

APPENDIX C-1

TRAFFIC ANALYSIS



April 4, 2018

Mr. Will Burns, AICP
David J. Powers & Associates, Inc.
1611 Telegraph Avenue, Ste. 1002
Oakland, CA 94612

Kawana Springs Community Park Circulation Analysis

Dear Mr. Burns;

As requested, W-Trans has prepared a traffic analysis for the proposed Kawana Springs Community Park project in southeast Santa Rosa. The purpose of the analysis is to address the potential circulation-related effects of the park on surrounding neighborhoods and streets. The study was completed in support of the project's CEQA review and is consistent with standard traffic engineering techniques.

Project Description

The proposed project would develop a city park on a currently-undeveloped 19.2-acre site within a residential area in Santa Rosa. Of the 19.2 acres, approximately 5.5 acres would be used as active park space, with the remainder comprised of passive spaces including oak riparian woodland areas, Colgan Creek, storm water detention areas, and seasonal wetland areas. The park would be bound on the north by Kawana Springs Road and on the south by Kawana Terrace. Meda Avenue splits the park space, with active spaces in the western portion to be used for a community garden and walking trails, and active components in the eastern section including picnic areas, a children's play area, a dog park, a bocce ball court, sand volleyball court, pump track, and other recreational spaces in addition to walking paths. The park's primary off-street parking lot would be accessed via Kawana Terrace, just east of the Meda Avenue intersection. A small off-street parking lot would also be provided at the community garden on Kawana Springs Road.

Study Area and Periods

The study area consists of Kawana Springs Road, Kawana Terrace, and Meda Avenue, all of which front the proposed park site in the southeast quadrant of the City of Santa Rosa. Intersection Level of Service (LOS) was analyzed for the intersection of Petaluma Hill Road/Kawana Springs Road, which is the major intersection nearest the proposed project site and therefore most likely to have a traffic impact associated with drivers traveling to and from the park. Operating conditions during the weekday p.m. peak period and Saturday midday peak period were evaluated to capture the highest potential impacts for the proposed project. The weekday p.m. peak hour occurs between 4:00 and 6:00 p.m. and typically reflects the highest level of commute-related congestion. In the project area, the Saturday midday peak period occurs between 1:00 and 3:00 p.m.

Circulation Setting

Vehicular Circulation

Kawana Springs Road is an east-west road that serves as a connector between residential areas to the east near the project site and commercial uses to the west and provides the area's primary connection to the surrounding arterial street network. Kawana Terrace is a local street that parallels Kawana Springs Road, providing access to several local neighborhood streets as well as the Taylor Mountain Regional Park parking lot. In the study area, Meda Avenue is a local residential north-south street. The speed limit on all three streets is 25 mph.

The study intersection at Petaluma Hill Road/Kawana Springs Road is signalized and has protected-permitted left-turn phasing on all four approaches, plus right-turn overlap signal phasing on the southbound and eastbound approaches. Marked crosswalks with pedestrian signals exist on the north, east, and west intersection legs.

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, and curb ramps provide access for pedestrians near the proposed project site; however, sidewalk gaps can be found along some of the roadways connecting to the project site.

- **Kawana Springs Road** – Intermittent sidewalk coverage is provided on Kawana Springs Road with gaps on the south side of the street between Petaluma Hill Road and Meda Avenue, and on the north side of the street from Brookwood Avenue to Taylor Mountain Place. Curb ramps are provided at each of the side street approaches and crosswalks at the intersection with Meda Avenue. Pedestrian-scale street lighting exists along the street.
- **Kawana Terrace** – Continuous sidewalk coverage exists on the north side of the street between Kawana Springs Road and Meda Avenue. To the east of Meda Avenue, Kawana Terrace transitions to a more rural character without curbs, sidewalks, or street lighting.
- **Meda Avenue** – Continuous sidewalks are provided on both sides of Meda Avenue between Kawana Terrace and Tokay Street. There are existing curb ramps at each corner and crosswalks at the intersection with Kawana Springs Road. Lighting is provided by pedestrian-scale street lights.

Bicycle Facilities

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

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

In the project area, Class II bike lanes exist on Kawana Springs Road, Petaluma Hill Road, and Brookwood Avenue. Otherwise, within the study area, bicyclists ride in the roadway on local streets. Table 1 summarizes the existing and planned bicycle facilities in the project vicinity, as contained in the *City of Santa Rosa Bicycle and Pedestrian Master Plan*, 2010.

Table 1– Bicycle Facility Summary

Status Facility	Class	Length (miles)	Begin Point	End Point
Existing				
Colgan Creek Trail	I	0.6	Colgan Ave	Petaluma Hill Rd
Petaluma Hill Rd	II	0.9	Barham Ave-Pressley St	Kawana Springs Rd
Kawana Springs Rd (WB)	II	0.50	Santa Rosa Ave	Petaluma Hill Rd
Kawana Springs Rd	II	0.50	Petaluma Hill Rd	Brookwood Ave
Planned				
Kawana Springs Rd	II	0.33	Brookwood Ave	Farmers Ln
Colgan Creek Trail	I	0.64	Meda Ave	Kawana Creek

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

Transit Facilities

Sonoma County Transit (SCT) and Santa Rosa CityBus provide fixed-route bus service in Santa Rosa and near the project. Santa Rosa CityBus Local Route 5 provides service to the downtown Mall, facilitating transfers to other routes and destinations throughout the City. Route 5 stops at the intersection of Petaluma Hill Road/Kawana Springs Road just west of the project site. The route operates Monday through Friday with approximately half-hour headways between 6:15 a.m. and 8:15 p.m. Saturday service operates with approximately one-hour headways between 6:30 a.m. and 7:30 p.m. Sunday service operates approximately one-hour headways from 10:30 a.m. and 4:30 p.m.

