

TJKM
Transportation
Consultants



Vision That Moves Your Community

Final Draft

**Traffic Impact Study
for Lavenida Lane
Subdivision**

In the City of Orinda

August 16, 2011

Pleasanton
Fresno
Sacramento
Santa Rosa





Vision That Moves Your Community

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Introduction and Summary

Introduction

This report presents the results of a traffic impact analysis for the proposed residential development located on Lavenida Lane southwest of Moraga Way, at the intersection of Lavenida Drive and Donna Maria Way, in the City of Orinda. The proposed development would consist of an 8-lot single-family residential subdivision on undeveloped land totaling 12.2 acres. The report includes the results of a traffic operations analysis, as well as an evaluation of external site access and driveway operations.

TJKM recently conducted the traffic study for the 24 Adobe Lane project, which is located on Adobe Lane between El Camino Moraga and Lavenida Drive adjacent to the proposed development. The development would consist of a 13-lot single-family residential subdivision on undeveloped land totaling 20.33 acres. The two projects are inter-related to each other, since both projects would potentially contribute traffic to the same nearby intersections along Moraga Way. This report incorporates pertinent findings from the 24 Adobe Lane traffic study.

Summary

The proposed residential development at 24 Adobe Lane is expected to generate approximately 124 daily trips on a typical weekday, with 9 trips during the a.m. peak hour and 13 trips during the p.m. peak hour.

The proposed Lavenida Subdivision is expected to generate approximately 77 daily trips on a typical weekday, including six trips during the a.m. peak hour and 8 trips during the p.m. peak hour. The trip generation estimates were based on the *ITE's Trip Generation*, 8th Edition, which contains trip generation rates for over 140 different land use codes. ITE Land Use Code 210 (Single-Family Detached Residential) was used for the trip generation calculation, which represents any single family residential development irrespective of the lot size.

Under Existing Conditions, four of the five study intersections are operating at level of service (LOS) C or better, which is within acceptable City of Orinda LOS standards. The intersection of Lavenida Drive and Moraga Way operates at LOS D during the a.m. peak hour, which is below City standards.

Under all scenarios, four study intersections are expected to continue operating acceptably at LOS C or better. The intersection of Lavenida Drive and Moraga Way is expected to continue operating at LOS D during the a.m. peak hour, which is below City standards. However, the addition of the Lavenida Lane Subdivision will not significantly increase delay at the intersection, therefore no mitigation is warranted.

TJKM reviewed the latest five-year collision history for all study intersections to determine any trends related to vehicle, bicycle, and pedestrian safety. One collision was reported within the five-year period at each of the study intersections except the Don Gabriel Way / El Camino Moraga intersection, where no collisions were reported. None of the reported collisions involved either a pedestrian or a bicycle. These results suggest that there are no existing safety issues at any of the study intersections.

TJKM reviewed the project site plan to evaluate on-site traffic circulation and access. Internal traffic circulation within the proposed project site is expected to be adequate and meets City's design standards.

Intersection Analysis Methodology

Study Intersections and Scenarios

TJKM evaluated traffic conditions at five study intersections during a.m. and p.m. peak hours for a typical weekday. Based on the traffic volume on Moraga Way, the peak periods observed were between 7:00 a.m. – 9:00 a.m. and 4:00 p.m. – 6:00 p.m. Traffic volume on Moraga Way was observed to be higher during the p.m. peak period as compared to the school pick-up peak period. The study intersections and their associated traffic controls are as follows:

1. Donna Maria Way/El Camino Moraga (One-Way Stop)
2. Don Gabriel Way/El Camino Moraga (One-Way Stop)
3. El Camino Moraga/Moraga Way (Signal)
4. Lavenida Drive/Moraga Way (One-Way Stop)
5. Estabueno Drive/Moraga Way (Two-Way Stop)

Figure 1 illustrates the study area intersections and proposed project vicinity. Figure 2 shows the project site plan.

This study addresses the following four (4) traffic scenarios:

1. Existing Conditions – This scenario evaluates the study intersections based on existing traffic counts and field surveys.
2. Existing plus Lavenida Project without the extension of Donna Maria Way (Scenario 1) – This scenario is similar to Existing Conditions, but with the addition of traffic from the proposed Lavenida Subdivision development without the extension of Donna Maria.
3. Existing plus 24 Adobe Lane plus Lavenida Project without the extension of Donna Maria Way (Scenario 2) – This scenario is similar to Existing Conditions, but with the addition of traffic from the proposed residential development at 24 Adobe Lane with access only from El Camino Moraga, and with the addition of traffic from the proposed residential development on Lavenida Lane.
4. Existing plus 24 Adobe Lane plus Lavenida Project with the extension of Donna Maria Way (Scenario 3) – This scenario is similar to Existing Conditions, but with the addition of traffic from the proposed residential development at 24 Adobe Lane with access from both El Camino Moraga and Lavenida Drive, and with the addition of traffic from the proposed residential development on Lavenida Lane.

Level of Service Analysis Methodology

Potential project traffic impacts on the study intersections were quantified through the determination of level of service (LOS), a qualitative measure describing operational conditions within a traffic stream. There are six levels of service defined for each type of facility (i.e., roadway or intersection) that is analyzed. LOS has letter designations ranging from A to F, with LOS A representing free flow traffic with little or no delay and LOS F representing jammed conditions with excessive delay and long back-ups. Procedures for analyzing each type of facility are based on the *Highway Capacity Manual 2000 (HCM 2000)*. The LOS methodology is described in detail in Appendix A.

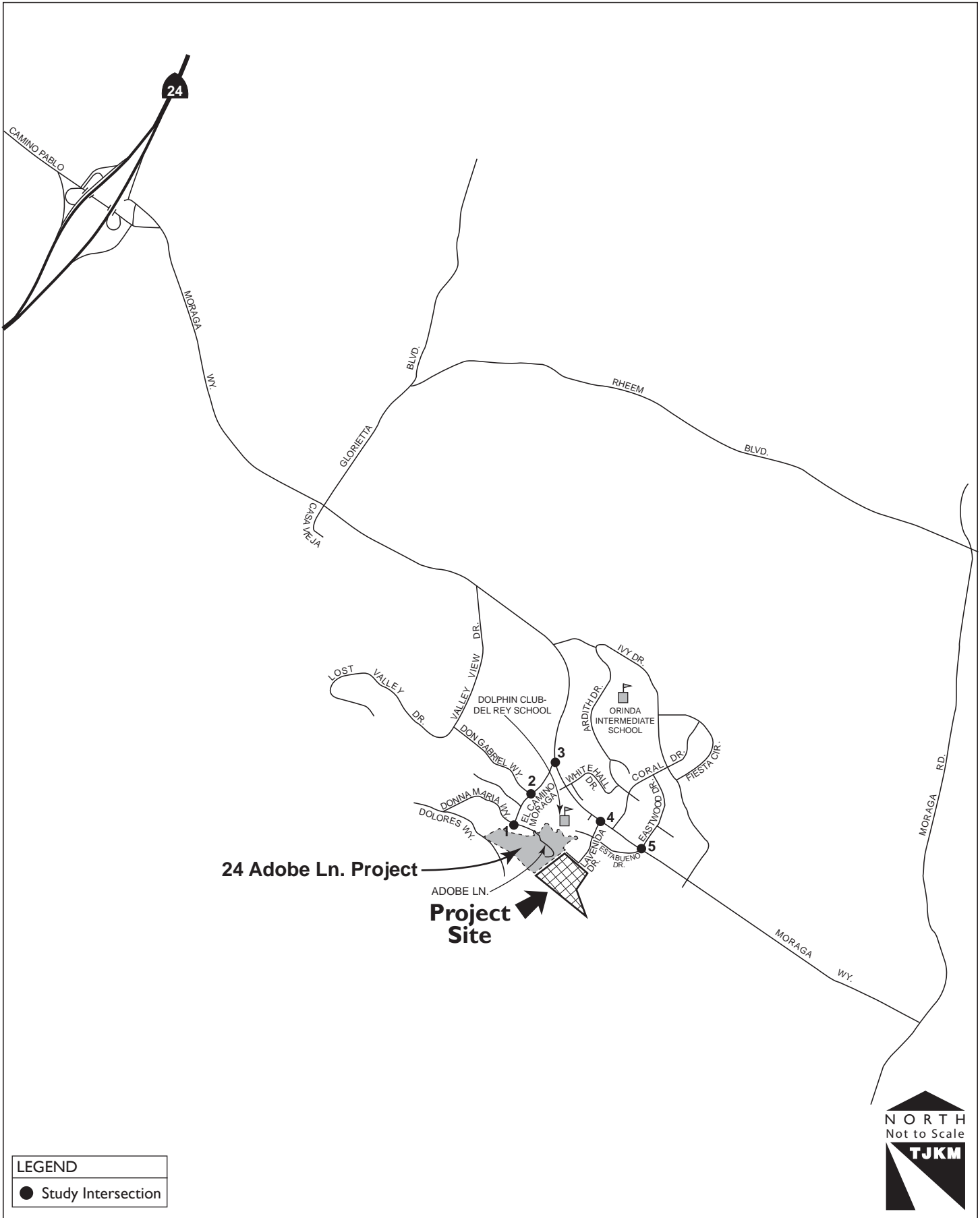
Significant Impact Criteria / Level of Service Standards

Based on City of Orinda standards and Contra Costa Transportation Authority guidelines and requirements, a set of significance criteria for transportation and circulation impacts has been established. The project would have a significant impact on transportation and circulation if it would:

- Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e. result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on the road, or congestion at an intersection);
- Either individually or cumulatively result in degradation of a LOS C standard established by the City of Orinda for designated roads (City of Orinda General Plan, Section 2.3.1, November 1994);
- Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., recreational facilities).

TJKM used the above criteria to determine whether the proposed project is expected to have a significant impact on the study intersections.

City of Orinda - Lavenida Lane Subdivision Vicinity Map





Existing Conditions

Existing Traffic Volumes, Intersection Lane Geometry, and Traffic Controls

TJKM staff collected existing weekday a.m. and p.m. peak hour vehicle counts at four study intersections in April 2009 and one intersection in October 2010. All counts were collected on typical weekdays during non-holiday weeks. Traffic volume on Moraga Way was observed to be higher during the p.m. peak period (i.e. 4:00 p.m. – 6:00 p.m.) as compared to the school pick-up peak period, therefore traffic volumes were collected between 7:00 a.m. – 9:00 a.m. and 4:00 p.m. – 6:00 p.m. Field verification of existing intersection lane configurations, types of traffic control, and signal phasing was conducted and provided the basis for the level of service analysis for existing conditions.

Figure 3 illustrates the existing lane geometry and traffic controls for the study intersections. Figure 4 shows existing turning movement volumes at the study intersections. Existing intersection count sheets are included in Appendix B.

Collision Analysis

TJKM obtained the latest five-year collision history for the study intersections from the California Statewide Integrated Traffic Records System (SWITRS) database, to determine any trends related to vehicle, bicycle, and pedestrian safety.

Table I shows collisions by type for each study intersection over the five-year evaluation period. One collision was reported within the five-year period at each of the study intersections except the intersection of Don Gabriel Way and El Camino Moraga, where no collisions were reported. None of the reported collisions involved either a pedestrian or a bicycle. These results suggest that there are no existing safety issues at any of the study intersections.

Table I: Collisions by Type, January 2003 – December 2007

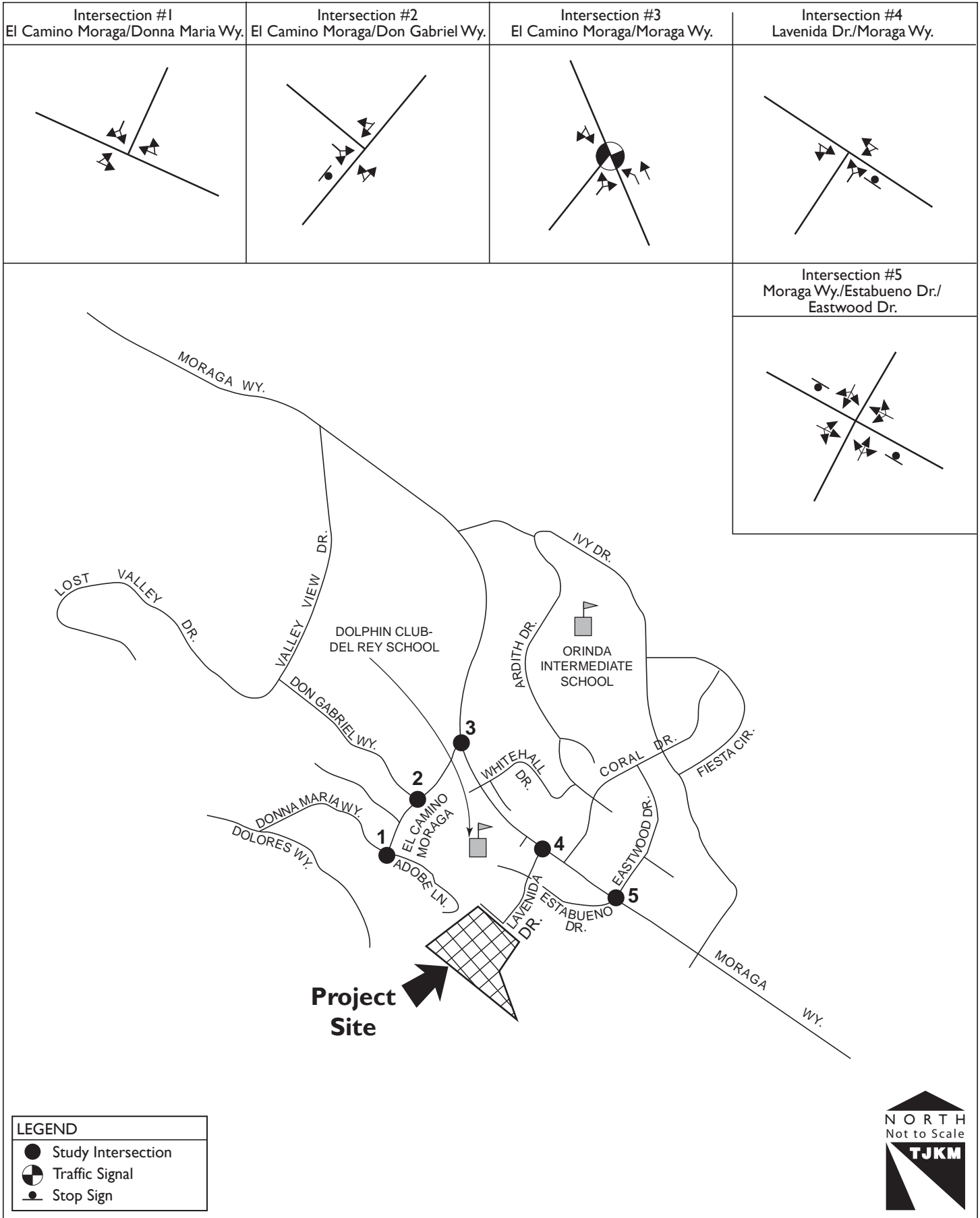
Intersection	Total	Collision Type							
		Head On	Side Swipe	Rear end	Broadside	Hit Object	Pedestrian	Bicycle	Other
Donna Maria Way / El Camino Moraga	1	0	1	0	0	0	0	0	0
Don Gabriel Way / El Camino Moraga	0	0	0	0	0	0	0	0	0
El Camino Moraga / Moraga Way	1	0	0	0	0	1	0	0	0
Lavenida Drive / Moraga Way	1	0	0	0	1	0	0	0	0
Estabueno Drive / Moraga Way	1	0	0	0	0	1	0	0	0




Source: Statewide Integrated Traffic Records System (SWITRS), California Highway Patrol; City of Orinda

Note: "Other" includes miscellaneous collision types in the collision reports not covered under the main categories.

