HEXAGON TRANSPORTATION CONSULTANTS, INC.

645 Almanor Avenue R&D Development

Transportation Impact Analysis

Prepared for:

City of Sunnyvale

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Executive Summary

This report presents the results of the transportation impact analysis (TIA) conducted for the proposed research and development (R&D) project at 645 Almanor Avenue in Sunnyvale, California. The project consists of 176,780 square feet of new building space. An existing 130,882 square foot R&D building will remain on the site. The site has access to Almanor Avenue. The potential impacts related to the project were evaluated following the standards and methodologies set forth by the City of Sunnyvale and the Santa Clara Valley Transportation Authority (VTA). The VTA administers the County Congestion Management Program (CMP). The traffic study includes an analysis of AM and PM peak hour traffic conditions for 13 signalized intersections and 4 freeway segments.

Project Trip Estimates

According to ITE trip generation rates, the project would generate 213 new trips during the AM peak hour and 212 new trips during the PM peak hour. The trip distribution pattern for the proposed project was estimated based on the residence distribution survey of current employees at the site, which was provided by the CIty of Sunnyvale.

Intersection Level of Service Impacts

Table ES-1 summarizes the results of the signalized intersection level of service analysis under the following conditions: existing (Chapter 2), background (Chapter 3), existing plus project (Chapter 4), background plus project (Chapter 4), cumulative no project (Chapter 5), and cumulative plus project (Chapter 5) conditions. The results of the level of service calculations show that, measured against City of Sunnyvale and CMP standards, all of the study intersections would continue to operate at acceptable levels of service under existing and existing plus project conditions.

The study intersections have been analyzed utilizing the VTA prescribed individual intersection analysis method using the Traffix software. The Mathilda/SR 237 complex does not lend itself to individual intersection analysis due to closely spaced, mutually dependent intersection operations and complex turning patterns.Nevertheless, under background no project and background plus project conditions, the intersection at Mathilda Avenue and SR (CA) 237 westbound ramps is shown to operate at LOS F during the AM and PM peak hours. The project would not cause a significant impact to this intersection under background conditions because it would not increase the critical delay by more than 4 seconds or the V/C by more than 0.01. All other study intersections would operate at acceptable levels of service during the AM and PM peak hours.

Under cumulative conditions, the intersection at Mathilda Avenue and SR 237 westbound ramps would operate at LOS F under both no project and with project scenarios during the AM and PM peak hours. In addition, the intersection at Mathilda Avenue and Ross Drive would operate at LOS F under both no project and with project scenarios during the PM peak hour. However, the project would not cause a significant impact to either intersection under cumulative conditions because it would not increase the critical delay by more than 4 seconds or the V/C by more than 0.01. Previous studies (North/South Corridor Study, Route

237 Corridor Study, etc.) have determined that major improvements are necessary to improve travel in the Mathilda Corridor. Improvements identified by the City and VTA include reconfiguration of the Mathilda/237 interchange to improve geometry and efficiency. The findings of LOS F at the intersection of Mathilda Avenue and SR 237 westbound ramps are consistent with the analysis of buildout of the City of Sunnyvale General Plan.

Public transit improvements in this area also have been recommended in the Valley Transportation Plan 2035. VTA is considering improvements to Express Bus and Limited Stop Bus routes serving Moffett Park. Near the project site, Route 54 will continue to operate as a Local Bus route. The Mary Avenue extension and planned improvements to public transit service in Moffett Park would relieve the transportation demand along SR237/Mathilda Avenue. The remaining signalized study intersections would operate at acceptable levels of service during the AM and PM peak hours under cumulative plus project conditions.

Freeway Segment Evaluation

The project's impacts at nearby freeway segments were evaluated in accordance with CMP guidelines (see Chapter 4). Based on this analysis, the project would not add sufficient traffic to freeway segments to cause a significant impact. Therefore, no mitigation is required.

Turn Pocket Analysis

At the intersection of Mathilda Avenue and Almanor Avenue, the queuing calculations show that the vehicle queue length for the eastbound left-turn movement would exceed the existing storage by one vehicle during the PM peak hour under background with project and cumulative with project conditions. The project is expected to increase this queue by 4 vehicles during the PM peak hour. However, since the right turn and through volumes at this intersection are fairly low, the periodic one vehicle queue overflow is not anticipated to impact the operation of the intersection. Therefore, no improvements are recommended.

Pedestrians, Bicycles and Transit

The project's impacts to pedestrian, bicycle, and transit facilities were evaluated (see Chapter 6). Based on this analysis, the project would not create any adverse impact to bicycle or transit facilities. The project would create the need for pedestrian facilities along its frontage.

> **Recommendation:** Sidewalks should be installed along the project frontage and along the frontage of 675 Almanor. These would tie into the sidewalks that are present on either side.

Site Access, Circulation and Parking

Site access and on-site circulation were evaluated using commonly accepted transportation planning principles. This review was based on the project site plan dated January 28, 2013. Because this site plan is conceptual, this study does not provide a complete analysis of site access and circulation. The site plan review resulted in the following findings:

- The main driveway is located on Almanor Avenue offset from the intersection with Pastoria Avenue. This offset will create left turn conflicts. It is recommended that the driveway be moved to align directly with Pastoria Avenue.
- The proposed project parking supply meets the minimum and maximum parking standards specified by the City of Sunnyvale.
- Prior to final design, the site plan should be reviewed by the City Division of Transportation and Traffic. Modifications to the project design may occur during the project permitting process.

- The driveway widths, radii and throat depth should be measured to confirm that they comply with traffic engineering guidance and are adequate to handle truck traffic. In addition, an analysis of the adequacy of onsite circulation for trucks should be conducted. Separated loading zones should be provided for each building on site.
- In order to ensure there would be sufficient sight distance at the project driveways, any landscaping, parking, and signage location should be consistent with City of Sunnyvale vision triangle standards.
- The drive aisle widths and garage ramp design are not shown on the conceptual plan. Prior to final design, the drive aisle widths should be reviewed for compliance with City standards.
- Pedestrian pathways are not shown on the conceptual site plan. Pedestrian paths should be provided between the parking areas and the buildings. Also, a pedestrian path should be provided between the two buildings. Pedestrian paths should follow desired lines, should have pedestrian scale lighting, and should be of sufficient width for comfortable walking.
- Bicycle parking should be provided in accordance with City of Sunnyvale bicycle parking standards.
- The final construction phasing plan has not yet been completed. The project applicant should work with the City and the contractor to minimize the impact of the construction process.

Table ES 1
Intersection Level of Service Summary

Intersection	Peak Hour	Count Date	Existing Avg Delay	Existing LOS	Existing + Project Avg Delay	Existing + Project LOS	Existing + Project Incr. In Crit. Delay	Existing + Project Incr. In Crit. V/C	Background No Project Avg Delay	Background No Project LOS	Background with Project Avg Delay	Background with Project LOS	Background with Project Incr. In Crit. Delay	Background with Project Incr. In Crit. V/C	Cumulative No Project Avg Delay	Cumulative No Project LOS	Cumulative With Project Avg Delay	Cumulative With Project LOS	Cumulative With Project Incr. In Crit. Delay	Cumulative With Project Incr. In Crit. V/C
CA 237 Service Rd (W) & Middlefield	AM	04/07/11	19.1	B	19.1	B	0.0	0.000	19.5	B	19.5	B	0.0	0.000	19.7	B	19.7	B	0.0	0.000
	PM	04/07/11	22.6	C	22.7	C	0.0	0.001	23.2	C	23.2	C	-0.1	-0.007	23.4	C	23.5	C	0.0	0.004
CA 237 Service Rd & Maude Ave	AM	11/08/11	30.1	C	30.1	C	0.4	0.018	30.6	C	30.8	C	0.6	0.018	31.3	C	31.5	C	0.8	0.018
	PM	11/16/11	31.2	C	31.3	C	0.0	0.018	31.8	C	32.0	C	0.1	0.018	32.3	C	32.5	C	0.2	0.018
Mary Ave & Maude Ave	AM	04/07/11	26.4	C	26.8	C	0.7	0.013	26.9	C	27.3	C	0.7	0.013	27.2	C	27.5	C	0.6	0.013
	PM	04/07/11	27.4	C	28.0	C	0.7	0.010	28.8	C	29.4	C	0.6	0.010	29.0	C	29.6	C	0.6	0.010
Borregas Ave & Maude Ave	AM	11/08/11	16.5	B	16.4	B	-0.3	0.009	16.4	B	16.3	B	-0.2	0.009	17.0	B	17.0	B	0.0	0.011
	PM	11/08/11	13.9	B	13.8	B	-0.1	0.009	13.7	B	13.6	B	-0.1	0.009	14.1	B	14.1	B	-0.1	0.009
Sunnyvale Ave & Maude Ave	AM	11/09/11	18.0	B	17.9	B	-0.1	0.002	18.6	B	18.5	B	0.0	0.002	19.6	B	19.4	B	-0.1	0.009
	PM	11/16/11	18.1	B	17.9	B	-0.2	0.009	18.0	B	17.9	B	-0.2	0.009	18.0	B	17.9	B	-0.1	0.009
N Fair Oaks Ave & Maude Ave	AM	11/09/11	27.6	C	28.3	C	1.1	0.010	28.8	C	29.4	C	0.9	0.010	29.2	C	29.8	C	0.8	0.010
	PM	11/16/11	28.8	C	29.2	C	0.6	0.010	30.4	C	30.9	C	0.6	0.010	31.6	C	32.1	C	0.7	0.010
Mathilda Ave & San Aleso Ave	AM	11/08/11	12.2	B	12.2	B	0.0	0.006	12.7	B	12.7	B	0.1	0.006	13.1	B	13.1	B	0.1	0.006
	PM	11/08/11	11.7	B	11.7	B	0.0	0.005	12.2	B	12.2	B	0.1	0.005	12.7	B	12.8	B	0.1	0.005
Mathilda Ave & Almanor Ave	AM	03/08/11	22.2	C	22.8	C	0.7	0.007	20.9	C	21.3	C	0.5	0.007	22.0	C	22.5	C	0.5	0.007
	PM	03/08/11	20.7	C	23.5	C	3.3	0.044	21.0	C	24.4	C	4.1	0.044	23.3	C	27.4	C	5.1	0.044
Mathilda Ave & Ross Dr	AM	03/08/11	14.0	B	14.0	B	0.0	0.001	13.1	B	13.2	B	0.0	0.001	14.1	B	14.2	B	0.0	0.001
	PM	03/08/11	14.6	B	14.6	B	0.0	0.001	45.8	D	46.0	D	0.6	0.001	**89.0**	**F**	**89.0**	**F**	0.6	0.001
Mathilda Ave & CA237 EB Ramps	AM	03/08/11	15.7	B	15.7	B	0.2	0.004	38.0	D	38.5	D	1.7	0.004	69.5	E	69.6	E	1.8	0.004
	PM	03/08/11	15.1	B	15.4	B	0.9	0.020	38.7	D	40.8	D	7.7	0.020	71.4	E	73.7	E	8.7	0.020
Mathilda Ave & CA237 WB Ramps	AM	03/08/11	14.3	B	14.6	B	0.4	0.010	**84.6**	**F**	**84.4**	**F**	0.0	0.000	**175.5**	**F**	**175.0**	**F**	0.0	0.000
	PM	03/08/11	20.1	C	20.2	C	0.0	0.002	**84.9**	**F**	**85.6**	**F**	0.8	0.002	**151.1**	**F**	**151.7**	**F**	0.8	0.002
Mathilda/ Maude *	AM	03/08/11	44.3	D	44.7	D	0.5	0.010	47.3	D	47.8	D	0.7	0.010	49.7	D	50.3	D	0.9	0.010
	PM	09/06/12	36.4	D	36.5	D	0.0	0.003	39.8	D	40.0	D	0.1	0.003	42.4	D	42.8	D	0.7	0.008
CA 237 Service Rd (E) & Middlefield Rd	AM	04/07/11	23.4	C	23.5	C	0.1	0.007	24.1	C	24.2	C	0.1	0.007	24.5	C	24.6	C	0.1	0.007
	PM	04/07/11	18.5	B	18.5	B	0.1	0.001	18.8	B	18.9	B	0.1	0.001	19.0	B	19.1	B	0.1	0.001

* Denotes CMP intersection
Bold indicates a substandard level of service.
Bold indicates a significant project impact.

1. Introduction

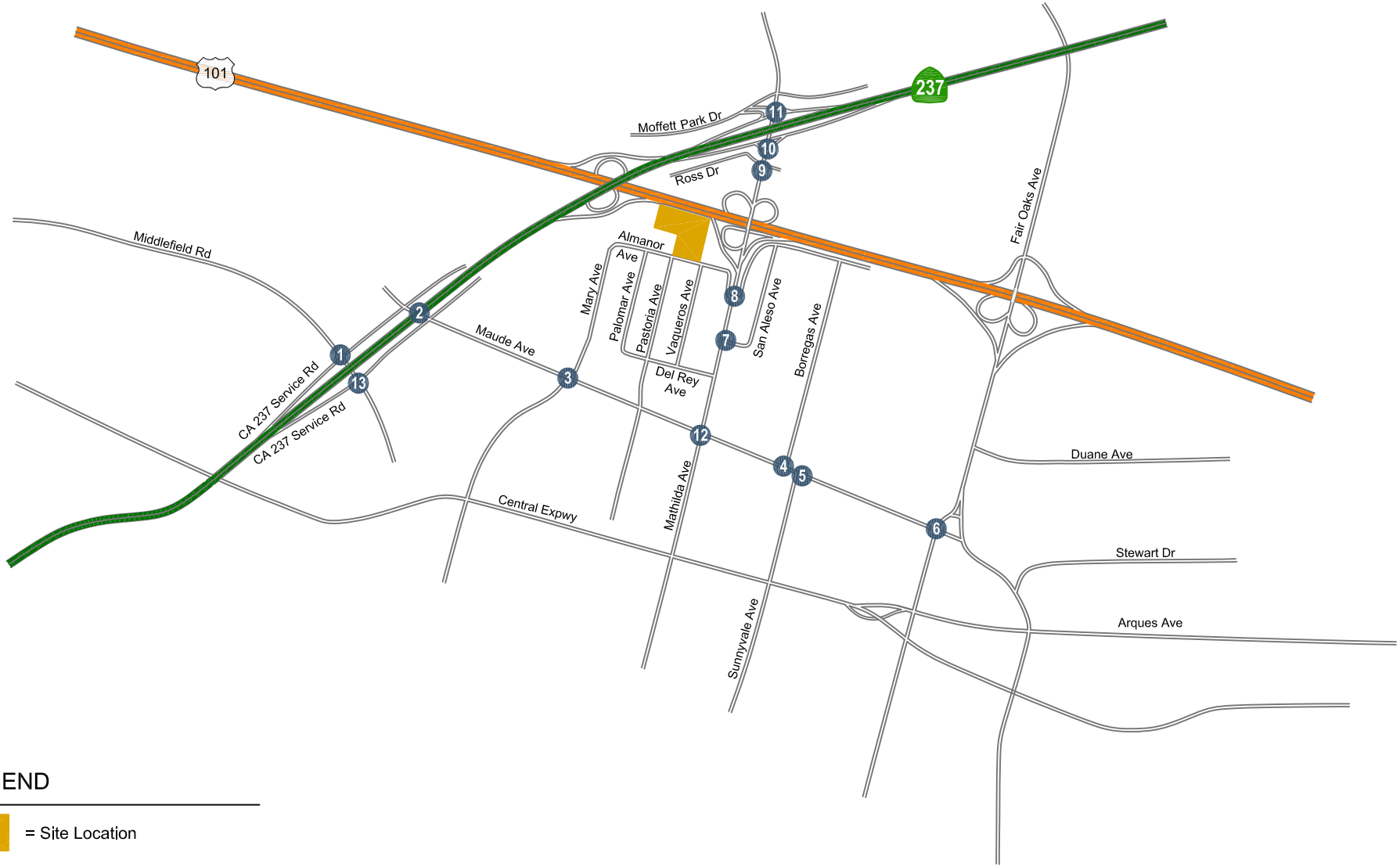
This report presents the results of the transportation impact analysis (TIA) conducted for the proposed research and development (R&D) project at 645 Almanor Avenue in Sunnyvale, California. The project consists of 176,780 square feet of new building space. An existing 130,882 square foot R&D building will remain on the site. The site has access to Almanor Avenue. The project site and surrounding study area are shown on Figure 1. The proposed site plan is shown on Figure 2.

