Appendix I:
Transportation Supporting Information

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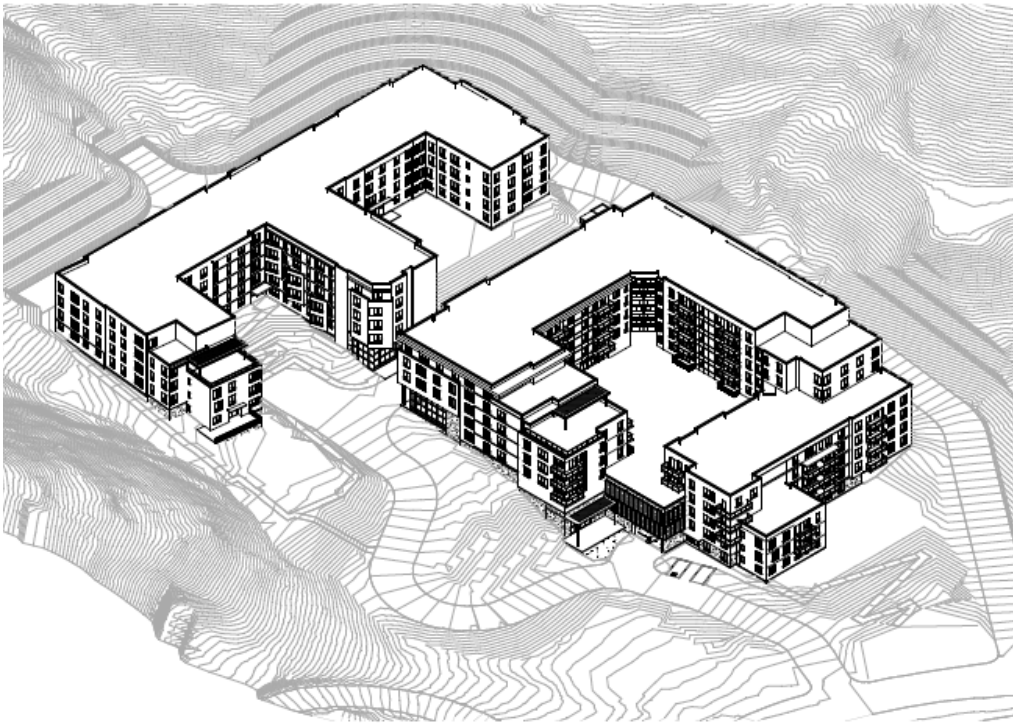
Final Traffic Impact Study for the Oak Hill Apartments Project



Prepared for the County of Marin

Submitted by
W-Trans

December 8, 2022

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Executive Summary

The proposed Oak Hill Apartments residential development project site is located just east of Drakes Cove Road and on the north side of East Sir Francis Drake Boulevard in unincorporated Marin County on land owned by the State of California. The proposed project consists of up to 250 affordable residential multifamily units in one three-to-five story building on a site that currently has a few sanitary sewer facilities but is otherwise vacant. The project site previously housed a shooting range. The trip generation for this project is anticipated to include an average of 1,360 trips per day, with 90 trips during the a.m. peak hour and 110 trips during the p.m. peak hour.

Access to the project site would be provided via a driveway on East Sir Francis Drake Boulevard approximately 165 feet east of Drakes Cove Road. Four alternatives were assessed for this access point, including installing stop controls on the access approach; installing a traffic signal on East Sir Francis Drake Boulevard at the project access; installing this traffic signal and providing an internal connection to Drakes Cove Road; and installing a traffic signal at East Sir Francis Drake Boulevard/Drakes Cove Road with project access on Drakes Cove Road. The purpose of the latter two alternatives would be to allow drivers on both Drakes Cove Road and the project access to enter or exit East Sir Francis Drake Boulevard at a signalized approach, which would assist in crossing the predominant traffic movements on East Sir Francis Drake Boulevard.

In addition to the project access, the study area includes the intersections of East Sir Francis Drake Boulevard with Larkspur Landing Circle, Drakes Cove Road, and Andersen Drive. An operational study was conducted for each of these intersections and, with each of the access alternatives, it was determined that all intersections would operate acceptably overall without or with the addition of project traffic, though certain alternatives would have better minor street approach operations for Drakes Cove Road and/or the project access. Either signalization with internal connection alternative would result in acceptable operations at both Drakes Cove Road and the project access, the project access signalization alternative without internal connection would result in LOS F operations for the Drakes Cove Road approach, and the stop-controlled project access alternative would result in LOS E or F operations for both the project access and Drakes Cove Road approaches. Turn lane queue lengths were also assessed and determined to remain within available stacking space for all scenarios.

Existing bicycle and transit facilities serving the project site are adequate; however, there is poor connectivity to the multi-use trail on the south side of East Sir Francis Drake Boulevard. Construction of a pedestrian crossing with a High-intensity Activated crossWalK (HAWK) beacon or a signal is recommended to improve the connection between the project site and multi-use path for pedestrians, bicyclists, and transit users. A HAWK is a traffic control device that activates to enable pedestrians to cross while drivers have a red indication like a traditional traffic signal, then the beacon switches to flashing red to enable drivers to proceed more quickly than with a signal once pedestrians are clear, then finally the beacon switches back to dark to enable drivers to proceed without stopping.

Access into the project site from East Sir Francis Drake Boulevard was evaluated, and a left-turn lane into the project site would be warranted, which would replace the existing acceleration lane for left-turning traffic entering East Sir Francis Drake Boulevard from Drakes Cove Road. A right-turn lane would also be warranted, though given that bicycle lanes are planned for this segment of roadway, widening the shoulder to provide a deceleration space would be more appropriate. A traffic signal would be warranted if an internal connection was constructed between the project access and Drakes Cove Road. Sight lines between drivers entering or exiting the project site and proceeding through on East Sir Francis Drake Boulevard were evaluated and found to be adequate for both the posted speed limit and field-measured critical speed.

A fire access road should be constructed that provides required access to the building exterior. Given the height of the building, this fire access road should also fulfill the requirements of an approved aerial apparatus access road where necessary as prescribed by the *California Fire Code* and *Municipal Code*. The project would have a less-than-significant impact on emergency response times.

As the project would be located in an area with residential vehicle miles traveled (VMT) less than 85 percent of the Countywide average, the project is presumed to have a less-than-significant impact to VMT.

Introduction

This report presents an analysis of the potential traffic impacts and effects on traffic operation that would be associated with development of a proposed 250-unit apartment complex to be located off East Sir Francis Drake Boulevard just east of Drakes Cove Road in the County of Marin. The traffic study was completed in accordance with the criteria established by the County of Marin and is consistent with standard traffic engineering techniques.

Prelude

The purpose of a traffic impact study is to provide decisionmakers with data that they can use to make an informed decision regarding the potential transportation impacts of a proposed project, and any associated improvements that would be required to mitigate these impacts to an acceptable level under CEQA or other policies. This report provides an analysis of those items that are identified as areas of environmental concern under the California Environmental Quality Act (CEQA) and that, if significant, require an EIR. Impacts associated with access for pedestrians, bicyclists, and to transit; the vehicle miles traveled (VMT) generated by the project; potential safety concerns such as increased queuing in dedicated turn lanes, adequacy of sight distance, need for turn lanes, and need for additional right-of-way controls; and emergency access are addressed in the context of the CEQA criteria. While no longer a part of the CEQA review process, vehicular traffic service levels at key intersections were evaluated for consistency with General Plan policies 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 anticipated travel patterns specific to the proposed project, then analyzing the effect the new traffic would be expected to have on the study intersections and need for improvements to maintain acceptable operation.

Project Profile

The project is a residential development proposed for a currently vacant site on East Sir Francis Drake Boulevard east of Drakes Cove Road in the County of Marin. The project as proposed includes up to 250 income-restricted (affordable) apartment units. The location of the project site is shown in Figure 1.

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Traffic Impact Study for the Oak Hill Apartments Project

Figure 1 – Study Area and Existing Lane Configurations

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Transportation Setting

Operational Analysis

Study Area and Periods

The study area consists of the following intersections:

1. East Sir Francis Drake Boulevard/Larkspur Landing Circle (East)
2. East Sir Francis Drake Boulevard/Drakes Cove Road
3. East Sir Francis Drake Boulevard/Project Access
4. East Sir Francis Drake Boulevard/Andersen Drive

It is noted that the project driveway was considered as a study intersection, though the *California Vehicle Code* defines an intersection as "the area embraced within the prolongation of the lateral curb lines, or, if none, then the lateral boundary lines of the roadways, of two highways which join one another at approximately right angles or the area within which vehicles traveling upon different highways joining at any other angle may come in conflict." This definition specifies that intersections are created where two "highways," or public streets, intersect. As driveways are not public streets, where they connect with a public road is not an intersection, so it would typically be unreasonable to evaluate it as such. As project access forms a critical part of this analysis, the project access point on East Sir Francis Drake Boulevard was assessed like an intersection, including operational delay. In addition, the driveway connection was evaluated for operational and safety issues such as adequacy of sight distance and need for turn lanes.

Operating conditions during the a.m. and p.m. peak periods were evaluated to capture the highest potential operational effects 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

East Sir Francis Drake Boulevard/Larkspur Landing Circle is a signalized tee intersection. East Sir Francis Drake Boulevard has two lanes in each direction and protected left-turn phasing in the eastbound direction. The Larkspur Landing Circle approach has two lanes and permissive phasing; the vehicle and pedestrian phases crossing East Sir Francis Drake Boulevard on the east and west legs activate concurrently with the Larkspur Landing Circle vehicle phase. There are curb ramps and crosswalks across all three legs, and a multi-use path parallel to East Sir Francis Drake Boulevard on the south side opposite Larkspur Landing Circle.

East Sir Francis Drake Boulevard/Drakes Cove Road is a tee-intersection with stop control on the Drakes Cove Road approach and no control on East Sir Francis Drake Boulevard. There is one approach lane from all three directions, a sidewalk on the northeast corner, and a multi-use path parallel to and south of East Sir Francis Drake Boulevard.

East Sir Francis Drake Boulevard/Project Access would provide access to the project site to and from East Sir Francis Drake Boulevard. There are multiple access alternatives evaluated later in the report, though at a minimum the Project Access approach would be stop controlled.

East Sir Francis Drake Boulevard/Andersen Drive is a tee-intersection. Andersen Drive is stop controlled while East Sir Francis Drake Boulevard is uncontrolled. There are bicycle lanes on Andersen Drive and on East Sir Francis

Drake Boulevard, and a marked bidirectional bicycle crossing on the Andersen Drive leg parallel to East Sir Francis Drake Boulevard.

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

Collision History

The collision history for the study area was reviewed to determine any trends or patterns that may indicate a safety issue. Collision rates were calculated based on records available from the California Highway Patrol as published in their Statewide Integrated Traffic Records System (SWITRS) reports. The most current five-year period available is January 2016 through December 2020.

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 *2018 Collision Data on California State Highways*, California Department of Transportation (Caltrans). These average rates statewide are for intersections in the same environment (urban, suburban, or rural), with the same number of approaches (three or four), and the same controls (all-way stop, two-way stop, or traffic signal). The study intersections of East Sir Francis Drake Boulevard/ Drakes Cove Road and East Sir Francis Drake Boulevard/Andersen Drive had collision rates higher than the statewide average for similar facilities in urban areas. The collision rate calculations are provided in Appendix A.

Table 1 – Collision Rates for the Study Intersections

Study Intersection	Number of Collisions (2016-2020)	Calculated Collision Rate (c/mve)	Statewide Average Collision Rate (c/mve)
1. E Sir Francis Drake Blvd/Larkspur Landing Cir	8	0.16	0.20
2. E Sir Francis Drake Blvd/Drakes Cove Rd	5	0.10	0.09
3. E Sir Francis Drake Blvd/Project Access	-	-	-
4. E Sir Francis Drake Blvd/Andersen Dr	11	0.21	0.09

Note: c/mve = collisions per million vehicles entering; Collisions at E Sir Francis Drake Blvd/Project Access were not assessed as the location does not currently exist

Of the five reported collisions for East Sir Francis Drake Boulevard/Drakes Cove Road, three were primarily attributed to speeding, one was the result of crossing into oncoming traffic, and one was caused by debris from an unsecured load. The three collisions attributed to speeding were caused by eastbound drivers on East Sir Francis Drake Boulevard.

There were 11 collisions reported for East Sir Francis Drake Boulevard/Andersen Drive during the study period, and they were primarily caused by right-of-way violations (six collisions), speeding (three collisions), and improper turning (two collisions). Six crashes were between southbound drivers turning left from Andersen Drive and westbound drivers proceeding through on East Sir Francis Drake Boulevard, including five during a weekday between 3:00 p.m. and 8:30 p.m. when the majority of traffic on East Sir Francis Drake Boulevard is traveling eastbound.

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, there is an existing but discontinuous

network of sidewalks, crosswalks, pedestrian signals, and curb ramps providing access for pedestrians in the vicinity of the proposed project site. Sidewalk gaps, obstacles, and barriers can be found along East Sir Francis Drake Boulevard connecting to the project site. For example, sidewalks along East Sir Francis Drake Boulevard only exist intermittently on the north side of the road west of Drakes Cove Road, and there are no sidewalks east of Drakes Cove Road on either side of the road. In addition, there are no crosswalks at East Sir Francis Drake Boulevard/Drakes Cove Road. 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.

Bicycle Facilities

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

- **Class I Multi-Use Path** – a completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross flows of motorized traffic minimized.
- **Class II Bike Lane** – a striped and signed lane for one-way bike travel on a street or highway.
- **Class III Bike Route** – signing only for shared use with motor vehicles within the same travel lane on a street or highway.
- **Class IV Bikeway** – also known as a separated bikeway, a Class IV Bikeway is for the exclusive use of bicycles and includes a separation between the bikeway and the motor vehicle traffic lane. The separation may include, but is not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking.

In the project area, there is a Class I multi-use path on the south side East Sir Francis Drake Boulevard, Class II bike lanes on Andersen Drive, and a Class II bike lane on the south side of the East Sir Francis Drake Boulevard ramps with I-580 with a Class IV bikeway on the north side that connects to Francisco Boulevard East. 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 *Marin County Unincorporated Area Bicycle and Pedestrian Master Plan,* County of Marin, 2018.

Table 2 – Bicycle Facility Summary

Status Facility	Class	Length (miles)	Begin Point	End Point
Existing				
E Sir Francis Drake Blvd	I	0.71	Drakes Cove Rd	Cal Park Hill Pathway
Cal Park Hill Pathway	I	1.30	Andersen Dr	E Sir Francis Drake Blvd
Larkspur Ferry Terminal	I	0.60	E Sir Francis Drake Blvd	E Sir Francis Drake Blvd
Andersen Dr	II	2.40	Lindaro St	E Sir Francis Drake Blvd
Freeway Legal Route	II	0.80	Andersen Dr	Main St
Larkspur Landing Cir	III	0.60	E Sir Francis Drake Blvd	E Sir Francis Drake Blvd
I-580 Overpass	IV	0.20	Andersen Dr	Francisco Blvd E
Planned				
E Sir Francis Drake Blvd	I/II	0.64	Drakes Cove Rd	Andersen Dr

Source: *Marin County Unincorporated Area Bicycle and Pedestrian Master Plan,* County of Marin, 2018

Transit Facilities

Regional and local fixed-route bus transit service is provided by the County of Marin through Marin Transit, the Golden Gate Bridge, Highway & Transportation District through the Larkspur Ferry, and the Sonoma-Marin Rail Transit District (SMART). These services connect to locations from the Mark West community north of Santa Rosa to San Francisco. Transit stations in the area provide a connection between local and regional transit services and the project site as summarized in Table 3. It is noted that service frequencies have been modified in response to the COVID-19 pandemic, but overall routes and stop locations have remained consistent with pre-pandemic conditions.

Table 3 – Transit Routes

Transit Agency Route	Distance to Stop (mi)[1]	Service			Connections
		Days of Operation	Time	Frequency	
Marin Transit					
Route 17	0.32	Weekdays Weekends	6:30 AM–11:30 PM 7:30 AM–11:30 PM	20–60 min 60 min	San Rafael, Larkspur Landing, Strawberry, Mill Valley, Sausalito
Route 29	0.49	Weekdays	6:45 AM–9:30 AM 2:45 PM–6:30 PM	60 min	San Rafael, Larkspur Landing, Marin Health Medical Center, College of Marin
Route 228	0.32	Weekdays Weekends	6:30 AM–8:30 PM 6:45 AM–7:30 PM	60 min 60 min	San Rafael, Larkspur Landing, College of Marin, Fairfax
Golden Gate Bridge, Highway & Transportation District					
Larkspur Ferry	0.36	Weekdays Weekends	6:30 AM–7:30 PM 9:30AM–8:15 PM	0.5–3 hrs 1–3.5 hrs	San Francisco
Sonoma-Marin Rail Transit District (SMART)					
SMART	0.62	Weekdays Weekends	5:00 AM–9:45 PM 7:30 AM–9:00 PM	0.5–3.5 hrs 2 hrs	Larkspur to Sonoma County Airport

Note: [1] Defined as the straight-line distance between the project site and the nearest transit stop

The nearest bus stop for Marin Transit Routes 17 and 228 is at Larkspur Landing Circle/Lincoln Village Circle. The nearest bus stop for Route 29 is at East Sir Francis Drake Boulevard/Larkspur Landing Circle. Ferry service is provided at the Larkspur Ferry Terminal and passenger rail service from the Larkspur SMART Station.

Two bicycles can use the rack on the front of most Marin Transit buses, 30 to 100 folding bikes and non-electric bikes may be brought aboard the Larkspur Ferry depending on the ship class, and 24 bicycles can be brought onto each two-car SMART train. For all transit services, bicycle storage is on a first come, first served basis.

Dial-a-ride, also known as paratransit, or door-to-door service, is available for those who are unable to independently use the transit system due to a physical or mental disability. Marin Transit offers a dial-a-ride service designed to serve the needs of individuals with disabilities within the project area and Marin County overall.

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), 6th Edition, Transportation Research Board, 2018. 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 the signals are coordinated or not, 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 signal timing obtained from the City of Larkspur.

The ranges of delay associated with the various levels of service are indicated in Table 4.

Table 4 – Intersection Level of Service Criteria		
LOS	**Two-Way Stop-Controlled**	**Signalized**
A	Delay of 0 to 10 seconds. Gaps in traffic are readily available for drivers exiting the minor street.	Delay of 0 to 10 seconds. Most vehicles arrive during the green phase, so do not stop at all.
B	Delay of 10 to 15 seconds. Gaps in traffic are somewhat less readily available than with LOS A, but no queuing occurs on the minor street.	Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop.
C	Delay of 15 to 25 seconds. Acceptable gaps in traffic are less frequent, and drivers may approach while another vehicle is already waiting to exit the side street.	Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.
D	Delay of 25 to 35 seconds. There are fewer acceptable gaps in traffic, and drivers may enter a queue of one or two vehicles on the side street.	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.
E	Delay of 35 to 50 seconds. Few acceptable gaps in traffic are available, and longer queues may form on the side street.	Delay of 55 to 80 seconds. Most, if not all, vehicles must stop and drivers consider the delay excessive.
F	Delay of more than 50 seconds. Drivers may wait for long periods before there is an acceptable gap in traffic for exiting the side streets, creating long queues.	Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.

Reference: *Highway Capacity Manual*, 6th Edition, Transportation Research Board, 2018

Traffic Operation Standards

While the project is proposed to be constructed in an unincorporated portion of Marin County, the intersections of East Sir Francis Drake Boulevard/Larkspur Landing Circle and East Sir Francis Drake Boulevard/Drakes Cove Road are in the City of Larkspur, and the intersection of East Sir Francis Drake Boulevard/Andersen Drive is in the City of San Rafael; the County has jurisdiction over only the project access point connection.

For the City of Larkspur, the Level of Service (LOS) standard is LOS D or better for signalized and unsignalized intersections as defined in the *2040 General Plan Draft*, City of Larkspur, 2020.

The City of San Rafael's *General Plan 2040*, 2021 contains Policy M-2.5 which states that the City's LOS standard is LOS D, though lower levels of service are allowed for certain facilities outside of this project's study area. The *City of San Rafael Transportation Analysis Guidelines*, 2021, prescribe that if an intersection is already at LOS E or F without the project, a deficiency would occur if the addition of project traffic would increase the intersection delay by five seconds or more. For queuing, a deficiency would occur if the 95th percentile vehicle queues would exceed the existing or planned length of a turn lane or off-ramp, create a speed differential between two adjacent lanes of travel, or increase already deficient queues by more than 50 feet.

The *Marin Countywide Plan*, Marin County Community Development Agency, 2014, established an operational standard of LOS D for intersections on urban and suburban arterials, including East Sir Francis Drake Boulevard. This standard is based on the Congestion Management Plan developed by the Transportation Authority of Marin. If an intersection is operating unacceptably, an increase in delay would be considered deficient if the project would cause an intersection operating acceptably without the project to experience deterioration in service from LOS E to F. This threshold was defined through correspondence with the County.

The City of Larkspur and the County of Marin do not prescribe thresholds of significance regarding queue lengths. Therefore, the queue length threshold defined by the City of San Rafael was applied to the entire study area.

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 In July 2021.

Consideration was given to the effects of the COVID-19 pandemic on travel patterns, and therefore daily traffic volumes available from Caltrans for the I-580 ramps to and from East Sir Francis Drake Boulevard were reviewed. These volumes indicate an average daily traffic (ADT) volume of approximately 25,600 vehicles using the ramps on a typical weekday in June 2019 compared to an ADT of 28,200 daily vehicles in June 2021 and a 24-hour machine count on East Sir Francis Drake Boulevard in July 2021 that recorded 28,153 vehicles. As these more recent volumes indicate an increase in traffic since 2019, it can be concluded that the traffic counts collected in July 2021 sufficiently represent typical traffic patterns in the study area despite the effects of the pandemic.