City of Orinda - Lavenida Lane Subdivision Existing Lane Geometry

Figure
3

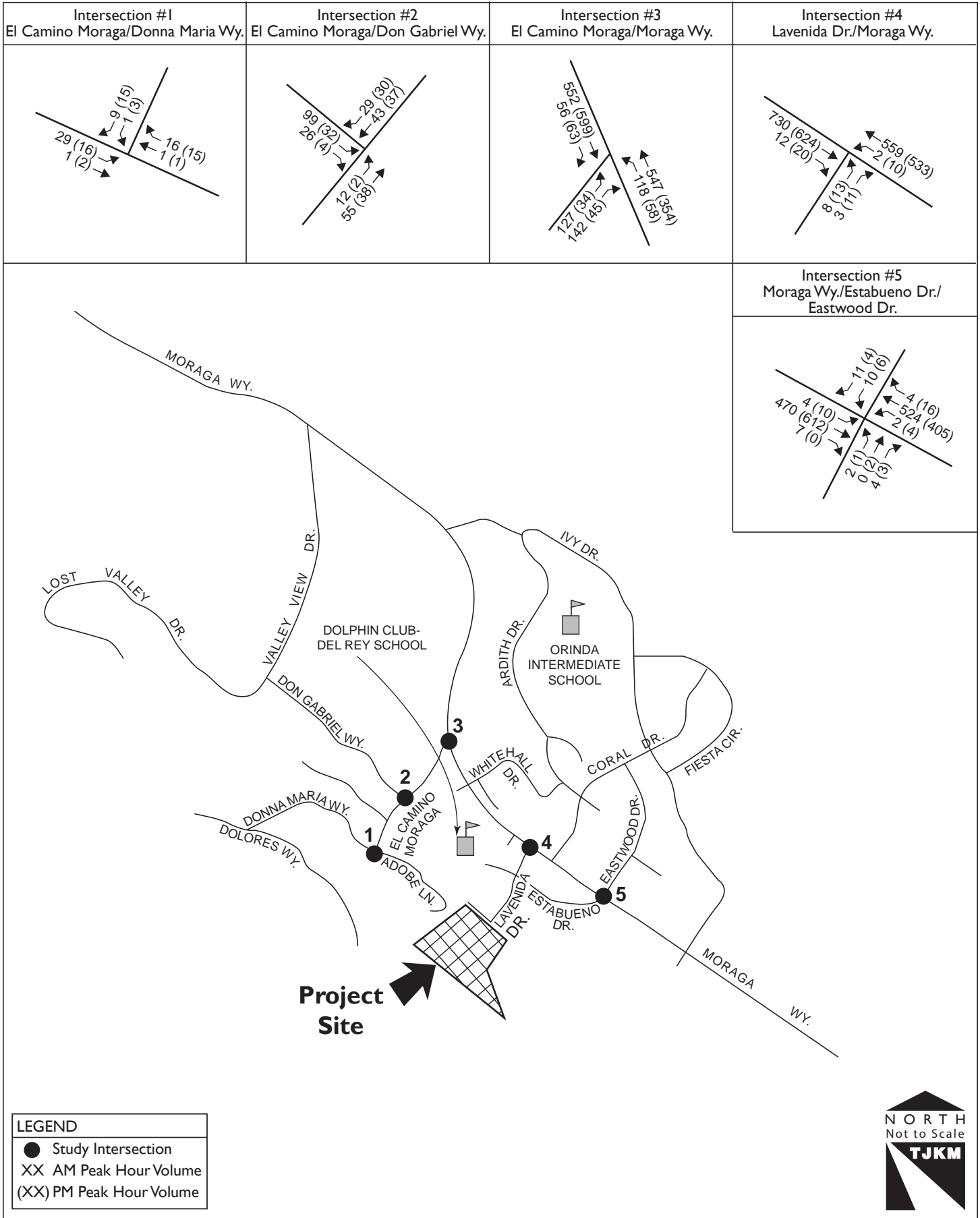


LEGEND	
	Study Intersection
	Traffic Signal
	Stop Sign



City of Orinda - Lavenida Lane Subdivision Existing Turning Movement Volumes

Figure
4



LEGEND	
●	Study Intersection
XX	AM Peak Hour Volume
(XX)	PM Peak Hour Volume



Intersection Level of Service Analysis – Existing Conditions

Table II below summarizes peak hour levels of service at the study intersections under Existing Conditions. LOS worksheets are provided in Appendix C.

Table II: Peak Hour Intersection Levels of Service – Existing Conditions

ID	Intersection	Control	Existing Conditions			
			A.M. Peak		P.M. Peak	
			Delay	LOS	Delay	LOS
1	Donna Maria Way/El Camino Moraga	One-Way Stop	8.5	A	8.5	A
2	Don Gabriel Way/El Camino Moraga	One-Way Stop	9.9	A	9.2	A
3	El Camino Moraga/Moraga Way	Signal	16.4	B	10.7	B
4	Lavenida Drive/Moraga Way	One-Way Stop	26.2	D	21.4	C
5	Estabueno Drive/Moraga Way	Two-Way Stop	19.0	C	20.7	C

Notes: Delay = Average control delay in seconds per vehicle, LOS = Level of Service. Values are for the critical minor approach of unsignalized intersections and overall for signalized intersections.

Under Existing Conditions, four of the five study intersections operate at an acceptable LOS C or better. The intersection of Lavenida Drive and Moraga Way currently operates at LOS D during the a.m. peak hour.

Mitigation is not necessary at this intersection, because it is physically and operationally infeasible to provide mitigation that would achieve acceptable LOS (for Orinda, LOS C or better) on the side street without impeding traffic flow on the major street. The most typical mitigation measure used for improving below-standard side street operations is to install a traffic signal. The intersection of Lavenida Drive and Moraga Way doesn't meet traffic signal warrants and adding a signal would increase the intersection delay on Moraga Way which is a major arterial within Orinda providing access to the freeway.

Existing plus Lavenida Project (Scenario I)

Proposed Project Location and Description

The proposed residential development at Lavenida Subdivision is to be located southwest of Moraga Way at the intersection of Donna Maria Way and Lavenida Drive in the City of Orinda. The project consists of an 8-lot single-family residential subdivision on undeveloped land totaling 12.2 acres. Figure 2 shows the project site plan and proposed internal circulation. As shown in Figure 2, access to all residential lots will be from Lavenida Lane, which would be the extension of Lavenida Drive. This scenario assumes that Donna Maria Way will not be extended between El Camino Moraga and Lavenida Drive.

Lavenida Subdivision Project Trip Generation

The Institute of Transportation Engineers (ITE) has compiled the results of trip generation research from over 4,250 individual land use studies throughout the United States and Canada. *ITE's Trip Generation*, 8th Edition, contains trip generation rates for over 140 different land use codes. Trip generation rates for the proposed project are based on data published in this manual. ITE Land Use Code 210 (Single-Family Detached Residential) was used for the trip generation calculation.

The proposed project's estimated trips are shown in Table III. Based on ITE trip generation rates, it is expected that the project will generate approximately 77 daily trips on a typical weekday, including 6 trips during the a.m. peak hour and 8 trips during the p.m. peak hour.

Table III: Project Trip Generation

Land Use (ITE Code)	Size	Daily		A.M. Peak			P.M. Peak				
		Rate	Trips	Rate	In	Out	Total	Rate	In	Out	Total
Single-Family Detached Residential (210)	8 units	9.57	77	0.75	1	5	6	1.01	5	3	8

Source: *Trip Generation*, 8th Edition (ITE, 2008)

Project Trip Distribution and Assignment

Trip distribution assumptions for the proposed project were developed based on existing travel patterns and knowledge of the study area. The distribution assumptions are listed below:

- 60 percent to/from north via Moraga Way
- 40 percent to/from south via Moraga Way

The project trips were assigned to the study area roadway network based on the above trip distribution assumptions.

Intersection Level of Service Analysis – Scenario I

Project trips were assigned according to the trip distribution listed above. Figure 5 shows the resulting turning movement volumes at the study intersections under this scenario. Table IV summarizes the results of the intersection LOS and delay analysis under this scenario. Detailed LOS calculations are included in Appendix D.

With the addition of the proposed project trips, four study intersections are expected to continue operating at acceptable levels of service. The intersection of Lavenida Drive and Moraga Way will continue to operate unacceptably at LOS D during the a.m. peak hour with 0.7 seconds increase in delay. The volume to capacity (v/c) ratio at the Lavenida Drive / Moraga Way intersection increases by only 0.02, which is an insignificant impact, and therefore mitigation is not warranted.

Table IV: Peak Hour Intersection Levels of Service –Scenario I

ID	Intersection	Control	Existing Conditions				Existing plus Lavenida Project Conditions Scenario I			
			A.M. Peak		P.M. Peak		A.M. Peak		P.M. Peak	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Donna Maria Way/ El Camino Moraga	One-Way Stop	8.5	A	8.5	A	8.5	A	8.5	A
2	Don Gabriel Way/ El Camino Moraga	One-Way Stop	9.9	A	9.2	A	9.9	A	9.2	A
3	El Camino Moraga/ Moraga Way	Signal	16.4	B	10.7	B	16.3	B	10.6	B
4	Lavenida Drive/ Moraga Way	One-Way Stop	26.2	D	21.4	C	26.9	D	21.9	C
5	Estabueno Drive/ Moraga Way	One-Way Stop	19.0	C	20.7	C	19.0	C	20.8	C

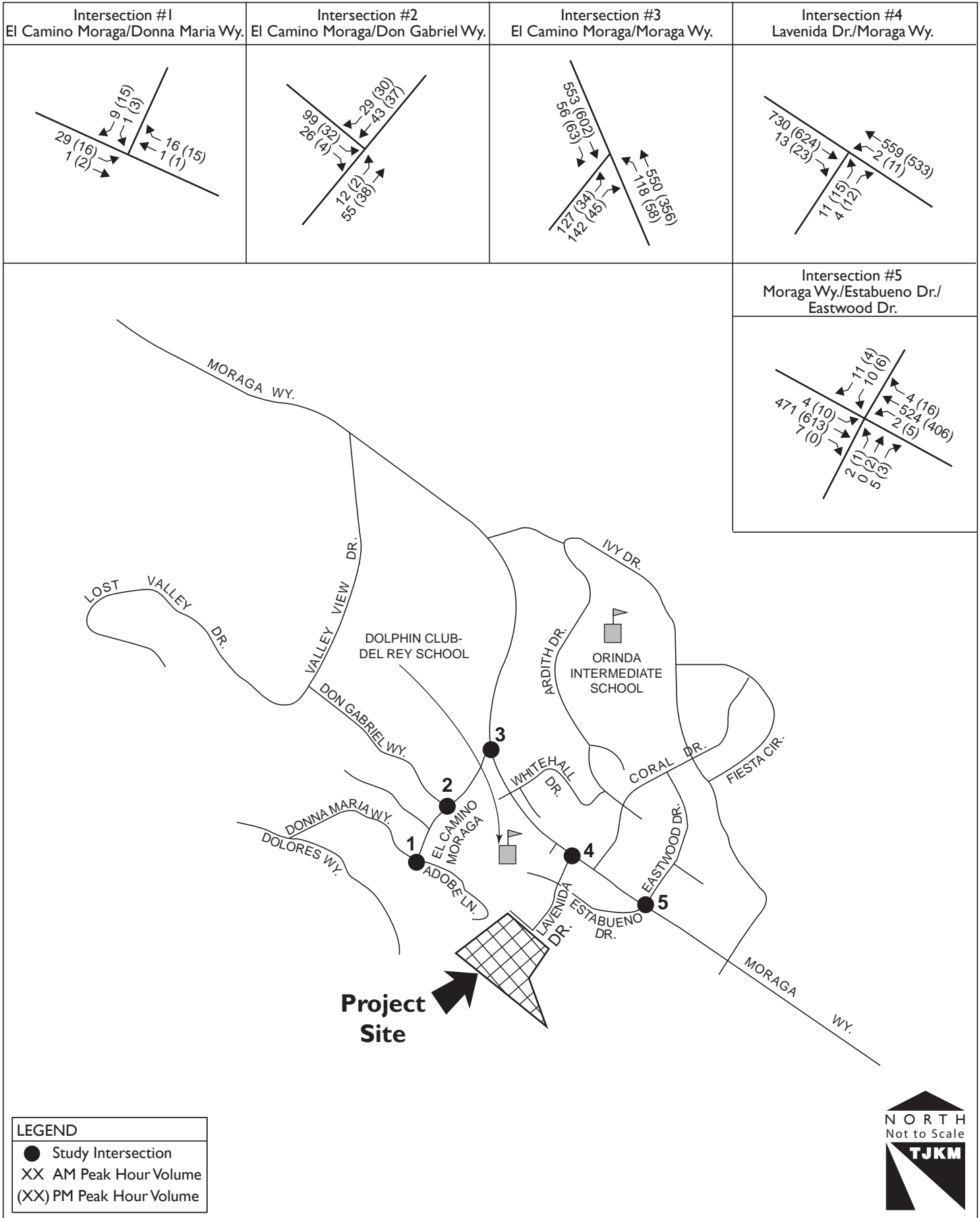
Notes: Delay = Average control delay in seconds per vehicle, LOS = Level of Service.
Values are for the critical minor approach of unsignalized intersections and overall for signalized intersections.

Project Site Circulation and Access

Based on review of the project site plan, a single access to the project site will be provided from Lavenida Lane, which is the extension of Lavenida Drive west of Donna Maria Way. The access driveway is expected to be adequate for project traffic. Lavenida Lane will terminate at a cul-de-sac to provide turn around areas for vehicles within the project site. The turn-around area is shown on the proposed site plan in Figure 2. Per AASHTO guidelines, a local street open at only one end shall provide a special turning area at the closed end, preferably circular. The minimum outside radius of the special turning area is specified to be 30 feet in residential areas. The proposed project site plan provides adequate turning radius for the turn-around.

City of Orinda - Lavenida Lane Subdivision Scenario I Turning Movement Volumes

Figure
5



LEGEND	
●	Study Intersection
XX	AM Peak Hour Volume
(XX)	PM Peak Hour Volume



Existing plus 24 Adobe Lane plus Lavenida Project without the extension of Donna Maria Way (Scenario 2)

This scenario is similar to Existing Conditions, but with the addition of traffic from the proposed residential development at 24 Adobe Lane with access only from El Camino Moraga, and with the addition of traffic from the proposed residential development on Lavenida Lane. This scenario assumes that Donna Maria Way will not be extended between El Camino Moraga and Lavenida Drive. Therefore, the access to all residential lots for 24 Adobe Lane development will be from Adobe Lane and access to all residential lots for Lavenida subdivision will be from Lavenida Drive.

Intersection Level of Service Analysis – Scenario 2

Figure 8 shows the resulting turning movement volumes at the study intersections under this scenario. Table VII summarizes the results of the intersection LOS and delay analysis under this access scenario. Detailed LOS calculations are included in Appendix G.