Scope of Study

The potential impacts of the project were evaluated following the standards and methodologies set forth by the City of Sunnyvale and the Santa Clara Valley Transportation Authority (VTA). The VTA administers the County Congestion Management Program (CMP). The traffic study includes an analysis of AM and PM peak hour traffic conditions for 13 signalized intersections and 4 freeway segments. The study intersections are identified below.

- Middlefield Road & CA 237 Service Road (W)
- Middlefield Road & CA 237 Service Road (E)
- CA 237 Service Road & Maude Avenue
- Mary Avenue & Maude Avenue
- Borregas Avenue and Maude Avenue
- Sunnyvale Avenue and Maude Avenue
- Fair Oaks Avenue and Maude Avenue
- Mathilda Avenue and San Aleso Avenue
- Mathilda Avenue and Almanor Avenue/Ahwanee Avenue
- Mathilda Avenue and Ross Drive
- Mathilda Avenue and CA 237 Eastbound Ramps
- Mathilda Avenue and CA 237 Westbound Ramps
- Mathilda Avenue and Maude Avenue *

*Denotes CMP intersection



LEGEND

= Site Location

X = Study Intersection

Figure 1

Site Location and Study Intersections

NORTH
Not to Scale

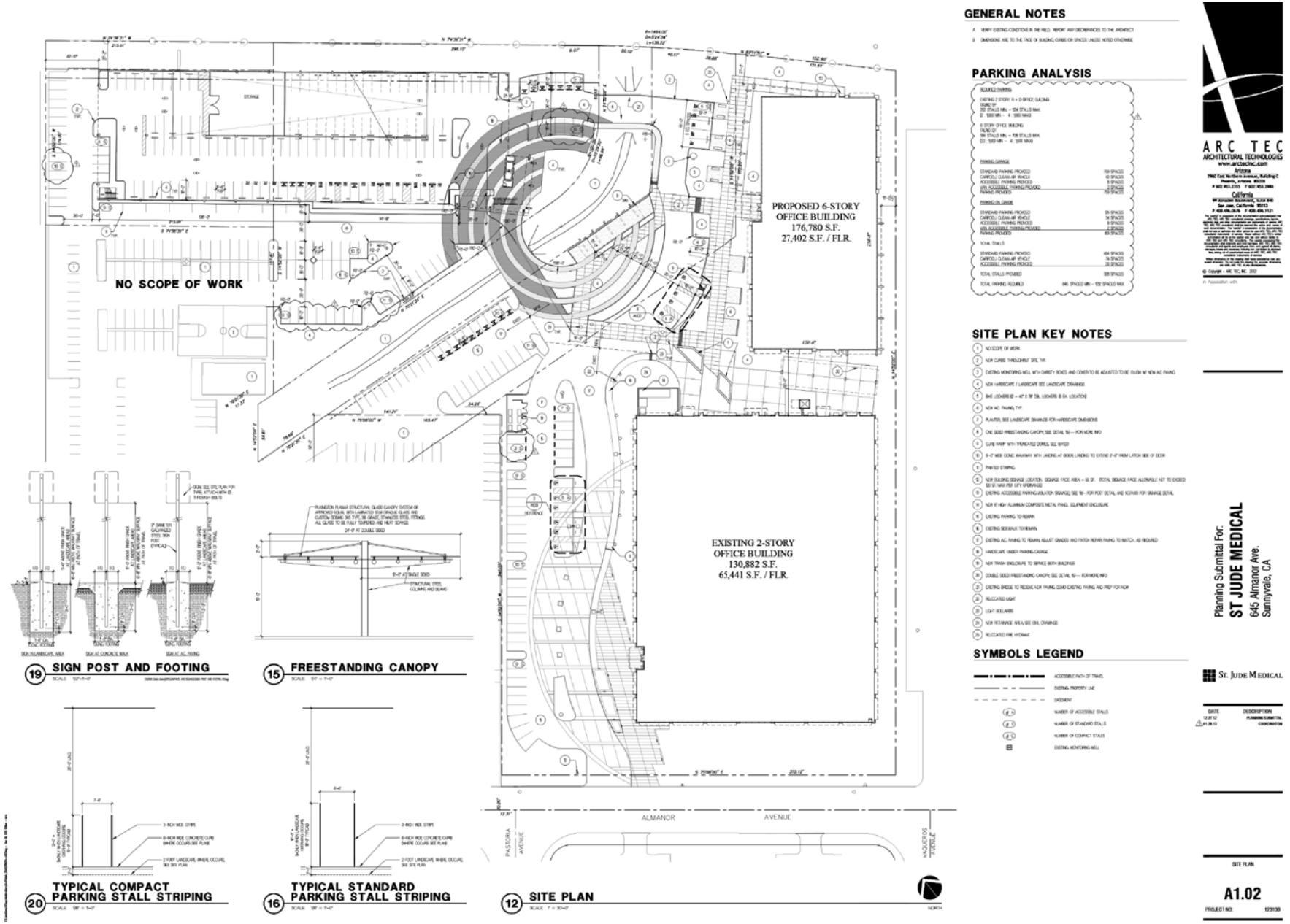


Figure 2
Site Plan

NORTH
Not to Scale

The study freeway segments are identified below.

- U.S. 101, between SR 237 and Mathilda Avenue
- U.S. 101, between Mathilda Avenue and Fair Oaks Avenue
- SR 237, between Mathilda Avenue and Fair Oaks Avenue
- SR 237, between Central Expressway and Maude Avenue

Traffic conditions at the study locations were analyzed for the weekday AM and PM peak hours of traffic. The AM peak hour of traffic is generally between 7:00 and 9:00 AM, and the PM peak hour is typically between 4:00 and 6:00 PM. It is during these periods that the most congested traffic conditions occur on an average weekday.

Traffic conditions were evaluated for the following scenarios:

Scenario 1: *Existing Conditions.* Existing intersection traffic volumes were obtained from the Mathilda & Maude traffic study and the Valley Transportation Authority (VTA) Congestion Management Program (CMP).

Scenario 2: *Background Conditions.* Background traffic volumes were estimated for the project completion year by applying a growth factor (to year 2015) to the existing AM and PM peak-hour volumes and adding approved but not yet completed developments in the project area. The growth factor and approved but not yet completed developments were provided by the City of Sunnyvale. Background conditions include full occupancy of the existing buildings on the site.

Scenario 3: *Existing + Project Conditions.* Projected peak hour traffic volumes were estimated by adding to existing traffic volumes the additional traffic generated by the project. Existing + Project conditions were evaluated relative to existing conditions in order to determine potential project impacts.

Scenario 4: *Background + Project Conditions.* Projected peak hour traffic volumes were estimated by adding to background traffic volumes the additional traffic generated by the project. Background + Project conditions were evaluated relative to background conditions in order to determine potential project impacts.

Scenario 5: *Cumulative Conditions.* Cumulative traffic volumes were estimated by applying a growth factor (to year 2017) to the existing AM and PM peak-hour volumes and adding traffic from approved and pending developments in the project area.

Scenario 6: *Cumulative + Project Conditions.* Projected peak hour traffic volumes were estimated by adding to cumulative traffic volumes the additional traffic generated by the project. Cumulative plus project conditions were evaluated relative to cumulative no project conditions in order to determine potential impacts.

Methodology

This section describes the methods used to determine the traffic conditions for each scenario described above. It includes descriptions of the data requirements, the analysis methodologies, and the applicable level of service standards.

Data Requirements

The data required for the analysis were obtained from field observations, new traffic counts, previous traffic studies, the City of Sunnyvale, the Institute of Transportation Engineers (ITE) manual entitled *Trip Generation, 9th Edition*, and the CMP Monitoring Report. The following data were collected from these sources:

- existing intersection volumes
- existing lane geometries
- signal timing and phasing
- approved but not yet completed projects
- applicable trip generation rates
- a yearly growth factor for the background and cumulative analysis

Analysis Methodologies and Level of Service Standards

Traffic conditions at the study intersections were evaluated using level of service (LOS). *Level of Service* is a qualitative description of operating conditions ranging from LOS A, or free-flow conditions with little or no delay, to LOS F, or jammed conditions with excessive delays. The various analysis methods are described below.

Signalized Intersections

The signalized study intersections are subject to the City of Sunnyvale level of service standards. The City of Sunnyvale level of service methodology is the Highway Capacity Manual (HCM) 2000 method for signalized intersections, utilizing the TRAFFIX software. TRAFFIX evaluates signalized intersection operations on the basis of average control delay time for all vehicles at the intersection. Since the 2000 HCM also is the CMP-designated intersection level of service methodology, the City of Sunnyvale methodology employs the CMP default values for the analysis parameters.

The City of Sunnyvale General Plan level of service standard for signalized intersections is LOS D or better, except that intersections on roadways considered “regionally significant” have a standard of LOS E. In the study area, the signalized intersections along Mathilda Avenue are considered regionally significant. The correlation between delay and level of service is shown in Table 1.

Significance criteria are used to establish what constitutes an impact. For this analysis, the criteria used to determine impacts on intersections are based on City of Sunnyvale Level of Service and County Congestion Management Program (CMP) standards. The project is said to create a significant adverse impact on traffic conditions at a signalized intersection in the City of Sunnyvale if for either peak hour:

1. The level of service at the intersection drops below its respective level of service standard when project traffic is added, or
2. An intersection that operates below its level of service standard under no project conditions experiences an increase in critical-movement delay of four (4) or more seconds, *and* the volume-to-capacity ratio (V/C) is increased by 0.01 or more when project traffic is added.

The operation of principal arterials and state highways located within urbanized Santa Clara County is measured by the level of service at CMP Intersections. CMP intersections are select, generally high-volume intersections located along these thoroughfares. The definition of a significant impact at a CMP intersection is the same as for the City of Sunnyvale, except that the standard for acceptable level of service for all CMP and regional intersections is LOS E or better. A significant impact by City of Sunnyvale and CMP standards is said to be satisfactorily mitigated when measures are implemented that would restore intersection conditions to its LOS standard *or* to an average delay that eliminates the project impact.

Table 1
Signalized Intersection Level of Service Based on Average Delay

Level of Service	Description	Average Control Delay Per Vehicle (sec.)
A	Signal progression is extremely favorable. Most vehicles arrive during the green phase and do not stop at all. Short cycle lengths may also contribute to the very low vehicle delay.	10.0 or less
B	Operations characterized by good signal progression and/or short cycle lengths. More vehicles stop than with LOS A, causing higher levels of average vehicle delay.	10.1 to 20.0
C	Higher delays may result from fair signal progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, though may still pass through the intersection without stopping.	20.1 to 35.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable signal progression, long cycle lenghts, or high volume-to-capacity (V/C) ratios. Many vehicles stop and individual cycle failures are noticeable.	35.1 to 55.0
E	This is considered to be the limit of acceptable delay. These high delay values generally indicate poor signal progression, long cycle lengths, and high volume-to-capacity (V/C) ratios. Individual cycle failures occur frequently.	55.1 to 80.0
F	This level of delay is considered unacceptable by most drivers. This condition often occurs with oversaturation, that is, when arrival flow rates exceed the capacity of the intersection. Poor progression and long cycle lengths may also be major contributing causes of such delay levels.	greater than 80.0

Source: Transportation Research Board, *2000 Highway Capacity Manual* (Washington, D.C., 2000) p10-16.

Freeway Segments

As prescribed in the CMP technical guidelines, the level of service for freeway segments is estimated based on vehicle density. Density is calculated by the following formula:

$$D = V / (N*S)$$

where:

D= density, in vehicles per mile per lane (vpmpl)

V= peak hour volume, in vehicles per hour (vph)

N= number of travel lanes

S= average travel speed, in miles per hour (mph)

The vehicle density on a segment is correlated to level of service as shown in Table 2. The CMP requires that mixed-flow lanes and auxiliary lanes be analyzed separately from HOV (carpool) lanes. The CMP specifies that a capacity of 2,300 vehicles per hour per lane (vphpl) be used for segments three lanes or

wider in one direction and a capacity of 2,200 vphpl be used for segments two lanes wide in one direction.

For this analysis, the criteria used to determine impacts on freeway segments are based on CMP standards. Per CMP requirements, freeway impacts are measured relative to existing conditions (i.e. there is no evaluation of freeways under background conditions). To be conservative, no project traffic was assumed to use the HOV lanes. The project is said to create a significant adverse impact on traffic conditions on a freeway segment if for either peak hour:

1. The level of service of the freeway segment is LOS F under existing conditions, and
2. The number of new trips added by the project is more than one percent of the freeway capacity.

Table 2
Freeway Segment Level of Service Based on Density

Level of Service	Description	Density (vehicles/mile/lane)
A	Average operating speeds at the free-flow speed generally prevail. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream.	11.0 or less
B	Speeds at the free-flow speed are generally maintained. The ability to maneuver within the traffic stream is only slightly restricted, and the general level of physical and psychological comfort provided to drivers is still high.	11.1 to 18.0
C	Speeds at or near the free-flow speed of the freeway prevail. Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes require more vigilance on the part of the driver.	18.1 to 26.0
D	Speeds begin to decline slightly with increased flows at this level. Freedom to maneuver within the traffic stream is more noticeably limited, and the driver experiences reduced physical and psychological comfort levels.	26.1 to 46.0
E	At this level, the freeway operates at or near capacity. Operations in this level are volatile, because there are virtually no usable gaps in the traffic stream, leaving little room to maneuver within the traffic stream.	46.1 to 58.0
F	Vehicular flow breakdowns occur. Large queues form behind breakdown points.	greater than 58.0

Source: Santa Clara County 2009 CMP (Based on the *Highway Capacity Manual* (2000), Washington, D.C.).