Intersection Levels of Service

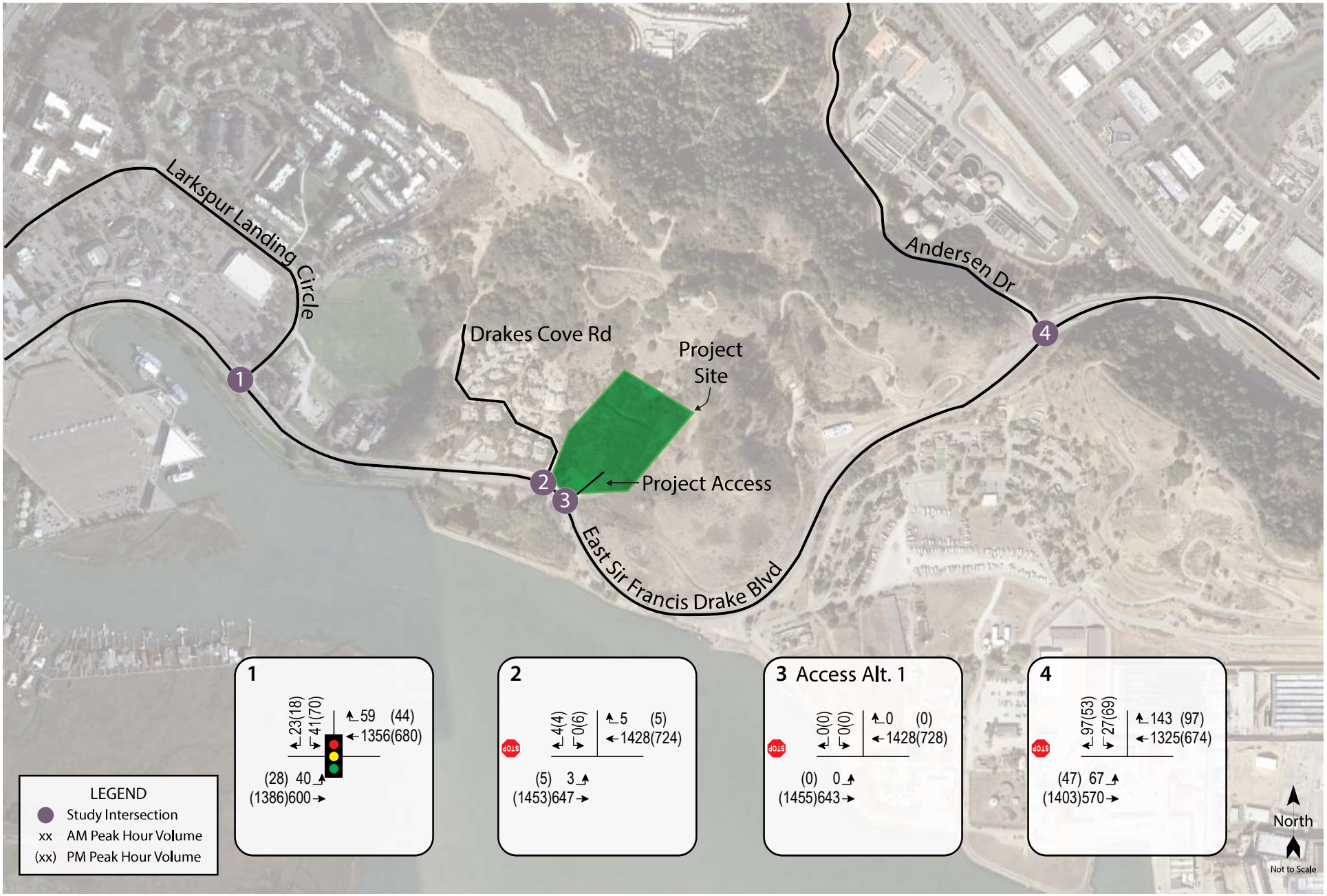
Under existing conditions, all intersections are operating with acceptable overall delay, although the southbound approach to East Sir Francis Drake Boulevard/Andersen Drive operates at LOS E during the a.m. peak hour and LOS F during the p.m. peak hour. A summary of the intersection Level of Service calculations is contained in Table 5, and copies of the calculations are provided in Appendix B. The existing traffic volumes are shown in Figure 2.

Table 5 – Existing Peak Hour Intersection Levels of Service

	Study Intersection	**Controls**	**AM Peak**		**PM Peak**	
	Approach		**Delay**	**LOS**	**Delay**	**LOS**
1.	E Sir Francis Drake Blvd/Larkspur Landing Cir	Signal	8.4	A	5.9	A
2.	E Sir Francis Drake Blvd/Drakes Cove Rd	TWSC	0.1	A	0.1	A
	Southbound (Drakes Cove Rd) Approach		28.2	D	24.3	C
3.	E Sir Francis Drake Blvd/Project Access	TWSC	-	-	-	-
	Southbound (Project Access) Approach		-	-	-	-
4.	E Sir Francis Drake Blvd/Andersen Dr	TWSC	0.9	A	1.8	A
	Southbound (Andersen Dr) Approach		*35.4*	*E*	*53.4*	*F*

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

On sections of certain arterial streets, it is typical to have all of the side streets operating at LOS E or F with long traffic delays, even where side street volumes are very low. It is noted, however, that the relevant jurisdictional standards applied for intersection operations only apply to overall intersection operations, and not individual approaches or movements. Therefore, even though the southbound approach to East Sir Francis Drake Boulevard/Andersen Drive is operating at LOS E or F during both peak hours, no countermeasures were explored as the intersection is operating acceptably overall.



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Traffic Impact Study for the Oak Hill Apartments Project

Figure 2 – Existing Traffic Volumes

Project Description

The project consists of up to 250 affordable residential multifamily units in one building ranging from three to five stories tall on a site that is currently vacant other than some sanitary sewer facilities. The previous land use was a shooting range for law enforcement personnel. The majority of parking spaces would be contained in a partially underground garage, and project access would be provided by a driveway connecting to East Sir Francis Drake Boulevard approximately 165 feet east of Drakes Cove Road or a driveway on Drakes Cove Road. The proposed project site plan is shown in Figure 3.

Trip Generation

The anticipated trip generation for the proposed project was estimated using standard rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 10th Edition, 2017 for "Multifamily Housing (Mid-Rise)" (ITE LU 221). The proposed project is expected to generate an average of 1,360 trips per day, including 90 trips during the a.m. peak hour and 110 during the p.m. peak hour; these new trips represent the increase in traffic associated with the project compared to existing volumes. The expected trip generation potential for the proposed project is indicated in Table 6.

Table 6 – Trip Generation Summary

Land Use	Dwelling Units	Daily		AM Peak Hour				PM Peak Hour			
		Rate	Trips	Rate	Trips	In	Out	Rate	Trips	In	Out
Apartments	250	5.44	1,360	0.36	90	23	67	0.44	110	67	43

Trip Distribution

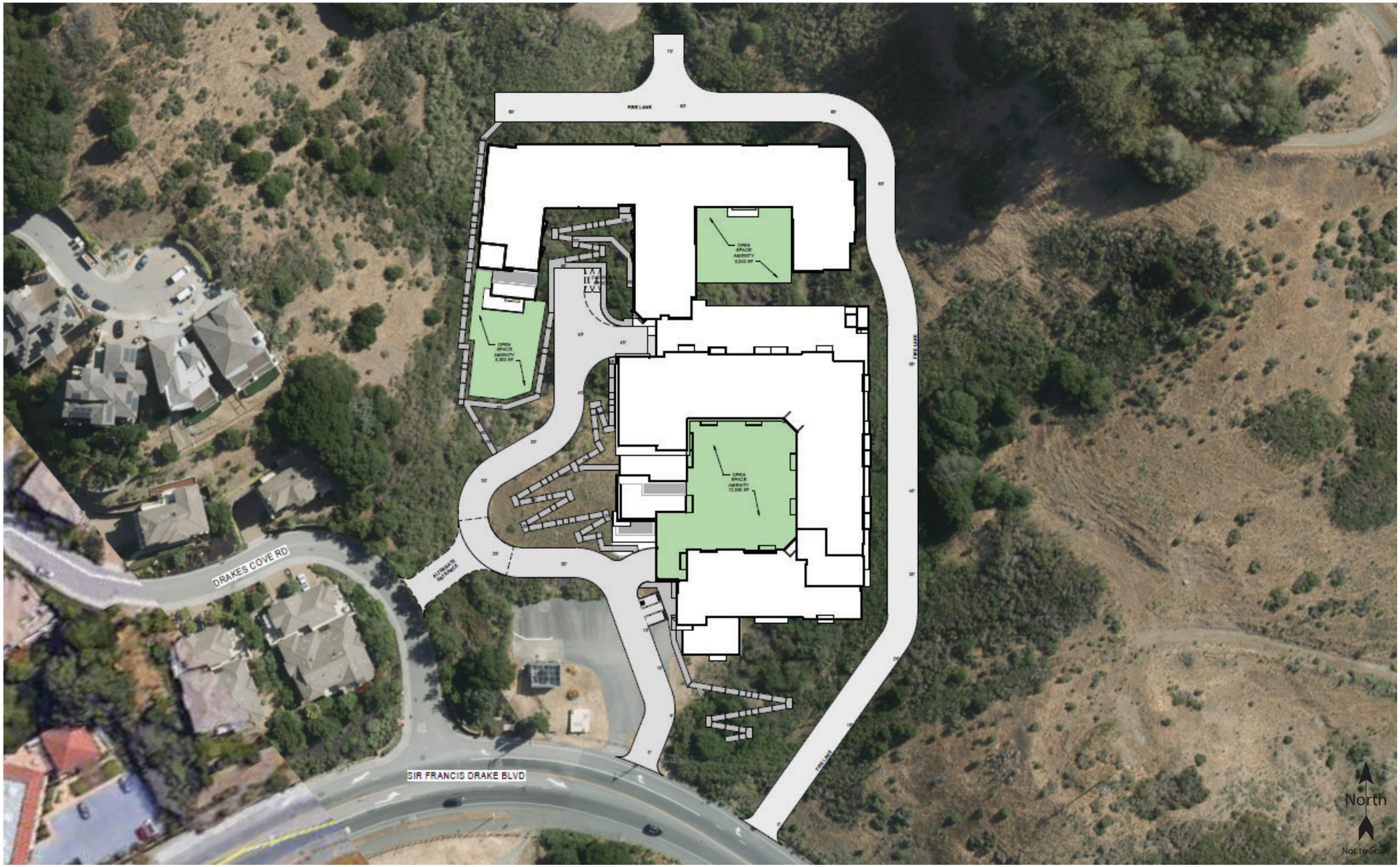
The pattern used to allocate new project trips to the street network was based on data from the US Census Bureau, the OnTheMap Application, and LEHD Origin-Destination Employment Statistics for 2018 for home-to-work trips. The applied distribution assumptions and resulting trips are shown in Table 7. Figure 4 shows the anticipated project volumes as applied to each study intersection.

Table 7 – Trip Distribution Assumptions

Route	Percent	Daily Trips	AM Trips	PM Trips
E Sir Francis Drake Blvd west of Larkspur Landing Cir	70%	952	64	78
E Sir Francis Drake Blvd east of Andersen Dr	15%	204	13	16
Andersen Dr north of E Sir Francis Drake Blvd	10%	136	9	11
Larkspur Landing Cir north of E Sir Francis Drake Blvd	5%	68	4	5
TOTAL	**100%**	**1,360**	**90**	**110**

Access Alternatives

Four access alternatives were considered to determine the optimal combination of stop control and signal control at East Sir Francis Drake Boulevard/Project Access and East Sir Francis Drake Boulevard/Drakes Cove Road, as well as the potential operational benefit of connecting the project and Drakes Cove Road internally. The four access alternatives are detailed below.



Source: Thompson Dorfman + Eden Housing 10/12

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Traffic Impact Study for the Oak Hill Apartments Project

Figure 3 – Site Plan

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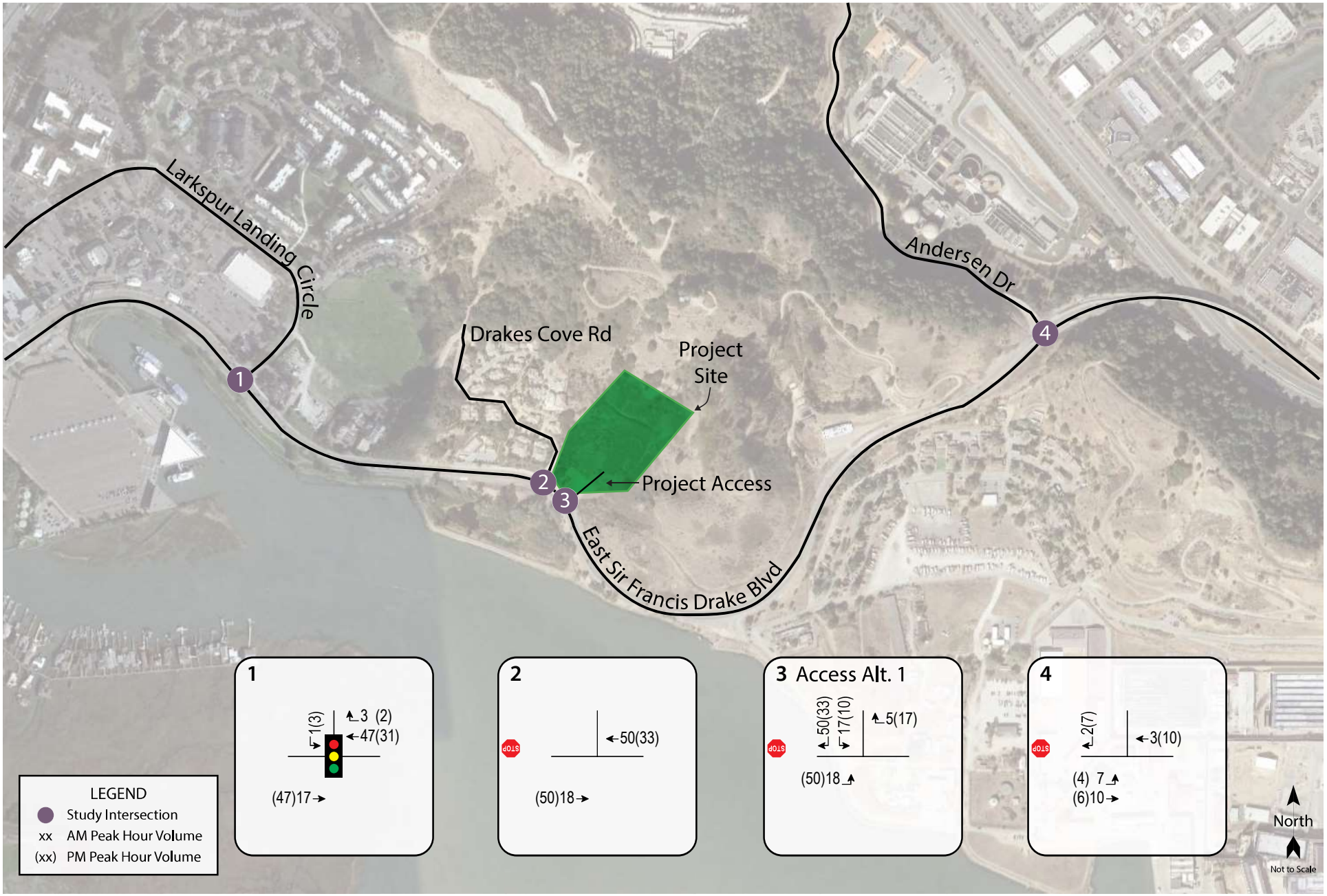

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Traffic Impact Study for the Oak Hill Apartments Project

Figure 4 – Project Traffic Volumes

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- **Alternative 1 – Existing Controls:** The project would connect to East Sir Francis Drake Boulevard with stop control on the project access approach only. No modifications to the controls on East Sir Francis Drake Boulevard or to Drakes Cove Road would occur, although the eastbound acceleration lane on East Sir Francis Drake Boulevard from Drakes Cove Road would be converted to a left-turn lane into the project site.

- **Alternative 2 – Signalized Project Access:** A traffic signal would be installed at East Sir Francis Drake Boulevard/Project Access and the eastbound acceleration lane from Drakes Cove Road would be converted to a left-turn lane into the project site.

- **Alternative 3 – Signalized Project Access with Internal Connection to/from Drakes Cove Road:** This option is the same as Alternative 2, except drivers would be able to route between Drakes Cove Road and the project site from East Sir Francis Drake Boulevard. The advantage would be that drivers at Drakes Cove Road wishing to turn left onto East Sir Francis Drake Boulevard or wishing to turn left from East Sir Francis Drake Boulevard onto Drakes Cove Road would instead be able to complete these movements with the aid of the traffic signal, instead of waiting for gaps in traffic to complete the movement. For this alternative, all left-turn movements were assumed to use East Sir Francis Drake Boulevard/Project Access, and right-turn movements were assumed to use the same intersection as in Alternatives 1 and 2.

- **Alternative 4 – Signalized Drakes Cove Road with Project Access via Drakes Cove Road:** This option would result in signalization of East Sir Francis Drake Boulevard/Drakes Cove Road with project access provided on Drakes Cove Road only such that all project trips would access East Sir Francis Drake Boulevard via Drakes Cove Road.

Schematic examples of each of these access alternatives are presented in Figures 5 through 8 for Alternatives 1 through 4, respectively.

Intersection Operation

Existing plus Project Conditions

Upon the addition of project-related traffic to the Existing volumes, the overall intersection delay of each study intersection is expected to be acceptable, although the minor street approaches would operate at LOS E or F in several instances. While this would not constitute an adverse effect of the project, nonetheless the high minor street delays should be considered when selecting a preferred alternative. Existing plus Project traffic volumes are shown in Figure 9. These results are summarized in Table 8 for the morning peak hour and Table 9 for the evening peak hour.

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Traffic Impact Study for the Oak Hill Apartments Project

Figure 5 – Stop Sign for Project Driveway Approach, Acceleration Lane Changed to Left-Turn Lane

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Traffic Impact Study for the Oak Hill Apartments Project

Figure 6 – Traffic Signal at Project Driveway, Acceleration Lane Changed to Left-Turn Lane

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Traffic Impact Study for the Oak Hill Apartments Project

Figure 7 – Traffic Signal at Project Driveway, Acceleration Lane Changed to Left-Turn Lane, Internal Access to Drakes Cove Road

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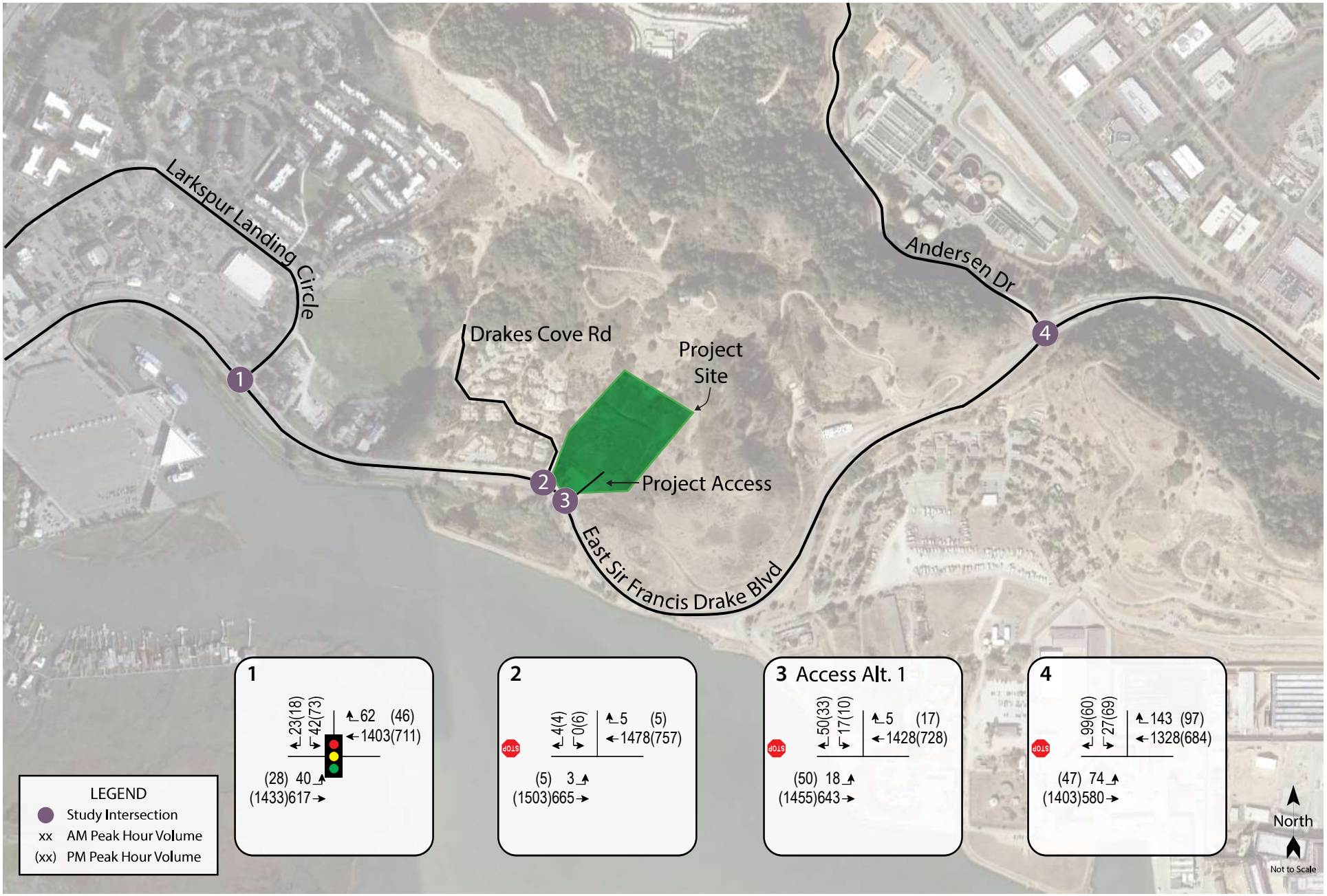
Traffic Impact Study for the Oak Hill Apartments Project

