Supplemental Attachment 4

TRAFFIC ENGINEERING PERFORMANCE ASSESSMENT (TEPA)

Prepared by
FEHR PEERS

332 Pine Street
4th Floor
San Francisco, CA 94104

November 19, 2018

Draft Traffic Engineering Performance Assessment (TEPA)

Prepared for:
San Francisco County Transportation Authority
Caltrans

US-101/I-280 Managed Lanes Project

Traffic Engineering Performance Assessment (TEPA)

DRAFT

Prepared for:
San Francisco County Transportation Authority
Caltrans

November 19, 2018

SF18-0985

FEHR PEERS

Table of Contents

1. Introduction 1
1.1 Report Purpose 2
1.2 Traffic Study Area 4
1.3 Data Sources and Reference Documents 7
1.4 Report Organization 7
2. Existing Conditions Analysis 9
2.1 Analysis Methodology 9
2.2 Current Traffic Data 9
2.2.1 AM Peak Hour Bottlenecks 12
2.2.2 PM Peak Hour Bottlenecks 13
2.3 Existing Operating Conditions 14
2.4 Collision Data 21
2.4.1 Mainline Collision History 21
3. Design Year Conditions Summary 29
3.1 Build Alternatives 29
3.1.1 No Build Alternative 29
3.1.2 Build Alternatives 30
3.1.3 Other Considerations 38
3.2 Near Term Traffic Demand Estimates 38
3.2.1 Year 2020 No Build Demand Development 38
3.2.2 Year 2020 Build Demand Development 39
3.3 Volume-to-Capacity Analysis 39
3.4 Travel Time Delay Analysis 57
3.5 Analysis Findings 57
3.5.1 2020 No Build Alternative 58
3.5.2 2020 Maximum Build – Alternative 1 60
3.5.3 2020 Minimum Build – Alternative 2 62
3.6 Local Street Opportunities 63
4. Traffic Studies Scope for the PA&ED Phase 65
4.1 Traffic Study Scope 65
4.1.1 Traffic Operations Analysis Study Area 65
4.1.2 Data Collection 66
4.1.3 Existing Conditions Analysis 67
4.1.4 Project Alternative Analysis 68
4.1.5 Traffic Forecasts 68
4.1.6 Future Year Operations Analysis 69

4.1.7 Traffic Analysis Report 69

5. Summary 70

List of Figures

Figure 1-1 Traffic Operations Analysis Study Area 3
Figure 2-1 US-101 Existing AM and PM Peak Hour Mainline and Ramp Volumes 10
Figure 2-2 I-280 Existing AM and PM Peak Hour Mainline and Ramp Volumes 11
Figure 3-1 Maximum Build Alternative 1A 33
Figure 3-2 Maximum Build Alternative 1B 34
Figure 3-3 Maximum Build Alternative 1C 35
Figure 3-4 Minimum Build Alternative 2A 36
Figure 3-5 Minimum Build Alternative 2B 37

List of Tables

Table 2-1: Capacity Assumptions for Traffic Analysis 9
Table 2-2: Northbound US-101 Existing Conditions Traffic Volume-to-Capacity Analysis Summary 15
Table 2-3: Southbound US-101 Existing Conditions Traffic Volume-to-Capacity Analysis Summary 17
Table 2-4: Northbound I-280 Existing Conditions Traffic Volume-to-Capacity Analysis Summary 19
Table 2-5: Southbound I-280 Existing Conditions Traffic Volume-to-Capacity Analysis Summary 20
Table 2-6: Study Area Collision History Summary – January 2014 through December 2017 21
Table 2-7: US-101 (San Francisco County) Collision History – January 2014 through December 2017 23
Table 2-8: US-101 (San Mateo County) Collision History – January 2014 through December 2017 25
Table 2-9: I-280 Collision History – January 2014 through December 2017 27
Table 3-1: Northbound US-101 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary 41
Table 3-2: Northbound US-101 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary 43
Table 3-3: Southbound US-101 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary 45
Table 3-4: Southbound US-101 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary 47
Table 3-5: Northbound I-280 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary 49
Table 3-6: Northbound I-280 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary 51
Table 3-7: Southbound I-280 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary 53
Table 3-8: Southbound I-280 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary 55
Table 3-9: 2020 No Build and 2020 Build Travel Time Delay 57

This page intentionally left blank.

1. Introduction

The United States Route 101 (US-101) corridor is one of the primary travel routes through the City of San Francisco, connecting the Peninsula to the North Bay and with direct access to the Bay Bridge. The Interstate 280 (I-280) is another primary north-south corridor through the City of San Francisco. Both corridors provide direct access to downtown and are currently congested beyond the AM and PM peak hours. Regional projections for land use growth[1] suggest that congestion levels will increase substantially in this region, thereby adversely affecting mobility, access and safety along the corridors.

The *US-101/I-280 Managed Lanes* project (Project) seeks to improve local and regional mobility, access and safety along the US-101 and I-280 corridors through the addition of an HOV/express lane in each direction. The extent of the managed lanes are described below and illustrated in **Figure 1-1**.

- US-101 Northbound, between the I-380 interchange and the Harney Way interchange
- US-101 Southbound, between the I-280 and I-380 interchanges[2]
- I-280 Northbound, between the 18th Street interchange and I-280 terminus at 5th and King Street in Downtown San Francisco
- I-280 Southbound, between the start of I-280 and the US-101 interchange

This Project would continue the proposed HOV/express lane system along US-101 in San Mateo County. The Project is anticipated to relieve congestion along the two corridors and provide incentives for traveler mode choice shifts to higher-occupancy modes of travel (i.e., HOV 2+ or HOV 3+). San Francisco County Transportation Authority (SFCTA) is the lead agency for this planning effort, and is working cooperatively with Caltrans District 4, the City of San Francisco, and County of San Mateo to advance this project through the approval process.

[1] *Plan Bay Area 2040* (Metropolitan Transportation Commission and the Association of Bay Area Governments, 2017)

[2] San Mateo County Transportation Authority, in coordination with Caltrans and City/County Association of San Mateo proposes to build continuous managed lanes on US-101 in San Mateo extending from I-380 in San Bruno to San Antonio Road in Mountain View.

1.1 Report Purpose

The project development team is preparing a Project Study Report-Project Development Support (PSR-PDS) document to advance the project to the next stage of development, in accordance with the Caltrans *Project Development Procedures Manual*. Consistent with those guidelines, this report will serve as the Traffic Engineering Performance Assessment (TEPA) that is a required element of a PSR-PDS. As specified in the guidelines, the intent of this TEPA report is to use readily-available information and apply macro-level analysis and evaluation techniques to provide a technical foundation for developing a preliminary purpose and need statement for the proposed project, and to outline the scope and magnitude of the more detailed analyses to be conducted as part of subsequent project development efforts. **Figure 1-1** presents the extents of the project and the proposed study limits (discussed further in **Chapter 2**).

LEGEND

Study Corridor

Figure 1-1

TEPA Study Area

1.2 Traffic Study Area

The project limits extend along US-101 in San Francisco and into San Mateo County passing through the Cities of Brisbane, South San Francisco, and Millbrae from about postmile SM 19.2 to postmile SF 3.001. The Project limits for I-280 are within the City of San Francisco extending from postmile SF R1.72 to postmile SF T7.26. The study area for this TEPA includes the following mainline and ramp segments, as illustrated on **Figure 1-1**:

- US-101 Mainline Segments, between I-380 interchange and the Cesar Chavez Street interchange
- US-101 Interchanges:
    - US-101/Cesar Chavez/Potrero Avenue
    - US-101/Alemany Boulevard/Bayshore Boulevard
    - US-101/Silver Avenue
    - US-101/I-280
    - US-101/Paul Avenue
    - US-101/Third Street
    - US-101/Harney Way/Alana Way
    - US-101/Sierra Point Parkway
    - US-101/Bayshore Boulevard
    - US-101/Oyster Point Boulevard
    - US-101/Grand Ave
    - US-101/Produce Avenue/S Airport Boulevard
    - US101/US-380
- I-280 Mainline Segments, between Ocean Avenue interchange and King Street
- I-280 Interchanges:
    - I-280/King Street
    - I-280/6th Street
    - I-280/18th Street
    - I-280/Mariposa Street
    - I-280/25th Street/Cesar Chavez
    - I-280/Alemany Boulevard/Mission Street
    - I-280/Monterey Boulevard
    - I-280/San Jose Avenue
    - I-280/Ocean Avenue/Geneva Avenue

The following provides a brief description of the key facilities.

US-101/Cesar Chavez/Potrero Avenue is a modified Type L-1 with direct ramps provided on surface streets along Cesar Chavez, Potrero Ave, and Bayshore Boulevard; however, the interchange provides full access and accommodates all ramp movements.

US-101/Alemany Boulevard/Bayshore Boulevard is a partial Type L-12 interchange that provides on-ramp access from Alemany Boulevard and San Bruno Avenue to southbound US-101 and northbound US-101. The interchange also provides off-ramp access from northbound US-101 to Alemany Boulevard and Bayshore Boulevard.

US-101/Silver Avenue is a partial Type L-6 interchange that provides full access and accommodates all ramp movements with access to southbound US-101. Off-ramp access is also provided from northbound US-101; however, on-ramp access to northbound US-101 is not provided at this location.