Intersection Operations

The operations analysis is based on vehicle queuing for high-demand movements at intersections. Vehicle queues were estimated using a Poisson probability distribution, which estimates the probability of "n" vehicles for a vehicle movement using the following formula:

$$P(x = n) = \frac{\lambda^n e^{-(\lambda)}}{n!}$$

Where:

P (x=n) = probability of "n" vehicles in queue per lane

n = number of vehicles in the queue per lane
λ = Average number of vehicles in the queue per lane (vehicles per hour per lane/signal cycles per hour)

The basis of the analysis is as follows: (1) the Poisson probability distribution is used to estimate the 95th percentile maximum number of queued vehicles per signal cycle for a particular movement; (2) the estimated maximum number of vehicles in the queue is translated into a queue length, assuming 25 feet per vehicle; and (3) the estimated maximum queue length is compared to the existing or planned available storage capacity for the movement.

Report Organization

The remainder of this report is divided into five chapters. Chapter 2 describes existing conditions on the roadway network and other transportation facilities. Chapter 3 presents the roadway operations under background conditions. Chapter 4 describes the methods used to estimate the project's impact on the transportation system. Chapter 5 describes the cumulative level of service results and Chapter 6 describes non-level of service issues associated with the proposed project.

2. Existing Conditions

This chapter describes the existing conditions for all of the major transportation facilities in the vicinity of the site, including the roadway network, transit service, and bicycle and pedestrian facilities.

Existing Roadway Network

Regional access to the project study area is provided by U.S. 101 and State Route (CA) 237. These facilities are described below.

US 101 is an eight-lane freeway (three mixed-flow lanes and one HOV lane in each direction) in the vicinity of the site. US 101 extends northward through San Francisco and southward through Gilroy. Access to and from the project study area is provided via its interchange at Mathilda Avenue.

SR (CA) 237 is a four to six-lane freeway in the vicinity of the project site that extends west to El Camino Real (Route 82) and east to I-880 in Milpitas. East of Mathilda Avenue, SR 237 has two mixed-flow lanes and one HOV lane in each direction. West of Mathilda Avenue, SR 237 has two mixed-flow lanes in each direction. SR 237 provides access to the project study area via an interchange at Mathilda Avenue and a split diamond interchange at Maude Avenue and Middlefield Road.

Major roadways within the project area include Mathilda Avenue, Mary Avenue, Central Expressway, and Fair Oaks Avenue. These roads are described below.

Mathilda Avenue is a six-lane to eight-lane arterial running north-south. In the study area Mathilda Avenue has four lanes southbound and three lanes northbound. Mathilda Avenue begins at Caribbean Drive in the north, extends southward, and transitions into Sunnyvale-Saratoga Road. Freeway interchanges are located at U.S. 101 and SR (CA) 237.

Fair Oaks Avenue is a four-lane to six-lane, north-south, arterial with two northbound lanes and three southbound lanes in the study area. North of US 101, Fair Oaks Avenue has a raised center median. Fair Oaks Avenue begins at Java Drive north of SR 237. Fair Oaks Avenue extends southward and transitions into Remington Drive at its junction with El Camino Real. Freeway interchanges are located at U.S. 101 and SR (CA) 237.

Central Expressway is a four-lane to six-lane expressway running east-west. In the study area, Central Expressway has two eastbound lanes and two westbound lanes. It begins at Trimble Road in the east, crosses Sunnyvale, extends westward and transitions into Alma

Street. Central Expressway connects to Mathilda Avenue via a square-loop interchange and connects to Mary Avenue with a traffic signal.

Mary Avenue extends north-south from U.S. 101 to I-280 and has a posted speed limit of 35 mph. Mary Avenue is a four-lane undivided minor arterial in the study area.

Other roadways in the immediate vicinity of the project site include Maude Avenue, Middlefield Road and Almanor Avenue. These facilities are described below.

Maude Avenue runs west to east and serves as the southern boundary of the project site. Maude Avenue is a four-lane roadway adjacent to the project site. It begins at Wolfe Road and ends at Logue Avenue. Maude Avenue is part of a split diamond freeway interchange with SR (CA) 237. Maude Avenue provides direct access to the project site.

Middlefield Road is a four-lane roadway running east-west. It begins at Central Expressway in Sunnyvale and extends west, eventually connecting to Jefferson Avenue in Redwood City. Middlefield Road is part of a split diamond freeway interchange with SR (CA) 237.

Pastoria Avenue is a two-lane north - south street that runs between Almanor Avenue and California Avenue. The intersection of Pastoria Avenue and Almanor Avenue is controlled by a stop sign on Pastoria.

Almanor Avenue is a two-lane east – west street that serves as the south boundary of the project site. It extends from Mary Avenue in the west to W Ahwanee Avenue in the east. It provides direct access to the project site. The intersection of Almanor Avenue and Mathilda Avenue has traffic signal.

Existing Bicycle and Pedestrian Facilities

According to the City of Sunnyvale Bicycle Map and the Santa Clara Valley Transportation Agency (VTA) Bikeways Map, there are numerous bike lanes and City-signed bike routes in the vicinity of the project site (see Figure 3). The following roadways contain bike lanes:

- Borregas Avenue, between Ahwanee Avenue and Maude Avenue
- Borregas Avenue, between Weddell Drive and Persian Drive
- Maude Avenue, between Pastoria Avenue and SR (CA) 237 Service Road
- Mary Avenue, between Almanor Avenue and Maude Avenue
- Almanor Avenue, between Mary Avenue and Vaqueros Avenue
- Caribbean Drive
- 1st Avenue
- Lawrence Station Road
- 11th Avenue
- Enterprise Way
- DeGuine Drive
- Kifer Road
- Crossman Drive
- Bordeaux Drive, between Moffett Park Drive and Java Drive

Near the project location there is also a bicycle shoulder on Lawrence Expressway. There are sidewalks on the south side of Almanor Avenue between Vaqueros Avenue and Mathilda Avenue. There are no sidewalks along the frontage of the project site. The project is located in an older industrial area, and there are many nearby streets without sidewalks. Sidewalks are lacking on Pastoria Avenue (both sides) and Maude Avenue. Most of the study intersections have crosswalks. The intersections at the Mathilda Avenue and SR (CA) 237 interchange have limited crosswalks.

Existing Transit Service

The closest existing transit service to the study area is provided by the Santa Clara Valley Transportation Authority (VTA) and Caltrain. The existing VTA and Caltrain services are described below and shown on Figure 4.

VTA Bus Service

Route 54 provides service between Sunnyvale/Lockheed-Martin Transit Center and De Anza College. Within the study area, Route 54 operates along Mathilda Avenue with 30-minute headways during commute hours. The closest bus stop to the project site is at the southwest corner of the Mathilda Avenue/Almanor Avenue intersection.

Light Rail Transit (LRT) Service

The VTA currently operates the 42.2-mile VTA light rail transit (LRT) line system extending from south San Jose through downtown to the northern areas of San Jose, Santa Clara, Mountain View, Milpitas, Campbell, and Sunnyvale. Service operates 21 hours per day, every 15 minutes during much of the day, and carries over 30,000 riders on an average weekday. The closest LRT station to the project site is the Lockheed Martin LRT Station, located 1.4 miles north of the project site. The Lockheed Martin station is served by bus Route 54 to and from the project site.

Caltrain Service

Caltrain provides commuter rail service between San Francisco and San Jose, with limited service to Gilroy during commute hours. The closest Caltrain station to the project site is the Sunnyvale Station. The Sunnyvale Station is located approximately one mile south of the project site. While there are no Caltrain shuttles that connect to the Sunnyvale Station, Caltrain riders can connect to the project site via VTA bus route 54.

During the morning peak period from 6:00-9:00 AM, the Sunnyvale Station is served by three baby bullet (express) and six limited-stop northbound trains with headways between five and forty-two minutes. A total of four southbound trains, two local-stop and two limited-stop, serve the Sunnyvale Station in the AM peak period with headways between 30 and 65 minutes. In the afternoon peak period between 4:00 and 7:00 PM, the station is served by two baby bullet, five limited-stop, and one local-stop southbound trains with headways between four and thirty-four minutes. There are two limited-stop northbound trains with 60 minute headways during the PM peak period.

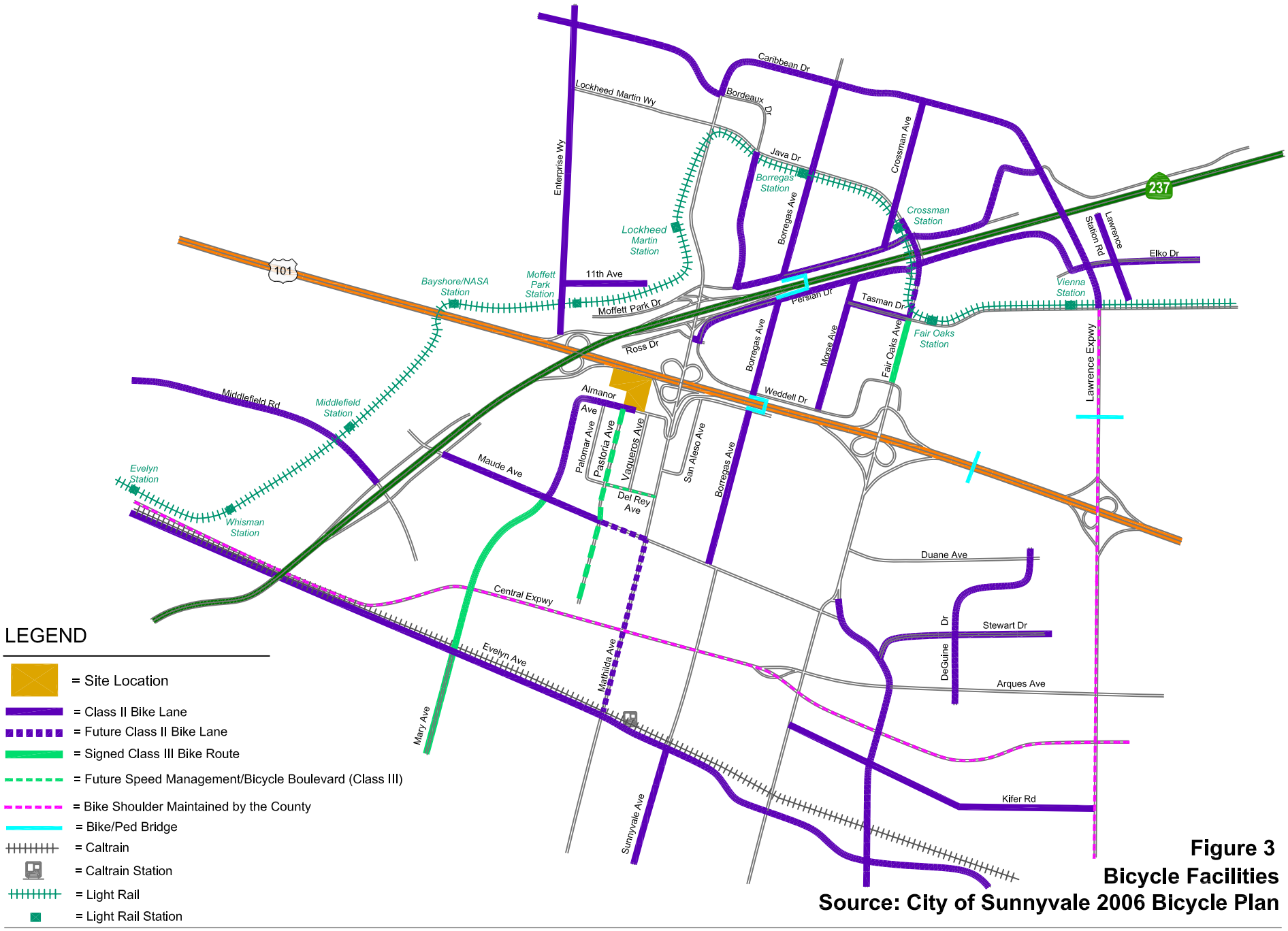


Figure 3
Bicycle Facilities
Source: City of Sunnyvale 2006 Bicycle Plan

NORTH
Not to Scale

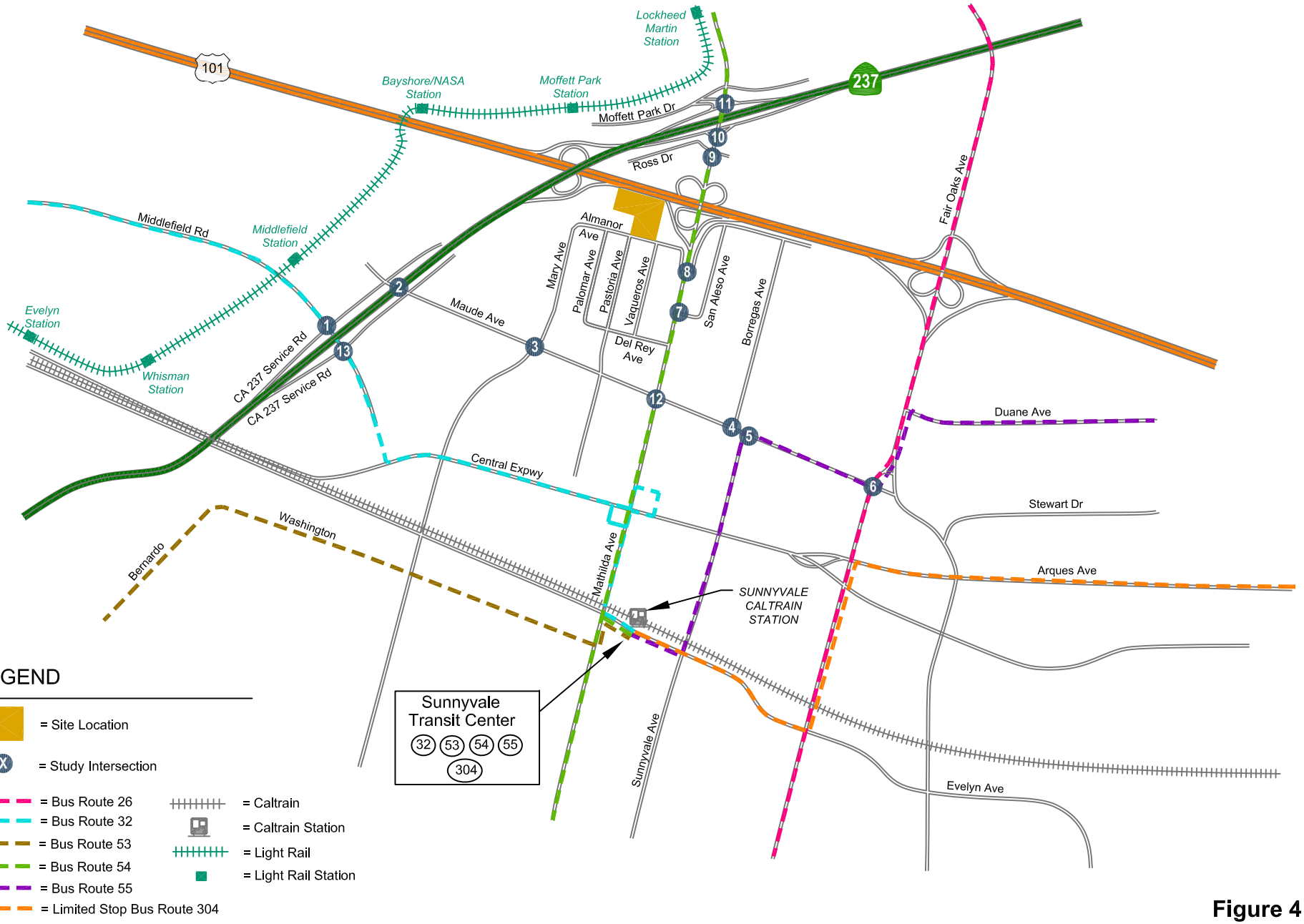


Figure 4
Existing Transit Service

NORTH
Not to Scale

Existing Lane Configurations and Traffic Volumes

The existing lane configurations at the study intersections were obtained from field observations and previous traffic impact analyses in the study area (see Figure 5). Existing traffic volumes were obtained from previous traffic impact analyses and the Valley Transportation Authority (VTA) Congestion Management Program (CMP) (see Figure 6).