Figure 8 – Traffic Signal at Drakes Cove Road, Acceleration Lane Changed to Painted Median, Internal Access to Drakes Cove Road



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Traffic Impact Study for the Oak Hill Apartments Project

Figure 9 – Existing Plus Project Traffic Volumes

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

Study Intersection *Approach*	Control	Scenario									
		Existing		E+PA1		E+PA2		E+PA3		E+PA4	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. ESFDB/Larkspur Landing Cir	Signal	8.4	A	8.7	A	8.7	A	8.7	A	8.7	A
2. ESFDB/Drakes Cove Rd	TWSC	0.1	A	0.1	A	0.1	A	0.1	A	-	-
SB (Drakes Cove Rd) Approach		*28.2*	*D*	*30.0*	*D*	*30.0*	*D*	*30.0*	*D*	-	-
Signalized	Signal	-	-	-	-	-	-	-	-	12.1	B
3. ESFDB/Project Access	TWSC	-	-	1.6	A	-	-	-	-	-	-
SB (Project Access) Approach		-	-	*42.8*	*E*	-	-	-	-	-	-
Signalized	Signal	-	-	-	-	12.8	B	12.8	B	-	-
4. ESFDB/Andersen Dr	TWSC	0.9	A	0.9	A	0.9	A	0.9	A	0.9	A
SB (Andersen Dr) Approach		*35.4*	*E*	*36.2*	*E*	*36.2*	*E*	*36.2*	*E*	*36.2*	*E*

Notes: ESFDB = East Sir Francis Drake Boulevard; TWSC = two- or one-way stop-control; Delay is measured in average seconds per vehicle; LOS = Level of Service; E+PA1 = Existing plus Project with Alternative 1; E+PA2 = Existing plus project with Alternative 2; E+PA3 = Existing plus Project with Alternative 3; E+PA4 = Existing plus Project with Alternative 4; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*

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

Study Intersection *Approach*	Control	Scenario									
		Existing		E+PA1		E+PA2		E+PA3		E+PA4	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. ESFDB/Larkspur Landing Cir	Signal	5.9	A	6.0	A	6.0	A	6.0	A	6.0	A
2. ESFDB/Drakes Cove Rd	TWSC	0.1	A	0.3	A	0.3	A	0.0	A	-	-
SB (Drakes Cove Rd) Approach		*24.3*	*C*	*74.3*	*F*	*74.3*	*F*	*14.2*	*B*	-	-
Signalized	Signal	-	-	-	-	-	-	-	-	13.6	B
3. ESFDB/Project Access	TWSC	-	-	1.9	A	-	-	-	-	-	-
SB (Project Access) Approach		-	-	*28.8*	*D*	-	-	-	-	-	-
Signalized	Signal	-	-	-	-	11.2	B	11.3	B	-	-
4. ESFDB/Andersen Dr	TWSC	1.8	A	1.8	A	1.8	A	1.8	A	1.8	A
SB (Andersen Dr) Approach		*53.4*	*F*	*55.3*	*F*	*55.3*	*F*	*55.3*	*F*	*55.3*	*F*

Notes: ESFDB = East Sir Francis Drake Boulevard; TWSC = two- or one-way stop-control; Delay is measured in average seconds per vehicle; LOS = Level of Service; E+PA1 = Existing plus Project with Alternative 1; E+PA2 = Existing plus project with Alternative 2; E+PA3 = Existing plus Project with Alternative 3; E+PA4 = Existing plus Project with Alternative 4; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*

Upon the addition of project traffic to existing volumes at East Sir Francis Drake Boulevard/Larkspur Landing Circle, the intersection would continue to operate at LOS A during both peak hours. Likewise, East Sir Francis Drake Boulevard/Andersen Drive would operate at LOS E during the a.m. peak hour and LOS F during the p.m. peak hour without or with the addition of project-generated traffic. An adverse effect would not occur as the overall intersection would continue to operate acceptably.

Under Alternative 1 (Existing Controls), the p.m. peak hour delay at East Sir Francis Drake Boulevard/ Drakes Cove Road would increase from 24.3 seconds (LOS C) to 74.3 seconds (LOS F) due to the conversion of the acceleration lane for drivers turning left onto East Sir Francis Drake Boulevard from Drakes Cove Road into a left-turn lane for drivers to turn into the project site. Without the acceleration lane, drivers on Drakes Cove Road turning left would need to wait for gaps to appear in both directions rather than just the westbound direction, increasing the approach delay. It is noted that the a.m. peak hour would likely incur a similar effect, except no southbound drivers turned left during the peak hour when the counts were performed. The project access approach to East Sir Francis Drake Boulevard/ Project Access would face a similar effect during the a.m. peak hour, with 42.8 seconds of delay (LOS E). This delay could be reduced by widening East Sir Francis Drake Boulevard to accommodate an acceleration lane similar to the existing acceleration lane for Drakes Cove Road.

With Alternative 2 (Signalized Project Access), the installation of a traffic signal at East Sir Francis Drake Boulevard/ Project Access would appreciably reduce delay for drivers entering from the project access though it would increase delay for drivers on East Sir Francis Drake Boulevard, who previously did not have any control delay at this location. Overall, East Sir Francis Drake Boulevard/Project Access would operate at LOS B during both peak hours. There would be no change to East Sir Francis Drake Boulevard/Drakes Cove Road compared to Alternative 1, so it would operate at the same Levels of Service.

Alternative 3 (Signalized Project Access with Internal Connection to/from Drakes Cove Road) would result in similar operations at East Sir Francis Drake Boulevard/Project Access as Alternative 2 – LOS B during both peak hours. By allowing drivers to route between Drakes Cove Road and the signal at East Sir Francis Drake Boulevard/Project Access, it is assumed that drivers turning left onto or off of East Sir Francis Drake Boulevard would prefer to use the signal to complete these movements, which would greatly reduce delay during the p.m. peak hour at East Sir Francis Drake Boulevard/Drakes Cove Road compared to Alternatives 1 or 2 as the left-turn movements were the primary contributor towards LOS F operation. For the morning peak hour, there were no left turns out of Drakes Cove Road observed; therefore, the operational analysis of Alternative 3 returned the same result as Alternatives 1 and 2 for the a.m. peak hour at East Sir Francis Drake Boulevard/Drakes Cove Road.

The application of Alternative 4 (Signalized Drakes Cove Road with Project Access on Drakes Cove Road) would result in LOS B operation at East Sir Francis Drake Boulevard/Drakes Cove Road during both peak hours.

Finding – Under all four alternatives, the study intersections would all operate at LOS A or B overall, precluding an adverse effect to operations. For informational purposes regarding the difference between the access options, Alternatives 3 and 4 would have the lowest minor approach delay at East Sir Francis Drake Boulevard/Drakes Cove Road and East Sir Francis Drake Boulevard/Project Access, though each alternative would require project access on Drakes Cove Road. Alternatives 1 and 2 would not require this internal connection but would result in LOS E or F operations on the Drakes Cove Road approach during the p.m. peak hour, and Alternative 1 would result in deficient operations on the project access approach during the a.m. peak hour. For Alternative 1, this deficiency could be eliminated by widening East Sir Francis Drake Boulevard to provide an acceleration lane for drivers turning left out of the project site.

Queuing

Under each scenario, the projected maximum queues in left-turn pockets at the study intersections were determined using the SIMTRAFFIC application of Synchro and averaging the maximum projected queue for each of ten runs. Summarized in Table 10 are the predicted queue lengths for the left-turn lanes. Copies of the SIMTRAFFIC projections are contained in Appendix C.

Table 10 – Maximum Left-Turn Queues Exceeding Available Storage

Study Intersection *Movement*	Available Storage	Maximum Queues									
		AM Peak Hour					PM Peak Hour				
		E	E + PA1	E + PA2	E + PA3	E + PA4	E	E + PA1	E + PA2	E + PA3	E + PA4
1. ESFDB/Larkspur Landing Cir											
Eastbound Left-Turn	170	66	64	60	62	65	76	87	95	81	129
2. ESFDB/Drakes Cove Rd											
Eastbound Left-Turn	150	13	10	17	-	70	19	18	15	-	128
3. ESFDB/Project Access											
Eastbound Left-Turn	110	-	39	48	63	-	-	47	60	58	-
4. ESFDB/Andersen Dr											
Eastbound Left-Turn	170	115	138	108	128	131	45	50	48	49	50

Notes: Maximum Queue based on the average of the maximum value from ten SIMTRAFFIC runs; all distances are measured in feet; ESFDB = East Sir Francis Drake Boulevard; E = existing conditions; E+PA1 = Existing plus Project with Alternative 1; E+PA2 = Existing plus project with Alternative 2; E+PA3 = Existing plus Project with Alternative 3; E+PA4 = Existing plus Project with Alternative 4; A dash indicates a movement where no left turns were assigned and therefore queue length was not reported

Finding – The project would not cause any queues to exceed available storage under any of the four alternatives studied. Therefore, the project would have a less-than-significant impact on queuing.

Alternative Modes

Pedestrian Facilities

Given the proximity of restaurants, retail, the SMART station, and the Larkspur Ferry Terminal to the west of the site, it is reasonable to assume that some project residents would want to walk or bicycle to reach these nearby amenities.

Internal Circulation and Project Frontage

The site plan shows a network of internal walkways connecting the various on-site facilities, including a sidewalk parallel to the drive aisle connecting the apartment building to East Sir Francis Drake Boulevard. No sidewalks are shown on East Sir Francis Drake Boulevard. The County of Marin maintains via *Municipal Code Section 24.04.440(a)* that "sidewalks shall be required on both sides of all roads within residential areas where densities will be equal to or ultimately exceed four units per acre." Based on information provided by County staff, this project would not be subject to any local ordinances relating to pedestrian circulation due to principles of State sovereignty.

Finding – The internal sidewalk network depicted on the site plan is anticipated to be adequate. There are gaps in the sidewalk network on the north side of East Sir Francis Drake Boulevard, though the project would not cause such gaps or result in or exacerbate any safety impact. The project would provide for an adequate connection to a pedestrian trail as outlined below. It is noted that the County has confirmed it would not require sidewalks along East Sir Francis Drake Boulevard based on principles of State sovereignty.

East Sir Francis Drake Crossing

There is an existing multi-use trail parallel to and on the south side of East Sir Francis Drake Boulevard that provides an existing connection to the amenities noted above. Construction of a crosswalk across East Sir Francis Drake Boulevard would enable residents and visitors of the project to access this trail, though right-of-way controls such as a signal or High-intensity Activated crossWalK (HAWK) beacon should be constructed to facilitate pedestrians crossing the busy road given the high speed of approaching traffic. A HAWK beacon is right-of-way control device that remains dark (does not control vehicle traffic) in the absence of pedestrian traffic but is activated when a pedestrian pushes the crosswalk button. At that point, the beacon flashes yellow for a few seconds before presenting a solid yellow followed by a red indication that requires motor vehicle traffic to stop; the simultaneous "walk" indication allows pedestrians to cross akin to a traditional traffic signal. Sufficient time is provided for the pedestrian to enter the roadway and begin crossing then the walk indication transitions to "flashing don't walk" (raised hand) and the traffic indication switches to flashing red, allowing pedestrians to finish crossing and drivers to proceed if safe after stopping. Once the "flashing don't walk" indication expires, the signal returns to dark and drivers are able to proceed without stopping.

Guidance from the Federal Highway Administration's *Field Guide for Selecting Countermeasures at Uncontrolled Pedestrian Crossing Locations,* July 2018, indicates that a HAWK would be recommended for this location given the geometry, volumes, and speeds along East Sir Francis Drake Boulevard.

Chapter 4C of the *California Manual on Uniform Traffic Control Devices* (CA-MUTCD) provides guidance for the installation of HAWKs based on a chart of major road vehicle volumes plotted against pedestrian volumes crossing the major street. The CA-MUTCD chart includes different minimum threshold lines based on the curb-to-curb width that the crossing treatment would occupy, with shorter lengths requiring higher volumes to warrant any particular treatment. With 2,188 vehicles on East Sir Francis Drake Boulevard during the p.m. peak hour, a HAWK would be warranted with 20 pedestrian crossings at any crosswalk length. To determine the likelihood that the volume of pedestrian trips that would be generated by the project would warrant installation of a HAWK, the

standard p.m. person-trip rate published in the *Trip Generation Manual* for "Multifamily Housing (Mid-Rise)" (Land Use #221) was used. The application of this rate indicates that the 250-unit project would be expected to generate an average of 130 person-trips during the p.m. peak hour, at a rate of 0.52 person-trips per dwelling unit.

According to the US Census data from the 2019 American Community Survey 11.2 percent of residents of the City of Larkspur used transit to commute to work, along with 3.8 percent walking and 1.0 taking "other" modes, which is assumed to include bicycling as it is not listed elsewhere in the data. The remainder reported driving alone, carpooling, or working from home. The combined 16 percent of commuters taking transit, walking, or other modes would represent 21 of the 130 person-trips generated by the project. As all transit stops/stations, employment centers, and other facilities accessible on foot are to the west of the project site, and continuous sidewalk coverage is not available on the north side of East Sir Francis Drake Boulevard, it was assumed that these 21 persons would desire to cross East Sir Francis Drake Boulevard to access the multi-use trail on the south side of the road to get to these amenities. With an estimated demand of 21 crossing pedestrians added to the 2,188 vehicles on East Sir Francis Drake Boulevard, a HAWK would be warranted per guidance from the CA-MUTCD.

The *Transportation Cooperative Research Program Report 112/National Cooperative Highway Research Program Report 562* (TCRPR 112/NCHRPR 562), Transportation Research Board, 2006, includes information for assessing pedestrian crossing treatments based on a chart of major road vehicle volumes plotted against pedestrian volumes crossing the major street. Depending on the volume of vehicles and pedestrians, the report recommends an increasing intensity of treatment, progressing from crosswalks to rectangular rapid flashing beacons (RRFBs), and finally to right-of-way control (HAWKs and signals). The minimum threshold for the installation of any of these devices is 20 pedestrians per hour crossing the major street. With 2,188 vehicles on East Sir Francis Drake Boulevard and an estimated crossing demand of 21 pedestrians during the p.m. peak hour, guidance from the TCRPR 112/ NCHRPR 562 indicates that a HAWK or signal would be appropriate.

It is noted that a crossing also has the potential to provide access to the multi-use trail for residents on Drakes Cove Road, which may further increase pedestrian demand at the crossing. A pedestrian connection between the project site and Drakes Cove Road should be provided to provide access between residences on Drakes Cove Road and the pedestrian crossing on East Sir Francis Drake Boulevard.

It is also noted that a HAWK or signal would intermittently stop traffic on East Sir Francis Boulevard, which may be a concern for westbound traffic approaching from the east of the site as the hill on the inside of that curve limits sight distance indicating the need for additional warning about the potential for a red signal or stopped vehicles around the corner, creating a potentially significant impact with regard to hazards posed by geometric design features. Following design guidance and best practice for sight-obstructed roadway facilities, such as installation of enhanced warning signs, potentially including a system that would activate a flashing beacon concurrent with a red signal for westbound traffic or when stopped traffic is detected, would raise awareness of stopped traffic for approaching drivers and reduce this potential impact to less than significant with mitigation.

Copies of the pedestrian crossing warrant worksheets are provided in Appendix D.

Finding – Considering the estimated pedestrian crossing demand generated by the project, a HAWK would be warranted based on guidance provided by the Federal Highway Administration, CA-MUTCD, and TCRPR 112/NCHRPR 562. There is a potential safety concern regarding westbound traffic unable to see the HAWK, signal, or queued vehicles around the hill east of the project site.

Recommendation – Installation of a pedestrian crossing is recommended on East Sir Francis Boulevard in conjunction with right-of-way control in the form of a signal or HAWK. This crossing should connect the project site and the multi-use trail. Enhanced signage should be posted east of the crossing for westbound drivers to raise awareness of the potential for crossing pedestrians, red signals, and stopped vehicles around the curve to result in a less-than-significant impact with mitigation to potential geometric design hazards.

Bicycle Facilities

Existing bicycle facilities, including the multi-use trail along the south side of East Sir Francis Boulevard, provide adequate access for bicyclists to the west of the project site, and the proposed Class I multi-use path and Class II bike lanes proposed in the *Marin County Unincorporated Area Bicycle and Pedestrian Master Plan* would provide adequate access to the east. However, accessing the multi-use trail across East Sir Francis Boulevard may be challenging given the volumes on the roadway, for which the pedestrian crossing recommended above would provide an enhanced connection for bicyclists between the project site and trail.

Finding – Existing and planned bicycle facilities serving the project site are or would be adequate, except crossing East Sir Francis Boulevard to access the multi-use trail may be difficult. The pedestrian crossing recommended above would enhance this connection for bicyclists as well.

Recommendation – The recommended pedestrian crossing on East Sir Francis Boulevard at the project access is further recommended as it would accommodate bicyclists routing between the site and multi-use trail.

Bicycle Storage

The project site plan does not identify the provision of bicycle parking or storage facilities, though the applicant has indicated that approximately 30 short-term and 180 long-term parking spaces would be provided. As the site is owned by the State, the County of Marin *Municipal Code* does not directly apply. This has been confirmed with County of Marin staff.

Finding – Bicycle parking is not required as the project is a State project for which County staff have determined their standards and policies do not apply. The applicant has indicated that approximately 30 short-term and 180 long-term spaces would be provided.

Transit

Existing transit routes are adequate to accommodate project-generated transit trips. Existing stops are within an acceptable walking distance of the site, though enhanced connectivity for pedestrians across East Sir Francis Boulevard would enable pedestrians to access these facilities more safely and conveniently.

It is noted that as a result of the COVID-19 pandemic, transit service frequencies have been reduced. However, the overall routes serving the study area and stop locations have not been changed and no effect to this analysis is anticipated as a result.

Finding – Transit facilities serving the project site are adequate. The previously recommended pedestrian crossing would improve access of these transit facilities for project site residents and visitors.

Recommendation – The recommended pedestrian crossing on East Sir Francis Boulevard at the project access is recommended further as it would enable pedestrians to more easily and safety cross East Sir Francis Boulevard to route between the project site and nearby transit facilities via the multi-use trail.

Access and Circulation

The project site currently has a paved driveway providing access to the site. The project would reconstruct this driveway and add an internal walkway to provide an off-street pedestrian connection between the project building and East Sir Francis Drake Boulevard. Note that this is separate from a sidewalk facility on and parallel to East Sir Francis Drake Boulevard, which is discussed further under the Pedestrian Facilities section. Between the four access alternatives, two alternatives propose stop control for vehicles leaving the site and entering East Sir Francis Drake Boulevard, and two alternatives propose installing a traffic signal at the project access point on East Sir Francis Drake Boulevard. All four alternatives would convert the eastbound acceleration lane for southbound drivers turning left at East Sir Francis Drake Boulevard/Drakes Cove Road into an eastbound left-turn lane for drivers turning into the project site.

Sight Distance

Sight distances along East Sir Francis Drake Boulevard at the project access point were evaluated using sight distance criteria contained in the *Highway Design Manual* (HDM) published by Caltrans. The recommended sight distances for approaches on the major street to driveways and private street intersections are based on stopping sight distance with approach travel speed used as the basis for determining the recommended sight distance.

For the posted speed limit of 35 miles per hour (mph) on East Sir Francis Drake Boulevard, the minimum stopping sight distance needed is 250 feet. However, speeds on East Sir Francis Drake Boulevard were checked through an informal speed survey using a speed radar gun to estimate the critical speed of traffic during the midday when volumes are lower and speeds are not constrained. The "critical speed" is defined as the speed at or below which 85 percent of drivers are observed to be traveling. Based on this informal study, the critical speed of drivers on East Sir Francis Drake Boulevard approaching eastbound (from the west) was measured as 47 mph, and westbound drivers (from the east) were measured traveling at a critical speed of 41 mph.

The HDM provides minimum stopping sight distances for increments of five mph. Between these increments, the HDM defers to *A Policy on Geometric Design of Highways and Streets* ("the Greenbook"), American Association of State Highway and Transportation Officials, 2018. The Greenbook prescribes a formula for converting speed into stopping sight distance that results in 385 feet for 47 mph and 312 feet for 41 mph. Based on a review of field conditions, sight lines extend more than 500 feet to the west and 340 feet to the east. Therefore, sight distance available at the project driveway is adequate for the posted speed limit as well as the critical speed of vehicles traveling on East Sir Francis Drake Boulevard.

Finding – Existing sight lines are adequate between traffic on East Sir Francis Drake Boulevard and drivers entering or exiting the project site, including as calculated in reference to both the posted speed limit and to the estimated critical speed.

Access Analysis

Left-Turn Lane Warrants

The need for a left-turn lane on East Sir Francis Drake Boulevard was evaluated based on criteria contained in the *Intersection Channelization Design Guide*, National Cooperative Highway Research Program (NCHRP) Report No. 279, Transportation Research Board, 1985, as well as an update of the methodology developed by the Washington State Department of Transportation and published in the *Method For Prioritizing Intersection Improvements*, January 1997. The NCHRP report references a methodology developed by M. D. Harmelink that includes equations that can be applied to expected or actual traffic volumes in order to determine the need for a left-turn pocket

based on safety issues. Using Existing plus Project peak hour volumes, a left-turn lane is warranted on East Sir Francis Drake Boulevard at the project access during either of the peak periods evaluated. Copies of the turn lane warrant worksheets are included in Appendix E.

Finding – During both peak hours, a left-turn lane into the project site would be warranted on East Sir Francis Drake Boulevard based on Existing plus Project volumes.