Table V: Peak Hour Intersection Levels of Service – Project Conditions Scenario 2

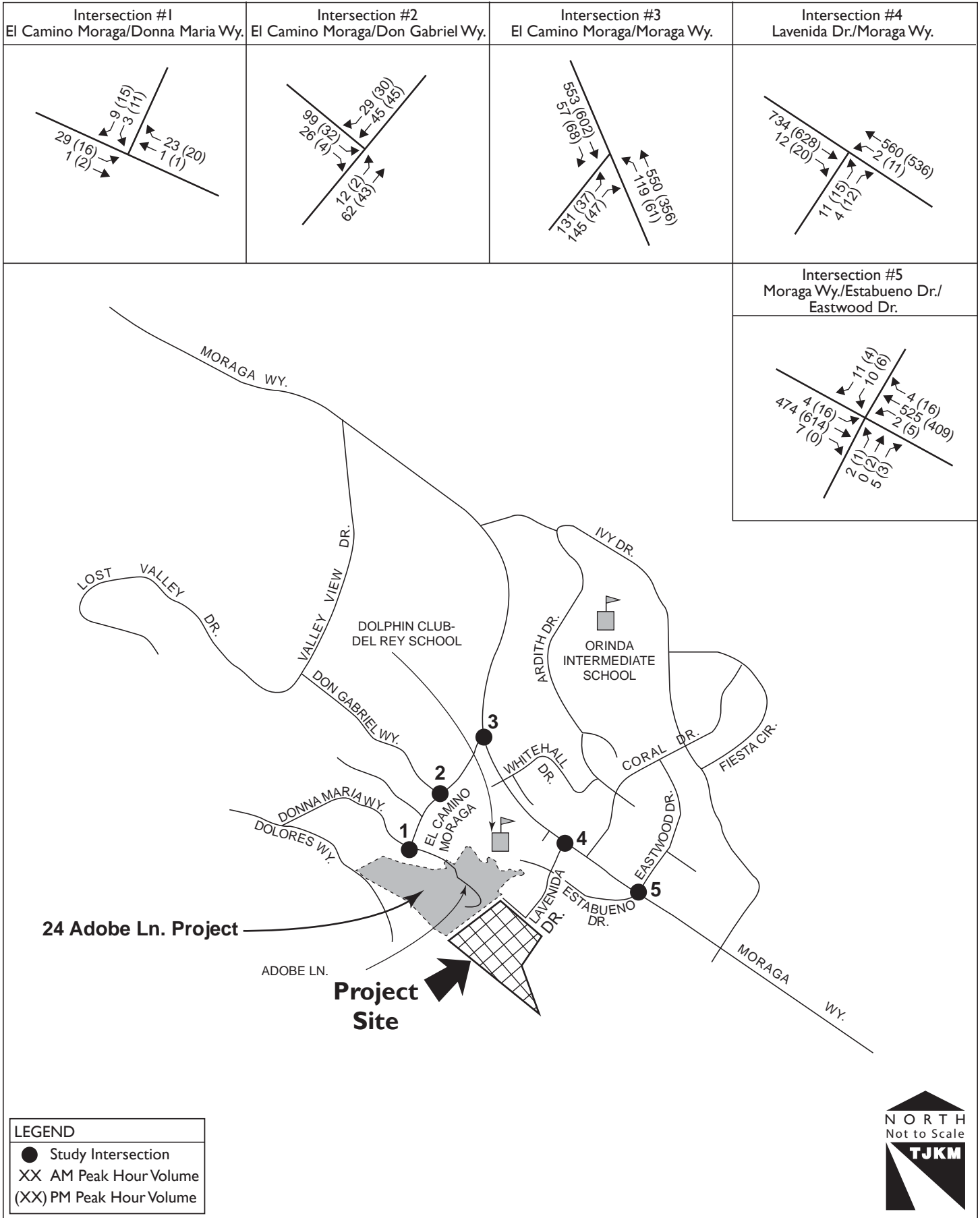
ID	Intersection	Control	Existing Conditions				Scenario 2			
			A.M. Peak		P.M. Peak		A.M. Peak		P.M. Peak	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Donna Maria Way/ El Camino Moraga	One-Way Stop	8.5	A	8.5	A	8.6	A	8.6	A
2	Don Gabriel Way/ El Camino Moraga	One-Way Stop	9.9	A	9.2	A	10.0	A	9.2	A
3	El Camino Moraga/ Moraga Way	Signal	16.4	B	10.7	B	16.8	B	10.8	B
4	Lavenida Drive/ Moraga Way	One-Way Stop	26.2	D	21.4	C	27.0	D	22.0	C
5	Estabueno Drive/ Moraga Way	One-Way Stop	19.0	C	20.7	C	19.1	C	20.9	C

Notes: Delay = Average control delay in seconds per vehicle, LOS = Level of Service.
Values are for the critical minor approach of unsignalized intersections and overall for signalized intersections.

With the addition of the proposed project trips, four study intersections are expected to continue operating at acceptable levels of service. Under Scenario 2, the intersection of Lavenida Drive and Moraga Way continue to operate unacceptably at LOS D during the a.m. peak hour. However, the volume to capacity (v/c) ratio at the Lavenida Drive / Moraga Way intersection increases by only 0.02, which is an insignificant impact, therefore mitigation is not warranted.

City of Orinda - Lavenida Lane Subdivision Scenario 2 Turning Movement Volumes

Figure
6



Existing plus 24 Adobe Lane plus Lavenida Project with the extension of Donna Maria Way (Scenario 3)

This scenario is similar to Existing Conditions, but with the addition of traffic from the proposed residential development at 24 Adobe Lane with access from both El Camino Moraga and Lavenida Drive, and with the addition of traffic from the proposed residential development on Lavenida Lane. This scenario assumes that Donna Maria Way will be extended between El Camino Moraga and Lavenida Drive. Therefore, the access to both the residential developments can be from Adobe Lane and from Lavenida Drive.

Intersection Level of Service Analysis – Scenario 3

Figure 9 shows the resulting turning movement volumes at the study intersections under this scenario. Table VII summarizes the results of the intersection LOS and delay analysis under this access scenario. Detailed LOS calculations are included in Appendix H.

Table VI: Peak Hour Intersection Levels of Service –Project Conditions Scenario 3

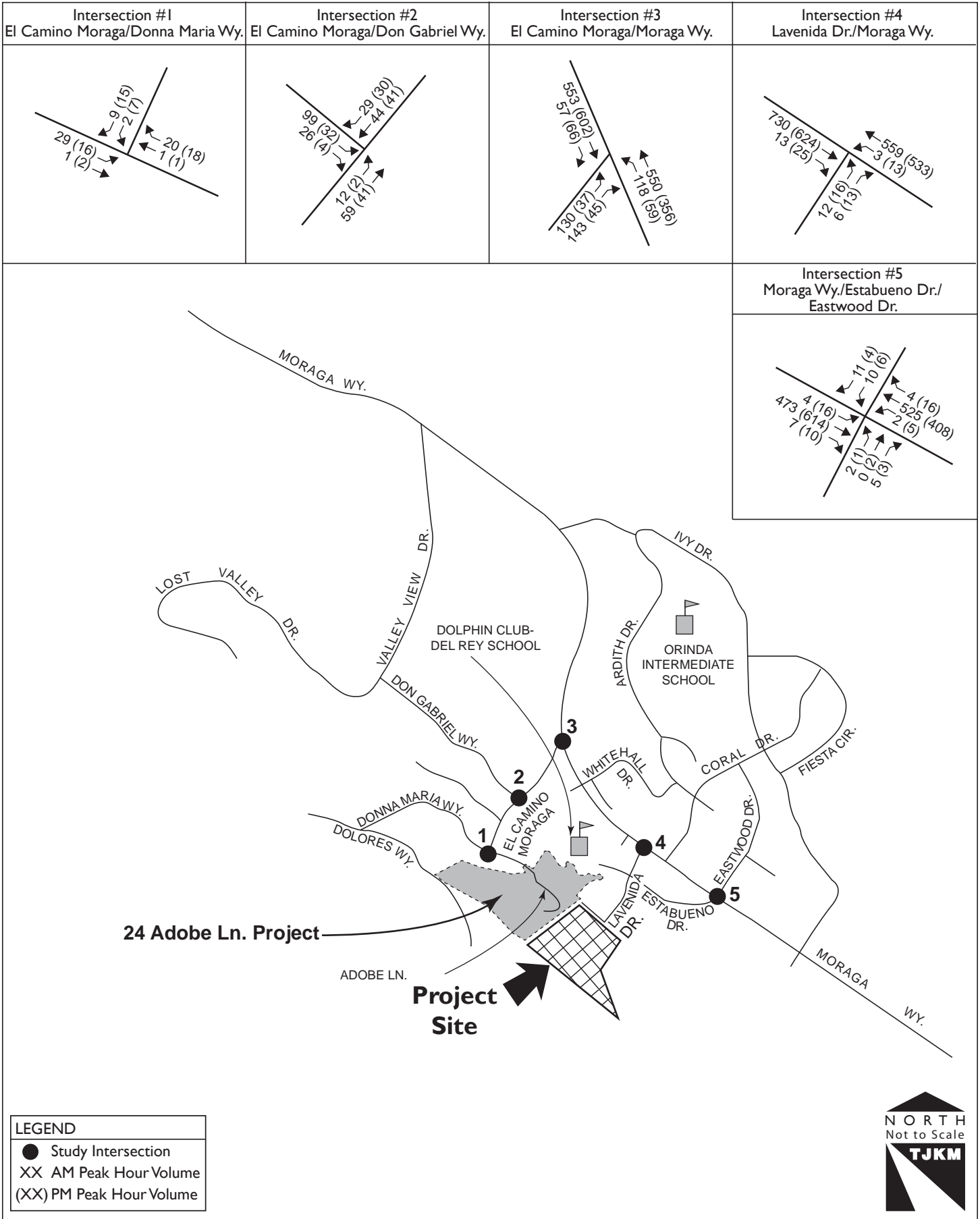
ID	Intersection	Control	Existing Conditions				Scenario 3			
			A.M. Peak		P.M. Peak		A.M. Peak		P.M. Peak	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Donna Maria Way/ El Camino Moraga	One-Way Stop	8.5	A	8.5	A	8.5	A	8.6	A
2	Don Gabriel Way/ El Camino Moraga	One-Way Stop	9.9	A	9.2	A	10.0	A	9.2	A
3	El Camino Moraga/ Moraga Way	Signal	16.4	B	10.7	B	16.6	B	10.8	B
4	Lavenida Drive/ Moraga Way	One-Way Stop	26.2	D	21.4	C	26.2	D	22.2	C
5	Estabueno Drive/ Moraga Way	One-Way Stop	19.0	C	20.7	C	19.1	C	20.9	C

Notes: Delay = Average control delay in seconds per vehicle, LOS = Level of Service.
Values are for the critical minor approach of unsignalized intersections and overall for signalized intersections.

With the addition of the proposed project trips, four study intersections are expected to continue operating at acceptable levels of service. Under Scenario 3, the intersection of Lavenida Drive and Moraga Way continue to operate unacceptably at LOS D during the a.m. peak hour. However, the volume to capacity (v/c) ratio at the Lavenida Drive / Moraga Way intersection increases by only 0.03, which is an insignificant impact, therefore mitigation is not warranted or required.

City of Orinda - Lavenida Lane Subdivision Scenario 3 Turning Movement Volumes

Figure
7



Conclusions

TJKM has reached the following conclusions regarding the proposed residential developments at 24 Adobe Lane and Lavenida Subdivision in the City of Orinda:

- The proposed residential development at 24 Adobe Lane is expected to generate approximately 124 daily trips on a typical weekday, with 9 trips during the a.m. peak hour and 13 trips during the p.m. peak hour.
- The proposed Lavenida Subdivision is expected to generate approximately 77 daily trips on a typical weekday, including 6 trips during the a.m. peak hour and 8 trips during the p.m. peak hour.
- Under Existing Conditions, four of the five study intersections are operating at level of service (LOS) C or better, which is within acceptable City of Orinda LOS standards. The intersection of Lavenida Drive and Moraga Way currently operates at LOS D during the a.m. peak hour, which is below City standards. . A typical mitigation of a traffic signal has been determined to be operationally undesirable. The intersection of Lavenida Drive and Moraga doesn't meet warrants for a traffic signal and adding a signal would increase the delay at this intersection.
- Under all scenarios, four study intersections are expected to continue operating acceptably at LOS C or better. The intersection of Lavenida Drive and Moraga Way is expected to continue operating at LOS D during the a.m. peak hour.
- The proposed project together with the 24 Adobe Project would add less than one second delay to the Lavenida Drive and Moraga Way intersection during peak hours and would thus not cause an increase in traffic that would be substantial in relation to existing traffic.
- TJKM reviewed the latest five-year collision history for all study intersections to determine any trends related to vehicle, bicycle, and pedestrian safety. One collision was reported within the five-year period at each of the study intersections except the Don Gabriel Way / El Camino Moraga intersection, where no collisions were reported. None of the reported collisions involved either a pedestrian or a bicycle. These results suggest that there are no existing safety issues at any of the study intersections.
- TJKM reviewed the project site plan to evaluate on-site traffic circulation and access. Internal traffic circulation within the proposed project site is expected to be adequate and meets City's design standards.

Appendix A – Level of Service Methodology

APPENDIX A

LEVEL OF SERVICE

The description and procedures for calculating capacity and level of service (LOS) are found in Transportation Research Board, *Highway Capacity Manual 2000*. *Highway Capacity Manual 2000* represents the latest research on capacity and quality of service for transportation facilities.

Quality of service requires quantitative measures to characterize operational conditions within a traffic stream. LOS is a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience.

Six levels of service are defined for each type of facility that has analysis procedures available. Letters designate each level, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each LOS represents a range of operating conditions and the driver's perception of these conditions. Safety is not included in the measures that establish service levels.

A general description of service levels for various types of facilities is shown in Table A-I

Table A-I: Level of Service Description

Facility Type	<i>Uninterrupted Flow</i>	<i>Interrupted Flow</i>
		Freeways Multi-lane Highways Two-lane Highways Urban Streets
LOS		
A	Free-flow	Very low delay.
B	Stable flow. Presence of other users noticeable.	Low delay.
C	Stable flow. Comfort and convenience starts to decline.	Acceptable delay.
D	High-density stable flow.	Tolerable delay.
E	Unstable flow.	Limit of acceptable delay.
F	Forced or breakdown flow.	Unacceptable delay

Source: *Highway Capacity Manual 2000*

Urban Streets

The term "urban streets" refers to urban arterials and collectors, including those in downtown areas.

Arterial streets are roads that primarily serve longer through trips. However, providing access to abutting commercial and residential land uses is also an important function of arterials.

Collector streets provide both land access and traffic circulation within residential, commercial and industrial areas. Their access function is more important than that of arterials, and unlike arterials their operation is not always dominated by traffic signals.

Downtown streets are signalized facilities that often resemble arterials. They not only move through traffic but also provide access to local businesses for passenger cars, transit buses, and trucks.

Pedestrian conflicts and lane obstructions created by stopping or standing buses, trucks and parking vehicles that cause turbulence in the traffic flow are typical of downtown streets.

The speed of vehicles on urban streets is influenced by three main factors, street environment, interaction among vehicles and traffic control. As a result, these factors also affect quality of service.

The street environment includes the geometric characteristics of the facility, the character of roadside activity and adjacent land uses. Thus, the environment reflects the number and width of lanes, type of median, driveway density, spacing between signalized intersections, existence of parking, level of pedestrian activity and speed limit.

The interaction among vehicles is determined by traffic density, the proportion of trucks and buses, and turning movements. This interaction affects the operation of vehicles at intersections and, to a lesser extent, between signals.

Traffic control (including signals and signs) forces a portion of all vehicles to slow or stop. The delays and speed changes caused by traffic control devices reduce vehicle speeds, however, such controls are needed to establish right-of-way.

The average travel speed for through vehicles along an urban street is the determinant of the operating LOS. The travel speed along a segment, section or entire length of an urban street is dependent on the running speed between signalized intersections and the amount of control delay incurred at signalized intersections.

LOS A describes primarily free-flow operations. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Control delay at signalized intersections is minimal.

LOS B describes reasonably unimpeded operations. The ability to maneuver within the traffic stream is only slightly restricted, and control delays at signalized intersections are not significant.

LOS C describes stable operations, however, ability to maneuver and change lanes in midblock location may be more restricted than at LOS B. Longer queues, adverse signal coordination, or both may contribute to lower travel speeds.

LOS D borders on a range in which in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LOS D may be due to adverse signal progression, inappropriate signal timing, high volumes, or a combination of these factors.

LOS E is characterized by significant delays and lower travel speeds. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections, and inappropriate signal timing.

LOS F is characterized by urban street flow at extremely low speeds. Intersection congestion is likely at critical signalized locations, with high delays, high volumes, and extensive queuing.

The methodology to determine LOS stratifies urban streets into four classifications. The classifications are complex, and are related to functional and design categories. Table A-II describes the functional and design categories, while Table A-III relates these to the urban street classification.

Once classified, the urban street is divided into segments for analysis. An urban street segment is a one-way section of street encompassing a series of blocks or links terminating at a signalized intersection. Adjacent segments of urban streets may be combined to form larger street sections, provided that the segments have similar demand flows and characteristics.

Levels of service are related to the average travel speed of vehicles along the urban street segment or section.

Travel times for existing conditions are obtained by field measurements. The maximum-car technique is used. The vehicle is driven at the posted speed limit unless impeded by actual traffic conditions. In the maximum-car technique, a safe level of vehicular operation is maintained by observing proper following distances and by changing speeds at reasonable rates of acceleration and deceleration. The maximum-car technique provides the best base for measuring traffic performance.

An observer records the travel time and locations and duration of delay. The beginning and ending points are the centers of intersections. Delays include times waiting in queues at signalized intersections. The travel speed is determined by dividing the length of the segment by the travel time. Once the travel speed on the arterial is determined, the LOS is found by comparing the speed to the criteria in Table A-IV. LOS criteria vary for the different classifications of urban street, reflecting differences in driver expectations.

