL WBT	WBT	NBL	NBR	
Lane Configurations	æ			€	*		
Traffic Vol, veh/h	320	28	36	186	51	26	
Future Vol, veh/h	320	28	36	186	51	26	
Conflicting Peds, #/hr	0	0	0	0	4	4	
Sign Control	Free	Free Free	Free	Free Free	Stop	Stop	
RT Channelized		None	•	None	. 1	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	29	
Major/Minor	Major1		Major2		Minor1		
Conflicting Flow All	0	0	348	0	296	338	
Choro 1					V CC		

Major/Minor	Major1	<u>_</u> _ c	2	Major2	c	Minor1 504	320	
Conflicting Flow All		0		348	0	296	338	
Stage 1				í		334		
Stage 2						262	ı	
Critical Hdwy		1		4.12		7.12	6.22	
Critical Hdwy Stg 1						6.12		
Critical Hdwy Stg 2				ì	,	6.12		
Follow-up Hdwy				2.218		3.518	3.318	
Pot Cap-1 Maneuver				1211		415	704	
Stage 1						089		
Stage 2						743	٠	
Platoon blocked, %								
Nov Cap-1 Maneuver				1206		403	701	
Mov Cap-2 Maneuver						403		
Stage 1						089		
Stage 2						716	ı	
pproach	ш	EB		WB		NB		
HCM Control Delay, s		0		1.3		13.8		
HCM LOS						В		
Ainor Lane/Major Mvmt	NBLn1 EBT		EBR WBL	WBT				
Capacity (veh/h)	518		1206					
CM Lane V/C Ratio	0.207		0.03					
HCM Control Delay (s)	13.8		8.1	0				
CM Lane LOS	В		A	A				
HCM 95th %tile O(veh)	0.8		0.1					

Penstemon Homes Traffic Impact Study 5:00 pm 03/20/2017 AM Future

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HCM 2010 TWSC 1: Meda Ave & Aston Ave

03/23/2017

03/23/2017

Intersection									
Int Delay, s/veh	2.4								
Movement		EBT	EBR		WBL	WBT	NBL	NBR	
Lane Configurations		æ				₩	×		
Traffic Vol, veh/h		405	23		22	321	47	52	
Future Vol, veh/h		405	23		22	321	47	52	
Conflicting Peds, #/hr		0	0		0	0	—	—	
Sign Control		Free	Free		Free	Free	Stop	Stop	
RT Channelized		1	None		1	None		None	
Storage Length		٠	٠		٠	,	0		
Veh in Median Storage, #		0	1		٠	0	0	,	
Grade, %		0	٠		٠	0	0		
Peak Hour Factor		100	100		100	100	100	100	
Heavy Vehicles, %		7	2		7	2	2	2	
Mvmt Flow		405	23		22	321	47	25	
Major/Minor	W	Major1		Ma	Major2		Minor1		
Conflicting Flow All		0	0		458	0	864	433	
Stage 1		•	٠		٠		432		
Stage 2		٠	,		٠		432		
Critical Hdwy		1	1		4.12		7.12	6.22	
Critical Hdwy Stg 1		٠			٠		6.12		
Critical Hdwy Stg 2		1	•		1	,	6.12		
Follow-up Hdwy		٠	٠	2	2.218		3.518	3.318	
Pot Cap-1 Maneuver		1	•	_	1103		274	623	
Stage 1		٠	٠		٠	·	602		
Stage 2		1	i.		1		602		
Platoon blocked, %		٠	٠						
Mov Cap-1 Maneuver		•	•	_	1102		261	622	
Mov Cap-2 Maneuver		٠	٠		٠		261		
Stage 1		•					602		
Stage 2		•	٠		٠		292		
Approach		EB			WB		NB		
HCM Control Delay, s		0			1.2		18		
HCMLOS							U		
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL \	WBT				
Capacity (veh/h)	375	1		1102	1				
HCM Lane V/C Ratio	0.264	1	1	0.05	٠				
HCM Control Delay (s)	18	•	•	8.4	0				
HCM Lane LOS	O	٠	٠	Þ	⋖				
HCM 95th %tile Q(veh)	-			0.2					

Penstemon Homes Traffic Impact Study 03/20/2017 PM Future

HCM 2010 TWSC 2: Linwood Ave & Aston Ave

nt Delay, s/veh 26.3	3 FBI	FBT	FBR	WBL	WBT	WBR	NBI	NBT	NBR	S	SBT	SBR
ane Configurations		4						4			4	M.
raffic Vol, veh/h	<u></u>	323	25	218		0	81	7	384	0	4	∞
-uture Vol, veh/h	-	323	25	218		0	81	2	384	0	4	∞
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	,	1	None	•	1	None	•	1	None	•	1	None
Storage Length					•			•			٠	22
Veh in Median Storage, #	•	0		•	0		•	0			0	
Grade, %	ľ	0			0		٠	0		٠	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	7	2	2	2
Wwnt Flow		323	52	218	133	0	27	0	38.4	0	-	α

Major/Minor	Major1			2	Major2			Minor1			Minor2		
Conflicting Flow All	137	0	0		379	0	0	930	928	357	1121	954	141
Stage 1		•	1			1		355	322	٠	573	573	ľ
Stage 2	٠	٠	٠		٠	٠		575	573		248	381	ľ
Critical Hdwy	4.12	1	1		4.12	1		7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1								6.12	5.52		6.12	5.52	ľ
Critical Hdwy Stg 2		٠	•		٠	•		6.12	5.52		6.12	5.52	
Follow-up Hdwy	2.218	٠			2.218			3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1447	•	1		1179	1		248	268	289	183	259	907
Stage 1	٠	٠	٠		٠	٠		662	930		202	504	ľ
Stage 2	٠	٠	٠		٠	٠	ı	503	504	٠	521	613	'
Platoon blocked, %		٠											
Mov Cap-1 Maneuver	1441	•	1		1175	1		203	213	682	19	205	006
Mov Cap-2 Maneuver		٠			٠			203	213		19	205	ľ
Stage 1		•	1			1		629	627	٠	203	402	
Stage 2	٠	٠	٠		٠	٠		393	402		226	610	ľ
Approach	EB				WB			B			SB		
HCM Control Delay, s	0				5.4			63.5			13.6		
HCM LOS								ш			В		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR WBL	WBL	WBT	WBT WBR SBLn1 SBLn2	SBLn2					
Capacity (veh/h)	481	1441			1175		- 205	006					
HCM Lane V/C Ratio	0.971 0.001	0.00	٠	,	0.186	٠	- 0.02	0.009					
HCM Control Delay (s)	63.5	7.5	0	•	8.8	0	- 22.9	22.9 9					
HCM Lane LOS	ш.	A	A	•	A	V		A					
HCM 95th %tile Q(veh)	12.4	0	1		0.7	1	- 0.1	0					

Penstemon Homes Traffic Impact Study 5:00 pm 03/20/2017 AM Future

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HCM 2010 TWSC 2: Linwood Ave & Aston Ave

03/23/2017

03/23/2017

Intersection													
Int Delay, s/veh 52.1	<u></u>												
Movement	EBL	EBT	EBR	WBL	3L WBT		WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			*	4			4			₹	*
Traffic Vol, veh/h	15	342	100	Č	369 31	317	0	26	0	309	15	0	0
Future Vol, veh/h	15	342	100	Š		317	0	26	0	309	15	0	0
Conflicting Peds, #/hr	0	0	_		-	0	0		0	-	0	0	0
Sign Control	Free	Free	Free	Ē	Free Free		Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	•	1	None		,	Ž	None	•	1	None	•	1	None
Storage Length		•	٠		,			٠	٠			•	22
Veh in Median Storage, #	•	0			,	0		•	0			0	
Grade, %		0	'			0		٠	0			0	
Peak Hour Factor	100	100	100		100 10	100	001	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	Š	369 31	317	0	26	0	309	15	0	0
Major/Minor	Major1			Major2	r2			Minor1			Minor2		
Conflicting Flow All	317	0	0	4	443	0	0	1479	1478	394	1633	1528	318
Stage 1	•	•	•					423	423		1055	1055	
Stage 2		1	•		ì	į,		1056	1055		578	473	٠
Critical Hdwy	4.12	•	•	4.	4.12			7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1		'	,		,			6.12	5.52		6.12	5.52	
Critical Hdwy Stg 2	•				,			6.12	5.52		6.12	5.52	
Follow-up Hdwy	2.218	•	•	2.218	8				4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1243	1	1	=	1117	ï		104	126	929	81	117	723
Stage 1		1	•					609	288		273	302	•
Stage 2	•				,	į.		272	302		201	228	,
Platoon blocked, %		•	•										
Mov Cap-1 Maneuver	1242	•	•	=	1116	ï		7	74	654	29	69	722
Mov Cap-2 Maneuver	•	•	•		,			71	74		29	69	٠
Stage 1	•	•	•			ï		266	278		269	181	
Stage 2		•	•		,			163	181		260	549	'
Approach	EB			Λ	WB			NB			SB		
HCM Control Delay, s	0.3				5.3			196.9			222.2		
HCMLOS								ш			ш		
													i
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR WBL	3L WBT		WBR SBLn1 SBLn2	SBLn2					
Capacity (veh/h)	282		*	- 1116	16	į.	- 29	•					
HCM Lane V/C Ratio	1.305	0		- 0.331	31		- 0.517						
HCM Control Delay (s)	196.9	7.9	0	,		0	- 222.2						
HCM Lane LOS	ш.	⋖	⋖			Ø		A					
HCM 95th %tile Q(veh)	18.3	0	1	,	1.5	į,	- 1.7	•					

Penstemon Homes Traffic Impact Study 03/20/2017 PM Future

HCM 2010 TWSC 2: Linwood Ave & Aston Ave

Int Delay, s/ven 9.5	2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			₩	¥.		₹	*
Traffic Vol, veh/h	_	323	52	218	133	0	81	2	384	0	4	∞
Future Vol, veh/h	-	323	52	218	133	0	81	7	384	0	4	∞
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		•			•		20	•	0		٠	22
Veh in Median Storage, #		0		•	0		•	0		•	0	
Grade, %		0		•	0		•	0		٠	0	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	7	2	2	2	2	2	2
Mvmt Flow	_	323	52	218	133	0	81	2	384	0	4	00

Major/Minor	Major1		2	Major2			Minor1			Minor2		
Conflicting Flow All	137	0 0		379	0	0	930	928	357	676	954	141
Stage 1				٠	٠	•	355	322		573		
Stage 2	٠			٠	٠	٠	575	573		326		
Critical Hdwy	4.12			4.12	٠	•	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1				٠		٠	6.12	5.52		6.12	5.52	
Critical Hdwy Stg 2				٠		٠	6.12	5.52		6.12	5.52	
Follow-up Hdwy	2.218			2.218		٠	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1447			1179	٠	•	248	268	289	248	259	907
Stage 1				٠	٠	٠	662	630	,	202	504	1
Stage 2					٠	•	503	204	·	199	613	
Platoon blocked, %					٠	٠						
Mov Cap-1 Maneuver	1441			1175	٠	٠	203	213	682	06	205	006
Mov Cap-2 Maneuver				٠		٠	203	213		06	205	
Stage 1				٠	٠	•	629	627		203	402	
Stage 2				٠	٠	•	393	402		287	610	*
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			5.4			20			13.6		
HCM LOS							S			В		
Minor Lane/Major Mvmt	NBLn1 NBLn2	2 EBL	EBT	EBR	WBL	WBT	WBR SBLn1 SBLn2	SBLn2				
Capacity (veh/h)	203 682	2 1441	1	,	1175		- 202	006				
HCM Lane V/C Ratio	0.409 0.563 0.001	3 0.001	٠	0	- 0.186	٠	- 0.02	0.02 0.009				
HCM Control Delay (s)	34.5 16.9	9 7.5	0	,	89.	0	- 22.9	6				
HCM Lane LOS	Ω	S	Ø	٠	Ø	V	0	A				
HCM 95th %tile Q(veh)	1.8 3.5	5 0	•	٠	0.7	٠	- 0.1	0				

Penstemon Homes Traffic Impact Study 5:00 pm 03/20/2017 AM Future with Improvements

Synchro 9 Report Page 2

HCM 2010 TWSC

03/24/2017

Ave	
Aston A	
Ave & ,	
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2: Lin	
2	ı