Recommendation – Installation of a left-turn lane on East Sir Francis Drake Boulevard for access to the project site is recommended. As there is an existing acceleration lane for drivers entering East Sir Francis Drake Boulevard from Drakes Cove Road in the same location as this potential left-turn lane, the existing acceleration lane should be converted into a left-turn lane by restriping the dashed lane line as a solid lane line, and replacing the lane drop arrows with left-turn arrows.

Right-Turn Lane Warrants

The need for a right-turn lane or taper was evaluated based on criteria contained in the *Intersection Channelization Design Guide*. A right-turn lane would consist of a lane installed to the right of the travel lane and would be a minimum of ten feet wide, plus a shoulder where not adjacent to a curb. A right-turn taper is a shoulder area that gets progressively wider as the motorist drives toward the intersection. Both improvements are meant to provide an area for motorists turning right to move out of the traffic lane without impeding through traffic.

Using the same criteria contained in the *Intersection Channelization Design Guide*, the warrants were evaluated using Existing plus Project volumes. Based on these assumptions, a right-turn lane would be warranted under a.m. peak hour conditions. Given the potential for conflict between the future planned bicycle lanes on East Sir Francis Drake Boulevard and a right-turn lane, instead it would be more appropriate to widen the shoulder to provide an area for drivers to decelerate while allowing a bicycle lane to be striped as planned in the *Marin County Unincorporated Area Bicycle and Pedestrian Master Plan,* County of Marin, 2018. Appendix E contains a copy of the turn lane warrant worksheets.

Finding – Under Existing plus Project volumes during the a.m. peak hour, a right-turn lane into the project site from East Sir Francis Drake Boulevard would be warranted although a widened shoulder would be more appropriate.

Recommendation – The shoulder on East Sir Francis Drake Boulevard adjacent to the project site should be widened along with construction of the project.

Traffic Signal Warrants

A signal warrant analysis was performed to determine potential need for a traffic signal at the project access on East Sir Francis Drake Boulevard. The warrant analysis was conducted assuming combination of the project access with Drakes Cove Road in order to provide a maximum reasonable side-street volume if internal connectivity were provided between the site and Drakes Cove Road.

Chapter 4C of the CA-MUTCD provides guidance on when a traffic signal should be considered. There are nine different warrants, or criteria, presented, as follows:

- Warrant 1, Eight-Hour Vehicular Volume
- Warrant 2, Four-Hour Vehicular Volume
- Warrant 3, Peak Hour Volume
- Warrant 4, Pedestrian Volume
- Warrant 5, School Crossing
- Warrant 6, Coordinated Signal System

- Warrant 7, Crash Experience
- Warrant 8, Roadway Network
- Warrant 9, Intersection Near a Grade Crossing

For the purposes of this study the Peak Hour Volume Warrant, which determines the need for traffic control based on the highest volume hour of the day, was used as an initial indication of traffic control needs. The use of this signal warrant is common practice for planning studies. Other warrants, which are more generally applicable to existing traffic issues, require collection of traffic volumes for the highest four or eight hours of the day, review of the collision history, and evaluation of the system surrounding the location.

Under the Peak Hour Volume Warrant the need for a traffic control signal may be indicated if an engineering study finds that the criteria in either of the following two categories are met:

A. If all three of the following conditions exist for the same one hour (any four consecutive 15-minute periods) of an average day:

    1. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: four vehicle-hours for a one-lane approach; or five vehicle-hours for a two-lane approach, and
    2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes, and
    3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for one hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes. If the intersection is within a built-up area of an isolated community with a population over 10,000 or the posted, statutory, or critical speed on the major street exceeds 40 mph, Figure 4C-4 may be used instead.

A key component of the Peak Hour Volume Warrant is the volume of traffic entering from the minor street, or in this case the project access combined with Drakes Cove Road. Condition A.2 requires 100 vehicles to enter from the minor street, and the figure for Condition B (Figure 4C-3) requires lower minor street volumes with higher major street volumes, but the curve bottoms out at a minimum requirement of 100 minor street vehicles or 70 vehicles for Figure 4C-4. As the critical speed on East Sir Francis Drake Boulevard was measured to be greater than 40 mph, the requirements of Figure 4C-4 apply.

Using the trip generation detailed in Table 6, it is anticipated that the project would generate 67 outbound vehicles during the a.m. peak hour and 43 outbound vehicles during the p.m. peak hour. Combined with the four outbound vehicles during the a.m. peak hour and ten outbound vehicles during the p.m. peak hour from Drakes Cove Road, there would be a side-street volume of 71 combined outbound vehicle during the morning peak hour and 53 vehicles during the evening peak hour. The morning peak hour volume is sufficient to meet the Peak Hour Volume warrant.

A copy of the Peak Hour Volume Warrant worksheet is included in Appendix F.

Finding – With the combined volume of the project access and Drakes Cove Road, a signal would be warranted per the Peak Hour Volume Warrant of the CA-MUTCD if the connection is made. A signal would not be warranted for the project access without the addition of traffic from Drakes Cove Road.

Recommendation – A pedestrian crossing with right-of-way control was recommended previously to assist pedestrians and bicyclists crossing East Sir Francis Drake Boulevard between the project site and multi-use trail. Either a traffic signal (if warranted) or HAWK (if a signal is not warranted) should be constructed at the location of this crossing.

Emergency Access

Site Access

It is noted that while County staff confirmed that County policies would not generally apply to this project, nonetheless County fire codes were reviewed as the Marin County Fire Department may respond to emergencies at the project site. The County of Marin *Municipal Code Section 16.16.010 – Adoption of California Fire Code and International Fire Code* adopts the *California Fire Code* as the standard for the County along with providing several relevant amendments. The *California Fire Code* (CFC) *Section 503.1.1 Buildings and Facilities* requires fire access roads to be provided within 150 feet of all exterior building walls. Fire access roads are roads traversable by fire response equipment and are at least 20 feet wide with vertical clearances of at least 13.5 feet. The County has made the following relevant amendments to CFC Section 503:

- Buildings over 30 feet in height shall have approved aerial apparatus access roads;
- Aerial apparatus access roads shall be at least 26 feet wide in the immediate vicinity of the building;
- At least one aerial apparatus access road shall be located parallel to the building and located 15 to 30 feet laterally away from the building;
- The side of the building with an aerial apparatus access road shall be approved by the fire code official; and
- Gates shall have a minimum net vertical clearance of 15 feet.

Most, if not all, of the project building would be greater than 30 feet in height and therefore required to have an adjacent approved apparatus access road that fulfills the above requirements. Dimensions are not provided on the site plan and are not necessary for this traffic impact study; however, the main drive aisle should be at least 20 feet wide throughout the project, and adjacent to the project building should be at least 26 feet wide, no closer than 15 feet, and no further than 30 feet from the building exterior. All building exteriors should be no more than 150 feet from fire access roads unless authorization is provided by the fire code official for an exemption such as installing an approved automatic sprinkler system.

While the CFC requires 13.5 feet of vertical clearance, the County of Marin *Municipal Code* requires 15 feet for gates. As gates typically represent a more restrictive condition than open roadway, it is assumed that this 15-foot requirement applies to the entire length of the fire access roads. A portion of the building overhangs the main drive aisle, and 15-foot clearance should be provided as this drive aisle would act as a fire access road.

Finding – The CFC and *Municipal Code* require construction of a fire access road, including an approved aerial apparatus access road adjacent to the project building, as well as providing several standards regarding width, overhead clearance, and positioning.

Recommendation – An approved aerial apparatus access road should be provided that is at least 20 feet wide throughout the site, and at least 26 feet wide adjacent to the building. The road adjacent to the building should be parallel to the building and positioned between 15 and 30 feet from the building exterior. The fire access road should have at least 15 feet vertical clearance throughout the project site. All building exteriors should be within 150 feet of the fire access road unless an exemption is granted by the fire code official.

Emergency Response Times

The project would increase traffic volumes on East Sir Francis Drake Boulevard by approximately four to five percent during the a.m. and p.m. peak hours, and across a typical 24-hour day. As indicated by the operational analysis, this minimal increase to area traffic would not cause nearby intersections to operate deficiently and would increase overall delays by less than one second per intersection, except if traffic signal control is installed at East Sir Francis Drake Boulevard/Drakes Cove Road in which case the delay would increase to an acceptable LOS B. It is noted that emergency vehicles have lights and sirens to bypass queued traffic and minimize the effects of intersection delay. Therefore, the project would have a nominal to no effect on emergency response times.

Finding – The project would have a less-than-significant impact on emergency response times.

Vehicle Miles Traveled (VMT)

Consideration was given to the project's potential generation of Vehicle Miles Traveled (VMT), using guidance provided by the California Governor's Office of Planning and Research (OPR) in the publication *Transportation Impacts (SB 743) CEQA Guidelines Update and Technical Advisory*, 2018. Guidance provided in this document with respect to assessing VMT for residential projects is that a project's generation of VMT that is 15 or more percent below the existing regional residential VMT per capita may indicate a less-than-significant transportation impact.

This premise was tested by obtaining data from the recently updated Transportation Authority of Marin Demand Model (TAMDM) maintained by TAM, as well as background model data prepared by Fehr & Peers for TAM during development of the model. Unincorporated areas within the County of Marin have a baseline residential VMT of 15.8 miles per resident. Based on OPR guidance, a project generating a VMT that is 15 percent or more below this value, or 13.4 miles per resident, would have a less-than-significant VMT impact. The TAMDM model includes traffic analysis zones (TAZ) covering geographic areas throughout Marin County, including 1,400 Micro Analysis Zones (MAZ) for which VMT characteristics are estimated. The project site is located within MAZ 811,319, which has a VMT per capita of 10.1 miles. Because this per capita VMT ratio is below the OPR-based significance threshold of 13.4 miles, the project would be considered to have a less-than-significant VMT impact. A summary of the VMT findings is provided in Table 11.

Table 11 – Vehicle Miles Traveled Analysis Summary

VMT Metric	Baseline VMT Rate	Significance Threshold	Project VMT Rate	Resulting Significance
Residential VMT per Capita (Unincorporated Countywide Baseline)	15.8	13.4	10.1	Less than significant

Note: VMT Rate is measured in VMT/Capita, or the number of daily miles driven per resident

Finding – The project would be expected to have a less-than-significant transportation impact on vehicle miles traveled.

Conclusions and Recommendations

Conclusions

- The anticipated trip generation for the proposed project is an average of 1,360 trips per day, including 90 trips during the a.m. peak hour and 110 trips during the p.m. peak hour.

- Four project access alternatives were explored in the operational analysis, including stop control on the project access approach to East Sir Francis Drake Boulevard, signalization of East Sir Francis Drake Boulevard/Project Access, signalization with internal connection to/from Drakes Cove Road, and signalization of East Sir Francis Drake Boulevard/Drakes Cove Road with internal connection to/from the project site.

- All four study intersections would operate acceptably overall under existing volumes without or with the addition of project traffic and construction of any of the four access alternatives.

- The two signalization alternatives with project access on Drakes Cove Road would provide the best minor street approach operations. The alternative to signalizing the project access without an internal connection would result in LOS F operations on the Drakes Cove Road approach to East Sir Francis Drake Boulevard as a result of increased delay for drivers approaching from Drakes Cove Road. The alternative to maintain existing controls (side street stop control) would result in the same LOS F operation and also result in LOS E operations for traffic entering East Sir Francis Drake Boulevard from the project access approach. This could be improved by construction of an acceleration lane for drivers turning left out of the project site, which would require widening East Sir Francis Drake Boulevard.

- For all study scenarios and access alternatives, queues were calculated and compared to available capacity for left-turn lanes at the four study intersections. The stacking distance for each turn lane assessed would be less than the turn lane capacity under existing conditions without or with the addition of project traffic and construction of any of the four access alternatives. Therefore, the project would result in a less-than-significant impact to vehicle queueing.

- While the internal pedestrian network depicted on the site plan would be adequate, a pedestrian crossing would provide access across East Sir Francis Drake Boulevard between the project site and multi-use trail, and installation of a HAWK would be warranted if the intersection is not signalized. A HAWK or traffic signal would provide enhanced pedestrian access and safety compared to an unsignalized crossing as it would provide a dedicated crossing phase for pedestrians concurrent with a red signal for drivers. This crossing would also enhance bicycle and transit access. Other than this crossing issue, transit facilities serving the project site are adequate. Bicycle storage is not depicted on the site plan and would not be required to meet applicable regulations.

- Sight lines between traffic on East Sir Francis Drake Boulevard and drivers entering or exiting the project site were measured and determined to be adequate in regard to both the posted speed limit and field-measured estimated critical speeds in each direction on East Sir Francis Drake Boulevard. A left-turn lane into the project site would be warranted during both peak hours, as would a right-turn lane during the a.m. peak hour though a widened shoulder would be a more appropriate facility given plans for a future bicycle lane. Installation of a traffic signal at East Sir Francis Drake Boulevard/Project Access would be warranted per the Peak Hour Volume Warrant of the CA-MUTCD if a connection was constructed between the project access and Drakes Cove Road.

- There are a series of requirements for fire access roads prescribed by the CFC and County of Marin *Municipal Code* that should be incorporated into the design of the fire access road, including an approved apparatus

access road given the tall height of the project buildings. The project would result in a nominal increase to traffic volumes and delays and would therefore have a less-than-significant impact on emergency response times.

- The project is located in an area with a baseline residential VMT more than 15 below the unincorporated countywide average and would therefore be presumed to have a less-than-significant impact to VMT.

Recommendations

- A pedestrian crossing with a HAWK (or signal) should be constructed on East Sir Francis Drake Boulevard to connect the project site and multi-use trail. This HAWK or signal should include enhanced warning signing for westbound drivers approaching the system.

- Construction of a left-turn lane on East Sir Francis Drake Boulevard into the project site is recommended. The existing acceleration lane for drivers entering from Drakes Cove Road should be converted into this turn lane by replacing the lane drop arrows and dashed lane line with left-turn arrows and a solid lane line, respectively.

- The shoulder on East Sir Francis Drake Boulevard adjacent to the project site should be widened to provide a deceleration space for westbound drivers entering the project site.

- The project site should be designed and constructed with a fire access road that is at least 20 feet wide with 15-foot vertical clearance throughout the project site. Adjacent to areas where the project building is higher than 30 feet, this road should fulfill the requirements of an approved aerial apparatus access road including being at least 26 feet wide, 15 to 30 feet from the building exterior, and parallel to the building. If an exemption is not granted by the fire code official, all building exteriors should be within 150 feet of a fire access road.

Study Participants and References

Study Participants

Principal in Charge	Dalene J. Whitlock, PE, PTOE
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Appendix A

Collision Rate Calculations

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Intersection Collision Rate Worksheet

Oak Hill Apartments TIS

Intersection # 1: East Sir Francis Drake Boulevard & Larkspur Landing Circle (East)
Date of Count: Tuesday, July 13, 2021

Number of Collisions: 8
Number of Injuries: 4
Number of Fatalities: 0
Average Daily Traffic (ADT): 28200
Start Date: January 1, 2016
End Date: December 31, 2020
Number of Years: 5

Intersection Type: Tee
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{8 \times 1{,}000{,}000}{28{,}200 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.16 c/mve**	**0.0%**	**50.0%**
Statewide Average*	**0.20 c/mve**	**0.5%**	**46.8%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection # 2: East Sir Francis Drake Boulevard & Drakes Cove Road
Date of Count: Tuesday, July 13, 2021

Number of Collisions: 5
Number of Injuries: 1
Number of Fatalities: 0
Average Daily Traffic (ADT): 28200
Start Date: January 1, 2016
End Date: December 31, 2020
Number of Years: 5

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

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{5 \times 1{,}000{,}000}{28{,}200 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.10 c/mve**	**0.0%**	**20.0%**
Statewide Average*	**0.09 c/mve**	**1.2%**	**46.9%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

Oak Hill Apartments TIS

Intersection # 4: East Sir Francis Drake Boulevard & Andersen Drive
Date of Count: Tuesday, July 13, 2021

Number of Collisions: 11
Number of Injuries: 7
Number of Fatalities: 0
Average Daily Traffic (ADT): 28200
Start Date: January 1, 2016
End Date: December 31, 2020
Number of Years: 5

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

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{11 \times 1{,}000{,}000}{28{,}200 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.21 c/mve**	**0.0%**	**63.6%**
Statewide Average*	**0.09 c/mve**	**1.2%**	**46.9%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Appendix B

Intersection Level of Service Calculations

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HCM 6th Signalized Intersection Summary
1: Sir Francis Drake Blvd & Larkspur Landing Cir

10/06/2021

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	40	600	1356	59	41	23
Future Volume (veh/h)	40	600	1356	59	41	23
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	43	638	1443	54	44	4
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	127	2795	2284	85	136	121
Arrive On Green	0.07	0.79	0.65	0.65	0.08	0.08
Sat Flow, veh/h	1781	3647	3587	130	1781	1585
Grp Volume(v), veh/h	43	638	733	764	44	4
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1847	1781	1585
Q Serve(g_s), s	1.7	3.4	17.9	18.0	1.7	0.2
Cycle Q Clear(g_c), s	1.7	3.4	17.9	18.0	1.7	0.2
Prop In Lane	1.00			0.07	1.00	1.00
Lane Grp Cap(c), veh/h	127	2795	1162	1207	136	121
V/C Ratio(X)	0.34	0.23	0.63	0.63	0.32	0.03
Avail Cap(c_a), veh/h	254	3372	1324	1376	846	753
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	32.5	2.0	7.5	7.5	32.2	31.5
Incr Delay (d2), s/veh	0.6	0.1	2.1	2.1	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.6	5.6	5.8	0.8	0.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	33.1	2.2	9.6	9.6	32.7	31.5
LnGrp LOS	C	A	A	A	C	C
Approach Vol, veh/h		681	1497		48	
Approach Delay, s/veh		4.1	9.6		32.6	
Approach LOS		A	A		C	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	9.8	53.3		10.6		63.0
Change Period (Y+Rc), s	4.5	5.1		5.0		5.1
Max Green Setting (Gmax), s	10.5	54.9		35.0		69.9
Max Q Clear Time (g_c+I1), s	3.7	20.0		3.7		5.4
Green Ext Time (p_c), s	0.0	28.2		0.1		13.6

Intersection Summary	
HCM 6th Ctrl Delay	8.4
HCM 6th LOS	A

HCM 6th TWSC
2: Sir Francis Drake Blvd & Drake Cove Rd

10/06/2021

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	647	1428	5	0	4
Future Vol, veh/h	3	647	1428	5	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	660	1457	5	0	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1462	0	-	0	2123	1457
Stage 1	-	-	-	-	1457	-
Stage 2	-	-	-	-	666	-
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	462	-	-	-	55	159
Stage 1	-	-	-	-	214	-
Stage 2	-	-	-	-	511	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	462	-	-	-	55	159
Mov Cap-2 Maneuver	-	-	-	-	157	-
Stage 1	-	-	-	-	213	-
Stage 2	-	-	-	-	511	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	28.2
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	462	-	-	-	159
HCM Lane V/C Ratio	0.007	-	-	-	0.026
HCM Control Delay (s)	12.8	-	-	-	28.2
HCM Lane LOS	B	-	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	643	1428	0	0	0
Future Vol, veh/h	0	643	1428	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	190	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	663	1472	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1472	0	-	0	1804	736
Stage 1	-	-	-	-	1472	-
Stage 2	-	-	-	-	332	-
Critical Hdwy	4.14	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.22	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	454	-	-	-	71	361
Stage 1	-	-	-	-	177	-
Stage 2	-	-	-	-	699	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	454	-	-	-	71	361
Mov Cap-2 Maneuver	-	-	-	-	71	-
Stage 1	-	-	-	-	177	-
Stage 2	-	-	-	-	699	-

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

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	454	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	67	570	1325	143	27	97
Future Vol, veh/h	67	570	1325	143	27	97
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	Free
Storage Length	170	-	-	270	0	80
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	70	594	1380	149	28	101

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1380	0	-	0	2114	-
Stage 1	-	-	-	-	1380	-
Stage 2	-	-	-	-	734	-
Critical Hdwy	4.12	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	-
Pot Cap-1 Maneuver	497	-	-	-	56	0
Stage 1	-	-	-	-	233	0
Stage 2	-	-	-	-	475	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	497	-	-	-	48	-
Mov Cap-2 Maneuver	-	-	-	-	146	-
Stage 1	-	-	-	-	200	-
Stage 2	-	-	-	-	475	-

Approach	EB	WB	SB
HCM Control Delay, s	1.4	0	35.4
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	497	-	-	-	146	-
HCM Lane V/C Ratio	0.14	-	-	-	0.193	-
HCM Control Delay (s)	13.4	-	-	-	35.4	0
HCM Lane LOS	B	-	-	-	E	A
HCM 95th %tile Q(veh)	0.5	-	-	-	0.7	-

HCM 6th Signalized Intersection Summary
1: Sir Francis Drake Blvd & Larkspur Landing Cir

10/06/2021

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	28	1386	680	44	70	18
Future Volume (veh/h)	28	1386	680	44	70	18
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			0.98	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	29	1444	708	30	73	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	96	2762	2308	98	164	146
Arrive On Green	0.05	0.78	0.67	0.67	0.09	0.00
Sat Flow, veh/h	1781	3647	3564	147	1781	1585
Grp Volume(v), veh/h	29	1444	362	376	73	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1840	1781	1585
Q Serve(g_s), s	1.2	11.8	6.6	6.6	3.0	0.0
Cycle Q Clear(g_c), s	1.2	11.8	6.6	6.6	3.0	0.0
Prop In Lane	1.00			0.08	1.00	1.00
Lane Grp Cap(c), veh/h	96	2762	1182	1224	164	146
V/C Ratio(X)	0.30	0.52	0.31	0.31	0.44	0.00
Avail Cap(c_a), veh/h	265	3900	1583	1639	806	717
HCM Platoon Ratio	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	0.00
Uniform Delay (d), s/veh	35.2	3.2	5.4	5.4	33.2	0.0
Incr Delay (d2), s/veh	0.6	0.6	0.5	0.5	0.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	2.3	2.0	2.1	1.3	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	35.8	3.8	6.0	6.0	33.9	0.0
LnGrp LOS	D	A	A	A	C	A
Approach Vol, veh/h		1473	738		73	
Approach Delay, s/veh		4.4	6.0		33.9	
Approach LOS		A	A		C	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	8.7	56.6		12.1		65.2
Change Period (Y+Rc), s	4.5	5.1		5.0		5.1
Max Green Setting (Gmax), s	11.5	68.9		35.0		84.9
Max Q Clear Time (g_c+I1), s	3.2	8.6		5.0		13.8
Green Ext Time (p_c), s	0.0	15.4		0.1		46.3

