Transportation Impact Study for BioMarin 999 3rd Street San Rafael Campus Expansion

Prepared for:
City of San Rafael

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Executive Summary

This study analyzes the transportation impacts associated with the proposed BioMarin San Rafael campus expansion project at 999 3rd Street in San Rafael. The proposed project will expand the current BioMarin campus by adding 110,000 gross square feet (GSF) of office and 97,000 GSF of laboratory space for research and development (R&D). Additionally, BioMarin is dedicating the northwest corner of the site for development of a senior center (18,000 GSF) and affordable housing (67 units) for low income seniors.

The CEQA transportation impact assessment consists of:

- Traffic operations at 36 intersections
- Traffic operations on five arterials
- Freeway operations on US 101 from north of the Mission Avenue ramps to south of the 2nd Street ramps
- Bicycle, pedestrian, and transit conditions at these locations and adjacent to the project site

The transportation assessment identifies significant and unavoidable impacts at two intersections, on one arterial, and on one freeway segment.

- 3rd Street and Tamalpais Avenue West intersection during the AM and PM peak hours (Cumulative conditions)
- 3rd Street arterial during the AM peak hour (Baseline conditions and Cumulative conditions)
- US 101 southbound Mission Avenue off-ramp diverge segment during the AM peak hour (Cumulative conditions)

Pedestrian safety concerns and the limited roadway and freeway width available to add lanes result in impacts being significant but unavoidable. Additional recommendations are provided to reduce vehicle delay on intersections operating unacceptably.

This study also provides a forecast of vehicle miles traveled for the project. Employee home-work VMT are estimated to be higher than City and regional averages.

This report additionally includes a review of the project site plan. Improvements are suggested to enhance vehicle and pedestrian access and safety. Crossing treatment and intersection control option to improve pedestrian connectivity and safety at the four intersections adjacent to the project site are also evaluated.

Introduction

This report documents the existing, baseline, and cumulative conditions for the proposed BioMarin San Rafael campus expansion project at 999 3rd Street in San Rafael. The report then analyzes the impacts of the proposed project on baseline and cumulative conditions.

Project Description

The proposed project will expand the current BioMarin campus by adding 110,000 gross square feet (GSF) of office and 97,000 GSF of laboratory space for research and development (R&D). BioMarin proposes to leverage its campus parking model, with visitor, ADA, and service parking on site. Most (non-ADA) BioMarin employees working at the project site will park at the existing BioMarin garage and surface parking south of 2nd Street, where there is a large parking surplus. Additionally, BioMarin is dedicating the northwest corner of the site for development of a senior center (18,000 GSF) and affordable housing (67 units) for low income seniors. The senior center will include classrooms, meeting spaces, and other senior services. The senior center will have parking located on the ground floor of the building. No parking will be provided for senior residents.

Project Location

The project site occupies approximately three acres, bounded by 3rd Street to the north, 2nd Street to the south, Brooks Street to the west, and Lindaro Street to the east as shown in Figure 1. This site is currently vacant and was formerly occupied by PG&E.

The project site is located in downtown San Rafael, an area of mixed office, retail, dining, and other uses. The site has good walking and transit access including to the C. Paul Bettini Transit Center and the Sonoma-Marin Area Rail Transit (SMART) San Rafael downtown train station approximately two blocks to the east. The US 101/2nd Street interchange is approximately three blocks to the east. The site is also adjacent to the existing BioMarin San Rafael campus located south of 2nd Street.

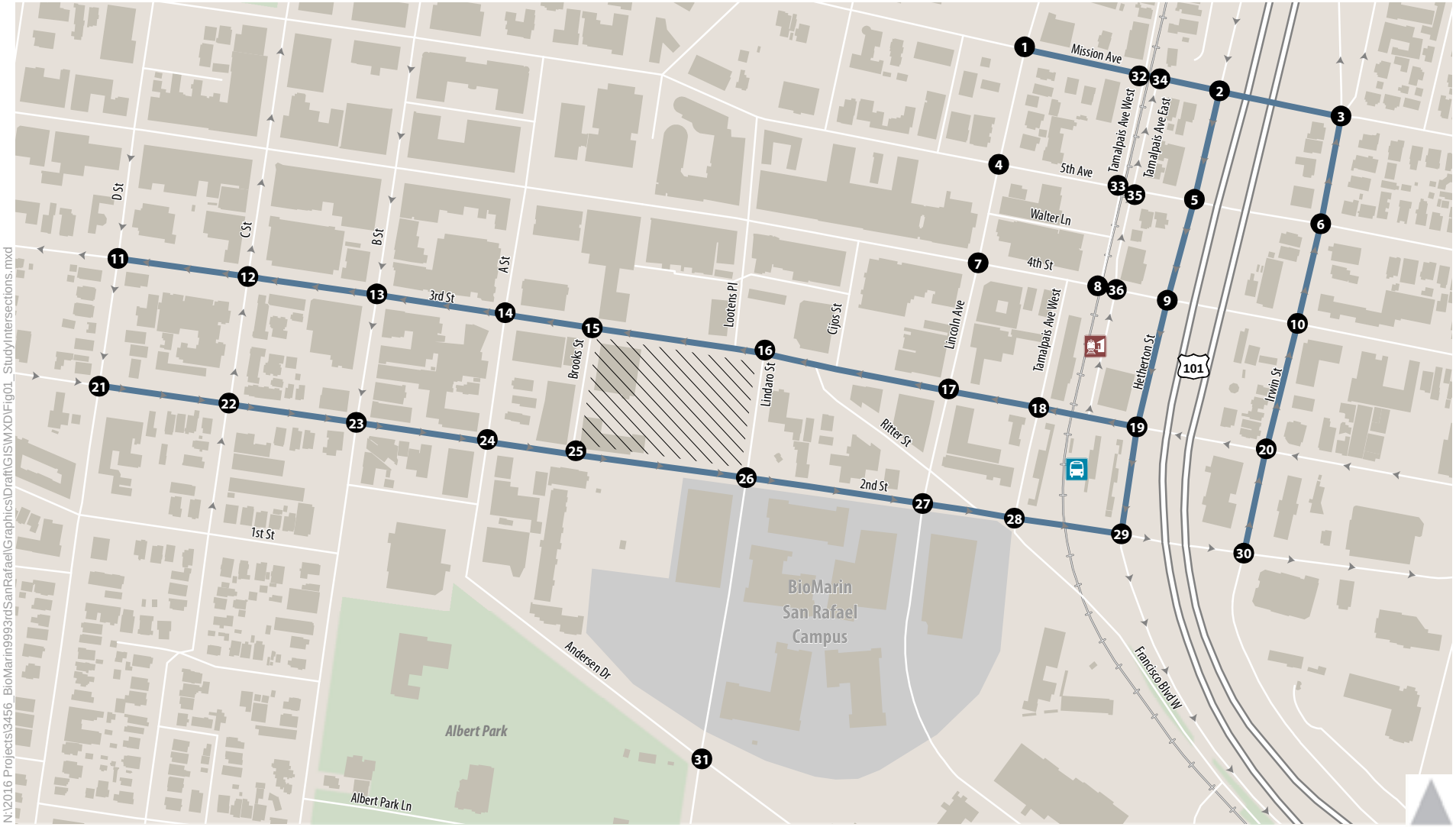

Figure 1

Project Location

Study Area

Intersections are generally the critical nodes of urban roadway networks that control system capacity and driver experience. Therefore, the operations of critical intersections surrounding the project site are used as indicators of the adequacy of the vehicular circulation system. During the scoping of the transportation impact analysis, the City requested analysis of 36 intersections, five arterial segments, and a section of US 101 (Figure 1) based on the project trip generation and distribution. These analysis locations are:

Study Intersections

1. Mission Avenue and Lincoln Avenue
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street
4. 5th Avenue and Lincoln Avenue
5. 5th Avenue and Hetherton Street
6. 5th Avenue and Irwin Street
7. 4th Street and Lincoln Avenue
8. 4th Street and Tamalpais Avenue West
9. 4th Street and Hetherton Street
10. 4th Street and Irwin Street
11. 3rd Street and D Street
12. 3rd Street and C Street
13. 3rd Street and B Street
14. 3rd Street and A Street
15. 3rd Street and Brooks Street
16. 3rd Street and Lindaro Street
17. 3rd Street and Lincoln Avenue
18. 3rd Street and Tamalpais Avenue West
19. 3rd Street and Hetherton Street
20. 3rd Street and Irwin Street
21. 2nd Street and D Street
22. 2nd Street and C Street
23. 2nd Street and B Street
24. 2nd Street and A Street
25. 2nd Street and Brooks Street
26. 2nd Street and Lindaro Street
27. 2nd Street and Lincoln Avenue
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp
30. 2nd Street and Irwin Street/US 101 Northbound Ramp
31. Andersen Drive and Lindaro Street
32. Tamalpais Avenue West and Mission Avenue
33. Tamalpais Avenue West and 5th Avenue
34. Tamalpais Avenue East and Mission Avenue
35. Tamalpais Avenue East and 5th Avenue
36. Tamalpais Avenue East and 4th Street

Arterial Study Segments

1. Mission Avenue from Lincoln Avenue to US 101 Northbound Ramp/Irwin Street
2. 3rd Street from Hetherton Street to D Street
3. 2nd Street from D Street to Hetherton Street/US 101 Southbound Ramp
4. Hetherton Street from Mission Avenue to 2nd Street
5. Irwin Street from 2nd Street to Mission Avenue

Freeway Study Segments

- US 101 segments from north of Mission Avenue ramps to south of 2nd Street ramps

Analysis Scenarios

The analysis includes an evaluation of transportation conditions during a typical weekday AM peak hour, occurring between 7:00 and 9:00 AM, and PM peak hour, occurring between 4:00 and 6:00 PM, when the combination of traffic on the surrounding roadway network and traffic generated by the project would peak.

This report presents the analysis of the following scenarios:

- Existing Conditions – Existing volumes based on recent traffic counts and the Synchro model provided by the City.

- Baseline Conditions – Existing volumes plus traffic volume estimates for approved, but not yet constructed, development; traffic increases due to regional growth expected prior to the proposed project opening (estimated 2023); and approved/funded transportation system improvements expected to be in place when the project opens. These projects are:

    - Seagate apartments, 703 3rd Street
    - Senior assisted housing, 1203 Lincoln Avenue
    - Addition of a leading pedestrian interval to the intersection of 3rd Street and Tamalpais Avenue West
    - SMART train extension to Larkspur

- Baseline Plus Project Conditions (R&D Only) – Baseline conditions plus project trip generation for the new R&D buildings only, assigned to the network based on existing travel patterns, site access, and the location and quantity of available parking.

- Baseline Plus Project Conditions (R&D & Senior Services and Housing) – Baseline conditions plus project trip generation developed for both the BioMarin and Senior Services and Housing buildings, assigned to the network based on existing travel patterns, site access, and the location and quantity of available parking.

- Cumulative Conditions – This scenario includes market-level population and employment growth and expected transportation improvements for year 2040. This scenario includes the Baseline Conditions scenario and adds the following:

    - Background growth, derived from the Metropolitan Transportation Commission Travel Demand Model

    - Conversion of C Street and D Street between 4th Street and 5th Street from one-way to two-way

    - Conversion of Tamalpais Avenue West between Mission Avenue and 4th Street from two-way to one-way southbound

  - Conversion of Tamalpais Avenue West between 4th Street and 3rd Street from two-way to one-way northbound
  - Changing downtown signal timing from pre-timed to adaptive

- Cumulative Plus Project Conditions (R&D Only) – Cumulative conditions plus project trip generation for the new R&D buildings only, assigned to the network based on existing travel patterns, site access, and the location and quantity of available parking.
- Cumulative Plus Project Conditions (R&D & Senior Services and Housing) – Baseline conditions plus project trip generation developed for both the BioMarin and Senior Services and Housing buildings, assigned to the network based on existing travel patterns, site access, and the location and quantity of available parking.

Study Methodology

This chapter presents the analysis methodology and significance criteria applied in this study.

Analysis Methods

This study analyzes traffic operations using level of service (LOS) as the primary measure of performance. Automobile LOS is a qualitative description of traffic flow from the perspective of motorists. The *Highway Capacity Manual* (HCM) defines six levels of service from LOS A representing the least congested traffic conditions to LOS F representing the most congested traffic conditions. These grades represent the perspective of drivers and are an indication of the comfort and convenience associated with driving, as well as speed, travel time, traffic interruptions, and freedom to maneuver.

Roadway Operations

Traffic operations at all study intersections and arterial segments were analyzed for weekday AM and PM peak hour conditions using procedures and methodologies contained in the *Highway Capacity Manual* (Transportation Research Board, 2010) (HCM 2010) for calculating delay at intersections and on arterials. These methodologies were applied using the Synchro software program. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for such intersections are based on HCM 2000 methodology. Additionally, the four intersections adjacent to the project site were analyzed using the SimTraffic software program. Existing conditions data were provided in Synchro network and data files by the City of San Rafael and then updated with traffic count data provided by the City, collected by Fehr & Peers in 2016, and new counts collected by Fehr & Peers on October 24, November 7, and December 13, 2017, and February 27, 2018. Updates were made to the Synchro networks to reflect current observed conditions.

Signalized and Unsignalized Intersections

Table 1 displays the average delay ranges associated with each LOS category for intersections.

TABLE 1: INTERSECTION LEVEL OF SERVICE DEFINITIONS		
Level of Service	**Average Control Delay (seconds/vehicle)[1]**	
	Signalized	**Unsignalized**
A	0 – 10.0	0 – 10.0
B	10.1 – 20.0	10.1 – 15.0
C	20.1 – 35.0	15.1 – 25.0
D	35.1 – 55.0	25.1 – 35.0
E	55.1 – 80.0	35.1 – 50.0
F	> 80.0	> 50.0

Notes:

1. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and acceleration delay based on Highway Capacity Manual (Transportation Research Board, 2010).

For signalized intersections, the LOS is based on the average delay experienced by all vehicles passing through the intersection. For side-street stop controlled intersections, the delay and LOS for the worst movement is reported along with the average delay for the entire intersection.

Arterials

Table 2 displays the average travel speed ranges associated with each LOS category for arterials. Thresholds are from the San Rafael 2020 General Plan.

TABLE 2: ARTERIAL LEVEL OF SERVICE DEFINITIONS	
Level of Service	**Speed (mph)**
A	≥ 25.1
B	19.1 - 25.0
C	13.1 – 19.0
D	9.1 – 13.0
E	7.1 – 9.0
F	≤ 7.0

Source: San Rafael 2020 General Plan.

As discussed in the following significance criteria section, arterial LOS for TAM Congestion Management Plan (CMP) segments are determined based on volume-to-capacity ratio (V/C). The San Rafael 2020 General Plan EIR used model results to estimate this number. The Metropolitan Transportation Commission Travel Demand Model is the current available model for downtown San Rafael. This model indicates a capacity of 950 vehicles/hour/lane on 2nd Street and 3rd Street. Because this is generally higher than expected for a downtown arterial, a capacity of 800 vehicles/hour/lane is applied for those CMP segments.

Freeway Segments

Freeway operations on basic, merge, and diverge segments were analyzed for weekday AM and PM peak hour conditions using procedures and methodologies contained in the Highway Capacity Manual, Sixth Edition (Transportation Research Board, 2017). Weave segments were analyzed using the Leisch methodology, based on the Highway Design Manual (California Department of Transportation, 2014). Similar to intersections, the operating characteristics of freeway segments are evaluated using the concept of LOS. Freeway basic, merge, and diverge segment LOS is based on vehicle density (passenger cars per lane per mile). Table 3 shows the correlation of density and LOS. Inputs to calculate freeway segment densities were obtained from Caltrans Performance Measurement System (PeMS) data and from the traffic counts discussed earlier.

TABLE 3: FREEWAY LEVEL OF SERVICE DEFINITIONS

Level of Service	Density (passenger cars per mile per lane)
A	≤ 11.0
B	11.1 - 18.0
C	18.1 – 26.0
D	26.1 – 35.0
E	35.1 – 45.0
F	≥ 45.1

Source: Highway Capacity Manual 2010.

The purpose of the freeway analysis is to determine the project's contribution to the available capacity on the freeway; therefore, the Highway Capacity Software (HCS) was used to complete the analysis of basic, merge, and diverge segments. HCS is an appropriate analysis tool because it applies the freeway methodologies in the HCM by accounting for the volume demand and available capacity by segment. The HCS tool is a static model, which does not account for downstream queues. However, since the purpose of this analysis is to determine the project's contribution to the regional network, the static model approach was the most appropriate to account for the project's contribution.

For information purposes only, changes in freeway ramp queue lengths were estimated. The HCM methodology used in the Synchro software program does not adequately account for queue spillover or short turn pockets. Therefore the differences between the Synchro estimated 95th percentile queue lengths under plus-project and no-project conditions are reported.

Traffic Forecasting

The Metropolitan Transportation Commission Travel Demand Model was used to estimate traffic growth in the study area. Although this model is the best available forecasting tool for San Rafael, it does not have a

network and traffic analysis zone structure sufficient to forecast traffic volume by segment in the study area. Thus the model was used to determine expected annual traffic volume growth in the study area. This growth was determined to be 0.4% annually and applied to the existing condition volumes to derive forecasts for baseline and cumulative year conditions.

Significance Criteria

The following thresholds of significance have been used to determine whether implementing the proposed project would result in a significant transportation impact. The San Rafael General Plan 2020, the San Rafael General Plan 2020 EIR, and the Marin County Congestion Management Plan were all used to develop these criteria and thresholds.

Signalized Intersections

The citywide LOS standard from the San Rafael General Plan 2020 is LOS D except as noted below:

- LOS E
    a. Downtown
    b. Irwin Street and Grand Avenue between 2nd Street and Mission Avenue
    c. 3rd Street and Union Street (maximum of 70 seconds of delay during peak hours)
    d. Andersen Drive and West Francisco Boulevard
    e. Andersen Drive and Bellam Boulevard
    f. Freitas Parkway and Civic Center Drive/Redwood Highway
    g. Merrydale Road and Civic Center Drive
    h. Merrydale Road and Las Gallinas
- LOS F
    a. Mission Avenue and Irwin Street
- Signalized intersections at Highway 101 and I-580 on-ramps and off-ramps are exempt from LOS standards because delay at these intersections is affected by regional traffic and not significantly impacted by local measures.

The San Rafael General Plan 2020 EIR defines the following as significant impacts:

- If a signalized intersection with baseline traffic volumes is operating at an acceptable LOS and deteriorates to an unacceptable operation with the addition of project traffic; or

- If a signalized intersection with baseline traffic volumes is at an unacceptable LOS and project traffic causes an increase in the delay of five seconds or more.

Unsignalized Intersections

Consistent with the San Rafael General Plan 2020 EIR, a significant impact at an unsignalized intersection is identified based on the following:

- If an unsignalized intersection with baseline traffic volumes is operating at an acceptable LOS and deteriorates to an unacceptable operation with the addition of project traffic; or

- If an unsignalized intersection with baseline traffic volumes is already operating at an unacceptable LOS and project traffic causes an increase in the delay of five seconds or more.

Arterials

The citywide LOS standard for arterials, as defined in San Rafael General Plan 2020, is LOS D except as noted below (Congestion Management Segments are west of US 101):

a. Downtown except as noted below — E
    - Congestion Management Segments (2nd, 3rd, and 4th Streets) — D

b. Arterials operating at LOS E outside Downtown, and F[1] — F

For the arterials in this analysis, the applied standard is LOS D for 2nd Street and 3rd Street, LOS E for eastbound Mission Avenue, and LOS F for all other arterials.

For the purposes of this analysis, a significant impact on an arterial is identified based on the following, consistent with the San Rafael General Plan 2020 EIR and the 2015 Marin County Congestion Management Plan Update:

- If an arterial with baseline traffic volumes is operating at an acceptable LOS and deteriorates to an unacceptable operation with the addition of project traffic.

- If an arterial with baseline traffic volumes is already at an unacceptable LOS and project impact causes a decrease in the calculated average travel speed of five miles per hour or more (City

[1] Arterials operating at LOS E outside Downtown, and F as of the date of adoption of General Plan 2020, are listed in Appendix C of the San Rafael General Plan 2020.

arterials) or 0.05 volume to capacity (V/C) or more (congestion management arterials), this impact is significant.

Freeway

The Marin County Congestion Management Plan establishes LOS E as the threshold for US 101 through San Rafael. The San Rafael General Plan 2020 EIR defines the following as significant impacts:

- If a freeway segment with baseline traffic volumes is operating at an acceptable LOS (LOS A, B, C, D, or E) and deteriorates to an unacceptable operation (LOS F).
- If a freeway segment with baseline traffic volumes is already at operating at LOS F and there is an increase in the V/C of 0.01 or more.

Bicycle/Pedestrian

The San Rafael General Plan 2020 includes the following goals for pedestrian and bicycle conditions:

Goal 16: Bikeways. It is the goal of San Rafael to have safe, convenient and attractive bikeways and amenities.

Goal 17: Pedestrian Paths. It is the goal of San Rafael to have safe, convenient and pleasurable pedestrian amenities.

Consistent with these goals, bicycle/pedestrian impacts would be significant if the project:

- Caused a substantial inconvenience or substantial reduction in quality of service for users of existing bicycle or pedestrian travel facilities
- Substantially reduced bicycle or pedestrian access
- Substantially reduced safety for bicyclists or pedestrians

Transit

The San Rafael General Plan 2020 includes the following goal related to the transit network:

C-14 Transit Network. Encourage the continued development of a safe, efficient, and reliable regional and local transit network to provide convenient alternatives to driving.

Consistent with this goal, transit impacts would be significant if the project:

- Induced substantial growth or concentration of population beyond the capacity of existing or planned public transit facilities.

- Increased demand for public transit service to such a degree that accepted service standards are not maintained.

- Reduced availability of public transit to users, or interfered with existing transit users.

Existing Conditions

This chapter describes the existing transportation system and traffic conditions within the study area. This includes the existing roadway network, as well as transit, bicycle, and pedestrian facilities within the vicinity of the project site. This scenario is informative and establishes present-day traffic conditions at the study intersections, arterials, and freeway segments.

The quantitative assessment of existing traffic conditions is based on an evaluation of current traffic counts. The City of San Rafael maintains a database of existing traffic volumes and provided Synchro files for use in this traffic study. These data were augmented with traffic counts collected by Fehr & Peers in 2016. Additional traffic counts were collected at study intersections on Tuesday, October 24; Tuesday, November 7, on Wednesday, December 13, 2017, and on Tuesday, February 27, 2018, during the AM (7-9 AM) and PM (4-6 PM) peak periods. Schools were in session at the time of the counts, weather conditions were dry, and no unusual traffic conditions were observed.

Roadway Network

The local circulation system near the project is shown in Figure 1. The project site is located in downtown San Rafael and west of US 101. The following roadways provide local access to the proposed project site. All of these local streets have sidewalks along both sides unless otherwise noted.

3rd Street – 3rd Street is primarily a three-lane one-way street that serves westbound traffic. 3rd Street widens from two lanes to three lanes at Grand Avenue and then continues under the freeway into downtown. At E Street, 3rd Street reduces to two lanes and then merges with 2nd Street just west of Hayes Street. On-street parking is prohibited along the north side of 3rd Street and the south side east of Lindaro Street.

2nd Street – 2nd Street is primarily a three-lane one-way street that serves eastbound traffic. 2nd Street separates from 3rd Street and widens to three lanes just east of Miramar Avenue and continues through downtown. At Grand Avenue, 2nd Street reduces to two lanes and then merges with 3rd Street just west of Union Street. On-street parking is prohibited along 2nd Street. There are no sidewalks on the north side of 2nd Street between Lincoln Avenue and Ritter Street and the south side of 2nd Street between Francisco Boulevard West and Irwin Street.

Brooks Street – Brooks Street is a one-block long two-way street, with one travel lane in each direction that runs north-south between 2nd Street and 3rd Street. On-street parking is prohibited except for three spaces along the east curb just south of 3rd Street.

Lindaro Street – Lindaro Street is a two-way street, with one travel lane in each direction, which runs north-south from 3rd Street to Woodland Avenue. The crosswalk on the west leg of the intersection with 3rd Street is unmarked. Lindaro Street passes through the existing BioMarin San Rafael campus between 2nd Street and Andersen Drive.

Figure 2 and Figure 3 display the existing peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively. Peak hours observed were 7:30-8:30 AM and 4:30-5:30 PM.

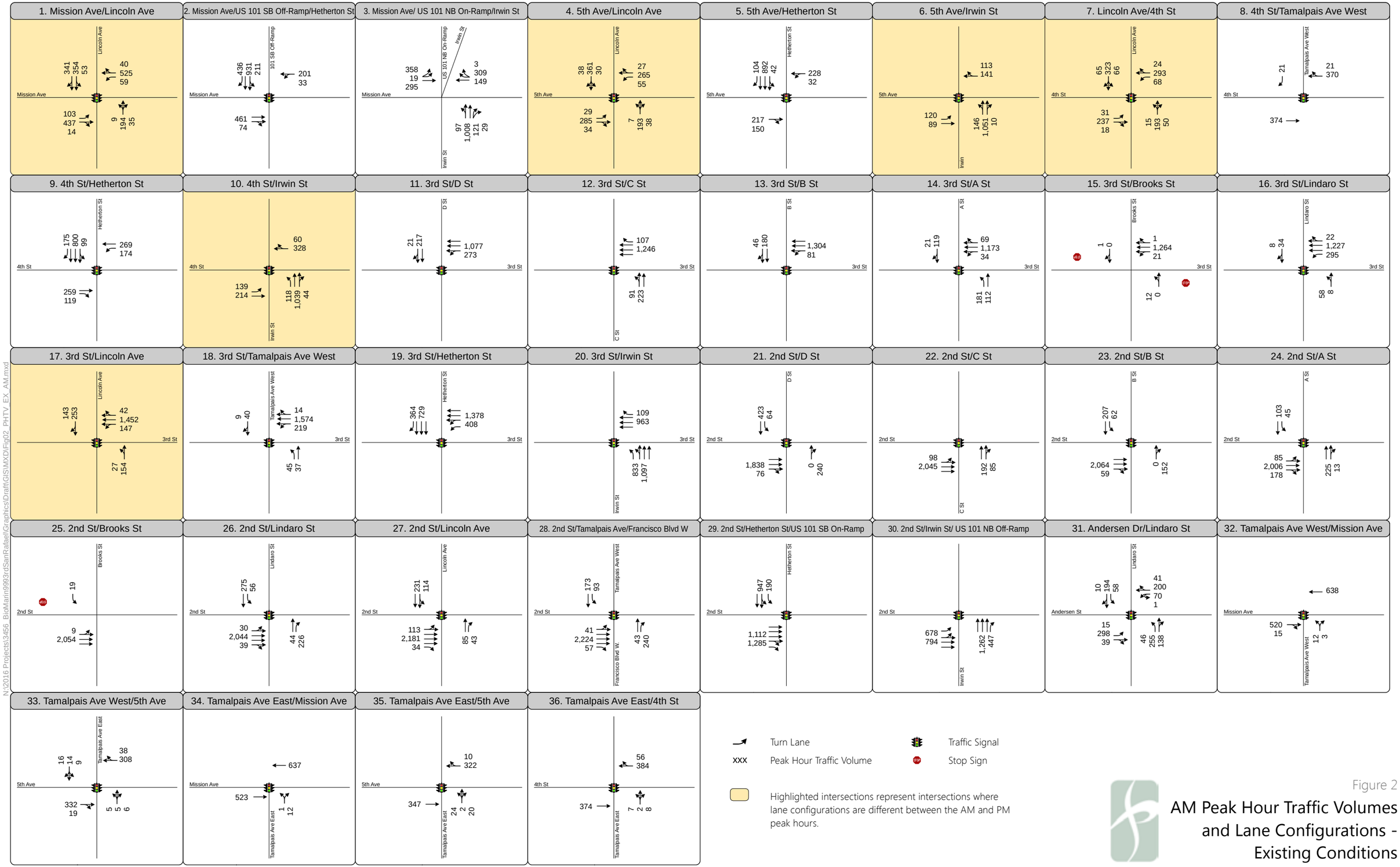

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Figure 2

AM Peak Hour Traffic Volumes and Lane Configurations - Existing Conditions

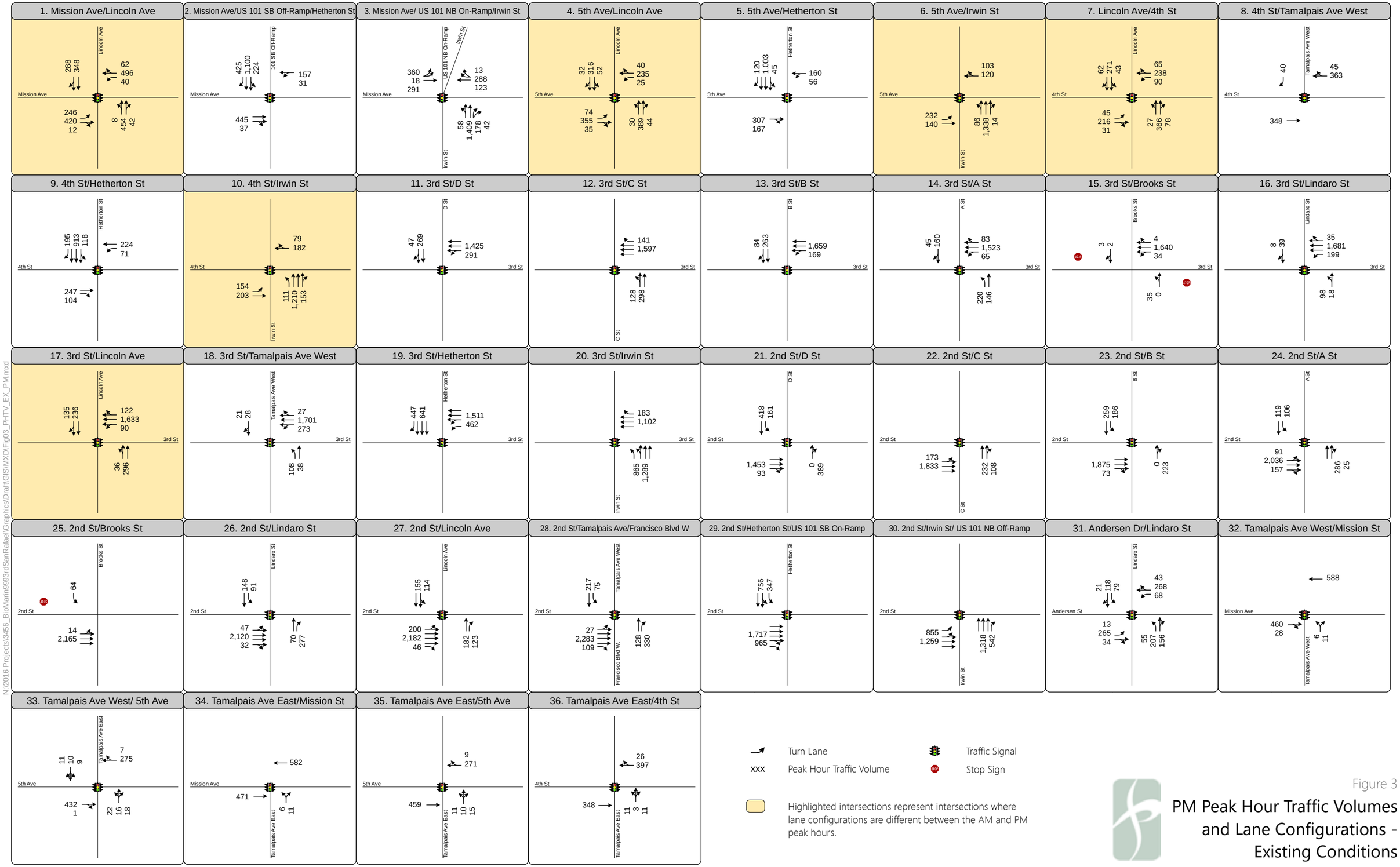

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Figure 3

PM Peak Hour Traffic Volumes and Lane Configurations - Existing Conditions

Intersection Operations

Table 4 summarizes the existing levels of service (LOS) at the study intersections. All intersections operate acceptably. Appendix A presents all LOS calculations.