03/24/2017

Intersection													
Int Delay, s/veh 13.3													
Movement	EBL	EBT	EBR	WBI		WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4				4			₹	¥.		₹	*-
Traffic Vol, veh/h	15	342	100	Š		317	0	29	0	309	15	0	0
Future Vol, veh/h	15	342	100	Š		317	0	29	0	309	15	0	0
Conflicting Peds, #/hr	0	0			-	0	0	-	0	-	0	0	0
Sign Control	Free	Free	Free	Ē	Free F	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	•	1	None				None			None		. '	None
Storage Length			٠					20	'	0		,	22
Veh in Median Storage, #	•	0	٠		÷	0	٠		0		٠	0	,
Grade, %	٠	0	٠			0	٠		0			0	٠
Peak Hour Factor	100	100	100	=	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2		7	7	7	2	7	2	2	7	2
Mvmt Flow	15	342	100	Š	369	317	0	29	0	309	15	0	0
Major/Minor	Major1			Major2	ır2			Minor1			Minor2		
Conflicting Flow All	317	0	0	4	443	0	0	1479	1478	394	1478	1528	318
Stage 1	•	1	•		÷	÷	٠	423			1055	1055	•
Stage 2	•	'	•				٠	1056			423	473	1
Critical Hdwy	4.12	1	•	4.	4.12			7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	•		٠					6.12	5.52		6.12	5.52	•
Critical Hdwy Stg 2	•		•		ï	٠	٠	6.12			6.12	5.52	•
Follow-up Hdwy	2.218		٠	2.218	29		٠	3.518	4	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1243	1	1	=	1117	÷	٠	104		655	104	117	723
Stage 1	•	1	٠			٠	٠	609			273	302	٠
Stage 2	•	1	1		í	÷	•	272	302		609	228	'
Platoon blocked, %			٠										
Mov Cap-1 Maneuver	1242		٠	1	116	٠	٠	71	74	654	37	69	722
Mov Cap-2 Maneuver	•		٠					71			37	69	٠
Stage 1	•		•		ï	٠	٠	299			269	181	•
Stage 2	1	1	٠				٠	163	<u>8</u>	٠	316	249	1
Approach	EB			>	WB			NB			SB		
HCM Control Delay, s	0.3			L)	5.3			38.6			157.3		
HCM LOS								ш			ш.		
Minor Lane/Major Mvmt	NBLn1 NBLn2	JBLn ₂	EBL	EBT EE	EBR V	WBL	WBT \	WBR SBLn1 SBLn2	SBLn ₂				
Capacity (veh/h)	71	654	1242		- 1	1116		- 37					
HCM Lane V/C Ratio	0.831	0.472	0.012		.0	0.331		- 0.405					
HCM Control Delay (s)	160.5	15.3	7.9	0	,	8.6	0	- 157.3	0				
HCM Lane LOS	ш	C	A	A		A	V		A				
HCM 95th %tile Q(veh)	4	2.5	0			1.5		- 1.4					

Penstemon Homes Traffic Impact Study 03/20/2017 PM Future with Improvements

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

03/23/2017

>
Drivewa
Ln/Private
Poinsettia l
Ave &
3: Linwood

03/23/2017

SBT SBR 8 S

> 8 4 00

400

EBL EBT EBR 400

Intersection	Int Delay, s/veh 0.1	Movement EBL E	Lane Configurations	Traffic Vol, veh/h 0	Future Vol, veh/h 0	Conflicting Peds, #/hr 8	Ś	pez	Storage Length -	Veh in Median Storage, #		10	des, %	Mvmt Flow 0	Mir	/ All	Stage 1 119 1		7.12		Critical Hdwy Stg 2 6.12 5.		ieuver	Stage 1 885 7				Mov Cap-2 Maneuver 733 6		Stage 2 908 8	Approach EB	HCM Control Delay, s 9		Minor Lane/Major Mvmt NBL N	Capacity (veh/h) 1449	HCM Lane V/C Ratio	lay (s)		HCM 95th %tile Q(veh) 0
		SBT SBR	4	151 4	151 4	7 0	Free Free	- None		- 0	- 0	100 100	2 2	151 4		0 0																							
		SBL SE	ľ	0	0	0	Free Fr					100	2	0	Major2	106			4.12			2.218	1485				1475				SB	0							
		NBR		2	2	4	Free	None				100	2	2		0	í		·				ì																
		NBL NBT	€\$	2 100	2 100	11 0	Free Free			0 -		100 100	2 2	2 100	Major1	166 0			1.12			2.218 -	1412 -			•	1397 -				NB	0.1							
				2	2	0		Φ.					2	2	Ma				2 ,															T SBR					
		BT WBR	4	0 2	0	0	top Sto	- Non		0		100 100	2	0		275 112	109	166	.52 6.2	.52	.52	3.31	632 941				622 931		800	753				SBL SBT	1475		0	A	0
		WBL WBT		0	0		Stop S					100	2	0	Minor1		109	167 1	7.12 6	6.12 5	6.12 5.52 -	3.518 4.0		3 968				661 6			WB	8.9	Α			0.002	8.9	Α	0
		EBR		2	2	=	top	oue				100	2	2		175			6.22				898				850							NBR EBLn1WBLn1	- 744	- 0.013 0.002	6.6 -	A	0 -
		EBT E	4			0	Stop S	Ž		0		100	2	0		274	164			5.52	5.52	.018 3	633	762	804			623	754	799				NBT N			0	A	
	2	EBL		2	2	7	Stop					100	2	2		277	164		7.12		6.12	7	675				199	199	828	887	EB	6.6	Α	NBL	1397	0.001	9.7	Α	0
Intersection	Int Delay, s/veh 0.5	Movement	Lane Configurations	Traffic Vol, veh/h	Future Vol, veh/h	Conflicting Peds, #/hr	Sign Control	RT Channelized	Storage Length	Veh in Median Storage, #	Grade, %	Peak Hour Factor	Heavy Vehicles, %	Mvmt Flow	Major/Minor	Conflicting Flow All	Stage 1	Stage 2	Critical Hdwy	Critical Hdwy Stg 1	Critical Hdwy Stg 2	Follow-up Hdwy	Pot Cap-1 Maneuver	Stage 1	Stage 2	Platoon blocked, %	Mov Cap-1 Maneuver	Mov Cap-2 Maneuver	Stage 1	Stage 2	Approach	HCM Control Delay, s	HCM LOS	Minor Lane/Major Mvmt	Capacity (veh/h)	HCM Lane V/C Ratio	HCM Control Delay (s)	HCM Lane LOS	HCM 95th %tile Q(veh)

Lane Configurations		}			\$			₽			\$	
Traffic Vol, veh/h	0	0	7	0	0	0	0	84	0	2	95	21
Future Vol, veh/h	0	0	7	0	0	0	0		0	2	95	21
Conflicting Peds, #/hr	∞	0	6	33	0	2	6	0	က	2	0	∞
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized			None		,	None			None	•	1	None
Storage Length	•	•				•	•	•	•	•	1	
Veh in Median Storage, #	•	0		•	0	1	,	0	•	•	0	
Grade, %	٠	0			0		ľ	0	٠		0	ľ
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	7	7	2	2	2	2	2	2	2	7	2
Mvmt Flow	0	0	2	0	0	0	0	84	0	2	95	21
				-			-					
Major/Minor	Minor2			Minori			MajorT			MajorZ		
Conflicting Flow All	211	206	124	207	216	95	125	0	0	87	0	0
Stage 1	119	119		87	87	1	•	•	٠	•	1	
Stage 2	92	87		120	129		'	,		1		ľ
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	•	•	4.12		
Critical Hdwy Stg 1	6.12	5.52		6.12	5.52	'			٠	•		ľ
Critical Hdwy Stg 2	6.12	5.52		6.12	5.52	1	•	•	•	•	1	
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218		٠	2.218		
Pot Cap-1 Maneuver	746	691	927	751	682	962	1462	•	٠	1509		
Stage 1	882	797		921	823	1		,		1		ľ
Stage 2	915	823	٠	884	789			•	•	•		
Platoon blocked, %								•	٠		•	
Mov Cap-1 Maneuver	733	682	911	740	674	952	1449	•	•	1498	1	
Mov Cap-2 Maneuver	733	682		740	674	•		•	٠	•	•	
Stage 1	877	789		918	821	1		1	•		1	
Stage 2	806	821		874	781	•		•	٠	•	1	
Approach	EB			WB			NB			SB		
HCM Control Delay, s	6			0			0			0.1		
HCMLOS	A			A								
Minor Lane/Major Mvmt	NBL	NBT	NBR EBI	NBR EBLn1WBLn1	SBL	SBT	SBR					
Capacity (veh/h)	1449	1	,	911 -	1498	1						
HCM Lane V/C Ratio			- 0.0	0.002 -	0.001	'						
HCM Control Delay (s)	0	•		0 6	7.4	0						
HCM Lane LOS	⋖	٠		A	A	A						
HCM 95th %tile Q(veh)	0	•		0	0							

Penstemon Homes Traffic Impact Study 5:00 pm 03/20/2017 AM Future

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Penstemon Homes Traffic Impact Study 03/20/2017 PM Future

HCM 2010 TWSC 4: Kawana Springs Rd & Taylor Mountain Pl

Int Delay, siveh 3.3 Wovement EBI Lane Configurations 22 Traffic Vol, veh/h 22 Conflicting Peds, #/hr 12 Sign Control Free RT Channelized 7.5 Storage Length 7.5 Storage Length 7.5 Free Mr Median Storage, # 7.5 Free Mr Median Storage, # 7.5 Wajert/Minor 100 Wajert/Minor 100 Wajert/Minor 100 Wajert/Minor 100 Wajert/Minor 100 Zana 22 Wajert/Minor 100 Zana 23 Wajert/Minor 100 Zana 23 Zana 24 Zana 25 Zana 2	22 22 1 1 Free	EBT			1	9		CRD	
ions h h h storage, # storage, # /%		EBT		FOW	1016	9		CRD	
h h h h h s, #lhr storage, # /%		EBI						CBD	
ions h h h i h i or or % MA				WBI	WBI WBR	ž	SBL	JUIN	
h h i storage,# or % All		÷		4			>-		
h, #hrr I Istorage, # or % All		298		303		34	98	81	
, #fhr I Storage, # or '% All		298		303		34	98	81	
i storage, # % % All		0		0		0	-		
storage,# or % Ma		Free		Free	e Free	3e	Stop	Stop	
storage, # or ,% Ma	,	None			- None	Je	. •	None	
or %%	٠						0		
Ma		0		J	0		0		
Ma	٠	0			0		0		
Ma	100	100		100		100	100	100	
Ma	7	2			C.	2	2	2	
Ma	22	298		303		34	98	81	
Ma									
	or1			Major2	2		Minor2		
	338	0				0	664	322	
Stage 1							321		
Stage 2				ľ			343		
Critical Hdwy 4.	4.12	٠					6.42	6.22	
Critical Hdwy Stg 1							5.42	,	
Critical Hdwy Stg 2				•	,	,	5.42		
	2.218						3.518	3.318	
neuver	1221					,	426	719	
Stage 1						,	735		
Stage 2		·			,	,	719		
					,				
	1220				,	,	416	718	
Aov Cap-2 Maneuver							416		
Stage 1							734		
Stage 2							703		
Approach	EB			WB	~		SB		
HCM Control Delay, s	9.0			0	0		15.1		
HCM LOS							ပ		
Minor Lane/Major Mvmt E	EBL	EBT W	WBT WBR SBLn1	SBLn1					
Capacity (veh/h) 12	1220			523					
	0.018			0.319					
HCM Control Delay (s)	œ	0		15.1					
HCM Lane LOS	Ø	۷		ပ					
HCM 95th %tile Q(veh)	0.1			1.4					

Penstemon Homes Traffic Impact Sludy 5:00 pm 03/20/2017 AM Future

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HCM 2010 TWSC 4: Kawana Springs F

03/23/2017

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03/23/2017

Intersection									
Int Delay, s/veh 1.8									
Movement	EBL	EBT			WBT	WBR	SBL	SBR	
Lane Configurations		₩			÷		¥		
Traffic Vol, veh/h	8	371			275	92	14.	28	
Future Vol, veh/h	8	371			275	9	14	28	
Conflicting Peds, #/hr	9	0			0	-	-	9	
Sign Control	Free	Free			Free	Free	Stop	Stop	
RT Channelized	•	None			•	None	. 1	None	
Storage Length					•		0		
Veh in Median Storage, #	•	0			0		0		
Grade, %	1	0			0		0		
Peak Hour Factor	100	100			100	100	100	100	
Heavy Vehicles, %	2	2			7	2	2	2	
Mvmt Flow	81	371			275	18	14	28	
Major/Minor	Major1			N	Major2		Minor2		
Conflicting Flow All	299	0			٠	0	824	296	
Stage 1		٠			٠		290		
Stage 2	•	٠			,		534		
Critical Hdwy	4.12	•			1	·	6.42	6.22	
Critical Hdwy Stg 1	•	٠			•		5.42		
Critical Hdwy Stg 2	•	•			•		5.42		
Follow-up Hdwy	2.218	٠			٠		3.518	3.318	
Pot Cap-1 Maneuver	1262	•			•		343	743	
Stage 1	•	٠			٠		759		
Stage 2	•	•			1	·	288		
Platoon blocked, %		٠			•				
Mov Cap-1 Maneuver	1255	•			•	·	312	735	
Mov Cap-2 Maneuver	•	٠			٠		312		
Stage 1	•	•			•		755		
Stage 2	•	٠			•		537		
Approach	EB				WB		SB		
HCM Control Delay, s	1.4				0		12.1		
HCMLOS							В		
Minor Lane/Major Mvmt	EBL	EBT	WBT V	WBR SBLn1					
Capacity (veh/h)	1255	1		- 582					
HCM Lane V/C Ratio	0.065	٠		- 0.124					
HCM Control Delay (s)		0		- 12.1					
HCM Lane LOS	⋖ ;	⋖	٠	ω ;					
HCM 95th %tile Q(veh)	0.2			- 0.4					