Existing Intersection Levels of Service

The results of the intersection level of service analysis under existing conditions are summarized in Table 3. The results show that, measured against City of Sunnyvale and CMP standards, all of the study intersections currently operate at acceptable levels of service during both the AM and PM peak hours of traffic. The level of service calculation sheets are included in Appendix C.

The intersections of Mathilda Avenue/Moffett Park Drive, Mathilda Avenue/SR 237 westbound ramps, Mathilda Avenue/SR 237 eastbound ramps and Mathilda Avenue/Ross Drive are closely-spaced intersections with multiple turning movements that operate as a single coordinated signal system. These intersections experience operational issues beyond what is reflected in the typical TRAFFIX level of service calculations. To supplement the TRAFFIX analysis, the results and findings from earlier studies (Moffett Towers TIA, Moffett Park Specific Plan, Citywide Deficiency Plan, VTA State Route Corridor Study) that used Synchro and Sim Traffic software programs to evaluate the Mathilda Avenue corridor are described as follows. These programs evaluate traffic operations at closely-spaced intersections, including potential queue spill-backs.

During the AM peak hour, based on the Synchro analysis presented in the Moffett Park Specific Plan (MPSP) EIR, the Mathilda Corridor between Moffett Park and Ross Drive operates at an acceptable LOS. During the PM peak hour in this corridor, the Mathilda Avenue/Moffett Park Drive intersection operates at an unacceptable LOS, while the remaining intersections operate at acceptable levels of service. The overall LOS through the corridor is LOS B during both the AM and PM peak hours.

The MPSP EIR also analyzed the Mathilda Avenue corridor using Sim Traffic to evaluate queuing issues and the effectiveness of the traffic signal coordination. Based on this analysis, during the AM peak hour, the northbound approach at the Mathilda Avenue/Ross Drive intersection experiences vehicle queuing beyond the storage currently provided. During the PM peak hour, the westbound approach and southbound approach at Mathilda Avenue/Moffett Park Drive also experience vehicular queuing beyond the storage currently provided. However, these queues do not extend more than three vehicles beyond the existing storage capacities.

Year 2011 traffic volumes for the subject intersections were provided by the City of Sunnyvale. These were compared to those in the MPSP EIR. The year 2011 AM peak hour volumes are about nine percent lower, and the year 2011 PM peak hour volumes are about two percent higher than those in the MPSP. Based on this comparison, it was determined that the MPSP EIR Synchro and Sim Traffic results are applicable to the results in this report. Additional observations at the subject intersections are described in the “Observed Existing Traffic Conditions” section of this chapter.

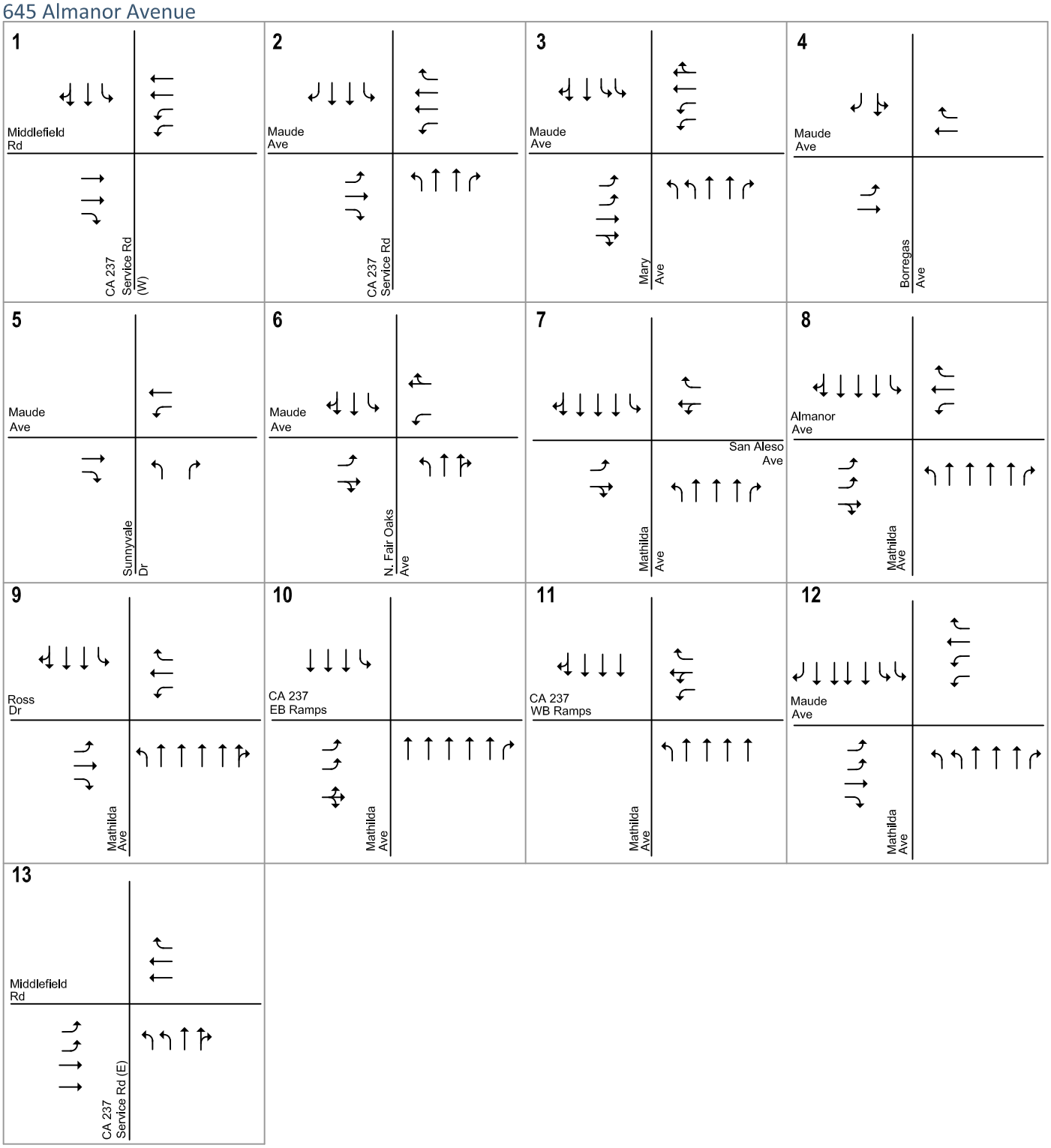


Figure 5
Existing Lane Configurations

NORTH
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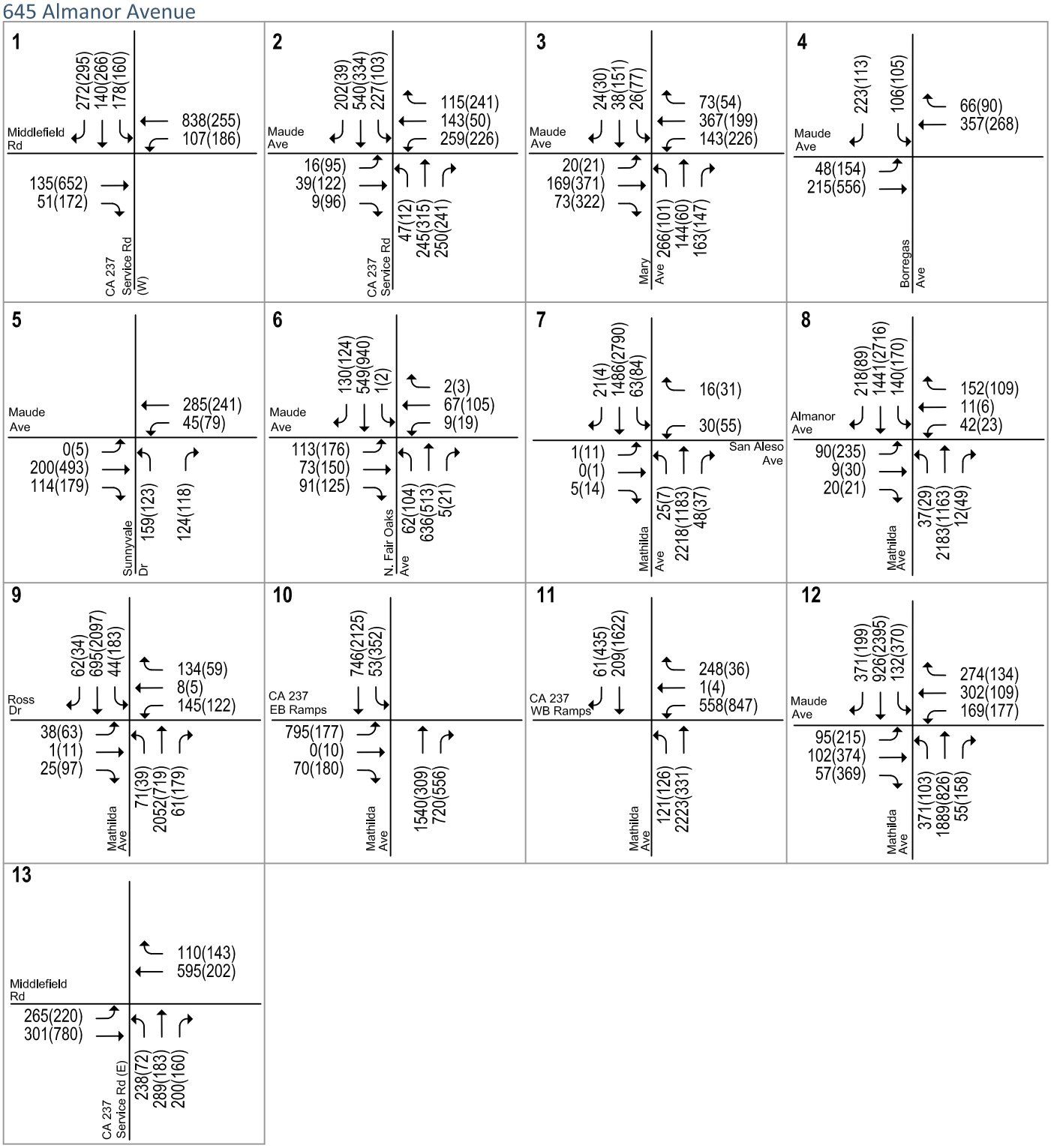


LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 6
Existing Traffic Volumes

Table 3
Existing Intersection Levels of Service

Intersection	Peak Hour	Count Date	Avg Delay	LOS
CA 237 Service Rd (W) & Middlefield	AM	04/07/11	19.1	B
	PM	04/07/11	22.6	C
CA 237 Service Rd & Maude Ave	AM	11/08/11	30.1	C
	PM	11/16/11	31.2	C
Mary Ave & Maude Ave	AM	04/07/11	26.4	C
	PM	04/07/11	27.4	C
Borregas Ave & Maude Ave	AM	11/08/11	16.5	B
	PM	11/08/11	13.9	B
Sunnyvale Ave & Maude Ave	AM	11/09/11	18.0	B
	PM	11/16/11	18.1	B
N Fair Oaks Ave & Maude Ave	AM	11/09/11	27.6	C
	PM	11/16/11	28.8	C
Mathilda Ave & San Aleso Ave	AM	11/08/11	12.2	B
	PM	11/08/11	11.7	B
Mathilda Ave & Almanor Ave	AM	03/08/11	22.2	C
	PM	03/08/11	20.7	C
Mathilda Ave & Ross Dr	AM	03/08/11	14.0	B
	PM	03/08/11	14.6	B
Mathilda Ave & CA237 EB Ramps	AM	03/08/11	15.7	B
	PM	03/08/11	15.1	B
Mathilda Ave & CA237 WB Ramps	AM	03/08/11	14.3	B
	PM	03/08/11	20.1	C
Mathilda/ Maude *	AM	03/08/11	44.3	D
	PM	09/06/12	36.4	D
CA 237 Service Rd (E) & Middlefield Rd	AM	04/07/11	23.4	C
	PM	04/07/11	18.5	B

* Denotes CMP intersection

Existing Freeway Levels of Service

Traffic volumes for the study freeway segments were obtained from the 2010 CMP Annual Monitoring Report (see Table 4). The results show that the following study freeway segments currently operate at LOS F in at least one direction during at least one peak hour:

- SR (CA) 237, eastbound between Mathilda Avenue and Fair Oaks – PM peak hour
- SR (CA) 237, westbound between Fair Oaks Avenue and Mathilda Avenue – AM peak hour
- SR (CA) 237, westbound between Maude Avenue and Central Expressway – PM peak hour
- U.S. 101, northbound between Mathilda Avenue and SR (CA) 237 – AM peak hour
- U.S. 101, northbound between Fair Oaks Avenue and Mathilda Avenue – AM peak hour

Table 4
Existing Freeway Levels of Service

Freeway	Segment	Direction	# of Mixed Flow Lanes	Capacity[1] (vphpl)	LOS (Density) Mixed Flow Lanes
SR 237	Central Expwy to Maude Av	EB	2	4400	D B
SR 237	Mathilda Av to N. Fair Oaks Av	EB	2	4400	D F
SR 237	N. Fair Oaks Av to Mathilda Av	WB	3	6900	F D
SR 237	Maude Av to Central Expwy	WB	2	4400	B F
US 101	N. Fair Oaks Av to Mathilda Av	NB	3	6900	F D
US 101	Mathilda Av to SR 237	NB	3	6900	F C
US 101	SR 237 to Mathilda Av	SB	3	6900	C D
US 101	Mathilda Av to N. Fair Oaks Av	SB	3	6900	D D

Notes:
[1] Capacity was based on the ideal capacity cited in the *2000 Highway Capacity Manual.*

Observed Existing Traffic Conditions

Traffic conditions in the field were observed in order to identify existing operational deficiencies and to confirm the accuracy of calculated levels of service. The purpose of this effort was (1) to identify any existing traffic problems that may not be directly related to intersection level of service, and (2) to identify any locations where the level of service calculation does not accurately reflect level of service in the field.