TABLE 4: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – EXISTING CONDITIONS

Intersection	Control Type	LOS / Average Delay [1, 2]	
		AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 20.8	D / 39.0
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	D / 35.1	C / 22.9
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 23.5	C / 22.2
4. 5th Avenue and Lincoln Avenue	Signal	B / 15.3	A / 9.1
5. 5th Avenue and Hetherton Street[3]	Signal	A / 6.8	A / 8.1
6. 5th Avenue and Irwin Street	Signal	D / 36.3	C / 28.9
7. 4th Street and Lincoln Avenue	Signal	B / 18.3	B / 19.8
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 5.9	A / 3.9
9. 4th Street and Hetherton Street[3]	Signal	A / 8.9	A / 9.1
10. 4th Street and Irwin Street	Signal	C / 32.4	C / 28.4
11. 3rd Street and D Street	Signal	C / 26.3	C / 29.5
12. 3rd Street and C Street	Signal	C / 24.7	C / 28.8
13. 3rd Street and B Street	Signal	C / 25.5	C / 32.6
14. 3rd Street and A Street	Signal	C / 26.1	C / 29.8
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.7 (13.3)	A (A) / 1.6 (9.0)
16. 3rd Street and Lindaro Street	Signal	A / 5.7	A / 9.8
17. 3rd Street and Lincoln Avenue	Signal	D / 42.5	C / 30.3
18. 3rd Street and Tamalpais Avenue West	Signal	C / 30.4	C / 32.2
19. 3rd Street and Hetherton Street	Signal	C / 31.8	D / 44.1
20. 3rd Street and Irwin Street	Signal	C / 27.5	C / 30.7
21. 2nd Street and D Street	Signal	A / 3.2	A / 3.3
22. 2nd Street and C Street	Signal	D / 37.5	D / 36.2
23. 2nd Street and B Street	Signal	A / 2.2	A / 2.9
24. 2nd Street and A Street	Signal	D / 37.6	D / 35.1
25. 2nd Street and Brooks Street	SSSC	A (C) / 2.5 (15.6)	A (D) / 2.9 (26.0)
26. 2nd Street and Lindaro Street	Signal	B / 13.6	B / 13.4

TABLE 4: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – EXISTING CONDITIONS			
Intersection	**Control Type**	**LOS / Average Delay [1, 2]**	
		AM	**PM**
27. 2nd Street and Lincoln Avenue	Signal	D / 42.7	D / 37.3
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	D / 44.4	D / 37.1
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	D / 48.4	C / 32.6
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	C / 28.0	D / 44.9
31. Andersen Drive and Lindaro Street	Signal	C / 22.3	C / 21.0
32. Tamalpais Avenue West and Mission Avenue[3]	Signal	C / 20.4	B / 10.3
33. Tamalpais Avenue West and 5th Avenue[3]	Signal	A / 5.5	A / 6.5
34. Tamalpais Avenue East and Mission Avenue[3]	Signal	D / 49.9	B / 19.6
35. Tamalpais Avenue East and 5th Avenue[3]	Signal	A / 5.6	A / 3.9
36. Tamalpais Avenue East and 4th Street[3]	Signal	B / 12.0	A / 9.8

Notes:
1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2018

Arterial Operations

Table 5 summarizes the existing levels of service on the arterials in the analysis area. All operate acceptably except for 2nd Street which operates unacceptably during the AM and PM peak hours. Appendix A includes arterial LOS calculations.

TABLE 5: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – EXISTING CONDITIONS

Arterial	Standard	LOS / Average Speed [1]	
		AM	PM
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	E / 8	D / 10
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 4	F / 6
3. 3rd Street WB from Hetherton Street to D Street	D	D / 11	D / 12
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**E / 7**	**E / 9**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 7	E / 8
6. Irwin Street NB from 2nd Street to Mission Avenue	F	D / 9	D / 10

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Freeway Operations

Figure 4 presents existing conditions freeway volumes, and Table 6 summarizes the freeway segment density and LOS results. Detailed calculations are included in Appendix A. As shown, all segments operate at acceptable levels during the AM and PM peak hours with the exception of the southbound weave segment between the 2nd Street on-ramp and the I-580 EB off-ramp during the AM peak hour.

TABLE 6: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – EXISTING CONDITIONS				
Segment	**Segment Type**	**Standard**	**LOS / Density (pc/mi/ln[1])**	
			AM	**PM**
Northbound				
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	E / -[2]
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 23	D / 29
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	C / 26	D / 34
Southbound				
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 36	D / 30
Mission Avenue Off-Ramp	Diverge	E	E / 37	D / 32
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 27	C / 21
2nd Street On-ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]

Notes:
1. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
2. Density not calculated in Leisch methodology.

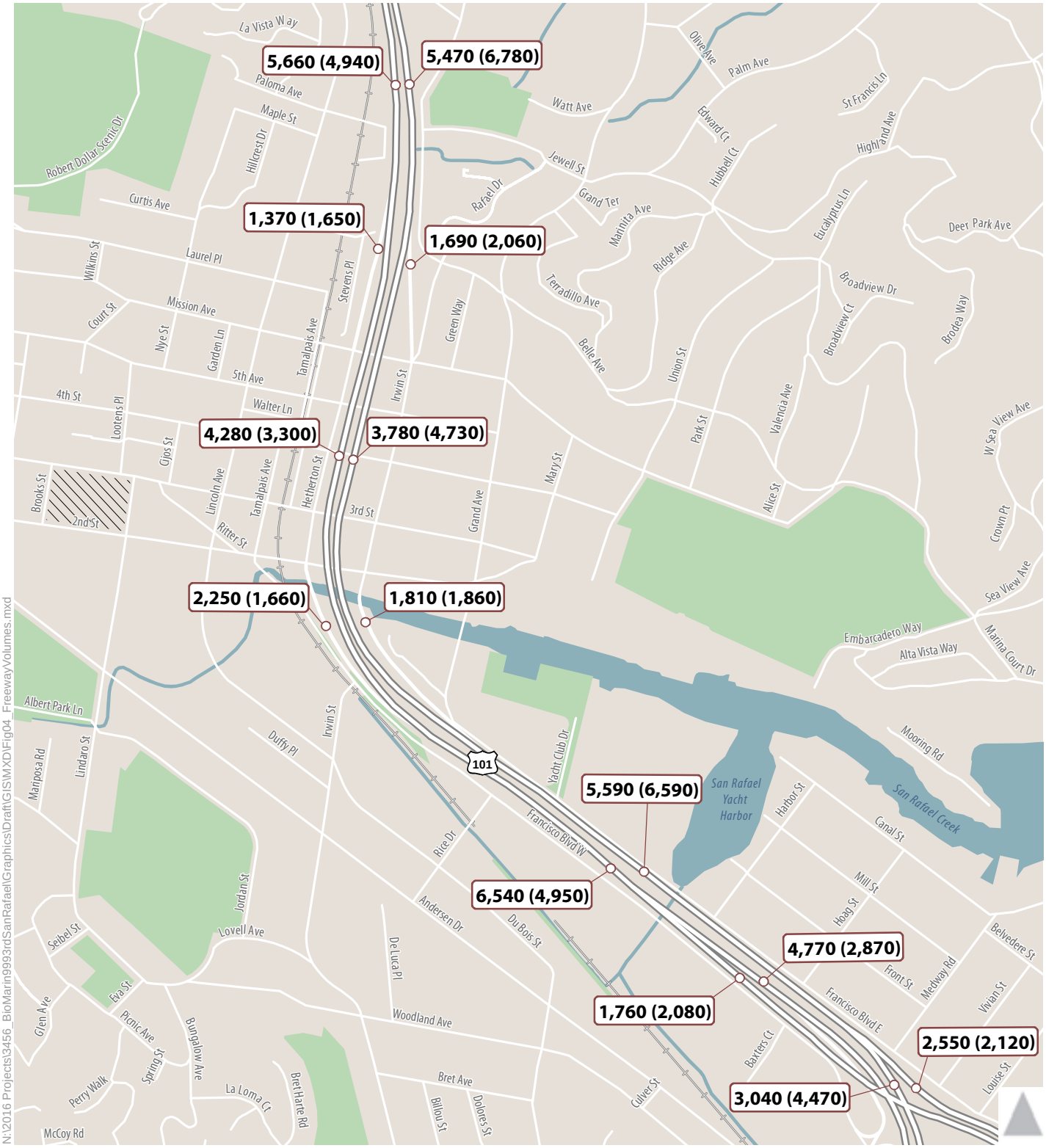
Source: Fehr & Peers, 2018

Ramp queues were also observed at the northbound 2nd Street and southbound Mission Avenue off-ramps. Maximum peak period queues were observed extending onto the freeway mainline at both off-ramps during the PM peak hour. Table 7 and Figure 5 summarize these observations.

TABLE 7: WEEKDAY PEAK HOUR OFF-RAMP QUEUES – EXISTING CONDITIONS			
Off-Ramp	**Ramp Storage Length (feet)**	**Maximum Queue (feet)[1]**	
		AM	**PM**
US 101 NB to 2nd Street	1,070	859	**2,952**
US 101 SB to Mission Avenue	940	584	**940+[2]**

Notes:
1. **Bold** indicates unacceptable operations.
2. End of queue could not be observed.

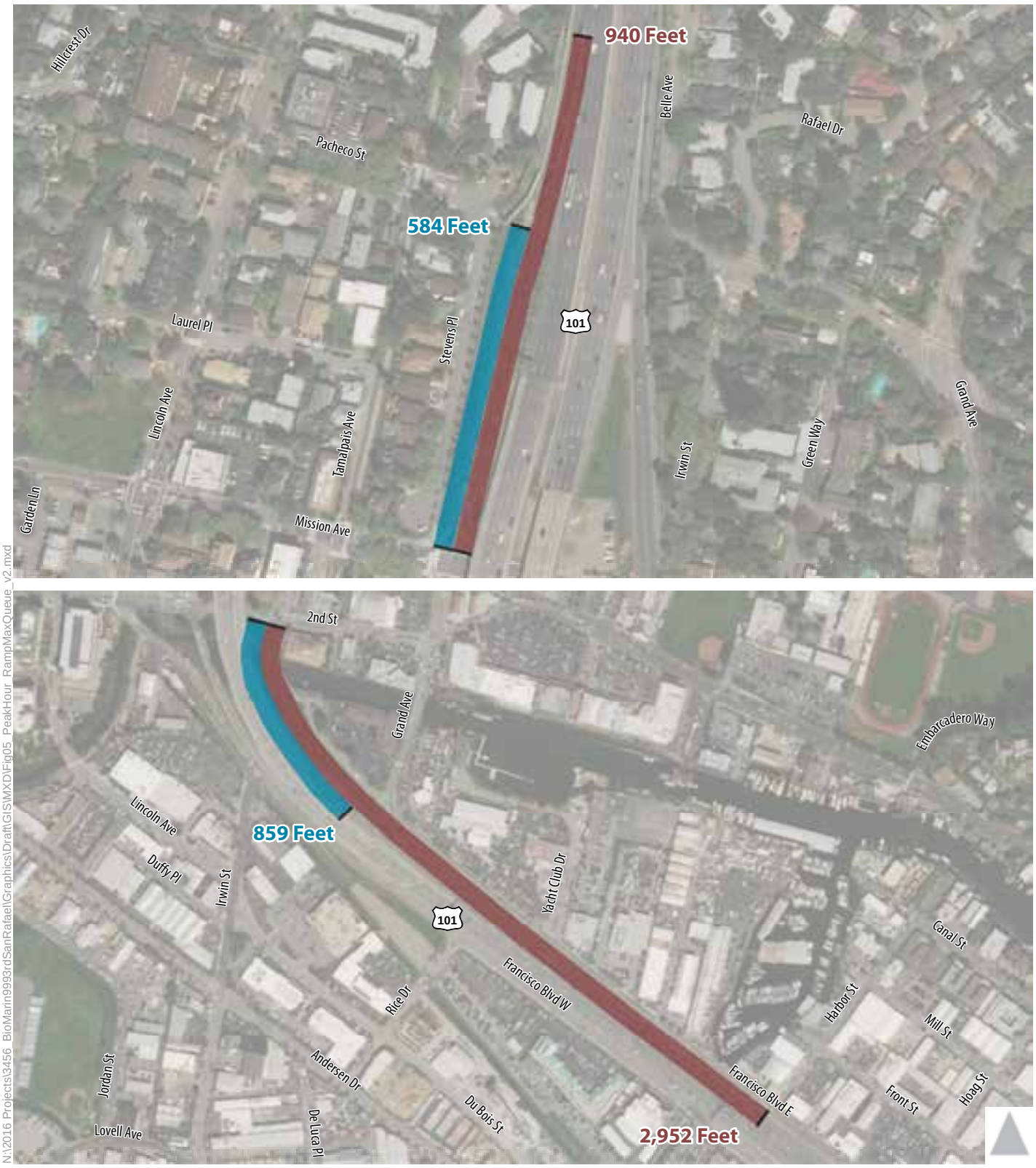
Source: Fehr & Peers, 2018



AM (PM) Freeway Volume

Figure 4

Weekday Peak Hour Freeway Volumes - Existing Conditions



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AM Maximum Queue Length

PM Maximum Queue Length

Figure 5

Weekday Peak Hour Off-Ramp Queues - Existing Conditions

Bicycle and Pedestrian Network

Bicycle Facilities

The existing bicycle network is limited within the study area:

- 4th Street is classified as a Class III bikeway (bike route) between 2nd Street and Tamalpais Avenue East and between Irwin Street and Union Street; sections of this bikeway have sharrow markings.
- Lincoln Avenue is classified as a Class III bikeway from 2nd Street to Irwin Street.
- Andersen Drive has westbound Class II bike lanes between A Street and Lindaro Street and is a Class III bikeway with sharrow markings eastbound.
- The Puerto Suello Hill Pathway (Class I bike path) passes through the study area.

The Marin County Bicycle Coalition (MCBC) map identifies Mission Avenue as the primary east-west on-street bikeway route through the study area. Lincoln Avenue, Anderson Drive, Irwin Street, and D Street are identified as primary north-south on-street bikeway routes on the MCBC map.

The 2018 San Rafael Bicycle & Pedestrian Master Plan proposes a feasibility study for an east-west bikeway through downtown along 4th Street. New north-south bicycle connections are proposed along D Street and C Street (Class IV protected bikeway couplet or Class III bicycle boulevard) and Tamalpais Avenue West (Class IV separated bikeway). The plan also proposes US 101 undercrossing improvements at 3rd Street, 4th Street, 5th Avenue, and Mission Avenue that would benefit bicyclists and pedestrians.

Pedestrian Network

Sidewalks are present along both sides of all roadways near the project site except for the following:

- South side of Ritter Street between Lincoln Avenue and 2nd Street
- North side of 2nd Street between Lincoln Avenue and Ritter Street
- South side of 2nd Street between Francisco Boulevard West and Irwin Street
- Sections of Tamalpais Avenue adjacent to the railroad tracks between Mission Avenue and 3rd Street

Adjacent to the project site, crosswalks are available as follows:

- **3rd Street and Brooks Street**: No crosswalks are marked on any of the three legs of the intersection. Pedestrian crossing of 3rd Street is prohibited on both the west and east legs. The nearest available marked crossings of 3rd Street are at A Street 220 feet to the west and Lindaro Street 450 feet to the east. An unmarked crosswalk is also at Lootens Place 370 feet to the east.

- **3rd Street and Lootens Place**: A crosswalk is marked on the north leg only; the west and east legs are unmarked. The nearest available marked crosswalks across 3rd Street are at Lindaro Street 90 feet to the east and A Street 590 feet to the west.
- **3rd Street and Lindaro Street**: Crosswalks are marked on the south and east legs only; the west leg is unmarked.
- **2nd Street and Brooks Street**: A crosswalk is marked on the north leg only; the west and east legs of the intersection, which span 2nd Street, are unmarked. The nearest available marked crosswalks across 2nd Street are at A Street 220 feet to the west and Lindaro Street 450 feet to the east.
- **2nd Street and Lindaro Street**: Crosswalks are marked on all four legs.

Pedestrian volumes were measured at four intersections adjacent to the project site in June 2016 and October/November 2017 as shown in Table 8. Pedestrian volumes crossing 2nd Street and 3rd Street at these intersections during the weekday AM and PM peak hours are relatively light under existing conditions, with the highest pedestrian counts occurring at the east leg of the 3rd Street and Lindaro Street intersection where 38 pedestrians crossed 3rd Street during the AM peak hour and 37 pedestrians crossed during the PM peak hour.

TABLE 8: INTERSECTION PEDESTRIAN VOLUMES – EXISTING CONDITIONS

Leg	Existing Weekday Pedestrian Counts	
	AM Peak Hour	PM Peak Hour
15. 3rd Street and Brooks Street		
West[1]	1	3
East[1]	2	4
North	38	37
South	36	51
16. 3rd Street and Lindaro Street		
East	38	37
North	26	51
South	22	30
25. 2nd Street and Brooks Street		
West	1	1
East	1	3
North	16	15
26. 2nd Street and Lindaro Street		
West	1	8
East	24	14
North	19	15
South	34	36

Note: [1]Pedestrian crossing currently prohibited but observed.
Source: Fehr & Peers, 2018.

Transit Network

Existing transit service within the study area is provided by bus at the San Rafael C. Paul Bettini Transit Center on Tamalpais Avenue approximately two blocks or 800 feet east of the project site. A total of 13 Marin Transit routes, eight Golden Gate Transit routes, and one Sonoma County Transit route currently serve the transit center. Greyhound also serves the center, as do airport bus companies and taxis. The transit center is well equipped with shelters and benches. Plans are being developed to build a new transit center that will be better able to accommodate buses and trains.

The Sonoma-Marin Area Rail Transit (SMART) San Rafael downtown station is also located approximately two blocks (950 feet) east of the project site. The train provides service to cities to the north, including to Novato, Petaluma, Santa Rosa, and the Sonoma County Airport. SMART operates 34 daily weekday trains and 10 daily trains on weekends and holidays. Weekday trains operate every 30 minutes in each direction

from about 5:30-10:00 AM and 3:30-9:30 PM, with limited midday service. Construction work is underway on the SMART Larkspur extension.

Collision History

Collision history at the study intersections was reviewed for the years 2015 to 2017. Table 9 presents the results of this review. Of the intersections adjacent to the project site, the intersection of 2nd Street and Lindaro Street had four collisions, with most common collision types of rear end and broadside and primary collision factor of unsafe speed. The intersection of 3rd Street and Hetherton Street had the most collisions over the three year period: a total of 12 collisions, 5 of which involved pedestrians or cyclists, and 1 of which involved a pedestrian fatality.

TABLE 9: COLLISION HISTORY AT STUDY INTERSECTIONS

Intersection	Number of Collisions					Most Common Collision Type	Most Common Primary Collision Factor (PCF)[2]	Collision Rate[3]
	3-Year Total[1]	Average Per Year	Total Injury Collisions	Total Fatal Collisions	Total Involving Peds or Bicyclists			
1. Mission Avenue and Lincoln Avenue	11	3.67	11		3	Head-On, Other	Traffic Signals and Signs	0.39
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street	3	1.00	3			Broadside	Traffic Signals and Signs	0.11
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street	10	3.33	10			Broadside	Traffic Signals and Signs	0.31
4. 5th Avenue and Lincoln Avenue	9	3.00	9		2	Various	Automobile Right of Way	0.47
5. 5th Avenue and Hetherton Street	5	1.67	5		1	Broadside	Traffic Signals and Signs	0.23
6. 5th Avenue and Irwin Street	3	1.00	3		1	Broadside	Various	0.13
7. 4th Street and Lincoln Avenue	6	2.00	6		2	Head-On, Rear End	Unsafe Speed, Pedestrian Right of Way	0.33
8. 4th Street and Tamalpais Avenue West	2	0.67	2		2	Vehicle/ Pedestrian, Other	Improper Turning, Pedestrian Right of Way	0.21
9. 4th Street and Hetherton Street	6	2.00	6		2	Head-On, Vehicle/ Pedestrian	Traffic Signals and Signs, Pedestrian Right of Way	0.27

TABLE 9: COLLISION HISTORY AT STUDY INTERSECTIONS

Intersection	Number of Collisions					Most Common Collision Type	Most Common Primary Collision Factor (PCF)[2]	Collision Rate[3]
	3-Year Total[1]	Average Per Year	Total Injury Collisions	Total Fatal Collisions	Total Involving Peds or Bicyclists			
10. 4th Street and Irwin Street	7	2.33	7		5	Vehicle/ Pedestrian	Pedestrian Right of Way	0.29
11. 3rd Street and D Street	0	0.00	0			-	-	-
12. 3rd Street and C Street	2	0.67	2			Broadside	Traffic Signals and Signs	0.08
13. 3rd Street and B Street	7	2.33	7		4	Vehicle/ Pedestrian, Broad-side	Automobile Right of Way	0.28
14. 3rd Street and A Street	3	1.00	3			Rear End	Unsafe Speed	0.12
15. 3rd Street and Brooks Street	1	0.33	1			Rear End	Unsafe Speed	0.05
16. 3rd Street and Lindaro Street	1	0.33	1		1	Vehicle/ Pedestrian	Pedestrian Right of Way	0.04
17. 3rd Street and Lincoln Avenue	11	3.67	11		5	Vehicle/ Pedestrian, Broad-side	Improper Turning, Pedestrian Right of Way	0.37
18. 3rd Street and Tamalpais Avenue West	8	2.67	8		5	Vehicle/ Pedestrian	Pedestrian Right of Way	0.32
19. 3rd Street and Hetherton Street	12	4.00	11	1	5	Vehicle/ Pedestrian, Broad-side	Traffic Signals and Signs	0.34
20. 3rd Street and Irwin Street	1	0.33	1			Head-On	Unsafe Speed	0.03
21. 2nd Street and D Street	6	2.00	6		2	Broadside	Traffic Signals and Signs, Unsafe Speed	0.21
22. 2nd Street and C Street	3	1.00	3			Various	Traffic Signals and Signs, Unsafe Speed	0.11
23. 2nd Street and B Street	1	0.33	1		1	Vehicle/ Pedestrian	Pedestrian Violation	0.03
24. 2nd Street and A Street	8	2.67	8		4	Broadside	Traffic Signals and Signs	0.25
25. 2nd Street and Brooks Street	1	0.33	1			Rear End	Unsafe Speed	0.04
26. 2nd Street and Lindaro Street	4	1.33	4			Rear End, Broadside	Unsafe Speed	0.12

TABLE 9: COLLISION HISTORY AT STUDY INTERSECTIONS

Intersection	Number of Collisions					Most Common Collision Type	Most Common Primary Collision Factor (PCF)[2]	Collision Rate[3]
	3-Year Total[1]	Average Per Year	Total Injury Collisions	Total Fatal Collisions	Total Involving Peds or Bicyclists			
27. 2nd Street and Lincoln Avenue	11	3.67	11		1	Broadside	Traffic Signals and Signs	0.32
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	6	2.00	5	1	1	Other	Improper Turning, Traffic Signals and Signs	0.16
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	5	1.67	5		1	Sideswipe	Traffic Signals and Signs	0.12
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	12	4.00	12		7	Vehicle/ Pedestrian	Pedestrian Right of Way	0.26
31. Andersen Drive and Lindaro Street	2	0.67	2		1	Vehicle/ Pedestrian, Side-swipe	Pedestrian Right of Way	0.13
32. Tamalpais Avenue West and Mission Avenue	0	0.00				-	Pedestrian Right of Way, Automobile Right of Way	-
33. Tamalpais Avenue West and 5th Avenue	2	0.67	2		1	Vehicle/ Pedestrian, Broad-side	-	0.21
34. Tamalpais Avenue East and Mission Avenue	1	0.33	1		1	Vehicle/ Pedestrian	Pedestrian Right of Way	0.08
35. Tamalpais Avenue East and 5th Avenue	0	0.00				-	-	-
36. Tamalpais Avenue East and 4th Stree[3]	2	0.67	2		2	Vehicle/ Pedestrian, Other	Improper Turning, Pedestrian Right of Way	0.21

Notes:
1. Total number of collisions from January 1, 2015 through December 31, 2017.
2. "Pedestrian Right of Way" indicates failure to yield to pedestrian, "Automobile Right of Way" indicates failure to yield to vehicle.
3. The collision rate is expressed as accidents per million vehicles entering the intersection.

Source: Table produced by Fehr & Peers (2018), data from Statewide Integrated Traffic Records System (SWITRS) through Transportation Injury Mapping System

Baseline Conditions

The Baseline scenario includes plus traffic volume estimates for approved, but not yet constructed, developments; traffic increases due to regional growth expected prior to the proposed project opening; and approved/funded transportation system improvements expected to be in place when the project opens.

The projects included in this scenario are:

- Seagate apartments, 703 3rd Street
- Senior assisted housing, 1203 Lincoln Avenue
- Addition of a leading pedestrian interval to the intersection of 3rd Street and Tamalpais Avenue West
- SMART train extension to Larkspur

Figure 6 and Figure 7 display the existing peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively.

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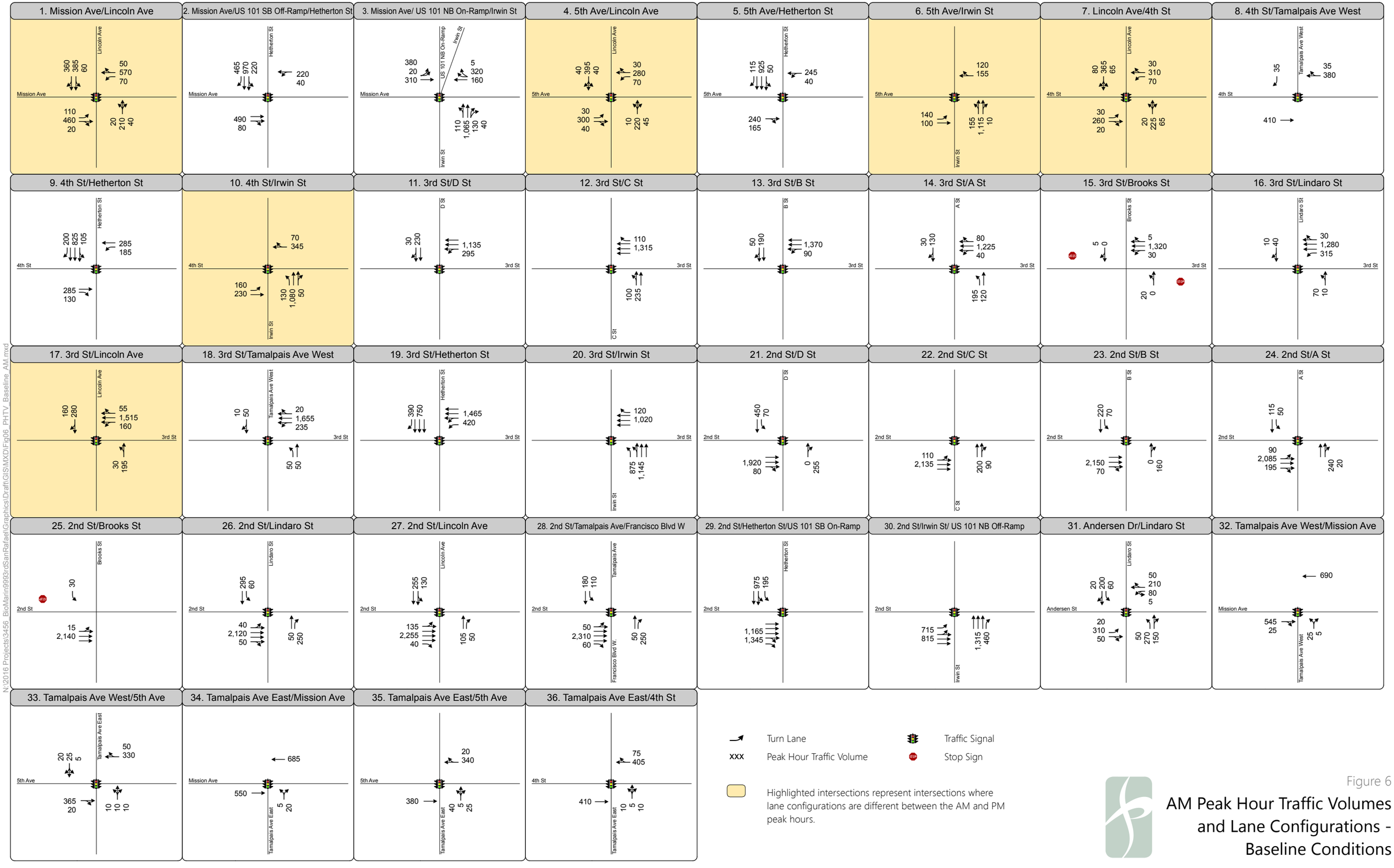

Figure 6

AM Peak Hour Traffic Volumes and Lane Configurations - Baseline Conditions

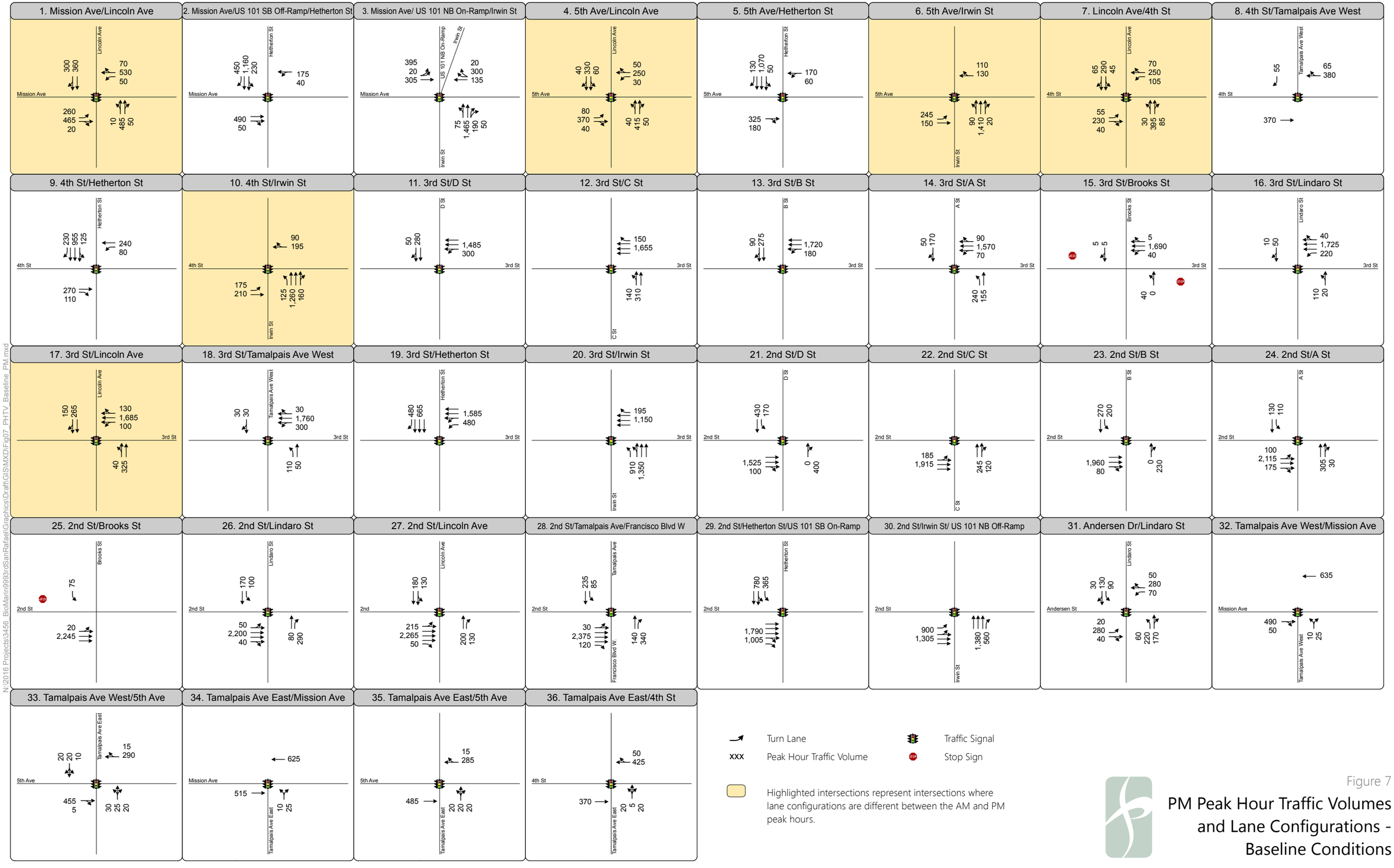

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Figure 7

PM Peak Hour Traffic Volumes and Lane Configurations - Baseline Conditions

Intersection Operations

Table 10 summarizes the existing levels of service (LOS) at the study intersections. All intersections operate acceptably. Appendix B presents all LOS calculations.