Penstemon Homes Traffic Impact Sludy 03/20/2017 PM Future

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

WBL W 226 226 226 100 1.00 1.00 1.00 1.00 1.74 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7 9.7	WBT WBR 346 45 346 45 6 16 0 0 100 0 1863 1900 346 34 347 34 1 0 2 2 502 49 603 0.30 0 1647 1647 164 0 1830 0 20.1 0 20.1 0 20.1 0 20.1 0 0.00 0 0.00 0 0.00 0 0.00 0 0.00 0 0.69	NBI 108 108 108 100 100 108 1100 1774 3.6 3.6 3.6 3.6 3.6 3.6 3.6 3.6 3.6 3.6	NBT 848 848 848 848 848 848 27 1.00 2 1.00	239 239 18 100 0.098 1.000 1.000 1.000 2.2 2.2 2.2 2.2 2.2 2.2 2.2 2.2 2.2	SBL 23 23 23 23 7 0 1.00 1.00 1.00 1.00 2 2 2 2 2 2 2 2 3 7 7 1.00 1.00 1.00 1.00 1.00 1.00 1.00	368 368 368 368 4 4 0 0 11.00 1863 1800 0.43 1863 368 1863	SBR 287 287 287 287 14 0 0 0.99 11.00 215 215 215 215 215 215 215 215 215 215
1		1	### 848 848 848 8 848 0 0 11.00 2 2 1.00 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	239 18 0 0.098 1.00 1900 212 0 1.00 1.00 2 317 0.45 698 698 523 26.2	23 23 23 7 7 0 1.00 1.00 23 23 23 22 22 229 0.03	368 368 368 4 4 0 0 11.00 1100 2 800 800 0.43 11863	287 287 14 0 0 0 0.0.9 1.00 1.100 2 813 813 215 215 215 215 1.00 2 2 2 1.00 1.00 1.00 1.00 1.00 1.0
176 230 53 226 5		4-5 - 105	848 848 8 848 0 0 11.00 11.00 2 120 1270 1270 1270 1270 1270 1270 1270 1	239 239 18 0 0.098 1.00 212 0 1.00 2317 698 698 523 1722 26.2	23 23 7 7 0 1.00 1.00 1863 2 2 2 2 2 2 2 2 2 2 2 2 7 7 7 7 7 7 7	368 368 4 4 0 0 0 11.00 11.00 2 800 800 0.43 11863 368	287 287 14 0 0.0.99 11.00 215 215 215 215 215 215 215 215 215 215
176 230 53 226 63 64 64 64 64 64 64 6			848 8 8 8 0 0 1.00 1.863 848 2 2 1.00 1.20 1.20 0.45 2.794 537 1.770 2.6.1	239 18 0 0.098 1.00 212 0 1.00 2 2 317 0.45 698 52.2 26.2	23 1.00 1.00 1.00 1.863 23 1 1 1.00 2 2 2 2 2 2 1.00	368 4 4 0 0 11.00 11.00 2 2 800 0.43 1863 368 800	287 0 0.99 11.00 11.00 11.00 2 215 215 215 215 215 215 215
5 2 12 1 0 0 0 0 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00			1.00 1.00 1.00 2 1.00 2 1.00 2 1.270 2.794 5.37 1.770 2.6.1 2.6.1	18 0 0 0.98 1.00 1.00 2.12 0 1.00 2.21 0.45 698 698 523 1722 26.2	1.00 1.00 1.00 1.00 2.3 2.3 2.29 0.03	4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	14 0 0.99 1.00 1.00 1.00 2 215 2 813 0.43 1.569
100 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			1.00 1.00 1.00 2 1.00 2 1.00 2 1.270 5.37 1.770 2.6.1 2.6.1	0.098 1.00 1900 212 0 1.00 1.00 2 317 0.45 698 523 1722 26.2	1.00 1.00 1863 23 23 1.00 229 0.03	11.00 11.00 11.00 2 800 0.43 1863 368	0.99 0.99 11863 215 1.00 2 813 0.43 0.43 1569
1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00			1.00 1863 848 2 1.00 2 1.20 0.45 2794 537 1770 26.1 26.1	0.98 11.00 1900 21.2 0 1.00 2 31.7 0.45 698 523 1722 26.2 26.2	1.00 1863 23 23 1.00 229 0.03	1.00 11863 368 1 1 1.00 2 800 0.43 11863 368	1.00 1.00 1.00 1.00 2 813 0.43 0.43 1.569
1863 1863 1863 1863 1863 1863 1863 1863 1863 1863 1863 1863 1863 1863 1863 1863 1863 13 226 1 1 1 1 1 1 1 1 1			1863 848 848 2 1.00 2 1.270 0.45 2794 537 1770 26.1 26.1	1900 212 0 1.00 2 2 317 0.45 698 523 1722 26.2 26.2	1.00 23 23 1.00 22 229 0.03	1.00 368 368 1 1.00 2 800 0.43 1863	1.00 215 215 1.00 1.00 2 813 0.43 215 215
176 283 132 132 132 132 133 133 23 133 23 133 23 133 13			2 1.00 2 1.00 2 1270 0.45 2794 537 1770 26.1	212 0 1.00 2 317 0.45 698 523 1722 26.2 26.2	23 23 1.00 2 229 0.03 1774	368 1.00 2 800 0.43 1863 368	215 1.00 2 813 0.43 1569 215
100 1.00 1.00 1.00 1.00 1.00 1.00 1.00			1.00 2 1.00 0.45 0.45 2794 537 1770 26.1 26.1	1.00 1.00 1.00 3.17 0.45 698 523 1722 26.2 26.2	1.00 2 229 0.03 1774	1.00 2 800 0.43 1863 368	1.00 2 813 0.43 0.43 215 215
1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00			1.00 2 1270 0.45 2794 537 1770 26.1 26.1	1.00 2 317 0.45 698 523 1722 26.2 26.2	1.00 2 229 0.03 1774	1.00 2 800 0.43 1863 368	1.00 2 813 0.43 1569 215
2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2			2 1270 0.45 2794 537 1770 26.1 26.1	2 317 0.45 698 523 1722 26.2 26.2	2 229 0.03 1774	2 800 0.43 1863 368	2 813 0.43 1569 215 1569
339 527 528 459 1774 1863 1575 1774 1 176 230 13 226 1774 1863 1575 1774 1 1774 1863 1575 1774 1 176 11.1 0.6 9.7 1.00 1.00 1.00 1.00 1339 527 528 459 1.25 0.44 0.02 449 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00			1270 0.45 2794 537 1770 26.1 26.1	317 0.45 698 523 1722 26.2 26.2	229 0.03 1774	800 0.43 1863 368	813 0.43 1569 215 1569
0.09 0.28 0.11 0 176 230 13 226 177 1863 1575 1774 1 177 1863 1575 1774 1 1 0			0.45 2794 537 1770 26.1 26.1 804	0.45 698 523 1722 26.2 26.2	0.03	0.43 1863 368	0.43 1569 215 1569
1774 1863 1575 1774 1 1774 1863 1575 1774 1 176 230 13 226 176 11.1 0.6 9.7 176 11.1 0.6 9.7 176 11.1 0.6 9.7 177 128 459 0.52 0.44 0.02 0.49 0 177 527 528 464 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00)		537 1770 26.1 26.1 804	698 523 1722 26.2 26.2	1774	368	215
176 230 13 226 177 14 1863 1575 1774 76 11.1 0.6 9.7 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 260 32.3 24.5 23.7 260 32.3 24.5 23.7 1.00 1.00 1.00 0.0 1.00 1.00 1.00 1.00 260 32.3 24.5 23.7 265 34.9 24.6 24.0 2 C C C 2 C C C 2 C C C 2 C C C C 2 C C C C C C C C C C C C C C C C C C C		_ , ,	537 1770 26.1 26.1	523 1722 26.2 26.2		368	215
1774 1863 1575 1774 76 11.1 0.6 9.7 76 11.1 0.6 9.7 1.00 1.00 1.00 339 527 528 459 337 527 528 464 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00	`	_ , ,	26.1 26.1 804	26.2	23	1062	1569
7.6 11.1 0.6 9.7 7.6 11.1 0.6 9.7 7.6 11.1 0.6 9.7 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.		, ,	26.1 26.1 804	26.2	1774	000	
76 11:1 0.6 9.7 1.00 1.00 1.00 0.52 0.44 0.02 0.49 0 3.77 5.28 464 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.0 0.0 0.0 eh 26.0 32.3 24.5 23.7 eh 26.0 32.45 23.7 eh 26.5 34.9 24.6 24.0 C C C C C C C C C C C C C C C C C C			26.1	26.2	0.8	15.4	8.4
hh 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.			804		0.8	15.4	8.4
0.52 0.44 0.02 0.49 0.05 0.49 0.00 0.40 0.00 0.40 0.00 0.40 0.00 0.40 0.00 0			500	782	00.1	OUR	01.7
377 527 528 464 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.			0.67	0.67	0.10	0.46	0.26
1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00	0 551		804	783	374	800	813
100 100 1.00 1.00 (1.00			1.00	1.00	1.00	1.00	1.00
veh 260 32.3 24.5 23.7 1 0.5 2.6 0.1 0.3 vehlin 3.7 6.1 0.3 4.7 C C C C C C C A19 A19 A1 2 3 4 T 2 3 4			1.00	1.00	1.00	1.00	1.00
weh 0.5 2.6 0.1 0.3 weh 0.0 0.0 0.0 0.0 wehlin 3.7 6.1 0.3 4.7 C	m		23.5	23.5	19.0	22.3	14.9
veh/ln 26 349 246 24.0 or C C C C C C C C C C C C C C C C C C C			4.4	4.5	0.1	1.9	0.8
vehlin 3.7 6.1 0.3 4.7 1 26.5 34.9 24.6 24.0 C C C C C C C C C C C C C C C C C C C	0.0 0.0		0.0	0.0	0.0	0.0	0.0
265 34.9 24.6 24.0 C C C C 419 31.0 C C 419 1 2 3 4			13.7	13.3	0.4	8.4	3.8
C C C C C C C C C C C C C C C C C C C	0.0 40.8	16.4	27.9	28.0	19.1	24.2	15.7
31.0 31.0 1 2 3 4		Ф	U	ပ	m	U	
71.0 31.0 C C T 3 4 4 1 2 3 4	909		1168			909	
C C 3 4	34.5		26.9			21.0	
1 2 3	S		O			O	
1 2 3	5 6	7	8				
		7	00				
35.0 8.8 51.6	(-,		54.3				
3.0 3.9 3.0 *4.3	3.0 3.9		4.3				
12.0 31.1 12.0 * 41		,_	40.7				
I1), s 11.7 13.1 5.6 17.4	7		28.2				
7.4	0.1 2.5	0.0	2.7				
Intersection Summary							
elay 27							
HCM 2010 LOS							

Penstemon Homes Traffic Impact Study 5.00 pm 03/20/2017 AM Future

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

03/23/2017

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	je-	*	¥	¥	£,		¥	₩		je-	*	*-
Traffic Volume (veh/h)	226	435	132	174	338	36	137	879	311	30	415	365
Future Volume (veh/h)	226	435	132	174	338	36	137	879	311	30	415	365
Number	2	2	12	-	9	16	3	00	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	12	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.97	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	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	226	435	79	174	338	32	137	879	292	30	415	238
Adj No. of Lanes	-	-		_		0		2	0		-	_
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	22	307	958	412	226	687	733
Arrive On Green	0.10	0.34	0.34	0.08	0.32	0.32	90.0	0.40	0.40	0.03	0.37	0.37
Sat Flow, veh/h	1774	1863	1574	1774	1656	171	1774	2394	1031	1774	1863	1545
Grp Volume(v), veh/h	226	435	79	174	0	373	137	201	469	30	415	238
Grp 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		0.09	1.00		0.62	1.00		1.00
ane Grp Cap(c), veh/h	402	632	637	344	0	286	307	708	662	226	687	733
//C Ratio(X)	0.56	69.0	0.12	0.51	00:00	0.64	0.45	0.71	0.71	0.13	09.0	0.32
Avail Cap(c_a), veh/h	414	632	637	389	0	286	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(I)	1.00	0.1	00.	00.1	0.00	0.0	00.	00.	0.1	1.00	0.1	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	0.9	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	5.5	0.0
%ile BackOfO(50%),ven/in	4.	5.1.3	4. 6	3	0.0	7.6	7.7	177	12.0	0.5	17.7	5.4
LnGrp Delay(d),s/ven	21.6	34.5	1.61	22.1	0.0	34.2	6.61	31.0	31.4	20.5	36.1	1./.
LnGrp LOS	ပ	ပ	8	U		ပ	8	ပ	ပ	ပ		B
Approach Vol, veh/h		740			547			1107			683	
Approach Delay, s/veh		28.9			30.3			29.8			29.0	
Approach LOS		ပ			O			O			ပ	
Timer	-	2	3	4	2	9	7	8				
Assigned Phs	-	2	3	4	2	9	7	∞				
Phs Duration (G+Y+Rc), s	11.5	37.8	9.5	41.2	13.3	36.0	6.4	44.3				
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	* 31	11.0	32.1	12.0	30.7				
Max Q Clear Time (g_c+I1), s	8.5	22.1	9.9	20.1	10.3	19.4	3.0	25.7				
Green Ext Time (p_c), s	0.1	3.8	0.1	5.2	0.0	4.4	0.0	3.0				
Intersection Summary												
HCM 2010 Ctrl Delay			29.5									
HCM 2010 LOS			ပ									