US-101/I-280 is a partial Type F-1 (Alt B) interchange that provides full access and accommodates all ramp movements with access to northbound and southbound I-280, except from southbound US-101 to north bound I-280.

US-101/Paul Avenue is a partial hybrid Type L-6 interchange and Type L-10 interchange. The interchange accommodates full access to southbound US-101 via on- and off-ramps from Bayshore Boulevard and San Bruno Avenue, respectively. Off-ramp access is also provided from northbound US-101 via Bayshore Boulevard; however, on-ramp access to northbound US-101 is not provided at this location.

US-101/Third Street is a hybrid Type L-4 (southbound) and Type L-10 (northbound) interchange that provides full access and accommodates all ramp movements with access to northbound and southbound US-101.

US-101/Harney Way/Alana Way is a hybrid Type L-6 (southbound) and Type L-10 (northbound) interchange that provides full access and accommodates all ramp movements with access to northbound and southbound US-101.

US-101/Sierra Point Parkway is a hybrid Type L-6 (southbound) and Type L-1 (northbound) interchange that provides full access and accommodates all ramp movements with access to northbound and southbound US-101 and Sierra Point Parkway.

US-101/Bayshore Boulevard is a partial Type L-11 interchange that provides full access and accommodates all ramp movements for southbound US-101. Off-ramp access is also provided from northbound US-101; however, on-ramp access to northbound US-101 is not provided at this location.

US-101/Oyster Point Boulevard is a hybrid Type L-11 (southbound off-ramp), Type L-12 (southbound on-ramp), Type L-6 (northbound off-ramp), and Type L-1 (northbound on-ramp) interchange that accommodates movements to and from northbound and southbound US-101 and Oyster Point Boulevard.

US-101/Grand Avenue is a partial hybrid Type L-1 (northbound and southbound off-ramp) and Type L-10 (northbound on-ramp) interchange that accommodates traffic to and from Grand Avenue and US-101. On-ramp access to southbound US-101 is not provided at this location.

US-101/Produce Avenue/S Airport Boulevard is a hybrid Type L-6 (northbound and southbound off-ramp) and Type L-12 (southbound on-ramp) interchange, which accommodates full access to and from US-101, Produce Avenue, and S Airport Boulevard.

US101/US-380 is a Type F-1 (Alt A) interchange with a southbound US-101 loop off-ramp to I-380 eastbound, that provides full access and accommodates all ramp movements with access to northbound and southbound US-101 and eastbound and westbound I-380.

I-280/King Street is the ramp terminus and origin of the I-280 freeway in the City of San Francisco and operates most similarly to a Type L-11 interchange that provides full access between northbound and southbound I-280 and King Street.

I-280/6th Street operates most similarly to a Type L-11 interchange that provides full access and accommodates all ramp movements with access to I-280, 6th Street, and Brannan Street.

I-280/18th Street is a partial Type L-1 interchange that provides full off-ramp access from southbound I-280 and full on-ramp access to northbound I-280 from 18th Street. On-ramp access to southbound I-280 and off-ramp access from northbound I-280 is not provided at this location.

I-280/Mariposa Street is a partial Type L-1 interchange that provides full on-ramp access to southbound I-280 and full off-ramp access from northbound I-280 to Mariposa Street. Off-ramp access from southbound I-280 and on-ramp access to northbound I-280 is not provided at this location.

I-280/25th Street/Cesar Chavez is a hybrid Type L-6 (southbound), Type L-11 (northbound off-ramp), and Type L-1 (northbound on-ramp) interchange that provides full access and accommodates all ramp movements with access to northbound and southbound I-280.

I-280/Alemany Boulevard/Mission Street is a Type L-4 interchange that provides full access and accommodates all ramp movements with access to I-280.

I-280/Monterey Boulevard is partial Type L-12 interchange that provides off-ramp access from southbound I-280 and on-ramp access to northbound I-280. On-ramp access to southbound I-280 and off-ramp access from northbound I-280 is not provided at this location.

I-280/San Jose Avenue is a partial Type L-11 interchange that provides on-ramp access to southbound I-280 and off-ramp access from northbound I-280. Off-ramp access from southbound I-280 and on-ramp access to northbound I-280 is not provided at this location.

I-280/Ocean Avenue/Geneva Avenue operates most similarly to a Type L-4 interchange with direct on- and off-ramps via Ocean Avenue and Geneva Avenue with exception to a direct on-ramp to southbound I-280 from Ocean Avenue.

This TEPA analysis focuses on mainline operations conducted at a planning level. A more detailed assessment of system components (e.g., weaving sections, merge/diverge sections, ramp-terminal intersections, local street intersections, etc.) will be addressed in the subsequent Project Approval/Environmental Document (PA/ED) stage of project development.

1.3 Data Sources and Reference Documents

The following data sources were used in the preparation of this document:

- Data and analysis from the *Managed Lane Analysis: Methodology and Findings Technical Memorandum*, completed by Fehr & Peers in March 2018.
- *San Francisco Freeway Corridor Management Study (FCMS) – Phase 1 Report*, completed by the SFCTA in March 2015.
- *San Francisco Freeway Corridor Management Study (FCMS) – Phase 2 Existing Conditions Report*, prepared by AECOM, ETC, and W-Trans in October 2016.
- *San Francisco Freeway Corridor Management Study (FCMS) – Phase 2 Draft Report*, completed by the SFCTA in October 2018.
- Mainline traffic count data from the Caltrans freeway Performance Measurement System (PeMS): provides recent (2017) data on mainline and ramp volumes in the study area.
- Recent collision data summaries were provided by Caltrans District 4 staff on August 21, 2018.

1.4 Report Organization

The remainder of this report is organized into the following sections:

- *Chapter 2 – Existing Conditions Analysis* – summarizes the current peak hour traffic and collision data available for the study area, and also documents the qualitative analysis conducted for mainline, ramp and arterial segments within the study area.
- *Chapter 3 – Year 2020 (Near Term) Conditions Summary* – summarizes preliminary estimates of design year peak hour traffic volumes and operations under the No Build and Build Alternatives.
- *Chapter 4 –Traffic Study Scope for the PA/ED* – describes the scope of work for the more detailed studies to be conducted at the PA/ED stage of project development.
- *Chapter* 5 – *Summary* – recaps the key operational issues that inform the development of the purpose and need statement for the project.

2. Existing Conditions Analysis

This chapter describes the current operating conditions of the traffic study area using readily available data. It also includes a segment-level planning analysis of the quality of existing traffic operations and a summary of recent collision statistics.

2.1 Analysis Methodology

A qualitative peak hour operations analysis was performed for mainline segments by comparing the counted (or forecasted) volume to an approximate per-lane capacity for each roadway facility. **Table 2-1** describes the capacities used in the analysis based on assumptions from other recently completed studies for the FCMS project.

Table 2-1: Capacity Assumptions for Traffic Analysis

Segment Type	Available Capacity in Vehicles Per Hour Per Lane	
	I-280	US-101
General Purpose Lane	2,000	1,900
Auxiliary Lane	1,000	1,000
Managed Lane	1,650	1,650