Intersection Summary	
HCM 6th Ctrl Delay	5.9
HCM 6th LOS	A

HCM 6th TWSC
2: Sir Francis Drake Blvd & Drake Cove Rd

10/06/2021

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	1453	724	5	6	4
Future Vol, veh/h	5	1453	724	5	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	1498	746	5	6	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	751	0	-	0	2254	746
Stage 1	-	-	-	-	746	-
Stage 2	-	-	-	-	1508	-
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	858	-	-	-	46	413
Stage 1	-	-	-	-	469	-
Stage 2	-	-	-	-	202	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	858	-	-	-	46	413
Mov Cap-2 Maneuver	-	-	-	-	146	-
Stage 1	-	-	-	-	466	-
Stage 2	-	-	-	-	202	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	24.3
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	858	-	-	-	197
HCM Lane V/C Ratio	0.006	-	-	-	0.052
HCM Control Delay (s)	9.2	-	-	-	24.3
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	1455	728	0	0	0
Future Vol, veh/h	0	1455	728	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	190	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	1500	751	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	751	0	-	0	1501	376
Stage 1	-	-	-	-	751	-
Stage 2	-	-	-	-	750	-
Critical Hdwy	4.14	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.22	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	854	-	-	-	113	622
Stage 1	-	-	-	-	427	-
Stage 2	-	-	-	-	427	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	854	-	-	-	113	622
Mov Cap-2 Maneuver	-	-	-	-	113	-
Stage 1	-	-	-	-	427	-
Stage 2	-	-	-	-	427	-

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

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	854	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	47	1403	674	97	69	53
Future Vol, veh/h	47	1403	674	97	69	53
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	Free
Storage Length	170	-	-	270	0	80
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	48	1446	695	100	71	55

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	695	0	-	0	2237	-
Stage 1	-	-	-	-	695	-
Stage 2	-	-	-	-	1542	-
Critical Hdwy	4.12	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	-
Pot Cap-1 Maneuver	901	-	-	-	~ 47	0
Stage 1	-	-	-	-	495	0
Stage 2	-	-	-	-	194	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	901	-	-	-	~ 45	-
Mov Cap-2 Maneuver	-	-	-	-	142	-
Stage 1	-	-	-	-	469	-
Stage 2	-	-	-	-	194	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	53.4
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	901	-	-	-	142	-
HCM Lane V/C Ratio	0.054	-	-	-	0.501	-
HCM Control Delay (s)	9.2	-	-	-	53.4	0
HCM Lane LOS	A	-	-	-	F	A
HCM 95th %tile Q(veh)	0.2	-	-	-	2.4	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

HCM 6th Signalized Intersection Summary
1: Sir Francis Drake Blvd & Larkspur Landing Cir

10/06/2021

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	40	617	1403	62	42	23
Future Volume (veh/h)	40	617	1403	62	42	23
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	43	656	1493	57	45	4
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	126	2802	2295	87	137	122
Arrive On Green	0.07	0.79	0.66	0.66	0.08	0.08
Sat Flow, veh/h	1781	3647	3584	133	1781	1585
Grp Volume(v), veh/h	43	656	758	792	45	4
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1846	1781	1585
Q Serve(g_s), s	1.7	3.6	19.1	19.3	1.8	0.2
Cycle Q Clear(g_c), s	1.7	3.6	19.1	19.3	1.8	0.2
Prop In Lane	1.00			0.07	1.00	1.00
Lane Grp Cap(c), veh/h	126	2802	1168	1214	137	122
V/C Ratio(X)	0.34	0.23	0.65	0.65	0.33	0.03
Avail Cap(c_a), veh/h	249	3313	1301	1352	831	740
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	33.2	2.1	7.7	7.7	32.8	32.0
Incr Delay (d2), s/veh	0.6	0.2	2.3	2.3	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.6	6.1	6.3	0.8	0.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	33.7	2.2	10.0	10.0	33.3	32.1
LnGrp LOS	C	A	A	A	C	C
Approach Vol, veh/h		699	1550		49	
Approach Delay, s/veh		4.2	10.0		33.2	
Approach LOS		A	A		C	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	9.8	54.4		10.8		64.2
Change Period (Y+Rc), s	4.5	5.1		5.0		5.1
Max Green Setting (Gmax), s	10.5	54.9		35.0		69.9
Max Q Clear Time (g_c+I1), s	3.7	21.3		3.8		5.6
Green Ext Time (p_c), s	0.0	28.0		0.1		14.2

Intersection Summary	
HCM 6th Ctrl Delay	8.7
HCM 6th LOS	A

HCM 6th TWSC
2: Sir Francis Drake Blvd & Drake Cove Rd

10/06/2021

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	665	1478	5	0	4
Future Vol, veh/h	3	665	1478	5	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	679	1508	5	0	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1513	0	-	0	2193	1508
Stage 1	-	-	-	-	1508	-
Stage 2	-	-	-	-	685	-
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	442	-	-	-	50	148
Stage 1	-	-	-	-	202	-
Stage 2	-	-	-	-	500	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	442	-	-	-	50	148
Mov Cap-2 Maneuver	-	-	-	-	149	-
Stage 1	-	-	-	-	201	-
Stage 2	-	-	-	-	500	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	30
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	442	-	-	-	148
HCM Lane V/C Ratio	0.007	-	-	-	0.028
HCM Control Delay (s)	13.2	-	-	-	30
HCM Lane LOS	B	-	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	18	643	1428	5	17	50
Future Vol, veh/h	18	643	1428	5	17	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	190	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	19	663	1472	5	18	52

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1477	0	-	0	1845	739
Stage 1	-	-	-	-	1475	-
Stage 2	-	-	-	-	370	-
Critical Hdwy	4.14	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.22	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	452	-	-	-	66	360
Stage 1	-	-	-	-	177	-
Stage 2	-	-	-	-	669	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	452	-	-	-	62	360
Mov Cap-2 Maneuver	-	-	-	-	62	-
Stage 1	-	-	-	-	165	-
Stage 2	-	-	-	-	669	-

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	42.8
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	452	-	-	-	162
HCM Lane V/C Ratio	0.041	-	-	-	0.426
HCM Control Delay (s)	13.3	0.4	-	-	42.8
HCM Lane LOS	B	A	-	-	E
HCM 95th %tile Q(veh)	0.1	-	-	-	1.9

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	74	580	1328	143	27	99
Future Vol, veh/h	74	580	1328	143	27	99
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	Free
Storage Length	170	-	-	270	0	80
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	77	604	1383	149	28	103

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1383	0	-	0	2141	-
Stage 1	-	-	-	-	1383	-
Stage 2	-	-	-	-	758	-
Critical Hdwy	4.12	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	-
Pot Cap-1 Maneuver	495	-	-	-	54	0
Stage 1	-	-	-	-	233	0
Stage 2	-	-	-	-	463	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	495	-	-	-	46	-
Mov Cap-2 Maneuver	-	-	-	-	143	-
Stage 1	-	-	-	-	197	-
Stage 2	-	-	-	-	463	-

Approach	EB	WB	SB
HCM Control Delay, s	1.5	0	36.2
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	495	-	-	-	143	-
HCM Lane V/C Ratio	0.156	-	-	-	0.197	-
HCM Control Delay (s)	13.6	-	-	-	36.2	0
HCM Lane LOS	B	-	-	-	E	A
HCM 95th %tile Q(veh)	0.5	-	-	-	0.7	-

HCM 6th Signalized Intersection Summary
1: Sir Francis Drake Blvd & Larkspur Landing Cir

10/06/2021

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	28	1433	711	46	73	18
Future Volume (veh/h)	28	1433	711	46	73	18
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			0.98	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	29	1493	741	32	76	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	95	2779	2331	101	163	145
Arrive On Green	0.05	0.78	0.67	0.67	0.09	0.00
Sat Flow, veh/h	1781	3647	3560	150	1781	1585
Grp Volume(v), veh/h	29	1493	380	393	76	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1840	1781	1585
Q Serve(g_s), s	1.3	12.6	7.1	7.1	3.2	0.0
Cycle Q Clear(g_c), s	1.3	12.6	7.1	7.1	3.2	0.0
Prop In Lane	1.00			0.08	1.00	1.00
Lane Grp Cap(c), veh/h	95	2779	1195	1237	163	145
V/C Ratio(X)	0.30	0.54	0.32	0.32	0.47	0.00
Avail Cap(c_a), veh/h	256	3770	1530	1584	779	693
HCM Platoon Ratio	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	0.00
Uniform Delay (d), s/veh	36.4	3.3	5.5	5.5	34.5	0.0
Incr Delay (d2), s/veh	0.7	0.6	0.6	0.5	0.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	2.5	2.2	2.3	1.4	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	37.1	3.9	6.0	6.0	35.3	0.0
LnGrp LOS	D	A	A	A	D	A
Approach Vol, veh/h		1522	773		76	
Approach Delay, s/veh		4.5	6.0		35.3	
Approach LOS		A	A		D	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	8.8	58.9		12.3		67.7
Change Period (Y+Rc), s	4.5	5.1		5.0		5.1
Max Green Setting (Gmax), s	11.5	68.9		35.0		84.9
Max Q Clear Time (g_c+I1), s	3.3	9.1		5.2		14.6
Green Ext Time (p_c), s	0.0	16.4		0.1		48.0

Intersection Summary	
HCM 6th Ctrl Delay	6.0
HCM 6th LOS	A

HCM 6th TWSC
2: Sir Francis Drake Blvd & Drake Cove Rd

10/06/2021

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	1503	757	5	6	4
Future Vol, veh/h	5	1503	757	5	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	1549	780	5	6	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	785	0	-	0	2339	780
Stage 1	-	-	-	-	780	-
Stage 2	-	-	-	-	1559	-
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	834	-	-	-	40	395
Stage 1	-	-	-	-	452	-
Stage 2	-	-	-	-	191	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	834	-	-	-	40	395
Mov Cap-2 Maneuver	-	-	-	-	137	-
Stage 1	-	-	-	-	449	-
Stage 2	-	-	-	-	191	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	25.6
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	834	-	-	-	185
HCM Lane V/C Ratio	0.006	-	-	-	0.056
HCM Control Delay (s)	9.3	-	-	-	25.6
HCM Lane LOS	A	-	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	50	1455	728	17	10	33
Future Vol, veh/h	50	1455	728	17	10	33
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	190	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	52	1500	751	18	10	34

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	769	0	-	0	1614	385
Stage 1	-	-	-	-	760	-
Stage 2	-	-	-	-	854	-
Critical Hdwy	4.14	-	-	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	2.22	-	-	-	3.52	3.32
Pot Cap-1 Maneuver	841	-	-	-	95	613
Stage 1	-	-	-	-	422	-
Stage 2	-	-	-	-	377	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	841	-	-	-	60	613
Mov Cap-2 Maneuver	-	-	-	-	60	-
Stage 1	-	-	-	-	265	-
Stage 2	-	-	-	-	377	-

Approach	EB	WB	SB
HCM Control Delay, s	2	0	28.8
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	841	-	-	-	195
HCM Lane V/C Ratio	0.061	-	-	-	0.227
HCM Control Delay (s)	9.6	1.7	-	-	28.8
HCM Lane LOS	A	A	-	-	D
HCM 95th %tile Q(veh)	0.2	-	-	-	0.8

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	51	1409	684	97	69	60
Future Vol, veh/h	51	1409	684	97	69	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	Free
Storage Length	170	-	-	270	0	80
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	53	1453	705	100	71	62

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	705	0	-	0	2264	-
Stage 1	-	-	-	-	705	-
Stage 2	-	-	-	-	1559	-
Critical Hdwy	4.12	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	-
Pot Cap-1 Maneuver	893	-	-	-	~ 45	0
Stage 1	-	-	-	-	490	0
Stage 2	-	-	-	-	191	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	893	-	-	-	~ 42	-
Mov Cap-2 Maneuver	-	-	-	-	139	-
Stage 1	-	-	-	-	461	-
Stage 2	-	-	-	-	191	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	55.3
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	893	-	-	-	139	-
HCM Lane V/C Ratio	0.059	-	-	-	0.512	-
HCM Control Delay (s)	9.3	-	-	-	55.3	0
HCM Lane LOS	A	-	-	-	F	A
HCM 95th %tile Q(veh)	0.2	-	-	-	2.4	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

HCM 6th Signalized Intersection Summary
1: Sir Francis Drake Blvd & Larkspur Landing Cir

10/06/2021

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	40	617	1403	62	42	23
Future Volume (veh/h)	40	617	1403	62	42	23
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	43	656	1493	57	45	4
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	126	2802	2295	87	137	122
Arrive On Green	0.07	0.79	0.66	0.66	0.08	0.08
Sat Flow, veh/h	1781	3647	3584	133	1781	1585
Grp Volume(v), veh/h	43	656	758	792	45	4
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1846	1781	1585
Q Serve(g_s), s	1.7	3.6	19.1	19.3	1.8	0.2
Cycle Q Clear(g_c), s	1.7	3.6	19.1	19.3	1.8	0.2
Prop In Lane	1.00			0.07	1.00	1.00
Lane Grp Cap(c), veh/h	126	2802	1168	1214	137	122
V/C Ratio(X)	0.34	0.23	0.65	0.65	0.33	0.03
Avail Cap(c_a), veh/h	249	3313	1301	1352	831	740
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	33.2	2.1	7.7	7.7	32.8	32.0
Incr Delay (d2), s/veh	0.6	0.2	2.3	2.3	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.6	6.1	6.3	0.8	0.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	33.7	2.2	10.0	10.0	33.3	32.1
LnGrp LOS	C	A	A	A	C	C
Approach Vol, veh/h		699	1550		49	
Approach Delay, s/veh		4.2	10.0		33.2	
Approach LOS		A	A		C	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	9.8	54.4		10.8		64.2
Change Period (Y+Rc), s	4.5	5.1		5.0		5.1
Max Green Setting (Gmax), s	10.5	54.9		35.0		69.9
Max Q Clear Time (g_c+I1), s	3.7	21.3		3.8		5.6
Green Ext Time (p_c), s	0.0	28.0		0.1		14.2

Intersection Summary	
HCM 6th Ctrl Delay	8.7
HCM 6th LOS	A

HCM 6th TWSC
2: Sir Francis Drake Blvd & Drake Cove Rd

10/06/2021

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	665	1478	5	0	4
Future Vol, veh/h	3	665	1478	5	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	679	1508	5	0	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1513	0	-	0	2193	1508
Stage 1	-	-	-	-	1508	-
Stage 2	-	-	-	-	685	-
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	442	-	-	-	50	148
Stage 1	-	-	-	-	202	-
Stage 2	-	-	-	-	500	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	442	-	-	-	50	148
Mov Cap-2 Maneuver	-	-	-	-	50	-
Stage 1	-	-	-	-	201	-
Stage 2	-	-	-	-	500	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	30
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	442	-	-	-	148
HCM Lane V/C Ratio	0.007	-	-	-	0.028
HCM Control Delay (s)	13.2	-	-	-	30
HCM Lane LOS	B	-	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.1

HCM 6th Signalized Intersection Summary
3: Sir Francis Drake Blvd & Project Driveway

10/06/2021

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	18	643	1428	5	17	50
Future Volume (veh/h)	18	643	1428	5	17	50
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	19	663	1472	5	18	52
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	169	1564	1564	1325	23	66
Arrive On Green	0.84	0.84	0.84	0.84	0.06	0.06
Sat Flow, veh/h	358	1870	1870	1585	414	1197
Grp Volume(v), veh/h	19	663	1472	5	71	0
Grp Sat Flow(s),veh/h/ln	358	1870	1870	1585	1634	0
Q Serve(g_s), s	3.6	7.5	50.3	0.0	3.6	0.0
Cycle Q Clear(g_c), s	53.8	7.5	50.3	0.0	3.6	0.0
Prop In Lane	1.00			1.00	0.25	0.73
Lane Grp Cap(c), veh/h	169	1564	1564	1325	91	0
V/C Ratio(X)	0.11	0.42	0.94	0.00	0.78	0.00
Avail Cap(c_a), veh/h	196	1701	1701	1442	492	0
HCM Platoon Ratio	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	0.00
Uniform Delay (d), s/veh	25.9	1.7	5.2	1.1	38.7	0.0
Incr Delay (d2), s/veh	0.3	0.2	10.4	0.0	13.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.8	9.3	0.0	1.8	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	26.2	1.9	15.7	1.1	52.3	0.0
LnGrp LOS	C	A	B	A	D	A
Approach Vol, veh/h		682	1477		71	
Approach Delay, s/veh		2.6	15.6		52.3	
Approach LOS		A	B		D	

Timer - Assigned Phs	2		4		6
Phs Duration (G+Y+Rc), s	73.9		9.1		73.9
Change Period (Y+Rc), s	4.5		4.5		4.5
Max Green Setting (Gmax), s	75.5		25.0		75.5
Max Q Clear Time (g_c+I1), s	55.8		5.6		52.3
Green Ext Time (p_c), s	4.7		0.2		17.1

Intersection Summary	
HCM 6th Ctrl Delay	12.8
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.
User approved volume balancing among the lanes for turning movement.

HCM 6th TWSC
4: Sir Francis Drake Blvd & Andersen Dr

10/06/2021

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	74	580	1328	143	27	99
Future Vol, veh/h	74	580	1328	143	27	99
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	Free
Storage Length	170	-	-	270	0	80
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	77	604	1383	149	28	103

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1383	0	-	0	2141	-
Stage 1	-	-	-	-	1383	-
Stage 2	-	-	-	-	758	-
Critical Hdwy	4.12	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	-
Pot Cap-1 Maneuver	495	-	-	-	54	0
Stage 1	-	-	-	-	233	0
Stage 2	-	-	-	-	463	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	495	-	-	-	46	-
Mov Cap-2 Maneuver	-	-	-	-	143	-
Stage 1	-	-	-	-	197	-
Stage 2	-	-	-	-	463	-

Approach	EB	WB	SB
HCM Control Delay, s	1.5	0	36.2
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	495	-	-	-	143	-
HCM Lane V/C Ratio	0.156	-	-	-	0.197	-
HCM Control Delay (s)	13.6	-	-	-	36.2	0
HCM Lane LOS	B	-	-	-	E	A
HCM 95th %tile Q(veh)	0.5	-	-	-	0.7	-

HCM 6th Signalized Intersection Summary
1: Sir Francis Drake Blvd & Larkspur Landing Cir

10/06/2021

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	28	1433	711	46	73	18
Future Volume (veh/h)	28	1433	711	46	73	18
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			0.98	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	29	1493	741	32	76	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	95	2779	2331	101	163	145
Arrive On Green	0.05	0.78	0.67	0.67	0.09	0.00
Sat Flow, veh/h	1781	3647	3560	150	1781	1585
Grp Volume(v), veh/h	29	1493	380	393	76	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1840	1781	1585
Q Serve(g_s), s	1.3	12.6	7.1	7.1	3.2	0.0
Cycle Q Clear(g_c), s	1.3	12.6	7.1	7.1	3.2	0.0
Prop In Lane	1.00			0.08	1.00	1.00
Lane Grp Cap(c), veh/h	95	2779	1195	1237	163	145
V/C Ratio(X)	0.30	0.54	0.32	0.32	0.47	0.00
Avail Cap(c_a), veh/h	256	3770	1530	1584	779	693
HCM Platoon Ratio	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	0.00
Uniform Delay (d), s/veh	36.4	3.3	5.5	5.5	34.5	0.0
Incr Delay (d2), s/veh	0.7	0.6	0.6	0.5	0.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	2.5	2.2	2.3	1.4	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	37.1	3.9	6.0	6.0	35.3	0.0
LnGrp LOS	D	A	A	A	D	A
Approach Vol, veh/h		1522	773		76	
Approach Delay, s/veh		4.5	6.0		35.3	
Approach LOS		A	A		D	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	8.8	58.9		12.3		67.7
Change Period (Y+Rc), s	4.5	5.1		5.0		5.1
Max Green Setting (Gmax), s	11.5	68.9		35.0		84.9
Max Q Clear Time (g_c+I1), s	3.3	9.1		5.2		14.6
Green Ext Time (p_c), s	0.0	16.4		0.1		48.0

Intersection Summary	
HCM 6th Ctrl Delay	6.0
HCM 6th LOS	A

HCM 6th TWSC
2: Sir Francis Drake Blvd & Drake Cove Rd

10/06/2021

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	1503	757	5	6	4
Future Vol, veh/h	5	1503	757	5	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	1549	780	5	6	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	785	0	-	0	2339	780
Stage 1	-	-	-	-	780	-
Stage 2	-	-	-	-	1559	-
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	834	-	-	-	40	395
Stage 1	-	-	-	-	452	-
Stage 2	-	-	-	-	191	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	834	-	-	-	40	395
Mov Cap-2 Maneuver	-	-	-	-	40	-
Stage 1	-	-	-	-	449	-
Stage 2	-	-	-	-	191	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	74.3
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	834	-	-	-	62
HCM Lane V/C Ratio	0.006	-	-	-	0.166
HCM Control Delay (s)	9.3	-	-	-	74.3
HCM Lane LOS	A	-	-	-	F
HCM 95th %tile Q(veh)	0	-	-	-	0.6

HCM 6th Signalized Intersection Summary
3: Sir Francis Drake Blvd & Project Driveway

10/06/2021

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	50	1455	728	17	10	33
Future Volume (veh/h)	50	1455	728	17	10	33
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	52	1500	751	18	10	34
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	614	1592	1592	1349	14	48
Arrive On Green	0.85	0.85	0.85	0.85	0.04	0.04
Sat Flow, veh/h	700	1870	1870	1585	362	1232
Grp Volume(v), veh/h	52	1500	751	18	45	0
Grp Sat Flow(s),veh/h/ln	700	1870	1870	1585	1630	0
Q Serve(g_s), s	1.6	49.4	8.2	0.1	2.2	0.0
Cycle Q Clear(g_c), s	9.8	49.4	8.2	0.1	2.2	0.0
Prop In Lane	1.00			1.00	0.22	0.76
Lane Grp Cap(c), veh/h	614	1592	1592	1349	64	0
V/C Ratio(X)	0.08	0.94	0.47	0.01	0.71	0.00
Avail Cap(c_a), veh/h	661	1720	1720	1458	497	0
HCM Platoon Ratio	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	0.00
Uniform Delay (d), s/veh	2.7	4.6	1.5	0.9	39.0	0.0
Incr Delay (d2), s/veh	0.1	10.5	0.2	0.0	13.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	6.9	0.5	0.0	1.1	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	2.8	15.1	1.7	0.9	52.3	0.0
LnGrp LOS	A	B	A	A	D	A
Approach Vol, veh/h		1552	769		45	
Approach Delay, s/veh		14.7	1.7		52.3	
Approach LOS		B	A		D	

Timer - Assigned Phs	2		4		6
Phs Duration (G+Y+Rc), s	74.4		7.7		74.4
Change Period (Y+Rc), s	4.5		4.5		4.5
Max Green Setting (Gmax), s	75.5		25.0		75.5
Max Q Clear Time (g_c+I1), s	51.4		4.2		10.2
Green Ext Time (p_c), s	18.4		0.1		6.4

Intersection Summary		
HCM 6th Ctrl Delay		11.2
HCM 6th LOS		B

Notes

User approved pedestrian interval to be less than phase max green.
User approved volume balancing among the lanes for turning movement.