TABLE 10: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – BASELINE CONDITIONS

Intersection	Control Type	LOS / Average Delay [1, 2]	
		AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 25.8	D / 43.3
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	D / 42.7	C / 26.9
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 25.6	C / 26.1
4. 5th Avenue and Lincoln Avenue	Signal	B / 16.0	A / 9.4
5. 5th Avenue and Hetherton Street[3]	Signal	A / 7.5	A / 8.9
6. 5th Avenue and Irwin Street	Signal	D / 41.0	C / 30.7
7. 4th Street and Lincoln Avenue	Signal	B / 19.2	C / 20.5
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 6.7	A / 4.5
9. 4th Street and Hetherton Street[3]	Signal	A / 9.7	A / 9.7
10. 4th Street and Irwin Street	Signal	D / 39.9	C / 30.0
11. 3rd Street and D Street	Signal	C / 27.5	C / 30.7
12. 3rd Street and C Street	Signal	C / 25.4	C / 29.6
13. 3rd Street and B Street	Signal	C / 26.7	C / 34.4
14. 3rd Street and A Street	Signal	C / 27.1	C / 31.5
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.9 (14.4)	A (B) / 2.0 (11.4)
16. 3rd Street and Lindaro Street	Signal	A / 5.9	B / 10.6
17. 3rd Street and Lincoln Avenue	Signal	D / 54.3	C / 31.7
18. 3rd Street and Tamalpais Avenue West[3]	Signal	C / 33.6	D / 47.8
19. 3rd Street and Hetherton Street	Signal	C / 32.5	D / 38.3
20. 3rd Street and Irwin Street	Signal	C / 28.9	C / 32.5
21. 2nd Street and D Street	Signal	A / 3.4	A / 3.4
22. 2nd Street and C Street	Signal	D / 42.9	D / 39.6
23. 2nd Street and B Street	Signal	A / 2.3	A / 3.0
24. 2nd Street and A Street	Signal	D / 41.6	D / 37.5
25. 2nd Street and Brooks Street	SSSC	A (B) / 2.8 (12.9)	A (D) / 3.4 (26.0)

TABLE 10: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – BASELINE CONDITIONS			
Intersection	**Control Type**	**LOS / Average Delay [1, 2]**	
		AM	**PM**
26. 2nd Street and Lindaro Street	Signal	B / 13.9	B / 15.7
27. 2nd Street and Lincoln Avenue	Signal	D / 48.3	D / 41.0
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	C / 29.2	C / 32.0
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	E / 73.6	C / 32.3
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	C / 29.7	D / 49.5
31. Andersen Drive and Lindaro Street	Signal	C / 24.5	C / 22.7
32. Tamalpais Avenue West and Mission Avenue[3]	Signal	C / 25.2	B / 13.4
33. Tamalpais Avenue West and 5th Avenue[3]	Signal	A / 6.8	A / 7.6
34. Tamalpais Avenue East and Mission Avenue[3]	Signal	E / 65.8	C / 26.3
35. Tamalpais Avenue East and 5th Avenue[3]	Signal	A / 6.5	A / 4.9
36. Tamalpais Avenue East and 4th Street[3]	Signal	B / 14.1	B / 11.8

Notes:
1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 18, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2019

Arterial Operations

Table 11 summarizes the baseline levels of service on the arterials in the analysis area. All operate acceptably except for 3rd Street and 2nd Street which both operate unacceptably during the AM and PM peak hours. Appendix B includes arterial LOS calculations.

TABLE 11: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – BASELINE CONDITIONS			
Arterial	**Standard**	**LOS / Average Speed [1]**	
		AM	**PM**
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	E / 7	E / 9
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 3	F / 5
3. 3rd Street WB from Hetherton Street to D Street	D	**E / 9**	**E / 8**
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 7**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 6	E / 8
6. Irwin Street NB from 2nd Street to Mission Avenue	F	E / 9	D / 10

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Freeway Operations

Figure 8 presents baseline conditions freeway volumes, and Table 12 summarizes the freeway segment density and LOS results. Detailed calculations are included in Appendix B. As shown, all segments operate at acceptable levels during the AM and PM peak hours with the exception of the southbound weave segment between the 2nd Street on-ramp and the I-580 EB off-ramp during the AM peak hour.

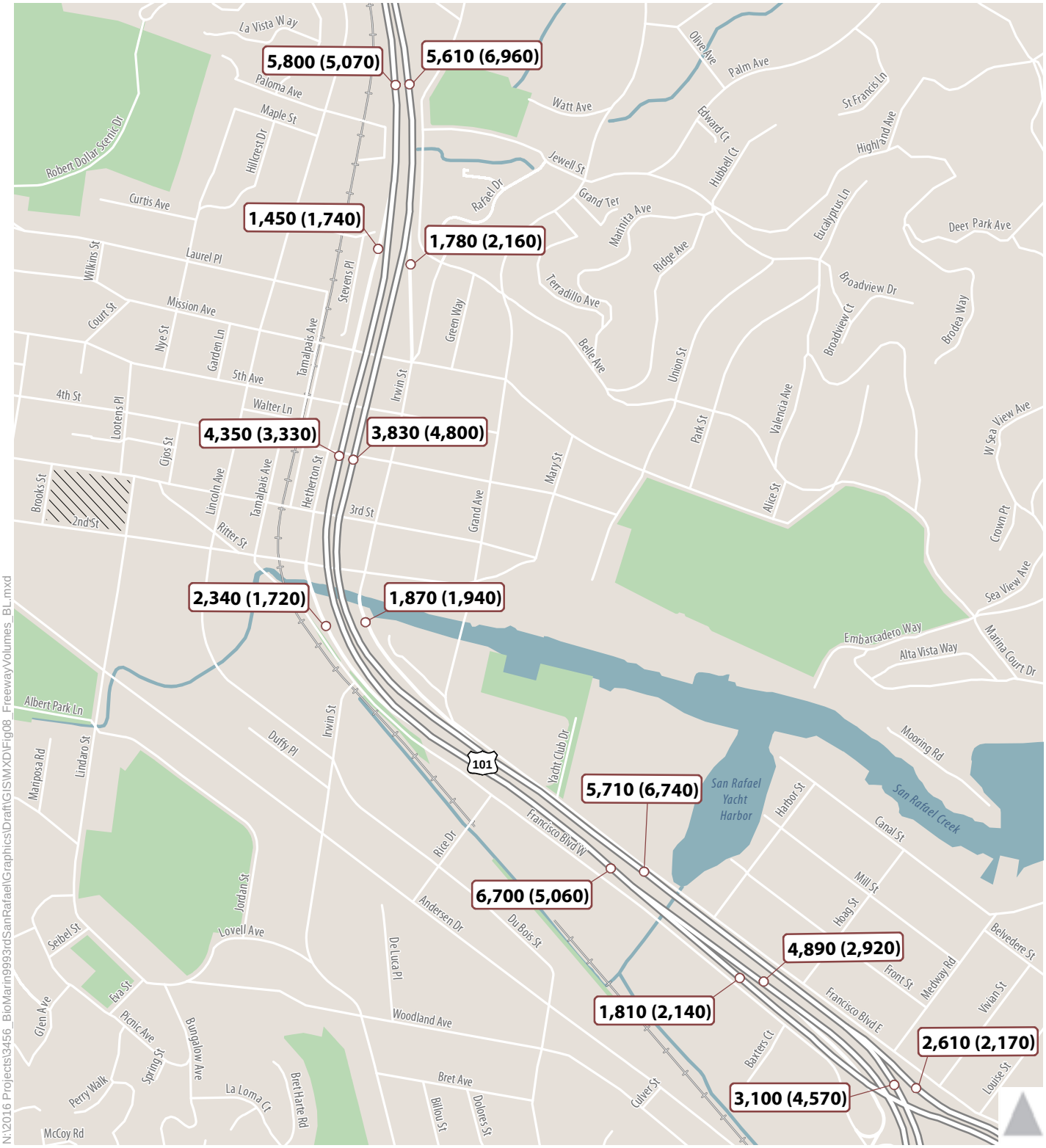
TABLE 12: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – BASELINE CONDITIONS				
Segment	**Segment Type**	**Standard**	**LOS / Density (pc/mi/ln[1])**	
			AM	**PM**
Northbound				
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	E / -[2]
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 23	D / 29
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	D / 27	D / 35
Southbound				
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 38	D / 31
Mission Avenue Off-Ramp	Diverge	E	E / 38	E / 33
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 27	C / 21
2nd Street On-ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]

Notes:
1. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
2. Density not calculated in Leisch methodology.
Source: Fehr & Peers, 2018

Changes in ramp queue lengths compared to existing conditions were also estimated at the northbound 2nd Street and southbound Mission Avenue off-ramps, for information purposes only. Table 13 summarizes these results.

TABLE 13: WEEKDAY PEAK HOUR OFF-RAMP QUEUE LENGTH INCREASE – BASELINE CONDITIONS		
Off-Ramp	**Increased Queue Length (feet)[1]**	
	AM	**PM**
US 101 NB to 2nd Street	150	25
US 101 SB to Mission Avenue	50	50

Notes:
1. Compared to existing conditions
Source: Fehr & Peers, 2018



AM (PM) Freeway Volume

Figure 8

Weekday Peak Hour Freeway Volumes - Baseline Conditions

Project Conditions

This chapter discusses trip generation and trip distribution of the proposed project.

Trip Generation

BioMarin R&D Facility

Current accepted trip generation methodologies, such as applying trip rates from the Institute of Transportation Engineers' (ITE) Trip Generation, are based on data collected at suburban, single-use, freestanding sites where virtually all of the trips are made by auto. These defining suburban characteristics limit the trip rate applicability to mixed-use projects and/or projects located in walkable districts with high levels of transit service that would have travel characteristics that are different from single-use suburban developments. The project site is both located in a walkable downtown district and proximate to transit, requiring an adjustment to ITE trip rates to reflect the level of transit use, walking, and bicycling that would occur to the project site. ITE recommends that local travel data is preferred if available to account for the unique context of project sites. For this trip generation assessment, trip generation forecasts are shown both based on trip count data at the existing BioMarin San Rafael campus and based on unadjusted ITE trip rates.

Table 14 provides trip generation forecasts based on peak hour driveway count data at the current BioMarin San Rafael campus parking facilities and the number of employees currently working at the campus. Count data was collected on Tuesday, October 24 and Tuesday, November 7, 2018. Schools were in session at the time of the counts, weather conditions were dry, and no unusual traffic conditions were observed. Using the number of employees working at the existing San Rafael campus buildings, peak hour trip rates per employee were calculated.

TABLE 14: TRIP GENERATION RATES FOR PROPOSED BIOMARIN FACILITY (BASED ON BIOMARIN SAN RAFAEL CAMPUS OBSERVATIONS)

Land Use	Units (employees)	Trip Rate			Trips		
		Daily	Peak Hour		Daily	Peak Hour	
			AM	PM		AM	PM
Research and Development Center	550	NA	0.37	0.35	NA	203	191

Note: NA = not available
Source: Fehr & Peers, 2018.

The trip rate calculated based on San Rafael campus driveway counts is lower than that estimated using unadjusted ITE trip rates (Table 15), which is discussed further below.

TABLE 15: TRIP GENERATION RATES FOR PROPOSED BIOMARIN FACILITY (BASED ON ITE)

Land Use	ITE Code	Units (employees)	Trip Rate			Trips		
			Daily	Peak Hour		Daily	Peak Hour	
				AM	PM		AM	PM
Research and Development Center	760	550	3.24	0.44	0.40	1,863	242	219

Source: Fehr & Peers, 2018.

An employee travel survey conducted at the BioMarin San Rafael Campus in March and April 2018 indicates that on a typical day 16 percent of BioMarin employees use modes other than drive alone, including transit, bicycle, telecommute, and walking. These survey results explain why the BioMarin trip rates are lower than unadjusted ITE trip rates.

- In the survey, driving alone represented 84 percent of mode split
- 8 percent of commute trips were made by public transportation
- 4 percent of workers telecommuted on a typical day
- The remainder of commute trips were by carpooling, biking, walking, or drop-off
- Many BioMarin employees have flexible work schedules and can commute outside of peak hours

The trip generation for the new building was calculated based on the number of new employees. The resulting trip generation is summarized below in Table 16. (Because full-day counts were not available, ITE rates were used to calculate daily trips.)

TABLE 16: TRIP GENERATION ESTIMATE FOR BIOMARIN R&D FACILITY																
Land Use	ITE Code	Units (employees)	Trip Rate							Trips						
			Daily	AM Peak Hour			PM Peak Hour			Daily	AM Peak Hour			PM Peak Hour		
				Total	In	Out	Total	In	Out		Total	In	Out	Total	In	Out
Research and Development Center	760	550	3.39	0.37	91%	9%	0.35	9%	91%	1,863	203	185	18	191	17	174
Source: Fehr & Peers, 2018																

Senior Services and Housing

The northwest corner of the project site is proposed for development of a senior center (18,000 GSF) and affordable housing (67 units) for low income seniors. The senior center will include classrooms, meeting spaces, and other senior services. Sixty-six of the apartments will be leased to residents who do not own vehicles, with the restriction made as a requirement of the lease. One apartment will be occupied by the center manager. The senior center will have 12 parking spaces.

Trip generation levels were determined using the ITE *Trip Generation Manual, 10th Edition* based on the land use for the senior center and housing, then applied trip reduction percentages based on characteristics of the project and surrounding area. The results of this analysis are summarized in Table 17 and explained below.

TABLE 17: TRIP GENERATION ESTIMATE FOR SENIOR CENTER AND HOUSING																
Land Use	ITE Code	Qty[1]	Trip Rate							Trips						
			Daily	AM Peak Hour			PM Peak Hour			Daily	AM Peak Hour			PM Peak Hour		
				Total	In	Out	Total	In	Out		Total	In	Out	Total	In	Out
Recreational Community Center	495	18 KSF	28.82	1.76	66%	34%	2.31	47%	53%	519	32	21	11	42	20	22
Senior Adult Housing – Attached	252	66 DU	3.64	0.20	35%	65%	0.27	55%	45%	240	13	5	8	18	10	8
Apartment	220	1 DU	6.95	0.49	23%	77%	0.62	63%	37%	7	0	0	0	1	1	0
Total Trips (before reduction)										766	45	26	19	61	31	30
Reduction			-23%	-26%			-26%			-176	-12	-7	-5	-16	-8	-8
Total Net External Vehicle Trips (after reduction)										590	33	19	14	32	16	16
Notes: [1]KSF = thousand square feet, DU = dwelling units Source: Fehr & Peers, 2018																

MXD Trip Reduction Methodology

The MXD trip reduction methodology was used to estimate the reduction in trips from standard ITE rates. The MXD model was developed through collaboration between consultants, the U.S. EPA, and an academic research team. Travel survey data was gathered from 239 mixed-use developments (MXDs) in six major metropolitan regions, and correlated with characteristics of the sites and their surroundings. The findings indicate that the amount of external traffic generated is affected by a wide variety of factors including the mix of employment and residents, the overall size and density of the development, the internal connectivity for walking or driving among land uses, the availability of transit service, and the surrounding trip destinations within the immediate area outside the project site. These characteristics were related statistically to trip behavior observed at the study development sites using statistical techniques. These statistical relationships produced equations, known as the EPA MXD model that allows predicting external vehicle trip reduction as a function of the MXD characteristics. Applying external vehicle trip reduction percentage to "raw trips," as predicted by ITE, produces an estimate for the number of vehicle trips traveling in or out of the site.

The MXD model adjusts trip generation rates to account for the influence of built environment variables such as

- the size of the mixed use analysis area,
- the number of intersections within the mixed use analysis area,
- the distance to transit,
- employment within a 30 minute transit trip,
- employment within one mile,
- average household size near the site, and
- average number of vehicles per household near the site.

A variety of research studies have demonstrated that these variables influence vehicle trip generation.

MXD+, Fehr & Peers' implementation of the MXD methodology, was applied to determine the reduction in automobile trips from the proposed senior center and senior housing facility because of its location in a downtown, mixed-use environment. The MXD+ analysis incorporates data from the EPA Smart Location database, the US Census American Community Survey, and the Metropolitan Transportation Commission travel model to estimate the number of trips to and from destinations outside of the analysis area via walking, biking, and transit.

To be conservative, walking, biking, and transit trips were reduced by 30%. Such factors as the income of senior center staff, which may necessitate increased driving for affordable housing, and potentially reduced mobility of senior center residents, which may reduce walking and biking trips, support this reduction. These results are summarized in Table 18.

TABLE 18: MXD TRIP REDUCTION SUMMARY		
Category	**Daily**	**Peak Hour**
Walking, biking, and transit	33%	37%
Additional project factors	-10%	-11%
Total trip reduction	**23%**	**26%**
Source: Fehr & Peers, 2018.		

These conclusions are also supported by an analysis done for an earlier version of this project. The senior center and senior housing project is an updated version of the Whistlestop project evaluated in 2014, which was also located in downtown San Rafael. W-Trans letter "Focused Traffic Analysis for the Whistlestop Project," dated July 8, 2014, identified several factors likely to reduce overall vehicle trips for the senior center and senior housing:

- The "Focused Traffic Analysis" documented existing mode shares for the current Whistlestop Senior Center located at 930 Tamalpais Avenue, adjacent to the Bettini Transit Center (Table 6 of that document). Forty percent of visitors arrived by walking, biking, or transit. Some residents of the on-site senior housing will also use the senior center. However, the 2014 analysis did not account for the trips generated by senior center staff. Additionally, the current project location is farther from Bettini Transit Center than the 2014 location, which was next to the transit center. Thus, the reductions shown in Table 19 are appropriate for this project.

TABLE 19: MODE SHARE FOR SENIOR CENTER VISITORS	
Mode	**Share**
Transit	24%
Paratransit	10%
Walking	6%
Private vehicle	60%
Total vehicle trip reduction	**40%**
Source: W-Trans, 2014.	

- The "Focused Traffic Analysis" estimated trip reduction considering that the housing will be occupied by low-income seniors and automobile ownership will be prohibited by lease requirements. However, some amount of traffic associated with visitors including family, friends, aides, and deliveries is still expected. The reductions shown in Table 17 are reasonable for these conditions.

Trip Generation Summary

Table 20 summarizes the total vehicle trip generation for the project, including both the BioMarin facility and the senior center and housing.

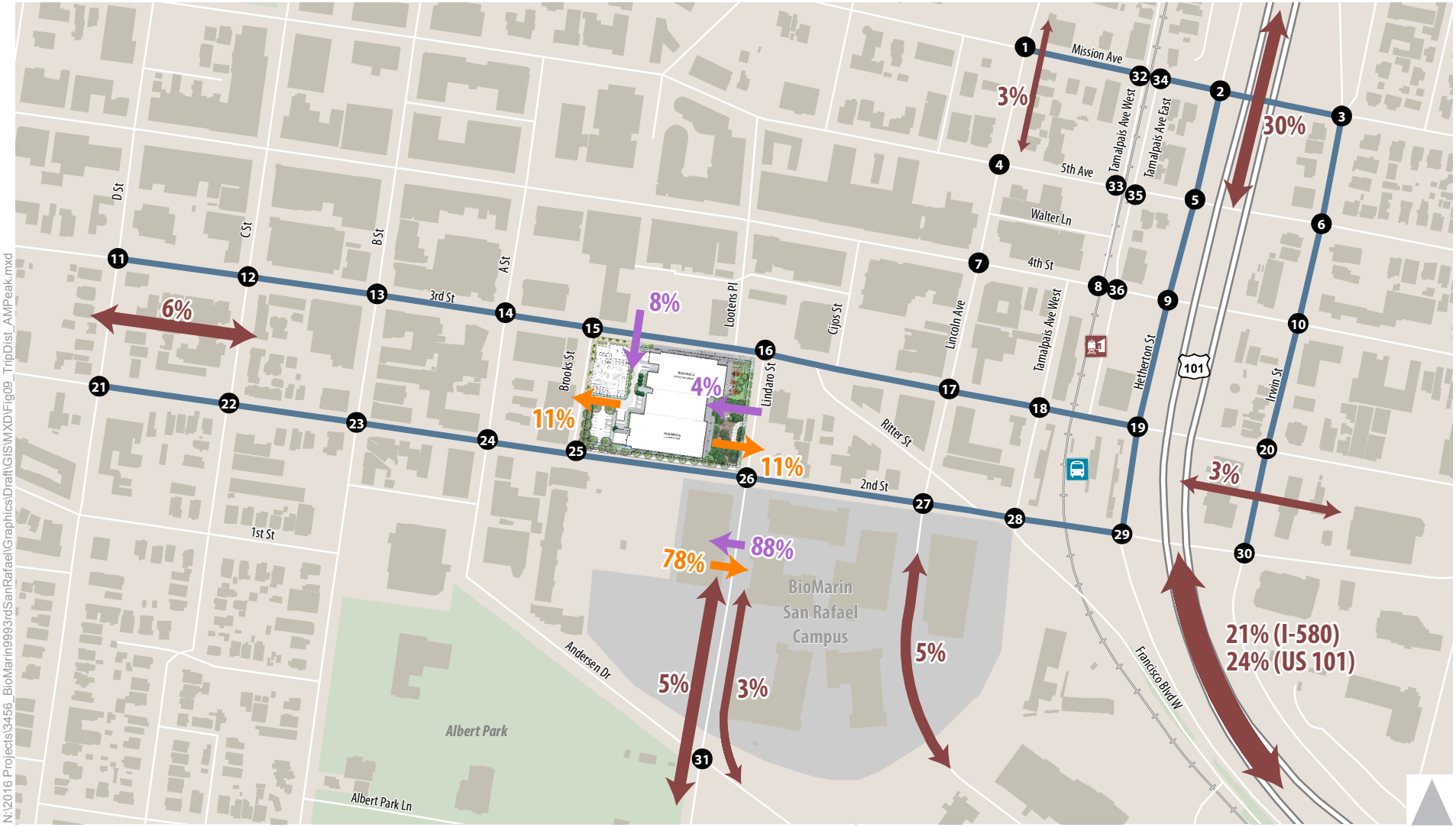
TABLE 20: TOTAL VEHICLE TRIP GENERATION SUMMARY

	Daily	AM Peak Hour			PM Peak Hour		
		Total	Enter	Exit	Total	Enter	Exit
BioMarin facility (daily from Table 15, peak hour from Table 16)	1,863	203	185	18	191	17	174
Senior center and housing (from Table 17)	590	33	19	14	45	23	22
Total	2,453	236	204	32	236	40	196

Source: Fehr & Peers, 2018

Trip Distribution

The project trip distribution shown below is based on zip codes of current BioMarin San Rafael campus employees. Vehicle trips from the proposed project were assigned through the study intersections to study area gateways as shown in Figure 9 and Figure 10. Because parking at the project site is limited (29 spaces), most BioMarin employees will use the BioMarin garage at 775 Lindaro Street. All Senior Center visitors and employees will use the Brooks Street driveways, as shown in Figure 11.



Study Intersection
Train Station
Transit Center
Study Segments
Rail
Building Footprint
Park Boundary
x% Trip Distribution
x% Inbound Trip Distribution
x% Outbound Trip Distribution

Figure 9

Trip Distribution (R & D Only) - AM Peak Hour

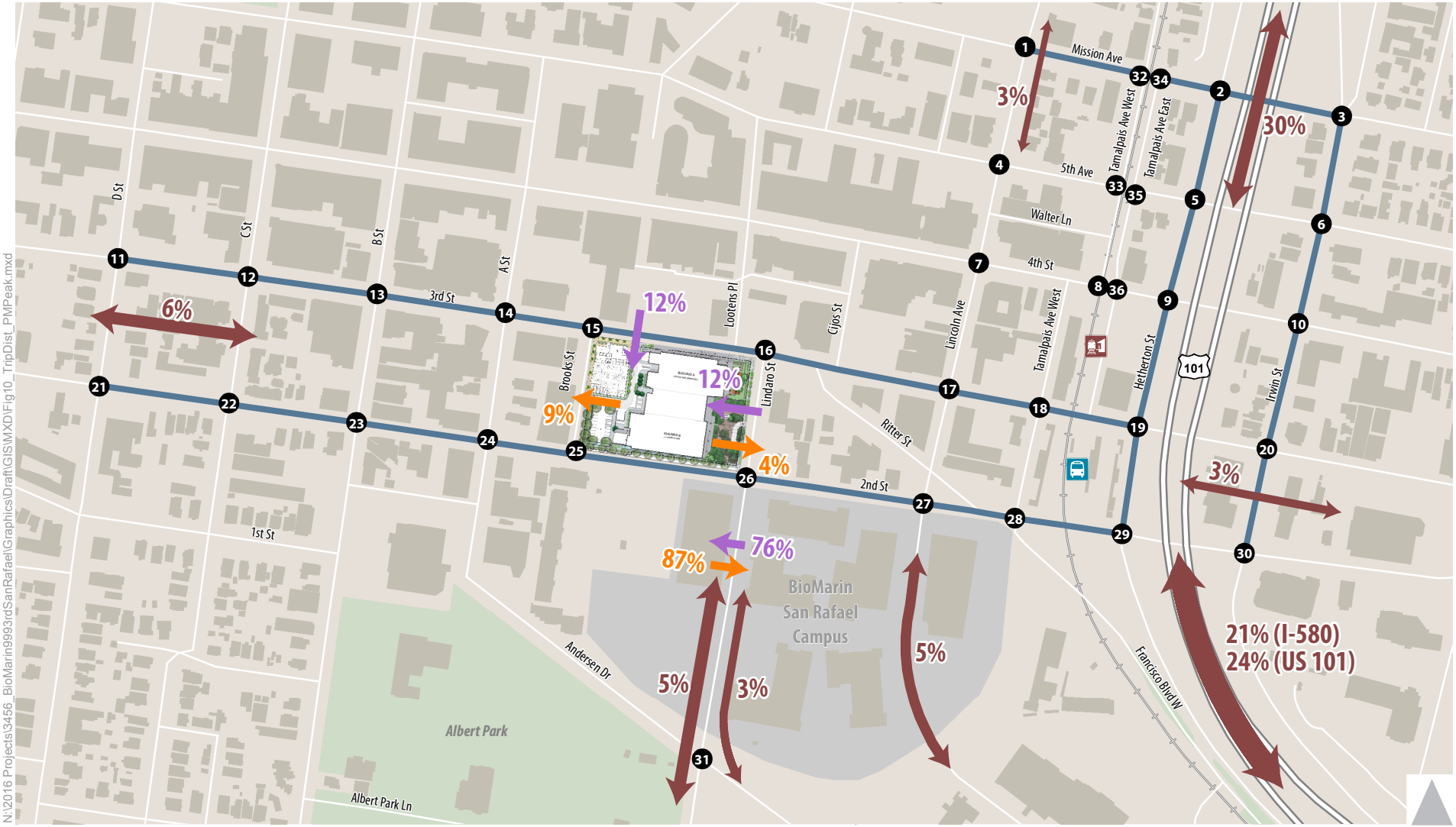


Figure 10

Trip Distribution (R & D Only) - PM Peak Hour

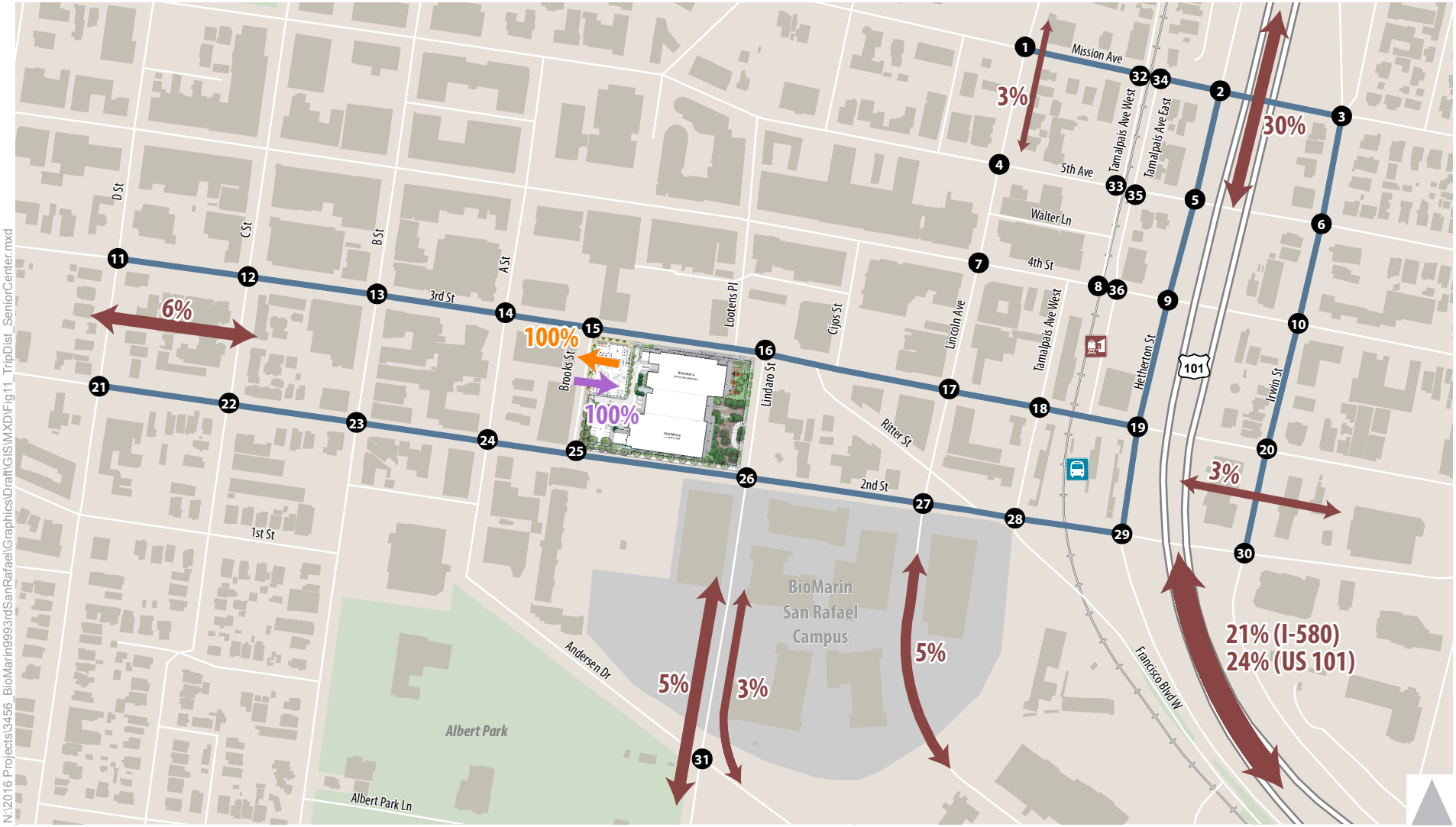


Figure 11

Trip Distribution (Senior Center and Housing)