SCT Route 46 also stops at the intersection of Kawana Springs Road/Petaluma Hill Road and provides service to the downtown transit center, Sonoma State University, and the Cotati SMART depot. Route 46 only operates during commute hours with about 50-minute headways in the northbound direction and 30-minute headways in the southbound direction.

Collision History

The collision histories for the three streets in the study area were reviewed to determine any trends or patterns that may indicate a safety issue. Where count information was available, the collision rate was calculated based on records available from the California Highway Patrol as published in their Statewide Integrated Traffic Records System (SWITRS) reports. The most current five-year period available is January 1, 2013 through December 31, 2017. Where the collision rate was calculated, it was compared to the statewide average for similar facilities, as indicated in *2013 Collision Data on California State Highways*, California Department of Transportation (Caltrans).

On Kawana Springs Road between Petaluma Hill Road and the eastern boundary of the proposed project, there were ten reported collisions in five years, resulting in a collision rate of 0.51 collisions per million vehicle miles (c/mvm), which is less than that statewide average of 2.21 c/mvm for similar facilities. Of the ten collisions, three occurred along the frontage of the proposed project, all of which were single-vehicle collisions. Two of the collisions occurred at night and had “driving under the influence” as the primary collision factor. The other had a primary collision factor of “unsafe speed” at the intersection with Meda Avenue, which at the time of the collision did not have all-way stop-controls in place.

On the full length of Kawana Terrace there were two reported collisions, though none were along the proposed project’s frontage. The two collisions were associated with unsafe starting and stopping at the intersection with Zircon Place.

Meda Avenue between Tokay Avenue and Kawana Terrace had only one reported collision within the most recent five years of data; it occurred near the intersection with Tokay Avenue and was therefore not along the project frontage.

Based on the collision records reviewed for the three segments, there is no indication of potential existing safety concerns that could be exacerbated by the addition of project-related traffic.

Intersection Level of Service Methodologies

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

The study intersection was analyzed using the signalized methodology published in the *Highway Capacity Manual* (HCM), Transportation Research Board, 2010. This methodology is based on factors including traffic volumes, green time for each movement, phasing, whether or not the signal is coordinated, truck traffic, and pedestrian

activity. The signal timing parameters for the intersection were obtained from the City of Santa Rosa. Average stopped delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology.

The ranges of delay associated with the various levels of service are indicated in Table 2.

Table 2 – Signalized Intersection Level of Service Criteria

LOS A	Delay of 0 to 10 seconds. Most vehicles arrive during the green phase, so do not stop at all.
LOS B	Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop.
LOS C	Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.
LOS D	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.
LOS E	Delay of 55 to 80 seconds. Most, if not all, vehicles must stop and drivers consider the delay excessive.
LOS F	Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.

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

Traffic Operations

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, as is standard practice for such studies, a minimum operation of LOS D for operation of the signalized intersection was applied.

Trip Generation

The Institute of Transportation Engineers (ITE) publication *Trip Generation Manual*, 10th Edition, 2017, is typically used as a source of trip generation rates for traffic impact analyses. Because *Trip Generation* contains limited data for parks and recreational uses, trip generation rates developed by SANDAG (San Diego Area Council of Governments) were instead applied. SANDAG has rates specific to developed "City Parks" with active uses including sports facilities and is well-suited to estimate the potential trip generation of Kawana Springs Park. The trip generation rates were applied only to the 5.5-acres of active park space, as the passive park acreage (comprised primarily of oak woodland, creekside and riparian areas, detention basins, and seasonal wetland areas) would be expected to generate essentially no park user activity or vehicle trips.

The standard rate for a City Park published by Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 10th Edition, 2017 was also reviewed but not considered for this project since the rates resulted in a lower trip generation than was achieved using the SANDAG rates.

Because the SANDAG reference does not include trip generation rates for the weekend peak hour, rates from the City Park land use in the *Trip Generation Manual* were used to determine a factor to translate weekday p.m. peak hour rates to a weekend peak hour rate. In reviewing the limited data in *Trip Generation*, it was determined that the weekend midday peak hour rate is approximately three-and-a-half times higher than the weekday p.m. peak hour rate. This factor was applied to SANDAG's p.m. peak rate to determine a weekend rate for the analysis.

Based on the applied assumptions and trip generation rates, the proposed project is expected to generate an average of 275 daily trips, including 25 during the p.m. peak hour and 87 during the weekend midday peak hour. The trip generation estimates for the proposed project are summarized in Table 3.

Table 3– Trip Generation Summary

Land Use	Units	Daily		PM Peak Hour				Weekend Midday Peak			
		Rate	Trips	Rate	Trips	In	Out	Rate	Trips	In	Out
City Park	5.5 ac	50	275	4.50	25	12	13	15.75	87	44	43

Note: ac=acres of active park space

Trip Distribution

The pattern used to allocate new project trips to the street network was based on prevailing circulation patterns, along with consideration of existing counts at the study intersection. While most of the park's users are likely to be from surrounding neighborhoods, 75 percent of auto trips were conservatively assumed to pass through the study intersection at Petaluma Hill Road/Kawana Springs Road. The remaining 25 percent of auto trips were assumed to be oriented to local neighborhoods within an approximately half-mile radius of the proposed park site. The applied distribution assumptions and resulting trips are shown in Table 4.

Table 4– Trip Distribution Assumptions

Route	Percent	Daily Trips	PM Peak Trips	Saturday Midday Peak Trips
To/From Petaluma Hill Rd North of Kawana Springs Rd	37%	102	9	33
To/From Petaluma Hill Rd South of Kawana Springs Rd	19%	52	5	16
To/From Kawana Springs Rd West of Petaluma Hill Rd	19%	52	5	16
To/From Neighborhood	25%	69	6	22
TOTAL	100%	275	25	87

Existing and Existing plus Project Conditions

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the p.m. and weekend peak periods. The Existing plus Project scenario adds traffic associated with the proposed Kawana Springs Park project to the existing volumes.