Table A-II: Functional and Design Categories for Urban Streets

<i>Criterion</i>	<i>Functional Category</i>			
	<i>Principal Arterial</i>		<i>Minor Arterial</i>	
Mobility function	Very important		Important	
Access function	Very minor		Substantial	
Points connected	Freeways, important activity centers, major traffic generators		Principal arterials	
Predominant trips served	Relatively long trips between major points and through trips entering, leaving, and passing through city		Trips of moderate length within relatively small geographical areas	
<i>Criterion</i>	<i>Design Category</i>			
	<i>High-Speed</i>	<i>Suburban</i>	<i>Intermediate</i>	<i>Urban</i>
Driveway access density	Very low density	Low density	Moderate density	High density
Arterial type	Multilane divided; undivided or two-lane with shoulders	Multilane divided; undivided or two-lane with shoulders	Multilane divided or undivided; one way, two lane	Undivided one way; two way, two or more lanes
Parking	No	No	Some	Usually
Separate left-turn lanes	Yes	Yes	Usually	Some
Signals per mile	0.5 to 2	1 to 5	4 to 10	6 to 12
Speed limits	45 to 55 mph	40 to 45 mph	30 to 40 mph	25 to 35 mph
Pedestrian activity	Very little	Little	Some	Usually
Roadside development	Low density	Low to medium density	Medium to moderate density	High density

Source: Highway Capacity Manual 2000

Table A-III: Urban Street Class based on Function and Design Categories

Design Category	Functional Category	
	Principal Arterial	Minor Arterial
High-Speed	I	Not applicable
Suburban	II	II
Intermediate	II	III or IV
Urban	III or IV	IV

Source: Highway Capacity Manual 2000

Table A-IV: Urban Street Levels of Service by Class

Urban Street Class	I	II	III	IV
Range of Free Flow Speeds (mph)	45 to 55	35 to 45	30 to 35	25 to 35
Typical Free Flow Speed (mph)	50	40	33	30
LOS	Average Travel Speed (mph)			
A	>42	>35	>30	>25
B	>34	>28	>24	>19
C	>27	>22	>18	>13
D	>21	>17	>14	>9
E	>16	>13	>10	>7
F	≤16	≤13	≤10	≤7

Source: Highway Capacity Manual 2000

Interrupted Flow

One of the more important elements limiting, and often interrupting the flow of traffic on a highway is the intersection. Flow on an interrupted facility is usually dominated by points of fixed operation such as traffic signals, stop and yield signs. These all operate quite differently and have differing impacts on overall flow.

Signalized Intersections

The capacity of a highway is related primarily to the geometric characteristics of the facility, as well as to the composition of the traffic stream on the facility. Geometrics are a fixed, or non-varying, characteristic of a facility.

At the signalized intersection, an additional element is introduced into the concept of capacity: time allocation. A traffic signal essentially allocates time among conflicting traffic movements seeking use of the same physical space. The way in which time is allocated has a significant impact on the operation of the intersection and on the capacity of the intersection and its approaches.

LOS for signalized intersections is defined in terms of control delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, traffic and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions, *i. e.*, in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Specifically, LOS criteria for traffic signals are stated in terms of average control delay per vehicle, typically for a 15-minute analysis period. Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the ratio of green time to cycle length and the volume to capacity ratio for the lane group.

For each intersection analyzed the average control delay per vehicle per approach is determined for the peak hour. A weighted average of control delay per vehicle is then determined for the intersection. A LOS designation is given to the control delay to better describe the level of operation. A description of levels of service for signalized intersections can be found in Table A-V

Table A-V: Description of Level of Service for Signalized Intersections

LOS	Description
A	Very low control delay, up to 10 seconds per vehicle. Progression is extremely favorable, and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.
B	Control delay greater than 10 and up to 20 seconds per vehicle. There is good progression or short cycle lengths or both. More vehicles stop causing higher levels of delay.
C	Control delay greater than 20 and up to 35 seconds per vehicle. Higher delays are caused by fair progression or longer cycle lengths or both. Individual cycle failures may begin to appear. Cycle failure occurs when a given green phase does not serve queued vehicles, and overflow occurs. The number of vehicles stopping is significant, though many still pass through the intersection without stopping.
D	Control delay greater than 35 and up to 55 seconds per vehicle. The influence of congestions becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volumes. Many vehicles stop, the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	Control delay greater than 55 and up to 80 seconds per vehicle. The limit of acceptable delay. High delays usually indicate poor progression, long cycle lengths, and high volumes. Individual cycle failures are frequent.
F	Control delay in excess of 80 seconds per vehicle. Unacceptable to most drivers. Oversaturation, arrival flow rates exceed the capacity of the intersection. Many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to higher delay.

Source: *Highway Capacity Manual 2000*

The use of control delay, which may also be referred to as signal delay, was introduced in the 1997 update to the *Highway Capacity Manual*, and represents a departure from previous updates. In the third edition, published in 1985 and the 1994 update to the third edition, delay only included stopped delay. Thus, the LOS criteria listed in Table A-V differs from earlier criteria.

Unsignalized Intersections

The current procedures on unsignalized intersections were first introduced in the 1997 update to the *Highway Capacity Manual* and represent a revision of the methodology published in the 1994 update to the 1985 *Highway Capacity Manual*. The revised procedures use control delay as a measure of effectiveness to determine LOS. Delay is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, traffic and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions, *i. e.*, in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Control delay is the increased time of travel for a vehicle approaching and passing through an unsignalized intersection, compared with a free-flow vehicle if it were not required to slow or stop at the intersection.

Two-Way Stop Controlled Intersections

Two-way stop controlled intersections in which stop signs are used to assign the right-of-way, are the most prevalent type of intersection in the United States. At two-way stop-controlled intersections the stop-controlled approaches are referred as the minor street approaches and can be either public streets or private driveways. The approaches that are not controlled by stop signs are referred to as the major street approaches.

The capacity of movements subject to delay are determined using the "critical gap" method of capacity analysis. Expected average control delay based on movement volume and movement capacity is calculated. A LOS designation is given to the expected control delay for each minor movement. LOS is not defined for the intersection as a whole. Control delay is the increased time of travel for a vehicle approaching and passing through a stop-controlled intersection, compared with a free-flow vehicle if it were not required to slow or stop at the intersection. A description of levels of service for two-way stop-controlled intersections is found in Table A-VI.

Table A-VI: Description of Level of Service for Two-Way Stop Controlled Intersections

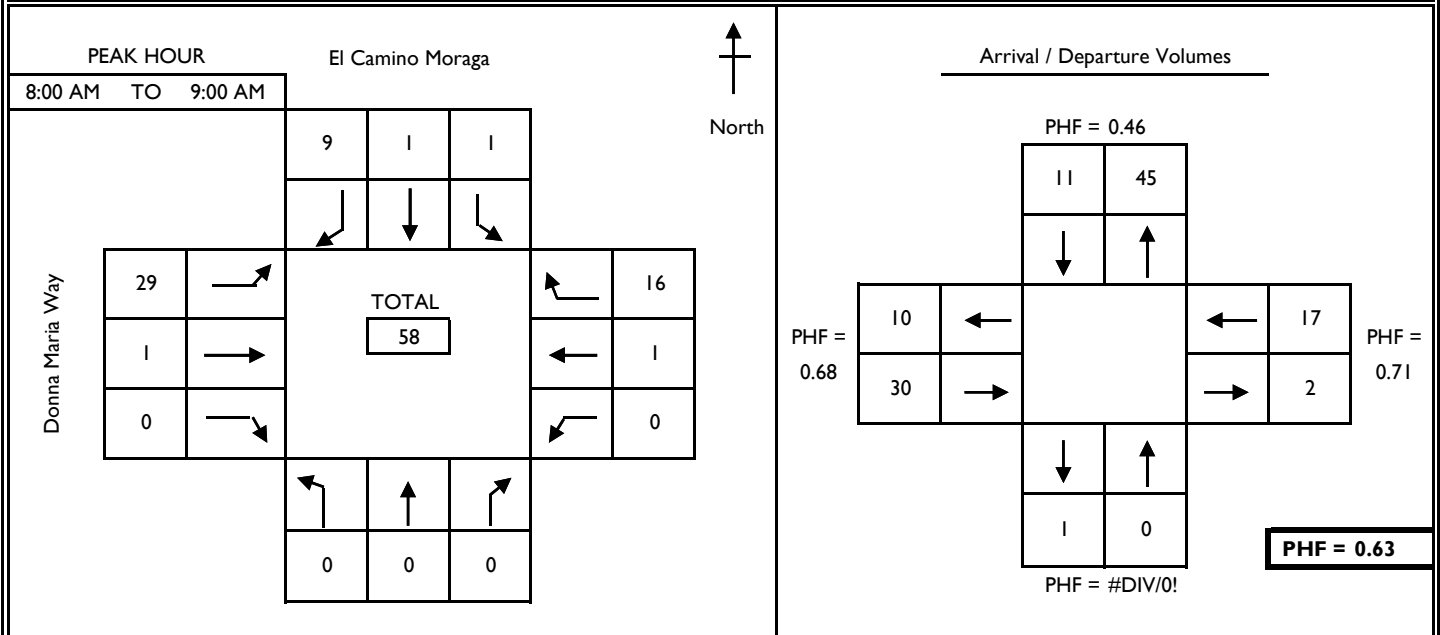
LOS	Description
A	Very low control delay less than 10 seconds per vehicle for each movement subject to delay.
B	Low control delay greater than 10 and up to 15 seconds per vehicle for each movement subject to delay.
C	Acceptable control delay greater than 15 and up to 25 seconds per vehicle for each movement subject to delay.
D	Tolerable control delay greater than 25 and up to 35 seconds per vehicle for each movement subject to delay.
E	Limit of tolerable control delay greater than 35 and up to 50 seconds per vehicle for each movement subject to delay.
F	Unacceptable control delay in excess of 50 seconds per vehicle for each movement subject to delay.

Source: *Highway Capacity Manual 2000*

Appendix B – Existing Traffic Counts

TJKM Intersection Turning Movement Summary

Project:	208-009 24 Adobe Lane	Control	Speed Limit	Survey Date:	4/16/2009	DAY:	Thursday
N-S Approach:	El Camino Moraga	Uncontrolled	25	Survey Time:	8:00 AM	To	9:00 AM
E-W Approach:	Donna Maria Way	Uncontrolled	25	City:	Orinda	Recorder:	Manish



Time Period		Eastbound			Northbound			Westbound			Southbound			Total
From	To	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	

SURVEY DATA															
7:00 AM	---	7:15 AM													0
7:15 AM	---	7:30 AM													0
7:30 AM	---	7:45 AM													0
7:45 AM	---	8:00 AM													0
8:00 AM	---	8:15 AM													0
8:15 AM	---	8:30 AM													0
8:30 AM	---	8:45 AM													0
8:45 AM	---	9:00 AM													0

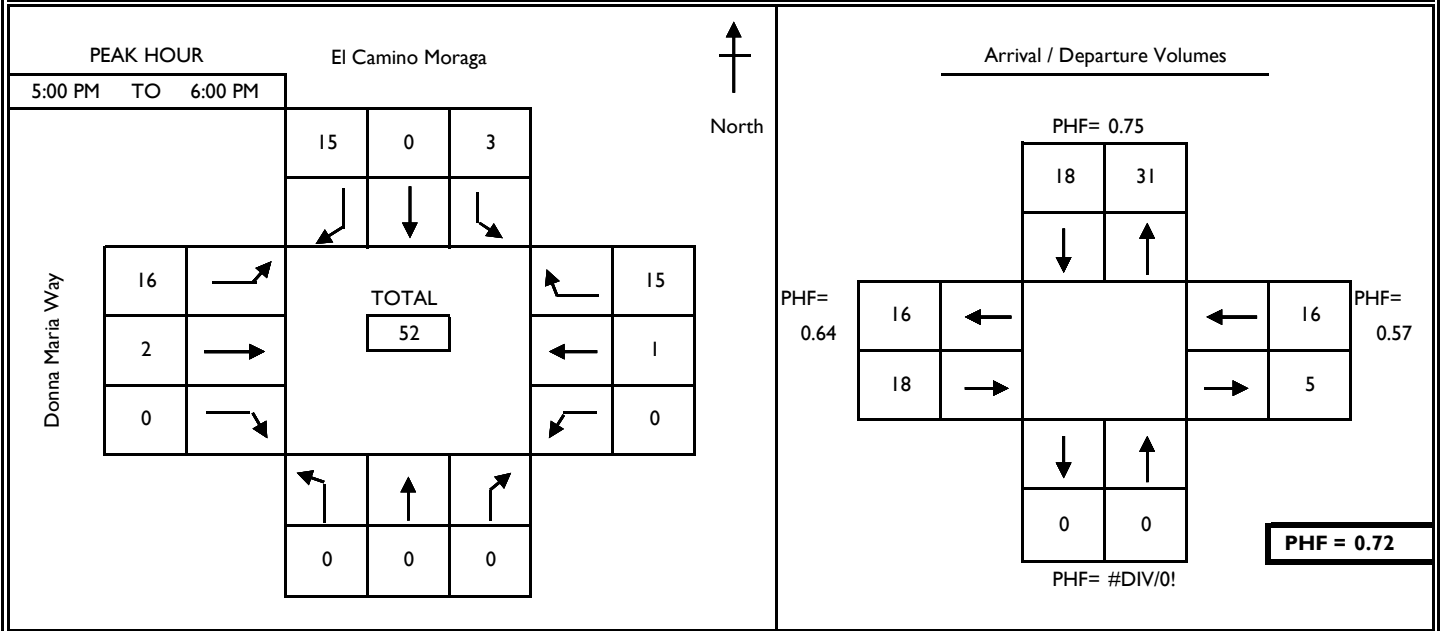
TOTAL BY PERIOD															
7:00 AM	---	7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	---	7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	---	7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	---	8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	---	8:15 AM	2	0	0	0	0	0	0	0	3	0	0	2	7
8:15 AM	---	8:30 AM	10	1	0	0	0	0	0	1	4	1	0	0	17
8:30 AM	---	8:45 AM	11	0	0	0	0	0	0	0	6	0	1	5	23
8:45 AM	---	9:00 AM	6	0	0	0	0	0	0	0	3	0	0	2	11

HOURLY TOTALS															
7:00 AM	---	8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	---	8:15 AM	2	0	0	0	0	0	0	0	3	0	0	2	7
7:30 AM	---	8:30 AM	12	1	0	0	0	0	0	1	7	1	0	2	24
7:45 AM	---	8:45 AM	23	1	0	0	0	0	0	1	13	1	1	7	47
8:00 AM	---	9:00 AM	29	1	0	0	0	0	0	1	16	1	1	9	58

PHF by Movement	0.66	0.25	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.25	0.67	0.25	0.25	0.45		Overall
PHF by Approach	0.68			#DIV/0!				0.71		0.46				0.63

TJKM Intersection Turning Movement Summary

Project:	208-009 24 Adobe Lane	Control	Speed Limit	Survey Date:	4/16/2009	DAY:	Thursday
N-S Approach:	El Camino Moraga	Uncontrolled	25	Survey Time:	5:00 PM	To	6:00 PM
E-W Approach:	Donna Maria Way	Uncontrolled	25	City:	Orinda	Recorder:	Manish



Time Period	Eastbound			Northbound			Westbound			Southbound			Total
	From	To		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	

SURVEY DATA														
4:00 PM	---	4:15 PM												0
4:15 PM	---	4:30 PM												0
4:30 PM	---	4:45 PM												0
4:45 PM	---	5:00 PM												0
5:00 PM	---	5:15 PM												0
5:15 PM	---	5:30 PM												0
5:30 PM	---	5:45 PM												0
5:45 PM	---	6:00 PM												0