Project Pedestrian Crossings

The BioMarin R&D facility and senior services and housing would generate a total of 215 new pedestrian trips during the AM peak hour and 213 new pedestrian trips during the PM peak hour. These trips would be most concentrated at intersections adjacent to the project site. The following factors were considered in assigning pedestrian trips to existing pedestrian crossings at intersections:

- Trips between the R&D facility and the Lindaro Street garage
- Trips between the R&D facility and the existing BioMarin San Rafael campus buildings
- Trips between the R&D facility and the San Rafael SMART station and transit center
- Trips between the R&D facility and other destinations (including residences and downtown)
- Trips between the senior service and housing and the San Rafael SMART station and transit center
- Trips between the senior service and housing and other destinations (including residences, shopping, and downtown)

These added project pedestrian crossings are summarized in Table 21. Most peak hour pedestrian trips generated by the project are employees that would travel to and from the Lindaro Street Garage. The most direct path for these pedestrians would involve using the crosswalk on the west side of the 2nd Street/Lindaro Street intersection. Some peak hour pedestrian trips would cross 3rd Street to travel to and from the existing parking garage on the north side of 3rd Street as well as businesses along 4th Street. Crossing 3rd Street at Brooks Street is currently prohibited. New project crossings in Table 21 are based on retention of this crossing restriction at 3rd Street and Brooks Street. If the existing barriers and signage were removed and a crosswalk were added on the east leg of the 3rd Street/Brooks Street intersection, most of the 4 crossings in the AM peak hour, 5 crossings in the PM peak hour, and 53 total daily crossings generated by the project would shift to this crosswalk from the south leg crosswalk.

TABLE 21: NEW PEDESTRIAN CROSSINGS		
Leg	**New Weekday Project Pedestrian Crossings**	
	AM Peak Hour	**PM Peak Hour**
15. 3rd Street and Brooks Street		
North		
South	4	5
16. 3rd Street and Lindaro Street		
East	5	5
North	5	5
South	23	26
25. 2nd Street and Brooks Street		
West		
East		
North	2	2
26. 2nd Street and Lindaro Street		
West	181	168
East	4	3
North	9	8
South	5	3
Source: Fehr & Peers, 2018.		

Baseline Plus Project Conditions (R&D Only)

The Baseline Plus Project (R&D Only) scenario includes baseline transportation conditions plus trips generated from the new R&D buildings. It does not include trips generated by the senior services and housing building.

Figure 12 and Figure 13 display the peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively.

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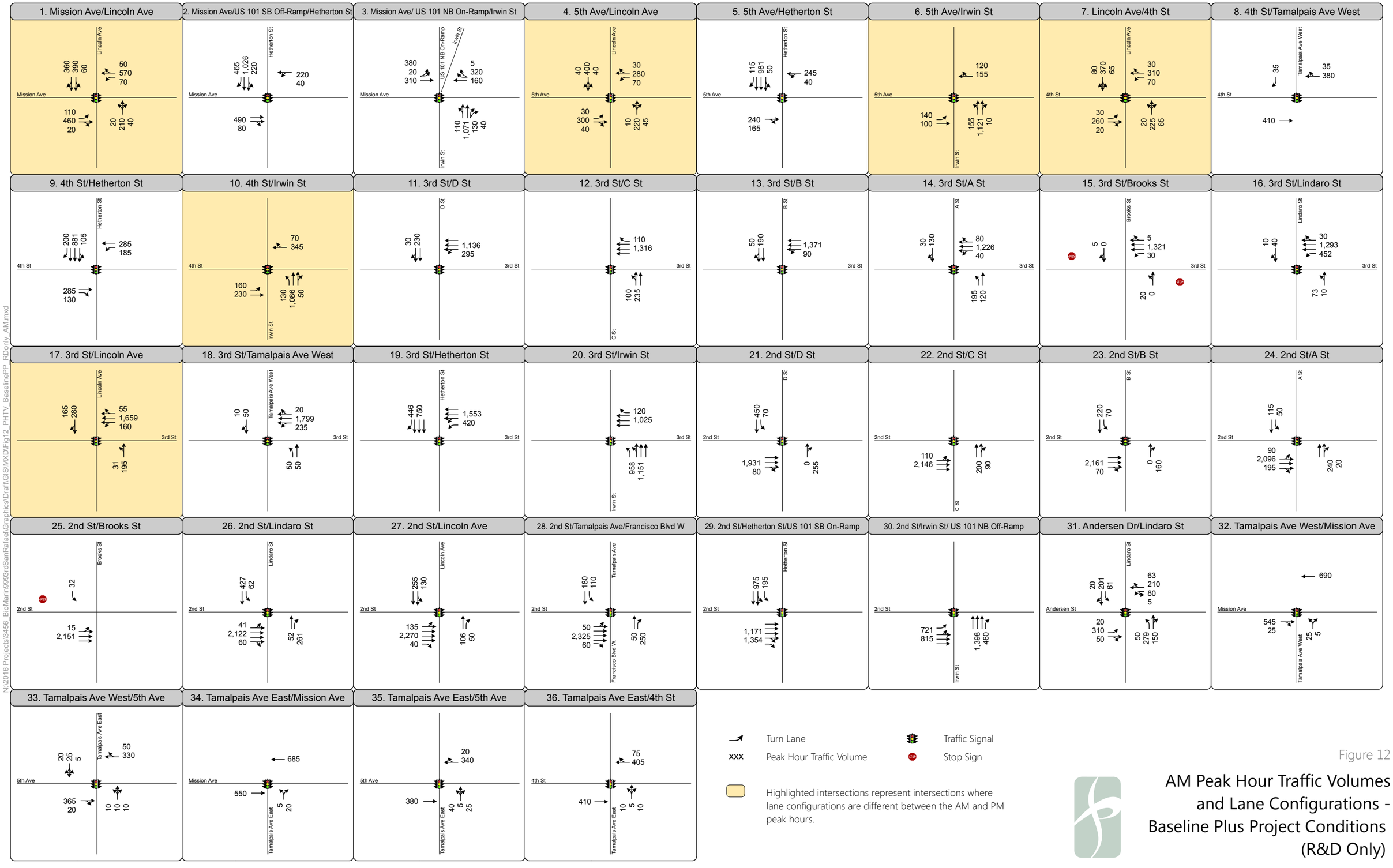

Figure 12

AM Peak Hour Traffic Volumes and Lane Configurations - Baseline Plus Project Conditions (R&D Only)

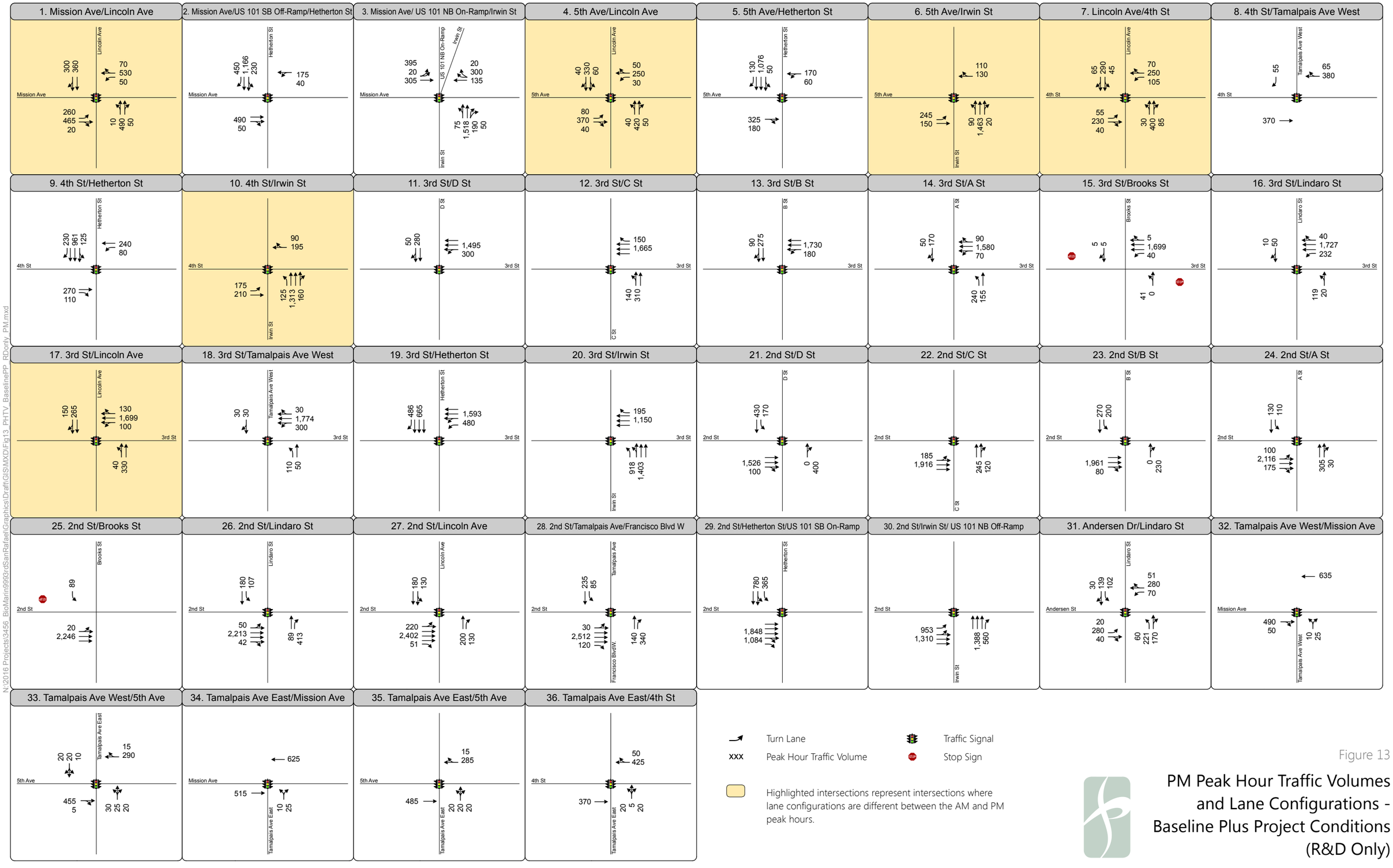

Figure 13

PM Peak Hour Traffic Volumes and Lane Configurations - Baseline Plus Project Conditions (R&D Only)

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Intersection Operations

Table 22 summarizes baseline plus project (R& D only) levels of service (LOS) at the study intersections. All intersections operate acceptably. Appendix C presents all LOS calculations.

TABLE 22: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)

Intersection	Control Type	Baseline LOS / Average Delay [1, 2]		Baseline Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 25.8	D / 43.3	C / 25.8	D / 43.2
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	D / 42.7	C / 26.9	D / 48.2	C / 27.4
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 25.6	C / 26.1	C / 25.5	C / 26.6
4. 5th Avenue and Lincoln Avenue	Signal	B / 16.0	A / 9.4	B / 16.0	A / 9.5
5. 5th Avenue and Hetherton Street[3]	Signal	A / 7.5	A / 8.9	A / 7.3	A / 8.9
6. 5th Avenue and Irwin Street	Signal	D / 41.0	C / 30.7	D / 41.3	C / 31.7
7. 4th Street and Lincoln Avenue	Signal	B / 19.2	C / 20.5	B / 19.1	C / 20.6
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 6.7	A / 4.5	A / 6.7	A / 4.5
9. 4th Street and Hetherton Street[3]	Signal	A / 9.7	A / 9.7	A / 9.6	A / 9.7
10. 4th Street and Irwin Street	Signal	D / 39.9	C / 30.0	D / 39.7	C / 30.2
11. 3rd Street and D Street	Signal	C / 27.5	C / 30.7	C / 27.5	C / 30.8
12. 3rd Street and C Street	Signal	C / 25.4	C / 29.6	C / 25.4	C / 29.7
13. 3rd Street and B Street	Signal	C / 26.7	C / 34.4	C / 26.7	C / 34.6
14. 3rd Street and A Street	Signal	C / 27.1	C / 31.5	C / 27.1	C / 31.6
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.9 (14.4)	A (B) / 2.0 (11.4)	A (B) / 2.7 (14.5)	A (B) / 2.6 (12.4)
16. 3rd Street and Lindaro Street	Signal	A / 5.9	B / 10.6	B / 13.3	B / 11.2
17. 3rd Street and Lincoln Avenue	Signal	D / 54.3	C / 31.7	E / 57.8	C / 31.9
18. 3rd Street and Tamalpais Avenue West [3]	Signal	C / 33.6	D / 47.8	D / 51.2	D / 49.9
19. 3rd Street and Hetherton Street	Signal	C / 32.5	D / 38.3	D /38.3	D / 38.9
20. 3rd Street and Irwin Street	Signal	C / 28.9	C / 32.5	C / 29.6	C / 33.5
21. 2nd Street and D Street	Signal	A / 3.4	A / 3.4	A / 3.4	A / 3.4
22. 2nd Street and C Street	Signal	D / 42.9	D / 39.6	D / 43.6	D / 39.6
23. 2nd Street and B Street	Signal	A / 2.3	A / 3.0	A / 2.3	A / 3.0

TABLE 22: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)

Intersection	Control Type	Baseline LOS / Average Delay [1, 2]		Baseline Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
24. 2nd Street and A Street	Signal	D / 41.6	D / 37.5	D / 42.1	D / 37.6
25. 2nd Street and Brooks Street	SSSC	A (B) / 2.8 (12.9)	A (D) / 3.4 (26.0)	A (C) / 2.8 (15.6)	A (D) / 4.0 (31.7)
26. 2nd Street and Lindaro Street	Signal	B / 13.9	B / 15.7	B / 16.4	B / 17.9
27. 2nd Street and Lincoln Avenue	Signal	D / 48.3	D / 41.0	D / 49.3	D / 48.9
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	C / 29.2	C / 32.0	C / 29.4	D / 36.4
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	E / 73.6	C / 32.3	E / 75.1	C / 32.6
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	C / 29.7	D / 49.5	C / 31.9	D / 50.6
31. Andersen Drive and Lindaro Street	Signal	C / 24.5	C / 22.7	C / 24.9	C / 23.0
32. Tamalpais Avenue West and Mission Avenue[3]	Signal	C / 25.2	B / 13.4	C / 25.2	B / 13.4
33. Tamalpais Avenue West and 5th Avenue[3]	Signal	A / 6.8	A / 7.6	A / 6.8	A / 7.5
34. Tamalpais Avenue East and Mission Avenue[3]	Signal	E / 65.8	C / 26.3	E / 65.8	C / 26.3
35. Tamalpais Avenue East and 5th Avenue[3]	Signal	A / 6.5	A / 4.9	A / 6.5	A / 4.9
36. Tamalpais Avenue East and 4th Street[3]	Signal	B / 14.1	B / 11.8	B / 14.0	B / 11.8

Notes:
1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 18, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2019

Arterial Operations

Table 23 summarizes the baseline levels with project (R& D only) levels of service on the arterials in the analysis area. Appendix C includes arterial LOS calculations.

TABLE 23: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)

Arterial	Standard	Baseline LOS / Average Speed [1]		Baseline Plus Project LOS / Average Speed [1]	
		AM	PM	AM	PM
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	E / 7	E / 9	E / 7	E / 9
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 3	F / 5	F / 3	F / 5
3. 3rd Street WB from Hetherton Street to D Street	D	**E / 9**	**E / 8**	**E / 8**	**E / 8**
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 7**	**F / 6**	**F / 6**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 6	E / 8	F / 6	E / 8
6. Irwin Street NB from 2nd Street to Mission Avenue	F	E / 9	D / 10	E / 8	D / 10

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Because the project would worsen operations on congestion management arterials expected to operate unacceptably, volume to capacity increases were calculated for those arterials. These results are reported in Table 24. Based on these results, the increase on 3rd Street in the AM peak hour is unacceptable.

TABLE 24: WEEKDAY PEAK HOUR ARTERIAL VOLUME/CAPACITY – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)

Segment	Baseline		Baseline Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
3. 3rd Street WB from Hetherton Street to D Street	0.773	0.860	0.833	0.866	**0.060**	0.006
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	0.784	0.873	0.789	0.916	0.005	0.043

Notes:
1. **Bold** indicates unacceptable increase.

Source: Fehr & Peers, 2018

Freeway Operations

Figure 14 presents baseline plus project (R&D only) conditions freeway volumes, and Table 25 summarizes the freeway segment density and LOS results. Detailed calculations are included in Appendix C. Addition of project traffic does not create any additional unacceptable operations.

TABLE 25: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)						
Segment	**Segment Type**	**Standard**	**Baseline LOS / Density (pc/mi/ln[1])**		**Baseline Plus Project LOS / Density (pc/mi/ln[1])**	
			AM	**PM**	**AM**	**PM**
Northbound						
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	E / -[2]	D / -[2]	E / -[2]
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 23	D / 29	C / 23	D / 30
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	D / 27	D / 35	D / 27	E / 35
Southbound						
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 38	D / 31	E / 39	D / 31
Mission Avenue Off-Ramp	Diverge	E	E / 38	E / 33	E / 38	E / 33
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 27	C / 21	D / 27	C / 21
2nd Street On-Ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]	**F / -[2]**	E / -[2]

Notes:
1. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
2. Density not calculated in Leisch methodology.

Source: Fehr & Peers, 2018

Volume to capacity was also calculated for the segment with unacceptable operations, as shown in Table 26. Increases due to the project were acceptable (less than 0.01).

TABLE 26: WEEKDAY PEAK HOUR FREEWAY VOLUME/CAPACITY – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)						
Segment	**Baseline**		**Baseline Plus Project**		**Increase**	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
Southbound						
2nd Street On-Ramp to I-580 EB Off-Ramp	1.183	NA[1]	1.185	NA[1]	0.002	NA[1]

Notes:
1. NA, acceptable operations. **Bold** indicates unacceptable increase.

Source: Fehr & Peers, 2018

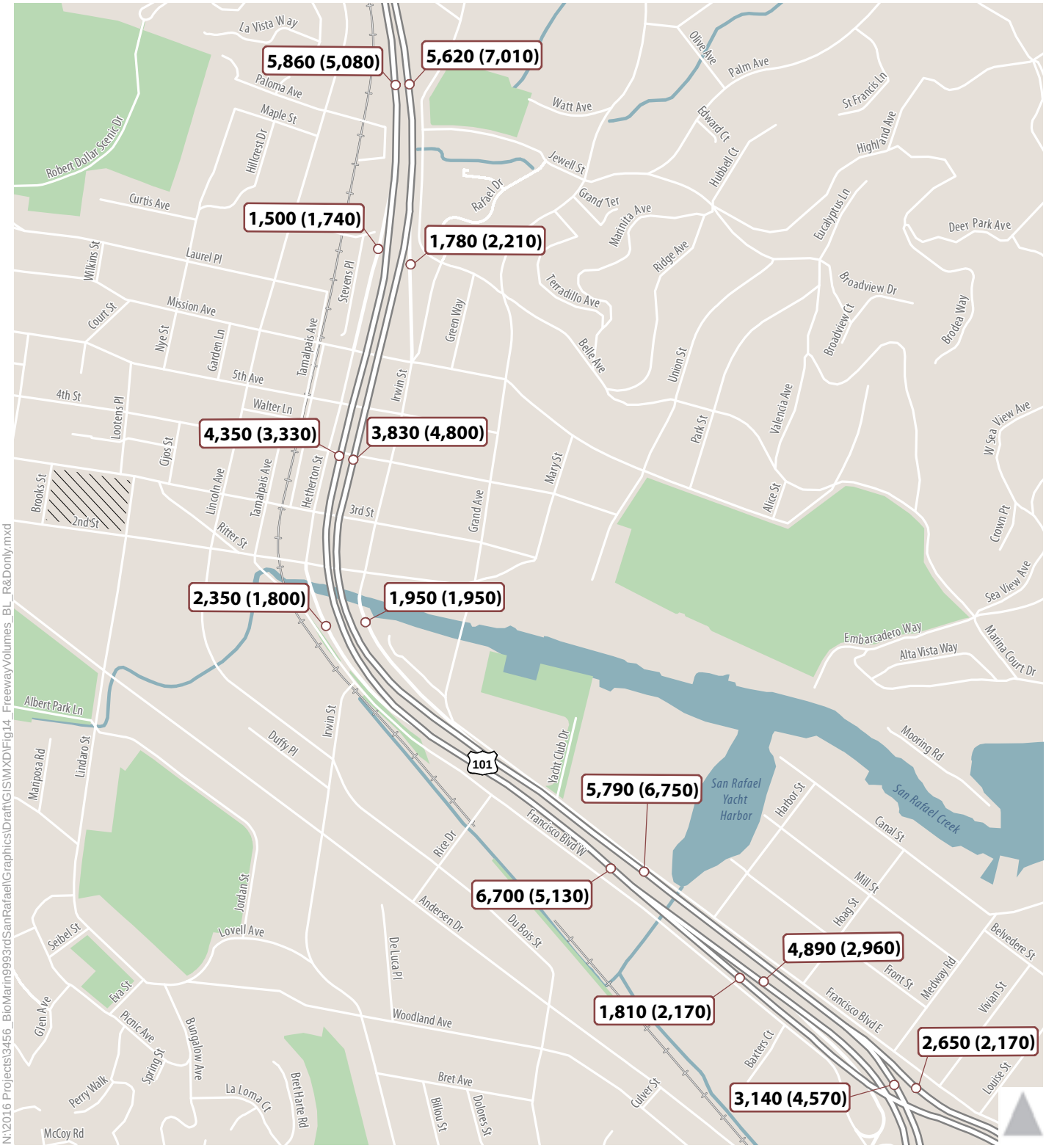
Changes in ramp queue lengths compared to baseline conditions were also estimated at the northbound 2nd Street and southbound Mission Avenue off-ramps, for information purposes only. Table 27 summarizes these results.

TABLE 27: WEEKDAY PEAK HOUR OFF-RAMP QUEUE LENGTH INCREASE – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY)

Off-Ramp	Increased Queue Length (feet)[1]	
	AM	PM
US 101 NB to 2nd Street	0	0
US 101 SB to Mission Avenue	25	0

Notes:
1. Compared to baseline conditions

Source: Fehr & Peers, 2018



AM (PM) Freeway Volume

Figure 14

Weekday Peak Hour Freeway Volumes - Baseline Plus Project Conditions (R&D Only)

Baseline Plus Project Conditions (R&D and Senior Services and Housing)

The Baseline Plus Project (R&D and Senior Services and Housing) scenario includes baseline transportation conditions plus trips generated from the new R&D buildings and the senior services and housing building.

Figure 15 and Figure 16 display the peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively.

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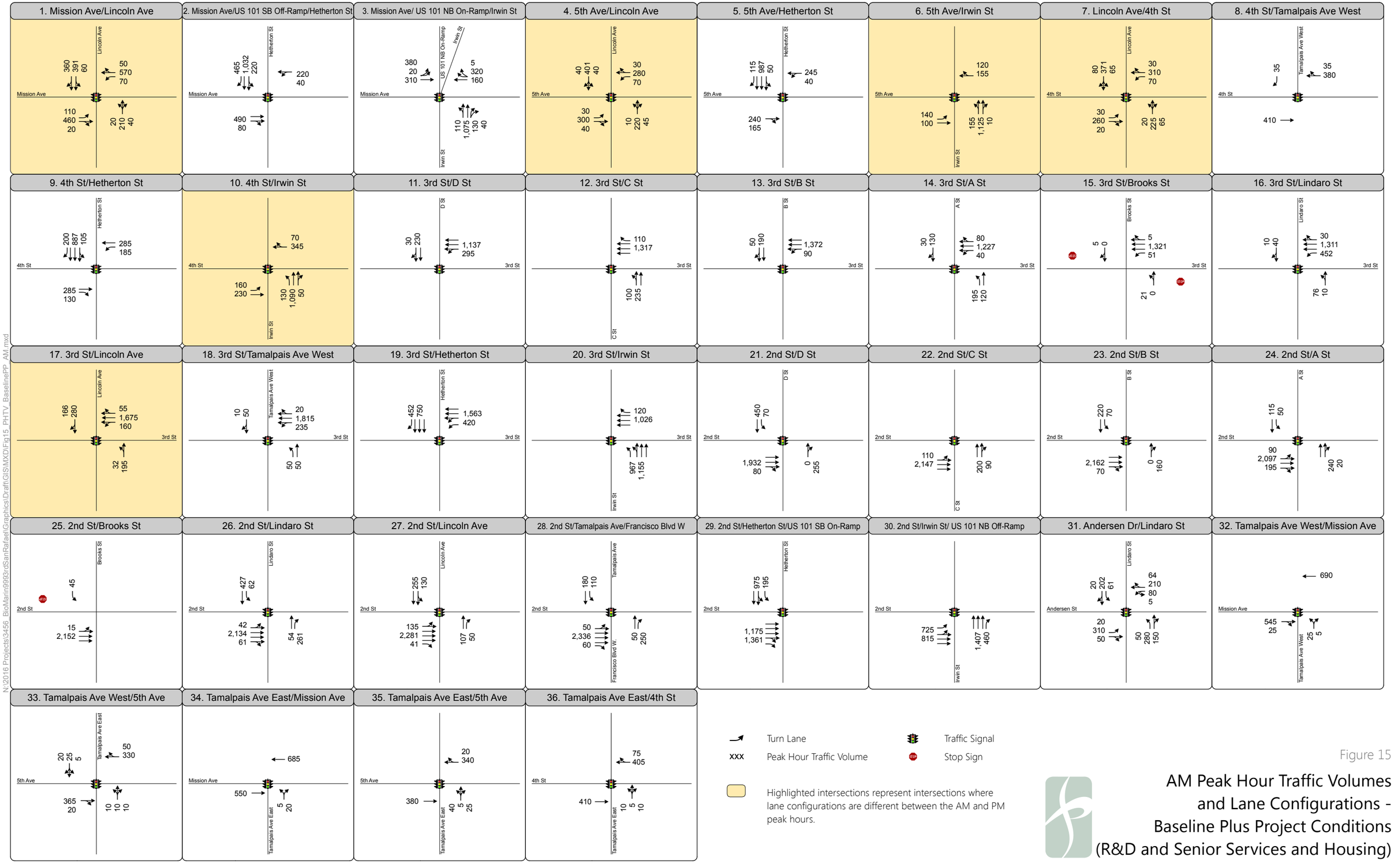


Figure 15

AM Peak Hour Traffic Volumes and Lane Configurations - Baseline Plus Project Conditions (R&D and Senior Services and Housing)

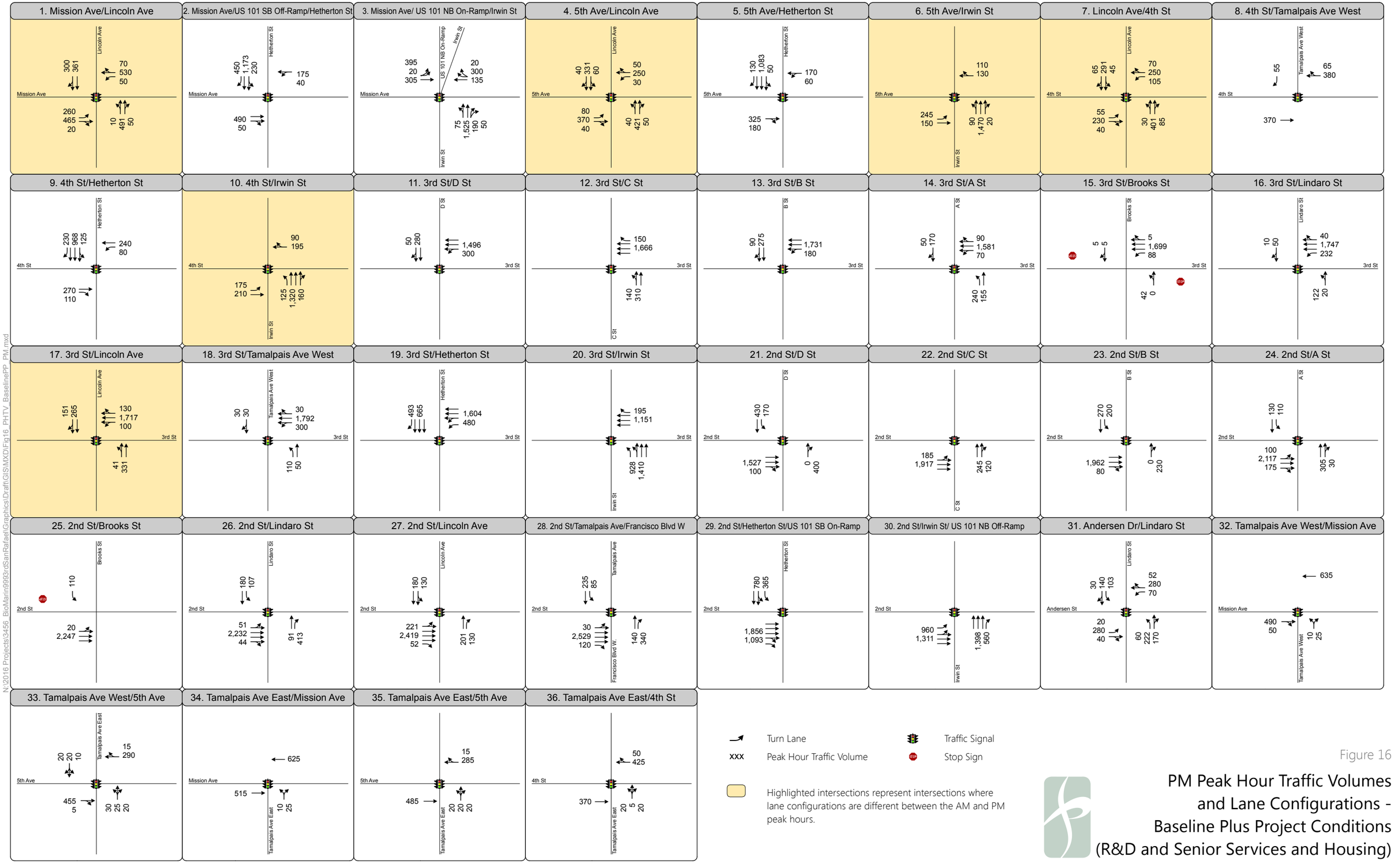


Figure 16

PM Peak Hour Traffic Volumes and Lane Configurations - Baseline Plus Project Conditions (R&D and Senior Services and Housing)

Intersection Operations

Table 28 summarizes baseline plus project (R& D and Senior Services and Housing) levels of service (LOS) at the study intersections. All intersections operate acceptably. Appendix D presents all LOS calculations.