The intersection of Petaluma Hill Road/Kawana Springs Road currently operates acceptably at LOS C during the weekday p.m. peak hour, and LOS B during the weekend midday peak hour. Upon the addition of project-related traffic to the existing volumes, the intersection is expected to continue operating acceptably at the same service levels as without the project. These results are summarized in Table 5.

Table 5 – Existing and Existing plus Project Peak Hour Intersection Levels of Service

Study Intersection	Existing Conditions				Existing plus Project			
	PM Peak		Weekend Peak		PM Peak		Weekend Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. Petaluma Hill Rd/Kawana Springs Rd	24.7	C	15.6	B	24.9	C	16.1	B

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

Finding – The study intersection is expected to continue operating acceptably at the same levels of service upon the addition of project-generated traffic to existing volumes.

Future and Future plus Project Conditions

Segment volumes for the horizon year of 2040 were obtained from the SCTA travel demand model and translated to turning movement volumes at the study intersection using the “Furness” method for the p.m. peak hour. 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. The SCTA model does not include weekend projections. Based on the model’s projected weekday growth on nearby segments, a growth factor of 1.28 (which translates to a growth rate of slightly greater than one percent per year) was applied to the existing weekend volumes to estimate weekend midday peak hour volumes in 2040.

Under future conditions without the project, the intersection is expected to continue operating acceptably at LOS C or better. Upon the addition of project-generated traffic to future volumes, operation is projected to remain unchanged and at acceptable levels. The Future and Future plus Project operating conditions are summarized in Table 6.

Table 6– Future and Future plus Project Peak Hour Levels of Service

Study Intersection	Future Conditions				Future plus Project			
	PM Peak		Weekend Peak		PM Peak		Weekend Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1.Petaluma Hill Rd/Kawana Springs Rd	29.3	C	18.4	B	29.6	C	19.0	B

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

Finding – The study intersection is projected to continue operating acceptably under Future conditions both without and with the addition of project-generated traffic.

Non-Auto Modes

Pedestrian Facilities

Given that the proposed project is located within a residential community, it is reasonable to assume that many users will want to walk or bicycle to reach the park.

As part of the project, walking trails would be installed throughout the site. Where there are currently no sidewalks along the south side of Kawana Springs Road the proposed project includes walking paths. The two sections of the park, divided by Meda Avenue, would be connected by crosswalks at the all-way stop-controlled Meda Avenue/Kawana Springs Avenue intersection. The crosswalks at the Meda Avenue intersection would also serve pedestrians crossing Kawana Springs Avenue.

The park would also include pedestrian connections to the existing sidewalk network on Meda Avenue south of Kawana Springs Road, and to the Meda Avenue/Kawana Terrace intersection. There are no proposed sidewalks or walking paths proposed along Kawana Terrace other than the connection to the intersection with Meda Avenue. Interior pathways link the park’s proposed parking lot on Kawana Terrace to the park’s facilities. Since the only other destination to the east on Kawana Terrace is the Taylor Mountain Regional Park parking lot, pedestrian facilities along the project’s Kawana Terrace frontage are not recommended as they would potentially encourage Taylor Mountain visitors to park their vehicle at the Kawana Springs parking lot, as opposed to using the Taylor Mountain paid parking lot. Pedestrian connectivity between Kawana Springs Park and Taylor Mountain Regional Park would still be accommodated by a developed pathway along Kawana Springs Road and pedestrian bridge over Colgan Creek near the Taylor Mountain Regional Park entrance.

Finding – Pedestrian facilities serving the project site are adequate.

Bicycle Facilities

Existing bicycle facilities, including bike lanes on streets together with shared use of minor streets, provide adequate access to the park for bicyclists. Bike lanes on Kawana Springs Road east of Brookwood Avenue are included in the City's Bike Plan, so it is recommended that the City install the bike lanes along the site's frontage as part of the park project.

Finding – Bicycle facilities serving the project site are generally adequate, though would benefit from completion of a planned bike lane on Kawana Springs Road.

Recommendation – The proposed project should include the installation of planned bike lanes on the segment of Kawana Springs Road fronting the project site between Brookwood Avenue and Rudesill Lane.

Transit

Existing transit routes are adequate to accommodate project-generated transit trips. Existing bus stops are within acceptable walking distance of the site, and accessible via continuous sidewalks.

Finding – Transit facilities serving the project site are adequate.

Conclusions and Recommendations

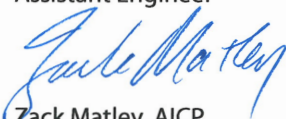
- The proposed project is expected to generate an average of 275 weekday trips, of which 25 would occur during the p.m. peak hour. Approximately 87 trips are anticipated to be generated during the Saturday midday peak hour.
- Under the existing and future scenarios, without and with the proposed project, the intersection of Kawana Springs Road/Petaluma Hill Road is expected to operate acceptably at LOS C or better.
- Transit facilities serving the site are adequate.
- The proposed bicycle and pedestrian facilities serving the site are generally adequate, though would benefit from an extension of the bike lane network.
- Construction of the proposed park should include the installation of bike lanes on the segment of Kawana Springs Road fronting the project site between Brookwood Avenue and Rudesill Lane.

Thank you for giving W-Trans the opportunity to provide these services. Please call if you have any questions.