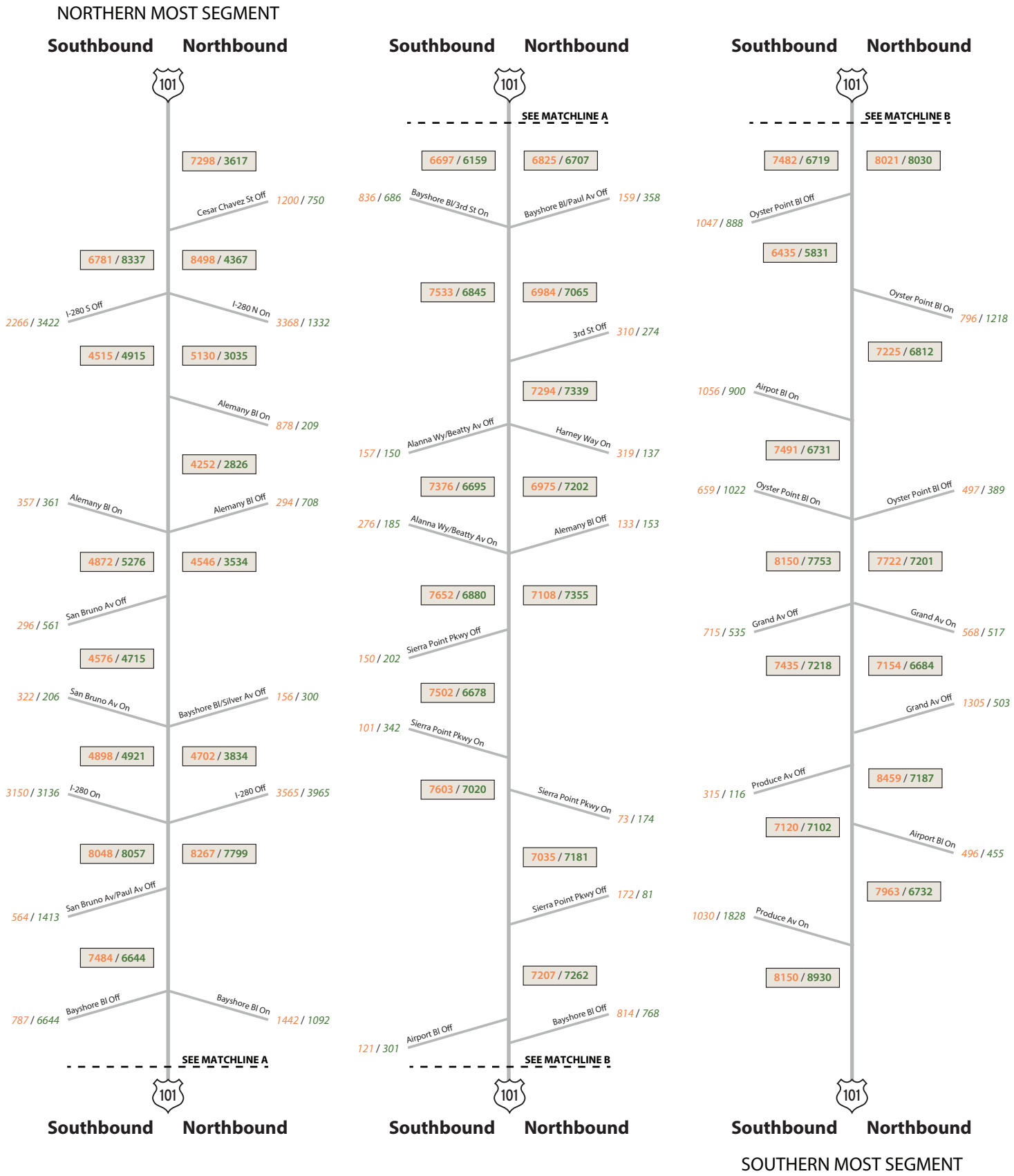
Source: Fehr & Peers

The resulting volume-to-capacity analysis was used to qualitatively assess the traffic operations along each study segment and generally categorize each into one of the following three categories:

- Under-capacity operations, V/C ratio less than 0.9
- Near-capacity operations, V/C ratio between 0.9 and 1.0
- Over-capacity operations, V/C ratio greater than 1.0

2.2 Current Traffic Data

The data sources used in the existing conditions analysis are listed in **Section 1.3**. Lane configurations were collected for study roadways in 2017; mainline travel speeds from the INRIX database were downloaded in late 2017. The existing US-101 and I-280 mainline and ramp peak hour volumes are shown on **Figure 2-1** and **Figure 2-2**, respectively.



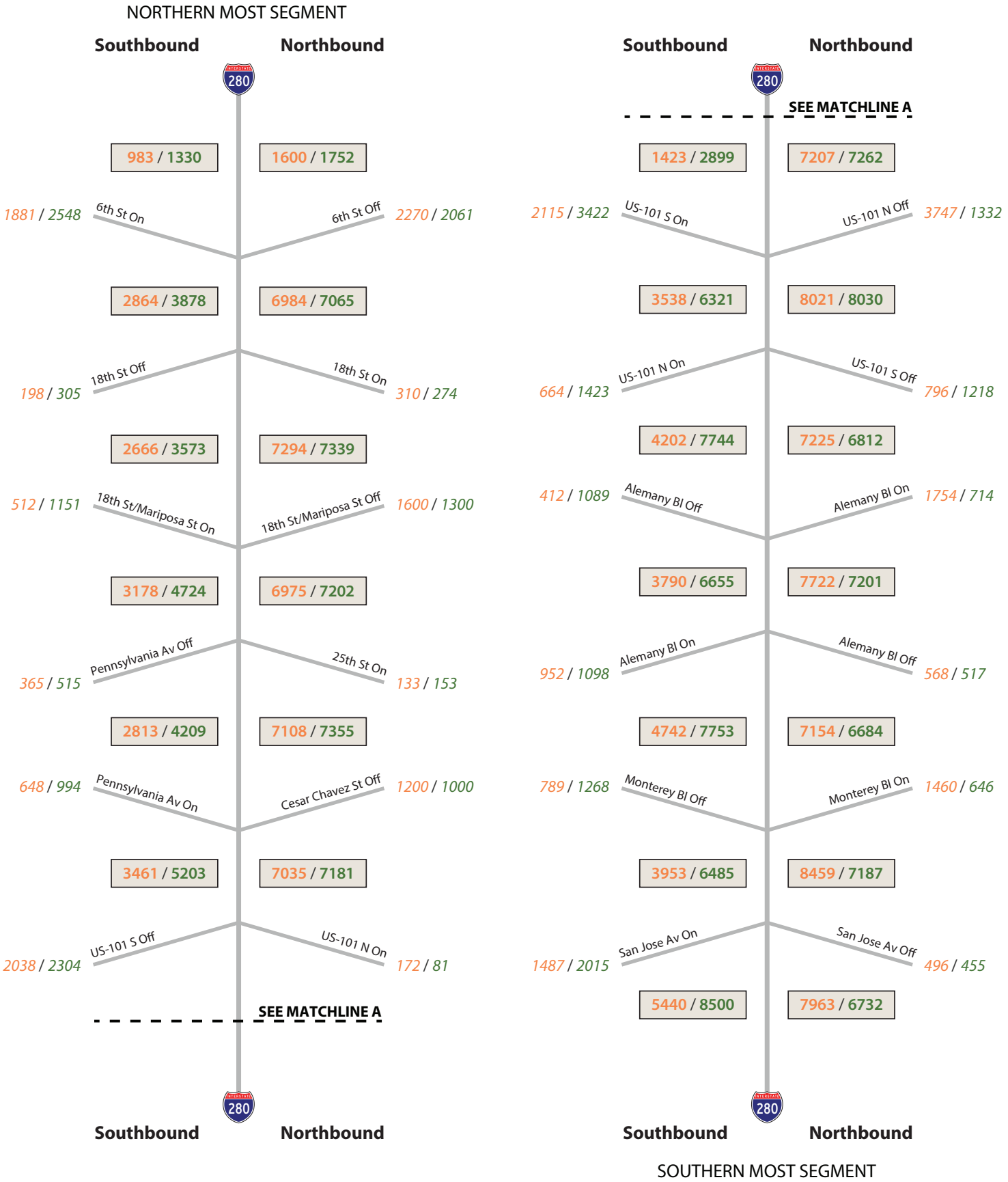
LEGEND

AM / PM Ramp Volume

AM / PM Mainline Volume

Figure 2-1

Existing US-101 Mainline and Ramp Peak Hour Volumes



LEGEND

AM / PM Ramp Volume

AM / PM Mainline Volume

Figure 2-2

Existing I-280 Mainline and Ramp Peak Hour Volumes

US-101 serves as a major north-south commute corridor for travelers who work or live in San Francisco and other jurisdictions along the Peninsula. Within the study area, US-101 generally peaks in both directions during the AM and PM peak hour with a concentration of traffic near South San Francisco and north of the I-280 interchange, approaching the Bay Bridge.

I-280 which terminates in San Francisco's South of Market (SoMA) neighborhood similarly serves as secondary commute corridor for travelers who work or live in San Francisco and the Peninsula. Within the study area, I-280 typically peaks during the AM and PM peak hour as traffic approaches the US-101 interchange in the northbound and southbound direction, respectively. Congestion near the I-280 terminus at King Street and 6th Street is present during the AM and PM peak hour.

To understand the travel speeds and congestion characteristics within the study area, a series of INRIX travel speed data downloads were taken for Tuesdays, Wednesdays, and Thursdays in mid-to-late September 2017. The data downloads include speeds by mainline segment at 15-minute intervals. The data were reviewed to confirm their consistency with field observed patterns of congestion and the presence of inclement weather or incidents; outlier data sets were discarded. A total of two weeks (or six days) worth of data was used in the AM and PM peak hour data set.

2.2.1 AM Peak Hour Bottlenecks

A summary of existing AM peak hour bottleneck locations is described by each freeway corridor below.

2.2.1.1 US-101

The primary northbound bottlenecks occur just north of the US-101/I-380 interchange between the Grand Avenue off-ramp and the Airport Boulevard on-ramp. The bottleneck results in a queue spillback outside the study area limits. North of the Airport Boulevard bottleneck, conditions will be generally free of congestion up to the SF/SM county line across all scenarios. Under existing conditions, the Hospital Curve bottleneck almost extends back to the SF/SM county limits at the Third Street/Bayshore Boulevard interchange. Downstream of the Hospital Curve bottleneck, conditions will be generally free of congestion except at the approach to the lower deck of the Bay Bridge in all scenarios.

The primary southbound bottleneck occurs between Bayshore Boulevard on-ramp and Alana Way off-ramp primarily due to the lane drop just south of the Bayshore Boulevard on-ramp. Traffic conditions are generally free south of the Alana Way/Harney Way interchange through the remainder of the study area. It should be noted that although congestion does not regularly occur around Hospital Curve in the southbound US-101 direction, the segment is typically at or near capacity during AM peak period and will constrain the traffic throughput along southbound US-101.

2.2.1.2 I-280

The primary northbound bottlenecks along I-280 occurs at the I-280/US-101 interchange due to the demand exceeding the capacity of the two lane connector between I-280 northbound and US-101 northbound. Congestion from this bottleneck typically spills back to the Ocean Avenue interchange. At the I-280 terminus, queues typically form due to the freeways interface with the local streets at King Street at 5th Street and 6th Street at Brannan Street. Queues from terminus typically spill back near the Mariposa Street interchange.