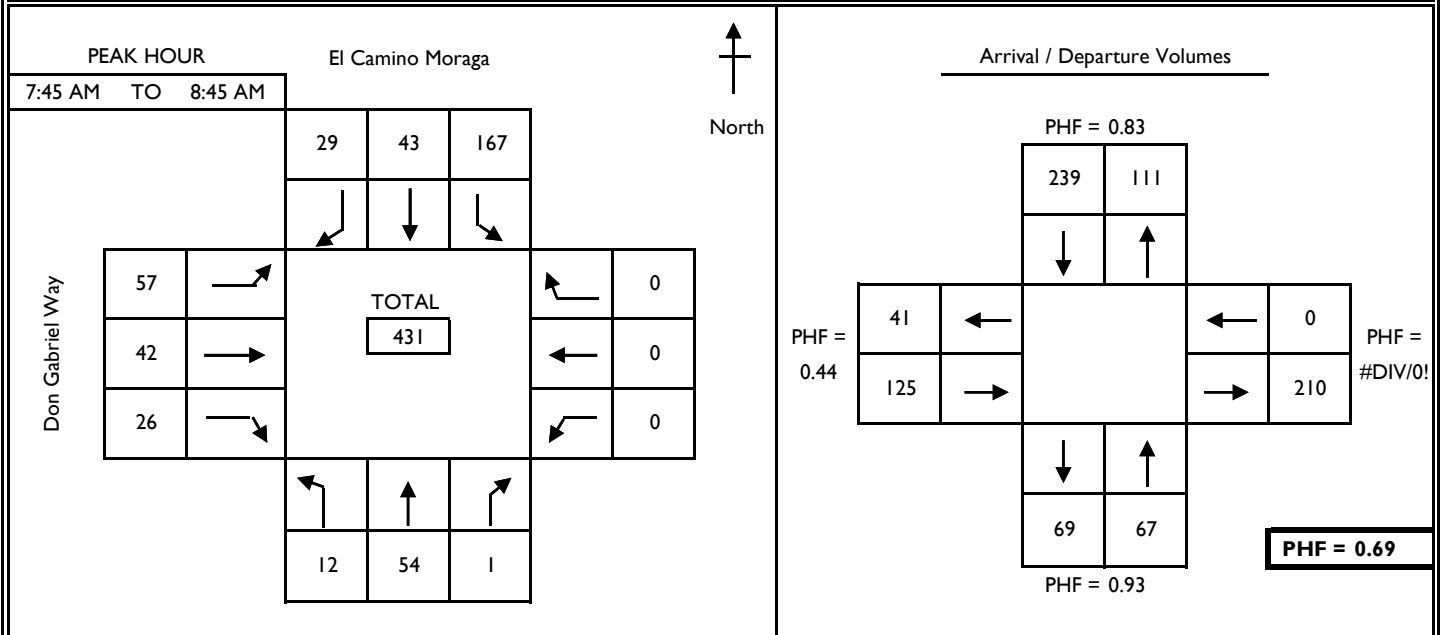
TOTAL BY PERIOD														
4:00 PM	---	4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	---	4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	---	4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	---	5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	---	5:15 PM	2	0	0	0	0	0	0	3	0	0	2	7
5:15 PM	---	5:30 PM	5	1	0	0	0	0	0	1	6	1	0	18
5:30 PM	---	5:45 PM	3	0	0	0	0	0	0	0	4	0	0	13
5:45 PM	---	6:00 PM	6	1	0	0	0	0	0	2	2	0	3	14

HOURLY TOTALS														
4:00 PM	---	5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	---	5:15 PM	2	0	0	0	0	0	0	3	0	0	2	7
4:30 PM	---	5:30 PM	7	1	0	0	0	0	0	1	9	1	0	25
4:45 PM	---	5:45 PM	10	1	0	0	0	0	0	1	13	1	0	38
5:00 PM	---	6:00 PM	16	2	0	0	0	0	0	1	15	3	0	52

PHF by Movement	0.67	0.50	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.25	0.63	0.38	#DIV/0!	0.63		Overall
PHF by Approach	0.64			#DIV/0!				0.57			0.75				0.72

TJKM Intersection Turning Movement Summary

Project:	208-009	Control:	STOP	Speed Limit:	25	Survey Date:	4/16/2009	DAY:	Thursday
N-S Approach:	El Camino Moraga					Survey Time:	7:45 AM	To:	9:00 AM
E-W Approach:	Don Gabriel Way			City:	Orinda	Recorder:	JL		



Time Period		Eastbound			Northbound			Westbound			Southbound			Total
From	To	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	

SURVEY DATA															
7:00 AM	---	7:15 AM													0
7:15 AM	---	7:30 AM													0
7:30 AM	---	7:45 AM													0
7:45 AM	---	8:00 AM													0
8:00 AM	---	8:15 AM													0
8:15 AM	---	8:30 AM													0
8:30 AM	---	8:45 AM													0
8:45 AM	---	9:00 AM													0

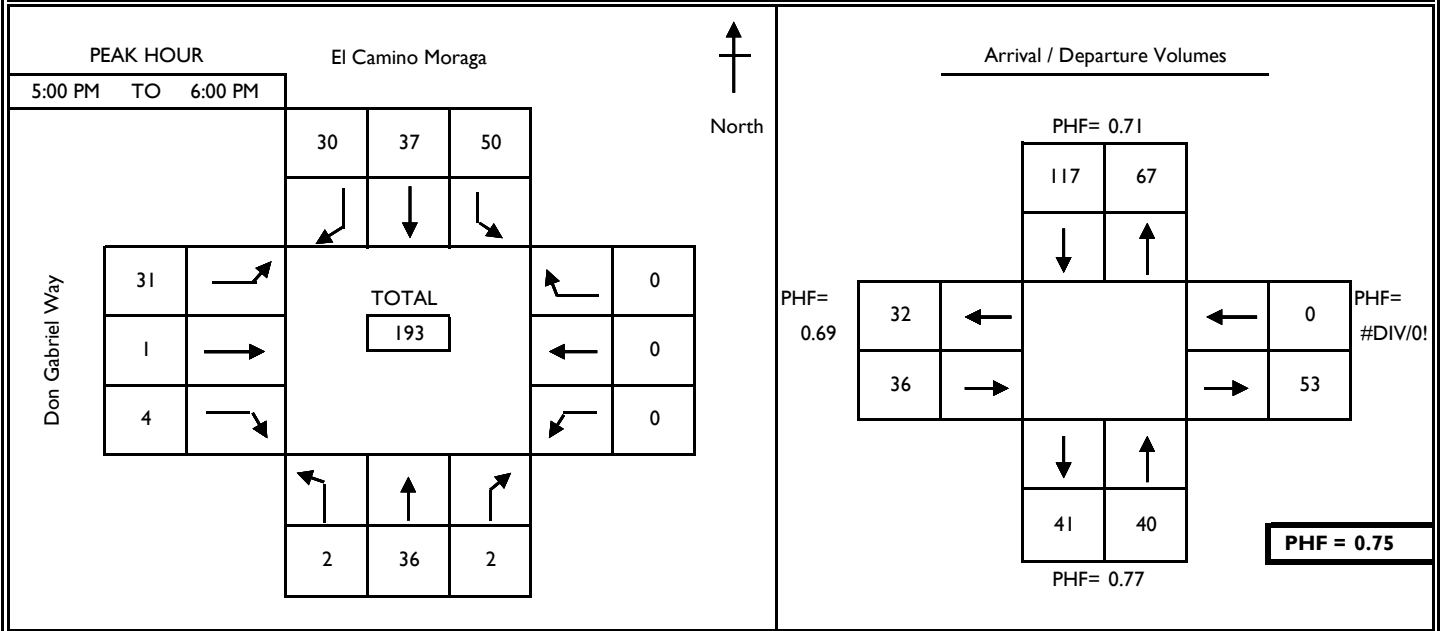
TOTAL BY PERIOD															
7:00 AM	---	7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	---	7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	---	7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	---	8:00 AM	33	24	14	2	15	1	0	0	0	51	9	7	156
8:00 AM	---	8:15 AM	8	9	5	7	9	0	0	0	0	40	6	14	98
8:15 AM	---	8:30 AM	5	2	2	2	13	0	0	0	0	28	9	3	64
8:30 AM	---	8:45 AM	11	7	5	1	17	0	0	0	0	48	19	5	113
8:45 AM	---	9:00 AM	9	0	2	1	14	1	0	0	0	14	8	6	55

HOURLY TOTALS															
7:00 AM	---	8:00 AM	33	24	14	2	15	1	0	0	0	51	9	7	156
7:15 AM	---	8:15 AM	41	33	19	9	24	1	0	0	0	91	15	21	254
7:30 AM	---	8:30 AM	46	35	21	11	37	1	0	0	0	119	24	24	318
7:45 AM	---	8:45 AM	57	42	26	12	54	1	0	0	0	167	43	29	431
8:00 AM	---	9:00 AM	33	18	14	11	53	1	0	0	0	130	42	28	330

PHF by Movement	0.43	0.44	0.46	0.43	0.79	0.25	#DIV/0!	#DIV/0!	#DIV/0!	0.82	0.57	0.52		Overall
PHF by Approach	0.44			0.93			#DIV/0!			0.83				0.69

TJKM Intersection Turning Movement Summary

Project:	208-009	Control:	STOP	Speed Limit:	25	Survey Date:	4/15/2009	DAY:	Wednesday
N-S Approach:	El Camino Moraga	Control:	STOP	Speed Limit:	25	Survey Time:	5:00 PM	To:	6:00 PM
E-W Approach:	Don Gabriel Way	Control:	0.00	Speed Limit:	0	City:	Orinda	Recorder:	



Time Period	Eastbound			Northbound			Westbound			Southbound			Total
	From	To		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	

SURVEY DATA														
4:00 PM	---	4:15 PM												0
4:15 PM	---	4:30 PM												0
4:30 PM	---	4:45 PM												0
4:45 PM	---	5:00 PM												0
5:00 PM	---	5:15 PM												0
5:15 PM	---	5:30 PM												0
5:30 PM	---	5:45 PM												0
5:45 PM	---	6:00 PM												0

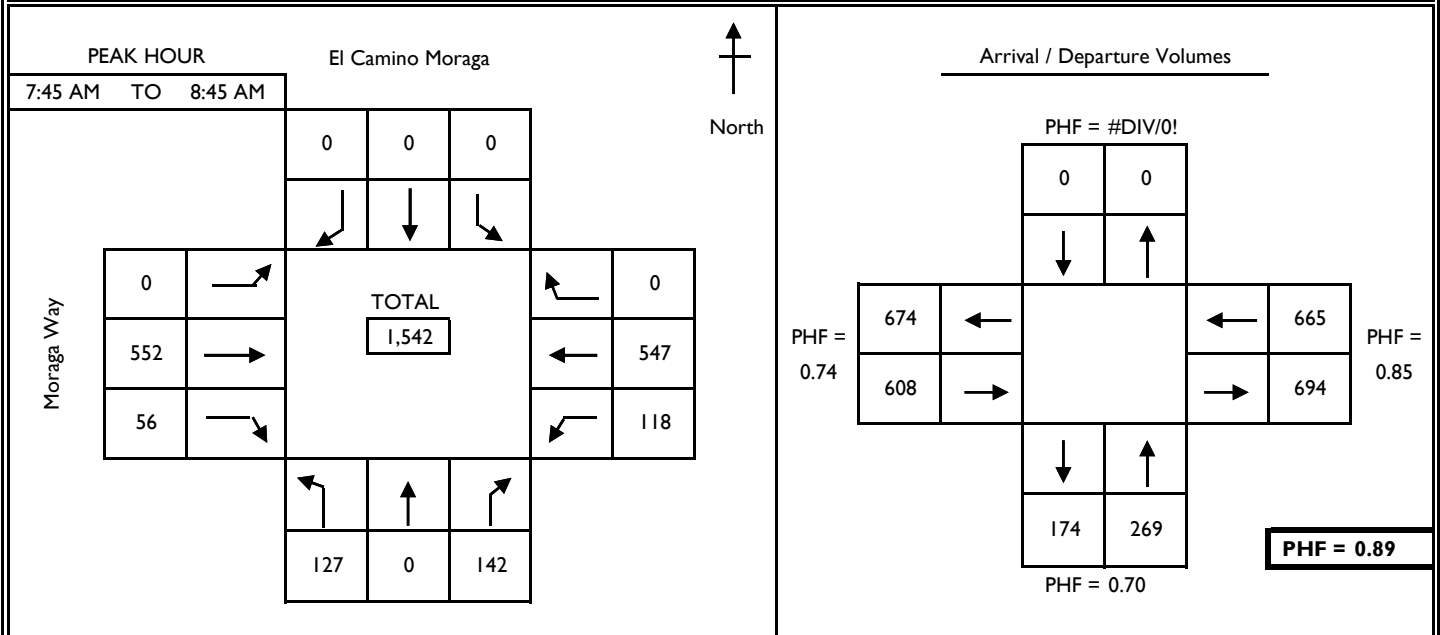
TOTAL BY PERIOD														
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4:15 PM	---	4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	---	4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	---	5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	---	5:15 PM	4	0	0	1	4	0	0	0	15	8	4	36
5:15 PM	---	5:30 PM	9	0	1	0	13	0	0	0	23	10	8	64
5:30 PM	---	5:45 PM	11	1	1	1	10	2	0	0	11	12	7	56
5:45 PM	---	6:00 PM	7	0	2	0	9	0	0	0	1	7	11	37

HOURLY TOTALS														
4:00 PM	---	5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	---	5:15 PM	4	0	0	1	4	0	0	0	15	8	4	36
4:30 PM	---	5:30 PM	13	0	1	1	17	0	0	0	38	18	12	100
4:45 PM	---	5:45 PM	24	1	2	2	27	2	0	0	49	30	19	156
5:00 PM	---	6:00 PM	31	1	4	2	36	2	0	0	50	37	30	193

PHF by Movement	0.70	0.25	0.50	0.50	0.69	0.25	#DIV/0!	#DIV/0!	#DIV/0!	0.54	0.77	0.68		Overall
PHF by Approach	0.69			0.77			#DIV/0!			0.71				0.75

TJKM Intersection Turning Movement Summary

Project:	208-009	Control:	Signal	Speed Limit:	35	Survey Date:	4/15/2009	DAY:	Wednesday
N-S Approach:	El Camino Moraga	Signal:	Signal	Speed Limit:	35	Survey Time:	7:00 AM	To:	9:00 AM
E-W Approach:	Moraga Way	City:	Orinda	Recorder:	JL				



Time Period		Eastbound			Northbound			Westbound			Southbound			Total
From	To	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	

SURVEY DATA															
7:00 AM	---	7:15 AM													0
7:15 AM	---	7:30 AM													0
7:30 AM	---	7:45 AM													0
7:45 AM	---	8:00 AM													0
8:00 AM	---	8:15 AM													0
8:15 AM	---	8:30 AM													0
8:30 AM	---	8:45 AM													0
8:45 AM	---	9:00 AM													0

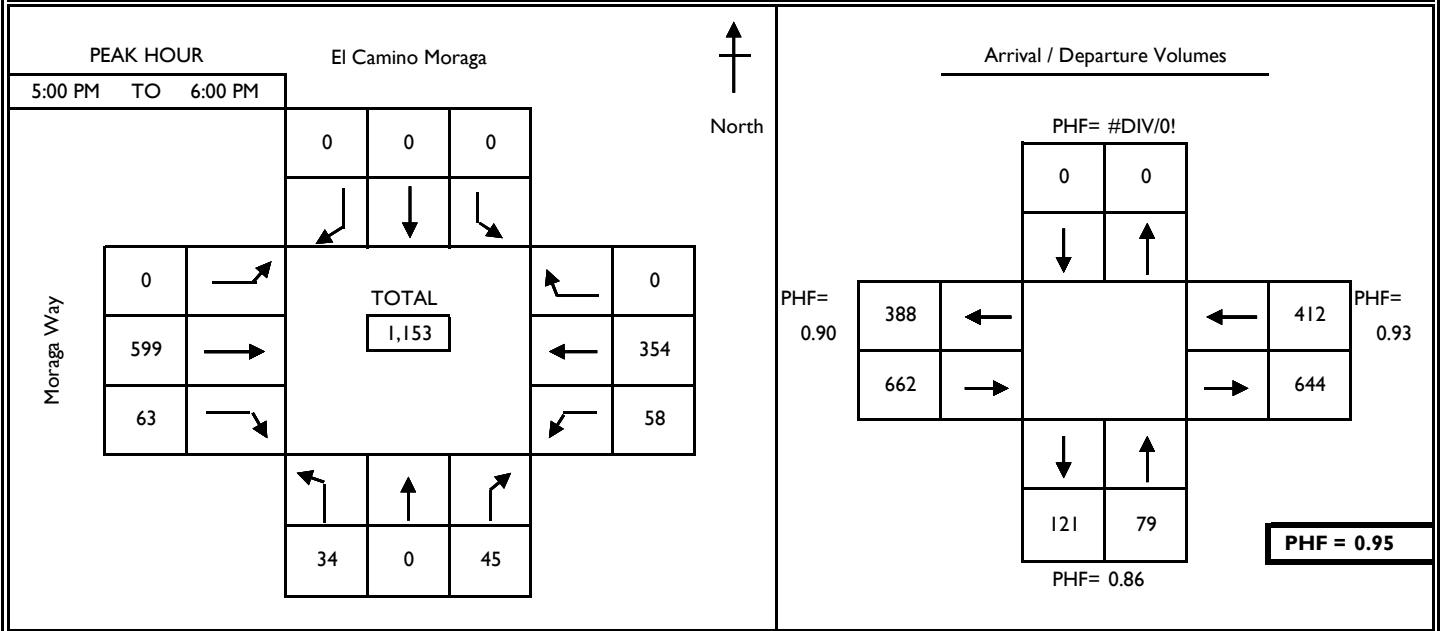
TOTAL BY PERIOD															
7:00 AM	---	7:15 AM	0	45	9	11	0	2	3	113	0	0	0	0	183
7:15 AM	---	7:30 AM	0	100	12	15	0	8	13	142	0	0	0	0	290
7:30 AM	---	7:45 AM	0	93	4	22	0	5	14	150	0	0	0	0	288
7:45 AM	---	8:00 AM	0	91	16	42	0	26	45	135	0	0	0	0	355
8:00 AM	---	8:15 AM	0	196	9	40	0	56	15	116	0	0	0	0	432
8:15 AM	---	8:30 AM	0	171	6	11	0	31	10	149	0	0	0	0	378
8:30 AM	---	8:45 AM	0	94	25	34	0	29	48	147	0	0	0	0	377
8:45 AM	---	9:00 AM	0	124	14	34	0	32	22	106	0	0	0	0	332