Sincerely,



Briana Byrne, EIT
Assistant Engineer



Zack Matley, AICP
Associate Principal



ZM/bkb/SRO392.L1

Enclosure: Level of Service Calculations

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

03/05/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		←	↑	←	↑	←	←	↑	←	←	↑	←
Traffic Volume (veh/h)	200	197	117	148	199	28	115	673	192	16	412	265
Future Volume (veh/h)	200	197	117	148	199	28	115	673	192	16	412	265
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Ob.) veh	0	0	0	0	0	0	0	0	0	0	0	12
Ped-Bike Adj(A_pbT)	0.99	1.00	1.00	1.00	0.97	1.00	0.98	1.00	0.98	1.00	0.98	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	1900	1863	1863	1863	1863
Adj Flow Rate, veh/h	200	197	64	148	199	24	115	673	173	16	412	138
Adj No. of Lanes	1	1	1	1	1	0	1	2	0	0	1	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	486	615	612	485	506	61	336	1196	307	271	735	761
Arrive On Green	0.09	0.33	0.33	0.08	0.31	0.31	0.06	0.43	0.43	0.02	0.39	0.39
Sat Flow, veh/h	1774	1863	1578	1774	1626	196	1774	2776	713	1774	1863	1547
Grp Volume(V), veh/h	200	197	64	148	0	223	115	429	417	16	412	138
Grp Sat Flow(s), veh/h/ln	1774	1863	1578	1774	0	1822	1774	1770	1719	1774	1863	1547
Q Serve(g.s), s	7.4	7.9	2.6	5.6	0.0	9.6	3.7	18.2	18.2	0.5	17.2	5.0
Cycle Q Clear(g.q), s	7.4	7.9	2.6	5.6	0.0	9.6	3.7	18.2	18.2	0.5	17.2	5.0
Prop In Lane	1.00	1.00	1.00	1.00	0.11	1.00	0.41	1.00	1.00	1.00	1.00	1.00
Lane Grp Cap(c), veh/h	486	615	612	485	0	567	336	762	741	271	735	761
V/C Ratio(X)	0.41	0.32	0.10	0.31	0.00	0.39	0.34	0.56	0.56	0.06	0.56	0.18
Avail Cap(c.a), veh/h	531	615	612	564	0	567	475	762	741	446	735	761
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	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.0	25.1	19.5	20.7	0.0	27.0	18.0	21.4	21.4	18.3	24.5	14.3
Incr Delay (d2), s/veh	0.2	1.4	0.3	0.1	0.0	2.0	0.2	3.0	3.1	0.0	3.1	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4
%ile BackOfQ(50%),veh/ln	3.6	4.3	1.2	2.7	0.0	5.2	1.8	9.4	9.2	0.3	12.0	2.2
LnGrp Delay(d),s/veh	20.2	26.4	19.9	20.9	0.0	29.1	18.2	24.4	24.5	18.3	32.0	14.8
LnGrp LOS	C	C	B	C	C	C	B	C	C	C	B	C
Approach Vol, veh/h	461			371			961			566		
Approach Delay, s/veh	22.8			25.8			23.7			27.4		
Approach LOS	C			C			C			C		

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.5	36.9	8.8	43.8	12.5	35.0	5.2	47.4
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	* 31	12.0	31.1	12.0	30.7
Max Q Clear Time (q.c+I1), s	7.6	9.9	5.7	19.2	9.4	11.6	2.5	20.2
Green Ext Time (p.c), s	0.1	1.3	0.1	1.6	0.1	1.2	0.0	2.8

Intersection Summary	
HCM 2010 Ctrl Delay	24.7
HCM 2010 LOS	C
Notes	
* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.	

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

03/05/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		←	↑	←	↑	←	←	↑	←	←	↑	←
Traffic Volume (veh/h)	188	142	53	94	151	26	86	330	67	28	377	173
Future Volume (veh/h)	188	142	53	94	151	26	86	330	67	28	377	173
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Ob.) veh	0	0	0	0	0	0	0	0	0	0	0	12
Ped-Bike Adj(A_pbT)	0.99	1.00	1.00	1.00	0.97	1.00	0.98	1.00	0.98	1.00	0.98	0.96
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	1900	1863	1863	1863	1863
Adj Flow Rate, veh/h	188	142	29	94	151	23	86	330	60	28	377	90
Adj No. of Lanes	1	1	1	1	1	0	1	2	0	0	1	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	470	361	445	479	254	39	408	1059	190	503	570	663
Arrive On Green	0.13	0.20	0.20	0.09	0.16	0.16	0.09	0.34	0.34	0.04	0.29	0.29
Sat Flow, veh/h	1774	1863	1581	1774	1572	239	1774	2987	536	1774	1863	1520
Grp Volume(V), veh/h	188	142	29	94	0	174	86	194	196	28	377	90
Grp Sat Flow(s), veh/h/ln	1774	1863	1581	1774	0	1811	1774	1770	1754	1774	1863	1520
Q Serve(g.s), s	3.5	2.8	0.6	1.8	0.0	3.8	1.3	3.5	3.6	0.5	7.7	1.6
Cycle Q Clear(g.q), s	3.5	2.8	0.6	1.8	0.0	3.8	1.3	3.5	3.6	0.5	7.7	1.6
Prop In Lane	1.00	1.00	1.00	1.00	0.13	1.00	0.31	1.00	1.00	1.00	1.00	1.00
Lane Grp Cap(c), veh/h	470	361	445	479	0	292	408	627	622	503	570	663
V/C Ratio(X)	0.40	0.39	0.07	0.20	0.00	0.60	0.21	0.31	0.32	0.06	0.66	0.14
Avail Cap(c.a), veh/h	967	923	926	824	0	685	766	1899	1882	920	2017	1844
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	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.1	16.2	12.2	13.7	0.0	18.0	9.8	10.4	10.4	9.7	14.1	7.7
Incr Delay (d2), s/veh	0.2	0.7	0.1	0.1	0.0	1.9	0.1	0.1	0.1	0.1	0.0	0.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.4
%ile BackOfQ(50%),veh/ln	1.9	1.6	0.3	0.9	0.0	2.2	0.7	1.7	1.8	0.2	7.0	0.7
LnGrp Delay(d),s/veh	13.4	16.9	12.3	13.8	0.0	19.9	9.9	10.5	10.5	9.7	24.0	7.7
LnGrp LOS	B	B	B	B	B	B	A	B	B	A	C	A
Approach Vol, veh/h	359			268			476			495		
Approach Delay, s/veh	14.7			17.8			10.4			20.2		
Approach LOS	B			B			B			C		