In the southbound direction, traffic is generally under-capacity as traffic volumes entering the freeway are constrained by the capacity of the King Street at 5th Street and 6th Street at Brannan Street intersections.

2.2.2 PM Peak Hour Bottlenecks

A summary of existing PM peak hour bottleneck locations is described by each freeway corridor below.

2.2.2.1 US-101

The demand for eastbound I-80 at the start of the Bay Bridge exceeds the available capacity resulting in a queue, which extends into the study area limits near the US-101/I-280 interchange. This controlling bottleneck likely hides the bottleneck formed by Hospital Curve which typically operates near or at capacity. In addition, northbound US-101 segments around the San Francisco/San Mateo County line typically operate at near-capacity conditions.

In the southbound US-101 direction, the primary bottleneck is at the Hospital Curve with queues extending beyond the study limits to the Bay Bridge terminus. South of Hospital Curve, traffic conditions are typically free flowing; however, a short amount of congestion is typically present through South San Francisco near the Grand Avenue and Oyster Point Boulevard interchanges.

2.2.2.2 I-280

Similar to the AM peak hour, the primary northbound bottleneck in the PM peak hour occurs at the I-280 terminus where queues typically form due to the freeways interface with the local streets at King Street at 5th Street and 6th Street at Brannan Street. Queues from the terminus typically spill back to the Mariposa Street interchange.

In the southbound direction, a bottleneck is typically formed near the Alemany Boulevard and Monterey Boulevard off-ramps. Queues typically spillback onto I-280/US-101 connector; however, do not typically extend beyond the US-101 interchange. Additional congestion is typically spotted near the start of the

freeway near the 25th Street and 18th Street interchanges; however, does not extend back into the local streets.

2.3 Existing Operating Conditions

Existing mainline traffic operations were evaluated by comparing the counted traffic volumes to the corresponding roadway capacity. **Table 2-2** and **Table 2-3** summarize the results for northbound and southbound US-101, respectively. **Table 2-4** and **Table 2-5** summarize the results for northbound and southbound I-280, respectively.

As shown, northbound US-101 generally operates at or near over-capacity conditions in the AM and PM peak hour. Congestion along the corridor is impacted by bottlenecks within the study area and outside the study area, such as Hospital Curve and the Bay Bridge. Southbound US-101 operates at or near capacity in the AM peak hour for most of the study segment. Within the study area, the PM peak hour experiences pockets of congestion or near-capacity conditions but generally operates under-capacity.

Northbound I-280 generally operates under-capacity in the AM and PM peak hour with exception of the freeway terminus. The local street network constrains the amount of traffic served at the freeway terminus causing queues to form at the King Street and 6th Street off-ramp. Southbound I-280 typically operates under-capacity during the AM peak hour. During the PM peak hour, a bottleneck is observed near the Alemany Boulevard and Monterey Boulevard interchange which spills back to the I-280/US-101 connector.

Throughout the US-101 and I-280 corridor, segment volumes are below the available capacity; however, operate in congestion due to the downstream bottlenecks which cause segments to operate at over-capacity conditions. The observations described above are consistent with those presented in the *FMCS Phase 2 Existing Conditions Report* (October 2016). A more detailed traffic operations analysis will be conducted during the PA/ED stage of this project and those results will provide a more rigorous evaluation of current conditions.

Table 2-2: Northbound US-101 Existing Conditions Traffic Volume-to-Capacity Analysis Summary

Segment[1]	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]
Airport Blvd Off to Airport Blvd On	4 GP + 1 Aux	8,600	7,963	Segment in Queue*	6,732	0.78
Airport Blvd On to Grand Av Off	4 GP + 1 Aux	8,600	8,600	1.00**	7,187	0.84
Grand Av Off to Grand Av On	4 GP	7,600	7,154	0.94	6,684	0.88
Grand Av On to Oyster Point Blvd Off	4 GP + 1 Aux	8,600	7,722	0.90	7,201	0.88
Oyster Point Blvd Off to Oyster Point Blvd On	4 GP	7,600	7,225	0.95	6,812	0.84
Oyster Point Blvd On to Bayshore Blvd Off	4 GP + 1 Aux	8,600	8,021	0.93	8,030	0.90
Bayshore Blvd Off to Sierra Point Pkwy Off	4 GP	7,600	7,207	0.95	7,262	0.96
Sierra Point Pkwy Off to Sierra Point Pkwy On	4 GP	7,600	7,035	0.93	7,181	0.93
Sierra Point Pkwy On to Harney Way Off	4 GP	7,600	7,108	0.94	7,355	0.96
Harney Way Off to Harney Way On	4 GP	7,600	6,975	0.92	7,202	0.94
Harney Way On to 3rd St Off	4 GP	7,600	7,294	0.96	7,339	0.97
3rd St Off to Bayshore Blvd/Paul Av Off	5 GP	9,500	6,984	Segment in Queue*	7,065	0.74
Bayshore Blvd/Paul Av Off to Bayshore Blvd On	5 GP	9,500	6,825	Segment in Queue*	6,707	0.71
Bayshore Blvd On to I-280 Off	4 GP + 1 Aux	8,600	8,267	Segment in Queue*	7,799	0.91
I-280 Off to Bayshore Blvd/Silver Av Off	3 GP	5,700	4,702	Segment in Queue*	3,834	0.67
Bayshore Blvd/Silver Av Off to Alemany Off	3 GP	5,700	4,546	Segment in Queue*	3,534	0.62
Alemany Blvd Off to Alemany Blvd On	3 GP	5,700	4,252	Segment in Queue*	2,826	0.50
Alemany Blvd On to I-280 N On	3 GP	5,700	5,130	Segment in Queue*	3,035	0.53

Table 2-2: Northbound US-101 Existing Conditions Traffic Volume-to-Capacity Analysis Summary

Segment[1]	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]
I-280 N On to Cesar Chavez St Off	4 GP + 1 Aux	8,600	8,498	Segment in Queue*	4,367	Segment in Queue*
Cesar Chavez St Off to Cesar Chavez St On	4 GP	7,600	7,298	Segment in Queue*	3,617	Segment in Queue*

Notes:
1. Starting from the southernmost segment and going north.
2. GP = general purpose lane, AUX = auxiliary lane
3. Yellow cell shading indicates near-capacity operations, red cell shading indicates over-capacity operations
* Segment in queue based on INRIX data and field observations, which supersede the V/C results.
** Controlling bottlenecks operate at V/C = 1.00 by definition.
Source: Fehr & Peers, 2018

Table 2-3: Southbound US-101 Existing Conditions Traffic Volume-to-Capacity Analysis Summary

Segment[1]	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C3
Cesar Chavez St On to I-280 S Off	3 GP + 2 Aux	7,700	6,781	Segment in Queue*	7,700	1.00**
I-280 S Off to Alemany Blvd On	3 GP	5,700	4,515	Segment in Queue*	4,915	0.86
Alemany Blvd On to San Bruno Av Off	3 GP + 1 Aux	6,700	4,872	Segment in Queue*	5,276	0.79
San Bruno Av Off to San Bruno Av On	3 GP	5,700	4,576	Segment in Queue*	4,715	0.83
San Bruno Av On to I-280 N On	3 GP	5,700	4,898	Segment in Queue*	4,921	0.86
I-280 On to San Bruno Av/Paul Av Off	5 GP	9,500	8,048	Segment in Queue*	8,057	0.85
San Bruno Av/Paul Av Off to Bayshore Blvd Off	5 GP	9,500	7,484	Segment in Queue*	6,644	0.7
Bayshore Blvd Off to Bayshore Blvd On	4 GP	7,600	6,697	Segment in Queue*	6,159	0.81
Bayshore Blvd On to Alanna Way/Beatty Av Off	4 GP	7,600	7,600	1.00**	6,845	0.90
Alanna Way/Beatty Av Off to Alanna Way/Beatty Av On	4 GP	7,600	7,376	0.97	6,695	0.88
Alanna Way/Beatty Av On to Sierra Point Pkwy Off	4 GP	7,600	7,600	1.00**	6,880	0.91
Sierra Point Pkwy Off to Sierra Point Pkwy On	4 GP	7,600	7,502	0.99	6,678	0.88
Sierra Point Pkwy On to Airport Blvd Off	4 GP	7,600	7,600	1.00**	7,020	0.92
Airport Blvd Off to Oyster Point Blvd Off	4 GP	7,600	7,482	0.98	6,719	0.88
Oyster Point Blvd Off to Airport Blvd On	4 GP	7,600	6,435	0.85	5,831	0.77
Airport Blvd On to Oyster Point Blvd On	4 GP	7,600	7,491	0.99	6,731	0.89
Oyster Point Blvd On to Grand Av Off	4 GP + 1 Aux	8,600	8,150	0.95	7,753	0.90
Grand Av Off to Produce Av Off	4 GP	7,600	7,435	0.98	7,218	0.95

Table 2-3: Southbound US-101 Existing Conditions Traffic Volume-to-Capacity Analysis Summary

Segment[1]	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C3
Produce Av Off to Produce Av On	4 GP	7,600	7,120	0.94	7,102	0.93
Produce Av On to I-380 Off	5 GP + 1 Aux	10,500	8,150	0.78	8,930	0.85