Overall the study intersections operate adequately during both the AM and PM peak hours of traffic, and the level of service analysis appears to accurately reflect actual existing traffic conditions. However, field observations revealed that some operational problems do occur.

Mathilda Avenue and SR (CA) 237 Westbound Ramps – In the AM peak hour, the Mathilda Avenue/SR 237 Westbound Ramps intersection experienced long queues in all northbound lanes. Traffic frequently spilled back into the Mathilda Avenue/SR 237 Eastbound Ramps intersection due

to the short storage length between the two intersections. During the PM peak hour, southbound traffic volumes were unable to clear the intersection in a single signal cycle due to heavy traffic volumes downstream.

Mathilda Avenue and SR (CA) 237 Eastbound Ramps – In the AM peak hour, the Mathilda Avenue/SR 237 Eastbound Ramps intersection experienced heavy traffic volumes on the northbound approach. Northbound traffic volumes were unable to clear the intersection in a single signal cycle due to heavy traffic volumes downstream. During the PM peak hour, southbound queues spilled back into the Mathilda Avenue/SR 237 Westbound Ramps intersection due to the short storage length between the two intersections.

3. Background Conditions

This chapter describes background traffic conditions, which are defined as near-term conditions just prior to completion of the proposed development. Included in this chapter are the procedures used to determine background traffic volumes and a description of the resulting traffic conditions.

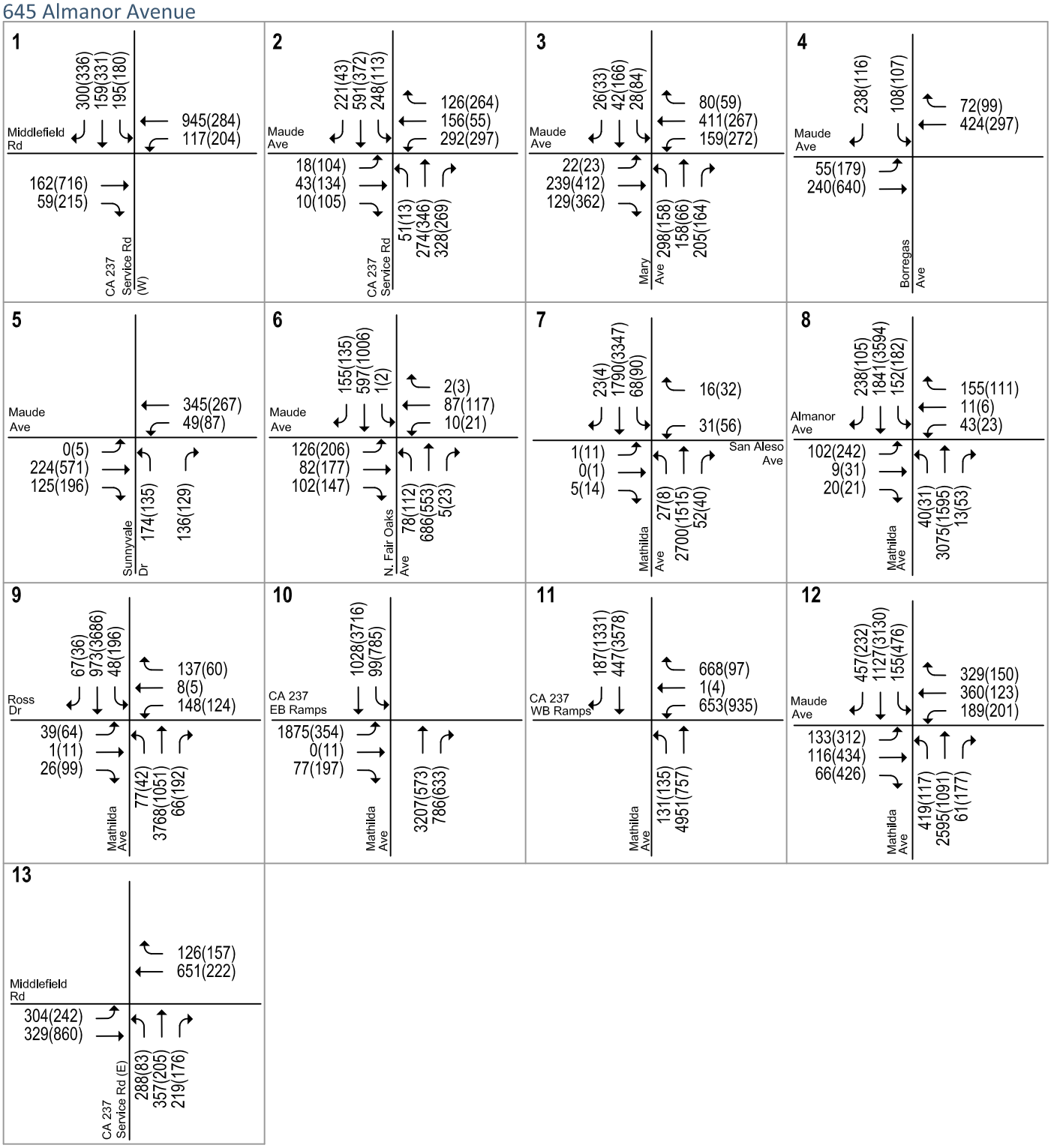
Background Traffic Volumes & Transportation Network

The transportation network under background conditions would be the same as the existing transportation network.

Background traffic volumes were estimated for the project completion year by applying a growth factor to the existing AM and PM peak hour volumes and adding traffic from approved but not yet completed developments in the project area (see Figure 7). Growth factors were provided by the City of Sunnyvale. For arterial street traffic, a 2 percent per year growth factor is assumed for the AM peak hour and a 1.75 percent per year growth factor is assumed for the PM peak hour. For the collector roadway traffic, the analysis uses a 2.28 percent per year growth rate during the AM peak hour and a 2.34 percent per year growth rate during the PM peak hour. Local roads are given a 0.5 percent per year growth rate during both AM and PM peak hours. If approved, the project would be completed approximately by year 2015. A list of approved but not yet completed developments from the City of Sunnyvale is shown in Appendix B.

Background Intersection Levels of Service

The results of the intersection level of service analysis under background conditions are summarized in Table 5. The results show that, measured against City of Sunnyvale and CMP standards, the intersection at Mathilda Avenue and SR (CA) 237 westbound ramps would operate at LOS F during both the AM and PM peak hours. The rest of the study intersections would operate at acceptable levels of service during both the AM and PM peak hours of traffic under background conditions. The level of service calculation sheets are included in Appendix C.



LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 7
Background Traffic Volumes

Table 5
Intersection Levels of Service Under Background Conditions

Intersection	Peak Hour	Existing		Background	
		Avg Delay	LOS	Avg Delay	LOS
CA 237 Service Rd (W) & Middlefield	AM	19.1	B	19.5	B
	PM	22.6	C	23.2	C
CA 237 Service Rd & Maude Ave	AM	30.1	C	30.6	C
	PM	31.2	C	31.8	C
Mary Ave & Maude Ave	AM	26.4	C	26.9	C
	PM	27.4	C	28.8	C
Borregas Ave & Maude Ave	AM	16.5	B	16.4	B
	PM	13.9	B	13.7	B
Sunnyvale Ave & Maude Ave	AM	18.0	B	18.6	B
	PM	18.1	B	18.0	B
N Fair Oaks Ave & Maude Ave	AM	27.6	C	28.8	C
	PM	28.8	C	30.4	C
Mathilda Ave & San Aleso Ave	AM	12.2	B	12.7	B
	PM	11.7	B	12.2	B
Mathilda Ave & Almanor Ave	AM	22.2	C	20.9	C
	PM	20.7	C	21.0	C
Mathilda Ave & Ross Dr	AM	14.0	B	13.1	B
	PM	14.6	B	45.8	D
Mathilda Ave & CA237 EB Ramps	AM	15.7	B	38.0	D
	PM	15.1	B	38.7	D
Mathilda Ave & CA237 WB Ramps	AM	14.3	B	**84.6**	**F**
	PM	20.1	C	**84.9**	**F**
Mathilda/ Maude *	AM	44.3	D	47.3	D
	PM	36.4	D	39.8	D
CA 237 Service Rd (E) & Middlefield Rd	AM	23.4	C	24.1	C
	PM	18.5	B	18.8	B

* Denotes CMP intersection
Bold indicates a substandard level of service.

4. Project Traffic Conditions

This chapter describes the existing plus project and background plus project conditions. Existing plus project traffic conditions could potentially occur if the project were to be occupied prior to the other approved projects in the area. It is unlikely that this traffic condition would occur, since other approved projects expected to add traffic to the study area would likely be built and occupied during the time the project is going through the development review process. This scenario describes a less congested traffic condition, since it ignores any potential traffic from prior approvals.

This chapter provides a description of the transportation system under project conditions and the method by which project traffic is estimated. It also summarizes project traffic conditions and describes any impacts caused by the project.

Transportation Network Under Project Conditions

It is assumed in this analysis that the transportation network under project conditions, including roadways and intersection lane configurations, would be the same as that described under existing conditions.

Project Trip Estimates

The magnitude of traffic produced by a new development and the locations where that traffic would appear are estimated using a three-step process: (1) trip generation, (2) trip distribution, and (3) trip assignment. In determining project trip generation, the magnitude of traffic entering and exiting the site is estimated for the AM and PM peak hours. As part of the project trip distribution, an estimate is made of the directions to and from which the project trips would travel. In the project trip assignment, the project trips are assigned to specific streets and intersections. These procedures are described below.

Trip Generation

Through empirical research, data have been collected that correlate to common land uses their propensity for producing traffic. Thus, for the most common land uses there are standard trip generation rates that can be applied to help predict the future traffic increases that would result from a new development. The magnitude of traffic added to the roadway system by a particular development is estimated by multiplying the applicable trip generation rates by the size of the development. The standard trip generation rates are published in the Institute of Transportation Engineers (ITE) manual entitled *Trip Generation*, 9th Edition.

The proposed project would construct 176,780 square feet of new building space for Reseach and Development uses. According to ITE trip generation rates, the project would generate 213 new trips during the AM peak hour and 212 new trips during the PM peak hour (see Table 6).

Table 6
Project Trip Generation Estimates

Land Use	ITE Code	Size		Daily Trip Rates	Daily Trips	AM Peak Hour Pk-Hr Rate	AM Peak Hour Trips In	AM Peak Hour Trips Out	AM Peak Hour Trips Total	PM Peak Hour Pk-Hr Rate	PM Peak Hour Trips In	PM Peak Hour Trips Out	PM Peak Hour Trips Total
Proposed Land Use													
Research and Development /a/	760	176.78	k.s.f.	9.12	1,612	1.21	177	36	213	1.20	32	180	212

Notes:
/a/ ITE trip rates for Research and Dvelopment Center (Land Use #760) were used. Fitted curve equation applied.
Source: ITE Trip Generation, 9th Edition.

Trip Distribution and Assignment

The trip distribution pattern for the proposed project was estimated based on the residence distribution survey of employees at the existing building on the site provided by the City of Sunnyvale (see Appendix B). The trip distribution pattern for the project is shown on Figure 8. The peak hour trips generated by the project were assigned to the roadway network in accordance with the project trip distribution patterns shown on Figure 8. Figure 9 shows the project trips at the study intersections.

Project Condition Traffic Volumes

Project impacts were evaluated relative to both (1) existing traffic volumes and (2) background traffic volumes. For the existing plus project scenario, projected peak hour traffic volumes with the project were estimated by adding the total new trips generated by the proposed project to *existing* traffic volumes. For the background plus project scenario, projected peak hour traffic volumes with the project were estimated by adding the new trips generated by the proposed project to *background* traffic volumes. The project condition traffic volumes at the study intersections for each scenario are shown in Figures 10 and 11.

Project Intersection Levels of Service

The results of the signalized intersection level of service analysis for the (1) existing plus project and (2) background plus project scenarios are summarized in Tables 7 and 8. It should be noted that, at some study intersections, the average delay under project conditions is shown to be better than under no project conditions. This occurs because the intersection delay is a weighted average of *all* intersection movements. The addition of project traffic to movements with delays lower than the average intersection delay (such as right turns) can reduce the average delay for the entire intersection.