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.0	12.2	6.8	16.5	8.4	10.9	4.7	18.7
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	21.1	12.0	* 46	17.0	16.1	12.0	45.7
Max Q Clear Time (q.c+I1), s	3.8	4.8	3.3	9.7	5.5	5.8	2.5	5.6
Green Ext Time (p.c), s	0.1	0.7	0.1	1.7	0.2	0.6	0.0	1.6

Intersection Summary								
HCM 2010 Ctrl Delay	15.6							
HCM 2010 LOS	B							
Notes								

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

03/12/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	↑	↗	←	↗	←	←	↗	←	←	↑	↗
Traffic Volume (veh/h)	200	199	117	150	201	33	115	673	194	20	412	265
Future Volume (veh/h)	200	199	117	150	201	33	115	673	194	20	412	265
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Ob.) veh	0	0	0	0	0	0	0	0	0	0	12	0
Ped-Bike Adj(A_pbT)	0.99	1.00	1.00	1.00	0.97	1.00	0.98	1.00	0.98	1.00	0.98	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	200	199	64	150	201	29	115	673	175	20	412	138
Adj No. of Lanes	1	1	1	1	1	0	1	2	0	1	1	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	480	614	611	484	493	71	336	1181	307	274	735	761
Arrive On Green	0.09	0.33	0.33	0.08	0.31	0.31	0.06	0.43	0.43	0.03	0.39	0.39
Sat Flow, veh/h	1774	1863	1578	1774	1586	229	1774	2768	719	1774	1863	1547
Grp Volume(v), veh/h	200	199	64	150	0	230	115	430	418	20	412	138
Grp Sat Flow(s),veh/h/ln	1774	1863	1578	1774	0	1815	1774	1770	1718	1774	1863	1547
Q Serve(g, s), s	7.4	8.0	2.6	5.7	0.0	10.0	3.7	18.4	18.4	0.7	17.2	5.0
Cycle Q Clear(g, c), s	7.4	8.0	2.6	5.7	0.0	10.0	3.7	18.4	18.4	0.7	17.2	5.0
Prop In Lane	1.00	1.00	1.00	1.00	0.13	1.00	0.42	1.00	1.00	1.00	1.00	1.00
Lane Grp Cap(c), veh/h	480	614	611	484	0	564	336	755	733	274	735	761
V/C Ratio(X)	0.42	0.32	0.10	0.31	0.00	0.41	0.34	0.57	0.57	0.07	0.56	0.18
Avail Cap(c, a), veh/h	525	614	611	562	0	564	475	755	733	442	735	761
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	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.0	25.2	19.6	20.7	0.0	27.2	18.0	21.7	21.7	18.2	24.5	14.3
Incr Delay (d2), s/veh	0.2	1.4	0.3	0.1	0.0	2.2	0.2	3.1	3.2	0.0	3.1	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4
%ile BackOfQ(50%),veh/ln	3.6	4.4	1.2	2.7	0.0	5.3	1.8	9.6	9.4	0.3	12.0	2.2
LnGrp Delay(d),s/veh	20.3	26.6	19.9	20.9	0.0	29.4	18.2	24.8	24.9	18.2	32.0	14.8
LnGrp LOS	C	C	B	C	C	C	B	C	C	C	B	C
Approach Vol, veh/h	463			380			963			570		
Approach Delay, s/veh	22.9			26.0			24.1			27.3		
Approach LOS	C			C			C			C		
Timer	1	2	3	4	5	6	7	8	7	8	7	8
Assigned Phs	1	2	3	4	5	6	7	8	7	8	7	8
Phs Duration (G+Y+Rc), s	10.6	36.9	8.8	43.8	12.5	35.0	5.6	47.0	5.6	47.0	5.6	47.0
Change Period (Y+Rc), s	3.0	3.9	3.0	* 4.3	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	* 31	12.0	31.1	12.0	30.7	12.0	31.1	12.0	30.7
Max Q Clear Time (g.c+I1), s	7.7	10.0	5.7	19.2	9.4	12.0	2.7	20.4	2.7	20.4	2.7	20.4
Green Ext Time (p.c), s	0.1	1.3	0.1	1.6	0.1	1.2	0.0	2.8	0.0	2.8	0.0	2.8
Intersection Summary												
HCM 2010 Ctrl Delay	24.9											
HCM 2010 LOS	C											
Notes												
HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.												