Penstemon Homes Traffic Impact Study 03/20/2017 PM Future

HCM 2010 TWSC 1: Meda Ave & Aston Ave

Intersection						
Int Delay, s/veh 2.4						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	÷			÷∓	>-	
Traffic Vol, veh/h	304	16		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 Free	Free	Stop	Stop
RT Channelized	•	None		None	. •	None
Storage Length	٠		٠		0	
Veh in Median Storage, #	0	÷	•	0	0	
Grade, %	0		٠	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

ir2 Minor1	320 0 509 316	312 -	- 197	4.12 - 6.42 6.22	5.42	5.42	18 - 3.518 3.318	1240 - 524 724	742 .	836 -			513 .	742 .	- 818	WB		8	91			0	
Major2	0 32			- 4.1			- 2.218	- 124				- 1235				*	0		EBR WBL WBT	- 1235	- 0.016	00	
Major1	0															EB	0						
Ž																			NBLn1 EBT	604	0.177	12.2	
Major/Minor	Conflicting Flow All	Stage 1	Stage 2	Critical Hdwy	Critical Hdwy Stg 1	Critical Hdwy Stg 2	Follow-up Hdwy	Pot Cap-1 Maneuver	Stage 1	Stage 2	Platoon blocked, %	Mov Cap-1 Maneuver	Mov Cap-2 Maneuver	Stage 1	Stage 2	Approach	HCM Control Delay, s	HCM LOS	Minor Lane/Major Mvmt	Capacity (veh/h)	HCM Lane V/C Ratio	HCM Control Delay (s)	

Penstemon Homes Traffic Impact Study 03/20/2017 AM Existing with Project

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HCM 2010 TWSC 1: Meda Ave & Aston Ave

03/24/2017

03/24/2017

Intersection								
Int Delay, s/veh	1.4							
Movement	EBT	FBR I	~	WBL	WBT	NBL	NBR	
Lane Configurations	1	2			₩	>		
Traffic Vol, veh/h	390) 53	~	43	226	56	29	
Future Vol, veh/h	39			43	226	26	29	
Conflicting Peds, #/hr	0	0 (0	0	0	-		
Sign Control	Free	e Free	4	Free	Free	Stop	Stop	
RT Channelized		- None	a)		None	. •	None	
Storage Length			l.	٠		0		
Veh in Median Storage, #				•	0	0		
Grade, %		0			0	0		
Peak Hour Factor	100	001 (0	100	100	100	100	
Heavy Vehicles, %		~	2	2	2	2	2	
Mvmt Flow	390	Δ,	~	43	226	26	29	
Major/Minor	Major1		ļ	Major2		Minor1		
Conflicting Flow All		0	0	443	0	730	418	
Stage 1				٠		417		
Stage 2				٠		313		
Critical Hdwy				4.12		6.42	6.22	
Critical Hdwy Stg 1				٠		5.42		
Critical Hdwy Stg 2				•	,	5.42		
Follow-up Hdwy				2.218		3.518	3.318	
Pot Cap-1 Maneuver				1117		389	635	
Stage 1				•	ı	999		
Stage 2				•	ı	741		
Platoon blocked, %					,			
Mov Cap-1 Maneuver				1116	ı	372	634	
Mov Cap-2 Maneuver				٠		372		
Stage 1				•		999		
Stage 2				•		208		
Approach	EB	8		WB		NB		
HCM Control Delay, s		0		1.3		13.5		
HCM LOS						В		
Minor Lane/Major Mvmt	NBLn1 EBT	r EBR	\ MBL	WBT				
Capacity (veh/h)	476		- 1116	1				
HCM Lane V/C Ratio			- 0.039	•				
HCM Control Delay (s)	13.5		- 8.4	0				
HCM Lane LOS			Α .	⋖				
HCM 95th %tile Q(veh)	0.4		- 0.1					

Penslemon Homes Traffic Impact Study 03/20/2017 PM Existing with Project

HCM 2010 TWSC 2: Linwood Ave & Aston Ave

Intersection													
Int Delay, s/veh 7.9	6.7												
Movement	П	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			4			4			÷			÷	*
Traffic Vol, veh/h		_	303	26	221	128	0	44	-	242	0	-	_
Future Vol, veh/h		-	303	26	221	128	0	44	-	242	0	-	-
Conflicting Peds, #/hr		0	0	4	4	0	4	4	0	4	0	0	0
Sign Control	ᇤ	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized		,		None	•	1	None	•	1	None	•	1	None
Storage Length		,				•			٠			٠	22
Veh in Median Storage, #			0		•	0		•	0		•	0	
Grade, %			0			0			0		٠	0	
Peak Hour Factor	-	001	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %		7	7	2	2	2	2	2	2	2	2	2	2
Mvmt Flow		_	303	99	221	128	0	44	-	242	0	_	_

Major/Minor	Major1			2	Major2		_	Minor1			Minor2		
Conflicting Flow All	132	0	0		363	0	0	912	911	339	1033	636	136
Stage 1		•	1			1		337	337	٠	574	574	
Stage 2	٠	٠	٠		٠	٠		575	574	٠	429	365	ľ
Critical Hdwy	4.12	1	1		4.12	1	·	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1		٠						6.12	5.52		6.12	5.52	ľ
Critical Hdwy Stg 2		٠	•		•	•		6.12	5.52		6.12	5.52	ľ
Follow-up Hdwy	2.218	٠			2.218			3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1453	•	1		1196	1		255	274	703	211	264	913
Stage 1	٠	٠	٠		٠	٠		119	641	٠	204	503	ľ
Stage 2	٠	٠	•		٠	•	·	503	503	٠	582	623	'
Platoon blocked, %		٠	٠			•							
Mov Cap-1 Maneuver	1447	٠	1		1191	1		213	217	869	115	209	906
Mov Cap-2 Maneuver		٠			•			213	217		115	209	ľ
Stage 1		•	1			1		674	638	٠	502	401	
Stage 2	٠	٠	٠			٠		366	401	٠	378	620	ľ
Approach	EB				WB			NB			SB		
HCM Control Delay, s	0				5.5			20.5			15.7		
HCM LOS								O			S		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR WBL		WBT	WBT WBR SBLn1 SBLn2	SBLn2					
Capacity (veh/h)	514	1447	1	1	1191	1	- 209	906					
HCM Lane V/C Ratio	0.558 0.001	100.			0.186		- 0.005	0.001					
HCM Control Delay (s)	20.5	7.5	0		8.7	0	- 22.3 9	6					
HCM Lane LOS	O	A	A	٠	A	V	· ·	⋖					
HCM 95th %tile O(veh)	3.4	0			0.7		0 -	0					

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HCM 2010 TWSC 2: Linwood Ave & Aston Ave

03/24/2017

03/24/2017

Intersection													
Int Delay, s/veh 10.9	6.												
Movement	EBL	EBT	EBR	×	WBL V	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4				4			4			€	¥C.
Traffic Vol, veh/h		326	92	,	337	230	0	39	0	252	_	0	0
Future Vol, veh/h		326	92	. ,	337	230	0	39	0	252	_	0	0
Conflicting Peds, #/hr	0	0			-	0	0	_	0	-	0	0	0
Sign Control	Free	Free	Free	ш.	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized			None		·	-	None			None			None
Storage Length												•	22
Veh in Median Storage, #		0	٠			0			0	٠		0	•
Grade, %		0	٠			0			0			0	٠
Peak Hour Factor	100	100	100	•	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	7	2		7	7	2	2	2	2	2	7	2
Mvmt Flow	_	326	35	. ,	337	230	0	39	0	252		0	0
Major/Minor	Major1			Major2	or2			Minor1			Minor2		
Conflicting Flow All	230	0	0	7	419	0	0	1280	-	374	1405	1325	231
Stage 1		1	•		ï	÷	·	375		٠	904	904	•
Stage 2		•				٠		902			201	421	1
Critical Hdwy	4.12			4	4.12		·	7.12		6.22	7.12	6.52	6.22
Critical Hdwy Stg 1								6.12			6.12	5.52	'
Critical Hdwy Stg 2	•		٠		ï	٠		6.12			6.12	5.52	,
Follow-up Hdwy	2.218			2.3	2.218	٠		3.518	4	€.	3.518	4.018	3.318
Pot Cap-1 Maneuver	1338	1		-	1140	÷	ř	143		672	117	126	808
Stage 1	•	1	٠		·	٠	÷	646			331	326	٠
Stage 2	•		·		ř	÷	í	331	326	í	225	289	'
Platoon blocked, %													
Mov Cap-1 Maneuver	1337		٠	-	139	٠		105		671	54	103	807
Mov Cap-2 Maneuver			٠					105		٠	24	103	٠
Stage 1	•		٠		ï	٠	·	645		٠	331	235	
Stage 2	1	1	٠					219	235	٠	344	288	1
Approach	EB				WB			NB			SB		
HCM Control Delay, s	0				9.6			36.9			72.9		
HCM LOS								Ш			ш.		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR M	WBL V	WBT \	NBR SB	WBR SBLn1 SBLn2					
Capacity (veh/h)	390	1337		- 1	1139			- 24					
HCM Lane V/C Ratio	0.746 0.001	0.001	٠	- 0.3	0.296		- 0.	0.019					
HCM Control Delay (s)	36.9	7.7	0	,	9.5	0		72.9 0					
HCM Lane LOS	ш	⋖	⋖		⋖	⋖		F					
HCM 95th %tile Q(veh)	9	0			1.2			0.1					

Penstemon Homes Traffic Impact Study 03/20/2017 PM Existing with Project

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

3: Linwood Ave & Poinsettia Ln/Private Driveway	inset	tia Ln	/Private	e Drivev	/ay						03/24/2017	72017
Intersection												
Int Delay, s/veh 2.2												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Vol, veh/h	3	0	m	16	0	20	_	27	9	7	98	2
Future Vol, veh/h	3	0	e	16	0	70	_	27	9	7	98	2
Conflicting Peds, #/hr	7	0	=	4	0	0	=	0	4	0	0	7
Sign Control	Stop	Stop Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	1	1	None	•	1	None	•	•	None	•	1	None
Storage Length	•	•		•	•			•		•	•	•
Veh in Median Storage, #	1	0	,	•	0	,	•	0		•	0	,
Grade, %	•	0		•	0	٠	•	0		•	0	٠
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	70	-	27	9	7	98	2

Major/Minor	Minor2			Minor1	or1			Major1			Major2		
Conflicting Flow All	191	181	109	,	180	179	71	66	0	0	19	0	0
Stage 1	112	112	•		99	99	٠					•	
Stage 2	79	69	'	-	114	113				'		٠	ľ
Critical Hdwy	7.12	6.52	6.22	7	7.12	6.52	6.22	4.12	,		4.12	٠	Ť
Critical Hdwy Stg 1	6.12	5.52	٠	9	6.12	5.52							
Critical Hdwy Stg 2	6.12	5.52	٠	9	6.12	5.52	٠				•	٠	
Follow-up Hdwy	3.518	4.018	4.018 3.318	3.5	3.518 4	4.018	3.318	2.218			2.218	٠	
Pot Cap-1 Maneuver	691	713	945	-	782	715	166	1494	•		1535	٠	
Stage 1	893	803	٠	0.	345	840	٠					٠	
Stage 2	930	837	•	ω	891	802	٠				•	٠	
Platoon blocked, %													
Mov Cap-1 Maneuver	737	669	925	-	29/	701	981	1478		1	1525	٠	Ť
Mov Cap-2 Maneuver	737	669		-	765	701	٠			ľ		٠	ľ
Stage 1	883	791	٠	0.	940	836	٠					٠	
Stage 2	904	833	٠	ω	874	790	٠				'	•	
Approach	EB			_	WB			NB			SB		
HCM Control Delay, s	9.4				9.3			0.1			0.5		
HCM LOS	A				⋖								
Minor Lane/Major Mvmt	NBL	NBT	NBR E	NBR EBLn1WBLn1	-n1	SBL	SBT	SBR					
Capacity (veh/h)	1478	-		820 8	872	1525							
HCM Lane V/C Ratio	0.001		-	- 0.007 0.041 0.005	041 0	000	٠						
HCM Control Delay (s)	7.4	0	•	9.4	6.3	7.4	0						
HCM Lane LOS	A	A	٠	A	V	V	⋖	,					
HCM 95th %tile Q(veh)	0	1	•	0	0.1	0	٠						