HOURLY TOTALS															
7:00 AM	---	8:00 AM	0	329	41	90	0	41	75	540	0	0	0	0	1,116
7:15 AM	---	8:15 AM	0	480	41	119	0	95	87	543	0	0	0	0	1,365
7:30 AM	---	8:30 AM	0	551	35	115	0	118	84	550	0	0	0	0	1,453
7:45 AM	---	8:45 AM	0	552	56	127	0	142	118	547	0	0	0	0	1,542
8:00 AM	---	9:00 AM	0	585	54	119	0	148	95	518	0	0	0	0	1,519

PHF by Movement	#DIV/0!	0.70	0.56	0.76	#DIV/0!	0.63	0.61	0.92	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!		Overall
PHF by Approach		0.74				0.70		0.85				#DIV/0!		0.89

TJKM Intersection Turning Movement Summary

Project:	208-009	Control	Speed Limit	Survey Date:	4/15/2009	DAY:	Wednesday
N-S Approach:	El Camino Moraga	Signal	35	Survey Time:	4:00 PM	To	6:00 PM
E-W Approach:	Moraga Way	0.00	0	City:	Orinda	Recorder:	



Time Period	Eastbound			Northbound			Westbound			Southbound			Total
	From	To		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	

SURVEY DATA														
4:00 PM	---	4:15 PM												0
4:15 PM	---	4:30 PM												0
4:30 PM	---	4:45 PM												0
4:45 PM	---	5:00 PM												0
5:00 PM	---	5:15 PM												0
5:15 PM	---	5:30 PM												0
5:30 PM	---	5:45 PM												0
5:45 PM	---	6:00 PM												0

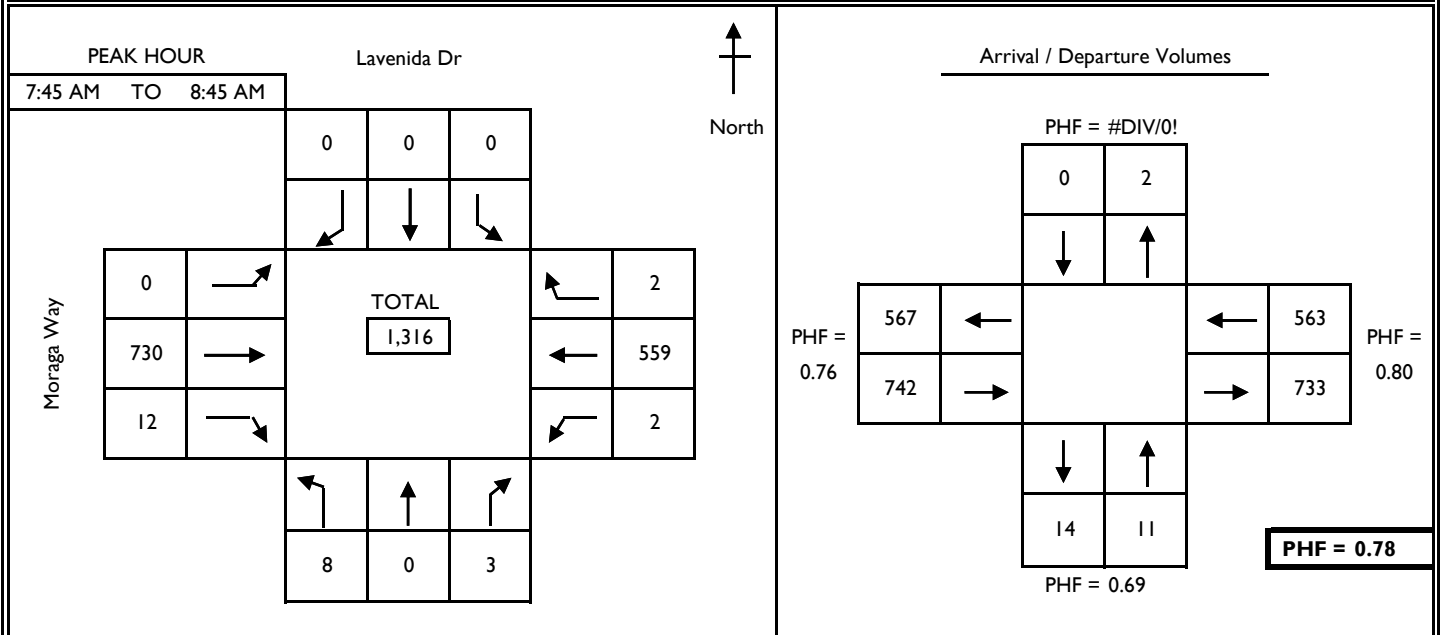
TOTAL BY PERIOD														
4:00 PM	---	4:15 PM	0	113	23	28	0	8	9	112	0	0	0	293
4:15 PM	---	4:30 PM	0	105	12	9	0	11	8	90	0	0	0	235
4:30 PM	---	4:45 PM	0	129	10	13	0	6	9	87	0	0	0	254
4:45 PM	---	5:00 PM	0	127	4	7	0	9	12	105	0	0	0	264
5:00 PM	---	5:15 PM	0	133	14	10	0	13	17	92	0	0	0	279
5:15 PM	---	5:30 PM	0	147	27	9	0	11	17	94	0	0	0	305
5:30 PM	---	5:45 PM	0	145	12	8	0	7	13	84	0	0	0	269
5:45 PM	---	6:00 PM	0	174	10	7	0	14	11	84	0	0	0	300

HOURLY TOTALS														
4:00 PM	---	5:00 PM	0	474	49	57	0	34	38	394	0	0	0	1,046
4:15 PM	---	5:15 PM	0	494	40	39	0	39	46	374	0	0	0	1,032
4:30 PM	---	5:30 PM	0	536	55	39	0	39	55	378	0	0	0	1,102
4:45 PM	---	5:45 PM	0	552	57	34	0	40	59	375	0	0	0	1,117
5:00 PM	---	6:00 PM	0	599	63	34	0	45	58	354	0	0	0	1,153

PHF by Movement	#DIV/0!	0.86	0.58	0.85	#DIV/0!	0.80	0.85	0.94	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!		Overall
PHF by Approach	0.90			0.86			0.93			#DIV/0!				0.95

TJKM Intersection Turning Movement Summary

Project:	Control	Speed Limit	Survey Date:	4/15/2009	DAY:	Wednesday
N-S Approach:	Lavenida Dr	STOP	25	Survey Time:	7:00 AM	To 9:00 AM
E-W Approach:	Moraga Way	Uncontrolled		City:	Orinda	Recorder: Manish



SURVEY DATA														
7:00 AM --- 7:15 AM														0
7:15 AM --- 7:30 AM														0
7:30 AM --- 7:45 AM														0
7:45 AM --- 8:00 AM														0
8:00 AM --- 8:15 AM														0
8:15 AM --- 8:30 AM														0
8:30 AM --- 8:45 AM														0
8:45 AM --- 9:00 AM														0

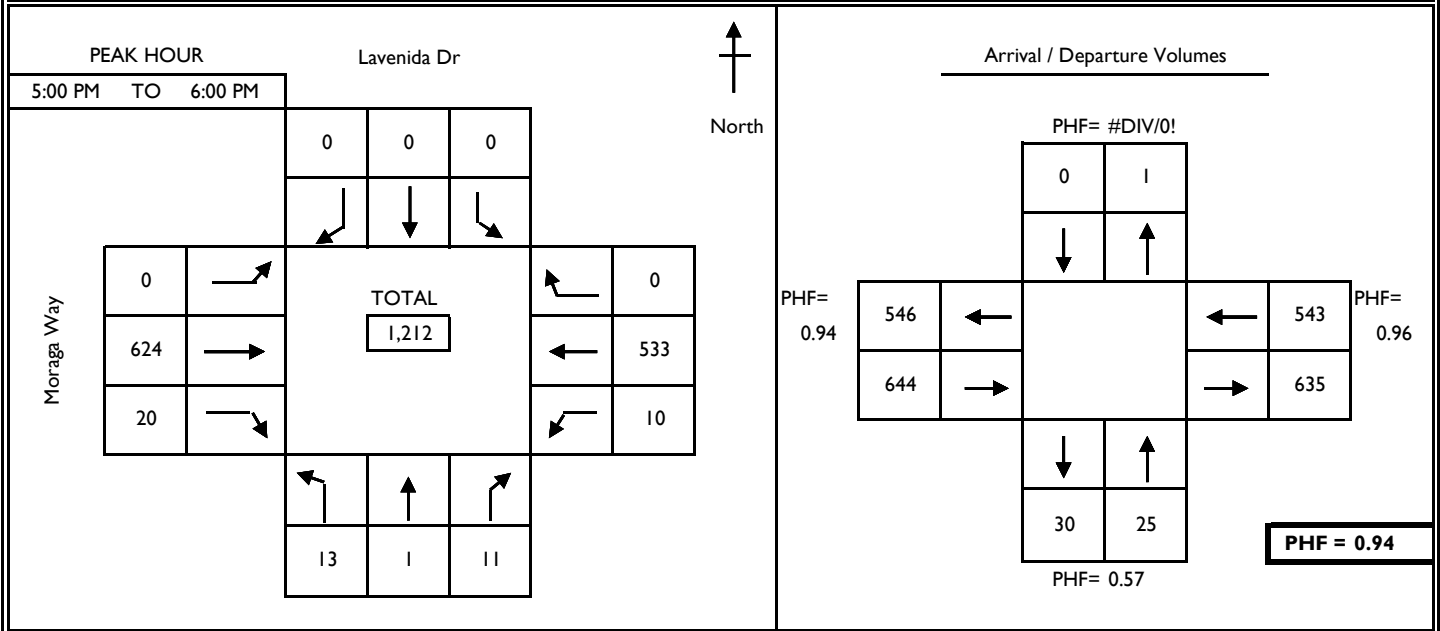
TOTAL BY PERIOD														
7:00 AM --- 7:15 AM	0	49	0	2	0	0	0	113	0	0	0	0		164
7:15 AM --- 7:30 AM	0	113	0	6	0	0	0	143	0	0	0	0		262
7:30 AM --- 7:45 AM	0	121	4	5	0	0	0	151	0	0	0	0		281
7:45 AM --- 8:00 AM	0	154	0	1	0	1	1	175	0	0	0	0		332
8:00 AM --- 8:15 AM	0	242	2	2	0	0	0	174	0	0	0	0		420
8:15 AM --- 8:30 AM	0	193	5	3	0	1	0	68	2	0	0	0		272
8:30 AM --- 8:45 AM	0	141	5	2	0	1	1	142	0	0	0	0		292
8:45 AM --- 9:00 AM	0	168	1	3	0	0	2	142	0	0	0	0		316

HOURLY TOTALS														
7:00 AM --- 8:00 AM	0	437	4	14	0	1	1	582	0	0	0	0		1,039
7:15 AM --- 8:15 AM	0	630	6	14	0	1	1	643	0	0	0	0		1,295
7:30 AM --- 8:30 AM	0	710	11	11	0	2	1	568	2	0	0	0		1,305
7:45 AM --- 8:45 AM	0	730	12	8	0	3	2	559	2	0	0	0		1,316
8:00 AM --- 9:00 AM	0	744	13	10	0	2	3	526	2	0	0	0		1,300

PHF by Movement	#DIV/0!	0.75	0.60	0.67	#DIV/0!	0.75	0.50	0.80	0.25	#DIV/0!	#DIV/0!	#DIV/0!		Overall
PHF by Approach		0.76			0.69			0.80			#DIV/0!			0.78

TJKM Intersection Turning Movement Summary

Project:	0	Control	Speed Limit	Survey Date:	DAY:	Saturday
N-S Approach:	Lavenida Dr	STOP	25	Survey Time:	4:00 PM	To 6:00 PM
E-W Approach:	Moraga Way	Uncontrolled	0	City:	Orinda	Recorder:



Time Period	Eastbound			Northbound			Westbound			Southbound			Total
	From	To		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	

SURVEY DATA														
4:00 PM	---	4:15 PM												0
4:15 PM	---	4:30 PM												0
4:30 PM	---	4:45 PM												0
4:45 PM	---	5:00 PM												0
5:00 PM	---	5:15 PM												0
5:15 PM	---	5:30 PM												0
5:30 PM	---	5:45 PM												0
5:45 PM	---	6:00 PM												0

TOTAL BY PERIOD														
4:00 PM	---	4:15 PM	0	138	1	1	0	0	2	114	0	0	0	256
4:15 PM	---	4:30 PM	0	115	3	1	0	0	1	124	0	0	0	244
4:30 PM	---	4:45 PM	6	132	6	4	0	5	6	116	1	0	0	276
4:45 PM	---	5:00 PM	0	139	4	6	1	3	7	109	0	0	0	269
5:00 PM	---	5:15 PM	0	154	9	4	1	4	4	124	0	0	0	300
5:15 PM	---	5:30 PM	0	165	7	6	0	5	6	135	0	0	0	324
5:30 PM	---	5:45 PM	0	146	4	3	0	2	0	142	0	0	0	297
5:45 PM	---	6:00 PM	0	159	0	0	0	0	0	132	0	0	0	291

HOURLY TOTALS														
4:00 PM	---	5:00 PM	6	524	14	12	1	8	16	463	1	0	0	1,045
4:15 PM	---	5:15 PM	6	540	22	15	2	12	18	473	1	0	0	1,089
4:30 PM	---	5:30 PM	6	590	26	20	2	17	23	484	1	0	0	1,169
4:45 PM	---	5:45 PM	0	604	24	19	2	14	17	510	0	0	0	1,190
5:00 PM	---	6:00 PM	0	624	20	13	1	11	10	533	0	0	0	1,212

PHF by Movement	#DIV/0!	0.95	0.56	0.54	0.25	0.55	0.42	0.94	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!		Overall
PHF by Approach		0.94			0.57			0.96			#DIV/0!			0.94

Appendix C – Level of Service Worksheets: Existing Conditions

HCM Unsignalized Intersection Capacity Analysis
 1: Donna Maria Way & El Camino Moraga

AM Existing
 11/8/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	29	1	1	16	1	9
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	1	1	17	1	10
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	18				74	10
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	18				74	10
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				100	99
cM capacity (veh/h)	1598				911	1072
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	33	18	11			
Volume Left	32	0	1			
Volume Right	0	17	10			
cSH	1598	1700	1053			
Volume to Capacity	0.02	0.01	0.01			
Queue Length 95th (ft)	2	0	1			
Control Delay (s)	7.1	0.0	8.5			
Lane LOS	A		A			
Approach Delay (s)	7.1	0.0	8.5			
Approach LOS			A			
Intersection Summary						
Average Delay			5.2			
Intersection Capacity Utilization		18.3%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 2: Don Gabriel Way & El Camino Moraga

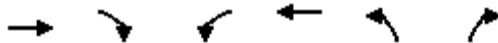
AM Existing
 11/8/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	99	26	12	55	43	29
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	108	28	13	60	47	32
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	148	62	78			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	148	62	78			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	87	97	99			
cM capacity (veh/h)	836	1002	1520			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	136	73	78			
Volume Left	108	13	0			
Volume Right	28	0	32			
cSH	866	1520	1700			
Volume to Capacity	0.16	0.01	0.05			
Queue Length 95th (ft)	14	1	0			
Control Delay (s)	9.9	1.4	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.9	1.4	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			5.0			
Intersection Capacity Utilization		24.0%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis
3: El Camino Moraga & Moraga Way