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

03/12/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↖	↗	↘	↖	↗	↘	↖	↗	↘
Traffic Volume (veh/h)	188	150	53	102	159	42	86	330	75	44	377	173
Future Volume (veh/h)	188	150	53	102	159	42	86	330	75	44	377	173
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Ob.) veh	0	0	0	0	0	0	0	0	0	0	12	0
Ped-Bike Adj(A_pbT)	0.99			1.00	1.00	0.97	0.99		0.98	1.00		0.96
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	188	150	29	102	159	39	86	330	68	44	377	90
Adj No. of Lanes	1	1	1	1	1	0	1	2	0	1	1	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	459	376	456	485	250	61	400	978	199	502	567	656
Arrive On Green	0.12	0.20	0.20	0.10	0.18	0.18	0.09	0.32	0.32	0.06	0.28	0.28
Sat Flow, veh/h	1774	1863	1581	1774	1436	352	1774	2919	593	1774	1863	1520
Grp Volume(V), veh/h	188	150	29	102	0	198	86	198	200	44	377	90
Grp Sat Flow(s), veh/h/ln	1774	1863	1581	1774	0	1788	1774	1770	1742	1774	1863	1520
Q Serve(Q,s), s	3.6	3.0	0.6	1.9	0.0	4.5	1.4	3.8	3.9	0.7	7.9	1.6
Cycle Q Clear(g,c), s	3.6	3.0	0.6	1.9	0.0	4.5	1.4	3.8	3.9	0.7	7.9	1.6
Prop In Lane	1.00	1.00	1.00	1.00	0.20	1.00	0.34	1.00	1.00	1.00	1.00	1.00
Lane Grp Cap(c), veh/h	459	376	456	485	0	312	400	593	584	502	567	656
V/C Ratio(X)	0.41	0.40	0.06	0.21	0.00	0.63	0.22	0.33	0.34	0.09	0.67	0.14
Avail Cap(c,a), veh/h	943	900	905	813	0	659	747	1853	1824	877	1967	1800
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	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.3	16.4	12.3	13.6	0.0	18.2	10.4	11.4	11.4	9.7	14.5	8.0
Incr Delay (d2), s/veh	0.2	0.7	0.1	0.1	0.0	2.1	0.1	0.1	0.1	0.0	0.5	0.0
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	9.7	0.0
%ile BackOfQ(50%),veh/ln	1.9	1.7	0.3	1.0	0.0	2.6	0.7	1.9	1.9	0.4	7.1	0.7
LnGrp Delay(d),s/veh	13.5	17.1	12.3	13.7	0.0	20.3	10.5	11.5	11.5	9.7	24.7	8.0
LnGrp LOS	B	B	B	B	C	C	B	B	B	A	C	A
Approach Vol, veh/h	367			300			484			511		
Approach Delay, s/veh	14.9			18.0			11.3			20.4		
Approach LOS	B			B			B			C		
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	7.3	12.8	6.9	16.7	8.4	11.6	5.5	18.1				
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	21.1	12.0	* 46	17.0	16.1	12.0	45.7				
Max Q Clear Time (g.c+I1), s	3.9	5.0	3.4	9.9	5.6	6.5	2.7	5.9				
Green Ext Time (p.c), s	0.1	0.7	0.1	1.7	0.2	0.7	0.0	1.6				
Intersection Summary												
HCM 2010 Ctrl Delay	16.1											
HCM 2010 LOS	B											
Notes												

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

03/05/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		←	↑	←	↑	←	←	↑	←	←	↑	←
Traffic Volume (veh/h)	226	435	132	174	338	39	137	678	311	30	415	365
Future Volume (veh/h)	226	435	132	174	338	39	137	678	311	30	415	365
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Ob) veh	0	0	0	0	0	0	0	0	0	0	0	12
Ped-Bike Adj(A_pbT)	0.99			1.00	1.00	0.97	1.00		0.98	1.00		0.98
Parking Bus, Adj												
Adj Sat Flow, veh/hln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	226	435	79	174	338	35	137	678	292	30	415	238
Adj No. of Lanes	1	1	1	1	1	0	1	2	0	1	1	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	392	614	622	335	515	53	315	978	421	233	705	750
Arrive On Green	0.10	0.33	0.33	0.09	0.31	0.31	0.06	0.41	0.41	0.03	0.38	0.38
Sat Flow, veh/h	1774	1863	1578	1774	1655	171	1774	2394	1031	1774	1863	1546
Grp Volume(V), veh/h	226	435	79	174	0	373	137	501	469	30	415	238
Grp Sat Flow(s),veh/hln	1774	1863	1578	1774	0	1827	1774	1770	1655	1774	1863	1546
Q Serve(g.s), s	8.4	20.4	3.2	6.6	0.0	17.7	4.5	23.4	23.4	1.0	17.8	9.4
Cycle Q Clear(g.c), s	8.4	20.4	3.2	6.6	0.0	17.7	4.5	23.4	23.4	1.0	17.8	9.4
Prop In Lane	1.00	1.00	1.00	1.00	0.09	1.00	0.62	1.00	0.62	1.00	1.00	1.00
Lane Grp Cap(c), veh/h	392	614	622	335	0	568	315	723	676	233	705	750
V/C Ratio(X)	0.58	0.71	0.13	0.52	0.00	0.66	0.43	0.69	0.69	0.13	0.59	0.32
Avail Cap(c.a), veh/h	419	614	622	396	0	568	440	723	676	386	705	750
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	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.2	29.3	19.3	22.3	0.0	29.8	19.0	24.4	24.4	19.8	25.9	15.8
Incr Delay (d2), s/veh	1.0	6.8	0.4	0.5	0.0	5.8	0.4	5.4	5.8	0.1	3.6	1.1
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	5.1	0.0
%ile BackOfQ(50%),veh/ln	4.1	11.7	1.5	3.2	0.0	9.8	2.2	12.5	11.8	0.5	12.5	4.2
LnGrp Delay(d),s/veh	22.2	36.1	19.7	22.8	0.0	35.7	19.3	29.8	30.2	19.8	34.6	16.9
LnGrp LOS	C	D	B	C	C	D	B	C	C	B	C	B
Approach Vol, veh/h	740			547			1107			683		
Approach Delay, s/veh	30.1			31.6			28.7			27.8		
Approach LOS	C			C			C			C		
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	11.6	36.9	9.4	42.1	13.4	35.0	6.4	45.2				
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	* 31	12.0	31.1	12.0	30.7				
Max Q Clear Time (g.c+I1), s	8.6	22.4	6.5	19.8	10.4	19.7	3.0	25.4				
Green Ext Time (g.e), s	0.1	2.0	0.1	1.7	0.1	1.7	0.0	2.2				
Intersection Summary												
HCM 2010 Ctrl Delay	29.3											
HCM 2010 LOS	C											
Notes:												