Penstemon Homes Traffic Impact Sludy 03/20/2017 AM Existing with Project

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

03/24/2017

Inforception													
Intersection	,												
Movement	EBL	EBT	EBR	WBL	L WBT	T WBR	38	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			*	4			4			4	
Traffic Vol, veh/h	0	0	_		1	0	13	0	48	18	22	24	12
Future Vol, veh/h	0	0	-			0	13	0	48	92	22	24	12
Conflicting Peds, #/hr	00	0	6		3	0	2	6	0	3	2	0	00
Sign Control	Stop	Stop	Stop	Stop	p Stop		Stop	Free	Free	Free	Free	Free	Free
RT Channelized	- '	- '	None			_	None		1	None	٠	1	None
Storage Length	ľ	ľ	٠					ľ	ľ		•	٠	ľ
Veh in Median Storage, #	•	0	٠			0	,	•	0		•	0	•
Grade. %	ľ	0	ľ		١.	0		ľ	0		ľ	0	ľ
Peak Hour Factor	100	100	100	10	100 10	1000	100	100	100	100	100	100	100
Heavy Vehicles, %	2	7	2		2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	_	,_	_	0	13	0	48	18	22	54	12
Major/Minor	Minor2			Minor1	Ę.			Major1			Major2		
Conflicting Flow All	185	182	78	174	4 179	6,	89	75	0	0	69	0	0
Stage 1	113	113	٠	9	9 09	09		•	•		•	•	•
Stage 2	72	69	,	114			,		1	٠	•	,	,
Critical Hdwy	7.12	6.52	6.22	7.12			6.22	4.12	1	·	4.12	1	,
Critical Hdwy Stg 1	6.12	5.52	٠	6.12	2 5.52	2	,		•			٠	•
Critical Hdwy Stg 2	6.12	5.52	•	6.12			ì	•	1		•	1	•
Follow-up Hdwy	3.518	4.018	3.318	3.518	4		3.318	2.218	1		2.218	•	•
Pot Cap-1 Maneuver	776	712	983	789			995	1524	1		1532	1	
Stage 1	892	802	٠	951		845	,		1		•	1	1
Stage 2	938	837	•	891	1 797		,	•			•	•	•
Platoon blocked, %									•			٠	•
Mov Cap-1 Maneuver	745	693	996	77	69 077	6 969	985	1511			1520		,
Mov Cap-2 Maneuver	745	693	٠	77		9			•		•	•	•
Stage 1	884	783	•	948		843	,		•		•	•	
Stage 2	919	832	٠	98	17 698	178		1	•		'	1	•
Approach	EB			≥	WB			NB			SB		
HCM Control Delay, s	8.7			6	9.2			0			1.9		
HCM LOS	A				A								
Minor Lane/Major Mvmt	NBL	NBT	NBR E	NBR EBLn1WBLn1	1 SBL		SBT SE	SBR					
Capacity (veh/h)	1511	1		966 873	3 1520	0.							
HCM Lane V/C Ratio	•		•	Ö	0	4							
HCM Control Delay (s)	0	•	•		7	4.	0						
HCM Lane LOS	V	•	٠	⋖		⋖	⋖						
HCM 95th %tile Q(veh)	0			0 0	0.1	0							

Penslemon Homes Traffic Impact Study 03/20/2017 PM Existing with Project

HCM 2010 TWSC 4: Kawana Springs Rd & Taylor Mountain Pl

Intersection

Movement	EBL	EBT		WBT	WBR	SBL	SBR	
Lane Configurations		4		æ		>-		
raffic Vol, veh/h	22	161		11	20	29	52	
Future Vol, veh/h	22	161		71	20	26	52	
Conflicting Peds, #/hr	_	0		0	0	-	_	
Sign Control	Free	Free		Free	Free Free	Stop	Stop	
RT Channelized	1	None		1	None		None	
Storage Length		٠				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	
Vivmt Flow	22	161		71	70	29	52	
Major/Minor	Major1			Major2		Minor2		
Conflicting Flow All	92	0		ľ	0	288	83	
Stage 1		٠		•		82		
Stage 2		٠		•		206		
Critical Hdwy	4.12	•		•		6.42	6.22	
Critical Hdwy Stg 1		٠				5.42		
Critical Hdwy Stg 2	•	•		•		5.42		
ollow-up Hdwy	2.218	•		•		3.518	3.318	
Pot Cap-1 Maneuver	1503	٠		•		702	926	
Stage 1	•	•		•		941		
Stage 2	•	•		•		829		
Platoon blocked, %		٠						
Mov Cap-1 Maneuver	1502	•		•		689	974	
Mov Cap-2 Maneuver	•	٠		•		689		
Stage 1	•	•		•		940		
Stage 2	•	٠		•		812		
Approach	EB			WB		SB		
HCM Control Delay, s	0.0			0		10.2		
HCM LOS						Ф		
Minor Lane/Major Mvmt	EBL	EBT	WBT WBR SBLn1	<u></u>				
Capacity (veh/h)	1502		867	8				
HCM Lane V/C Ratio	0.015	٠	0.139	6				
HCM Control Delay (s)	7.4	0	10.2	2				
HCM Lane LOS	⋖ '	⋖		m				
JCM OFTH Wills Oweh)								

Penstemon Homes Traffic Impact Study 03/20/2017 AM Existing with Project

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HCM 2010 TWSC 4: Kawana Springs F

03/24/2017

П	
ountair	
Σ	
, Taylor	
Rd &	
Springs	
awana S _l	

03/24/2017

Intersection									
Int Delay, s/veh	4								
Movement	EBL	EBT			WBT	WBR	SBL	SBR	
Lane Configurations		4			Ŷ,		>		
Traffic Vol, veh/h	26	92			43	2	2	44	
Future Vol, veh/h	26	9			43	2	2	44	
Conflicting Peds, #/hr	9	0			0	-	-	9	
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	26	99			43	2	2	44	
Major/Minor	Major1				Major2		Minor2		
Conflicting Flow All	54	0				0	236	58	
Stage 1	•				•		52		
Stage 2	•	٠			•		184		
Critical Hdwy	4.12	٠					6.42	6.22	
Critical Hdwy Stg 1					•		5.42		
Critical Hdwy Stg 2	•				•		5.42		
Follow-up Hdwy	2.218				•		3.518	3.318	
Pot Cap-1 Maneuver	1551				•		752	1008	
Stage 1	•				•		026		
Stage 2	•	٠			•		848		
Platoon blocked, %					•				
Mov Cap-1 Maneuver	1542				•		714	266	
Mov Cap-2 Maneuver	•				•		714		
Stage 1	•				•		964		
Stage 2	•				•		808		
Approach	EB				WB		SB		
HCM Control Delay, s	3.5				0		6		
HCMLOS							A		
Minor Lane/Major Mvmt	EBL	EBT W	WBT \	WBR SBLn1					
Capacity (veh/h)	1542	٠		- 958					
HCM Lane V/C Ratio	0.038	٠		- 0.051					
HCM Control Delay (s)	7.4	0	÷	6 -					
HCM Lane LOS	V	A	٠	Α .					
HCM 95th %tile Q(veh)	0.1	٠		- 0.2					

Penslemon Homes Traffic Impact Study 03/20/2017 PM Existing with Project

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

03/24/2017

	1	†	~	-	ţ	4	•	-	•	٠	-	*
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	*	*	¥.	¥	Ť,		r	₩.		×	+	*
Traffic Volume (veh/h)	125	129	45	175	189	29	80	768	168	14	338	181
Future Volume (veh/h)	125	129	42	175	189	29	80	299	168	14	338	182
Number	വ	2	12	- (9	16	с	∞ α	<u> </u>	_	4 (4
Initial Q (Qb), ven	0 6	0	0 8	0 6	0	0 0	0 6	0	0 0	0 6	0	0 8
Ped-Bike Adj(A_pb1)	8.6	100	1.09	00.1	100	1.00	00.1	0	0.98	8.6	00	1.00
Adi Sat Flow veh/h/In	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	125	129	2	175	189	18	80	768	141	14	338	109
Adj No. of Lanes	-	-	-	-	-	0	-	2	0	-	-	_
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	206	48	464	1437	264	284	842	815
Arrive On Green	0.07	0.28	0.28	0.09	0.30	0.30	0.02	0.48	0.48	0.02	0.45	0.45
Sat Flow, verin	175	120	13/2	175	7/01	461	4//-	0/67	040	1//4	1803	100
Gra Sat Flow(s) vehill	1774	1962	1575	1774	o c	1021	1774	1770	1752	1774	1062	1560
O Serve(a s) s	5.4	7.00	0.0	7.5	0	000	2.5	19.8	10.8	0.5	13.4	400
Cycle O Clear(a_c).s	2 4	2.0	0.2	7.5	0.0	0.0	2.5	19.8	19.8	0.5	13.4	4.0
Prop In Lane	1.00		1.00	1.00		0.09	1.00		0.31	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	208	527	524	545	0	554	269	822	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(I)	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	- :	0.0	0.5	0.0	1.9	0.1	2.4	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 BackUtU(50%),ven/in	75.6	3.2	0.1	3.6	0:0	5.7	14.5	201	10.1	14.0	2.1	2 5
Lindip Delay(u),3/veli LnGrp LOS	C.C.2	5 C	7.4.0 C	C C	0.0	35.1 C	<u>+</u>	777 C	7.77 C	B 9	0.12 O	- E
Approach Vol, veh/h		259			382			686			461	
Approach Delay, s/veh		28.5			28.3			21.6			19.7	
Approach LOS		O			O			O			В	
Timer	-	2	3	4	2	9	7	8				
Assigned Phs	1	2	3	4	2	9	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	* 41	12.0	31.1	12.0	40.7				
Max O Clear Time (g_c+l1), s	9.5	7.9	4.5	15.4	7.4	11.8	2.5	21.8				
Green Ext Time (p_c), s	0.1	2.0	0.0	6.1	0.1	Σ.	0.0	9.6				
Intersection Summary												
HCM 2010 Ctrl Delay			23.3									
HCM 2010 LOS			O									
Notes												
Notes												