HCM 6th TWSC
4: Sir Francis Drake Blvd & Andersen Dr

10/06/2021

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	51	1409	684	97	69	60
Future Vol, veh/h	51	1409	684	97	69	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	Free
Storage Length	170	-	-	270	0	80
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	53	1453	705	100	71	62

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	705	0	-	0	2264	-
Stage 1	-	-	-	-	705	-
Stage 2	-	-	-	-	1559	-
Critical Hdwy	4.12	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	-
Pot Cap-1 Maneuver	893	-	-	-	~ 45	0
Stage 1	-	-	-	-	490	0
Stage 2	-	-	-	-	191	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	893	-	-	-	~ 42	-
Mov Cap-2 Maneuver	-	-	-	-	139	-
Stage 1	-	-	-	-	461	-
Stage 2	-	-	-	-	191	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	55.3
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	893	-	-	-	139	-
HCM Lane V/C Ratio	0.059	-	-	-	0.512	-
HCM Control Delay (s)	9.3	-	-	-	55.3	0
HCM Lane LOS	A	-	-	-	F	A
HCM 95th %tile Q(veh)	0.2	-	-	-	2.4	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM 6th Signalized Intersection Summary
1: Sir Francis Drake Blvd & Larkspur Landing Cir

10/06/2021

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	40	617	1403	62	42	23
Future Volume (veh/h)	40	617	1403	62	42	23
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	43	656	1493	57	45	4
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	126	2802	2295	87	137	122
Arrive On Green	0.07	0.79	0.66	0.66	0.08	0.08
Sat Flow, veh/h	1781	3647	3584	133	1781	1585
Grp Volume(v), veh/h	43	656	758	792	45	4
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1846	1781	1585
Q Serve(g_s), s	1.7	3.6	19.1	19.3	1.8	0.2
Cycle Q Clear(g_c), s	1.7	3.6	19.1	19.3	1.8	0.2
Prop In Lane	1.00			0.07	1.00	1.00
Lane Grp Cap(c), veh/h	126	2802	1168	1214	137	122
V/C Ratio(X)	0.34	0.23	0.65	0.65	0.33	0.03
Avail Cap(c_a), veh/h	249	3313	1301	1352	831	740
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	33.2	2.1	7.7	7.7	32.8	32.0
Incr Delay (d2), s/veh	0.6	0.2	2.3	2.3	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.6	6.1	6.3	0.8	0.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	33.7	2.2	10.0	10.0	33.3	32.1
LnGrp LOS	C	A	A	A	C	C
Approach Vol, veh/h		699	1550		49	
Approach Delay, s/veh		4.2	10.0		33.2	
Approach LOS		A	A		C	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	9.8	54.4		10.8		64.2
Change Period (Y+Rc), s	4.5	5.1		5.0		5.1
Max Green Setting (Gmax), s	10.5	54.9		35.0		69.9
Max Q Clear Time (g_c+I1), s	3.7	21.3		3.8		5.6
Green Ext Time (p_c), s	0.0	28.0		0.1		14.2

Intersection Summary	
HCM 6th Ctrl Delay	8.7
HCM 6th LOS	A

HCM 6th TWSC
2: Sir Francis Drake Blvd & Drake Cove Rd

10/06/2021

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	668	1478	5	0	4
Future Vol, veh/h	0	668	1478	5	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	682	1508	5	0	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1513	0	-	0	2190	1508
Stage 1	-	-	-	-	1508	-
Stage 2	-	-	-	-	682	-
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	442	-	-	-	50	148
Stage 1	-	-	-	-	202	-
Stage 2	-	-	-	-	502	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	442	-	-	-	50	148
Mov Cap-2 Maneuver	-	-	-	-	50	-
Stage 1	-	-	-	-	202	-
Stage 2	-	-	-	-	502	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	30
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	442	-	-	-	148
HCM Lane V/C Ratio	-	-	-	-	0.028
HCM Control Delay (s)	0	-	-	-	30
HCM Lane LOS	A	-	-	-	D
HCM 95th %tile Q(veh)	0	-	-	-	0.1

HCM 6th Signalized Intersection Summary
3: Sir Francis Drake Blvd & Project Driveway

10/06/2021

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	21	643	1428	5	17	50
Future Volume (veh/h)	21	643	1428	5	17	50
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	22	663	1472	5	18	52
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	169	1564	1564	1325	23	66
Arrive On Green	0.84	0.84	0.84	0.84	0.06	0.06
Sat Flow, veh/h	358	1870	1870	1585	414	1197
Grp Volume(v), veh/h	22	663	1472	5	71	0
Grp Sat Flow(s),veh/h/ln	358	1870	1870	1585	1634	0
Q Serve(g_s), s	4.2	7.5	50.3	0.0	3.6	0.0
Cycle Q Clear(g_c), s	54.4	7.5	50.3	0.0	3.6	0.0
Prop In Lane	1.00			1.00	0.25	0.73
Lane Grp Cap(c), veh/h	169	1564	1564	1325	91	0
V/C Ratio(X)	0.13	0.42	0.94	0.00	0.78	0.00
Avail Cap(c_a), veh/h	196	1701	1701	1442	492	0
HCM Platoon Ratio	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	0.00
Uniform Delay (d), s/veh	26.2	1.7	5.2	1.1	38.7	0.0
Incr Delay (d2), s/veh	0.3	0.2	10.4	0.0	13.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.8	9.3	0.0	1.8	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	26.5	1.9	15.7	1.1	52.3	0.0
LnGrp LOS	C	A	B	A	D	A
Approach Vol, veh/h		685	1477		71	
Approach Delay, s/veh		2.7	15.6		52.3	
Approach LOS		A	B		D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		73.9		9.1		73.9
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		75.5		25.0		75.5
Max Q Clear Time (g_c+I1), s		56.4		5.6		52.3
Green Ext Time (p_c), s		4.7		0.2		17.1

Intersection Summary		
HCM 6th Ctrl Delay		12.8
HCM 6th LOS		B

Notes

User approved pedestrian interval to be less than phase max green.
User approved volume balancing among the lanes for turning movement.

HCM 6th TWSC
4: Sir Francis Drake Blvd & Andersen Dr

10/06/2021

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	74	580	1328	143	27	99
Future Vol, veh/h	74	580	1328	143	27	99
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	Free
Storage Length	170	-	-	270	0	80
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	77	604	1383	149	28	103

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1383	0	-	0	2141	-
Stage 1	-	-	-	-	1383	-
Stage 2	-	-	-	-	758	-
Critical Hdwy	4.12	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	-
Pot Cap-1 Maneuver	495	-	-	-	54	0
Stage 1	-	-	-	-	233	0
Stage 2	-	-	-	-	463	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	495	-	-	-	46	-
Mov Cap-2 Maneuver	-	-	-	-	143	-
Stage 1	-	-	-	-	197	-
Stage 2	-	-	-	-	463	-

Approach	EB	WB	SB
HCM Control Delay, s	1.5	0	36.2
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	495	-	-	-	143	-
HCM Lane V/C Ratio	0.156	-	-	-	0.197	-
HCM Control Delay (s)	13.6	-	-	-	36.2	0
HCM Lane LOS	B	-	-	-	E	A
HCM 95th %tile Q(veh)	0.5	-	-	-	0.7	-

HCM 6th Signalized Intersection Summary
1: Sir Francis Drake Blvd & Larkspur Landing Cir

10/06/2021

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	28	1433	711	46	73	18
Future Volume (veh/h)	28	1433	711	46	73	18
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			0.98	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	29	1493	741	32	76	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	95	2779	2331	101	163	145
Arrive On Green	0.05	0.78	0.67	0.67	0.09	0.00
Sat Flow, veh/h	1781	3647	3560	150	1781	1585
Grp Volume(v), veh/h	29	1493	380	393	76	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1840	1781	1585
Q Serve(g_s), s	1.3	12.6	7.1	7.1	3.2	0.0
Cycle Q Clear(g_c), s	1.3	12.6	7.1	7.1	3.2	0.0
Prop In Lane	1.00			0.08	1.00	1.00
Lane Grp Cap(c), veh/h	95	2779	1195	1237	163	145
V/C Ratio(X)	0.30	0.54	0.32	0.32	0.47	0.00
Avail Cap(c_a), veh/h	256	3770	1530	1584	779	693
HCM Platoon Ratio	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	0.00
Uniform Delay (d), s/veh	36.4	3.3	5.5	5.5	34.5	0.0
Incr Delay (d2), s/veh	0.7	0.6	0.6	0.5	0.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	2.5	2.2	2.3	1.4	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	37.1	3.9	6.0	6.0	35.3	0.0
LnGrp LOS	D	A	A	A	D	A
Approach Vol, veh/h		1522	773		76	
Approach Delay, s/veh		4.5	6.0		35.3	
Approach LOS		A	A		D	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	8.8	58.9		12.3		67.7
Change Period (Y+Rc), s	4.5	5.1		5.0		5.1
Max Green Setting (Gmax), s	11.5	68.9		35.0		84.9
Max Q Clear Time (g_c+I1), s	3.3	9.1		5.2		14.6
Green Ext Time (p_c), s	0.0	16.4		0.1		48.0

Intersection Summary		
HCM 6th Ctrl Delay		6.0
HCM 6th LOS		A

HCM 6th TWSC
2: Sir Francis Drake Blvd & Drake Cove Rd

10/06/2021

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	1508	757	5	0	4
Future Vol, veh/h	0	1508	757	5	0	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	150	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	1555	780	5	0	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	785	0	-	0	2335	780
Stage 1	-	-	-	-	780	-
Stage 2	-	-	-	-	1555	-
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	834	-	-	-	40	395
Stage 1	-	-	-	-	452	-
Stage 2	-	-	-	-	192	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	834	-	-	-	40	395
Mov Cap-2 Maneuver	-	-	-	-	40	-
Stage 1	-	-	-	-	452	-
Stage 2	-	-	-	-	192	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	14.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	834	-	-	-	395
HCM Lane V/C Ratio	-	-	-	-	0.01
HCM Control Delay (s)	0	-	-	-	14.2
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

HCM 6th Signalized Intersection Summary
3: Sir Francis Drake Blvd & Project Driveway

10/06/2021

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	55	1449	728	17	16	33
Future Volume (veh/h)	55	1449	728	17	16	33
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	57	1494	751	18	16	34
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	610	1587	1587	1345	22	46
Arrive On Green	0.85	0.85	0.85	0.85	0.04	0.04
Sat Flow, veh/h	700	1870	1870	1585	517	1098
Grp Volume(v), veh/h	57	1494	751	18	51	0
Grp Sat Flow(s),veh/h/ln	700	1870	1870	1585	1647	0
Q Serve(g_s), s	1.8	49.4	8.3	0.1	2.5	0.0
Cycle Q Clear(g_c), s	10.2	49.4	8.3	0.1	2.5	0.0
Prop In Lane	1.00			1.00	0.31	0.67
Lane Grp Cap(c), veh/h	610	1587	1587	1345	69	0
V/C Ratio(X)	0.09	0.94	0.47	0.01	0.74	0.00
Avail Cap(c_a), veh/h	659	1718	1718	1456	501	0
HCM Platoon Ratio	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	0.00
Uniform Delay (d), s/veh	2.9	4.7	1.6	1.0	38.9	0.0
Incr Delay (d2), s/veh	0.1	10.4	0.2	0.0	14.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	7.2	0.5	0.0	1.3	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	2.9	15.1	1.8	1.0	53.3	0.0
LnGrp LOS	A	B	A	A	D	A
Approach Vol, veh/h		1551	769		51	
Approach Delay, s/veh		14.6	1.8		53.3	
Approach LOS		B	A		D	

Timer - Assigned Phs	2		4		6
Phs Duration (G+Y+Rc), s	74.3		7.9		74.3
Change Period (Y+Rc), s	4.5		4.5		4.5
Max Green Setting (Gmax), s	75.5		25.0		75.5
Max Q Clear Time (g_c+I1), s	51.4		4.5		10.3
Green Ext Time (p_c), s	18.4		0.1		6.4

Intersection Summary		
HCM 6th Ctrl Delay		11.3
HCM 6th LOS		B

Notes

User approved pedestrian interval to be less than phase max green.
User approved volume balancing among the lanes for turning movement.

HCM 6th TWSC
4: Sir Francis Drake Blvd & Andersen Dr

10/06/2021

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	51	1409	684	97	69	60
Future Vol, veh/h	51	1409	684	97	69	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	Free
Storage Length	170	-	-	270	0	80
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	53	1453	705	100	71	62

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	705	0	-	0	2264	-
Stage 1	-	-	-	-	705	-
Stage 2	-	-	-	-	1559	-
Critical Hdwy	4.12	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	-
Pot Cap-1 Maneuver	893	-	-	-	~ 45	0
Stage 1	-	-	-	-	490	0
Stage 2	-	-	-	-	191	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	893	-	-	-	~ 42	-
Mov Cap-2 Maneuver	-	-	-	-	139	-
Stage 1	-	-	-	-	461	-
Stage 2	-	-	-	-	191	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	55.3
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	893	-	-	-	139	-
HCM Lane V/C Ratio	0.059	-	-	-	0.512	-
HCM Control Delay (s)	9.3	-	-	-	55.3	0
HCM Lane LOS	A	-	-	-	F	A
HCM 95th %tile Q(veh)	0.2	-	-	-	2.4	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM 6th Signalized Intersection Summary
1: Sir Francis Drake Blvd & Larkspur Landing Cir

10/06/2021

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	40	617	1403	62	42	23
Future Volume (veh/h)	40	617	1403	62	42	23
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	43	656	1493	57	45	4
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	126	2802	2295	87	137	122
Arrive On Green	0.07	0.79	0.66	0.66	0.08	0.08
Sat Flow, veh/h	1781	3647	3584	133	1781	1585
Grp Volume(v), veh/h	43	656	758	792	45	4
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1846	1781	1585
Q Serve(g_s), s	1.7	3.6	19.1	19.3	1.8	0.2
Cycle Q Clear(g_c), s	1.7	3.6	19.1	19.3	1.8	0.2
Prop In Lane	1.00			0.07	1.00	1.00
Lane Grp Cap(c), veh/h	126	2802	1168	1214	137	122
V/C Ratio(X)	0.34	0.23	0.65	0.65	0.33	0.03
Avail Cap(c_a), veh/h	249	3313	1301	1352	831	740
HCM Platoon Ratio	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
Uniform Delay (d), s/veh	33.2	2.1	7.7	7.7	32.8	32.0
Incr Delay (d2), s/veh	0.6	0.2	2.3	2.3	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.6	6.1	6.3	0.8	0.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	33.7	2.2	10.0	10.0	33.3	32.1
LnGrp LOS	C	A	A	A	C	C
Approach Vol, veh/h		699	1550		49	
Approach Delay, s/veh		4.2	10.0		33.2	
Approach LOS		A	A		C	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	9.8	54.4		10.8		64.2
Change Period (Y+Rc), s	4.5	5.1		5.0		5.1
Max Green Setting (Gmax), s	10.5	54.9		35.0		69.9
Max Q Clear Time (g_c+I1), s	3.7	21.3		3.8		5.6
Green Ext Time (p_c), s	0.0	28.0		0.1		14.2

Intersection Summary	
HCM 6th Ctrl Delay	8.7
HCM 6th LOS	A

HCM 6th Signalized Intersection Summary
2: Sir Francis Drake Blvd & Drake Cove Rd

03/11/2022

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	21	647	1428	10	17	54
Future Volume (veh/h)	21	647	1428	10	17	54
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	660	1457	10	17	55
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	176	1558	1558	1320	22	70
Arrive On Green	0.83	0.83	0.83	0.83	0.06	0.06
Sat Flow, veh/h	361	1870	1870	1585	380	1228
Grp Volume(v), veh/h	21	660	1457	10	73	0
Grp Sat Flow(s),veh/h/ln	361	1870	1870	1585	1630	0
Q Serve(g_s), s	3.8	7.5	48.2	0.1	3.6	0.0
Cycle Q Clear(g_c), s	52.0	7.5	48.2	0.1	3.6	0.0
Prop In Lane	1.00			1.00	0.23	0.75
Lane Grp Cap(c), veh/h	176	1558	1558	1320	93	0
V/C Ratio(X)	0.12	0.42	0.94	0.01	0.78	0.00
Avail Cap(c_a), veh/h	208	1725	1725	1462	498	0
HCM Platoon Ratio	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	0.00
Uniform Delay (d), s/veh	24.8	1.8	5.2	1.2	38.1	0.0
Incr Delay (d2), s/veh	0.3	0.2	9.5	0.0	13.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.8	8.7	0.0	1.8	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	25.1	1.9	14.7	1.2	51.4	0.0
LnGrp LOS	C	A	B	A	D	A
Approach Vol, veh/h		681	1467		73	
Approach Delay, s/veh		2.7	14.6		51.4	
Approach LOS		A	B		D	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		72.7		9.2		72.7
Change Period (Y+Rc), s		4.5		4.5		4.5
Max Green Setting (Gmax), s		75.5		25.0		75.5
Max Q Clear Time (g_c+I1), s		54.0		5.6		50.2
Green Ext Time (p_c), s		4.9		0.2		18.0

Intersection Summary	
HCM 6th Ctrl Delay	12.1
HCM 6th LOS	B

Notes
User approved pedestrian interval to be less than phase max green.
User approved volume balancing among the lanes for turning movement.