Notes:
1. Starting from the northernmost segment and going south.
2. GP = general purpose lane, AUX = auxiliary lane
3. Yellow cell shading indicates near-capacity operations, red cell shading indicates over-capacity operations
* Segment in queue based on INRIX data and field observations, which supersede the V/C results.
** Controlling bottlenecks operate at V/C = 1.00 by definition.
Source: Fehr & Peers, 2018

Table 2-4: Northbound I-280 Existing Conditions Traffic Volume-to-Capacity Analysis Summary

Segment[1]	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]
Ocean Av On to San Jose Av Off	4 GP + 1 Aux	9,000	7,178	Segment in Queue*	6,177	0.69
San Jose Av Off to Monterey Blvd On	4 GP	8,000	5,475	Segment in Queue*	4,427	0.55
Monterey Blvd On to Alemany Blvd Off	3 GP + 1 Aux	7,000	6,935	Segment in Queue*	5,073	0.72
Alemany Blvd Off to Alemany Blvd On	4 GP	8,000	6,242	Segment in Queue*	4,363	0.55
Alemany Blvd On to US-101 S Off	4 GP + 1 Aux	9,000	7,996[4]	1.00**	5,077	0.56
US-101 S Off to US-101 N Off	4 GP	8,000	6,861	0.86	4,245	0.53
US-101 N Off to US-101 N On	2 GP	4,000	3,114	0.78	2,913	0.73
US-101 N On to Cesar Chavez St Off	3 GP	6,000	6,000	1.00**	5,659	0.94
Cesar Chavez St Off to 25th St On	3 GP	6,000	5,074	0.85	4,659	0.78
25th St On to Mariposa St Off	3 GP + 1 Aux	7,000	5,374	0.77	5,009	0.72
Mariposa St Off to 18th St On	3 GP	6,000	3,774	Segment in Queue ***	3,709	Segment in Queue ***
18th St On to 6th St Off	3 GP + 1 Aux	7,000	3,870	Segment in Queue ***	3,813	Segment in Queue ***
6th St Off to King St	2 GP	4,000	1,600	Segment in Queue ***	1,752	Segment in Queue ***

Notes:
1. Starting from the southernmost segment and going north.
2. GP = general purpose lane, AUX = auxiliary lane
3. Yellow cell shading indicates near-capacity operations, red cell shading indicates over-capacity operations
4. The bottleneck at this location is caused by a deficient ramp design where the off-ramp traffic exceeds the available capacity. The off-ramp demand results in a bottleneck and queue spillback.
* Segment in queue based on INRIX data and field observations, which supersede the V/C results.
** Controlling bottlenecks operate at V/C = 1.00 by definition.
*** Freeway terminus metered by local street capacity. Segment in queue based on INRIX data and field observations which supersede the V/C results.
Source: Fehr & Peers, 2018

Table 2-5: Southbound I-280 Existing Conditions Traffic Volume-to-Capacity Analysis Summary

Segment[1]	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]
King St to 6th St On	2 GP	4,000	983	0.25	1,330	0.33
6th St On to 18th St Off	3 GP + 1 Aux	7,000	2,864	0.41	3,878	0.55
18th St Off to 18th St On	3 GP	6,000	2,666	0.44	3,573	0.6
18th St On to Pennsylvania Av Off	3 GP	6,000	3,178	0.53	4,724	0.79
Pennsylvania Av Off to Pennsylvania Av On	3 GP	6,000	2,813	0.47	4,209	0.7
Pennsylvania Av On to US-101 S Off	3 GP	6,000	3,461	0.58	5,203	0.87
US-101 S Off to US-101 S On	2 GP	4,000	1,423	0.36	2,899	Segment in Queue*
US-101 S On to US-101 N On	4 GP	8,000	3,538	0.44	6,321	Segment in Queue*
US-101 N On to Alemany Blvd Off	4 GP + 1 Aux	9,000	4,202	0.47	7,744	Segment in Queue*
Alemany Blvd Off to Alemany Blvd On	4 GP	8,000	3,790	0.47	6,655	Segment in Queue*
Alemany Blvd On to Monterey Blvd Off	4 GP	8,000	4,742	0.59	7,753[4]	1.00**
Monterey Blvd Off to San Jose Av On	4 GP	8,000	3,953	0.49	6,485	0.81
San Jose Av On to Ocean Av Off	4 GP + 1 Aux	9,000	5,440	0.6	8,500	0.94
Ocean Av Off to Ocean Av On	5 GP	10,000	4,694	0.47	7,300	0.73

Notes:
1. Starting from the northernmost segment and going south.
2. GP = general purpose lane, AUX = auxiliary lane
3. Yellow cell shading indicates near-capacity operations, red cell shading indicates over-capacity operations
4. The bottleneck at this location is caused by a deficient ramp design where the off-ramp traffic exceeds the available capacity. The off-ramp demand results in a bottleneck and queue spillback.
* Segment in queue based on INRIX data and field observations, which supersede the V/C results.
** Controlling bottlenecks operate at V/C = 1.00 by definition.
Source: Fehr & Peers, 2018

2.4 Collision Data

This section summarizes collision statistics for key mainline and arterial segments within the study area.

2.4.1 Mainline Collision History

Caltrans staff provided collision data for US-101 and I-280 through the study area between January 2014 and December 2017 (the most recent four years of complete data). **Table 2-6** summarizes the collision data within the study area by corridor. **Table 2-7**, **Table 2-8**, and **Table 2-9** detail the collision data for US-101 (San Francisco County), US-101 (San Mateo County) and I-280 (San Francisco County), respectively.

Table 2-6: Study Area Collision History Summary – January 2014 through December 2017

Facility	Number of Collisions		
	Total	Fatality	Fatal + Injury
US-101, between PM 20.977 (San Mateo County) to PM 4.132 (San Francisco County)			
Mainline Total	2,600	7	933
Ramp Total	337	1	133
I-280, between PM 20.977 to PM 26.03			
Mainline Total	793	3	322
Ramp Total	228	0	101

Source: Caltrans District TASAS data between 1/1/2014 and 12/31/2017

As the data shows, 2,600 collisions were reported on US-101, while 337 collisions were reported on the ramps between the I-380 interchange and Vermont Street interchange between 2014 and 2017. Seven fatal collisions occurred on the mainline, with one on the ramps. The San Mateo County segment of US-101 mainline exhibits a collision rate lower than the statewide average for similar facilities; however, the San Francisco County segment of US-101 mainline exhibits a collision rate higher than the statewide average. 33 out of the 41 ramps within the study area reported collisions rates, either fatal, fatal plus injury, or total, which exceeded the statewide average for similar facilities.

Rear-end and side-swipe type collisions, which are generally due to driver's inattention, unsafe speeds, or lane changing in recurring traffic congestion, accounted for almost 86% of all reported collisions on the US-101 mainline. Collisions that were a result of hitting an object accounted for approximately 10% of all collisions, and 2% of the reported collisions were due to overturned vehicles. The primary reported collision factors included improper turns, speeding, and other violations.

793 collisions were reported along I-280 while 228 collisions were reported on the ramps between 2014 and 2017. Three fatal collisions were reported along the mainline and none reported on the ramps. I-280

mainline exhibits a collision rate lower than the statewide average for similar facilities. 14 of the 26 ramps within the study area reported collisions rates, either fatal, fatal plus injury, or total, which exceeded the statewide average for similar facilities.

Similar to US-101, the primary type of collision reported along mainline I-280 were rear-end and side-swipe collisions, which accounted for almost 75% of all reported collisions. Collisions that were a result of hitting an object accounted for about 19% of all collisions, and 2% of the reported collisions were due to overturned vehicles. The primary reported collision factors included improper turns, speeding, and other violations.

Table 2-7: US-101 (San Francisco County) Collision History – January 2014 through December 2017

Facility	Number of Collisions			Collision Rate (collisions/million vehicle miles)					
				Actual			State Average		
	Total	Fatality	Fatal + Injury	Fatality	Fatal + Injury	Total	Fatality	Fatal + Injury	Total
US-101 Mainline									
Between PM 0.00 to PM 4.132	1,963	5	683	0.004	0.50	**1.43**	0.006	0.42	1.30
US-101/Harney Way/Alana Way Interchange Ramps									
Southbound Off To Harney Way	4	0	0	0.000	0.00	**0.87**	0.002	0.23	0.78
US-10 /Third Street/Bayshore Boulevard Interchange Ramps									
Northbound Off To Third St	0	0	0	0.000	0.00	0.00	0.003	0.84	0.69
Northbound Off To Bayshore Blvd	3	0	1	0.000	0.24	**0.73**	0.003	0.24	0.00
Southbound On From Third St/ Bayshore Blvd	2	0	1	0.000	0.10	0.20	0.003	0.10	0.28
Northbound On From Bayshore Blvd	3	0	1	0.000	0.04	0.12	0.003	0.10	0.28
Southbound On From Third St	0	0	0	0.000	0.00	0.00	0.003	0.19	0.56
Southbound On From Bayshore Blvd	1	0	0	0.000	0.00	**0.68**	0.003	0.19	0.56
Southbound Off To Bayshore Blvd	8	0	8	0.000	**0.43**	0.43	0.003	0.24	0.69
US-101/San Bruno Avenue/Paul Street Interchange Ramps									
Southbound Off To San Bruno/Paul	11	0	2	0.000	0.17	**0.93**	0.002	0.23	0.78
US-101/I-280 Interchange Connector Ramps									
Southbound On From I-280	9	0	5	0.000	**0.08**	0.15	0.001	0.06	0.20
Northbound Off To I-280	13	0	7	0.000	**0.12**	0.23	0.002	0.08	0.25
US-101/Bayshore Boulevard Interchange Ramps									
Northbound Off To Bayshore Blvd	8	0	2	0.000	**0.43**	**1.71**	0.002	0.23	0.78
US-101/San Bruno Avenue Interchange Ramps									
Southbound On From San Bruno Ave	0	0	0	0.000	0.00	0.00	0.001	0.14	0.48
Southbound Off To San Bruno Ave	8	0	5	0.000	**0.46**	0.74	0.002	0.23	0.78
US-101/Alemany Boulevard Interchange Ramps									
Southbound Off To Alemany Blvd	7	0	2	0.000	**0.56**	**1.96**	0.002	0.23	0.78
Northbound Off To Alemany Blvd/ Industrial	7	0	3	0.000	**0.38**	0.89	0.004	0.32	0.92
Southbound On From Alemany Blvd	5	0	3	0.000	**0.51**	**0.86**	0.002	0.13	0.39
Northbound On From Alemany Blvd	2	0	1	0.000	0.09	0.19	0.002	0.13	0.39
Southbound Off To Southbound I-280/Alemany Blvd	17	0	12	0.000	**0.17**	0.24	0.002	0.08	0.25