AM Existing
11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩		↩	↩	↩	↩
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.99		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1840		1770	1863	1690	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	1840		1770	1863	1690	
Volume (vph)	552	56	118	547	127	142
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	600	61	128	595	138	154
RTOR Reduction (vph)	5	0	0	0	53	0
Lane Group Flow (vph)	656	0	128	595	239	0
Turn Type			Prot			
Protected Phases	4		3	8	2	
Permitted Phases						
Actuated Green, G (s)	25.1		7.7	36.8	12.7	
Effective Green, g (s)	25.1		7.7	36.8	12.7	
Actuated g/C Ratio	0.44		0.13	0.64	0.22	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	803		237	1192	373	
v/s Ratio Prot	c0.36		0.07	c0.32	c0.14	
v/s Ratio Perm						
v/c Ratio	0.82		0.54	0.50	0.64	
Uniform Delay, d1	14.2		23.2	5.5	20.3	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	6.5		2.5	0.3	3.7	
Delay (s)	20.7		25.7	5.8	24.1	
Level of Service	C		C	A	C	
Approach Delay (s)	20.7			9.3	24.1	
Approach LOS	C			A	C	

Intersection Summary

HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	57.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
 4: Moraga Way & Lavenida Way

AM Existing
 11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	↻
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	730	12	2	559	8	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	793	13	2	608	9	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			807		1412	800
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			807		1412	800
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		94	99
cM capacity (veh/h)			818		152	385

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	807	610	12
Volume Left	0	2	9
Volume Right	13	0	3
cSH	1700	818	182
Volume to Capacity	0.47	0.00	0.07
Queue Length 95th (ft)	0	0	5
Control Delay (s)	0.0	0.1	26.2
Lane LOS		A	D
Approach Delay (s)	0.0	0.1	26.2
Approach LOS			D

Intersection Summary			
Average Delay		0.3	
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	4	470	7	2	524	4	2	0	4	10	0	11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	511	8	2	570	4	2	0	4	11	0	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	574			518			1111	1102	515	1104	1103	572
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	574			518			1111	1102	515	1104	1103	572
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	100	99	94	100	98
cM capacity (veh/h)	999			1048			181	210	560	186	210	520

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	523	576	7	23
Volume Left	4	2	2	11
Volume Right	8	4	4	12
cSH	999	1048	330	280
Volume to Capacity	0.00	0.00	0.02	0.08
Queue Length 95th (ft)	0	0	2	7
Control Delay (s)	0.1	0.1	16.1	19.0
Lane LOS	A	A	C	C
Approach Delay (s)	0.1	0.1	16.1	19.0
Approach LOS			C	C

Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization	39.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
 1: Donna Maria Way & El Camino Moraga

PM Existing
 11/8/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	16	2	1	15	3	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	2	1	16	3	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	17				46	9
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	17				46	9
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	98
cM capacity (veh/h)	1600				953	1072

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	20	17	20
Volume Left	17	0	3
Volume Right	0	16	16
cSH	1600	1700	1051
Volume to Capacity	0.01	0.01	0.02
Queue Length 95th (ft)	1	0	1
Control Delay (s)	6.5	0.0	8.5
Lane LOS	A		A
Approach Delay (s)	6.5	0.0	8.5
Approach LOS			A

Intersection Summary			
Average Delay		5.2	
Intersection Capacity Utilization	17.7%	ICU Level of Service	A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
 2: Don Gabriel Way & El Camino Moraga

PM Existing
 11/8/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	32	4	2	38	37	30
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	4	2	41	40	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)	807					
pX, platoon unblocked						
vC, conflicting volume	102	57	73			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	102	57	73			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	100	100			
cM capacity (veh/h)	895	1010	1527			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	39	43	73			
Volume Left	35	2	0			
Volume Right	4	0	33			
cSH	906	1527	1700			
Volume to Capacity	0.04	0.00	0.04			
Queue Length 95th (ft)	3	0	0			
Control Delay (s)	9.2	0.4	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.2	0.4	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			2.4			
Intersection Capacity Utilization			13.8%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis
3: El Camino Moraga & Moraga Way

PM Existing
11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩		↩	↩	↩	↩
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.99		1.00	1.00	0.92	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1839		1770	1863	1683	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	1839		1770	1863	1683	
Volume (vph)	599	63	58	354	34	45
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	651	68	63	385	37	49
RTOR Reduction (vph)	4	0	0	0	42	0
Lane Group Flow (vph)	715	0	63	385	44	0
Turn Type			Prot			
Protected Phases	4		3	8	2	
Permitted Phases						
Actuated Green, G (s)	25.4		4.2	33.6	7.5	
Effective Green, g (s)	25.4		4.2	33.6	7.5	
Actuated g/C Ratio	0.52		0.09	0.68	0.15	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	951		151	1275	257	
v/s Ratio Prot	c0.39		c0.04	0.21	c0.03	
v/s Ratio Perm						
v/c Ratio	0.75		0.42	0.30	0.17	
Uniform Delay, d1	9.4		21.3	3.1	18.1	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	3.4		1.9	0.1	0.3	
Delay (s)	12.7		23.2	3.2	18.4	
Level of Service	B		C	A	B	
Approach Delay (s)	12.7			6.0	18.4	
Approach LOS	B			A	B	

Intersection Summary

HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	49.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
 4: Moraga Way & Lavenida Way

PM Existing
 11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	↻
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	624	20	10	533	13	11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	678	22	11	579	14	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			700		1290	689
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			700		1290	689
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		92	97
cM capacity (veh/h)			897		178	446

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	700	590	26
Volume Left	0	11	14
Volume Right	22	0	12
cSH	1700	897	246
Volume to Capacity	0.41	0.01	0.11
Queue Length 95th (ft)	0	1	9
Control Delay (s)	0.0	0.3	21.4
Lane LOS		A	C
Approach Delay (s)	0.0	0.3	21.4
Approach LOS			C

Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization	46.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	10	612	0	4	405	16	1	2	3	6	0	4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	665	0	4	440	17	1	2	3	7	0	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	458			665			1149	1153	665	1149	1145	449
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	458			665			1149	1153	665	1149	1145	449
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			99	99	99	96	100	99
cM capacity (veh/h)	1103			924			172	194	460	171	197	610

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	676	462	7	11
Volume Left	11	4	1	7
Volume Right	0	17	3	4
cSH	1103	924	265	240
Volume to Capacity	0.01	0.00	0.02	0.05
Queue Length 95th (ft)	1	0	2	4
Control Delay (s)	0.3	0.1	18.9	20.7
Lane LOS	A	A	C	C
Approach Delay (s)	0.3	0.1	18.9	20.7
Approach LOS			C	C

Intersection Summary			
Average Delay		0.5	
Intersection Capacity Utilization	48.5%	ICU Level of Service	A
Analysis Period (min)		15	

Appendix D – Level of Service Worksheets: Scenario I

HCM Unsignalized Intersection Capacity Analysis
 1: Donna Maria Way & El Camino Moraga

AM Scenario 1
 11/8/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	29	1	1	16	1	9
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	1	1	17	1	10
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	18				74	10
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	18				74	10
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				100	99
cM capacity (veh/h)	1598				911	1072

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	33	18	11
Volume Left	32	0	1
Volume Right	0	17	10
cSH	1598	1700	1053
Volume to Capacity	0.02	0.01	0.01
Queue Length 95th (ft)	2	0	1
Control Delay (s)	7.1	0.0	8.5
Lane LOS	A		A
Approach Delay (s)	7.1	0.0	8.5
Approach LOS			A

Intersection Summary			
Average Delay		5.2	
Intersection Capacity Utilization	18.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
 2: Don Gabriel Way & El Camino Moraga

AM Scenario 1
 11/8/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	99	26	12	55	43	29
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	108	28	13	60	47	32
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	148	62	78			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	148	62	78			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	87	97	99			
cM capacity (veh/h)	836	1002	1520			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	136	73	78			
Volume Left	108	13	0			
Volume Right	28	0	32			
cSH	866	1520	1700			
Volume to Capacity	0.16	0.01	0.05			
Queue Length 95th (ft)	14	1	0			
Control Delay (s)	9.9	1.4	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.9	1.4	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			5.0			
Intersection Capacity Utilization		24.0%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis
3: El Camino Moraga & Moraga Way

AM Scenario 1
11/8/2010



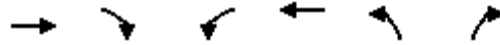
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩		↩	↩	↩	↩
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.99		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1840		1770	1863	1690	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	1840		1770	1863	1690	
Volume (vph)	553	56	118	550	127	142
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	601	61	128	598	138	154
RTOR Reduction (vph)	5	0	0	0	53	0
Lane Group Flow (vph)	658	0	128	598	239	0
Turn Type			Prot			
Protected Phases	4		3	8	2	
Permitted Phases						
Actuated Green, G (s)	25.2		7.7	36.9	12.7	
Effective Green, g (s)	25.2		7.7	36.9	12.7	
Actuated g/C Ratio	0.44		0.13	0.64	0.22	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	805		237	1193	373	
v/s Ratio Prot	c0.36		0.07	c0.32	c0.14	
v/s Ratio Perm						
v/c Ratio	0.82		0.54	0.50	0.64	
Uniform Delay, d1	14.2		23.3	5.5	20.4	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	6.4		2.5	0.3	3.7	
Delay (s)	20.6		25.8	5.8	24.1	
Level of Service	C		C	A	C	
Approach Delay (s)	20.6			9.3	24.1	
Approach LOS	C			A	C	

Intersection Summary

HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	57.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: Moraga Way & Lavenida Way

AM Scenario 1
11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	↻
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	730	13	2	559	11	4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	793	14	2	608	12	4
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			808		1412	801
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			808		1412	801
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		92	99
cM capacity (veh/h)			818		152	385
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	808	610	16			
Volume Left	0	2	12			
Volume Right	14	0	4			
cSH	1700	818	181			
Volume to Capacity	0.48	0.00	0.09			
Queue Length 95th (ft)	0	0	7			
Control Delay (s)	0.0	0.1	26.9			
Lane LOS		A	D			
Approach Delay (s)	0.0	0.1	26.9			
Approach LOS			D			
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization		49.2%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
5: Estabueno &

AM Scenario 1
11/8/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	4	471	7	2	524	4	2	0	5	10	0	11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	512	8	2	570	4	2	0	5	11	0	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	574			520			1112	1103	516	1106	1104	572
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	574			520			1112	1103	516	1106	1104	572
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	100	99	94	100	98
cM capacity (veh/h)	999			1047			181	210	559	185	210	520
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	524	576	8	23								
Volume Left	4	2	2	11								
Volume Right	8	4	5	12								
cSH	999	1047	350	279								
Volume to Capacity	0.00	0.00	0.02	0.08								
Queue Length 95th (ft)	0	0	2	7								
Control Delay (s)	0.1	0.1	15.5	19.0								
Lane LOS	A	A	C	C								
Approach Delay (s)	0.1	0.1	15.5	19.0								
Approach LOS			C	C								
Intersection Summary												
Average Delay			0.6									
Intersection Capacity Utilization			39.1%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 1: Donna Maria Way & El Camino Moraga

PM Scenario 1
 11/8/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	16	2	1	15	3	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	2	1	16	3	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	17				46	9
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	17				46	9
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	98
cM capacity (veh/h)	1600				953	1072

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	20	17	20
Volume Left	17	0	3
Volume Right	0	16	16
cSH	1600	1700	1051
Volume to Capacity	0.01	0.01	0.02
Queue Length 95th (ft)	1	0	1
Control Delay (s)	6.5	0.0	8.5
Lane LOS	A		A
Approach Delay (s)	6.5	0.0	8.5
Approach LOS			A

Intersection Summary			
Average Delay		5.2	
Intersection Capacity Utilization	17.7%	ICU Level of Service	A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
 2: Don Gabriel Way & El Camino Moraga

PM Scenario 1
 11/8/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↔			↑	↓	↔
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	32	4	2	38	37	30
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	4	2	41	40	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)	807					
pX, platoon unblocked						
vC, conflicting volume	102	57	73			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	102	57	73			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	100	100			
cM capacity (veh/h)	895	1010	1527			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	39	43	73			
Volume Left	35	2	0			
Volume Right	4	0	33			
cSH	906	1527	1700			
Volume to Capacity	0.04	0.00	0.04			
Queue Length 95th (ft)	3	0	0			
Control Delay (s)	9.2	0.4	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.2	0.4	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			2.4			
Intersection Capacity Utilization	13.8%		ICU Level of Service	A		
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis
3: El Camino Moraga & Moraga Way

PM Scenario 1
11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩		↩	↩	↩	↩
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.99		1.00	1.00	0.92	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1839		1770	1863	1683	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	1839		1770	1863	1683	
Volume (vph)	602	63	58	356	34	45
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	654	68	63	387	37	49
RTOR Reduction (vph)	4	0	0	0	42	0
Lane Group Flow (vph)	718	0	63	387	44	0
Turn Type			Prot			
Protected Phases	4		3	8	2	
Permitted Phases						
Actuated Green, G (s)	25.7		4.2	33.9	7.5	
Effective Green, g (s)	25.7		4.2	33.9	7.5	
Actuated g/C Ratio	0.52		0.09	0.69	0.15	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	957		150	1278	256	
v/s Ratio Prot	c0.39		c0.04	0.21	c0.03	
v/s Ratio Perm						
v/c Ratio	0.75		0.42	0.30	0.17	
Uniform Delay, d1	9.3		21.4	3.1	18.3	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	3.3		1.9	0.1	0.3	
Delay (s)	12.6		23.3	3.2	18.6	
Level of Service	B		C	A	B	
Approach Delay (s)	12.6			6.0	18.6	
Approach LOS	B			A	B	
Intersection Summary						
HCM Average Control Delay			10.6		HCM Level of Service	B
HCM Volume to Capacity ratio			0.60			
Actuated Cycle Length (s)			49.4		Sum of lost time (s)	12.0
Intersection Capacity Utilization			53.5%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis
 4: Moraga Way & Lavenida Way

PM Scenario 1
 11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	624	23	11	533	15	12
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	678	25	12	579	16	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			703		1294	691
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			703		1294	691
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		91	97
cM capacity (veh/h)			894		177	445

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	703	591	29
Volume Left	0	12	16
Volume Right	25	0	13
cSH	1700	894	242
Volume to Capacity	0.41	0.01	0.12
Queue Length 95th (ft)	0	1	10
Control Delay (s)	0.0	0.4	21.9
Lane LOS		A	C
Approach Delay (s)	0.0	0.4	21.9
Approach LOS			C

Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: Estabueno &

PM Scenario 1
11/8/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	10	613	0	5	406	16	1	2	3	6	0	4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	666	0	5	441	17	1	2	3	7	0	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	459			666			1153	1158	666	1153	1149	450
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	459			666			1153	1158	666	1153	1149	450
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			99	99	99	96	100	99
cM capacity (veh/h)	1102			923			171	193	459	170	195	609

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	677	464	7	11
Volume Left	11	5	1	7
Volume Right	0	17	3	4
cSH	1102	923	264	238
Volume to Capacity	0.01	0.01	0.02	0.05
Queue Length 95th (ft)	1	0	2	4
Control Delay (s)	0.3	0.2	19.0	20.8
Lane LOS	A	A	C	C
Approach Delay (s)	0.3	0.2	19.0	20.8
Approach LOS			C	C

Intersection Summary			
Average Delay		0.5	
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix E – Level of Service Worksheets: Scenario 2

HCM Unsignalized Intersection Capacity Analysis
 1: Donna Maria Way & El Camino Moraga

AM Scenario 2
 11/8/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	29	1	1	23	3	9
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	1	1	25	3	10
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	26				78	14
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	26				78	14
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				100	99
cM capacity (veh/h)	1588				907	1066

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	33	26	13
Volume Left	32	0	3
Volume Right	0	25	10
cSH	1588	1700	1021
Volume to Capacity	0.02	0.02	0.01
Queue Length 95th (ft)	2	0	1
Control Delay (s)	7.1	0.0	8.6
Lane LOS	A		A
Approach Delay (s)	7.1	0.0	8.6
Approach LOS			A

Intersection Summary			
Average Delay		4.8	
Intersection Capacity Utilization	18.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
 2: Don Gabriel Way & El Camino Moraga