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

03/05/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	↑	←	←	↑	←	←	↑	←	←	↑	←
Lane Volume (veh/h)	241	182	68	120	193	33	110	422	86	36	483	221
Future Volume (veh/h)	241	182	68	120	193	33	110	422	86	36	483	221
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Ob) veh	0	0	0	0	0	0	0	0	0	0	0	12
Ped-Bike Adj(A_pbT)	0.99	1.00	1.00	1.00	0.97	1.00	0.98	1.00	0.98	1.00	0.96	0.96
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/hln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	241	182	44	120	193	30	110	422	79	36	483	138
Adj No. of Lanes	1	1	1	1	1	0	1	2	0	1	1	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	443	415	490	449	273	42	348	1149	213	464	644	748
Arrive On Green	0.14	0.22	0.22	0.09	0.18	0.18	0.09	0.37	0.37	0.05	0.33	0.33
Sat Flow, veh/h	1774	1863	1581	1774	1567	244	1774	2969	551	1774	1863	1524
Grp Volume(V), veh/h	241	182	44	120	0	223	110	250	251	36	483	138
Grp Sat Flow(s), veh/hln	1774	1863	1581	1774	0	1811	1774	1770	1751	1774	1863	1524
Q Serve(g.s), s	5.5	4.5	1.1	2.8	0.0	6.2	2.0	5.5	5.6	0.7	12.6	2.8
Cycle Q Clear(g.c), s	5.5	4.5	1.1	2.8	0.0	6.2	2.0	5.5	5.6	0.7	12.6	2.8
Prop In Lane	1.00	1.00	1.00	1.00	0.13	1.00	0.31	1.00	0.31	1.00	1.00	1.00
Lane Grp Cap(c), veh/h	443	415	490	449	0	315	348	685	678	464	644	748
V/C Ratio(X)	0.54	0.44	0.09	0.27	0.00	0.71	0.32	0.37	0.37	0.08	0.75	0.18
Avail Cap(c.a), veh/h	768	734	766	693	0	545	605	1510	1495	769	1604	1535
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	15.3	19.4	14.2	16.9	0.0	22.5	12.0	12.3	12.3	10.7	17.1	8.2
Incr Delay (d2), s/veh	0.4	0.7	0.1	0.1	0.0	2.9	0.2	0.1	0.1	0.0	0.7	0.0
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 BackOfQ(50%),veh/ln	2.9	2.5	0.5	1.5	0.0	3.6	1.0	2.8	2.8	0.3	10.2	1.2
LnGrp Delay(d),s/veh	15.7	20.1	14.3	17.0	0.0	25.4	12.2	12.4	12.5	10.8	27.8	8.2
LnGrp LOS	B	C	B	B	C	C	B	B	B	B	C	A
Approach Vol, veh/h	467			343			611			657		
Approach Delay, s/veh	17.3			22.5			12.4			22.7		
Approach LOS	B			C			B			C		
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	8.0	15.9	7.8	21.8	10.5	13.4	5.5	24.1				
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	21.1	12.0	* 46	17.0	16.1	12.0	45.7				
Max Q Clear Time (g.c+I1), s	4.8	6.5	4.0	14.6	7.5	8.2	2.7	7.6				
Green Ext Time (g.e), s	0.1	0.9	0.1	2.3	0.2	0.7	0.0	2.1				
Intersection Summary												
HCM 2010 Ctrl Delay	18.4											
HCM 2010 LOS	B											
Notes												