Table 2-7: US-101 (San Francisco County) Collision History – January 2014 through December 2017

Facility	Number of Collisions			Collision Rate (collisions/million vehicle miles)					
				Actual			State Average		
	Total	Fatality	Fatal + Injury	Fatality	Fatal + Injury	Total	Fatality	Fatal + Injury	Total
US-101/Cesar Chavez Interchange Ramps									
Northbound Off To Cesar Chavez	10	0	3	0.000	**0.10**	**0.34**	0.003	0.09	0.25
Southbound On From Potrero Ave/ Cesar Chavez	10	0	6	0.000	**0.14**	**0.24**	0.001	0.03	0.20
Southbound On From Eastbound Cesar Chavez	4	0	1	0.000	0.06	0.23	0.003	0.19	0.56
Southbound On From Southbound Potrero Ave	4	0	3	0.000	**0.12**	0.16	0.003	0.10	0.28
Southbound Off To Bayshore Blvd	3	0	1	0.000	0.09	0.27	0.003	0.15	0.45
Southbound Off To Eastbound Cesar Chavez	7	0	4	0.000	**0.30**	**0.53**	0.003	0.15	0.45
Southbound Off To Cesar Chavez/ Bayshore Blvd	2	0	1	0.000	0.04	0.08	0.002	0.08	0.25
Southbound Off To Cesar Chavez/ Potrero Ave	2	0	0	0.000	0.00	0.18	0.003	0.24	0.69
Northbound On From Bayshore Blvd	6	0	1	0.000	0.05	0.31	0.003	0.19	0.56
Northbound On From Cesar Chavez	6	0	1	0.000	0.10	0.60	0.002	0.21	0.60
Southbound Off To Cesar Chavez/ Potrero Ave	7	0	3	0.000	0.08	0.20	0.002	0.08	0.25
Northbound On From Cesar Chavez/ Bayshore Blvd	17	0	4	0.000	**0.14**	**0.58**	0.001	0.06	0.20
US-101/Vermont Street Interchange Ramps									
Northbound Off To Vermont St/ Mariposa St	7	0	1	0.000	0.09	**0.61**	0.003	0.18	0.50

Notes:
Gray bold cell indicates actual average is greater than the state average.
Source: Caltrans District TASAS data between 1/1/2014 and 12/31/2017

Table 2-8: US-101 (San Mateo County) Collision History – January 2014 through December 2017

Facility	Number of Collisions			Collision Rate (collisions/million vehicle miles)					
				Actual			State Average		
	Total	Fatality	Fatal + Injury	Fatality	Fatal + Injury	Total	Fatality	Fatal + Injury	Total
US-101 Mainline									
Between PM 20.977 to PM 26.03	637	2	250	0.001	0.15	0.39	0.004	0.32	1.02
US-101/I-380 Interchange Connector Ramps									
Northbound On From I-380	0	0	0	0.000	0.00	0.00	0.001	0.06	0.20
Southbound Off To Westbound I-380	13	0	5	0.000	**0.18**	**0.47**	0.003	0.12	0.37
US-101/Produce Avenue/Airport Boulevard Interchange Ramps									
Southbound On From Produce Ave/ Airport Blvd	8	0	2	0.000	0.08	0.30	0.002	0.12	0.33
Northbound Off To S Airport Blvd	11	0	1	0.000	0.06	0.67	0.002	0.23	0.78
Northbound On From S Airport Blvd	2	0	0	0.000	0.00	0.29	0.001	0.14	0.48
Southbound Off To Produce Ave/ Airport Blvd	6	0	3	0.000	**0.33**	0.66	0.002	0.23	0.78
US-101/Grand Avenue/Airport Boulevard/Industrial Way Interchange Ramps									
Northbound Off To Industrial Way	4	1	3	**0.071**	0.21	0.29	0.003	0.24	0.69
Northbound On From Grand Av/Airport	12	0	3	0.000	0.23	**0.92**	0.001	0.23	0.68
Southbound Off To Airport/Miller	9	0	2	0.000	0.18	**0.81**	0.002	0.23	0.78
US-101/Oyster Point Boulevard Interchange Ramps									
Southbound On From Oyster Point Blvd	8	0	5	0.000	**0.41**	**0.66**	0.001	0.14	0.48
Northbound Off To Oyster Point Blvd	0	0	0	0.000	0.00	0.00	0.002	0.23	0.78
Northbound On From Oyster Point Blvd	13	0	4	0.000	**0.29**	**0.93**	0.002	0.21	0.60
Southbound Off To Oyster Point Blvd	3	0	1	0.000	**0.68**	**2.05**	0.003	0.15	0.45
US-101/Bayshore Boulevard Ramps									
Southbound On From Bayshore Blvd	8	0	5	0.000	**3.42**	**5.47**	0.002	0.12	0.33
Southbound Off To Old Bayshore Blvd	19	0	3	0.000	**0.47**	**2.99**	0.003	0.18	0.50
Northbound Off To Old Bayshore Blvd	4	0	2	0.000	0.14	0.29	0.003	0.15	0.45
US-101/Sierra Point Parkway									
Northbound Off Marina Boulevard	2	0	2	0.000	**0.86**	0.86	0.004	0.32	0.92
Northbound On Sierra Pt Pkwy/Marina Blvd	5	0	1	0.000	**0.69**	**3.46**	0.002	0.21	0.60
Southbound On Sierra Pt Pkwy/Marina Blvd	1	0	0	0.000	0.00	0.33	0.001	0.14	0.48

Table 2-8: US-101 (San Mateo County) Collision History – January 2014 through December 2017

Facility	Number of Collisions			Collision Rate (collisions/million vehicle miles)					
				Actual			State Average		
	Total	Fatality	Fatal + Injury	Fatality	Fatal + Injury	Total	Fatality	Fatal + Injury	Total
Southbound Off Marina Blvd/Sierra Pt Pkwy	2	0	1	0.000	**0.27**	0.54	0.002	0.23	0.78
US-101/Harney Way/Alana Way Interchange Ramps									
Northbound Off To Harney Way	11	0	7	0.000	**1.88**	**2.95**	0.003	0.24	0.69
Northbound On From Harney Way	1	0	1	0.000	0.21	0.21	0.003	0.23	0.71
Southbound On From Harney Way	2	0	0	0.000	0.00	0.47	0.001	0.14	0.48

Notes:
Gray bold cell indicates actual average is greater than the state average.
Source: Caltrans District TASAS data between 1/1/2014 and 12/31/2017

Table 2-9: I-280 Collision History – January 2014 through December 2017

Facility	Number of Collisions			Collision Rate (collisions/million vehicle miles)					
				Actual			State Average		
	Total	Fatality	Fatal + Injury	Fatality	Fatal + Injury	Total	Fatality	Fatal + Injury	Total
I-280 Mainline									
PM R1.708 to PM T7.26	793	3	322	0.002	0.25	0.61	0.005	0.31	0.96
I-280/Ocean Avenue/Geneva Avenue Interchange Ramps									
Southbound Off To Westbound Ocean Ave	0	0	0	0.000	0.00	.0.00	0.003	0.24	0.69
Southbound Off To Geneva Ave	12	0	6	0.000	**0.51**	**1.03**	0.004	0.32	0.92
Northbound On From Geneva Ave	3	0	2	0.000	0.20	0.30	0.002	0.21	0.60
Northbound On From Ocean Ave	6	0	4	0.000	**0.30**	0.46	0.002	0.21	0.60
Northbound On From Ocean Ave/ Geneva Ave	1	0	1	0.000	0.04	0.04	0.001	0.06	0.20
Southbound Off To Ocean Ave/ Geneva Ave	2	0	1	0.000	0.04	0.09	0.002	0.08	0.25
I-280/San Jose Avenue Interchange Ramps									
Southbound On From San Jose Ave	13	0	5	0.000	0.16	0.42	0.003	0.19	0.56
Northbound Off To San Jose Ave	5	0	2	0.000	0.07	0.18	0.003	0.15	0.45
I-280/Monterey Avenue Interchange Ramps									
Northbound On From Monterey Ave	3	0	0	0.000	0.00	0.17	0.002	0.21	0.60
Southbound Off To Monterey Ave	4	0	2	0.000	0.10	0.20	0.004	0.32	0.92
I-280/Alemany Boulevard Interchange Ramps									
Northbound Off To Northbound Alemany Blvd	6	0	3	0.000	0.23	**0.47**	0.003	0.09	0.25
Southbound On From Southbound Alemany Blvd	4	0	2	0.000	**0.12**	0.23	0.003	0.10	0.28
Northbound On From Northbound Alemany Blvd	9	0	4	0.000	**0.21**	**0.46**	0.003	0.10	0.28
Southbound Off To Southbound Alemany Blvd	2	0	0	0.000	0.00	0.13	0.003	0.09	0.25
I-280/US-101 Interchange Connector Ramps									
Northbound Off To Southbound US-101	10	0	5	0.000	**0.30**	**0.61**	0.003	0.15	0.45
Northbound Off To Northbound US-101	36	0	19	0.000	**0.25**	**0.47**	0.003	0.15	0.45