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	74	580	1328	143	27	99
Future Vol, veh/h	74	580	1328	143	27	99
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	Free
Storage Length	170	-	-	270	0	80
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	77	604	1383	149	28	103

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1383	0	-	0	2141	-
Stage 1	-	-	-	-	1383	-
Stage 2	-	-	-	-	758	-
Critical Hdwy	4.12	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	-
Pot Cap-1 Maneuver	495	-	-	-	54	0
Stage 1	-	-	-	-	233	0
Stage 2	-	-	-	-	463	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	495	-	-	-	46	-
Mov Cap-2 Maneuver	-	-	-	-	143	-
Stage 1	-	-	-	-	197	-
Stage 2	-	-	-	-	463	-

Approach	EB	WB	SB
HCM Control Delay, s	1.5	0	36.2
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	495	-	-	-	143	-
HCM Lane V/C Ratio	0.156	-	-	-	0.197	-
HCM Control Delay (s)	13.6	-	-	-	36.2	0
HCM Lane LOS	B	-	-	-	E	A
HCM 95th %tile Q(veh)	0.5	-	-	-	0.7	-

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	28	1433	711	46	73	18
Future Volume (veh/h)	28	1433	711	46	73	18
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			0.98	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	29	1493	741	32	76	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	95	2779	2331	101	163	145
Arrive On Green	0.05	0.78	0.67	0.67	0.09	0.00
Sat Flow, veh/h	1781	3647	3560	150	1781	1585
Grp Volume(v), veh/h	29	1493	380	393	76	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1777	1840	1781	1585
Q Serve(g_s), s	1.3	12.6	7.1	7.1	3.2	0.0
Cycle Q Clear(g_c), s	1.3	12.6	7.1	7.1	3.2	0.0
Prop In Lane	1.00			0.08	1.00	1.00
Lane Grp Cap(c), veh/h	95	2779	1195	1237	163	145
V/C Ratio(X)	0.30	0.54	0.32	0.32	0.47	0.00
Avail Cap(c_a), veh/h	256	3770	1530	1584	779	693
HCM Platoon Ratio	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	0.00
Uniform Delay (d), s/veh	36.4	3.3	5.5	5.5	34.5	0.0
Incr Delay (d2), s/veh	0.7	0.6	0.6	0.5	0.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	2.5	2.2	2.3	1.4	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	37.1	3.9	6.0	6.0	35.3	0.0
LnGrp LOS	D	A	A	A	D	A
Approach Vol, veh/h		1522	773		76	
Approach Delay, s/veh		4.5	6.0		35.3	
Approach LOS		A	A		D	

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	8.8	58.9		12.3		67.7
Change Period (Y+Rc), s	4.5	5.1		5.0		5.1
Max Green Setting (Gmax), s	11.5	68.9		35.0		84.9
Max Q Clear Time (g_c+I1), s	3.3	9.1		5.2		14.6
Green Ext Time (p_c), s	0.0	16.4		0.1		48.0

Intersection Summary	
HCM 6th Ctrl Delay	6.0
HCM 6th LOS	A

HCM 6th Signalized Intersection Summary
2: Sir Francis Drake Blvd & Drake Cove Rd

03/11/2022

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	55	1453	724	22	16	37
Future Volume (veh/h)	55	1453	724	22	16	37
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	57	1498	746	23	16	38
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	594	1567	1567	1328	28	66
Arrive On Green	0.84	0.84	0.84	0.84	0.06	0.06
Sat Flow, veh/h	700	1870	1870	1585	478	1135
Grp Volume(v), veh/h	57	1498	746	23	55	0
Grp Sat Flow(s),veh/h/ln	700	1870	1870	1585	1642	0
Q Serve(g_s), s	2.1	56.3	9.3	0.2	2.8	0.0
Cycle Q Clear(g_c), s	11.4	56.3	9.3	0.2	2.8	0.0
Prop In Lane	1.00			1.00	0.29	0.69
Lane Grp Cap(c), veh/h	594	1567	1567	1328	95	0
V/C Ratio(X)	0.10	0.96	0.48	0.02	0.58	0.00
Avail Cap(c_a), veh/h	621	1637	1637	1387	476	0
HCM Platoon Ratio	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	0.00
Uniform Delay (d), s/veh	3.4	5.7	1.9	1.2	39.6	0.0
Incr Delay (d2), s/veh	0.1	13.1	0.2	0.0	5.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	11.5	1.1	0.0	1.3	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	3.5	18.8	2.1	1.2	45.0	0.0
LnGrp LOS	A	B	A	A	D	A
Approach Vol, veh/h		1555	769		55	
Approach Delay, s/veh		18.2	2.1		45.0	
Approach LOS		B	A		D	

Timer - Assigned Phs	2		4		6
Phs Duration (G+Y+Rc), s	76.8		9.5		76.8
Change Period (Y+Rc), s	4.5		4.5		4.5
Max Green Setting (Gmax), s	75.5		25.0		75.5
Max Q Clear Time (g_c+I1), s	58.3		4.8		11.3
Green Ext Time (p_c), s	13.9		0.1		6.4

Intersection Summary		
HCM 6th Ctrl Delay		13.6
HCM 6th LOS		B

Notes

User approved pedestrian interval to be less than phase max green.
User approved volume balancing among the lanes for turning movement.

HCM 6th TWSC
4: Sir Francis Drake Blvd & Andersen Dr

10/06/2021

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	51	1409	684	97	69	60
Future Vol, veh/h	51	1409	684	97	69	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	Free
Storage Length	170	-	-	270	0	80
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	53	1453	705	100	71	62

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	705	0	-	0	2264	-
Stage 1	-	-	-	-	705	-
Stage 2	-	-	-	-	1559	-
Critical Hdwy	4.12	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	-
Pot Cap-1 Maneuver	893	-	-	-	~ 45	0
Stage 1	-	-	-	-	490	0
Stage 2	-	-	-	-	191	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	893	-	-	-	~ 42	-
Mov Cap-2 Maneuver	-	-	-	-	139	-
Stage 1	-	-	-	-	461	-
Stage 2	-	-	-	-	191	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	55.3
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	893	-	-	-	139	-
HCM Lane V/C Ratio	0.059	-	-	-	0.512	-
HCM Control Delay (s)	9.3	-	-	-	55.3	0
HCM Lane LOS	A	-	-	-	F	A
HCM 95th %tile Q(veh)	0.2	-	-	-	2.4	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

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Appendix C

Queuing Calculations

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Intersection: 1: Sir Francis Drake Blvd & Larkspur Landing Cir

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	78	139	43	188	218	79	63
Average Queue (ft)	30	52	4	106	104	30	19
95th Queue (ft)	66	114	25	180	183	63	50
Link Distance (ft)		457	457	882		444	444
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	170				230		
Storage Blk Time (%)		0		0	0		
Queuing Penalty (veh)		0		0	0		

Intersection: 2: Sir Francis Drake Blvd & Drake Cove Rd

Movement	EB	WB	SB
Directions Served	L	T	LR
Maximum Queue (ft)	27	11	29
Average Queue (ft)	2	0	3
95th Queue (ft)	13	5	18
Link Distance (ft)		112	290
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	150		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: Sir Francis Drake Blvd & Project Driveway

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 4: Sir Francis Drake Blvd & Andersen Dr

Movement	EB	EB	B9	WB	WB	SB	SB
Directions Served	L	T	T	T	R	L	R
Maximum Queue (ft)	136	73	44	26	77	158	92
Average Queue (ft)	53	5	2	1	6	41	6
95th Queue (ft)	115	64	53	25	42	119	46
Link Distance (ft)		236	2124	438		376	
Upstream Blk Time (%)		0					
Queuing Penalty (veh)		3					
Storage Bay Dist (ft)	170				270		80
Storage Blk Time (%)	0	0		0		6	0
Queuing Penalty (veh)	2	0		0		5	0

Network Summary

Network wide Queuing Penalty: 10

Intersection: 1: Sir Francis Drake Blvd & Larkspur Landing Cir

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	139	317	237	130	130	130	40
Average Queue (ft)	27	144	59	56	54	53	14
95th Queue (ft)	76	264	178	108	113	104	40
Link Distance (ft)		457	457	882		444	444
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	170				230		
Storage Blk Time (%)	0	3					
Queuing Penalty (veh)	0	1					

Intersection: 2: Sir Francis Drake Blvd & Drake Cove Rd

Movement	EB	EB	B10	B10	SB
Directions Served	L	T	T		LR
Maximum Queue (ft)	31	7	286	172	31
Average Queue (ft)	3	0	12	6	8
95th Queue (ft)	19	6	172	121	30
Link Distance (ft)		163	882	882	290
Upstream Blk Time (%)			0	0	
Queuing Penalty (veh)			0	0	
Storage Bay Dist (ft)	150				
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 3: Sir Francis Drake Blvd & Project Driveway

Movement	EB
Directions Served	LT
Maximum Queue (ft)	3
Average Queue (ft)	0
95th Queue (ft)	3
Link Distance (ft)	112
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 4: Sir Francis Drake Blvd & Andersen Dr

Movement	EB	WB	SB	SB
Directions Served	L	R	L	R
Maximum Queue (ft)	52	30	73	19
Average Queue (ft)	17	2	33	1
95th Queue (ft)	45	17	62	13
Link Distance (ft)			376	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	170	270		80
Storage Blk Time (%)			0	0
Queuing Penalty (veh)			0	0

Network Summary

Network wide Queuing Penalty: 1

Intersection: 1: Sir Francis Drake Blvd & Larkspur Landing Cir

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	71	141	45	202	212	98	66
Average Queue (ft)	31	51	3	114	113	33	21
95th Queue (ft)	64	115	23	194	197	72	53
Link Distance (ft)		457	457	882		444	444
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	170				230		
Storage Blk Time (%)		0		0	0		
Queuing Penalty (veh)		0		0	0		

Intersection: 2: Sir Francis Drake Blvd & Drake Cove Rd

Movement	EB	WB	SB
Directions Served	L	T	LR
Maximum Queue (ft)	21	6	29
Average Queue (ft)	1	0	4
95th Queue (ft)	10	4	20
Link Distance (ft)		112	290
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	150		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: Sir Francis Drake Blvd & Project Driveway

Movement	EB	B9	SB
Directions Served	LT	T	LR
Maximum Queue (ft)	42	66	148
Average Queue (ft)	13	7	55
95th Queue (ft)	39	78	131
Link Distance (ft)	112	236	484
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		1	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Sir Francis Drake Blvd & Andersen Dr

Movement	EB	EB	B9	WB	WB	SB	SB
Directions Served	L	T	T	T	R	L	R
Maximum Queue (ft)	157	153	194	94	59	232	93
Average Queue (ft)	65	20	32	3	8	79	14
95th Queue (ft)	138	138	351	54	37	258	73
Link Distance (ft)		236	2124	438		376	
Upstream Blk Time (%)		2				7	
Queuing Penalty (veh)		15				0	
Storage Bay Dist (ft)	170				270		80
Storage Blk Time (%)	2	1		0		18	0
Queuing Penalty (veh)	13	1		0		18	0

Network Summary

Network wide Queuing Penalty: 49

Intersection: 1: Sir Francis Drake Blvd & Larkspur Landing Cir

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	130	367	290	143	140	114	44
Average Queue (ft)	31	169	85	64	61	56	15
95th Queue (ft)	87	313	232	124	122	103	42
Link Distance (ft)		457	457	882		444	444
Upstream Blk Time (%)		0					
Queuing Penalty (veh)		0					
Storage Bay Dist (ft)	170				230		
Storage Blk Time (%)	0	5					
Queuing Penalty (veh)	0	1					

Intersection: 2: Sir Francis Drake Blvd & Drake Cove Rd

Movement	EB	B10	SB
Directions Served	L	T	LR
Maximum Queue (ft)	31	504	32
Average Queue (ft)	3	38	9
95th Queue (ft)	18	298	31
Link Distance (ft)		882	290
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	150		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: Sir Francis Drake Blvd & Project Driveway

Movement	EB	WB	SB
Directions Served	LT	T	LR
Maximum Queue (ft)	55	2	128
Average Queue (ft)	18	0	39
95th Queue (ft)	47	2	94
Link Distance (ft)	112	672	484
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Sir Francis Drake Blvd & Andersen Dr

Movement	EB	WB	SB	SB
Directions Served	L	R	L	R
Maximum Queue (ft)	53	35	68	9
Average Queue (ft)	21	2	34	0
95th Queue (ft)	50	16	62	9
Link Distance (ft)			376	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	170	270		80
Storage Blk Time (%)			0	
Queuing Penalty (veh)			0	

Network Summary

Network wide Queuing Penalty: 1

Intersection: 1: Sir Francis Drake Blvd & Larkspur Landing Cir

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	70	144	39	210	212	78	72
Average Queue (ft)	28	55	4	111	108	32	20
95th Queue (ft)	60	117	21	192	187	67	55
Link Distance (ft)		457	457	882		444	444
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	170				230		
Storage Blk Time (%)		0		0	0		
Queuing Penalty (veh)		0		0	0		

Intersection: 2: Sir Francis Drake Blvd & Drake Cove Rd

Movement	EB	EB	WB	SB
Directions Served	L	T	T	LR
Maximum Queue (ft)	27	74	24	29
Average Queue (ft)	3	7	1	4
95th Queue (ft)	17	41	15	19
Link Distance (ft)		163	112	290
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	150			
Storage Blk Time (%)		0		
Queuing Penalty (veh)		0		

Intersection: 3: Sir Francis Drake Blvd & Project Driveway

Movement	EB	EB	WB	WB	B7	B9	B9	SB
Directions Served	L	T	T	R	T	T		LR
Maximum Queue (ft)	57	130	638	50	139	36	6	104
Average Queue (ft)	18	52	331	2	12	1	0	43
95th Queue (ft)	48	121	710	31	93	31	4	86
Link Distance (ft)	112	112	672		2124	236	236	481
Upstream Blk Time (%)		1	2			0		
Queuing Penalty (veh)		3	24			0		
Storage Bay Dist (ft)				190				
Storage Blk Time (%)			9	0				
Queuing Penalty (veh)			0	0				

Intersection: 4: Sir Francis Drake Blvd & Andersen Dr

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	131	53	3	70	169	83
Average Queue (ft)	54	2	0	7	58	15
95th Queue (ft)	108	35	5	38	153	74
Link Distance (ft)		236	438		376	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	170			270		80
Storage Blk Time (%)	0	0			14	0
Queuing Penalty (veh)	1	0			14	0

Network Summary

Network wide Queuing Penalty: 43

Intersection: 1: Sir Francis Drake Blvd & Larkspur Landing Cir

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	153	423	326	133	131	125	44
Average Queue (ft)	32	179	88	60	57	53	13
95th Queue (ft)	95	348	255	114	114	102	40
Link Distance (ft)		457	457	882		444	444
Upstream Blk Time (%)		0					
Queuing Penalty (veh)		0					
Storage Bay Dist (ft)	170				230		
Storage Blk Time (%)		6					
Queuing Penalty (veh)		2					

Intersection: 2: Sir Francis Drake Blvd & Drake Cove Rd

Movement	EB	EB	B5	B10	B10	SB
Directions Served	L	T	T	T		LR
Maximum Queue (ft)	25	244	385	729	444	31
Average Queue (ft)	2	114	69	125	44	9
95th Queue (ft)	15	278	288	589	328	30
Link Distance (ft)		163	421	882	882	290
Upstream Blk Time (%)		5	1	0		
Queuing Penalty (veh)		70	10	2		
Storage Bay Dist (ft)	150					
Storage Blk Time (%)		5				
Queuing Penalty (veh)		0				

Intersection: 3: Sir Francis Drake Blvd & Project Driveway

Movement	EB	EB	WB	WB	SB
Directions Served	L	T	T	R	LR
Maximum Queue (ft)	85	130	162	17	74
Average Queue (ft)	23	88	45	1	29
95th Queue (ft)	60	168	124	10	60
Link Distance (ft)	112	112	672		481
Upstream Blk Time (%)	0	5			
Queuing Penalty (veh)	0	35			
Storage Bay Dist (ft)				190	
Storage Blk Time (%)			0		
Queuing Penalty (veh)			0		

Intersection: 4: Sir Francis Drake Blvd & Andersen Dr

Movement	EB	WB	WB	SB	SB
Directions Served	L	T	R	L	R
Maximum Queue (ft)	46	2	22	81	9
Average Queue (ft)	20	0	1	37	0
95th Queue (ft)	48	2	13	65	9
Link Distance (ft)		438		376	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	170		270		80
Storage Blk Time (%)				0	
Queuing Penalty (veh)				0	

Network Summary

Network wide Queuing Penalty: 118

Intersection: 1: Sir Francis Drake Blvd & Larkspur Landing Cir

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	77	150	65	207	213	83	51
Average Queue (ft)	29	53	5	113	112	32	20
95th Queue (ft)	62	119	32	192	187	66	50
Link Distance (ft)		457	457	882		444	444
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	170				230		
Storage Blk Time (%)		0		0	0		
Queuing Penalty (veh)		0		0	0		

Intersection: 2: Sir Francis Drake Blvd & Drake Cove Rd

Movement	EB	B5	B10	WB	WB	SB
Directions Served	T	T	T	T	R	LR
Maximum Queue (ft)	108	50	20	28	5	29
Average Queue (ft)	10	2	1	1	0	4
95th Queue (ft)	60	50	20	15	5	19
Link Distance (ft)	163	421	882	112	112	290
Upstream Blk Time (%)	0	0		0		
Queuing Penalty (veh)	1	1		0		
Storage Bay Dist (ft)						
Storage Blk Time (%)	0					
Queuing Penalty (veh)	0					

Intersection: 3: Sir Francis Drake Blvd & Project Driveway

Movement	EB	EB	WB	WB	B7	B9	B9	SB
Directions Served	L	T	T	R	T	T		LR
Maximum Queue (ft)	75	130	706	94	268	93	5	99
Average Queue (ft)	25	52	356	5	52	4	0	44
95th Queue (ft)	63	121	740	53	337	62	5	83
Link Distance (ft)	112	112	672		2124	236	236	481
Upstream Blk Time (%)	0	1	2			0		
Queuing Penalty (veh)	0	3	35			1		
Storage Bay Dist (ft)				190				
Storage Blk Time (%)			10	0				
Queuing Penalty (veh)			0	0				

Intersection: 4: Sir Francis Drake Blvd & Andersen Dr

Movement	EB	EB	B9	WB	WB	SB	SB
Directions Served	L	T	T	T	R	L	R
Maximum Queue (ft)	146	96	255	64	72	286	104
Average Queue (ft)	60	12	25	4	5	106	21
95th Queue (ft)	128	104	308	68	41	313	90
Link Distance (ft)		236	2124	438		376	
Upstream Blk Time (%)		2		0		7	
Queuing Penalty (veh)		12		0		0	
Storage Bay Dist (ft)	170				270		80
Storage Blk Time (%)	2	1		0		28	0
Queuing Penalty (veh)	13	1		0		28	0

Network Summary

Network wide Queuing Penalty: 97

Intersection: 1: Sir Francis Drake Blvd & Larkspur Landing Cir

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	112	414	338	143	131	125	46
Average Queue (ft)	29	183	95	63	59	53	14
95th Queue (ft)	81	357	274	122	118	99	41
Link Distance (ft)		457	457	882		444	444
Upstream Blk Time (%)		1	0				
Queuing Penalty (veh)		0	0				
Storage Bay Dist (ft)	170				230		
Storage Blk Time (%)		8					
Queuing Penalty (veh)		2					

Intersection: 2: Sir Francis Drake Blvd & Drake Cove Rd

Movement	EB	B5	B10	B10	SB
Directions Served	T	T	T		LR
Maximum Queue (ft)	247	400	598	480	29
Average Queue (ft)	123	80	131	62	4
95th Queue (ft)	284	321	617	407	20
Link Distance (ft)	163	421	882	882	290
Upstream Blk Time (%)	5	1	1	0	
Queuing Penalty (veh)	75	15	4	1	
Storage Bay Dist (ft)					
Storage Blk Time (%)	5				
Queuing Penalty (veh)	0				

Intersection: 3: Sir Francis Drake Blvd & Project Driveway

Movement	EB	EB	WB	WB	SB
Directions Served	L	T	T	R	LR
Maximum Queue (ft)	78	146	151	27	75
Average Queue (ft)	24	91	44	2	31
95th Queue (ft)	58	170	121	12	61
Link Distance (ft)	112	112	672		481
Upstream Blk Time (%)	0	5			
Queuing Penalty (veh)	0	39			
Storage Bay Dist (ft)				190	
Storage Blk Time (%)			0		
Queuing Penalty (veh)			0		

Intersection: 4: Sir Francis Drake Blvd & Andersen Dr

Movement	EB	WB	SB	SB
Directions Served	L	R	L	R
Maximum Queue (ft)	55	38	78	38
Average Queue (ft)	20	2	34	2
95th Queue (ft)	49	17	62	21
Link Distance (ft)			376	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	170	270		80
Storage Blk Time (%)			0	0
Queuing Penalty (veh)			0	0

Network Summary

Network wide Queuing Penalty: 136

Queuing and Blocking Report
AM Ex+Project with Signalized Drakes Cove Road
03/11/2022

Intersection: 1: Sir Francis Drake Blvd & Larkspur Landing Cir

Movement	EB	EB	EB	WB	WB	B5	SB	SB
Directions Served	L	T	T	T	TR	T	L	R
Maximum Queue (ft)	90	158	62	206	216	23	76	61
Average Queue (ft)	30	56	4	115	110	1	30	20
95th Queue (ft)	65	125	30	192	190	23	64	52
Link Distance (ft)		457	457	882		163	444	444
Upstream Blk Time (%)						0		
Queuing Penalty (veh)						0		
Storage Bay Dist (ft)	170				230			
Storage Blk Time (%)		0		0	0			
Queuing Penalty (veh)		0		0	0			

Intersection: 2: Sir Francis Drake Blvd & Drake Cove Rd

Movement	EB	EB	B5	B10	WB	WB	B7	B9	B9	SB
Directions Served	L	T	T	T	T	R	T	T		LR
Maximum Queue (ft)	83	152	56	5	656	48	72	69	5	71
Average Queue (ft)	27	44	3	0	213	2	3	2	0	34
95th Queue (ft)	70	117	61	5	523	32	43	39	5	61
Link Distance (ft)		163	421	882	834		2124	236	236	290
Upstream Blk Time (%)		1	0		0			0		
Queuing Penalty (veh)		5	1		7			0		
Storage Bay Dist (ft)	150					275				
Storage Blk Time (%)		1			4					
Queuing Penalty (veh)		0			0					

Intersection: 4: Sir Francis Drake Blvd & Andersen Dr

Movement	EB	EB	B9	WB	WB	SB	SB
Directions Served	L	T	T	T	R	L	R
Maximum Queue (ft)	150	131	162	17	50	256	84
Average Queue (ft)	61	15	15	1	5	73	13
95th Queue (ft)	131	120	168	13	29	226	69
Link Distance (ft)		236	2124	438		376	
Upstream Blk Time (%)		2				1	
Queuing Penalty (veh)		12				0	
Storage Bay Dist (ft)	170				270		80
Storage Blk Time (%)	2	1				17	0
Queuing Penalty (veh)	12	1				17	0

Network Summary

Network wide Queuing Penalty: 56

Queuing and Blocking Report
PM Ex+Project with Signalized Drakes Cove Road
03/11/2022

Intersection: 1: Sir Francis Drake Blvd & Larkspur Landing Cir

Movement	EB	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	T	TR	L	R
Maximum Queue (ft)	128	324	268	142	136	132	40
Average Queue (ft)	40	166	118	64	59	53	13
95th Queue (ft)	129	365	301	122	119	101	38
Link Distance (ft)		457	457	882		444	444
Upstream Blk Time (%)		1	1				
Queuing Penalty (veh)		0	0				
Storage Bay Dist (ft)	170				230		
Storage Blk Time (%)	0	16			0		
Queuing Penalty (veh)	0	4			0		

Intersection: 2: Sir Francis Drake Blvd & Drake Cove Rd

Movement	EB	EB	B5	B10	B10	WB	WB	SB
Directions Served	L	T	T	T		T	R	LR
Maximum Queue (ft)	153	260	495	867	709	158	26	83
Average Queue (ft)	44	225	214	592	409	61	3	31
95th Queue (ft)	128	282	483	1165	920	134	18	64
Link Distance (ft)		163	421	882	882	823		290
Upstream Blk Time (%)	0	13	2	3	0			
Queuing Penalty (veh)	0	196	35	23	4			
Storage Bay Dist (ft)	150						275	
Storage Blk Time (%)	0	13						
Queuing Penalty (veh)	1	7						

Intersection: 4: Sir Francis Drake Blvd & Andersen Dr

Movement	EB	WB	SB	SB
Directions Served	L	R	L	R
Maximum Queue (ft)	53	45	76	24
Average Queue (ft)	21	3	33	1
95th Queue (ft)	50	20	61	15
Link Distance (ft)			376	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	170	270		80
Storage Blk Time (%)			0	0
Queuing Penalty (veh)			0	0

Network Summary

Network wide Queuing Penalty: 271

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Appendix D

Pedestrian Crossing Worksheets

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Table 1 provides initial countermeasure options for various roadway conditions. Each matrix cell indicates possibilities that may be appropriate for designated pedestrian crossings. Not all of the countermeasures listed in the matrix cell should necessarily be installed at a crossing.