TABLE 28: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Intersection	Control Type	Baseline LOS / Average Delay [1, 2]		Baseline Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 25.8	D / 43.3	C / 25.8	D / 43.2
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	D / 42.7	C / 26.9	D / 49.0	C / 27.8
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 25.6	C / 26.1	C / 25.6	C / 26.7
4. 5th Avenue and Lincoln Avenue	Signal	B / 16.0	A / 9.4	B / 16.0	A / 9.5
5. 5th Avenue and Hetherton Street[3]	Signal	A / 7.5	A / 8.9	A / 7.3	A / 8.9
6. 5th Avenue and Irwin Street	Signal	D / 41.0	C / 30.7	D / 41.6	C / 31.8
7. 4th Street and Lincoln Avenue	Signal	B / 19.2	C / 20.5	B / 19.1	C / 20.6
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 6.7	A / 4.5	A / 6.7	A / 4.5
9. 4th Street and Hetherton Street[3]	Signal	A / 9.7	A / 9.7	A / 9.5	A / 9.7
10. 4th Street and Irwin Street	Signal	D / 39.9	C / 30.0	D / 39.7	C / 30.2
11. 3rd Street and D Street	Signal	C / 27.5	C / 30.7	C / 27.6	C / 30.9
12. 3rd Street and C Street	Signal	C / 25.4	C / 29.6	C / 25.5	C / 29.7
13. 3rd Street and B Street	Signal	C / 26.7	C / 34.4	C / 26.7	C / 34.6
14. 3rd Street and A Street	Signal	C / 27.1	C / 31.5	C / 27.1	C / 31.6
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.9 (14.4)	A (B) / 2.0 (11.4)	A (B) / 2.8 (13.0)	A (B) / 2.9 (13.3)
16. 3rd Street and Lindaro Street	Signal	A / 5.9	B / 10.6	B / 11.1	B / 12.2
17. 3rd Street and Lincoln Avenue	Signal	D / 54.3	C / 31.7	E / 59.1	C / 32.2
18. 3rd Street and Tamalpais Avenue West[3]	Signal	C / 33.6	D / 47.8	D / 53.9	D / 52.5
19. 3rd Street and Hetherton Street	Signal	C / 32.5	D / 38.3	D / 37.9	D / 39.7
20. 3rd Street and Irwin Street	Signal	C / 28.9	C / 32.5	C / 29.7	C / 33.9
21. 2nd Street and D Street	Signal	A / 3.4	A / 3.4	A / 3.4	A / 3.4
22. 2nd Street and C Street	Signal	D / 42.9	D / 39.6	D / 43.7	D / 39.7
23. 2nd Street and B Street	Signal	A / 2.3	A / 3.0	A / 2.3	A / 3.0

TABLE 28: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Intersection	Control Type	Baseline LOS / Average Delay [1, 2]		Baseline Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
24. 2nd Street and A Street	Signal	D / 41.6	D / 37.5	D / 42.1	D / 37.6
25. 2nd Street and Brooks Street	SSSC	A (B) / 2.8 (12.9)	A (D) / 3.4 (26.0)	A (C) / 3.0 (19.9)	A (D) / 3.9 (27.8)
26. 2nd Street and Lindaro Street	Signal	B / 13.9	B / 15.7	B / 16.3	B / 19.8
27. 2nd Street and Lincoln Avenue	Signal	D / 48.3	D / 41.0	D / 50.1	D / 50.2
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	C / 29.2	C / 32.0	C / 29.5	D / 37.1
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	E / 73.6	C / 32.3	E / 76.1	C / 32.7
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	C / 29.7	D / 49.5	C / 32.2	D / 50.9
31. Andersen Drive and Lindaro Street	Signal	C / 24.5	C / 22.7	C / 25.0	C / 23.1
32. Tamalpais Avenue West and Mission Avenue[3]	Signal	C / 25.2	B / 13.4	C / 25.2	B / 13.4
33. Tamalpais Avenue West and 5th Avenue[3]	Signal	A / 6.8	A / 7.6	A / 6.8	A / 7.6
34. Tamalpais Avenue East and Mission Avenue[3]	Signal	E / 65.8	C / 26.3	E / 65.8	C / 26.3
35. Tamalpais Avenue East and 5th Avenue[3]	Signal	A / 6.5	A / 4.9	A / 6.5	A / 4.9
36. Tamalpais Avenue East and 4th Street[3]	Signal	B / 14.1	B / 11.8	B / 14.0	B / 11.8

Notes:
1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 18, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2018

Arterial Operations

Table 29 summarizes the baseline levels with project (R&D and Senior Services and Housing) levels of service on the arterials in the analysis area. 3rd Street LOS would decrease to an unacceptable level during the AM peak hour. Appendix D includes arterial LOS calculations.

TABLE 29: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Arterial	Standard	Baseline LOS / Average Speed [1]		Baseline Plus Project LOS / Average Speed [1]	
		AM	PM	AM	PM
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	E / 7	E / 9	E / 7	E / 9
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 3	F / 5	F / 3	F / 5
3. 3rd Street WB from Hetherton Street to D Street	D	**E / 9**	**E / 8**	**E / 7**	**E / 8**
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 7**	**F / 6**	**F / 5**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 6	E / 8	F / 6	E / 8
6. Irwin Street NB from 2nd Street to Mission Avenue	F	E / 9	D / 10	E / 8	D / 9

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Because the project would worsen operations on congestion management arterials expected to operate unacceptably, volume to capacity increases were calculated for those arterials. These results are reported in Table 30. Based on these results, the increase on 3rd Street in the AM peak hour is unacceptable.

TABLE 30: WEEKDAY PEAK HOUR ARTERIAL VOLUME/CAPACITY – BASELINE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Segment	Baseline		Baseline Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
3. 3rd Street WB from Hetherton Street to D Street	0.773	0.860	0.840	0.874	**0.067**	0.013
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	0.784	0.873	0.793	0.922	0.008	0.048

Notes:
1. **Bold** indicates unacceptable increase.
Source: Fehr & Peers, 2018

Freeway Operations

Figure 17 presents baseline plus project (R&D and Senior Services and Housing) conditions freeway volumes, and Table 31 summarizes the freeway segment density and LOS results. Detailed calculations are included in Appendix D. Addition of project traffic does not create any additional unacceptable operations.

TABLE 31: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – BASELINE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Segment	Segment Type	Standard	Baseline LOS / Density (pc/mi/ln[1])		Baseline Plus Project LOS / Density (pc/mi/ln[1])	
			AM	PM	AM	PM
Northbound						
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	E / -[2]	D / -[2]	E / -[2]
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 23	D / 29	C / 23	D / 30
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	D / 27	D / 35	D / 27	E / 35
Southbound						
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 38	D / 31	E / 39	D / 31
Mission Avenue Off-Ramp	Diverge	E	E / 38	E / 33	E / 38	E / 33
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 27	C / 21	D / 27	C / 21
2nd Street On-ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]	**F / -[2]**	E / -[2]

Notes:
2. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
3. Density not calculated in Leisch methodology.
Source: Fehr & Peers, 2018

Volume to capacity was also calculated for the segment with unacceptable operations, as shown in Table 32. Increases due to the project were acceptable (less than 0.01).

TABLE 32: WEEKDAY PEAK HOUR FREEWAY VOLUME/CAPACITY – BASELINE PLUS PROJECT CONDITIONS (R&D ONLY AND SENIOR SERVICES AND HOUSING)

Segment	Baseline		Baseline Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
Southbound						
2nd Street On-Ramp to I-580 EB Off-Ramp	1.183	NA[1]	1.187	NA[1]	0.004	NA[1]

Notes:
1. NA, acceptable operations. **Bold** indicates unacceptable increase.
Source: Fehr & Peers, 2018

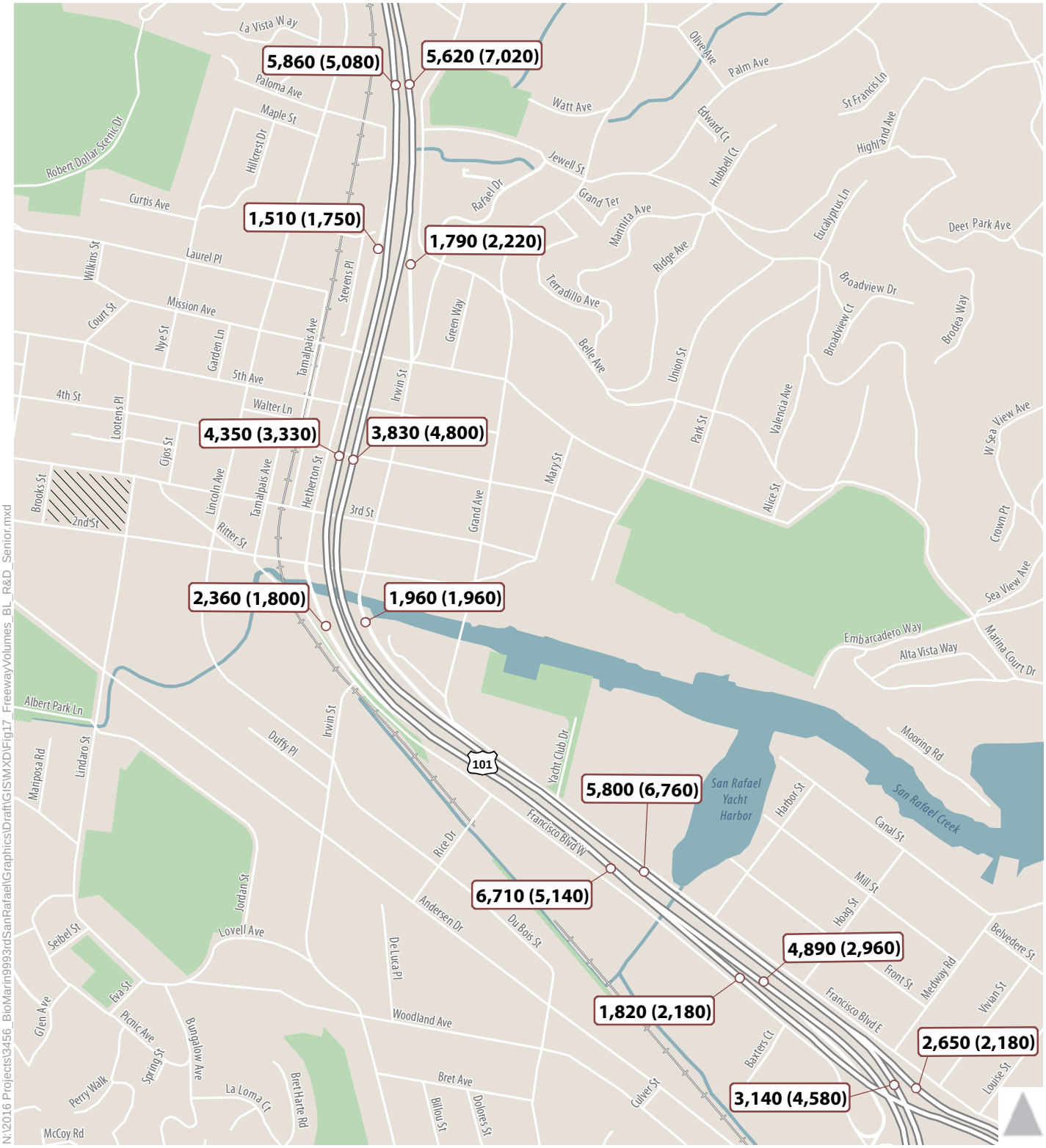
Changes in ramp queue lengths compared to baseline conditions were also estimated at the northbound 2nd Street and southbound Mission Avenue off-ramps, for information purposes only. Table 33 summarizes these results.

TABLE 33: WEEKDAY PEAK HOUR OFF-RAMP QUEUE LENGTH INCREASE – BASELINE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Off-Ramp	Increased Queue Length (feet)[1]	
	AM	PM
US 101 NB to 2nd Street	0	0
US 101 SB to Mission Avenue	25	0

Notes:
1. Compared to baseline conditions

Source: Fehr & Peers, 2018



AM (PM) Freeway Volume

Figure 17

Weekday Peak Hour Freeway Volumes - Baseline Plus Project Conditions (R&D and Senior Services and Housing)

Cumulative Conditions

The Cumulative scenario includes market-level population and employment growth and expected transportation improvements for year 2040.

Figure 18 and Figure 19 display the Cumulative peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively.

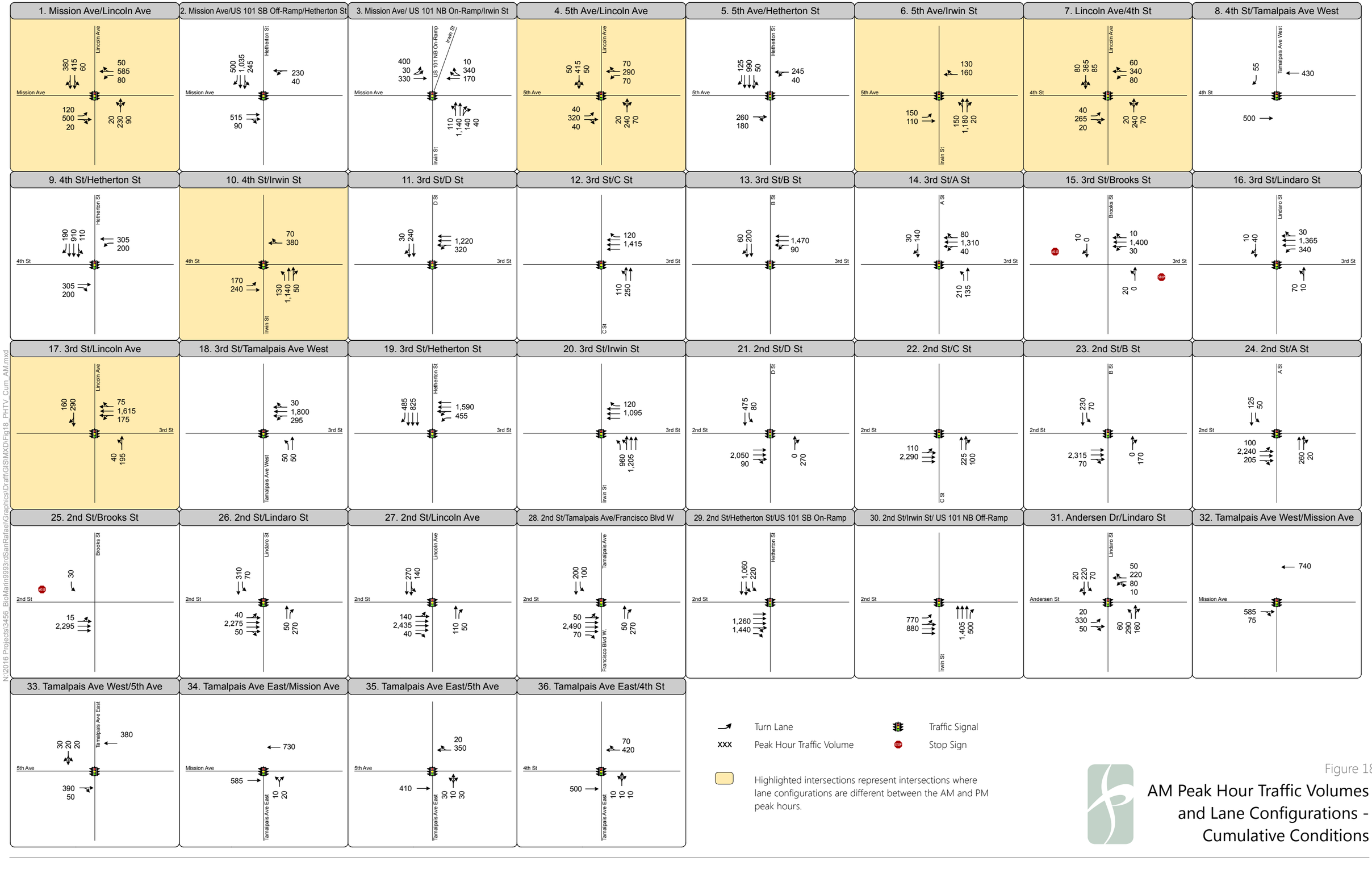


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Figure 18

AM Peak Hour Traffic Volumes and Lane Configurations - Cumulative Conditions

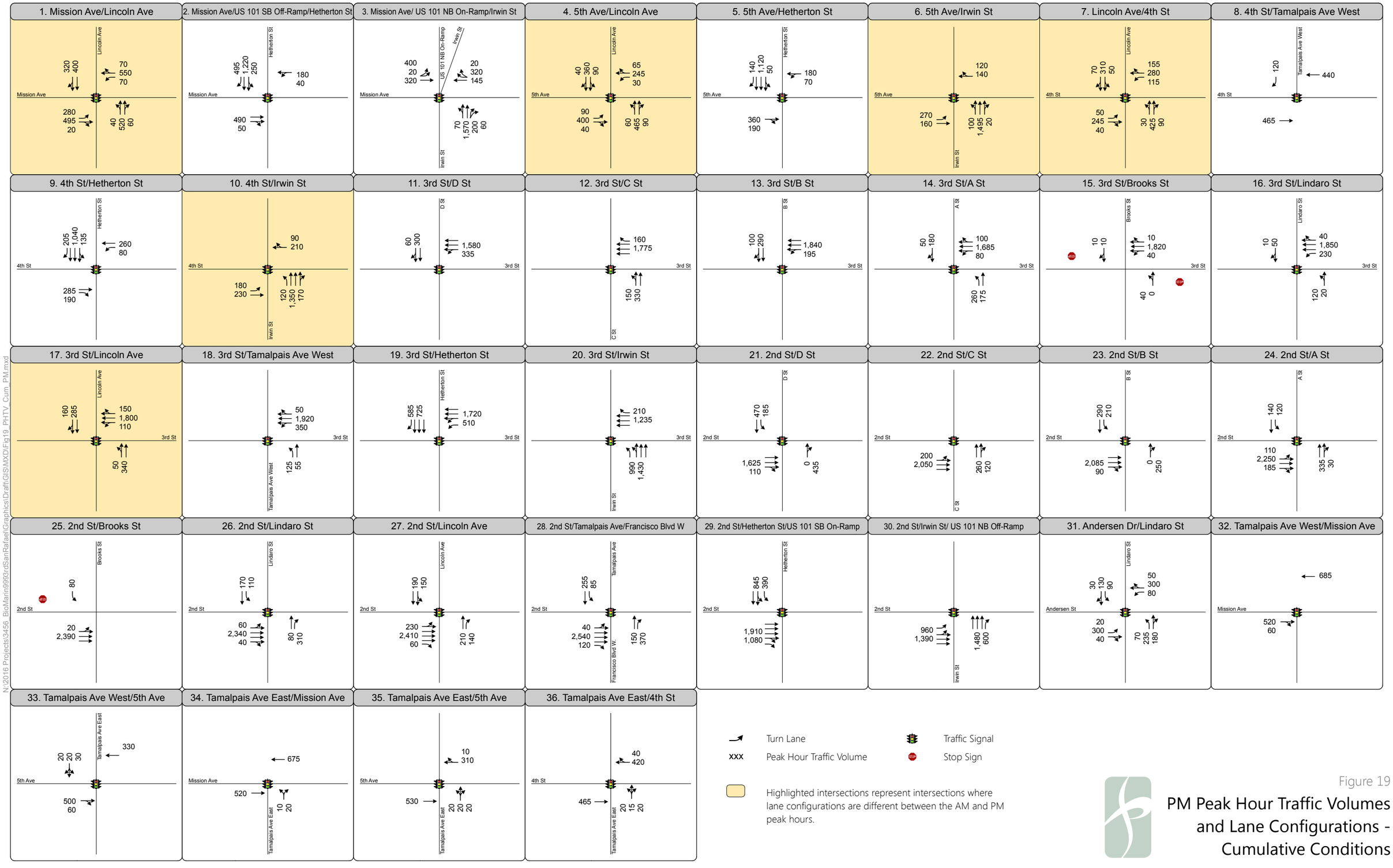

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Figure 19

PM Peak Hour Traffic Volumes and Lane Configurations - Cumulative Conditions

Intersection Operations

Table 34 summarizes the Cumulative levels of service (LOS) at the study intersections. All intersections operate acceptably except for the 3rd Street and Tamalpais Avenue West intersection (PM peak hour only) and 2nd Street and Hetherton Street/US 101 Southbound Ramp intersection (AM peak hour only). Appendix E presents all LOS calculations.

TABLE 34: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – CUMULATIVE CONDITIONS

Intersection	Control Type	LOS / Average Delay [1, 2]	
		AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 27.5	C / 31.6
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	C / 23.9	B / 19.1
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 27.2	C / 28.1
4. 5th Avenue and Lincoln Avenue	Signal	C / 25.2	A / 9.8
5. 5th Avenue and Hetherton Street[3]	Signal	B / 13.0	B / 13.9
6. 5th Avenue and Irwin Street	Signal	C / 33.3	C / 31.0
7. 4th Street and Lincoln Avenue	Signal	C / 27.7	C / 22.1
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 7.0	A / 6.4
9. 4th Street and Hetherton Street[3]	Signal	B / 10.1	A / 9.6
10. 4th Street and Irwin Street	Signal	D / 48.6	C / 31.7
11. 3rd Street and D Street	Signal	C / 23.6	C / 27.4
12. 3rd Street and C Street	Signal	C / 23.2	C / 28.1
13. 3rd Street and B Street	Signal	C / 25.3	C / 32.5
14. 3rd Street and A Street	Signal	C / 26.7	C / 34.2
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.8 (13.5)	A (B) / 3.3 (13.9)
16. 3rd Street and Lindaro Street	Signal	A / 8.2	A / 9.4
17. 3rd Street and Lincoln Avenue	Signal	D / 52.2	C / 29.6
18. 3rd Street and Tamalpais Avenue West	Signal	E / 65.6	**F / 86.4**
19. 3rd Street and Hetherton Street	Signal	D / 38.3	D / 47.1
20. 3rd Street and Irwin Street	Signal	C / 28.3	D / 38.3
21. 2nd Street and D Street	Signal	D / 39.1	C / 32.5
22. 2nd Street and C Street	Signal	C / 28.6	C / 28.9
23. 2nd Street and B Street	Signal	C / 32.2	E / 56.4

TABLE 34: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – CUMULATIVE CONDITIONS			
Intersection	**Control Type**	**LOS / Average Delay [1, 2]**	
		AM	**PM**
24. 2nd Street and A Street	Signal	C / 27.4	C / 30.5
25. 2nd Street and Brooks Street	SSSC	A (C) / 2.6 (21.2)	A (D) / 3.4 (27.5)
26. 2nd Street and Lindaro Street	Signal	B / 14.3	B / 14.9
27. 2nd Street and Lincoln Avenue	Signal	D / 38.2	D / 38.3
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	D / 35.7	D / 46.5
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	**F / 95.9**	C / 34.7
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	D / 47.1	D / 52.5
31. Andersen Drive and Lindaro Street	Signal	C / 27.2	C / 24.0
32. Tamalpais Avenue West and Mission Avenue[3]	Signal	C / 27.1	B / 12.5
33. Tamalpais Avenue West and 5th Avenue[3]	Signal	A / 6.6	A / 9.0
34. Tamalpais Avenue East and Mission Avenue[3]	Signal	D / 46.1	C / 27.1
35. Tamalpais Avenue East and 5th Avenue[3]	Signal	A / 7.3	A / 5.7
36. Tamalpais Avenue East and 4th Street[3]	Signal	B / 16.1	A / 9.9

Notes:
1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2018

Arterial Operations

Table 35 summarizes the cumulative levels of service on the arterials in the analysis area. Mission Avenue, 3rd Street, and 2nd Street all experience unacceptable operations. Appendix E includes arterial LOS calculations.

TABLE 35: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – CUMULATIVE CONDITIONS

Arterial	Standard	LOS / Average Speed [1]	
		AM	PM
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	**F / 7**	E / 8
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 3	F / 4
3. 3rd Street WB from Hetherton Street to D Street	D	**F / 6**	**F / 6**
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 6**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 4	E / 7
6. Irwin Street NB from 2nd Street to Mission Avenue	F	F / 7	D / 9

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Freeway Operations

Figure 20 presents cumulative conditions freeway volumes, and Table 36 summarizes the freeway segment density and LOS results. Detailed calculations are included in Appendix E. As shown, all segments operate at acceptable levels with the exception of the northbound weave segment between the I-580 EB on-ramp and the 2nd Street off-ramp during the PM peak hour, the southbound Mission Avenue off-ramp diverge segment, and the southbound weave segment between the 2nd Street on-ramp and the I-580 EB off-ramp during the AM peak hour.

TABLE 36: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – CUMULATIVE CONDITIONS				
Segment	**Segment Type**	**Standard**	**LOS / Density (pc/mi/ln[1])**	
			AM	**PM**
Northbound				
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	**F / -[2]**
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 25	D / 33
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	D / 27	E / 39
Southbound				
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 43	D / 34
Mission Avenue Off-Ramp	Diverge	E	**F / -[2]**	**F / -[2]**
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 26	C / 21
2nd Street On-ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]

Notes:
1. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
2. Density not calculated in Leisch methodology or when V/C>1.

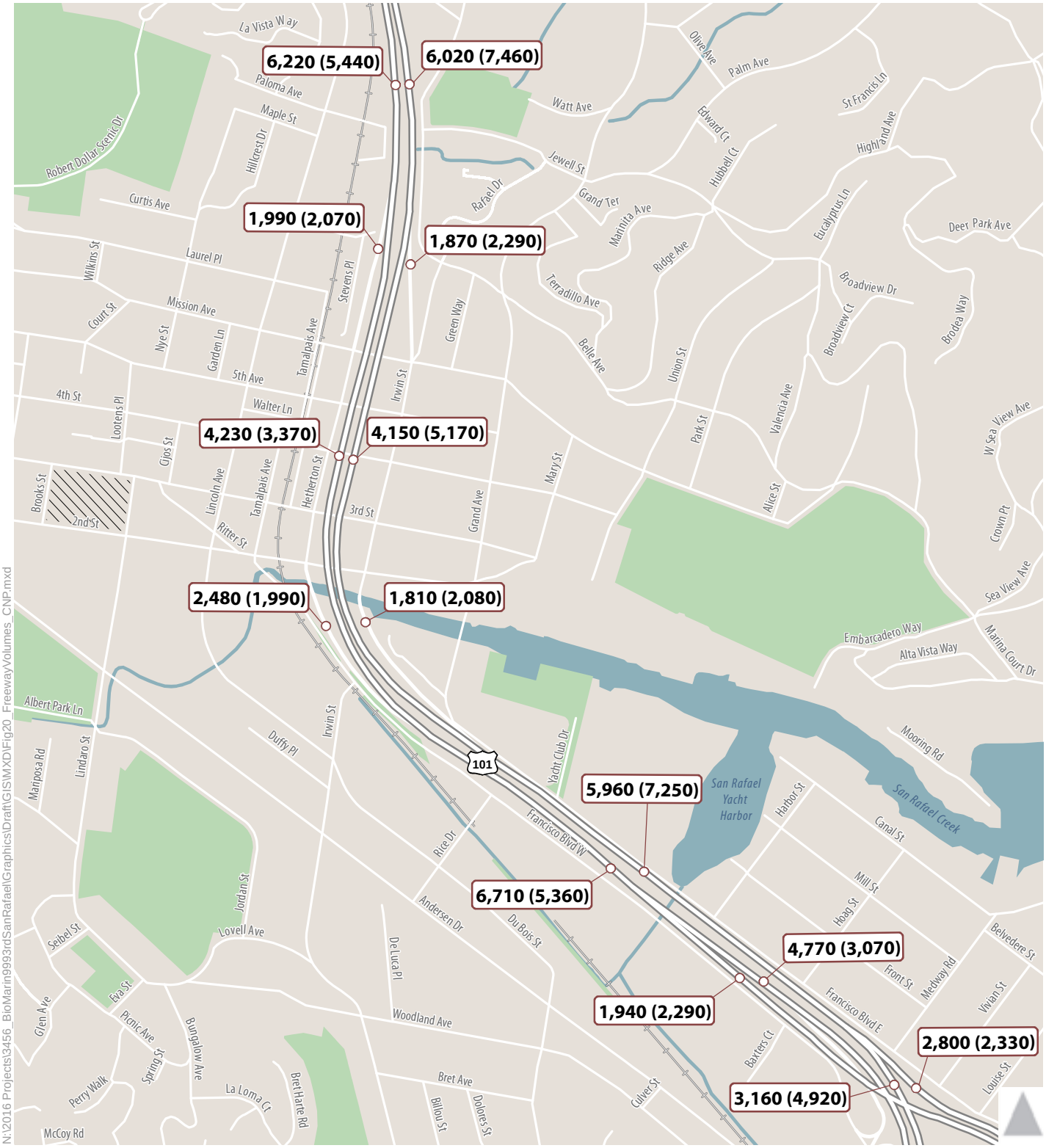
Source: Fehr & Peers, 2018

Changes in ramp queue lengths compared to existing conditions were also estimated at the northbound 2nd Street and southbound Mission Avenue off-ramps, for information purposes only. Table 37 summarizes these calculations. Expected signal improvements in the cumulative scenario contribute to these results.