Table 2-9: I-280 Collision History – January 2014 through December 2017

Facility	Number of Collisions			Collision Rate (collisions/million vehicle miles)					
				Actual			State Average		
	Total	Fatality	Fatal + Injury	Fatality	Fatal + Injury	Total	Fatality	Fatal + Injury	Total
Northbound On From Northbound US-101	4	0	1	0.000	0.02	0.08	0.002	0.11	0.32
Northbound Off To Cesar Chavez	14	0	10	0.000	**0.59**	0.82	0.004	0.32	0.92
Southbound On From Southbound US-101	2	0	0	0.000	0.00	0.02	0.002	0.11	0.32
Northbound On From Northbound US-101	3	0	1	0.000	0.07	0.21	0.002	0.13	0.39
Southbound Off To Southbound US-101	21	0	6	0.000	**0.20**	0.69	0.003	0.15	0.45
I-280/Cesar Chavez/25th Street Interchange Ramps									
Southbound On From 25th St/Cesar Chavez	8	0	6	0.000	0.42	**0.56**	0.001	0.14	0.48
Southbound Off To 25th St/Cesar Chavez	4	0	1	0.000	0.11	0.44	0.002	0.23	0.78
Northbound On From Indiana St	0	0	0	0.000	0.00	0.00	0.003	0.19	0.56
I-280/Mariposa Street Interchange Ramps									
Northbound Off To Mariposa St	15	0	1	0.000	0.09	**1.33**	0.004	0.32	0.92
Southbound On From Mariposa St	2	0	0	0.000	0.00	0.19	0.002	0.21	0.60
Southbound Off To Mariposa	0	0	0	0.000	0.00	0.00	0.002	0.31	0.92
I-280/18th Street Interchange Ramps									
Southbound Off 18th St	0	0	0	0.000	0.00	0.00	0.004	0.32	0.92
Northbound On From 18th St	0	0	0	0.000	0.00	0.00	0.002	0.21	0.60
Southbound Off To 18th/Mariposa	7	0	3	0.000	**0.55**	**1.28**	0.002	0.31	0.92
I-280/King Street Interchange Ramps									
Northbound Off To King/5th St	28	0	14	0.000	**0.36**	**0.71**	0.003	0.24	0.69
Southbound On From King/5th St	4	0	2	0.000	0.07	0.15	0.003	0.19	0.56

Notes:
Gray bold cell indicates actual average is greater than the state average.
Source: Caltrans District TASAS data between 1/1/2014 and 12/31/2017

3. Design Year Conditions Summary

This section describes a preliminary assessment of opening year (2020) operating conditions under a No Build and Build alternative for the *US-101/I-280 Managed Lanes Study* project. Consistent with the PSR-PDS guidelines, this discussion is not intended to be detailed or comprehensive; instead, it utilizes readily available information sources to estimate the order-of-magnitude change in traffic demand anticipated in the future and to comment on the likely effects of these future traffic volumes on the quality of study area operations and safety.

3.1 Build Alternatives

The project proposes two build alternatives. Alternative 1, maximum build, would widen and install a managed lane (HOV and/or express lane) and Alternative 2, minimum build, would convert an existing general purpose lane into the managed lane. The purpose of the project is to provide a managed facility in each direction of US-101 and I-280 from the terminus of the San Mateo 101 Express Lanes Project at I-380 and the I-280 terminus in San Francisco. Both corridors experience congestion under current conditions, resulting in an overall degradation of operations through the corridor. As such, the goal of the managed lane project would be to:

- Create a facility that extends the benefits from San Mateo 101 Express Lanes Project into San Francisco
- Increase the mainline person throughput
- Encourage carpooling and transit use
- Improve travel time and reliability for HOV and transit users
- Minimize degradation to general purpose lanes and local streets
- Optimize freeway system management and traffic operations

An extensive process was undertaken to develop a wide range of alternative configurations for consideration in this study. A description of each alternative is described below.

3.1.1 No Build Alternative

Under the No Build alternative, no modifications are expected along the US-101 and I-280 corridors, north of I-380, except at the following locations:

- Auxiliary lanes on Northbound US-101, between Sierra Point Parkway on-ramp and Harney Way off-ramp
- Auxiliary lanes on Southbound US-101, between Alanna Way/Harney Way on-ramp and Sierra Point Parkway off-ramp
- Auxiliary lanes on Southbound US-101, between Sierra Point Parkway on-ramp and Oyster Point Boulevard off-ramp

3.1.2 Build Alternatives

Alternative 1 is considered the maximum build alternative because the managed lane would be achieved through a lane add which typically requires a shoulder conversion and freeway widening. Three variants are proposed as part of this alternative. Alternative 2 is the minimum build alternative where the managed lane would be achieved via a lane conversion of an existing general purpose lane.

The Build Alternative included in this TEPA is intended to provide information on the improvements to be evaluated during the PA/ED phase, define an adequate footprint for environmental technical studies, provide opportunities to meet geometric standards to the extent feasible, minimize environmental impacts, and provide cost-effective solutions. Thus, for the purpose of this analysis, only one maximum build (Alternative 1A) and one minimum build (Alternative 2A) were evaluated.

Alternative 1 – Maximum Build

Three maximum build variants are proposed, as described below.

Alternative 1A

Under Alternative 1A, a managed lane would be provided through shoulder conversion and freeway widening. In the northbound direction, a managed lane would be provided via a lane add from I-380 to approximately 1,000 feet south of the Bayshore Boulevard overcrossing. A 2.3-mile gap would be present in the northbound direction before the managed lane begins again along northbound I-280 approximately 2,400 feet north of the US-101/I-280 connector to the I-280 terminus at 5th/King Street. Alternative 1A would remove the Bayshore Boulevard on-ramp access to northbound US-101; however, the alternative would provide direct access to northbound I-280. In the southbound direction, a lane add would begin at the 6th Street on-ramp through the US-101/I-280 connector, where the managed lane would continue through a lane add along southbound US-101 to the I-380 interchange. **Figure 3-1** illustrates the extent of the manage lane on the existing facility.

Alternative 1B

Under Alternative 1B, a managed lane is proposed through shoulder conversion, freeway widening, general purpose lane conversion, and elevated structure. In the northbound direction, a managed lane would be provided from I-380 to just north of the Bayshore Boulevard overcrossing by converting approximately 1,500 feet of the general purpose lane. The managed lane would then enter an elevated direct connector structure beginning in the US-101 median and aligning over the northbound US-101 freeway lanes and along the right side of the I-280 double deck before touching down in the I-280 median near 25th Street, and terminating at the I-280 terminus at 5th/King Street. Unlike Alternative 1A, Alternative 1B would provide a continuous northbound managed lane. The southbound US-101 managed lane would replicate the Alternative 1A southbound scenario. **Figure 3-2** illustrates the extent of the manage lane on the existing facility.

Alternative 1C

Alternative 1C would replicate Alternative 1B with the exception of the managed lane direct connector would serve as a reversible lane facility. A moveable barrier facility would be required at each end of the elevated structure. Therefore, a continuous managed lane facility would be provided between I-380 and the I-280 terminus for the peak direction only. The off-peak direction would have a gap in the manage lane facility where the direct-connector is present. **Figure 3-3** illustrates the extent of the manage lane on the existing facility.

Alternative 2 – Minimum Build

Two minimum build variants are proposed, as described below.

Alternative 2A

Under Alternative 2A, a managed lane would be provided by converting the left most general purpose lane to a managed lane in both directions. In the northbound direction, a managed lane would be provided from the I-380 interchange to approximately 400 feet north of the Bayshore Boulevard Overcrossing. A 3.5 mile gap would be present in the northbound direction before the managed lane begins approximately 400 feet north of the 18th Street overcrossing to the I-280 terminus at 5th/King Street through a lane addition. In the southbound direction, a managed lane would be provided by converting the left most general purpose lane between the 6th Street on-ramp to the I-380 interchange. A lane add would be provided through the US-101/I-280 connector through a shoulder conversion; thus, a continuous managed lane would be provided in the southbound direction. **Figure 3-4** illustrates the extent of the manage lane on the existing facility.