Penstemon Homes Traffic Impact Study 03/20/2017 AM Existing with Project

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

03/24/2017

Continue (verh) Continue (EBL EBI EBR WBL NBL						•	
10	1				NBR	SBL	SBT	SBR
200 209 117 152 206 28 115 673 198 16 412 5) 200 209 117 152 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 2 0 0 0 0 2 0 0 0 0 2 0 0 0 0 492 631 624 487 1 0 0 0 0 1 0 0 0 0 2 0 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 487 1 174 1863 1574 1774 1774 1 100 100 100 100 1 0 0 0 0 0 1 0 0 0	ا_				k	*	ĸ
) 200 209 117 152 206 28 115 673 198 14 412 0 0 0 0 0 0 0 0 17 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0) 200 209 117 152 0 0 0 0 0 0 0 0 100 100 100 1 100 100 100 1 100 209 64 152 100 100 100 1 100 100 100 100 1 100 100 100 100 1 100 100 100 1 101 101 101 101 101 101 101 101 101 101				198	16	412	265
5 2 12 1 6 16 16 3 8 18 18 7 4 4 0.99 0.99 0.99 1.00 0.97 1.00 0.98 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.0	6 2 12 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0				198	16	412	265
0.09 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 6	16		18	7	4	14
0.999 0.099 1.00 0.97 1.00 0.098 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.0	109 100				0	0	12	0
1.00 1.00	100 1.00 1.00 1.00 1.00 1.00 1.00 1.00				0.98	1.00	,	0.98
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1.00 1.00	6 27 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				1900	1863	1863	1863
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May	492 631 624 487 1774 1863 1574 1774 200 209 64 152 200 209 64 152 7.3 8.4 2.6 5.7 7.3 8.4 2.6 5.7 7.3 8.4 2.6 5.7 7.3 8.4 2.6 5.7 1.00 1.00 1.00 eh 492 631 624 487 1.00 1.00 1.00 1.00 eh 195 246 192 201 eh 0.0 0.0 0.0 0.0 eh 0.0 0.0 0.0 0.0 eh 0.0 31 624 487 7.3 8.4 2.6 5.7 7.4 8.8 624 487 8 7 8 8 8 42.9 9 8 8 8 42.9 9 9 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8				2	2	7	2
1774 1863 1574 1774 1633 190 1774 2753 732 1774 1865 1574 1865 1774 1865 1574 1774 1863 1974 1774 1863 1574 1774 1863 1774 1863 1574 1774 1863 1774 1863 1774 1777 1775 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1777 17	1774 1863 1574 1774 1863 1574 1774 1863 1574 1774 1863 1574 1774 1863 1574 1774 1863 1574 1774 1863 1574 1774 1863 1574 1774 1863 1574 1774 1863 1574 1774 1774 1863 1574 1774				309	262	719	745
1774 1863 1574 1774 1633 190 1774 2753 732 1774 1863 1574 1774 1633 190 1774 2753 732 1774 1863 1774 1863 1774 1773 844 2.6 5.7 0.0 98 3.7 18.7 174 1863 174 1774 1773 844 2.6 5.7 0.0 98 3.7 18.7 18.7 174 1774 1774 1775 1774 1863 1774 1775 1774 1863 1774 1775 1774 1863 1774 1775 1774 1863 1774 1775 1774 1863 1774 1775 1774 1863 1774 1775 1774 1863 1774 1775 1774 1775 1774 1863 1774 1775 1774 1863 1774 1775 1774 1775 1774 1775 1774 1775 1774 1863 1774 1775 1774 1775 1774 1775 1774 1775 1774 1775	1774 1863 1574 1774 1863 1574 1774 1774 1863 1574 1774 1774 1863 1574 1774 1774 1863 1574 1774 1773 84 2.6 5.7 1.00		Ŭ		0.42	0.02	0.39	0.39
1774 1863 1574 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1863 1774 1774 1775 1774 1863 1774 1775 1774 1863 1774 1775 1774 1863 1774 1775 1774 1774 1775 1774	174 1863 1574 1774 1863 1574 1774 1863 1574 1774 1863 1574 1774 1774 1863 1574 1774 173 84 2.6 5.7 173 84 2.6 5.7 173 84 2.6 5.7 100				732	1774	1863	1546
1774 1863 1574 1774 0 1823 1774 1774 1863 1774 1863 1774 1863 1774 1863 1774 187 1774 1883 1774 187 177 1774 1883 1774 187 177 1774 1883 1774 187 177 1774 1883 1774 187 177 1774 187 17	1774 1863 1574 1774 7.3 8.4 2.6 5.7 1.00 1.00 1.00 1.00 492 631 624 487 621 631 624 487 621 631 624 487 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.0 0.0 2. 14 0.3 0.1 0.0 0.0 0.0 0.0 3. 4 5 1.2 2.8 1.7 26.0 19.3 2.3 1.7 3 4 4.2.9 1.3 1.7 3 4 4.2.9 1.3 1.7 3 4 4.2.9 1.3 1.7 10.4 5.7 19.4 0.1 2.8 0.1 4.7				420	16	412	138
7.3 8.4 2.6 5.7 0.0 9.8 3.7 18.7 18.7 0.5 17.4 7.3 8.4 2.6 5.7 0.0 9.8 3.7 18.7 18.7 0.5 17.4 1.00 631 6.24 487 0 585 326 719 100 0.5 100 100 0.5 174 724 262 719 0.41 0.33 0.10 0.03 0.35 0.58 0.58 0.58 0.58 0.00 0.57 179 100	7.3 8.4 2.6 5.7 1.00 1.00 1.00 492 631 624 487 0.41 0.33 0.10 0.31 (2.5) 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00		`		1715	1774	1863	1546
7.3 8.4 2.6 5.7 0.0 9.8 3.7 18.7 18.7 0.5 17.4 1.00 1.00 1.00 0.10 1.00 0.43 1.00	73 84 26 57 100 100 100 492 631 624 487 621 631 624 487 521 631 624 547 100 100 100 100 100 100 100 100 100 100 195 246 190 201 00 00 00 00 36 45 1.2 28 197 260 193 203 B C B C 473 4 1 2 3 4 1 2 3 4 1 1 3 8 8 8 429 1 1 2 3 4 1 1 3 8 8 8 429 1 1 2 8 1 4 7 1 1 3 8 8 8 7 1 1 2 8 1 4 7 1 1 3 8 8 8 7 1 1 2 8 1 4 7 1 1 3 8 8 8 7 1 1 2 8 1 1 4 7				18.7	0.5	17.4	5.1
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041 0.33 0.10 0.31 0.00 0.39 0.35 0.58 0.58 0.06 0.57 521 0.31 0.00 0.39 0.35 0.58 0.58 0.06 0.57 521 0.31 0.00 1.00 1.00 1.00 1.00 1.00 1.0	041 033 0.10 0.31 100 1.00 1.00 1.00 100 1.00 1.00 1.00 195 246 19.0 20.1 00 00 0.0 0.0 0.0 3.6 45 1.2 28 19.7 260 1.3 0.1 B C B C 473 1 2 3 4 1 1 2 3 4 1 0 3.21 1.20 31 1 2 3 4 1 1 2 3 4 1 2 3 4 1 2 3 4 1 3 4 1 3 5 4 1 3 5 5 5 6 1 3 5 6 1 3 5 7 7 8 1 3 7 8 1 3 8 8 8 1 3 8 8 1				724	262	719	745
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1,00	100 1.00 1.00 1.00 1.00 1.00 1.00 1.00				724	436	719	745
100 1.00 1.00 1.00 1.00 1.00 1.00 1.00	130 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1				1.00	1.00	1:00	1.00
19,5	19.5 24.6 19.0 20.1 0.0 0.0 0.0 0.0 3.6 4.5 1.2 2.8 19.7 26.0 19.3 20.3 B C B C 473 C B C 473 1.1 2 3 4 1 2 3 4 1 1 3 4 1 1				00.1	1.00	00.1	00.1
0.2 1.4 0.3 0.1 0.0 2.0 0.2 3.3 3.4 0.0 3.3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	00 00 00 00 00 00 00 00 00 00 00 00 00			. ~	22.1	18.9	25.2	14.9
3.6	19.7 260 19.3 20.3 B C B C B C C B C C C C C C C C C C C				3.4	0.0	2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2	0.5
3.6 4.5 1.2 2.8 0.0 5.2 1.8 9.8 9.5 0.3 12.2 1.9.7 26.0 19.3 2.0.3 0.0 28.4 18.8 25.4 25.5 18.9 33.2 18.	3.6 4.5 1.2 2.8 1.9 2.6 1.9 2.8 1.0 2.8 2.8 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.6 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0				0.0	0.0	4.7	0.0
17, 260 19,3 20,3 0.0 284 18.8 254 255 18.9 35.2 473 8.9 2.5 0.0 28.4 28.5 25.5 473 382 382 36.7 24.6 28.5 1	1, 260 19.3 20.3 19.4 20.5 22.5		-		9.5	0.3	12.2	2.3
S	473 225 C C C C C C C C C C C C C C C C C C				25.5	18.9	33.2	15.4
1	225 C C C 1 2 3 4 106 37.8 8.8 42.9 3.0 3.9 3.0 *4.3 7.7 10.4 5.7 19.4 0.1 2.8 0.1 4.7		ر	3	ر	2	ن ا	٦
225	25.5 C 3 4 1 2 3 4 10.6 37.8 8.8 42.9 3.0 33.9 3.0 *4.3 11.0 32.1 12.0 *3.1 7.7 10.4 5.7 19.4 0.1 2.8 0.1 4.7	382		9 3			200	
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30 39 30 43 30 39 30 110 32.1 12.0 *31 11.0 32.1 12.0 7.7 104 5.7 19.4 9.3 11.8 2.5 0.1 28 0.1 4.7 0.1 2.7 0.0 25.2 C	30 3.9 3.0 4.3 11.0 32.1 12.0 3.1 17.7 10.4 5.7 19.4 0.1 2.8 0.1 4.7 25.2 C							
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77 104 57 194 9.3 118 2.5 0.1 2.8 0.1 4.7 0.1 2.7 0.0 25.2 C	77 104 57 194 0.1 28 0.1 4.7 25.2 C							
0.1 2.8 0.1 4.7 0.1 2.7 0.0 25.2 C	0.1 2.8 0.1 4.7 25.2 C							
Mrine								

Penslemon Homes Traffic Impact Study 03/20/2017 PM Existing with Project

HCM 2010 TWSC 1: Meda Ave & Aston Ave

Intersection									
Int Delay, s/veh 2.	2.6								
Movement		EBT	EBR	Λ	WBL	WBT	NBL	NBR	
Lane Configurations		÷				₩	>		
Traffic Vol, veh/h		332	28		36	193	51	26	
Future Vol, veh/h		332	78		36	193	51	56	
Conflicting Peds, #/hr		0	0		0	0	4	4	
Sign Control		Free	Free	_	Free	Free	Stop	Stop	
RT Channelized		1	None		-	None	·	None	
Storage Length			٠				0		
Veh in Median Storage, #		0	٠		٠	0	0		
Grade, %		0	٠		٠	0	0		
Peak Hour Factor		100	100		100	100	100	100	
Heavy Vehicles, %		7	2		7	2	2	2	
Mvmt Flow		332	28		36	193	51	26	
Major/Minor	M	Major1		Ma	Major2		Minor1		
Conflicting Flow All		0	0		360	0	615	350	
Stage 1		•	٠				346		
Stage 2		•	٠		٠		269		
Critical Hdwy		1	1	`	4.12		7.12	6.22	
Critical Hdwy Stg 1			٠		٠		6.12		
Critical Hdwy Stg 2		1	•		÷		6.12		
Follow-up Hdwy		•	٠	2	2.218		3.518	3.318	
Pot Cap-1 Maneuver		•	٠	_	1199		403	693	
Stage 1		•	٠		٠		029		
Stage 2		1	1		÷		737		
Platoon blocked, %		•	٠						
Mov Cap-1 Maneuver		1	•	_	1194		391	069	
Mov Cap-2 Maneuver		•	•		٠		391		
Stage 1		1	•		٠		029		
Stage 2		•	٠		٠		402		
Approach		EB			WB		NB		
HCM Control Delay, s		0			1.3		14		
HCM LOS							В		
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL V	WBT				
Capacity (veh/h)	206	1	1	1194	1				
HCM Lane V/C Ratio	0.211	•	٠	0.03					
HCM Control Delay (s)	14	1	•	8.1	0				
HCM Lane LOS	В	٠	٠	⋖	⋖				
HCM 95th %tile Q(veh)	0.8	1	•	0.1	٠				

Penstemon Homes Traffic Impact Study 5:00 pm 03/20/2017 AM Future with Project

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HCM 2010 TWSC

03/24/2017

a)	
Ă	
Aston	
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Ave	
Meda	
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03/24/2017

Int Delay, s/veh 2.2									
Movement	_	EBT	EBR	Λ	WBL	WBT	NBL	NBR	
Lane Configurations		£				₩	¥		
Traffic Vol, veh/h	•	417	23		22	328	47	52	
Future Vol, veh/h	•	417	23		22	328	47	52	
Conflicting Peds, #/hr		0	0		0	0	-	-	
Sign Control	_	Free	Free	_	Free	Free	Stop	Stop	
RT Channelized		1	None			None		None	
Storage Length		٠			٠		0		
Veh in Median Storage, #		0	1		٠	0	0		
Grade, %		0	٠		٠	0	0		
Peak Hour Factor		100	100		100	100	100	100	
Heavy Vehicles, %		7	2		7	2	2	2	
Mvmt Flow	•	417	23		22	328	47	52	
Major/Minor	Maj	Major1		Ma	Major2		Minor1		
Conflicting Flow All		0	0		470	0	883	445	
Stage 1		1	٠				444		
Stage 2		٠	٠				439		
Critical Hdwy		•	٠	7	4.12	ı	6.42	6.22	
Critical Hdwy Stg 1		٠	٠			,	5.42		
Critical Hdwy Stg 2		٠	1		٠	,	5.42		
Follow-up Hdwy		٠	٠	2.	2.218		3.518	3.318	
Pot Cap-1 Maneuver		1		_	1092		316	613	
Stage 1		٠	1				646		
Stage 2		1	1		÷		920		
Platoon blocked, %		•	٠						
Mov Cap-1 Maneuver		1	•		1091		2%	612	
Mov Cap-2 Maneuver		٠	•		٠		296		
Stage 1		٠	٠		٠		646		
Stage 2		1	٠			,	609		
Approach		EB			WB		NB		
HCM Control Delay, s		0			1.2		16.7		
HCMLOS							O		
Minor Lane/Major Mvmt	NBLn1 E	EBT	EBR	WBL V	WBT				
Capacity (veh/h)	406			1001					
HCM Lane V/C Ratio	0.244	٠		0.05					
HCM Control Delay (s)	16.7	•	٠	8.5	0				
HCM Lane LOS	O	٠	٠	⋖	⋖				
HCM 95th %tile Q(veh)	6.0			0.2					