TABLE 37: WEEKDAY PEAK HOUR OFF-RAMP QUEUES – CUMULATIVE CONDITIONS		
Off-Ramp	**Increased Queue Length (feet)[1]**	
	AM	**PM**
US 101 NB to 2nd Street	225	75
US 101 SB to Mission Avenue	0	0

Notes:
1. Compared to existing conditions

Source: Fehr & Peers, 2018



AM (PM) Freeway Volume

Figure 20

Weekday Peak Hour Freeway Volumes - Cumulative Conditions

Cumulative Plus Project Conditions (R&D Only)

The Cumulative Plus Project (R&D Only) scenario includes cumulative transportation conditions plus trips generated from the new R&D buildings. It does not include trips generated by the senior services and housing building.

Figure 21 and Figure 22 display the peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively.

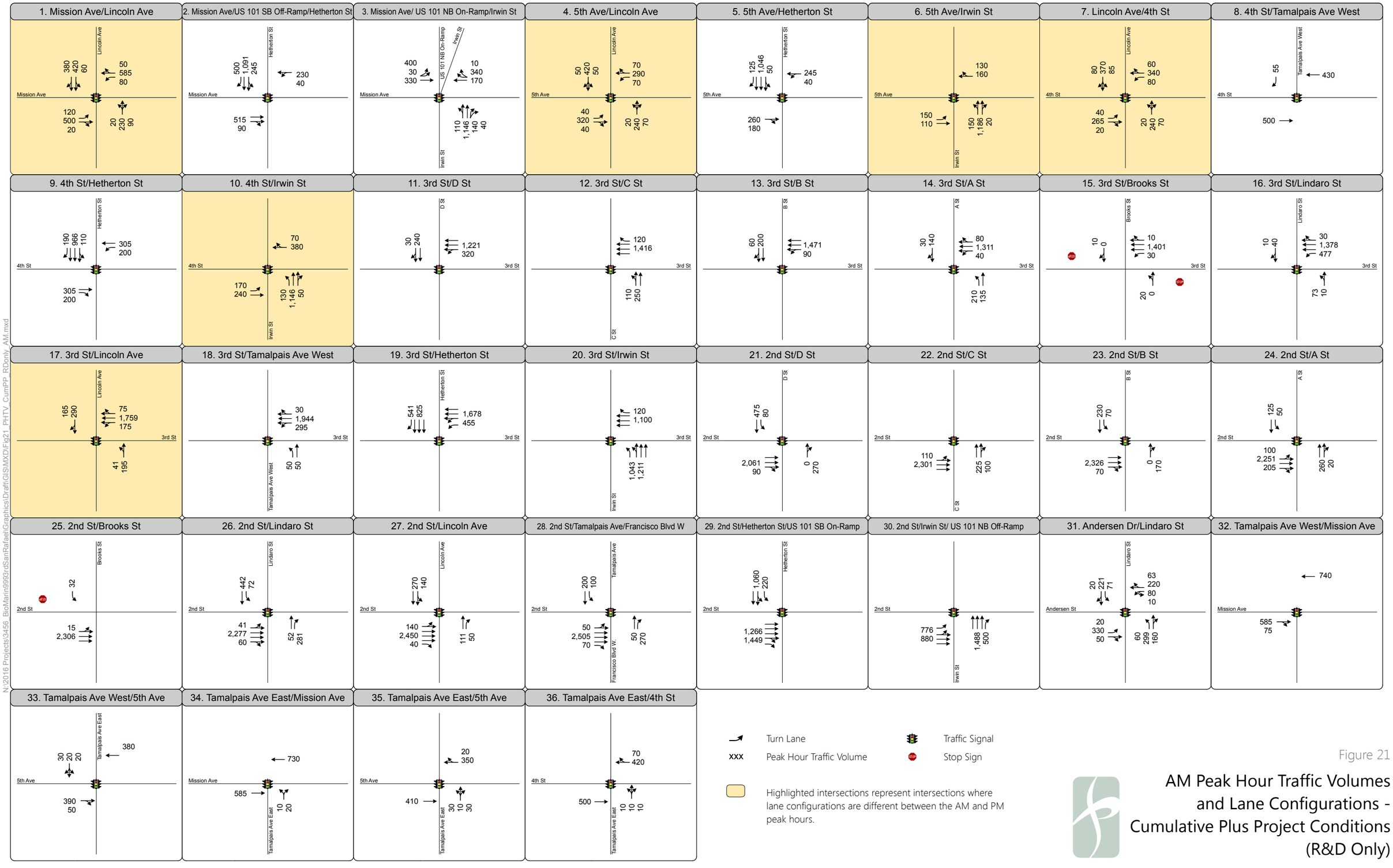


Figure 21

AM Peak Hour Traffic Volumes and Lane Configurations - Cumulative Plus Project Conditions (R&D Only)

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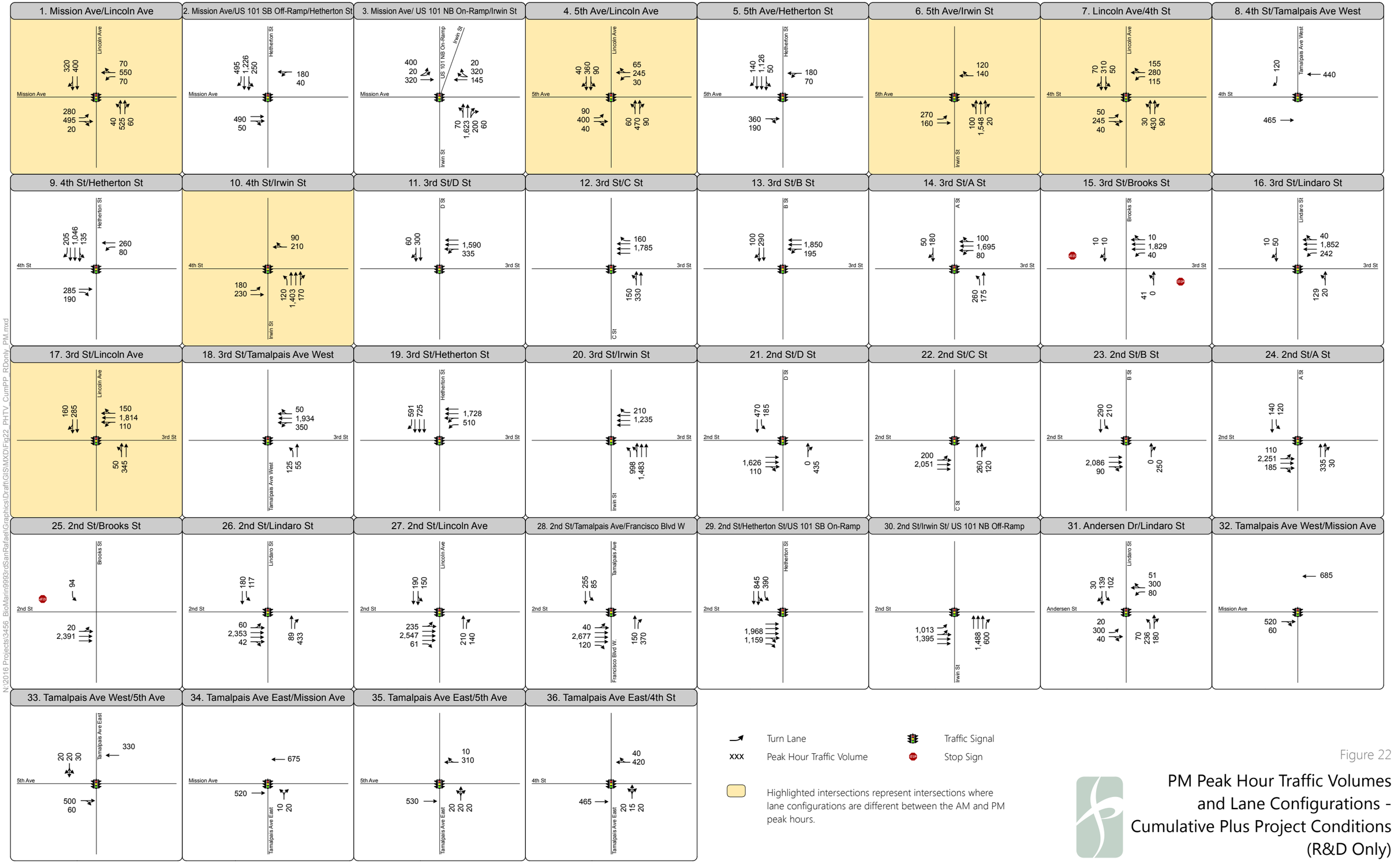


Figure 22

PM Peak Hour Traffic Volumes and Lane Configurations - Cumulative Plus Project Conditions (R&D Only)

Intersection Operations

Table 38 summarizes cumulative plus project (R& D only) levels of service (LOS) at the study intersections. All intersections operate acceptably except for 3rd Street and Tamalpais Avenue West, where increasing westbound volumes create unacceptable AM peak hour conditions and worsen unacceptable operations slightly in the PM peak hour; and 2nd Street and Hetherton Street/US 101 Southbound Ramp, where operations worsen slightly in the AM peak hour. Appendix F presents all LOS calculations.

TABLE 38: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)

Intersection	Control Type	Cumulative LOS / Average Delay [1, 2]		Cumulative Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 27.5	C / 31.6	C / 27.5	C / 31.6
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	C / 23.9	B / 19.1	C / 24.7	B / 19.2
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 27.2	C / 28.1	C / 27.3	C / 31.2
4. 5th Avenue and Lincoln Avenue	Signal	C / 25.2	A / 9.8	C / 25.1	A / 9.8
5. 5th Avenue and Hetherton Street[3]	Signal	B / 13.0	B / 13.9	B / 12.8	B / 14.5
6. 5th Avenue and Irwin Street	Signal	C / 33.3	C / 31.0	C / 33.7	C / 31.4
7. 4th Street and Lincoln Avenue	Signal	C / 27.7	C / 22.1	C / 27.6	C / 22.2
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 7.0	A / 6.4	A / 7.0	A / 6.3
9. 4th Street and Hetherton Street[3]	Signal	B / 10.1	A / 9.6	A / 9.9	A / 9.3
10. 4th Street and Irwin Street	Signal	D / 48.6	C / 31.7	D / 48.0	C / 31.8
11. 3rd Street and D Street	Signal	C / 23.6	C / 27.4	C / 23.6	C / 27.5
12. 3rd Street and C Street	Signal	C / 23.2	C / 28.1	C / 23.2	C / 28.2
13. 3rd Street and B Street	Signal	C / 25.3	C / 32.5	C / 25.3	C / 32.6
14. 3rd Street and A Street	Signal	C / 26.7	C / 34.2	B / 18.2	C / 24.5
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.8 (13.5)	A (B) / 3.3 (13.9)	A (A) / 2.1 (8.3)	A (C) / 3.7 (16.1)
16. 3rd Street and Lindaro Street	Signal	A / 8.2	A / 9.4	B / 12.2	B / 10.6
17. 3rd Street and Lincoln Avenue	Signal	D / 52.2	C / 29.6	E / 60.7	C / 29.6
18. 3rd Street and Tamalpais Avenue West	Signal	E / 65.6	**F / 86.4**	**F / 93.4**	**F / 89.0**
19. 3rd Street and Hetherton Street	Signal	D / 38.3	D / 47.1	D / 46.0	D / 48.2
20. 3rd Street and Irwin Street	Signal	C / 28.3	D / 38.3	C / 28.7	D / 38.4
21. 2nd Street and D Street	Signal	D / 39.1	C / 32.5	D / 39.1	C / 32.5

TABLE 38: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)

Intersection	Control Type	Cumulative LOS / Average Delay [1, 2]		Cumulative Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
22. 2nd Street and C Street	Signal	C / 28.6	C / 28.9	C / 28.7	C / 28.9
23. 2nd Street and B Street	Signal	C / 32.2	E / 56.4	C / 32.2	E / 56.4
24. 2nd Street and A Street	Signal	C / 27.4	C / 30.5	C / 27.5	C / 30.5
25. 2nd Street and Brooks Street	SSSC	A (C) / 2.6 (21.2)	A (D) / 3.4 (27.5)	A (C) / 2.9 (19.9)	A (D) / 3.8 (29.9)
26. 2nd Street and Lindaro Street	Signal	B / 14.3	B / 14.9	B / 18.5	C / 21.7
27. 2nd Street and Lincoln Avenue	Signal	D / 38.2	D / 38.3	D / 36.4	D / 44.4
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	D / 35.7	D / 46.5	D / 36.4	E / 60.4
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	**F / 95.9**	C / 34.7	**F / 97.0**	D / 35.9
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	D / 47.1	D / 52.5	E / 56.4	E / 57.0
31. Andersen Drive and Lindaro Street	Signal	C / 27.2	C / 24.0	C / 27.7	C / 24.3
32. Tamalpais Avenue West and Mission Avenue[3]	Signal	C / 27.1	B / 12.5	C / 27.1	B / 12.5
33. Tamalpais Avenue West and 5th Avenue[3]	Signal	A / 6.6	A / 9.0	A / 6.6	A / 9.1
34. Tamalpais Avenue East and Mission Avenue[3]	Signal	D / 46.1	C / 27.1	D / 46.1	C / 27.1
35. Tamalpais Avenue East and 5th Avenue[3]	Signal	A / 7.3	A / 5.7	A / 7.1	A / 5.8
36. Tamalpais Avenue East and 4th Street[3]	Signal	B / 16.1	A / 9.9	B / 16.0	A / 9.9

Notes:
1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2018

Arterial Operations

Table 39 summarizes the cumulative plus project (R& D only) levels of service on the arterials in the analysis area. The speed decrease on Mission Avenue is less than one mile per hour and thus acceptable. Appendix F includes arterial LOS calculations.

TABLE 39: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)

Arterial	Standard	Cumulative LOS / Average Speed [1]		Cumulative Plus Project LOS / Average Speed [1]	
		AM	PM	AM	PM
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	**F / 7**	E / 8	**F / 7**	E / 8
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 3	F / 4	F / 3	F / 4
3. 3rd Street WB from Hetherton Street to D Street	D	**F / 6**	**F / 6**	**F / 5**	**F / 5**
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 6**	**F / 6**	**F / 5**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 4	E / 7	F / 4	E / 7
6. Irwin Street NB from 2nd Street to Mission Avenue	F	F / 7	D / 9	F / 6	E / 9

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Because the project would worsen operations on congestion management arterials expected to operate unacceptably, volume to capacity increases were calculated for those arterials. These results are reported in Table 40. Based on these results, the increase on 3rd Street in the AM peak hour is unacceptable.

TABLE 40: WEEKDAY PEAK HOUR ARTERIAL VOLUME/CAPACITY – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)

Segment	Cumulative		Cumulative Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
3. 3rd Street WB from Hetherton Street to D Street	0.865	0.960	0.925	0.966	**0.060**	0.006
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	0.844	0.934	0.848	0.977	0.005	0.043

Notes:
1. **Bold** indicates unacceptable increase.

Source: Fehr & Peers, 2018

Freeway Operations

Figure 23 presents cumulative plus project (R&D only) conditions freeway volumes, and Table 41 summarizes the freeway segment density and LOS results. Detailed calculations are included in Appendix F. As shown, project traffic does not cause any segment density to increase to an unacceptable LOS.

TABLE 41: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)

Segment	Segment Type	Standard	Cumulative LOS / Density (pc/mi/ln[1])		Cumulative Plus Project LOS / Density (pc/mi/ln[1])	
			AM	PM	AM	PM
Northbound						
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	**F / -[2]**	D / -[2]	**F / -[2]**
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 25	D / 33	C / 25	D / 33
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	D / 27	E / 39	D / 29	E / 40
Southbound						
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 43	D / 34	E / 43	D / 34
Mission Avenue Off-Ramp	Diverge	E	**F / -[2]**	**F / -[2]**	**F / -[2]**	**F / -[2]**
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 26	C / 21	D / 26	C / 21
2nd Street On-ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]	**F / -[2]**	E / -[2]

Notes:
4. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
5. Density not calculated in Leisch methodology.

Source: Fehr & Peers, 2018

Volume to capacity was also calculated for the segments with unacceptable operations, as shown in Table 42. Increases due to the project were acceptable (less than 0.01), except for the Mission Avenue off-ramp in the AM peak hour.

TABLE 42: WEEKDAY PEAK HOUR FREEWAY VOLUME/CAPACITY – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)

Segment	Cumulative		Cumulative Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
Northbound						
I-580 On-Ramp to 2nd Street Off-Ramp	NA[1]	1.043	NA[1]	1.045	NA[1]	0.002
Southbound						
Mission Avenue Off-Ramp (Freeway)	0.977	0.854	0.986	0.856	0.009	0.002
Mission Avenue Off-Ramp (Ramp)	1.073	1.054	1.106	1.060	**0.033**	0.006
2nd Street On-Ramp to I-580 EB Off-Ramp	1.201	NA[1]	1.203	NA[1]	0.002	NA[1]

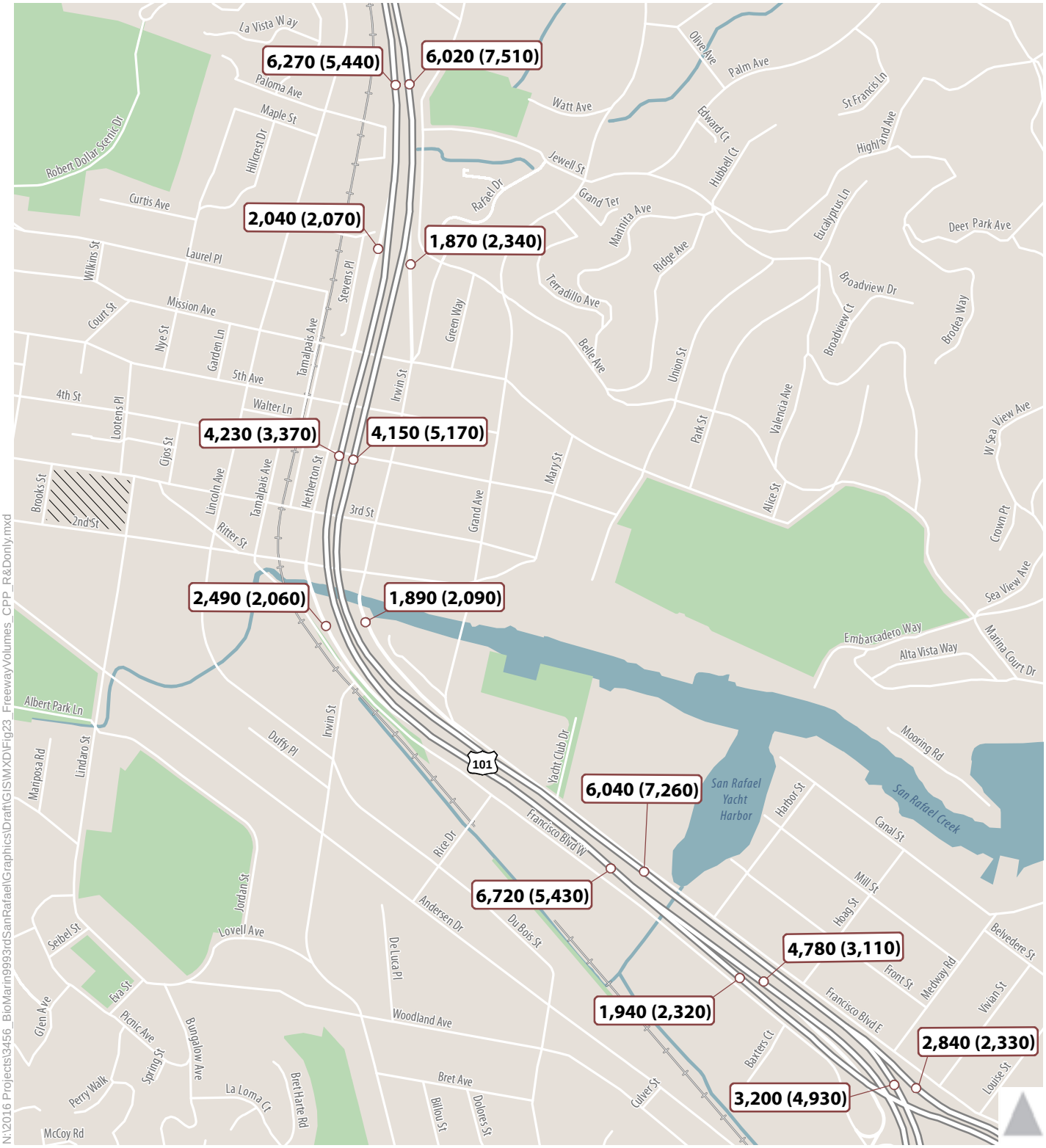
Notes:
1. NA, acceptable operations. **Bold** indicates unacceptable increase.
Source: Fehr & Peers, 2018

Changes in ramp queue lengths compared to cumulative conditions were also estimated at the northbound 2nd Street and southbound Mission Avenue off-ramps, for information purposes only. Table 43 summarizes these results.

TABLE 43: WEEKDAY PEAK HOUR OFF-RAMP QUEUE LENGTH INCREASE – CUMULATIVE PLUS PROJECT CONDITIONS (R&D ONLY)

Off-Ramp	Increased Queue Length (feet)[1]	
	AM	PM
US 101 NB to 2nd Street	0	25
US 101 SB to Mission Avenue	0	0

Notes:
1. Compared to cumulative conditions
Source: Fehr & Peers, 2018



AM (PM) Freeway Volume

Figure 23

Weekday Peak Hour Freeway Volumes - Cumulative Plus Project Conditions (R&D Only)

Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

The Cumulative Plus Project (R&D and Senior Services and Housing) scenario includes cumulative transportation conditions plus trips generated from the new R&D buildings and the senior services and housing building.

Figure 24 and Figure 25 display the peak hour traffic volumes, lane configurations, and traffic controls at each study intersection for the AM and PM peak hours, respectively.

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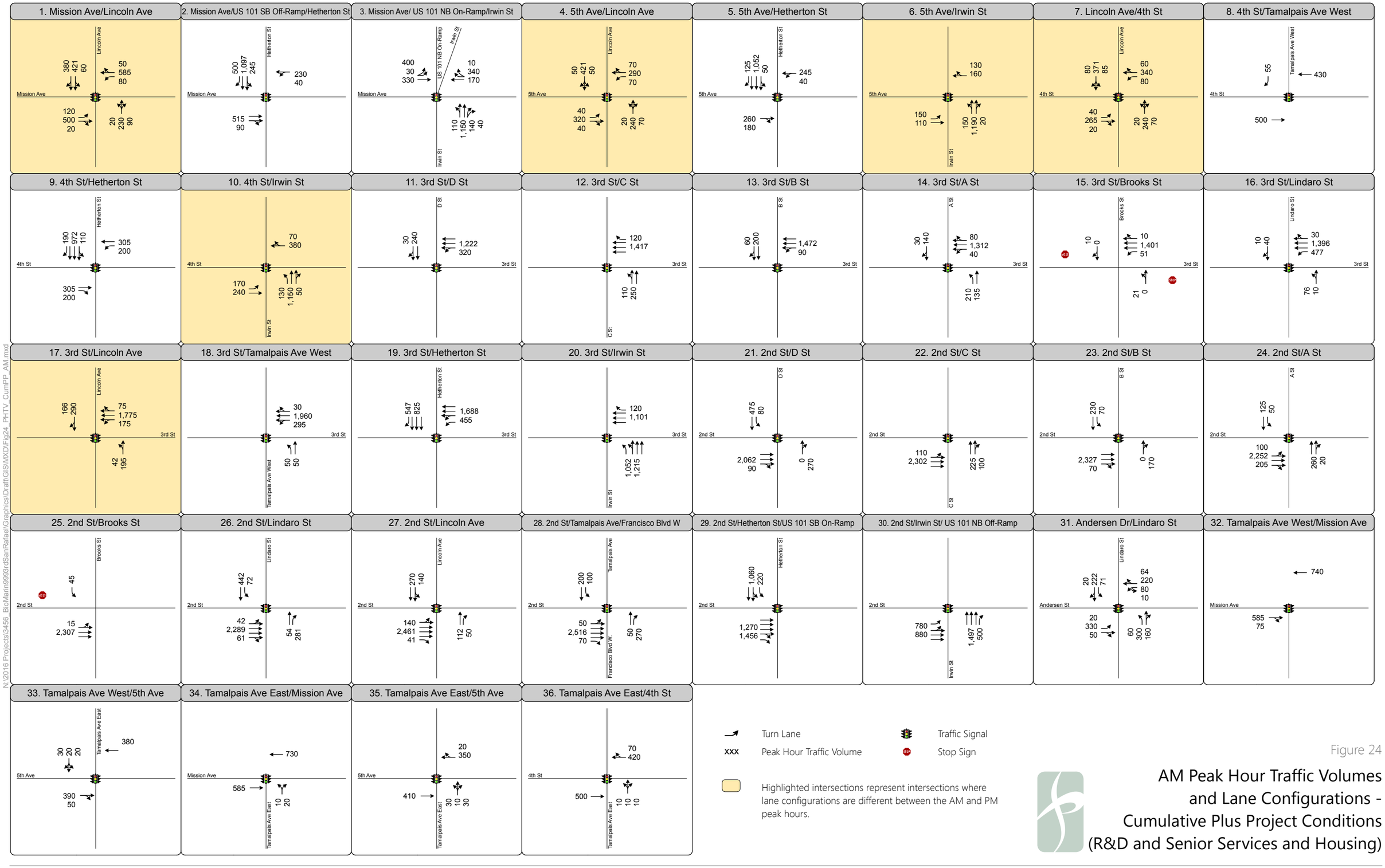

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Figure 24

AM Peak Hour Traffic Volumes and Lane Configurations - Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

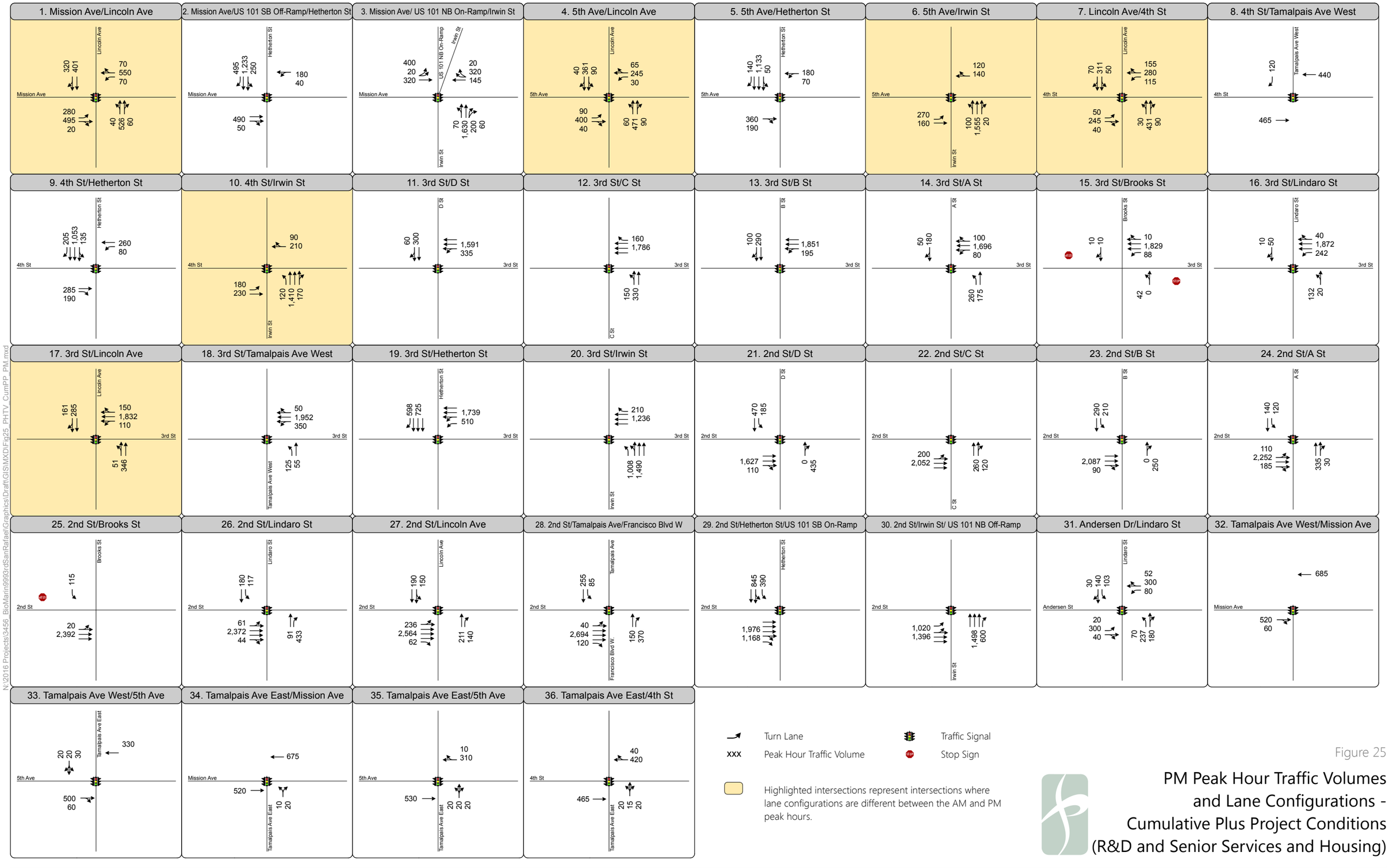

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Figure 25

PM Peak Hour Traffic Volumes and Lane Configurations - Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Intersection Operations

Table 44 summarizes cumulative plus project (R& D and Senior Services and Housing) levels of service (LOS) at the study intersections. All intersections operate acceptably except for 3rd Street and Tamalpais Avenue West, where increasing westbound volumes create unacceptable AM peak hour conditions and worsen unacceptable operations significantly in the PM peak hour; and 2nd Street and Hetherton Street/US 101 Southbound Ramp, where operations worsen slightly in the AM peak hour. Appendix G presents all LOS calculations.