Table 7
Existing plus Project Intersection Levels of Service

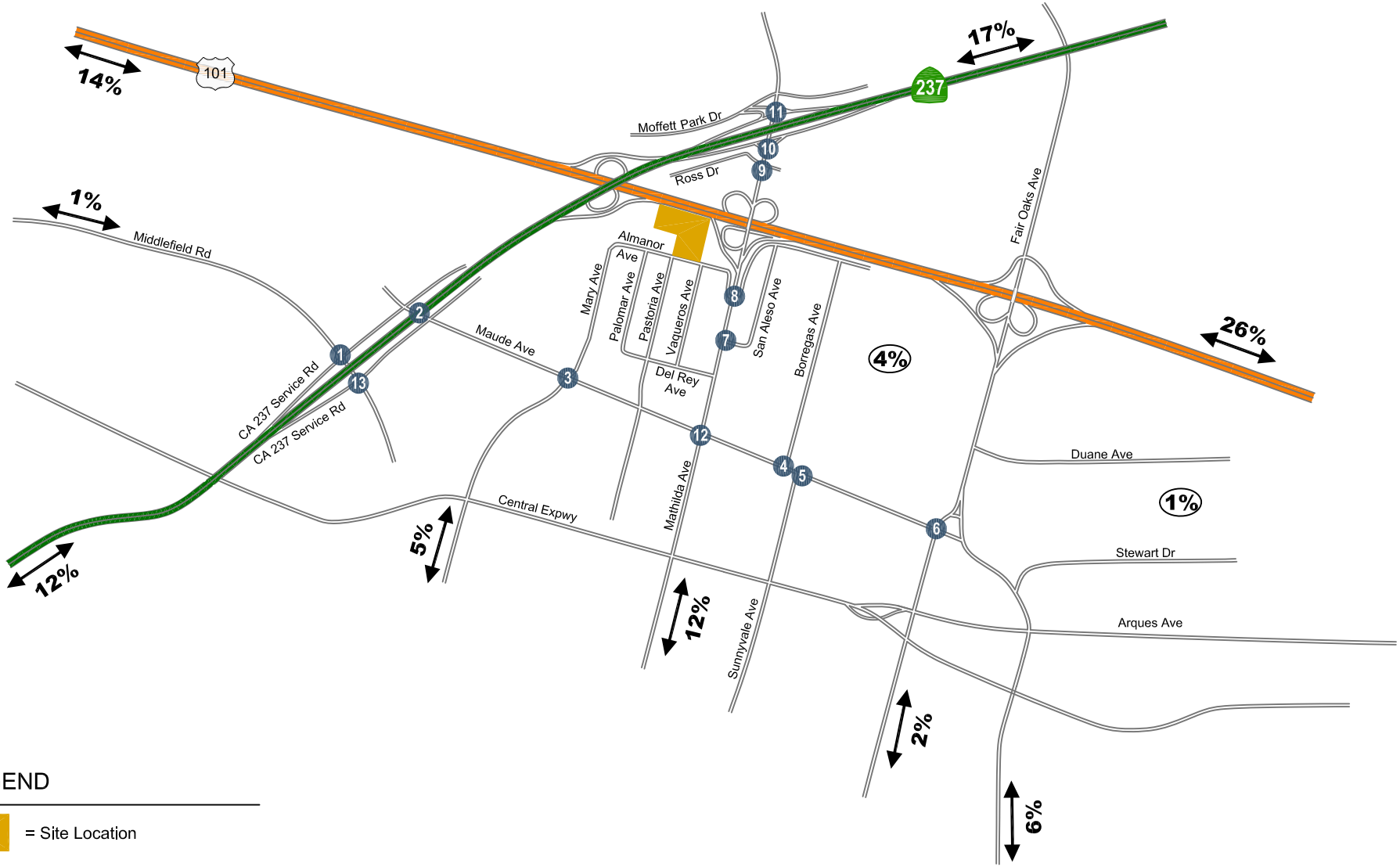
Intersection	Peak Hour	Existing		Existing + Project	
		Avg Delay	LOS	Avg Delay	LOS
CA 237 Service Rd (W) & Middlefield	AM	19.1	B	19.1	B
	PM	22.6	C	22.7	C
CA 237 Service Rd & Maude Ave	AM	30.1	C	30.1	C
	PM	31.2	C	31.3	C
Mary Ave & Maude Ave	AM	26.4	C	26.8	C
	PM	27.4	C	28.0	C
Borregas Ave & Maude Ave	AM	16.5	B	16.4	B
	PM	13.9	B	13.8	B
Sunnyvale Ave & Maude Ave	AM	18.0	B	17.9	B
	PM	18.1	B	17.9	B
N Fair Oaks Ave & Maude Ave	AM	27.6	C	28.3	C
	PM	28.8	C	29.2	C
Mathilda Ave & San Aleso Ave	AM	12.2	B	12.2	B
	PM	11.7	B	11.7	B
Mathilda Ave & Almanor Ave	AM	22.2	C	22.8	C
	PM	20.7	C	23.5	C
Mathilda Ave & Ross Dr	AM	14.0	B	14.0	B
	PM	14.6	B	14.6	B
Mathilda Ave & CA237 EB Ramps	AM	15.7	B	15.7	B
	PM	15.1	B	15.4	B
Mathilda Ave & CA237 WB Ramps	AM	14.3	B	14.6	B
	PM	20.1	C	20.2	C
Mathilda/ Maude *	AM	44.3	D	44.7	D
	PM	36.4	D	36.5	D
CA 237 Service Rd (E) & Middlefield Rd	AM	23.4	C	23.5	C
	PM	18.5	B	18.5	B

* Denotes CMP intersection

Table 8
Background plus Project Intersection Levels of Service

Intersection	Peak Hour	Background Avg Delay	Background LOS	Background + Project Avg Delay	Background + Project LOS	Incr. In Crit. Delay	Incr. In Crit. V/C
CA 237 Service Rd (W) & Middlefield	AM	19.5	B	19.5	B	0.0	0.000
	PM	23.2	C	23.2	C	-0.1	-0.007
CA 237 Service Rd & Maude Ave	AM	30.6	C	30.8	C	0.6	0.018
	PM	31.8	C	32.0	C	0.1	0.018
Mary Ave & Maude Ave	AM	26.9	C	27.3	C	0.7	0.013
	PM	28.8	C	29.4	C	0.6	0.010
Borregas Ave & Maude Ave	AM	16.4	B	16.3	B	-0.2	0.009
	PM	13.7	B	13.6	B	-0.1	0.009
Sunnyvale Ave & Maude Ave	AM	18.6	B	18.5	B	0.0	0.002
	PM	18.0	B	17.9	B	-0.2	0.009
N Fair Oaks Ave & Maude Ave	AM	28.8	C	29.4	C	0.9	0.010
	PM	30.4	C	30.9	C	0.6	0.010
Mathilda Ave & San Aleso Ave	AM	12.7	B	12.7	B	0.1	0.006
	PM	12.2	B	12.2	B	0.1	0.005
Mathilda Ave & Almanor Ave	AM	20.9	C	21.3	C	0.5	0.007
	PM	21.0	C	24.4	C	4.1	0.044
Mathilda Ave & Ross Dr	AM	13.1	B	13.2	B	0.0	0.001
	PM	45.8	D	46.0	D	0.6	0.001
Mathilda Ave & CA237 EB Ramps	AM	38.0	D	38.5	D	1.7	0.004
	PM	38.7	D	40.8	D	7.7	0.020
Mathilda Ave & CA237 WB Ramps	AM	**84.6**	**F**	**84.4**	**F**	0.0	0.000
	PM	**84.9**	**F**	**85.6**	**F**	0.8	0.002
Mathilda/ Maude *	AM	47.3	D	47.8	D	0.7	0.010
	PM	39.8	D	40.0	D	0.1	0.003
CA 237 Service Rd (E) & Middlefield Rd	AM	24.1	C	24.2	C	0.1	0.007
	PM	18.8	B	18.9	B	0.1	0.001

* Denotes CMP intersection
Bold indicates a substandard level of service.
Bold indicates a significant project impact.