Penstemon Homes Traffic Impact Study 03/20/2017 PM Future with Project

HCM 2010 TWSC 2: Linwood Ave & Aston Ave

03/24/2017	
0	

Intersection														
Int Delay, s/veh	34													
Movement	EBL	EBT	EBR		WBL	WBT	WBR		NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4				4				4			4	*
Traffic Vol, veh/h	-	323	64		228	133	0		88	5	390	0	4	∞
Future Vol, veh/h	,	323	64		228	133	0		88	7	390	0	4	00
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		1	1	None		1	1	None	•	1	None
Storage Length		'	•		٠	•	٠		•	٠		•	•	22
Veh in Median Storage, #	•	0	•		1	0	•		٠	0	i	•	0	
Grade, %		0	٠		٠	0	٠			0		•	0	
Peak Hour Factor	100	100	100		100	100	100		100	100	100	100	100	100
Heavy Vehicles, %	2	7	2		7	7	7		7	7	2	2	7	2
Mvmt Flow	_	323	64		228	133	0		88	2	390	0	4	8
Major/Minor	Major1			Ma	Major2			☒	Minor1			Minor2		
Conflicting Flow All	137	0	0		391	0	0		926	954	363	1150	986	141
Stage 1		•	•		٠	•	٠		361	361		263	263	
Stage 2	,	,	,		٠	•	٠		262	593	,	227	393	٠
Critical Hdwy	4.12	•	1		4.12	•	٠		7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1		•	•		٠	٠	٠		6.12	5.52		6.12	5.52	
Critical Hdwy Stg 2		•	1		1	•					·	6.12		•
Follow-up Hdwy	2.218		•	2	2.218	٠	٠	m			3.318	3.518		3.318
Pot Cap-1 Maneuver	1447	1	1	`	1168	1	1		238	259	682	175	248	406
Stage 1		1	١		1	•	٠		657	979		492	493	•
Stage 2	•		•		1	1	٠		491	493		515	909	•
Platoon blocked, %			•			•	٠							
Mov Cap-1 Maneuver	1441		•		1164	1	•		193	202	219	61	194	006
Mov Cap-2 Maneuver		•	•		٠	٠	٠		193	202		61	194	
Stage 1		1	1		1	1	•		654	623	ŀ	490	387	
Stage 2		1	1		٠	٠	٠		378	387		217	603	•
Approach	EB				WB				NB			SB		
HCM Control Delay, s	0				9.9				83.3			14		
HCM LOS									ш			В		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR \	WBL	WBT	WBR SBLn1 SBLn2	3Ln1SE	3Ln2					
Capacity (veh/h)	461	1441		,	1164		٠	194	006					
HCM Lane V/C Ratio	1.041	0	1	- 0	0.196	•	- 0	- 0.021 0	0.009					
HCM Control Delay (s)	83.3	7.5	0	·	8.8	0	•	23.9	6					
HCM Lane LOS	ш.	⋖	⋖	٠	⋖	⋖	٠	ပ	⋖					
HCM 95th %tile Q(veh)	14.7	0	•	·	0.7			0.1	0					

Penstemon Homes Traffic Impact Study 5:00 pm 03/20/2017 AM Future with Project

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HCM 2010 TWSC 2: Linwood Ave & Aston Ave

03/24/2017

Intersection												
Int Delay, s/veh 70.4	4:											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			€			€	*-
Traffic Vol, veh/h	15	342	112	379	317	0	99	0	315	15	0	0
Future Vol, veh/h	15	342	112	379	317	0	99	0	315	15	0	
Conflicting Peds, #/hr	0	0	-	_	0	0		0	_	0	0	J
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	•	•	None	•	1	None	•	1	None	•	1	None
Storage Length		•		٠	٠			٠				22
Veh in Median Storage, #	•	0		•	0		•	0		•	0	
Grade, %		0		٠	0		٠	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	. 4
Mvmt Flow	15	342	112	379	317	0	99	0	315	15	0	0

	318		ľ	6.22	ľ		3.318	723				722			ľ									
	1560	1075	485	6.52	5.52	5.52	4.018	112	296	222		64	94	173	543									
Minor2	1662	1075	587	7.12	6.12	6.12	3.518	77	266	496		26	26	262	251	SB	260.4	ш.						
	400		٠	6.22			3.318	920	٠	٠		649		٠	٠									
	1504	429	1075	6.52	5.52	5.52	4.018	121	584	296		69	69	574	173									
Minor1	1505	429	1076	7.12	6.12		3.518	100	604	266		19	19	594	155	NB	267.8	ш	3BLn2		٠	0	⋖	1
2	0																		WBR SBLn1 SBLn2	- 26	- 0.577	- 260.4	بد	- 1.8
	0																		WBT WB			0	A	
Major2	455		٠	4.12	٠		2.218	1106	٠	٠		1105	٠	٠	٠	WB	5.4		WBL	- 1105	- 0.343	6.6 -	∀ .	- 1.5
	0			,	,						,								FBR I			0	A	
																			EBT					
	0		ľ		ľ				ľ		ľ				ľ				EBL	1242	0.012	7.9	A	0
Major1	317			4.12			2.218	1243				1242				EB	0.3		NBLn1	259 1242	1.471	267.8	ш.	21.8
Major/Minor	Conflicting Flow All	Stage 1	Stage 2	Critical Hdwy	Critical Hdwy Stg 1	Critical Hdwy Stg 2	Follow-up Hdwy	Pot Cap-1 Maneuver	Stage 1	Stage 2	Platoon blocked, %	Mov Cap-1 Maneuver	Mov Cap-2 Maneuver	Stage 1	Stage 2	Approach	HCM Control Delay, s	HCMLOS	Minor Lane/Major Mvmt	Capacity (veh/h)	HCM Lane V/C Ratio	HCM Control Delay (s)		HCM 95th %tile Q(veh)

Penstemon Homes Traffic Impact Study 03/20/2017 PM Future with Project

HCM 2010 TWSC

2: Linwood Ave & Aston Ave

TWSC	Ave &
HCM 2010	2: Linwood

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e & Aston Ave

03/24/2017

Stop None 55 3.318 6.22 0 0 o o dop 11560 1075 485 6.52 5.52 5.52 5.52 112 112 296 552 64 64 543 SBT . 0 0 6 15 0 Stop 1504 1075 429 7.12 6.12 6.12 6.12 100 266 604 34 34 262 306 SB 77.11 315 315 315 None 0 0 - . 3.318 649 0 0 o o dog 1504 429 1075 6.52 5.52 5.52 5.52 121 121 584 296 69 69 574 173 NBLn1NBLn2 EBL EBT EBR WBL WBT WBRSBLn1SBLn2 1505 - 429 - 1076 - 7.12 - 6.12 - 6.12 - 100 - 604 - 266 66 66 1 1 1 50 . 67 67 594 155 NB 49.3 E 0 0 Free None 100 2 0 . 0 A 0 0 100 317 - 1105 - 0.343 - 9.9 - A - 1.5 317 317 0 Free 379 379 1 Free 100 2 379 Major2 455 4.12 2.218 1105 WB 5.4 67 649 1242 0.985 0.485 0.012 209.7 15.7 7.9 F C A 4.9 2.7 0 112 112 1 Free None 100 2 112 0 0 100 342 EBT 342 342 0 Free 15 0 Free 2.218 100 Major1 317 1242 EB 0.3 16.2 Lane Configurations
Traffic Vol, vehh
Future Vol, vehh
Conflicting Peds, #hr
Sign Control
Sign Control
Storage Length
Veh in Median Storage, #
Grade, %
Grade, %
Mwnt How Minor Lane/Major Murnt
Capacity (vehh)
HCM Lane V/C Ratio
HCM Control Delay (s)
HCM Lane LOS
HCM Lane LOS
HCM HCM Fish %tile Q(veh) Approach HCM Control Delay, s HCM LOS Platoon blocked, %
Mov Cap-1 Maneuver
Mov Cap-2 Maneuver
Stage 1 Conflicting Flow All Stage 1 Stage 2 Critical Hdwy Critical Hdwy Stg 1 Critical Hdwy Stg 2 Follow-up Hdwy Pot Cap-1 Maneuver Int Delay, s/veh Stage 1 Stage 2 Major/Minor

6.22

6.22

4.12

Conflicting Flow All Stage 1 Stage 2 Critical Hdwy Critical Hdwy Stg 1 Critical Hdwy Stg 2

986 593 393 6.52 5.52 5.52 4.018 248 493

955 593 362 7.12 6.12 6.12 6.12 492 492

954 361 593 6.52 5.52 5.52 4.018 259 626 626

956 361 595 7.12 6.12 6.12 6.12 3.518 2.38 657

3.318

3.318

2.218 1168

2.218

900

119

1164

1441

Follow-up Hdwy
Pot Cap-1 Maneuwer
Stage 1
Stage 2
Stage 2
Platoon blocked, %
Mov Cap-1 Maneuwer
Mov Cap-2 Maneuwer
Stage 2
Stage 2

194 194 387 603

83 83 490 276

202 202 623 387

193 193 654 378

SB 14 B

21.4 C

Approach HCM Control Delay, s HCM LOS

- 194 900 - 0.021 0.009 - 23.9 9 - C A - 0.1 0

- 1164 - 0.196 - 8.8 - A - 0.7

. . O A . 1441 0.001 7.5 A

193 677 0.466 0.576 C 39 17.3 E C 2.2 3.7

Capacity (veh/h)
HCM Lane V/C Ratio
HCM Control Delay (s)
HCM Lane LOS
HCM 95th %tile Q(veh)

WBR SBLn1 SBLn2

NBLn1 NBLn2 EBL EBT EBR WBL WBT

Minor Lane/Major Mvmt

100

. 100 2 0

100 2 390

100 2 88

100

-100 2 228

100 1

Major2 391

Major1 137

Major/Minor

0 0 0 0 133

0 001

Traffic Vol, veh/h
Future Vol, veh/h
Confliding Peds, #/hr
Sign Control
RT Channelized
Storage Length
Veh in Median Storage, #
Crade, %
Peak Hour Factor
Heavy Vehicles, %
Mvmt Flow

0 0 100

4 0 Stop

390 390 390 Stop None

. 50

0 0 Stop

88 88 4 Stop

0 0 4 Free None

64 64 4 Free None

Free 1

323 323 0 Free

133 133 Free

SBT

WBT

EBT EBR

Lane Configurations

10

Int Delay, s/veh

Improvements	
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Synchro	

Synchro 9 Report Page 2

Penstemon Homes Traffic Impact Study 03/20/2017 PM Future with Project with Improvements

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

Intersection												
Int Delay, s/veh 1.6												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Vol, veh/h	2	0	2	=	0	15	2	100	20	21	151	4
Future Vol, veh/h	2	0	2	=	0	15	2	100	20	21	121	4
Conflicting Peds, #/hr	7	0	=	4	0	0	=	0	4	0	0	7
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized			None		1	None		•	None		•	None
Storage Length		•			•			٠			•	
Veh in Median Storage, #	•	0			0		•	0		•	0	
Grade, %	•	0		٠	0		•	0		•	0	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	7	2	2	7	2	2	7	2
Mvmt Flow	2	0	2	=	0	15	2	100	20	21	151	4

Major/Minor	Minor2			Minor1			Major1	or1			Major2		
Conflicting Flow All	335	334	175	327	7 326	121		166	0	0	124	0	0
Stage 1	206	206	٠	118		1		ì		,			
Stage 2	129	128	٠	20	9 208	٠							
Critical Hdwy	7.12	6.52	6.22	7.12		6.22	4	4.12			4.12		
Critical Hdwy Stg 1	6.12	5.52		6.12	2 5.52	٠							
Critical Hdwy Stg 2	6.12	5.52	٠	6.12	2 5.52	•		ì					
Follow-up Hdwy	3.518	4.018	3.318	3.518	8 4.018	3.318	2.2	2.218			2.218		٠
Pot Cap-1 Maneuver		286	898	626	6 592	930	1/	1412			1463		
Stage 1	796	731	٠	887	7 798	٠							
Stage 2	875	790	٠	793	3 730	•		·			٠		
Platoon blocked, %													
Mov Cap-1 Maneuver	200	267	850	09		920	=	1397	,		1453		1
Mov Cap-2 Maneuver	260	267		909	5 573	٠							
Stage 1	786	712	٠	882		•			·		٠		
Stage 2	853	785	٠	16	768 711	٠				,	٠	٠	
Approach	EB			WB	В			NB			SB		
HCM Control Delay, s	10.2			6	6.6			0.1			6.0		
HCM LOS	В				A								
Minor Lane/Major Mvmt	NBL	NBT	NBR EF	NBT NBR EBLn1WBLn1 SBL	1 SBL	SBT	SBR						
Capacity (veh/h)	1397	1	•	97 769	754 1453	1	٠						
HCM Lane V/C Ratio	0.001		0 -	- 0.014 0.034 0.014	4 0.014	•							
HCM Control Delay (s)	9.7	0	,	10.2 9.9	9 7.5	0							
HCM Lane LOS	A	A	٠	В	A	A							
HCM 95th %tile Q(veh)	0		٠	0 0.1	1 0	٠							