TABLE 44: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Intersection	Control Type	Cumulative LOS / Average Delay [1, 2]		Cumulative Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
1. Mission Avenue and Lincoln Avenue	Signal	C / 27.5	C / 31.6	C / 27.5	C / 31.6
2. Mission Avenue and US 101 Southbound Ramp/Hetherton Street[3]	Signal	C / 23.9	B / 19.1	C / 24.8	B / 18.5
3. Mission Avenue and US 101 Northbound Ramp/Irwin Street[3]	Signal	C / 27.2	C / 28.1	C / 27.4	C / 31.7
4. 5th Avenue and Lincoln Avenue	Signal	C / 25.2	A / 9.8	C / 25.1	A / 9.8
5. 5th Avenue and Hetherton Street[3]	Signal	B / 13.0	B / 13.9	B / 12.9	B / 14.2
6. 5th Avenue and Irwin Street	Signal	C / 33.3	C / 31.0	C / 33.9	C / 31.5
7. 4th Street and Lincoln Avenue	Signal	C / 27.7	C / 22.1	C / 27.6	C / 22.2
8. 4th Street and Tamalpais Avenue West[3]	Signal	A / 7.0	A / 6.4	A / 7.0	A / 6.3
9. 4th Street and Hetherton Street[3]	Signal	B / 10.1	A / 9.6	A / 9.9	A / 9.5
10. 4th Street and Irwin Street	Signal	D / 48.6	C / 31.7	D / 48.0	C / 31.8
11. 3rd Street and D Street	Signal	C / 23.6	C / 27.4	C / 23.6	C / 27.5
12. 3rd Street and C Street	Signal	C / 23.2	C / 28.1	C / 23.2	C / 28.2
13. 3rd Street and B Street	Signal	C / 25.3	C / 32.5	C / 25.3	C / 32.7
14. 3rd Street and A Street	Signal	C / 26.7	C / 34.2	B / 18.2	C / 24.6
15. 3rd Street and Brooks Street	SSSC	A (B) / 1.8 (13.5)	A (B) / 3.3 (13.9)	A (B) / 2.3 (10.6)	A (B) / 2.8 (13.3)
16. 3rd Street and Lindaro Street	Signal	A / 8.2	A / 9.4	B / 15.3	A / 9.4
17. 3rd Street and Lincoln Avenue	Signal	D / 52.2	C / 29.6	E / 63.2	C / 29.8
18. 3rd Street and Tamalpais Avenue West	Signal	E / 65.6	**F / 86.4**	**F / 96.7**	**F / 94.0**
19. 3rd Street and Hetherton Street	Signal	D / 38.3	D / 47.1	D / 47.1	D / 49.4
20. 3rd Street and Irwin Street	Signal	C / 28.3	D / 38.3	C / 28.8	D / 38.6
21. 2nd Street and D Street	Signal	D / 39.1	C / 32.5	D / 39.1	C / 32.5
22. 2nd Street and C Street	Signal	C / 28.6	C / 28.9	C / 28.7	C / 28.9

TABLE 44: WEEKDAY PEAK HOUR INTERSECTION OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Intersection	Control Type	Cumulative LOS / Average Delay [1, 2]		Cumulative Plus Project LOS / Average Delay [1, 2]	
		AM	PM	AM	PM
23. 2nd Street and B Street	Signal	C / 32.2	E / 56.4	C / 32.2	E / 56.4
24. 2nd Street and A Street	Signal	C / 27.4	C / 30.5	C / 27.5	C / 30.5
25. 2nd Street and Brooks Street	SSSC	A (C) / 2.6 (21.2)	A (D) / 3.4 (27.5)	A (C) / 2.9 (22.0)	A (D) / 3.8 (27.7)
26. 2nd Street and Lindaro Street	Signal	B / 14.3	B / 14.9	B / 18.6	C / 21.0
27. 2nd Street and Lincoln Avenue	Signal	D / 38.2	D / 38.3	D / 37.1	D / 46.1
28. 2nd Street and Tamalpais Avenue/Francisco Boulevard West	Signal	D / 35.7	D / 46.5	D / 37.0	E / 61.4
29. 2nd Street and Hetherton Street/US 101 Southbound Ramp	Signal	**F / 95.9**	C / 34.7	**F / 97.9**	D / 35.9
30. 2nd Street and Irwin Street/US 101 Northbound Ramp	Signal	D / 47.1	D / 52.5	E / 57.6	E / 57.6
31. Andersen Drive and Lindaro Street	Signal	C / 27.2	C / 24.0	C / 27.8	C / 24.3
32. Tamalpais Avenue West and Mission Avenue[3]	Signal	C / 27.1	B / 12.5	C / 27.1	B / 12.5
33. Tamalpais Avenue West and 5th Avenue[3]	Signal	A / 6.6	A / 9.0	A / 6.6	A / 9.1
34. Tamalpais Avenue East and Mission Avenue[3]	Signal	D / 46.1	C / 27.1	D / 46.1	C / 26.8
35. Tamalpais Avenue East and 5th Avenue[3]	Signal	A / 7.3	A / 5.7	A / 7.1	A / 5.7
36. Tamalpais Avenue East and 4th Street[3]	Signal	B / 16.1	A / 9.9	B / 16.0	A / 9.9

Notes:
1. LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.
2. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
3. The HCM 2010 methodology in Synchro does not provide delay or LOS when signal timing includes a pedestrian-only phase, intersections with more than four legs, or clustered intersections. Thus, the results for intersections 2, 3, 5, 8, 9, 32, 33, 34, 35, and 36 are based on HCM 2000 methodology.

Source: Fehr & Peers, 2018

Arterial Operations

Table 45 summarizes the cumulative plus project (R& D and Senior Services and Housing) levels of service on the arterials in the analysis area. The speed decrease on Mission Avenue is less than one mile per hour and thus acceptable. Appendix G includes arterial LOS calculations.

TABLE 45: WEEKDAY PEAK HOUR ARTERIAL OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Arterial	Standard	Cumulative LOS / Average Speed [1]		Cumulative Plus Project LOS / Average Speed [1]	
		AM	PM	AM	PM
1. Mission Avenue EB from Lincoln Avenue to US 101 NB Ramp/Irwin Street	E	**F / 7**	E / 8	**F / 7**	E / 8
2. Mission Avenue WB from US 101 NB Ramp/Irwin Street to Lincoln Avenue	F	F / 3	F / 4	F / 3	F / 4
3. 3rd Street WB from Hetherton Street to D Street	D	**F / 6**	**F / 6**	**F / 5**	**F / 5**
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 6**	**F / 6**	**F / 5**
5. Hetherton Street SB from Mission Avenue to 2nd Street	F	F / 4	E / 7	F / 4	E / 7
6. Irwin Street NB from 2nd Street to Mission Avenue	F	F / 7	D / 9	F / 6	E / 9

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.

Source: Fehr & Peers, 2018

Because the project would worsen operations on congestion management arterials expected to operate unacceptably, volume to capacity increases were calculated for those arterials. These results are reported in Table 46. Based on these results, the increase on 3rd Street in the AM peak hour is unacceptable.

TABLE 46: WEEKDAY PEAK HOUR ARTERIAL VOLUME/CAPACITY – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Segment	Cumulative		Cumulative Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
3. 3rd Street WB from Hetherton Street to D Street	0.865	0.960	0.931	0.974	**0.067**	0.013
4. 2nd Street EB from D Street to Hetherton Street/US 101 SB Ramp	0.844	0.934	0.852	0.983	0.008	0.048

Notes:
1. NA = not applicable, calculation not required. **Bold** indicates unacceptable increase.

Source: Fehr & Peers, 2018

Freeway Operations

Figure 26 presents cumulative plus project (R&D and Senior Services and Housing) conditions freeway volumes, and Table 47 summarizes the freeway segment density and LOS results. Detailed calculations are

included in Appendix G. As shown, project traffic does not cause any segment density to increase to an unacceptable LOS.

TABLE 47: WEEKDAY PEAK HOUR FREEWAY OPERATIONS – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Segment	Segment Type	Standard	Cumulative LOS / Density (pc/mi/ln[1])		Cumulative Plus Project LOS / Density (pc/mi/ln[1])	
			AM	PM	AM	PM
Northbound						
I-580 On-Ramp to 2nd Street Off-Ramp	Weave	E	D / -[2]	**F / -[2]**	D / -[2]	**F / -[2]**
2nd Street Off-Ramp to Mission Avenue On-Ramp	Basic	E	C / 25	D / 33	C / 25	D / 33
Mission Avenue On-Ramp to Lincoln Avenue On-Ramp	Basic	E	D / 27	E / 39	D / 29	E / 40
Southbound						
Lincoln Avenue On-Ramp to Mission Avenue On-Ramp	Basic	E	E / 43	D / 34	E / 44	D / 34
Mission Avenue Off-Ramp	Diverge	E	**F / -[2]**	**F / -[2]**	**F / -[2]**	**F / -[2]**
Mission Avenue Off-Ramp to 2nd Street On-Ramp	Basic	E	D / 26	C / 21	D / 26	C / 21
2nd Street On-ramp to I-580 EB Off-Ramp	Weave	E	**F / -[2]**	E / -[2]	**F / -[2]**	E / -[2]

Notes:
2. pc/mi/ln = passenger car per mile per lane. **Bold** indicates unacceptable operations.
3. Density not calculated in Leisch methodology.
Source: Fehr & Peers, 2018

Volume to capacity was also calculated for the segments with unacceptable operations, as shown in Table 48. Increases due to the project were acceptable (less than 0.01), except for the Mission Avenue off-ramp in the AM peak hour.

TABLE 48: WEEKDAY PEAK HOUR FREEWAY VOLUME/CAPACITY – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING

Segment	Cumulative		Cumulative Plus Project		Increase	
	AM	PM	AM	PM	AM	PM
Northbound						
I-580 On-Ramp to 2nd Street Off-Ramp	NA[1]	1.043	NA[1]	1.047	NA[1]	0.004
Southbound						
Mission Avenue Off-Ramp (Freeway)	0.9774	0.854	0.9868	0.856	0.0094	0.002
Mission Avenue Off-Ramp (Ramp)	1.073	1.054	1.106	1.060	**0.033**	0.006
2nd Street On-Ramp to I-580 EB Off-Ramp	1.201	NA[1]	1.204	NA[1]	0.003	NA[1]

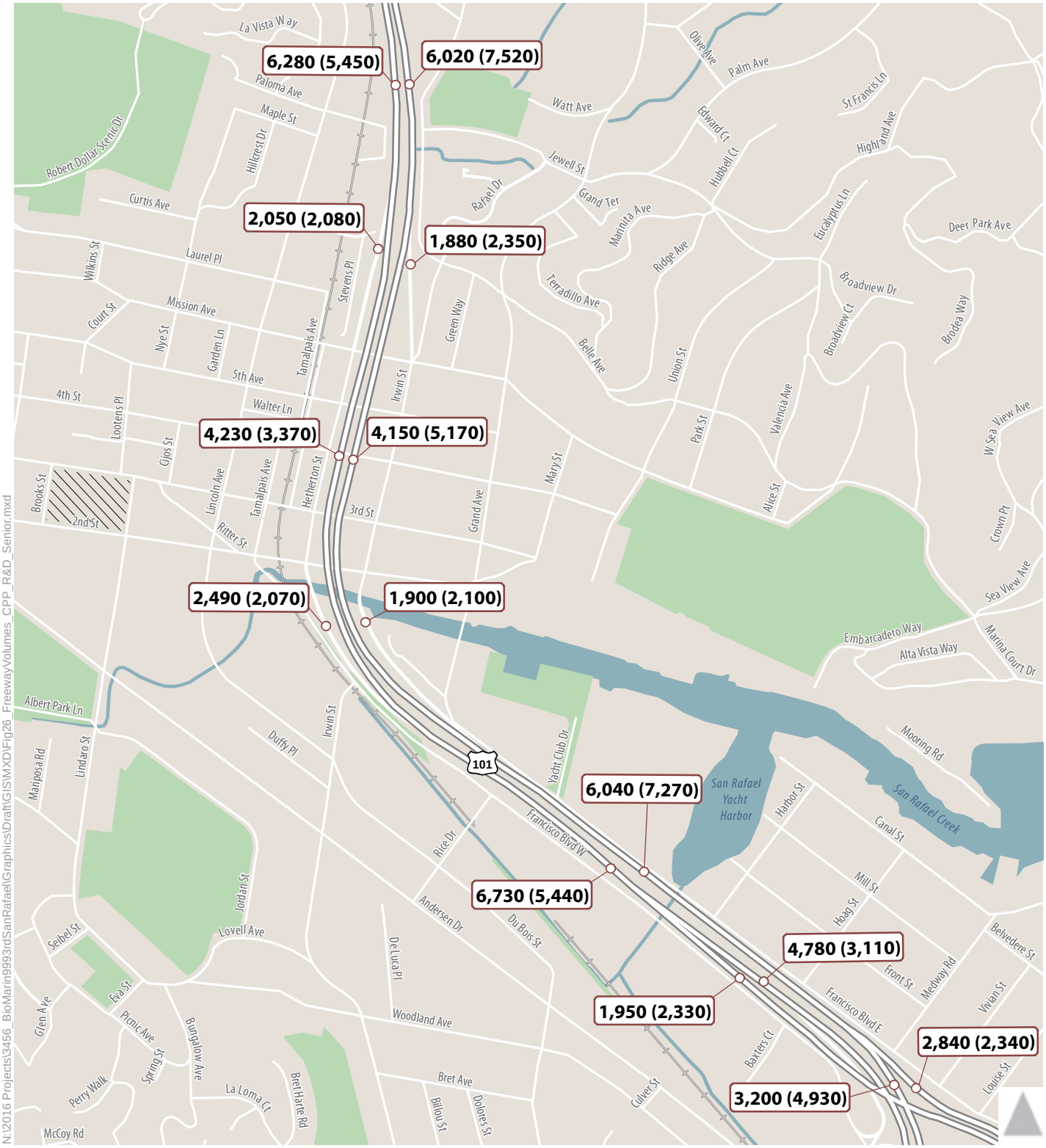
Notes:
2. NA, acceptable operations. **Bold** indicates unacceptable increase.
Source: Fehr & Peers, 2018

Changes in ramp queue lengths compared to cumulative conditions were also estimated at the northbound 2nd Street and southbound Mission Avenue off-ramps, for information purposes only. Table 49 summarizes these calculations.

TABLE 49: WEEKDAY PEAK HOUR OFF-RAMP QUEUE LENGTH INCREASE – CUMULATIVE PLUS PROJECT CONDITIONS (R&D AND SENIOR SERVICES AND HOUSING)

Off-Ramp	Increased Queue Length (feet)[1]	
	AM	PM
US 101 NB to 2nd Street	0	25
US 101 SB to Mission Avenue	0	0

Notes:
1. Compared to cumulative conditions
Source: Fehr & Peers, 2018



AM (PM) Freeway Volume

Figure 26

Weekday Peak Hour Freeway Volumes - Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Impacts and Mitigation Measures

This chapter summarizes the significance of transportation and traffic impacts using the criteria described in Study Methodology. Where impacts are deemed significant, mitigation measures are recommended to lessen their significance. This study identifies the transportation and traffic impacts of the BioMarin R&D buildings only as well as the impacts of the BioMarin R&D buildings with the senior services and housing. In all cases, the transportation/traffic effects of these two scenarios would be similar or the same. Therefore, a single impact statement is provided that applies to both plus-project scenarios.

Project-Specific Impacts

Vehicle Travel

Vehicle trips generated by the proposed project would increase traffic volumes on study roadway segments and intersections, as described below.

Intersection Operations

All intersections would continue to operate at an acceptable LOS under Baseline Plus Project conditions.

Arterial Operations

Under baseline plus project conditions, most arterials would experience a less than significant increase in delay (City arterials) or volume to capacity (congestion management arterials). Adaptive signal implementation is planned under cumulative conditions in Downtown San Rafael, which would improve vehicle operations compared to the existing pretimed signal system. Earlier implementation would improve baseline conditions. A second exclusive eastbound right turn lane at the 2nd Street and Hetherton Street/ US 101 Southbound Ramp intersection was also reviewed to see if it would improve 2nd Street speed; however, there is limited space (less than 100 feet) between the SMART extension and the ramp, and improvements would be minor. 2nd Street cannot be widened without significant impacts to downtown.

However, 3rd Street volume to capacity would increase significantly during the AM peak hour.

Impacts and Mitigation Measures

Impact-1: Vehicle trips generated by the proposed project would increase traffic levels on study arterials. These project trips would cause volume to capacity to increase unacceptably on the 3rd Street arterial during the AM peak hour. Therefore, this is considered a significant impact.

Mitigation Measure-1: Implement the BioMarin San Rafael Campus Transportation Demand Management (TDM) Plan and conduct ongoing annual monitoring.

Trip generation calculations for this project show that current TDM measures provided by the campus have helped reduce peak hour trip rates 12-15% below levels generated by R&D uses in suburban areas without trip reduction programs based on national (i.e., ITE) trip rates.

Mitigation Measure 1 refers to additional trip reduction strategies described in the Biomarin TDM Plan prepared for this project that, if implemented and monitored on an ongoing basis, would reduce peak hour trips by another 10%, based on California Air Pollution Control Officers (CAPCOA) estimates and the surrounding Downtown San Rafael transportation and land use context.

Mitigation Measure-2: Install adaptive signals on 3rd Street.

Adaptive signal implementation is planned under cumulative conditions in Downtown San Rafael, and this arterial would be included in implementation. By replacing the current pretimed signal control system, earlier implementation of adaptive signals would improve baseline conditions. However, per discussion with the City of San Rafael in a meeting on November 8, 2018, the City noted that these improvements are not likely to be implemented in this timeframe.

These two mitigation measures would increase traffic speed along the corridor, but the corridor would still continue to operate unacceptably. 3rd Street cannot be widened without significant impacts to downtown San Rafael.

Improvements at the 3rd Street and Hetherton Street intersection would also improve 3rd Street arterial speed. A mitigation measure that would involve converting the southbound through lane on Hetherton Street that is adjacent to the exclusive right turn lane into a second right-turn lane (i.e., resulting in two through lanes and two right turn lanes onto 3rd Street, given the approximate 50/50 balance between through and right turn movements) was evaluated. This would reduce vehicle delays, but result in a potential secondary impact to pedestrians using the west crosswalk as motorists making a right turn from the new second right turn lane may find it difficult to see pedestrians, particularly those walking in the southbound direction. Given the potential secondary pedestrian impacts of the above mitigation measure, it is deemed to be infeasible.

Significance after Mitigation: Because this impact cannot be fully mitigated, it remains **significant and unavoidable**.

Freeway Operations

The project will add vehicle trips to US 101. Most segments are expected to operate acceptably under baseline plus project conditions. The US 101 SB weave segment from 2nd Street to I-580 EB operates at LOS F under baseline conditions. Project trips will increase volume to capacity by less than 0.01 on this segment. Therefore, this impact is considered **less than significant**.

Bicycle and Pedestrian Travel

Bicycle trips in the study area would increase as a result of the proposed project, as supported by the discussion in Project Conditions. Pedestrian trips in the study area will increase as a result of the proposed project, particularly at the 2nd Street and Lindaro Street intersection. The projected increase in vehicles at the intersections in the vicinity of the proposed project may result in an increase in vehicle-bicycle-pedestrian conflicts at intersections in the study area. However, the proposed project would not create potentially hazardous conditions for bicycles and pedestrians, or otherwise interfere with bicycle and pedestrian accessibility to the site and adjoining areas because the project does not remove existing facilities and does not prohibit the construction of proposed future facilities in the project vicinity. The project's impact to bicycle and pedestrian facilities is therefore considered less than significant.

To accommodate bicyclists, both the BioMarin R&D facilities and the senior services and housing facilities should include safe, secure bicycle parking.

Additionally, construction of the facilities proposed in the 2018 San Rafael Bicycle & Pedestrian Master Plan would support bicyclists and pedestrians accessing this project. In particular, the east-west bikeway through downtown, conceptually shown as along 4th Street, would create improved bicycle connections that would serve the project. For pedestrians, the planned improvements at and between the US 101 ramp intersections on 2nd Street would be beneficial. The other proposed US 101 undercrossing improvements would also benefit both pedestrians and bicyclists.

Construction of an additional crosswalk is recommended on the west leg of the signalized intersection of 3rd Street and Lindaro Street. This crosswalk would create a more direct connection between the project site, Lootens Place, and business areas to the north. Vehicle level of service at the intersection would not be reduced.

Transit Travel

Transit trips in the study area would increase as a result of the project, as supported by the discussion in Project Conditions. Most employees at the project site would walk to the San Rafael Transportation Center and SMART station to access the rail and bus service provided there. A total of 22 bus routes currently stop at the San Rafael Transportation Center. A survey of BioMarin employees at the San Rafael campus in the spring of 2018 indicated that 16 percent of employees travel by transit on a typical day. The proposed project, with 550 employees, would generate 88 new daily transit trips. The BioMarin employees using transit split their trips among SMART (77 percent), Golden Gate Transit (17 percent), and Marin Transit (6 percent). The project would thus add 68 daily riders to SMART, 15 daily riders to Golden Gate Transit routes, and 5 daily riders to Marin Transit routes on a typical weekday. This level of added transit ridership would not have a significant impact on the SMART, Golden Gate Transit, or Marin Transit routes serving Downtown San Rafael. Therefore, the project impacts to transit facilities are considered less than significant.

Cumulative Impacts

Vehicle Travel

Vehicle trips generated by the proposed project would increase traffic volumes on study roadway segments and intersections, as described below.

Intersection Operations

Most study intersections would continue to operate at an acceptable LOS under cumulative plus project conditions.

Project traffic would increase the average control delay by two seconds at the 2nd Street and Hetherton Street/ US 101 Southbound Ramp intersection during the AM peak hour, when it is already expected to operate at an unacceptable LOS. Because this increase is less than five seconds, it is considered less than significant. Addition of a second exclusive eastbound right turn lane at this intersection would reduce delay at this intersection. However, there is limited space (less than 100 feet) between the SMART extension and the ramp, and improvements would be insufficient to eliminate the increase.

One intersection would experience significant impacts.

Impacts and Mitigation Measures

Impact-2: Vehicle trips generated by the proposed project would increase cumulative traffic volumes at study intersections. These project trips would cause operations to degrade from an acceptable LOS to an unacceptable LOS at the 3rd Street and Tamalpais Avenue West intersection during the AM peak hour and increase delay significantly during the PM peak hour. Therefore, this is considered a significant impact.

Mitigation Measure-1: Implement the BioMarin San Rafael Campus Transportation Demand Management (TDM) Plan and conduct ongoing annual monitoring.

Mitigation Measure-3: Reduce lane widths and add a westbound left-turn pocket at the 3rd Street and Tamalpais Avenue intersection.

This measure would provide additional capacity for the westbound through and left-turn movements. This change would improve operations to LOS D. This improvement could be accomplished during planned redesign of the transit center at the southeast corner of this intersection. However, this may not be feasible within the transit center design. TDM measures alone would not completely mitigate this impact.

Significance after Mitigation: Because the feasibility of the proposed mitigation measure is uncertain given the ongoing process of selecting a preferred alternative for the transit center and trip reduction strategies in the new TDM Plan would not reduce trips to a level that would reduce added intersection delay to a less than significant level, the impact remains **significant and unavoidable.**

Arterial Operations

Under cumulative plus project conditions, most arterials would experience a less than significant increase in delay (City arterials) or volume to capacity (congestion management arterials). Eliminating parking on Irwin Street in the AM peak hour as currently done in the PM peak hour was evaluated, but the improvement to speed was less than 1 mile per hour. Irwin Street cannot be widened without significant impacts to adjacent properties. Similarly, a second exclusive eastbound right turn lane at the 2nd Street and Hetherton Street/ US 101 Southbound Ramp intersection was reviewed to see if it would improve 2nd Street speed; however, there is limited space (less than 100 feet) between the SMART extension and the ramp, and improvements would be minor. 2nd Street cannot be widened without significant impacts to downtown.

However, 3rd Street volume to capacity would increase significantly during the AM peak hour.

Impacts and Mitigation Measures

Impact-3: Vehicle trips generated by the proposed project would add vehicle trips to study arterials. These project trips would cause volume to capacity to increase unacceptably on the 3rd Street arterial during the AM peak hour. Therefore, this is considered a significant impact.

Mitigation Measure-1: Implement the BioMarin San Rafael Campus Transportation Demand Management (TDM) Plan and conduct ongoing annual monitoring.

Intersection improvements at the 3rd Street and Tamalpais Avenue West intersection would also benefit 3rd Street arterial speed. This improvement could be accomplished during planned redesign of the Transit Center at the southeast corner of this intersection. However, this may not be feasible within the Transit Center design. TDM measures alone would not completely mitigate this impact.

Intersection improvements at the 3rd Street and Hetherton Street intersection would also benefit 3rd Street arterial speed. Converting the southbound through lane on Hetherton Street that is adjacent to the exclusive right turn lane into a second right-turn lane (i.e., resulting in two through lanes and two right turn lanes onto 3rd Street, given the approximate 50/50 balance between through and right turn movements) was evaluated. This would reduce vehicle delays, but result in a potential secondary impact to pedestrians using the west crosswalk as motorists making a right turn from the new second right turn lane may find it difficult to see pedestrians, particularly those walking in the southbound direction. Given the potential secondary pedestrian impacts of the above mitigation measure, it is deemed to be infeasible.

The TDM mitigation measure described above would not result in a sufficient reduction in traffic to reduce the increase in volume to capacity to an acceptable level. 3rd Street cannot be widened without significant impacts to downtown San Rafael. Therefore, the impact is considered significant and unavoidable on this arterial.

Significance after Mitigation: Significant and unavoidable

Freeway Operations

The project will add vehicle trips to US 101. Three segments will experience unacceptable operations under cumulative plus project conditions. For two segments (US 101 NB I-580 On-Ramp to 2nd Street Off-Ramp and US 101 SB 2nd Street On-ramp to I-580 EB Off-Ramp), project trips will increase volume to capacity by less than 0.01. However, for one segment, US 101 SB Mission Avenue Off-Ramp, project trips will increase volume to capacity by more than 0.01.

Impacts and Mitigation Measures

Impact-4: Vehicle trips generated by the proposed project would add vehicle trips to study freeway segments. These project trips would cause volume to capacity to increase unacceptably on the US 101 SB Mission Avenue Off-Ramp diverge segment during the AM peak hour. Therefore, this is considered a significant impact.

Mitigation Measure-1: Implement the BioMarin San Rafael Campus Transportation Demand Management (TDM) plan and conduct ongoing annual monitoring.

TDM improvements alone would reduce the increase in volume to capacity, but not to an acceptable level. Insufficient width exists to add lanes to this segment of US 101 SB.

Significance after Mitigation: Significant and unavoidable

Vehicle Miles Traveled

A vehicle miles traveled (VMT) analysis was completed in preparation for City of San Rafael implementation of Senate Bill (SB) 743. The City has not yet adopted policies relating to SB 743. Therefore, results of this analysis are for informational purposes only. This section describes the methodology used to calculate the daily home-work VMT per employee. This VMT is that generated by an employee's trips between work and home. The results are presented along with a short discussion below.

Assumptions and Methodology

To determine the average daily home-work VMT per employee at the existing BioMarin San Rafael campus, zip code data provided by BioMarin that listed employee residential locations was analyzed. Figure 27 illustrates the existing employee residential distribution.

This data was used to calculate the distance between existing employee zip codes and the project site. The average home-work travel distance per driver was calculated by using the weighted average of distances between each zip code and the project site based on the number of employees residing in each zip code. Using the mode share data discussed in Project Conditions, this number was adjusted to calculate the average VMT per employee.

Comparable data was not available for the senior services and housing. However, residents will not be able to own vehicles, as a restriction of the lease, and the facility manager will reside in an on-site apartment. These factors will reduce VMT for the site. BioMarin will also generate more than 80% of project site trips.

The main limitations of this approach are that distances were calculated based on zip codes, which provides an approximate estimate of distance traveled. Workers residing at longer distances may be more likely to telecommute or use transit such as SMART rail or Golden Gate Transit buses, which may cause VMT forecasts to be overestimated.

Results

The average trip driver trip length for employees at the proposed project based on existing BioMarin employee zip code data is estimated to be approximately 21.6 miles, or 43 VMT. Adjusting for mode share, the average home-work daily VMT per driver is estimated to be 37.

For comparison purposes, the average home-work VMT per worker for San Rafael and the Bay Area was determined using the Metropolitan Transportation Commission (MTC) Regional Travel Model.

The results of this analysis are presented in Table 50. BioMarin employees would have 61% greater VMT than the average San Rafael employee as determined by the MTC travel model.