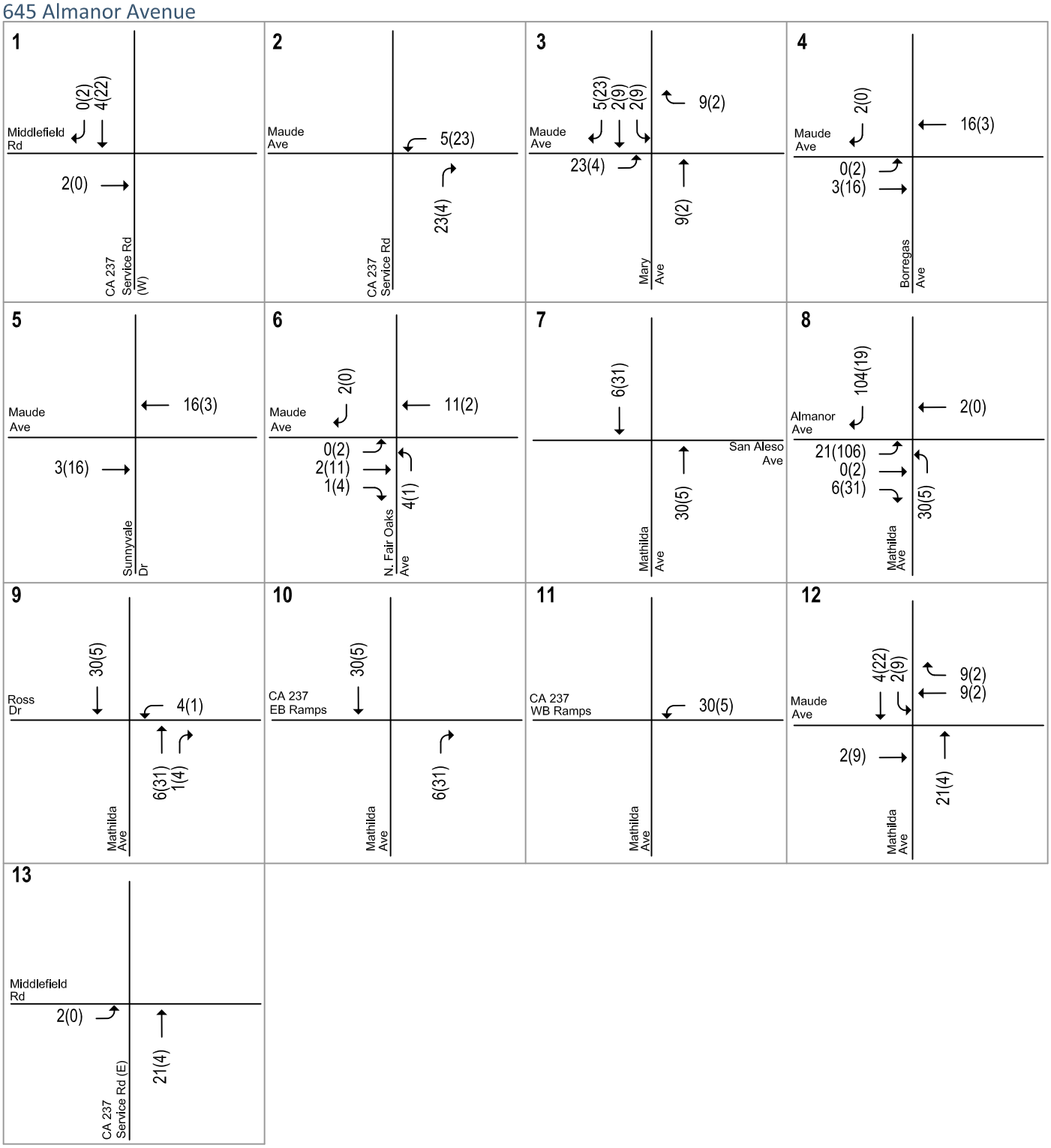
LEGEND

= Site Location

X = Study Intersection

Figure 8
Project Trip Distribution

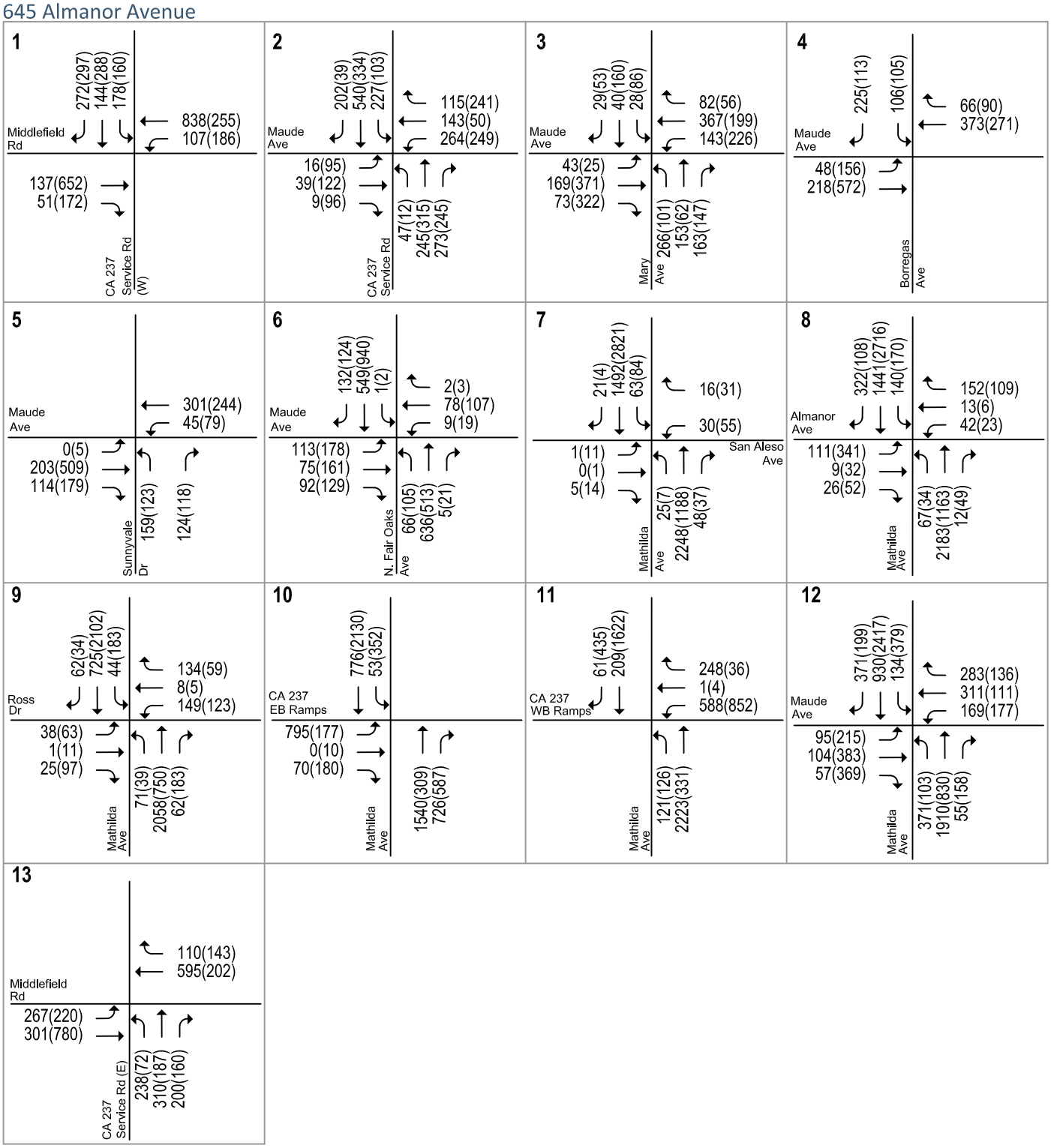
NORTH
Not to Scale



LEGEND

XX(XX) = AM(PM) Peak-Hour Trips

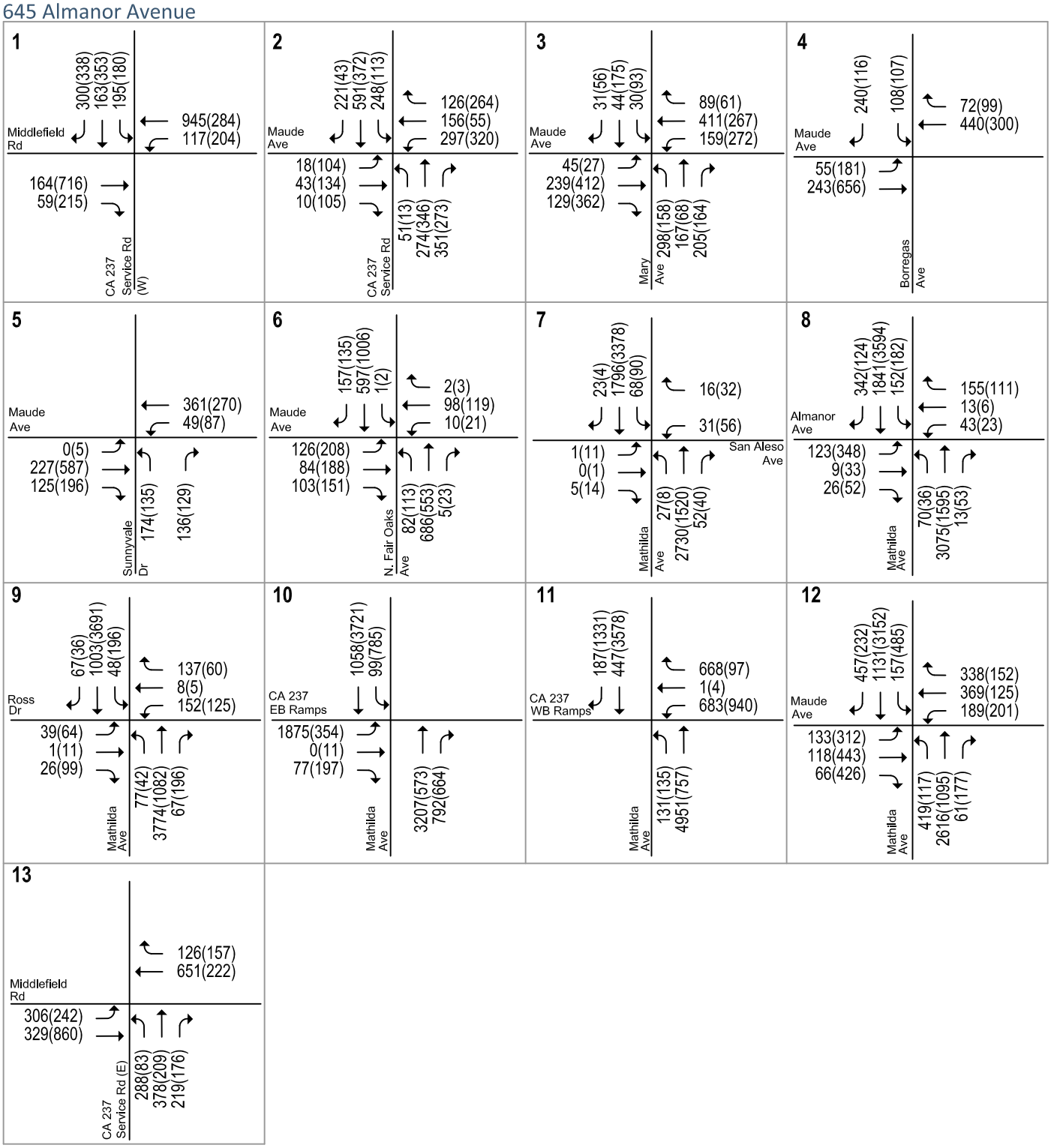
Figure 9
Project Trip Assignment



LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 10
Existing Plus Project Traffic Volumes



LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 11
Background Plus Project Traffic Volumes

The results of the level of service calculations show that under existing plus project conditions, all of the study intersections would continue to operate at acceptable levels of service (see Chapter 1 for LOS standards and impact criteria).

Under background no project and background plus project conditions, the intersection at Mathilda Avenue and SR (CA) 237 westbound ramps would operate at LOS F during the AM and PM peak hours. However, the project would not cause a significant impact to this intersection under background conditions because it would not increase the critical delay by more than 4 seconds or the V/C by more than 0.01. All other study intersections would operate at acceptable levels of service during the AM and PM peak hours. The level of service calculation sheets are included in Appendix C.

Project Freeway Segment Evaluation

The project's impacts at nearby freeway segments were evaluated in accordance with CMP guidelines. The results are summarized in Table 9. Based on this analysis, the project would not add sufficient traffic to freeway segments to cause a significant impact. Therefore, no mitigation is required.

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Table 9
Existing Plus Project Freeway Level of Service Analysis

Freeway	Segment	Direction	# of Mixed Flow Lanes	Capacity[1] (vphpl)	LOS (Density) Mixed Flow Lanes	1% of Capacity	Peak Hour	Project Trips
SR 237	Central Expwy to Maude Av	EB	2	4400	D B	44	AM PM	21 4
SR 237	Mathilda Av to N. Fair Oaks Av	EB	2	4400	D F	44	AM PM	4 31
SR 237	N. Fair Oaks Av to Mathilda Av	WB	3	6900	F D	69	AM PM	30 5
SR 237	Maude Av to Central Expwy	WB	2	4400	B F	44	AM PM	4 22
US 101	N. Fair Oaks Av to Mathilda Av	NB	3	6900	F D	69	AM PM	46 8
US 101	Mathilda Av to SR 237	NB	3	6900	F C	69	AM PM	5 25
US 101	SR 237 to Mathilda Av	SB	3	6900	C D	69	AM PM	25 4
US 101	Mathilda Av to N. Fair Oaks Av	SB	3	6900	D D	69	AM PM	9 47

Notes:
[1] Capacity was based on the ideal capacity cited in the *2000 Highway Capacity Manual.*

5. Cumulative Conditions

This chapter describes cumulative traffic conditions, which are defined as the conditions of year 2017. Included in this chapter are the procedures used to determine cumulative traffic volumes and a description of the resulting traffic conditions.

Cumulative Traffic Volumes & Transportation Network

The transportation network under cumulative conditions would be the same as the existing transportation network.

Cumulative traffic volumes were estimated by applying a growth factor (to year 2017) to the existing AM and PM peak hour volumes and adding traffic from approved and pending developments in the project area. Growth factors were provided by the City of Sunnyvale. For arterial street traffic, a 2 percent per year growth factor is assumed for the AM peak hour and a 1.75 percent per year growth factor is assumed for the PM peak hour. For the collector roadway traffic, the analysis uses a 2.28 percent per year growth rate during the AM peak hour and a 2.34 percent per year growth rate during the PM peak hour. Local roads are given a 0.5 percent per year growth rate during both AM and PM peak hours. Approved and pending development projects from the City of Sunnyvale included for the analysis are shown in Appendix B. Cumulative plus project peak hour traffic volumes were estimated by adding to cumulative traffic volumes the additional traffic generated by the project. The cumulative no project traffic volumes at study intersections are shown in Figure 12, and the cumulative plus project traffic volumes are shown in Figure 13.

Cumulative Intersection Levels of Service

Cumulative plus project conditions were evaluated relative to cumulative no-project conditions in order to determine potential project impacts. Cumulative level of service results are shown in Table 10.

Under cumulative plus project conditions, the proposed project would not cause a significant traffic impact at any study intersections according to City of Sunnyvale standards. The intersection at Mathilda Avenue and SR (CA) 237 westbound ramps would operate at LOS F under both no project and with project scenarios during the AM and PM peak hours. In addition, the intersection at Mathilda Avenue and Ross Drive would operate at LOS F under both no project and with project scenarios during the PM peak hour. However, the project would not cause a significant impact to either intersection under cumulative conditions because it would not increase the critical delay by more than 4 seconds or the V/C by more than 0.01 under VTA guidelines. The Mathilda/SR 237 complex does not lend itself to individual intersection analysis due to closely spaced, mutually dependent intersection operations and complex nearing patterns. Previous studies (North/South

Corridor Study, Route 237 Corridor Study, etc.) have determined that major improvements are necessary to improve travel in the Mathilda Corridor. Improvements identified by the City and VTA include reconfiguration of the Mathilda/237 interchange to improve geometry and efficiency. The findings of LOS F at the intersection of Mathilda Avenue and SR (CA) 237 westbound ramps are consistent with the analysis of buildout of the City of Sunnyvale General Plan.

Public transit improvements in this area also have been recommended in the Valley Transportation Plan 2035. VTA is considering improvements to Express Bus and Limited Stop Bus routes serving Moffett Park. Near the project site, Route 54 will continue to operate as a Local Bus route. The Mary Avenue extension and planned improvements to public transit service in Moffett Park would relieve the transportation demand along Mathilda Avenue. The remaining signalized study intersections would operate at acceptable levels of service during the AM and PM peak hours under cumulative plus project conditions. The level of service calculation sheets are included in Appendix C.

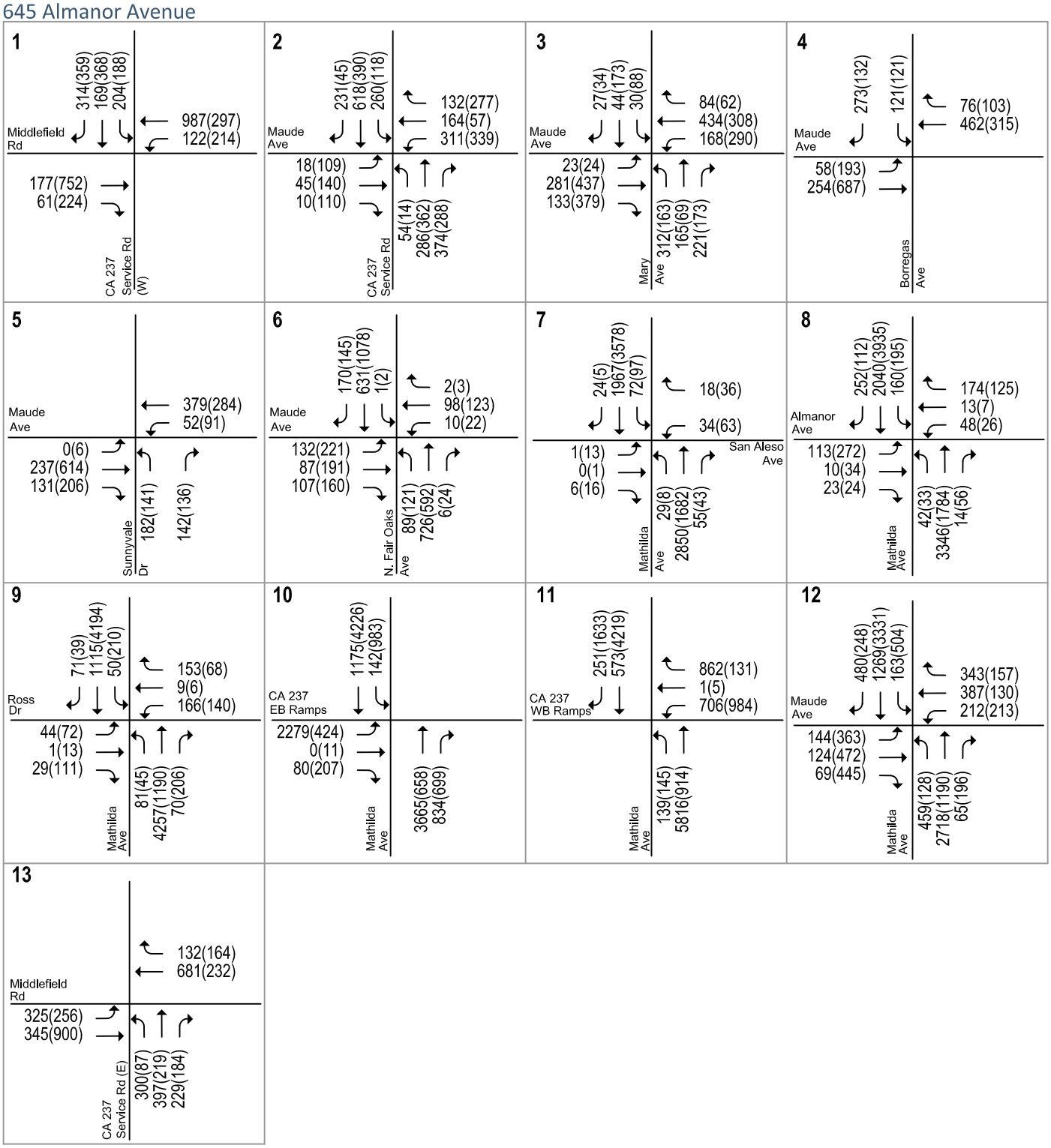
Cumulative Freeway Segment Evaluation

CMP guidelines state that an impact would occur at a freeway segment when a proposed development would add traffic greater than 1% of the capacity of the freeway segment. The results of the analysis presented in Chapter 4 showed that the project would not add trips greater than 1% of the capacity at any freeway segment. For this reason, the proposed project would not result in any cumulative impacts to freeway segments.

Table 10
Cumulative Signalized Intersection Level of Service

Intersection	Peak Hour	Cumulative					
		No Project		With Project			
		Avg Delay	LOS	Avg Delay	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C
CA 237 Service Rd (W) & Middlefield	AM	19.7	B	19.7	B	0.0	0.000
	PM	23.4	C	23.5	C	0.0	0.004
CA 237 Service Rd & Maude Ave	AM	31.3	C	31.5	C	0.8	0.018
	PM	32.3	C	32.5	C	0.2	0.018
Mary Ave & Maude Ave	AM	27.2	C	27.5	C	0.6	0.013
	PM	29.0	C	29.6	C	0.6	0.010
Borregas Ave & Maude Ave	AM	17.0	B	17.0	B	0.0	0.011
	PM	14.1	B	14.1	B	-0.1	0.009
Sunnyvale Ave & Maude Ave	AM	19.6	B	19.4	B	-0.1	0.009
	PM	18.0	B	17.9	B	-0.1	0.009
N Fair Oaks Ave & Maude Ave	AM	29.2	C	29.8	C	0.8	0.010
	PM	31.6	C	32.1	C	0.7	0.010
Mathilda Ave & San Aleso Ave	AM	13.1	B	13.1	B	0.1	0.006
	PM	12.7	B	12.8	B	0.1	0.005
Mathilda Ave & Almanor Ave	AM	22.0	C	22.5	C	0.5	0.007
	PM	23.3	C	27.4	C	5.1	0.044
Mathilda Ave & Ross Dr	AM	14.1	B	14.2	B	0.0	0.001
	PM	**89.0**	**F**	**89.0**	**F**	0.6	0.001
Mathilda Ave & CA237 EB Ramps	AM	69.5	E	69.6	E	1.8	0.004
	PM	71.4	E	73.7	E	8.7	0.020
Mathilda Ave & CA237 WB Ramps	AM	**175.5**	**F**	**175.0**	**F**	0.0	0.000
	PM	**151.1**	**F**	**151.7**	**F**	0.8	0.002
Mathilda/ Maude *	AM	49.7	D	50.3	D	0.9	0.010
	PM	42.4	D	42.8	D	0.7	0.008
CA 237 Service Rd (E) & Middlefield Rd	AM	24.5	C	24.6	C	0.1	0.007
	PM	19.0	B	19.1	B	0.1	0.001