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

03/12/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	226	437	132	176	340	44	137	678	313	34	415	365
Future Volume (veh/h)	226	437	132	176	340	44	137	678	313	34	415	365
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Ob.) veh	0	0	0	0	0	0	0	0	0	0	0	12
Ped-Bike Adj(A_pbT)	0.99	1.00	1.00	1.00	0.97	1.00	0.98	1.00	0.98	1.00	0.98	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/hln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	226	437	79	176	340	40	137	678	294	34	415	238
Adj No. of Lanes	1	1	1	1	1	0	1	2	0	1	1	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	386	613	621	334	507	60	315	969	420	235	704	750
Arrive On Green	0.10	0.33	0.33	0.09	0.31	0.31	0.06	0.41	0.41	0.04	0.38	0.38
Sat Flow, veh/h	1774	1863	1578	1774	1631	192	1774	2388	1036	1774	1863	1546
Grp Volume(V), veh/h	226	437	79	176	0	380	137	502	470	34	415	238
Grp Sat Flow(s),veh/hln	1774	1863	1578	1774	0	1823	1774	1770	1654	1774	1863	1546
Q Serve(g.s.) s	8.4	20.6	3.2	6.6	0.0	18.1	4.5	23.6	23.6	1.1	17.8	9.4
Cycle Q Clear(g.c.) s	8.4	20.6	3.2	6.6	0.0	18.1	4.5	23.6	23.6	1.1	17.8	9.4
Prop In Lane	1.00	1.00	1.00	1.00	0.11	1.00	0.63	1.00	1.00	1.00	1.00	1.00
Lane Grp Cap(c), veh/h	386	613	621	334	0	567	315	718	671	235	704	750
V/C Ratio(X)	0.59	0.71	0.13	0.53	0.00	0.67	0.43	0.70	0.70	0.14	0.59	0.32
Avail Cap(c.a), veh/h	414	613	621	394	0	567	440	718	671	383	704	750
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	21.4	29.4	19.4	22.4	0.0	30.0	19.0	24.7	24.7	19.8	25.9	15.8
Incr Delay (d2), s/veh	1.1	6.9	0.4	0.5	0.0	6.2	0.4	5.6	6.0	0.1	3.6	1.1
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	5.1	0.0
%ile BackOfQ(50%),veh/ln	4.1	11.7	1.5	3.2	0.0	10.1	2.2	12.6	11.8	0.6	12.5	4.2
LnGrp Delay(d),s/veh	22.4	36.3	19.8	22.8	0.0	36.2	19.4	30.3	30.6	19.9	34.6	16.9
LnGrp LOS	C	D	B	C	C	D	B	C	C	B	C	B
Approach Vol, veh/h	742			556			1109			687		
Approach Delay, s/veh	30.3			32.0			29.1			27.8		
Approach LOS	C			C			C			C		
Timer	1	2	3	4	5	6	7	8	7	8	7	8
Assigned Phs	1	2	3	4	5	6	7	8	7	8	7	8
Phs Duration (G+Y+Rc), s	11.6	36.8	9.4	42.1	13.5	35.0	6.7	44.9	6.7	44.9	6.7	44.9
Change Period (Y+Rc), s	3.0	3.9	3.0	* 4.3	3.0	3.9	3.0	4.3	3.0	4.3	3.0	4.3
Max Green Setting (Gmax), s	12.0	31.1	12.0	* 31	12.0	31.1	12.0	30.7	12.0	30.7	12.0	30.7
Max Q Clear Time (g.c+I1), s	8.6	22.6	6.5	19.8	10.4	20.1	3.1	25.6	3.1	25.6	3.1	25.6
Green Ext Time (g_e), s	0.1	2.0	0.1	1.7	0.1	1.7	0.0	2.1	0.0	2.1	0.0	2.1
Intersection Summary												
HCM 2010 Ctrl Delay	29.6			29.6			29.1			27.8		
HCM 2010 LOS	C			C			C			C		
Notes												
* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.												

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

03/12/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Future Volume (veh/h)	241	190	68	128	201	49	110	422	94	52	483	221
Traffic Volume (veh/h)	241	190	68	128	201	49	110	422	94	52	483	221
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Ob.) veh	0	0	0	0	0	0	0	0	0	0	0	12
Ped-Bike Adj(A_pbT)	0.99			1.00	1.00	0.97	1.00		0.98	1.00		0.96
Parking Bus. Adj												
Adj Sat Flow, veh/hln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	241	190	44	128	201	46	110	422	87	52	483	138
Adj No. of Lanes	1	1	1	1	1	0	1	2	0	1	1	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh. %	2	2	2	2	2	2	2	2	2	2	2	2
Cap. veh/h	432	432	502	453	271	62	340	1081	221	462	640	742
Arrive On Green	0.14	0.23	0.23	0.09	0.19	0.19	0.09	0.35	0.35	0.06	0.32	0.32
Sat Flow, veh/h	1774	1863	1581	1774	1458	334	1774	2916	596	1774	1863	1524
Grp Volume(V), veh/h	241	190	44	128	0	247	110	255	254	52	483	138
Grp Sat Flow(s), veh/hln	1774	1863	1581	1774	0	1792	1774	1770	1742	1774	1863	1524
Q Serve(g.s.) s	5.6	4.8	1.1	3.1	0.0	7.1	2.1	6.0	6.1	1.0	13.0	2.9
Cycle Q Clear(g.c.) s	5.6	4.8	1.1	3.1	0.0	7.1	2.1	6.0	6.1	1.0	13.0	2.9
Prop In Lane	1.00	1.00	1.00	1.00	0.19	1.00	0.34	1.00	1.00	1.00	1.00	1.00
Lane Grp Cap(c), veh/h	432	432	502	453	0	333	340	656	646	462	640	742
V/C Ratio(X)	0.56	0.44	0.09	0.28	0.00	0.74	0.32	0.39	0.39	0.11	0.75	0.19
Avail Cap(c.a), veh/h	747	715	748	686	0	525	589	1472	1449	735	1563	1498
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	15.5	19.5	14.3	16.8	0.0	22.8	12.7	13.4	13.4	10.8	17.6	8.5
Incr Delay (d2), s/veh	0.4	0.7	0.1	0.1	0.0	3.3	0.2	0.1	0.1	0.0	0.7	0.0
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	10.3	0.0
%ile BackOfQ(50%),veh/ln	3.0	2.7	0.5	1.6	0.0	4.1	1.1	3.0	3.0	0.5	10.4	1.2
LnGrp Delay(d),s/veh	15.9	20.2	14.4	16.9	0.0	26.1	12.9	13.5	13.5	10.9	28.6	8.6
LnGrp LOS	B	C	B	B	C	C	B	B	B	B	C	A
Approach Vol, veh/h	475			375			619			673		
Approach Delay, s/veh	17.5			23.0			13.4			23.1		
Approach LOS	B			C			B			C		
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	8.1	16.8	7.9	22.2	10.6	14.3	6.3	23.7				
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	21.1	12.0	* 46	17.0	16.1	12.0	45.7				
Max Q Clear Time (g.c+I1), s	5.1	6.8	4.1	15.0	7.6	9.1	3.0	8.1				
Green Ext Time (p.c), s	0.1	1.0	0.1	2.3	0.2	0.7	0.0	2.1				
Intersection Summary												
HCM 2010 Ctrl Delay	19.0											
HCM 2010 LOS	B											
Notes												