TABLE 50: HOME-WORK VEHICLE MILES TRAVELED

Location	Estimated Average Home-Work VMT / Employee
BioMarin R&D[1]	37
Downtown San Rafael[2]	20
San Rafael[2]	23
Bay Area[2]	17

Notes:

1. BioMarin data based on employee survey data provided by BioMarin
2. San Rafael and Bay Area data estimated using the MTC Regional Travel Model

Source: Fehr & Peers, 2018

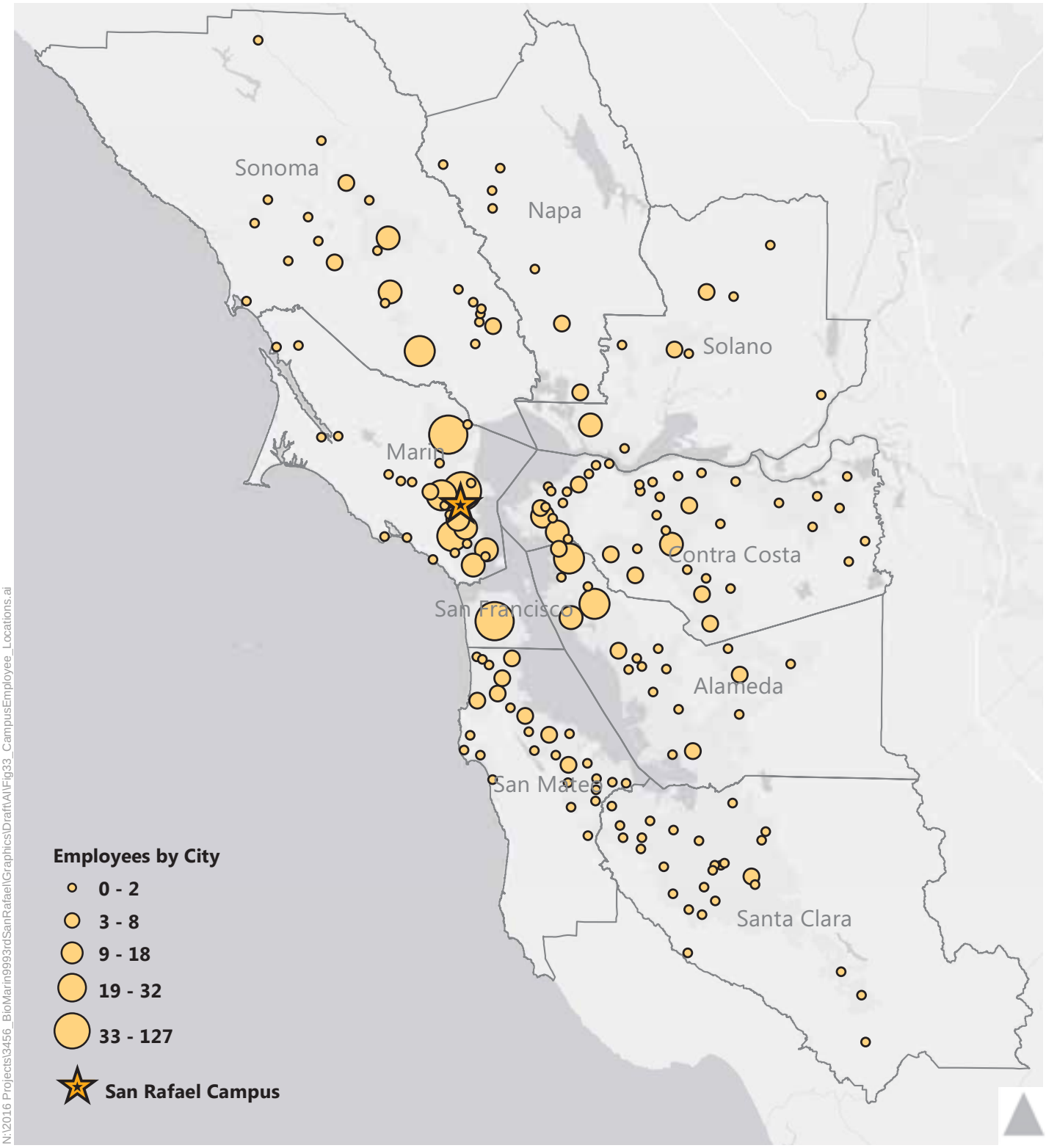


Figure 27

2018 BioMarin San Rafael Campus Employee Home Locations

Site Plan Review

This chapter analyzes site access and internal circulation for vehicles, bicycles, and pedestrians. Site recommendations are presented in Figure 28.

Access to the project would be provided from six unsignalized driveways as indicated in Figure 28. One-way driveways on Lindaro Street would provide access to the east side of the BioMarin R&D facility, and a one-way entrance driveway from 3rd Street and exit driveway to Brooks Street would provide access to the west side of the BioMarin R&D facility. Parking on the ground floor of the senior services and housing building will be accessed from one-way driveways on Brooks Street.

> ***Recommendation:*** Maintain landscaping at project driveways to avoid sight distance conflicts. Shrubs should not be higher than approximately 30 inches and tree canopies should be approximately six feet from the ground.
>
> ***Recommendation:*** Prohibit parking for approximately 20 feet on either side of project driveways to maintain proper sight distances.
>
> ***Recommendation:*** Consider adding westbound left turn pocket for the driveway at 3rd Street.
>
> ***Recommendation:*** Consider stop sign pavement legends to control which traffic movements within the parking lot have priority.
>
> ***Recommendation:*** Consider vehicle activated audible and visual warning for pedestrians of cars exiting project driveways with restricted views.
>
> ***Recommendation:*** Update curb ramps to be ADA compliant pairs on all corners of project site. Where feasible, curb ramps should be directional.

Emergency vehicles can access the site using the Lindaro Street driveways, 3rd Street driveway, and the southernmost Brooks Street driveway. The 3rd Street driveway and Brooks Street driveway will be gated.

> ***Recommendation:*** Coordinate with San Rafael fire and police services to provide access to gated driveways on 3rd Street and Brooks Street.

Bicycle parking is planned for both the BioMarin R&D facility and the senior services and housing.

- BioMarin R&D facility
    - Short term: Bike racks accommodating four bikes are planned on Lindaro Street.

- Long term: A bike storage room accommodating 34 bikes is planned on the first floor.

- Senior services and housing
  - Short term: Four bike racks are planned along 3rd Street.
  - Long term: A bike storage room accommodating six bikes is planned on the first floor.

This bicycle parking should meet the requirements of San Rafael Municipal Code section 14.18.090.

Project Driveway

Consider vehicle activated audible and visual warning of cars exiting driveway for pedestrians

Consider stop sign legends to control which movements have priority

Maintain landscaping and prohibit parking 20ft on either side of driveways and sidewalks to limit sight distance issues

Figure 28

Site Plan Review

Crossing Treatments and Intersection Controls

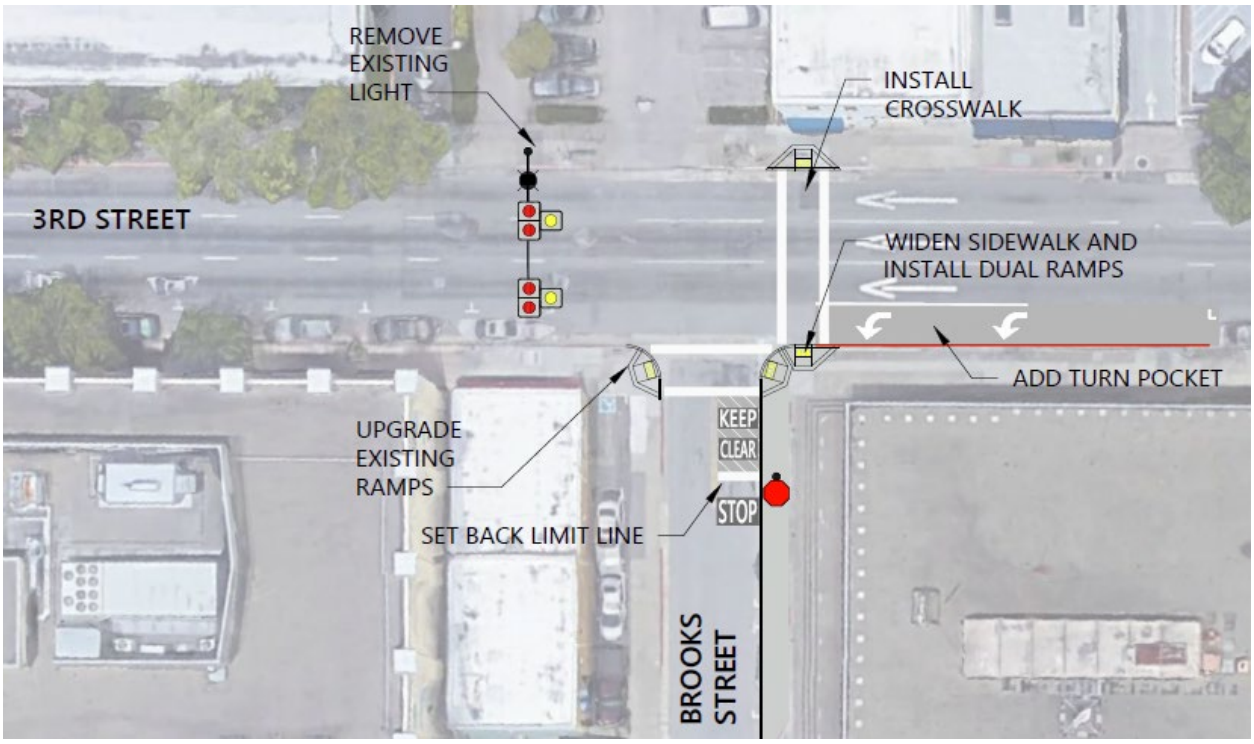
Crossing treatments and intersection controls were reviewed at the four intersections adjacent to the project site, based on the pedestrian crossings discussed in the Project Conditions chapter.

3rd Street and Brooks Street

Currently, pedestrian crossing of 3rd Street at Brooks Street is prohibited. A signalized crossing is present at A Street 240 feet to the west, providing connectivity to downtown destinations. However, entrances to the senior center and housing near the intersection of 3rd Street and Brooks Street are expected to increase pedestrian crossing demands at this intersection, as described in Project Conditions. Pedestrian hybrid beacon and signalization options were evaluated for this intersection to better accommodate pedestrians.

Installation of a Pedestrian Hybrid Beacon

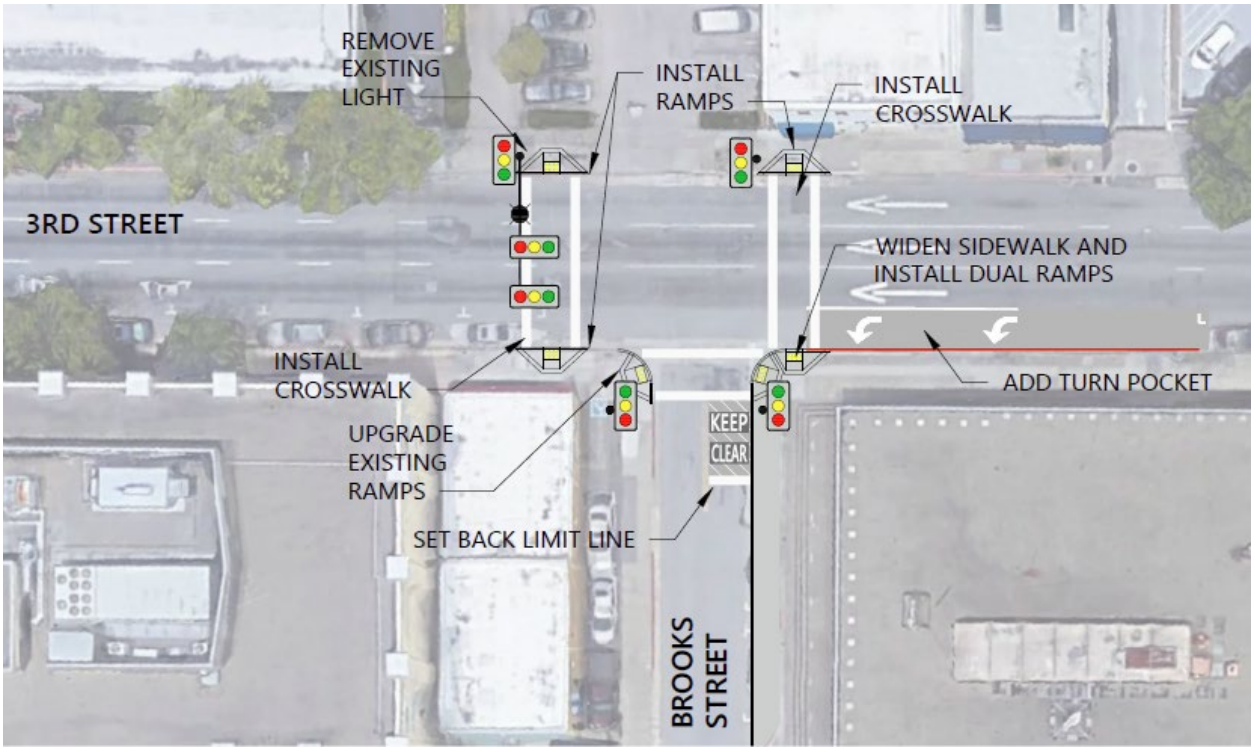
Considering current illegal crossings, new demand, and shift of some demand from the crosswalk on the east leg of the intersection of 3rd Street and A Street, 3rd Street and Brooks Street may meet the warrant for a pedestrian hybrid beacon (PHB). Seven pedestrians were observed crossing illegally during the PM peak hour, and demand for another five crossings is expected to be generated by the project. Shifting eight of the 57 crossings on the east leg of the intersection of 3rd Street and A Street would meet the warrant. A PHB on the east leg of the intersection would operate at LOS A.



Conceptual - not for construction. Additional detailed analysis and engineering design required.

Signalization

The intersection is not projected to meet the peak hour warrant for signalization. The intersection would operate at LOS A if signalized.



Conceptual - not for construction. Additional detailed analysis and engineering design required.

Intersection operations impacts are shown in Table 51. The intersection would operate at LOS A under both options.

TABLE 51: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 3RD STREET AND BROOKS STREET

Intersection	LOS/Average Delay[1,2]					
	SSSC		SSSC with PHB		Signal	
	AM	PM	AM	PM	AM	PM
15. 3rd Street and Brooks Street	A (B) / 2.3 (10.6)	A (B) / 2.8 (13.3)	A (C) / 3.7 (11.7)	A (C) / 7.6 (16.7)	A / 6.5	A / 5.0

Notes:
LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.

1. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
2. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Arterial operations impacts are shown in Table 52. Both options would change speed on 3rd Street by less than one mile per hour in the AM and PM peak hours.

TABLE 52: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 3RD STREET AND BROOKS STREET (ARTERIAL RESULTS)

Arterial	Standard	LOS / Average Speed [1,2]					
		SSSC		SSSC with PHB		Signal	
		AM	PM	AM	PM	AM	PM
3rd Street WB from Hetherton Street to D Street	D	**F / 5**	**F / 5**	**F /5**	**F / 5**	**F /5**	**F / 5**

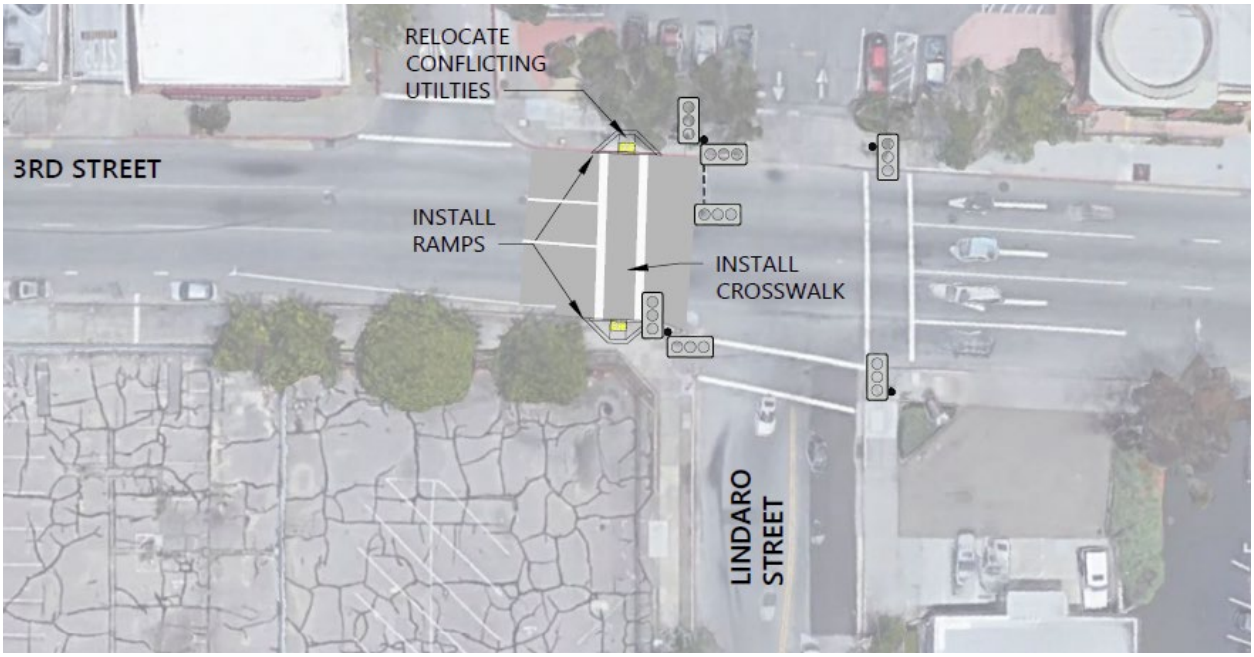
Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.
3. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

3rd Street and Lindaro Street

Currently a marked crosswalk is not present on the west leg of the 3rd Street and Lindaro Street intersection. Pedestrians walking between the project site (or existing pedestrians arriving at the southwest corner of the intersection) and downtown would need to cross the other three legs of the intersection. In all cases, pedestrian signals should be updated to meet current ADA standards, including countdown timers.

Adding a crosswalk on the west leg of the intersection would create a more direct connection to downtown. Although the northbound movements at the intersection would experience approximately three seconds greater delay, most of the vehicle volume is on the westbound movements, and overall operations for the intersection would improve (Table 53).



Conceptual - not for construction. Additional detailed analysis and engineering design required.

TABLE 53: COMPARISON OF CROSSWALK OPTIONS FOR INTERSECTION OF 3RD STREET AND LINDARO STREET

Intersection	LOS/Average Delay[1,2]			
	No crosswalk on west leg		Crosswalk on west leg	
	AM	PM	AM	PM
16. 3rd Street and Lindaro Street	B / 15.3	A / 9.4	B / 11.7	A / 8.5

Notes:
LOS = Level of Service. SSSC = Side-Street Stop Control. **Bold** indicates unacceptable operations.

1. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches.
2. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Arterial operations impacts are shown below in Table 54. Adding the crosswalk would change speed on 3rd Street by less than one mile per hour in the AM and PM peak hours.

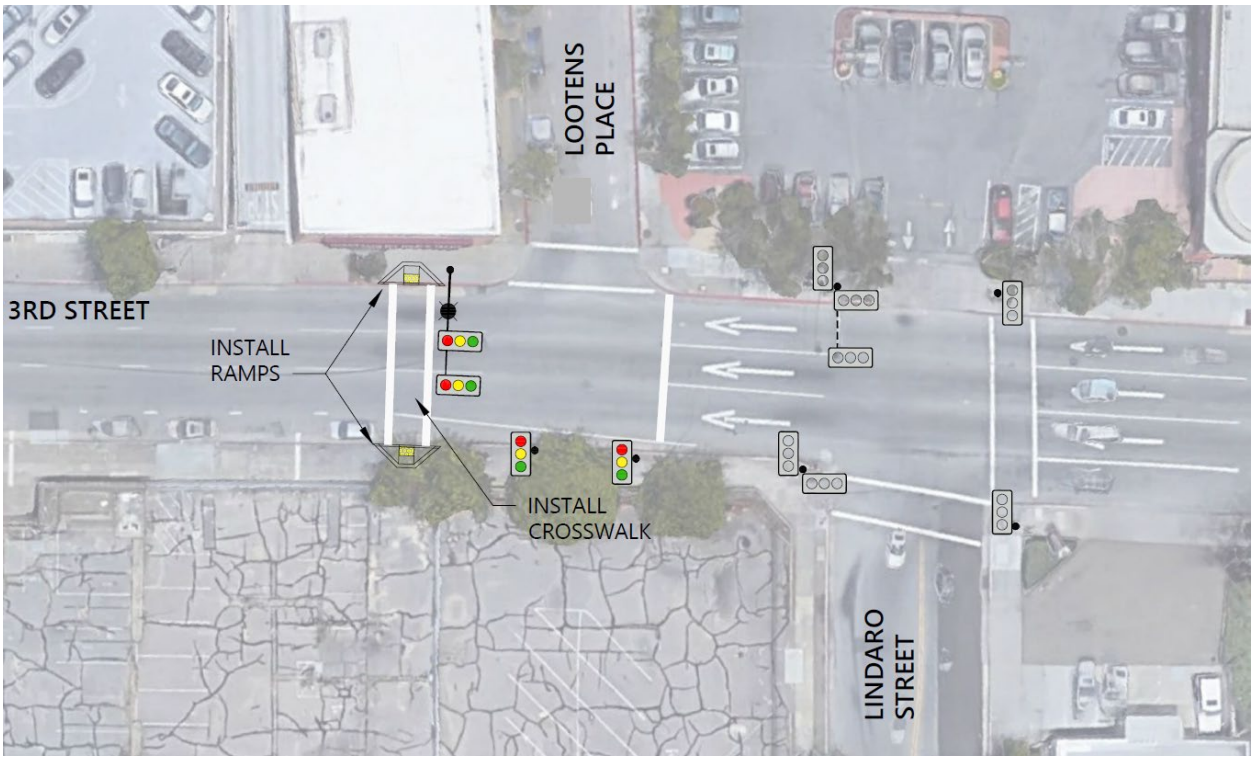
TABLE 54: COMPARISON OF CROSSWALK OPTIONS FOR INTERSECTION OF 3RD STREET AND LINDARO STREET (ARTERIAL RESULTS)

Arterial	Standard	LOS / Average Speed [1,2]			
		No crosswalk on west leg		Crosswalk on west leg	
		AM	PM	AM	PM
3rd Street WB from Hetherton Street to D Street	D	**F / 5**	**F / 5**	**F / 5**	**F / 5**

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.
3. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Alternatively, the Lindaro intersection and Lootens Place intersections could be configured with clustered signals, with a crosswalk on the west leg of the Lootens Place intersection. The intersection would operate acceptably at LOS C under Cumulative Plus Project conditions, though delay would increase somewhat. Removing the Walgreens driveway from the intersection would reduce delay somewhat in the AM peak hour, and leave it essentially unchanged in the PM peak hour. These options are summarized in Table 55.



Conceptual - not for construction. Additional detailed analysis and engineering design required.

TABLE 55: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 3RD STREET AND LINDARO STREET						
Intersection	**LOS/Average Delay[1,2]**					
	Signal at Lindaro Street only		**Signals at Lindaro and Lootens Place**		**Signals at Lindaro and Lootens Place, no Walgreens driveway**	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
16. 3rd Street and Lindaro Street	B / 15.3	A / 9.4	C / 31.3	C / 22.7	C / 25.0	C / 24.1

Notes:
LOS = Level of Service. SSSC = Side-Street Stop Control.

1. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches.
2. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Arterial operations impacts are shown below (Table 56). Signalizing Lootens Place would change speed on 3rd Street by less than one mile per hour in the AM and PM peak hours.

TABLE 56: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 3RD STREET AND LINDARO STREET (ARTERIAL RESULTS)							
Arterial	**Standard**	**LOS / Average Speed [1]**					
		Signal at Lindaro Street only		**Signals at Lindaro and Lootens Place**		**Signals at Lindaro and Lootens Place, no Walgreens driveway**	
		AM	**PM**	**AM**	**PM**	**AM**	**PM**
3rd Street WB from Hetherton Street to D Street	D	**F / 5**	**F / 5**	**F / 5**	**F / 5**	**F / 5**	**F / 5**

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.
3. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

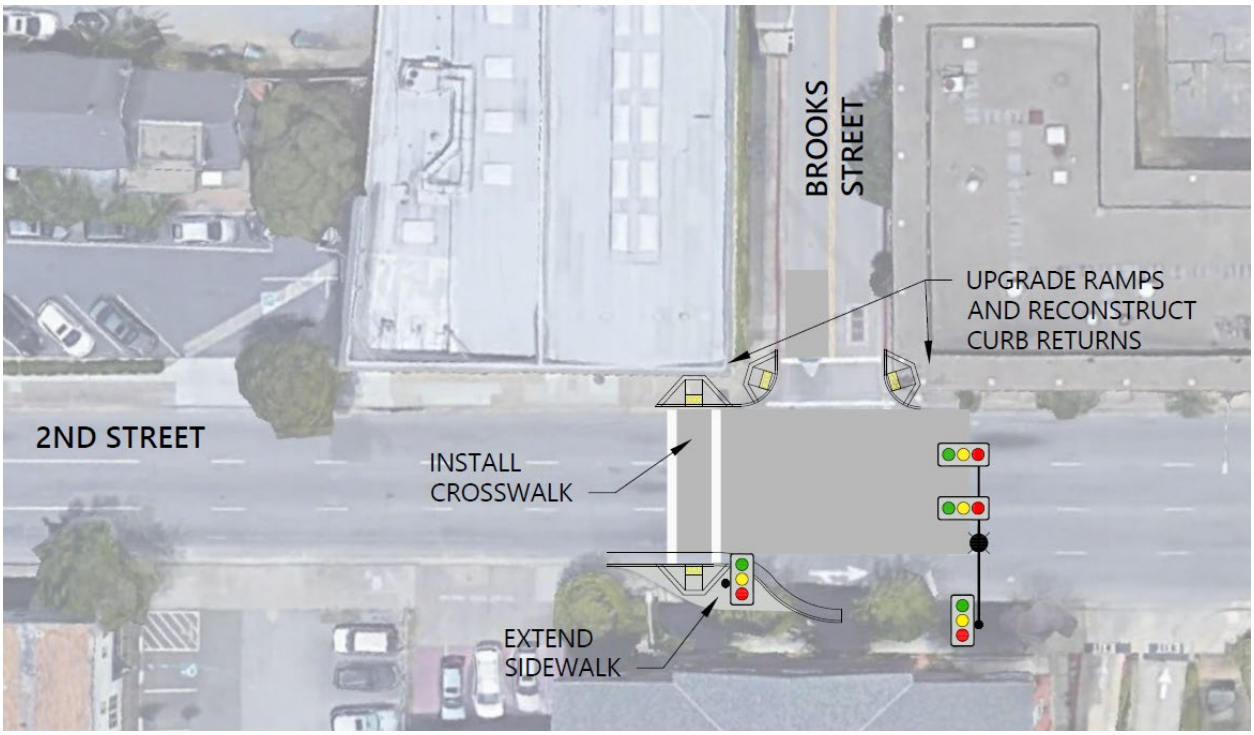
2nd Street and Brooks Street

Vehicles turning from southbound Brooks Street to eastbound 2nd Street currently have limited visibility to eastbound vehicles at this side-street stop controlled intersection because of the siting of the building on the northwest corner of the intersection. Southbound vehicles must proceed into the crosswalk on the north leg of the intersection, blocking pedestrian crossings, to increase the view of eastbound traffic.

Although a marked crosswalk across 2nd Street is not provided at this intersection, pedestrian crossings are not prohibited. However, due to the proximity of the signalized crossing at A Street (200 feet to the west) and the locations of likely pedestrian destinations, little demand is expected for a crossing at this location.

Signalization

Although a peak hour signal warrant is not met for this intersection, adding a signal would improve safety at this intersection by addressing limited sight distance. The overall impacts of installing a traffic signal at this location on adjacent intersections would be small (Table 57).



Conceptual - not for construction. Additional detailed analysis and engineering design required.

TABLE 57: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 2ND STREET AND BROOKS STREET				
Intersection	**LOS/Average Delay[1,2]**			
	SSSC		**Signal**	
	AM	**PM**	**AM**	**PM**
25. 2nd Street and Brooks Street	A (C) / 2.9 (22.0)	A (D) / 3.8 (27.7)	A / 6.4	A / 8.1

Notes:
LOS = Level of Service. SSSC = Side-Street Stop Control.

1. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
2. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Arterial operations impacts are shown below (Table 58). Addition of the signal would reduce speed on 2nd Street by one mile per hour in the AM peak hour and less than one mile per hour in the PM peak hour.

TABLE 58: COMPARISON OF CONTROL OPTIONS FOR INTERSECTION OF 2ND STREET AND BROOKS STREET (ARTERIAL RESULTS)					
Arterial	**Standard**	**LOS / Average Speed [1,2]**			
		SSSC		**Signal**	
		AM	**PM**	**AM**	**PM**
2nd Street from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 5**	**F / 5**	**F / 5**

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.
3. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Conversion of Brooks to One-Way Northbound

By removing southbound traffic on Brooks Street, the limited visibility condition for vehicles turning from southbound Brooks Street to eastbound 2nd Street would be eliminated. Some traffic would have to make additional turns; however, overall impacts on adjacent intersections would be small (Table 59), with some improvements due to one-way flows.

TABLE 59: EFFECT OF ONE-WAY CONVERSION OF BROOKS STREET

Intersection	Control Type	LOS/Average Delay[1,2]			
		Two-Way		One-Way Northbound	
		AM	PM	AM	PM
14. 3rd Street and A Street	Signal	B / 18.2	C / 24.6	B / 18.3	C / 24.2
15. 3rd Street and Brooks Street	SSSC	A (B) / 2.3 (10.6)	A (B) / 2.8 (13.3)	A (B) / 2.1 (13.4)	A (C) / 3.9 (22.6)
16. 3rd Street and Lindaro Street	Signal	B / 15.3	A / 9.4	B / 13.0	A / 8.7
24. 2nd Street and A Street	Signal	C / 27.5	C / 30.5	C / 27.9	C / 34.6
25. 2nd Street and Brooks Street	SSSC	A (C) / 2.9 (22.0)	A (D) / 3.8 (27.7)	A (A) / 2.7 (2.9)	A (A) / 2.7 (3.0)
26. 2nd Street and Lindaro Street	Signal	B / 18.6	C / 21.0	B / 18.0	B / 18.5

Notes:
LOS = Level of Service. SSSC = Side-Street Stop Control.

1. For signalized and all-way stop controlled intersections, average intersection delay is reported in seconds per vehicle for all approaches. For side-street stop controlled intersections, the delay and LOS is reported for the entire intersection and the highest delay movement (shown in parentheses).
2. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

Arterial operations impacts are shown in Table 60. Addition of the signal would reduce speed on 2nd Street by less than one mile per hour in the AM and PM peak hours.

TABLE 60: EFFECT OF ONE-WAY CONVERSION OF BROOKS STREET (ARTERIAL RESULTS)

Arterial	Standard	LOS / Average Speed [1,2]			
		SSSC		Signal	
		AM	PM	AM	PM
2nd Street from D Street to Hetherton Street/US 101 SB Ramp	D	**F / 6**	**F / 5**	**F / 6**	**F / 5**

Notes:
1. LOS = Level of Service. **Bold** indicates unacceptable operations.
2. Arterial speed is reported in miles per hour as the average speed for a vehicle traveling from one end of the arterial to the other.
3. Cumulative Plus Project Conditions (R&D and Senior Services and Housing)

Source: Fehr & Peers, 2019

2nd Street and Lindaro Street

Crosswalks are present on all four legs of this intersection, and the intersection operates acceptably. No changes are recommended.

Appendix A:
Existing Conditions –
Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

January 23, 2019

FEHR PEERS

Appendix B:
Baseline Conditions –
Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

January 23, 2019

FEHR PEERS

Appendix C:
Baseline Plus Project Conditions (R&D Only) –
Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

January 23, 2019

FEHR PEERS

Appendix D:
Baseline Plus Project Conditions (R&D and Senior Services and Housing) – Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

January 23, 2019

FEHR PEERS

Appendix E:
Cumulative Conditions – Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

January 23, 2019

FEHR PEERS

Appendix F:
Cumulative Plus Project Conditions (R&D Only) –
Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

January 23, 2019

FEHR PEERS

Appendix G:
Cumulative Plus Project Conditions (R&D and Senior Services and Housing) – Technical Calculations

Transportation Impact Study

for BioMarin 999 3rd Street

San Rafael Campus Expansion

January 23, 2019

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