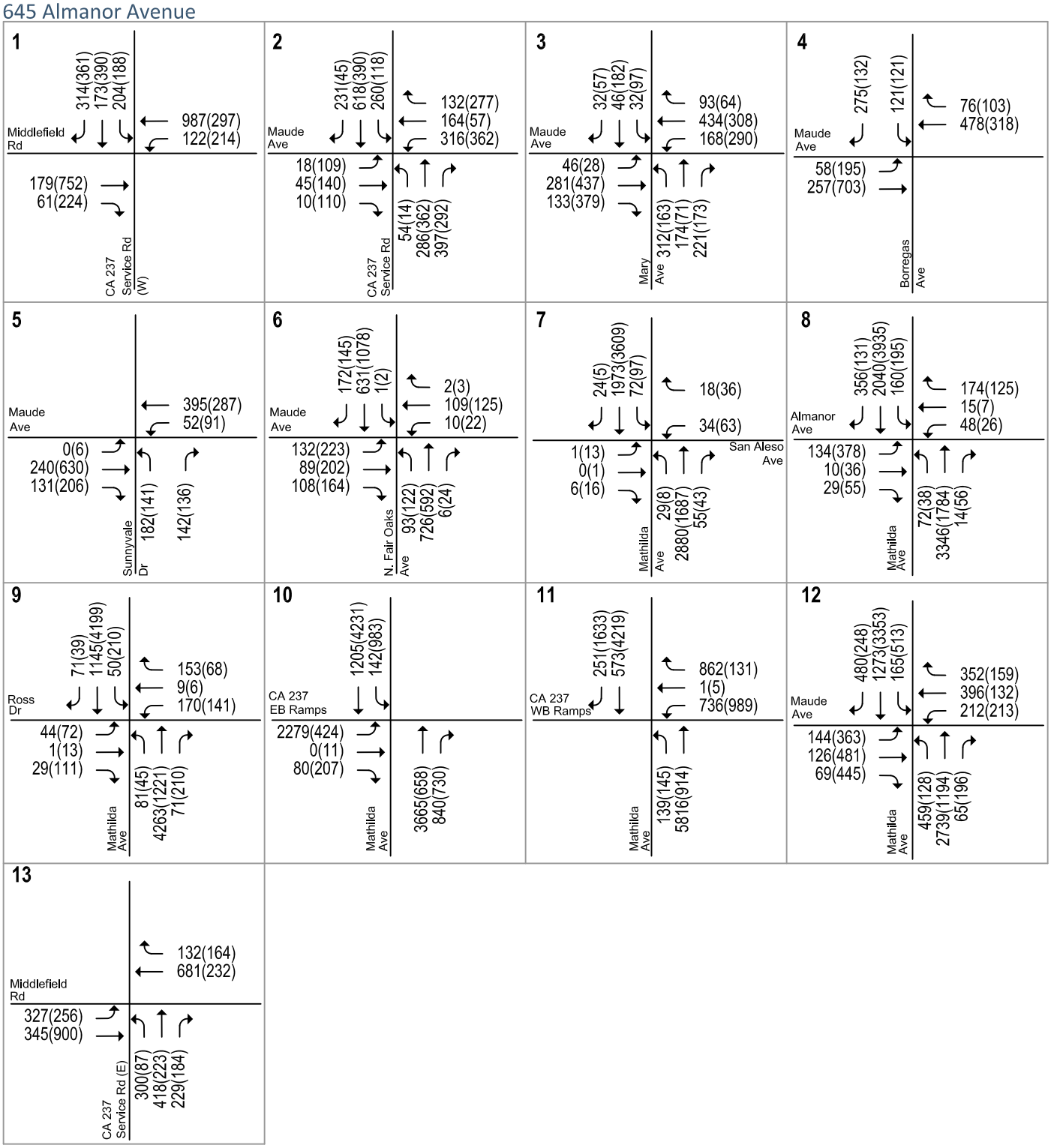
* Denotes CMP intersection
Bold indicates a substandard level of service.
Bold indicates a significant project impact.



LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 12
Cumulative No Project Traffic Volumes



LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 13
Cumulative Plus Project Traffic Volumes

6. Other Transportation Issues

This chapter presents an analysis of other transportation issues associated with the proposed development including:

- Bike, pedestrian and transit facilities;
- Left turn pocket analysis;
- Site circulation and access review; and
- Parking.

Unlike the level of service impact methodology, which is adopted by the City Council, the analyses in this chapter are based on professional judgment in accordance with the standards and methods employed by the traffic engineering community.

Pedestrians, Bicycles and Transit

Given that the project is located in an industrial park with few residential uses nearby, it is reasonable to assume that commute pedestrian trips would comprise no more than two percent of the travel mode share to the site during the peak commute periods. This would equate to approximately 4 new pedestrian trips during the AM and PM peak hours. In addition, the project would generate some pedestrian trips to and from transit stops in the project area (see further discussion below).

Sidewalks are present along portions of Almanor Avenue and along Mathilda Avenue, which provide pedestrian connections between the project site and the nearest bus stops. However, there are no sidewalks along the project frontage or the frontage at 675 Almanor. The project is located in an older industrial area, and there are many nearby streets without sidewalks. Sidewalks are lacking on Almanor Avenue between the project site and Mary Avenue (both sides), Pastoria Avenue (both sides) and Maude Avenue in the surrounding area. Despite the fact that few pedestrian trips are expected, the existing sidewalk system surrounding the site is deficient and should be upgraded. The sidewalk system in the area can be completed when the adjacent properties redevelop.

> **Recommendation:** Sidewalks should be installed along the project frontage and along the frontage of 675 Almanor. These would tie into the sidewalks that are present on either side.

It is reasonable to assume that bicycle trips would comprise no more than five percent of the travel mode share to the site during the peak commute periods. This would equate to approximately 11 new bicycle trips during the AM and PM peak hours. The project is located near existing bike lanes that are provided along portions of Almanor Avenue and Mary Avenue. Although many streets within the project vicinity do not have bike lanes, the traffic volumes and vehicle speeds are sufficiently low that shared use of the roadway between bikes and motor vehicles is feasible. The Sunnyvale Bicycle Plan recommends bicycle lanes on Maude Avenue between Pastoria Avenue and Mathilda Avenue and shared-use symbols on Maude Avenue to the east of Mathilda Avenue. The volume of bicycle trips generated by the project would not exceed the bicycle-carrying capacity of streets surrounding the site, and the increase in bicycle trips would not require new off-site bicycle facilities.

Assuming a commute hour transit mode share of 3 percent (the maximum permitted for traffic analysis according to VTA guidelines), the project would generate 6 new transit riders during the AM and PM peak hours. The VTA route 54 bus operates with 30 minute headways, which calculates to four buses per hour (two in each direction). The average number of new riders would be less than two per bus. According to VTA data, the average bus route ridership for Route 54 is 13 patrons per bus. Thus, the new ridership generated by the proposed project could be accommodated by the existing transit service provided in the project vicinity.

Turn Pocket Analysis

The analysis of project intersection levels of service was supplemented with an analysis of left turn operations for the intersections at Mathilda Avenue/Almanor Avenue and Mary Avenue/Maude Avenue.

The turn movements selected for evaluation include the northbound left turn and the eastbound left turn at Mathilda Avenue/Almanor Avenue. In addition, the eastbound left turn movement was evaluated at Mary Avenue/Maude Avenue. These locations were selected because (1) the project would add a substantial number of trips to these movements and (2) the cumulative plus project traffic volumes for the movements are sufficiently high such that it is possible the turn pocket queue could overflow during peak hours.

Vehicle queues were estimated using a Poisson probability distribution. The basis of the analysis is as follows: (1) the Poisson probability distribution is used to estimate the 95th percentile maximum number of queued vehicles per signal cycle for a particular movement; (2) the estimated maximum number of vehicles in the queue is translated into a queue length, assuming 25 feet per vehicle; and (3) the estimated maximum queue length is compared to the existing or planned available storage capacity for the movement.

Table 11 shows that left turn storage would be adequate except for the eastbound left turn movement at Mathilda Avenue and Almanor Avenue.

Mathilda Avenue and Almanor Avenue

Under all conditions, the northbound left-turn queues would be less than the storage capacity at the intersection of Mathilda Avenue and Almanor Avenue during both the AM and PM peak hours. Under background with project and cumulative with project conditions, the 95th percentile vehicle queue for the eastbound left turn lane is expected to exceed the available storage by one vehicle during the PM peak hour. The project is expected to increase this queue by 4 vehicles during the PM peak hour. However, since the right turn and through volumes are fairly low, the periodic one vehicle queue overflow is not anticipated to impact the operation of the intersection. Therefore, no improvements are recommended.

Mary Avenue and Maude Avenue

The eastbound left-turn queues (95th percentile) are projected to be less than the storage capacity during both AM and PM peak hours under all scenarios.

Table 11
Intersection Left Turn Operations Analysis

Measurement	Mathilda / Almanor NBL AM	Mathilda / Almanor NBL PM	Mathilda / Almanor EBL AM	Mathilda / Almanor EBL PM	Mary / Maude EBL AM	Mary / Maude EBL PM
Existing						
Cycle/Delay[1] (sec)	120	105	120	105	100	100
Volume (vphpl)	37	29	90	235	20	21
Avg. Queue (veh/ln.)	1.2	0.8	3.0	6.9	0.6	0.6
Avg. Queue[2] (ft./ln)	31	21	75	171	14	15
95th %. Queue (veh/ln.)	3	3	6	11	2	2
95th %. Queue (ft./ln)	75	75	150	275	50	50
Storage (ft./ ln.)	354	354	372	372	300	300
Adequate (Y/N)	Y	Y	Y	Y	Y	Y
Background						
Cycle/Delay[1] (sec)	120	105	120	105	100	100
Volume (vphpl)	40	31	102	242	22	23
Avg. Queue (veh/ln.)	1.3	0.9	3.4	7.1	0.6	0.6
Avg. Queue[2] (ft./ln)	33	23	85	176	15	16
95th %. Queue (veh/ln.)	3	3	7	12	2	2
95th %. Queue (ft./ln)	75	75	175	300	50	50
Storage (ft./ ln.)	354	354	372	372	300	300
Adequate (Y/N)	Y	Y	Y	Y	Y	Y
Background + Project						
Cycle/Delay[1] (sec)	120	105	120	105	100	100
Volume (vphpl)	70	36	123	348	45	27
Avg. Queue (veh/ln.)	2.3	1.1	4.1	10.2	1.3	0.8
Avg. Queue[2] (ft./ln)	58	26	103	254	31	19
95th %. Queue (veh/ln.)	5	3	8	16	3	2
95th %. Queue (ft./ln)	125	75	200	400	75	50
Storage (ft./ ln.)	354	354	372	372	300	300
Adequate (Y/N)	Y	Y	Y	**N**	Y	Y
Cumulative + Project						
Cycle/Delay[1] (sec)	120	105	120	105	100	100
Volume (vphpl)	72	38	134	378	46	28
Avg. Queue (veh/ln.)	2.4	1.1	4.5	11.0	1.3	0.8
Avg. Queue[2] (ft./ln)	60	28	112	276	32	19
95th %. Queue (veh/ln.)	5	3	8	17	3	2
95th %. Queue (ft./ln)	125	75	200	425	75	50
Storage (ft./ ln.)	354	354	372	372	300	300
Adequate (Y/N)	Y	Y	Y	**N**	Y	Y

[1] Vehicle queue calculations based on cycle length for signalized intersections.
[2] Assumes 25 Feet Per Vehicle Queued
[3] Vehicle queue calculations based on movement delay for unsignalized intersections.

Site Access and Circulation

Site access and on-site circulation were evaluated using commonly accepted transportation planning principles. This review is based on the project site plan submitted to the City of Sunnyvale on January 28, 2013.

> **Recommendation:** Because this site plan is conceptual, this study does not provide a complete analysis of site access and circulation. Prior to final design, the site plan should be reviewed by the City Division of Transportation and Traffic. Modifications to the project design may occur during the project permitting process.

Site Access

The site plan shows that the project would share the same driveway located on Almanor Avenue with the existing building on site. This driveway is located adjacent to, but not aligned with, the intersection at Pastoria Avenue and Almanor Avenue. The offset between the driveway and Pastoria Avenue creates left turn conflicts.

The project site can also be accessed by the three driveways for the adjacent site at 675 Almanor Avenue. Currently, the parking lots for 645 Almanor Avenue and 675 Almanor Avenue are connected to each other. The site plan dated January 28, 2013 shows the connection between these two sites would remain the same. Therefore, there would be a total of four driveways available for the project site. During the AM and PM peak hour, the project would generate 177 inbound trips and 180 outbound trips, which calculates to an average of three vehicles per minute. The main driveway has a throat depth able to accommodate this traffic, so queuing at the driveway should not be a problem.

> **Recommendation:** The main project driveway should be relocated so that it aligns directly with Pastoria Avenue.

> **Recommendation:** Prior to final design, the driveway widths, radii and throat depth should be measured to confirm that they comply with City of Sunnyvale standards and are adequate to handle truck traffic. In order to ensure there would be sufficient sight distance at the project driveways, any landscaping, parking, and signage location should be consistent with City of Sunnyvale vision triangle standards.

Site Circulation

The onsite circulation was reviewed in accordance with generally accepted traffic engineering standards. Generally, the proposed plan would provide adequate connectivity through the parking areas for vehicles, bicycles, and pedestrians. The project would provide 90-degree parking throughout the site.

Almost all the parking areas for the site are connected together. However, there is one dead end aisle shown within the garage. This dead end should be eliminated if possible.

> **Recommendation:** The drive aisle widths and garage ramp design are not shown on the conceptual plan. Prior to final design, the drive aisle widths should be reviewed for compliance with City standards. In addition, an analysis of the adequacy of onsite circulation for trucks should be conducted. Loading zones should be provided for each building.

Pedestrian paths are not shown on the conceptual site plan. The project should provide pedestrian paths through each parking area to connect the parking areas with the buildings. The site plan should also show pedestrian connections between the two buildings. All the proposed pedestrian paths on site should be along desired lines. Pedestrian scale lighting should be provided and the

width of all the pedestrian paths should be checked for comfortable walking and to comply with City standards.

Parking

The City of Sunnyvale parking standard for Research & Development is a minimum parking supply of 1 space per 500 square feet, and a maximum parking supply of 1 space per 250 square feet. The proposed project would construct 176,780 square feet of new research and development buildings. With the existing Building on site, there would be a total of 307,662 square feet of research & development building space on site. City of Sunnyvale parking standards require that the project provide a minimum of 615 parking spaces onsite and a maximum of 1231 parking spaces on site. Based on the January 28, 2013 conceptual site plan, the proposed underground parking garage and the surface parking space would provide a total of 928 parking spaces including 20 accessible spaces, which would comply with the minimum and maximum parking standards specified by the City of Sunnyvale.

The City's municipal code requires bike parking equal to five percent of the total number of vehicular parking spaces. This yields a minimum requirement of 47 bicycle spaces. For research and development uses, the City recommends 75% of the spaces designated as Class I (lockers or guarded parking) and 25% of the spaces designated as Class II (bike racks). This equates to 36 Class I spaces and 11 Class II spaces. The conceptual site plan dated January 28, 2013 does not show bike parking spaces.