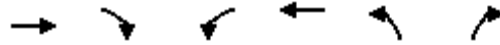
AM Scenario 2
 11/8/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	99	26	12	62	45	29
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	108	28	13	67	49	32
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	158	65	80			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	158	65	80			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	87	97	99			
cM capacity (veh/h)	826	999	1517			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	136	80	80			
Volume Left	108	13	0			
Volume Right	28	0	32			
cSH	857	1517	1700			
Volume to Capacity	0.16	0.01	0.05			
Queue Length 95th (ft)	14	1	0			
Control Delay (s)	10.0	1.3	0.0			
Lane LOS	A	A				
Approach Delay (s)	10.0	1.3	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			4.9			
Intersection Capacity Utilization		24.3%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis
3: El Camino Moraga & Moraga Way

AM Scenario 2
11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↶		↷	↶	↷	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.99		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1839		1770	1863	1690	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	1839		1770	1863	1690	
Volume (vph)	553	57	119	550	131	145
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	601	62	129	598	142	158
RTOR Reduction (vph)	5	0	0	0	53	0
Lane Group Flow (vph)	658	0	129	598	247	0
Turn Type			Prot			
Protected Phases	4		3	8	2	
Permitted Phases						
Actuated Green, G (s)	25.3		7.8	37.1	13.0	
Effective Green, g (s)	25.3		7.8	37.1	13.0	
Actuated g/C Ratio	0.44		0.13	0.64	0.22	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	801		238	1190	378	
v/s Ratio Prot	c0.36		0.07	c0.32	c0.15	
v/s Ratio Perm						
v/c Ratio	0.82		0.54	0.50	0.65	
Uniform Delay, d1	14.4		23.5	5.6	20.5	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	6.8		2.5	0.3	4.0	
Delay (s)	21.2		26.0	5.9	24.5	
Level of Service	C		C	A	C	
Approach Delay (s)	21.2			9.5	24.5	
Approach LOS	C			A	C	

Intersection Summary

HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	58.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: Moraga Way & Lavenida Way

AM Scenario 2
11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩			↩	↩	↩
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	733	13	2	560	11	4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	797	14	2	609	12	4
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			811		1417	804
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			811		1417	804
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		92	99
cM capacity (veh/h)			815		151	383
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	811	611	16			
Volume Left	0	2	12			
Volume Right	14	0	4			
cSH	1700	815	180			
Volume to Capacity	0.48	0.00	0.09			
Queue Length 95th (ft)	0	0	7			
Control Delay (s)	0.0	0.1	27.0			
Lane LOS		A	D			
Approach Delay (s)	0.0	0.1	27.0			
Approach LOS			D			
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization		49.4%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
5: Estabueno &

AM Scenario 2
11/8/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	4	474	7	2	525	4	2	0	5	10	0	11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	515	8	2	571	4	2	0	5	11	0	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	575			523			1117	1107	519	1110	1109	573
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	575			523			1117	1107	519	1110	1109	573
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	100	99	94	100	98
cM capacity (veh/h)	998			1044			180	209	557	184	208	519

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	527	577	8	23
Volume Left	4	2	2	11
Volume Right	8	4	5	12
cSH	998	1044	348	278
Volume to Capacity	0.00	0.00	0.02	0.08
Queue Length 95th (ft)	0	0	2	7
Control Delay (s)	0.1	0.1	15.6	19.1
Lane LOS	A	A	C	C
Approach Delay (s)	0.1	0.1	15.6	19.1
Approach LOS			C	C

Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization	39.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
 1: Donna Maria Way & El Camino Moraga

PM Scenario 2
 11/8/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	16	2	1	20	11	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	2	1	22	12	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	23				49	12
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	23				49	12
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				99	98
cM capacity (veh/h)	1592				950	1069

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	20	23	28
Volume Left	17	0	12
Volume Right	0	22	16
cSH	1592	1700	1015
Volume to Capacity	0.01	0.01	0.03
Queue Length 95th (ft)	1	0	2
Control Delay (s)	6.5	0.0	8.6
Lane LOS	A		A
Approach Delay (s)	6.5	0.0	8.6
Approach LOS			A

Intersection Summary			
Average Delay		5.3	
Intersection Capacity Utilization	17.7%	ICU Level of Service	A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
 2: Don Gabriel Way & El Camino Moraga

PM Scenario 2
 11/8/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	32	4	2	43	45	30
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	4	2	47	49	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)	807					
pX, platoon unblocked						
vC, conflicting volume	116	65	82			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	116	65	82			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	100	100			
cM capacity (veh/h)	879	999	1516			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	39	49	82			
Volume Left	35	2	0			
Volume Right	4	0	33			
cSH	890	1516	1700			
Volume to Capacity	0.04	0.00	0.05			
Queue Length 95th (ft)	3	0	0			
Control Delay (s)	9.2	0.3	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.2	0.3	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			2.2			
Intersection Capacity Utilization	14.2%		ICU Level of Service	A		
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis
3: El Camino Moraga & Moraga Way

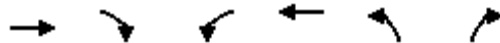
PM Scenario 2
11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻		↻	↻	↻	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.99		1.00	1.00	0.92	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1837		1770	1863	1685	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	1837		1770	1863	1685	
Volume (vph)	602	68	61	356	37	47
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	654	74	66	387	40	51
RTOR Reduction (vph)	4	0	0	0	43	0
Lane Group Flow (vph)	724	0	66	387	48	0
Turn Type			Prot			
Protected Phases	4		3	8	2	
Permitted Phases						
Actuated Green, G (s)	26.1		4.3	34.4	7.5	
Effective Green, g (s)	26.1		4.3	34.4	7.5	
Actuated g/C Ratio	0.52		0.09	0.69	0.15	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	961		153	1284	253	
v/s Ratio Prot	c0.39		c0.04	0.21	c0.03	
v/s Ratio Perm						
v/c Ratio	0.75		0.43	0.30	0.19	
Uniform Delay, d1	9.4		21.6	3.0	18.5	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	3.4		1.9	0.1	0.4	
Delay (s)	12.7		23.6	3.2	18.9	
Level of Service	B		C	A	B	
Approach Delay (s)	12.7			6.1	18.9	
Approach LOS	B			A	B	
Intersection Summary						
HCM Average Control Delay			10.8		HCM Level of Service	B
HCM Volume to Capacity ratio			0.61			
Actuated Cycle Length (s)			49.9		Sum of lost time (s)	12.0
Intersection Capacity Utilization			54.1%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis
 4: Moraga Way & Lavenida Way

PM Scenario 2
 11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↻			↻	↻	↻
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	625	23	11	536	15	12
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	679	25	12	583	16	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			704		1298	692
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			704		1298	692
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		91	97
cM capacity (veh/h)			893		176	444

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	704	595	29
Volume Left	0	12	16
Volume Right	25	0	13
cSH	1700	893	240
Volume to Capacity	0.41	0.01	0.12
Queue Length 95th (ft)	0	1	10
Control Delay (s)	0.0	0.4	22.0
Lane LOS		A	C
Approach Delay (s)	0.0	0.4	22.0
Approach LOS			C

Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: Estabueno &

PM Scenario 2
11/8/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	10	614	0	5	409	16	1	2	3	6	0	4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	667	0	5	445	17	1	2	3	7	0	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	462			667			1158	1162	667	1158	1153	453
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	462			667			1158	1162	667	1158	1153	453
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			99	99	99	96	100	99
cM capacity (veh/h)	1099			922			170	192	459	168	194	607

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	678	467	7	11
Volume Left	11	5	1	7
Volume Right	0	17	3	4
cSH	1099	922	263	237
Volume to Capacity	0.01	0.01	0.02	0.05
Queue Length 95th (ft)	1	0	2	4
Control Delay (s)	0.3	0.2	19.1	20.9
Lane LOS	A	A	C	C
Approach Delay (s)	0.3	0.2	19.1	20.9
Approach LOS			C	C

Intersection Summary			
Average Delay		0.5	
Intersection Capacity Utilization	48.3%	ICU Level of Service	A
Analysis Period (min)		15	

Appendix F – Level of Service Worksheets: Scenario 3

HCM Unsignalized Intersection Capacity Analysis
 1: Donna Maria Way & El Camino Moraga

AM Scenario 3
 11/8/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↔		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	29	1	1	20	2	9
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	1	1	22	2	10
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	23				76	12
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	23				76	12
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				100	99
cM capacity (veh/h)	1592				909	1069

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	33	23	12
Volume Left	32	0	2
Volume Right	0	22	10
cSH	1592	1700	1036
Volume to Capacity	0.02	0.01	0.01
Queue Length 95th (ft)	2	0	1
Control Delay (s)	7.1	0.0	8.5
Lane LOS	A		A
Approach Delay (s)	7.1	0.0	8.5
Approach LOS			A

Intersection Summary			
Average Delay		4.9	
Intersection Capacity Utilization	18.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
 2: Don Gabriel Way & El Camino Moraga

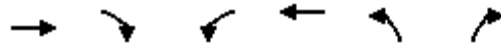
AM Scenario 3
 11/8/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	99	26	12	59	44	29
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	108	28	13	64	48	32
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	154	64	79			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	154	64	79			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	87	97	99			
cM capacity (veh/h)	831	1001	1519			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	136	77	79			
Volume Left	108	13	0			
Volume Right	28	0	32			
cSH	861	1519	1700			
Volume to Capacity	0.16	0.01	0.05			
Queue Length 95th (ft)	14	1	0			
Control Delay (s)	10.0	1.3	0.0			
Lane LOS	A	A				
Approach Delay (s)	10.0	1.3	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			5.0			
Intersection Capacity Utilization		24.2%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis
3: El Camino Moraga & Moraga Way

AM Scenario 3
11/8/2010



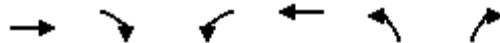
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩		↩	↩	↩	↩
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.99		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1839		1770	1863	1691	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	1839		1770	1863	1691	
Volume (vph)	553	57	118	550	130	143
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	601	62	128	598	141	155
RTOR Reduction (vph)	5	0	0	0	52	0
Lane Group Flow (vph)	658	0	128	598	244	0
Turn Type			Prot			
Protected Phases	4		3	8	2	
Permitted Phases						
Actuated Green, G (s)	25.2		7.7	36.9	12.9	
Effective Green, g (s)	25.2		7.7	36.9	12.9	
Actuated g/C Ratio	0.44		0.13	0.64	0.22	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	802		236	1189	377	
v/s Ratio Prot	c0.36		0.07	c0.32	c0.14	
v/s Ratio Perm						
v/c Ratio	0.82		0.54	0.50	0.65	
Uniform Delay, d1	14.3		23.4	5.6	20.4	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	6.8		2.5	0.3	3.8	
Delay (s)	21.1		25.9	5.9	24.2	
Level of Service	C		C	A	C	
Approach Delay (s)	21.1			9.4	24.2	
Approach LOS	C			A	C	

Intersection Summary

HCM Average Control Delay	16.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	57.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: Moraga Way & Lavenida Way

AM Scenario 3
11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↷			↶	↷	
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	730	13	3	559	12	6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	793	14	3	608	13	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			808		1415	801
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			808		1415	801
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		91	98
cM capacity (veh/h)			818		151	385
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	808	611	20			
Volume Left	0	3	13			
Volume Right	14	0	7			
cSH	1700	818	189			
Volume to Capacity	0.48	0.00	0.10			
Queue Length 95th (ft)	0	0	9			
Control Delay (s)	0.0	0.1	26.2			
Lane LOS		A	D			
Approach Delay (s)	0.0	0.1	26.2			
Approach LOS			D			
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			49.2%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
5: Estabueno &

AM Scenario 3
11/8/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	4	472	8	2	525	4	2	0	5	10	0	11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	513	9	2	571	4	2	0	5	11	0	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	575			522			1115	1105	517	1109	1108	573
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	575			522			1115	1105	517	1109	1108	573
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	100	99	94	100	98
cM capacity (veh/h)	998			1045			180	209	558	184	209	519

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	526	577	8	23
Volume Left	4	2	2	11
Volume Right	9	4	5	12
cSH	998	1045	349	278
Volume to Capacity	0.00	0.00	0.02	0.08
Queue Length 95th (ft)	0	0	2	7
Control Delay (s)	0.1	0.1	15.6	19.1
Lane LOS	A	A	C	C
Approach Delay (s)	0.1	0.1	15.6	19.1
Approach LOS			C	C

Intersection Summary			
Average Delay		0.6	
Intersection Capacity Utilization	39.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
 1: Donna Maria Way & El Camino Moraga

PM Scenario 3
 11/8/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	16	2	1	18	7	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	2	1	20	8	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	21				48	11
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	21				48	11
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				99	98
cM capacity (veh/h)	1595				951	1070

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	20	21	24
Volume Left	17	0	8
Volume Right	0	20	16
cSH	1595	1700	1029
Volume to Capacity	0.01	0.01	0.02
Queue Length 95th (ft)	1	0	2
Control Delay (s)	6.5	0.0	8.6
Lane LOS	A		A
Approach Delay (s)	6.5	0.0	8.6
Approach LOS			A

Intersection Summary			
Average Delay		5.2	
Intersection Capacity Utilization	17.7%	ICU Level of Service	A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
 2: Don Gabriel Way & El Camino Moraga

PM Scenario 3
 11/8/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	32	4	2	41	41	30
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	4	2	45	45	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)	807					
pX, platoon unblocked						
vC, conflicting volume	110	61	77			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	110	61	77			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	100	100			
cM capacity (veh/h)	886	1004	1521			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	39	47	77			
Volume Left	35	2	0			
Volume Right	4	0	33			
cSH	898	1521	1700			
Volume to Capacity	0.04	0.00	0.05			
Queue Length 95th (ft)	3	0	0			
Control Delay (s)	9.2	0.4	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.2	0.4	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			2.3			
Intersection Capacity Utilization	14.0%		ICU Level of Service	A		
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis
3: El Camino Moraga & Moraga Way

PM Scenario 3
11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔		↔	↔	↔	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.99		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1838		1770	1863	1686	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	1838		1770	1863	1686	
Volume (vph)	602	66	59	356	37	45
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	654	72	64	387	40	49
RTOR Reduction (vph)	4	0	0	0	42	0
Lane Group Flow (vph)	722	0	64	387	47	0
Turn Type			Prot			
Protected Phases	4		3	8	2	
Permitted Phases						
Actuated Green, G (s)	25.9		4.2	34.1	7.5	
Effective Green, g (s)	25.9		4.2	34.1	7.5	
Actuated g/C Ratio	0.52		0.08	0.69	0.15	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	960		150	1281	255	
v/s Ratio Prot	c0.39		c0.04	0.21	c0.03	
v/s Ratio Perm						
v/c Ratio	0.75		0.43	0.30	0.19	
Uniform Delay, d1	9.3		21.6	3.1	18.4	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	3.4		1.9	0.1	0.4	
Delay (s)	12.7		23.5	3.2	18.7	
Level of Service	B		C	A	B	
Approach Delay (s)	12.7			6.1	18.7	
Approach LOS	B			A	B	
Intersection Summary						
HCM Average Control Delay			10.8		HCM Level of Service	B
HCM Volume to Capacity ratio			0.60			
Actuated Cycle Length (s)			49.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			53.8%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis
4: Moraga Way & Lavenida Way

PM Scenario 3
11/8/2010



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖		↗
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	624	25	13	533	16	13
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	678	27	14	579	17	14
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			705		1299	692
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			705		1299	692
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		90	97
cM capacity (veh/h)			893		175	444

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	705	593	32
Volume Left	0	14	17
Volume Right	27	0	14
cSH	1700	893	240
Volume to Capacity	0.41	0.02	0.13
Queue Length 95th (ft)	0	1	11
Control Delay (s)	0.0	0.4	22.2
Lane LOS		A	C
Approach Delay (s)	0.0	0.4	22.2
Approach LOS			C

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization	48.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: Estabueno &

PM Scenario 3
11/8/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	10	614	0	5	408	16	1	2	3	6	0	4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	667	0	5	443	17	1	2	3	7	0	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	461			667			1157	1161	667	1157	1152	452
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	461			667			1157	1161	667	1157	1152	452
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			99	99	99	96	100	99
cM capacity (veh/h)	1100			922			170	192	459	169	194	607

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	678	466	7	11
Volume Left	11	5	1	7
Volume Right	0	17	3	4
cSH	1100	922	263	237
Volume to Capacity	0.01	0.01	0.02	0.05
Queue Length 95th (ft)	1	0	2	4
Control Delay (s)	0.3	0.2	19.0	20.9
Lane LOS	A	A	C	C
Approach Delay (s)	0.3	0.2	19.0	20.9
Approach LOS			C	C

Intersection Summary			
Average Delay		0.5	
Intersection Capacity Utilization	48.3%	ICU Level of Service	A
Analysis Period (min)	15		