For multi-lane roadway crossings with vehicle AADTs exceeding 10,000, a marked crosswalk alone is typically insufficient (Zegeer, 2005). Under such conditions, more substantial crossing improvements (such as the refuge island, PHB, and RRFB) are also needed to prevent an increase in pedestrian crash potential.

Table 1. Application of pedestrian crash countermeasures by roadway feature.

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
2 lanes (1 lane in each direction)	❶ 2 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6 7 9	① 5 6 7 9	① 5 6 ❾
3 lanes with raised median (1 lane in each direction)	❶ 2 3 4 5	❶ ❸ 5 7 9	① ❸ 5 ❼ ❾	① 3 4 5 7 9	① ❸ 5 ❼ ❾	① ❸ 5 ❼ ❾	① ❸ 4 5 7 9	① ❸ 5 ❼ ❾	① ❸ 5 ❾
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	❶ 2 3 4 5 6 7 9	❶ ❸ 5 6 7 9	① ❸ 5 6 ❾	① 3 4 5 6 7 9	① ❸ 5 6 ❼ ❾	① ❸ 5 6 ❾	① ❸ 4 5 6 7 9	① ❸ 5 6 ❾	① ❸ 5 6 ❾
4+ lanes with raised median (2 or more lanes in each direction)	❶ ❸ 5 7 8 9	❶ ❸ 5 7 8 9	① ❸ 5 8 ❾	① ❸ 5 7 8 9	① ❸ 5 ❼ 8 ❾	① ❸ 5 8 ❾	① ❸ 5 ❼ 8 ❾	① ❸ 5 8 ❾	① ❸ 5 8 ❾
4+ lanes w/o raised median (2 or more lanes in each direction)	❶ ❸ 5 6 7 8 9	① ❸ 5 ❻ 7 8 9	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ 7 8 9	① ❸ 5 ❻ ❼ 8 ❾	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ 8 ❾

Given the set of conditions in a cell,

- # Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.
- ● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.
- ○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

1. High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs
2. Raised crosswalk
3. Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
4. In-Street Pedestrian Crossing sign
5. Curb extension
6. Pedestrian refuge island
7. Rectangular Rapid-Flashing Beacon (RRFB)**
8. Road Diet
9. Pedestrian Hybrid Beacon (PHB)**

*Refer to Chapter 4, 'Using Table 1 and Table 2 to Select Countermeasures,' for more information about using multiple countermeasures.

**It should be noted that the PHB and RRFB are not both installed at the same crossing location.

This table was developed using information from: Zegeer, C.V., J.R. Stewart, H.H. Huang, P.A. Lagerwey, J. Feaganes, and B.J. Campbell. (2005). Safety effects of marked versus unmarked crosswalks at uncontrolled locations: Final report and recommended guidelines. FHWA, No. FHWA-HRT-04-100, Washington, D.C.; FHWA. Manual on Uniform Traffic Control Devices, 2009 Edition. (revised 2012). Chapter 4F, Pedestrian Hybrid Beacons. FHWA, Washington, D.C.; FHWA. Crash Modification Factors (CMF) Clearinghouse. http://www.cmfclearinghouse.org/; FHWA. Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE). http://www.pedbikesafe.org/PEDSAFE/; Zegeer, C., R. Srinivasan, B. Lan, D. Carter, S. Smith, C. Sundstrom, N.J. Thirsk, J. Zegeer, C. Lyon, E. Ferguson, and R. Van Houten. (2017). NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments. Transportation Research Board, Washington, D.C.; Thomas, Thirsk, and Zegeer. (2016). NCHRP Synthesis 498: Application of Pedestrian Crossing Treatments for Streets and Highways. Transportation Research Board, Washington, D.C.; and personal interviews with selected pedestrian safety practitioners.

Pedestrian Hybrid Beacon (HAWK) Signal Warrant

Low-Speed Roadway

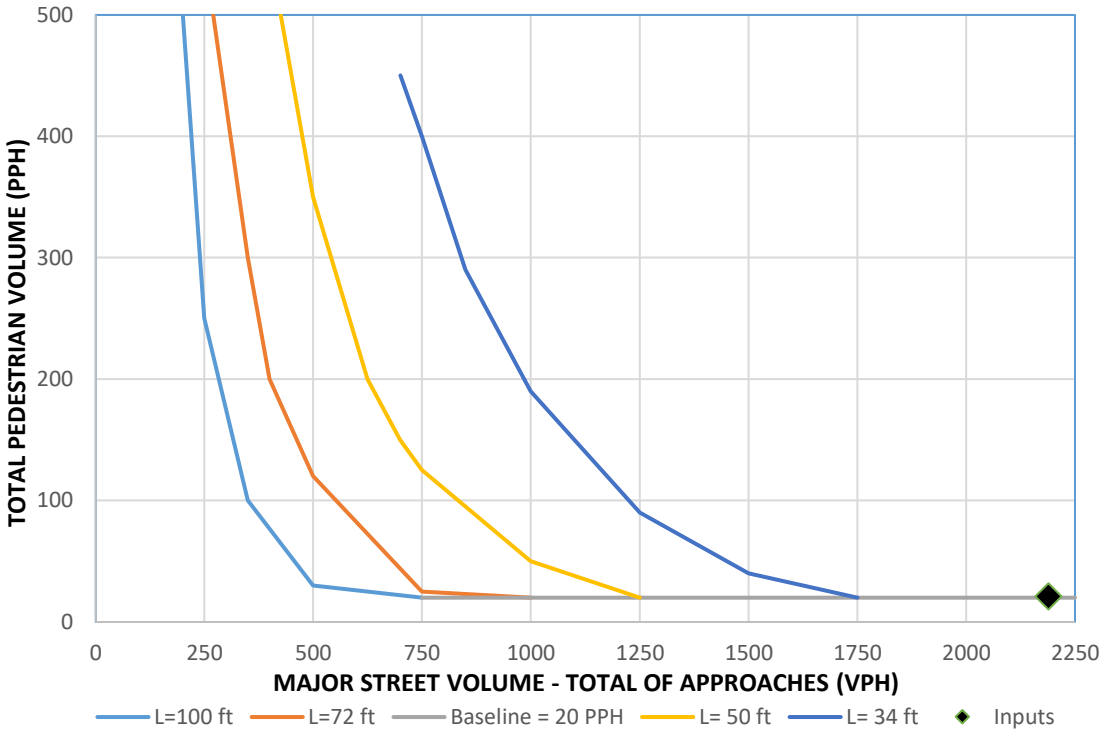
Project Name: Oak Hill Apartments

Scenario: PM plus Project
Location: Project Driveway/Sir Francis Drake Blvd
Date of Count: Tuesday, July 13, 2021

Speed Limit: 35 mph
Crosswalk Length: 60 feet

Major Street Approach Volume: 2,188 VPH
Pedestrians Crossing: 21 PPH

WARRANT MET? **Yes**



Note: Installation of a HAWK Singal is warranted when the plotted point (see graph above) falls above the curve representing the corresponding crosswalk length (L).

If the length (L) of the crosswalk does not match one displayed on the graph, interpolate between existing curves to find the position of the curve representing the crosswalk length being analyzed.

Reference: California Manual on Uniform Traffic Control Devices (MUTCD) 2014 Edition

TCRP Report 112 - NCHRP Report 562 - Pedestrian Crossing Treatment Worksheet
Worksheet 1: Peak-Hour, 35 MPH or Less

Analyst and Site Information

Analyst:	W-Trans	Major Street:	Sir Francis Drake Boulevard
Analysis Date:	15-Aug-21	Minor Street or Location:	Project Driveway
Data Collection Date:	7/13/2021	Peak Hour:	4pm-5pm

Step 1: Select worksheet (speed reflects posted or statutory speed limit or 85th percentile speed on the major street):
a) Worksheet 1 - 35 mph or less
b) Worksheet 2- exceeds 35 mph, communities with less than 10,000, or where major transit stop exists

Step 2: Does the crossing meet minimum pedestrian volumes to be considered for a TCD type of treatment?

2a	Peak-hour pedestrian volume (ped/h), vp	**2a**	21
	○If 2a ≥ 20 ped/h, then go to Step 3.		
	○If 2a < 20 ped/h, then consider median refuge islands, curb extensions, traffic calming, etc. as feasible.		

Step 3: Does the crossing meet the pedestrian volume warrant for a traffic signal?

3a	Major road volume, total of both approaches during peak hour (veh/h), V maj-s	**3a**	2188
3b	○Minimum signal warrant volume for peak hour (use 3a for Vmaj-s), SC	**3b**	158.36
	•SC = 0.00021 Vmaj-s² - 0.74072 Vmaj-s + 734.125)/0.75 **OR**		
	•[(0.00021 3a² - 0.74072 3a + 734.125)/0.75]		
3c	○If 3b< 133, then enter 133. If 3b ≥ 133, then enter 3b.	**3c**	158.3625067
3d	○If 15th percentile crossing speed of pedestrians is less than 3.5 ft/s (1.1 m/s), then reduce 3c by up to 50 percent; otherwise enter 3c.	**3d**	158.3625067
	○If 2a ≥ 3d, then the warrant has been met and a traffic signal should be considered if not within 300 ft of another traffic signal. Otherwise, the warrant has not been met. Go to Step 4.		

Step 4: Estimate pedestrian delay.

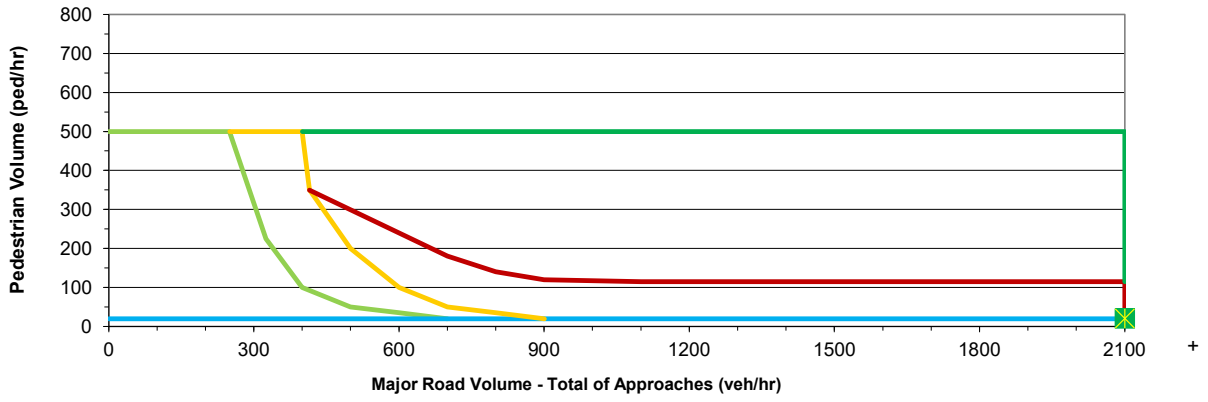
4a	Pedestrian crossing distance, curb to curb (ft), L	**4a**	60
4b	Pedestrian walking speed (ft.s), Sp	**4b**	3.5
4c	Pedestrian start-up time and end clearance time (s), ts	**4c**	7
4d	○Critical gap required for crossing pedestrian (s), tc= (L/Sp) + ts OR [(4a/4b) + 4c)]	**4d**	24.14
4e	Major road volume, total of both approaches or approach being crossed if median refuge island is present during peak hour (veh.h), Vmaj-d	**4e**	2188
4f	○Major road flow rate (veh/s), v = Vmaj-d/3600 OR [4e/3600]	**4f**	0.61
4g	○Average pedestrian delay (s/person), dp = $(e^{v\,tc}$ - v tc - 1) / v OR [$(e^{4f \times 4d}$-4f x 4d - 1) / 4f]	**4g**	3880332.40
4h	○Total pedestrian delay (h), Dp=(dp x Vp) / 3600 OR [(4g x 2a) / 3600]	**4h**	22635.27
	(this is estimated delayfor all pedestrians crossing the major roadway without a crossing treatment - assumes 05 compliance). This calculated value can be replaced with the actual total pedestrian delay measured at the site.		

Step 5: Select treatment based upon total pedestrian delay and expected motorist compliance.

5a	Expected motorist compliance at pedestrian crossings in region, Comp = high or low	**5a**	LOW

Total Pedestrian Delay Dp (**4h**) and Comp (**5a**)	**Treatment Category** (see Descriptions of Sample Treatments for examples)
Dp ≥21.3h (Comp = high or low) OR 5.3h≤Dp<21.3 h and Comp = low	USE RED
1.3h ≤ Dp < 21.3h and Comp = high or low) OR 5.3 ≤ Dp < 21.3 h and Comp = high	DO NOT USE ACTIVE OR ENHANCED
Dp < 1.3 h (Comp = high or low)	DO NOT USE CROSSWALK

Roadway Configuration: 66' Wide, >35 mph, Vped =3.5 ft/s



LEGEND
Study Intersection
Signal
Enhanced-High Visibility/Active when Present
Red
Enhanced-High Visibility/Active when Present (if high compliance expected) OR Red (if low compliance expected)
Striped Crosswalk
No Treatment

DESCRIPTIONS OF TREATMENT TYPE

RED	ENHANCED-HIGH VISIBILITY/ACTIVE WHEN PRESENT	
	Active When Present	**Enhanced/High Visibility**
• Midblock Signal	• In Roadway Warning Lights	• In-Street Crossing Signs
		• High Visibility Signs/Markings
	• Passive/Pushbutton Flashing Beacons	• Pedestrian Refuge Islands
• Half Signal		• Raised Crosswalks
	• Pedestrian Crossing Flags	• Curb Extensions
		• Advanced Signage
• HAWK	• Rapid Rectangular Flashing Beacons	• Advanced Stop/Yield Lines
		• Constant Flashing Yellow Beacons

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Appendix E

Turn Lane Warrant Worksheets

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Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Sir Francis Drake Blvd/Project Access
Study Scenario: Existing plus Project AM

Direction of Analysis Street: East/West

Cross Street Intersects: From the North

Sir Francis Drake Blvd

Westbound Volumes (veh/hr)

Through Volume = 1428

Right Turn Volume = 5

Westbound Speed Limit: 35 mph

Westbound Configuration: 2 Lanes - Undivided

Project Driveway

Sir Francis Drake Blvd

Eastbound Volumes (veh/hr)

643 = Through Volume

18 = Left Turn Volume

Eastbound Speed Limit: 35 mph

Eastbound Configuration: 2 Lanes - Undivided

Westbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold	AV =	1012.6
Advancing Volume	Va =	1433
If AV<Va then warrant is met		Yes

Right Turn Lane Warranted: **YES**

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

1. Check taper volume criteria

N/A

2. Check advance volume threshold criteria for taper

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

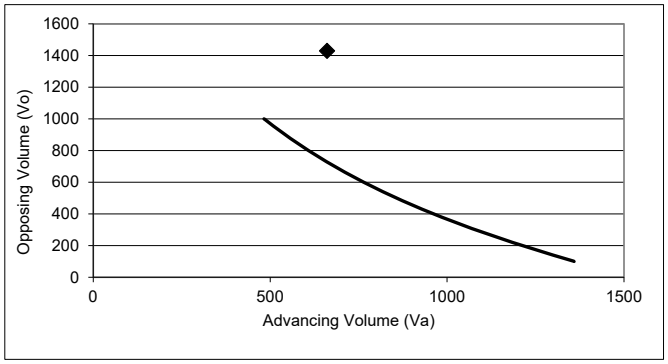
Right Turn Taper Warranted: **N/A**

Eastbound Left Turn Lane Warrants

Percentage Left Turns %lt 2.7 %

Advancing Volume Threshold AV 295 veh/hr

If AV<Va then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 35 mph

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

Left Turn Lane Warranted: **YES**

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

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Sir Francis Drake Blvd/Project Access
Study Scenario: Existing plus Project PM

Direction of Analysis Street: East/West

Cross Street Intersects: From the North

Sir Francis Drake Blvd

Westbound Volumes (veh/hr)

Through Volume = 728

Right Turn Volume = 17

Westbound Speed Limit: 35 mph

Westbound Configuration: 2 Lanes - Undivided

Project Driveway

Sir Francis Drake Blvd

Eastbound Volumes (veh/hr)

1455 = Through Volume

50 = Left Turn Volume

Eastbound Speed Limit: 35 mph

Eastbound Configuration: 2 Lanes - Undivided

Westbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold	AV =	922.6
Advancing Volume	Va =	745
If AV<Va then warrant is met		No

Right Turn Lane Warranted: **NO**

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

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

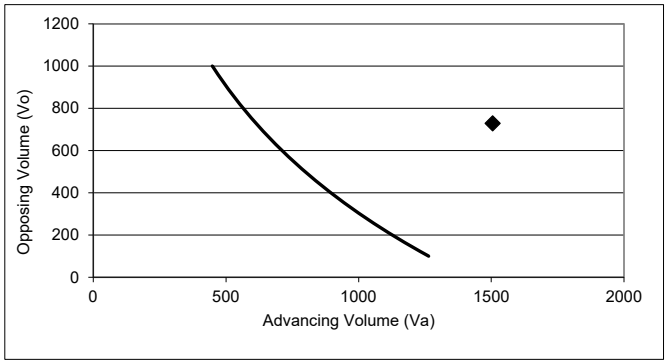
Advancing Volume Threshold	AV =	-
Advancing Volume	Va =	745
If AV<Va then warrant is met		-

Right Turn Taper Warranted: **NO**

Eastbound Left Turn Lane Warrants

Percentage Left Turns	%lt	3.3 %
Advancing Volume Threshold	AV	614 veh/hr

If AV<Va then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 35 mph

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

Left Turn Lane Warranted: **YES**

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

Appendix F

Traffic Signal Peak-Hour Volume Warrant Worksheet

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Warrant 3: Peak-Hour Volumes and Delay

Sir Francis Drake Blvd & Project Access
Marin County

Project Name: Oak Hill Apartments TIS

Intersection: 4

	Major Street	Minor Street
Street Name	Sir Francis Drake Blvd	Project Access
Direction	E-W	N-S
Number of Lanes	1	1
Approach Speed	35	35

Population less than 10,000? No
Date of Count: Tuesday, July 13, 2021
Scenario: Existing plus Project (Combined Driveways)

Warrant 3 Met?: Met when either Condition A or B is met — **No**

Condition A: Met when conditions A1, A2, and A3 are met — Not Met

Condition A1 — Not Met

The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one lane approach, or five vehicle-hours for a two-lane approach

Minor Approach Delay: N/A vehicle-hours

Condition A2 — Not Met

The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic of 150 vph for two moving lanes

Minor Approach Volume: 71 vph

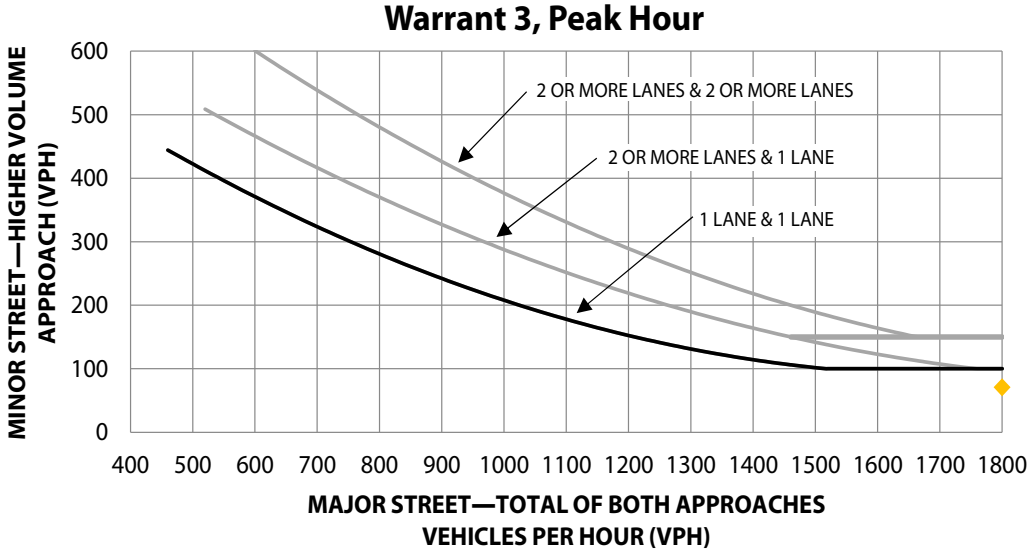
Condition A3 — Met

The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more appraches or 650 vph for intersections with three approaches

Total Entering Volume: 2194 vph

Condition B — Not Met

The plotted point falls above the curve



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