Penstemon Homes Traffic Impact Study 5:00 pm 03/20/2017 AM Future with Project

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HCM 2010 TWSC

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3: Linwood Ave
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03/24/2017

acitocorota												
	ļ											
Int Delay, s/veh 1.	9.1											
Movement	EBL	EBT	EBR	WBL	. WBT	WBR	NBL	NBT -	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Vol, veh/h	0	0	2	=======================================		13	J		18	23	95	21
Future Vol, veh/h	0	0	2	11	0		0		18	23	95	21
Conflicting Peds, #/hr	00	0	6	(*)	0		6	0	3	2	0	00
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	. '	- '	None			_		1	None	•	•	None
Storage Length	ľ	ľ			ľ			ľ				ľ
Veh in Median Storage, #	•	0	٠		0	•		0		•	0	
Grade, %		0	٠		0			0			0	ľ
Peak Hour Factor	100	100	100	100	1	100	100	19	100	100	100	100
Heavy Vehicles, %	2	2	2		2		2		2	2	2	2
Mvmt Flow	0	0	2	1	0	13	0	84	18	23	95	21
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	569	266	124	258	3 267	104	125	0	0	105	0	0
Stage 1	161	161	٠	%	96 (•				•		
Stage 2	108	105		162	171	٠	·			٠	•	'
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	,	٠	4.12	•	
Critical Hdwy Stg 1	6.12	5.52		6.12		٠						
Critical Hdwy Stg 2	6.12	5.52	•	6.12	5.52	1				•	•	
Follow-up Hdwy	3.518	4.018	3.318	3.518	4	3.318	2.218	-	٠	2.218	•	•
Pot Cap-1 Maneuver	684	640	927	9692		951	1462	,	٠	1486	•	
Stage 1	841	765	٠	911		•			٠		•	1
Stage 2	897	808	٠	840	757	•			٠	•		
Platoon blocked, %											•	
Mov Cap-1 Maneuver	929	622	911	119		941	1449	_		1475	•	
Mov Cap-2 Maneuver	922	622	٠	119		١			٠	•	•	
Stage 1	834	746		806	813	1				•	1	
Stage 2	878	806	٠	817		٠	·		٠	٠	•	1
Approach	EB			WB	~		NB	~		SB		
HCM Control Delay, s	6			6.7			0			1.2		
HCMLOS	A			4								
Minor Lane/Major Mvmt	NBL	NBT	NBR EB	NBR EBLn1WBLn1	SBL	SBT	SBR	ı				
Capacity (veh/h)	1449	ľ	٠	911 798	1475	1						
HCM Lane V/C Ratio	ľ	ľ	0	0.002 0.03	910.0	•						
HCM Control Delay (s)	0	1	,	9 9.7	7.5	0						
HCM Lane LOS	A		٠	A	٧	A						
HCM 95th %tile Q(veh)	0	1		0 0.1	0	•						

Penslemon Homes Traffic Impact Study 03/20/2017 PM Future with Project

HCM 2010 TWSC 4: Kawana Springs Rd & Taylor Mountain PI

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TWSC	Sprin
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SM 2	4: Kawana
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03/24/2017

Rd & Taylor Mountain Pl

2.1

Intersection Int Delay, s/veh

03/24/2017

acitocostal										
veh	3.7									
Movement	EBL	EBT			WBT		WBR	SBL	SBR	
Lane Configurations		€3						Þ		
Traffic Vol, veh/h	40	298			303	~	34	98	92	
Future Vol, veh/h	40	298			30	3	34	98	92	
Conflicting Peds, #/hr		0			0	0	0	-	-	
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	40	298			303	3	34	98	92	
Major/Minor	Major1				Major2	2		Minor2		
Conflicting Flow All	338	0				١.	0	700	322	
Stage 1	•	1				ì		321		
Stage 2	•					į,		379		
Critical Hdwy	4.12	1				į.		6.42	6.22	
Critical Hdwy Stg 1	•	•				,		5.42		
Critical Hdwy Stg 2	•	•				į		5.42		
Follow-up Hdwy	2.218	•						3.518	3.318	
Pot Cap-1 Maneuver	1221	1				į.	ì	405	719	
Stage 1	•	1				,		735		
Stage 2	•	1				į.	,	692		
Platoon blocked, %		•								
Mov Cap-1 Maneuver	1220	•				į.		388	718	
Mov Cap-2 Maneuver		•						388		
Stage 1	•	1				į.		734		
Stage 2	•	1						999		
Approach	EB				WB	В		SB		
HCM Control Delay, s	1					0		15.8		
HCM LOS								ပ		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR SBLn1	3Ln1					
Capacity (veh/h)	1220	1			509					
HCM Lane V/C Ratio	0.033			٠	0.35					
HCM Control Delay (s)	8.1	0		٠	15.8					
HCM Lane LOS	A	⋖	٠	٠	ပ					
HCM 95th %tile Q(veh)	0.1		1	•	1.6					

Morromont						צייי	
MOVEILIEIII	EDL	EDI	MDI	NO.	700	NOC	
Lane Configurations		Ŧ			<u>}</u>		
Traffic Vol, veh/h	66	371	275	2	14	69	
Future Vol, veh/h	66	371	27		14	69	
Conflicting Peds, #/hr	9	0		- 1	-	9	
Sign Control	Free	Free	Free	e Free	Stop	Stop	
RT Channelized	•	None		- None	. •	None	
Storage Length					0		
Veh in Median Storage, #	٠	0		- 0	0		
Grade, %		0			0		
Peak Hour Factor	100	100	100	001 0	100	100	
Heavy Vehicles, %	2	2		2 2	2	2	
Mvmt Flow	66	371	275		14	69	
Major/Minor	Major1		Major2	2	Minor2		
Conflicting Flow All	299	0		0 -	098	296	
Stage 1	•				290		
Stage 2					570		
Critical Hdwy	4.12				6.42	6.22	
Critical Hdwy Stg 1					5.42		
Critical Hdwy Stg 2	•				5.42		
Follow-up Hdwy	2.218				3.518	3.318	
Pot Cap-1 Maneuver	1262				326	743	
Stage 1					759		
Stage 2	•				266		
Platoon blocked, %							
Mov Cap-1 Maneuver	1255				290	735	
Mov Cap-2 Maneuver	•				290		
Stage 1	•				755		
Stage 2	•				202		
Approach	EB		WB	~	SB		
HCM Control Delay, s	1.7			0	12.2		
HCM LOS					В		
Minor Lane/Major Mvmt	EBL	EBT WBT WBR SBLn1	3R SBLn1				
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	V	Α .	В .				
HCM 05th %tile O(veh)	00		L				

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

2:1

03/24/2017

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
Lane Configurations	<u>r</u>	+	X	<u>r</u>	42		<u>r</u>	4₽		<u>r</u>	*
Traffic Volume (veh/h)	226	447	132	178	345	36	137	8/9	317	30	415
Future Volume (veh/h)	226	447	132	178	345	36	137	678	317	30	415
Number	2	.5	12	-	9	J6	~	∞ (20	_	4
nital Q (Qb), veh	0 0	0	0	0 5	0	0 6	0 0	0	0	0 0	7.
Ped-bike Adj(A_pur)	90.1	5	100	3 5	200	0.97	00.1	6	0.70	9.1	5
Parking bus, Auj	1863	1863	1863	1862	1863	1000	1863	1863	1000	1843	1862
Adi Flow Rate, veh/h	226	447	79	178	345	35.	137	678	298	30	415
Adi No. of Lanes	-		-	-	-	0	-	2	0	- 3	-
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	397	630	635	337	533	24	307	951	418	224	687
Arrive On Green	0.10	0.34	0.34	60.0	0.32	0.32	90.0	0.40	0.40	0.03	0.37
Sat Flow, veh/h	1774	1863	1574	1774	1659	168	1774	2377	1045	1774	1863
Grp Volume(v), veh/h	226	447	79	178	0	380	137	505	471	30	415
Grp Sat Flow(s),veh/h/ln	1774	1863	1574	1774	0	1828	1774	1770	1652	1774	1863
Q Serve(g_s), s	8.3	20.9	3.2	9.9	0.0	17.8	4.6	23.9	23.9	1.0	18.1
Cycle Q Clear(g_c), s	8.3	20.9	3.2	9.9	0.0	17.8	4.6	23.9	23.9	1.0	18.1
Prop In Lane	1.00		1.00	1.00		0.00	1.00		0.63	1.00	
_ane Grp Cap(c), veh/h	397	630	635	337	0	287	307	708	199	224	687
//C Ratio(X)	0.57	0.71	0.12	0.53	0.00	0.65	0.45	0.71	0.71	0.13	09.0
Avail Cap(c_a), veh/h	409	630	635	380	0	287	431	208	199	377	687
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
Upstream Filter(I)	1.00	1.00	1.00	0.5	0.00	00.1	1.00	1.00	1:00	1.00	1.00
Jniform 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
Incr Delay (d2), s/veh	=	6.7	0.4	0.5	0.0	2.5	0.4	0.9	6.5	0.1	3.9
nitial 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	5.5
%ile BackOfQ(50%),veh/ln	4.1	11.8	1.4	3.2	0.0	6.6	2.3	12.8	12.0	0.5	12.8
-nGrp 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
IIIGID LOS	ر	752	۵	ر	011	د	٥	7 5	د	ر	2 6
Approach Delay skieh		707			30.0			300			200
Approach LOS		S			S			0			S
imer	-	2	~	7	יכ	9	7	00			
Assigned Phs	-,	2	c c	4	2	9	7	0			
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+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	* 31	11.0	32.1	12.0	30.7			
Max Q Clear Time (g_c+I1), s	9.8	22.9	9.9	20.1	10.3	19.8	3.0	25.9			
Green Ext Time (p_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			O								
Notes											

C 21.1

C 1174 27.2 C 8 54.2 4.3 40.7 28.5 5.6

> 6.0 3.0 12.0 2.8 0.0

87.2 3.9 31.1 22.6 2.5

> 3.0 3.0 12.0 9.6 0.1

> *4.3 *41 17.5 7.5

8.8 3.0 12.0 5.6 0.1

3.0 12.0 11.8 0.0

> Max Green Setting (Gmax), s Max Q Clear Time (g_c+l1), s

Green Ext Time (p_c), s

Intersection Summary HCM 2010 Ctrl Delay HCM 2010 LOS

Phs Duration (G+Y+Rc), s

Change Period (Y+Rc), s

798 0.46 798 1.00 1.00 22.4 1.9 0.0 8.4 24.3

802 0.67 802 11.00 11.00 23.7 4.5 0.0 0.0

0.00 0.00 0.00 0.00 0.00 0.00 0.00

527 0.46 527 1.00 1.00 32.5 2.9 0.0 6.5 6.5

> Avail Cap(C_a), veh/h HCM Platoon Ratio Upstream Filler(I) Uniform Delay (d), s/veh Incr Delay (d2), s/veh Initial Q Delay(d3),s/veh

%ile BackOfQ(50%),veh/ln

InGrp Delay(d),s/veh InGrp LOS Approach Vol, veh/h

Approach Delay, s/veh

Approach LOS

13 0.6 0.6 0.0 1.00 0.02 5.28 5.28 1.00 1.00 0.1 0.0 0.3 2.4.6 0.3

23 0.8 0.8 0.10 0.10 371 1.00 1.00 0.1 0.0 0.4

0.0

242 1863 11.8

Grp Volume(v), veh/h Grp Sat Flow(s),veh/h/ln Q Serve(g_s), s Cycle Q Clear(g_c), s

Cap, veh/h Arrive On Green Sat Flow, veh/h Prop In Lane Lane Grp Cap(c), veh/h

V/C Ratio(X)

368 1863 15.5 15.5

1.00 1863 368 1 1.00 2 2 798 798 0.43

1.00 1863 353 1.00 2 2 505 505 0.30

1.00 1863 242 1 1.00 2 2 2 527 0.28 1863

1.00 11.00 11.00 176 1.00 2 335 0.09

53 53 12 0 0 0 0.09 1.00 1.00 1.00 2 2 528 528 60.28

initial Q (Db), veh
Ped-Bike Adj(A_pbT)
Parking Bus, Adj
Adj Sat Flow, veh/In/In
Adj Flow Rate, veh/In/In
Adj Flow Rate, veh/In/In
Adj Flow Rate, veh/In/In
Adj Flow Rate, veh/In
Adj Rou of Lanes
Peac Hour Factor
Percent Heavy Veh, %

Fraffic Volume (veh/h)

-uture Volume (veh/h)

-ane Configurations

1.00 848 2 2 1.00 2 1.258 0.45 541 1770 26.5

7 0 11.00 11.00 2 23 2 11.00 2 2 2 2 2 2 2 3 7 7 7 7 7 7 7 7 7

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Appendix C

Proportional Share Calculations



Equitable Share Calculations Aston Avenue/Linwood Avenue

Total Volume Entering the Intersection of

Penstemon Place

PM PM Existing 1243

Project Trips (T) 35 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 Improveme \$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 Prepared By: BKB MINOR Street Name: Poinsettia Ln Date: 1.9.2018
City of Santa Rosa

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	Α	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	В	<u>Collisions</u> 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.
	C1	Minimum Volumes 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.
No	C3	OR 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.
No	D	Combination Warrant 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 inteersection 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