Alternative 2B

Under Alternative 2B, a managed lane would be provided through a lane conversion in the northbound direction starting from I-380 to just north of the Bayshore Boulevard. A managed lane direct connector would be constructed to provide a continuous facility between US-101 and I-280 like Alternative 1B. The southbound managed lane would be identical to Alternative 2A except that a lane add would be constructed through a shoulder conversion. A continuous managed lane facility would be provided throughout the project limits for this option in the peak direction only. The off-peak direction would have a gap. **Figure 3-5** illustrates the extent of the manage lane on the existing facility.

LEGEND

Study Corridor

Alternative A

Figure 3-1

2020 Maximum Build Alternative 1A

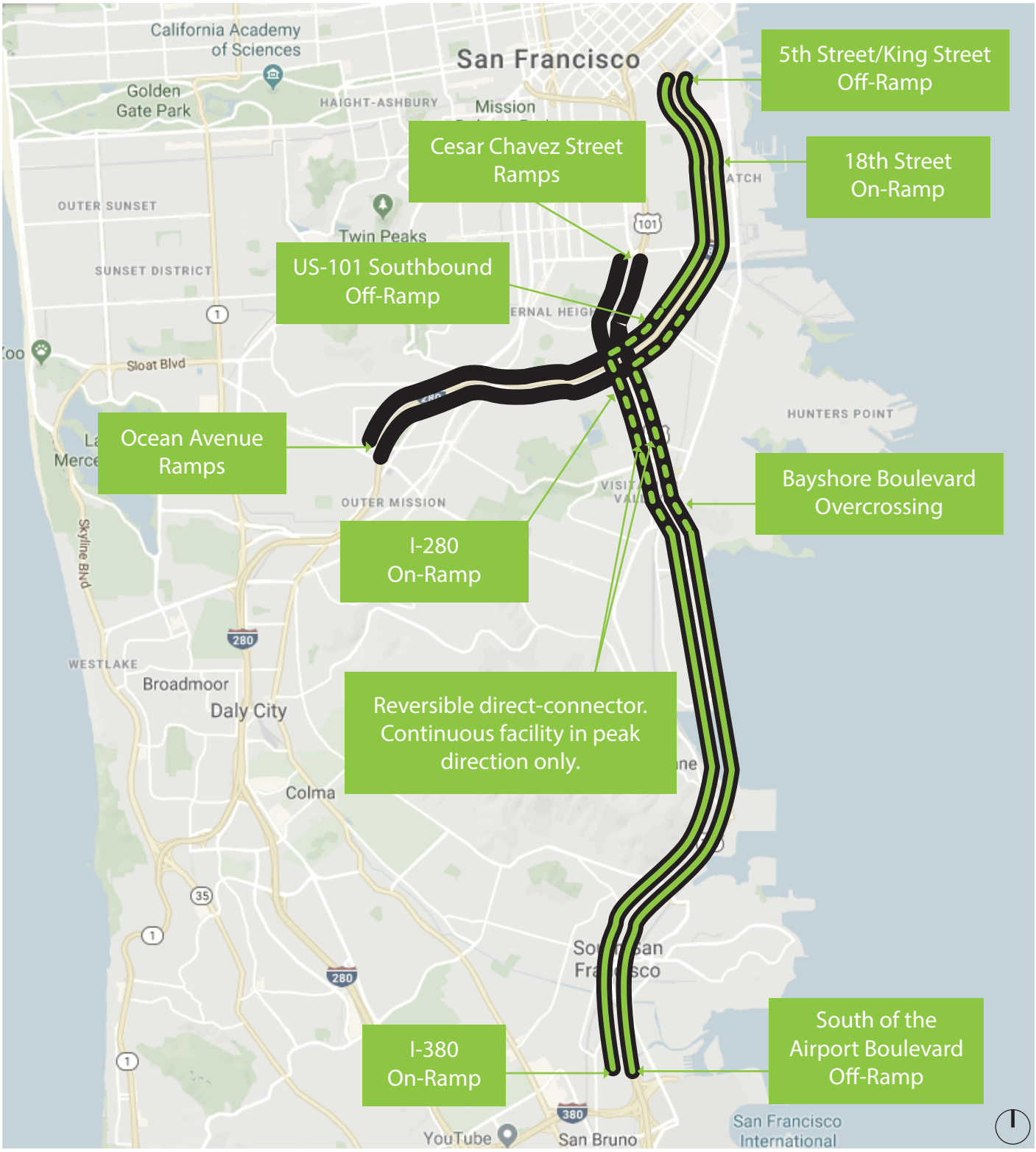
LEGEND

Study Corridor

Alternative B

Figure 3-2

2020 Maximum Build Alternative 1B



LEGEND

Study Corridor

Alternative C

Figure 3-3

2020 Maximum Build Alternative 1C

LEGEND

Study Corridor

Alternative A

Figure 3-4

2020 Minimum Build Alternative 2A

LEGEND

Study Corridor

Alternative B

Figure 3-5

2020 Minimum Build Alternative 2B

3.1.3 Other Considerations

Auxiliary Lanes

In addition to the addition of the managed lane facility, auxiliary lanes may be proposed to improve weaving operations at ramp locations and express lane access points. The addition of new auxiliary lanes was not included in this assessment and thus, will be analyzed as part of the PA&ED phase through a detailed traffic analysis, described in Chapter 4.

Managed Lane Access & Occupancy

Both Build alternatives will utilize a continuous access design such that the managed lane facility will be non-barrier separated from the general purpose lanes. Detailed traffic operations analysis will be completed during the PA/ED phase to inform if a separated ingress/egress location must be provided to improve operation or address safety. The alternatives described above details the proposed limits of the managed lane facility; however, detailed traffic studies to be completed during the PA/ED phase will determine the exact limits of the Project. Additionally, the alternatives will need to conform to the planned San Mateo County Express Lanes Project which proposes an Express Lane with HOV 3+ occupancy; thus, it is assumed that the remaining portion of the managed lane will also be HOV 3+.

3.2 Near Term Traffic Demand Estimates

This section describes the methodology used to develop Year 2020 forecasts which represents the near-term horizon year, the earliest that the proposed Project would open. The recently completed *FCMS Phase 1 and Phase 2 Reports* were used to provide the near-term traffic volumes in the US-101 and I-280 corridors.

3.2.1 Year 2020 No Build Demand Development

Year 2020 forecasts were based on recent SF-CHAMP model outputs for freeway segments within San Francisco County and the C/CAG model for freeway segments within San Mateo County. Year 2020 No Build demand volumes were derived for each freeway mainline based on the net increase between the baseline (or existing) year and future year travel demand models. These volumes are consistent with the volumes reported in the *FCMS Phase 2 Draft Report* for the lane add and lane convert scenarios.

3.2.2 Year 2020 Build Demand Development

With the 2020 No-Build demand established, the 2020 Build (or Managed Lanes) scenario demands were developed based on the net increase between the 2020 No-Build and 2020 Build travel models. Under Alternative 1, the lane add scenario, the 2020 Build C/CAG and SF-CHAMP model runs were used. For Alternative 2, lane convert, the 2020 Build C/CAG model runs were unavailable; therefore, the SF-CHAMP model runs, which include study corridor segments south of the San Francisco County line, were used in the development of 2020 Build demand volumes.

As described above, the managed lane facility will need to conform to the planned San Mateo County Express Lanes Project which proposes one express lane with HOV 3+ configuration. However, the available forecasts completed in prior studies only provide the HOV2+ under the lane add scenario. Therefore, for the purpose of this assessment the 2020 Build volumes reflect an HOV 2+ scenario, without express lanes, in order to compare each alternative to one another equally. Detailed studies and new forecasts with revised occupancies will be prepared as part of the PA/ED phase.

3.3 Volume-to-Capacity Analysis

The following section summarizes Year 2020 volume-to-capacity (V/C) analysis. The following tables describe the 2020 No Build, 2020 Build Alternative 1, and 2020 Build Alternative 2:

- **Table 3-1**: Northbound US-101 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary
- **Table 3-2**: Northbound US-101 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary
- **Table 3-3**: Southbound US-101 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary
- **Table 3-4**: Southbound US-101 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary
- **Table 3-5:** Northbound I-280 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary
- **Table 3-6**: Northbound I-280 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary
- **Table 3-7**: Southbound I-280 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary

- **Table 3-8**: Southbound I-280 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary

Table 3-1: Northbound US-101 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Maximum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
Airport Blvd Off to Airport Blvd On	4 GP + 1 Aux	8,600	8,920	Segment in Queue*	7,595	Segment in Queue*	4 GP + 1 Aux + 1 ML	8,600	7,732	0.90	6,995	0.81
Airport Blvd On to Grand Av Off	4 GP + 1 Aux	8,600	8,600	1.00**	8,057	Segment in Queue*	4 GP + 1 Aux + 1 ML	8,600	8,240	0.96	7,389	0.86
Grand Av Off to Grand Av On	4 GP	7,600	7,312	0.96	7,574	Segment in Queue*	4 GP + 1 ML	7,600	6,968	0.92	6,997	0.92
Grand Av On to Oyster Point Blvd Off	4 GP + 1 Aux	8,600	7,890	0.92	8,098	Segment in Queue*	4 GP + 1 Aux + 1 ML	8,600	7,450	0.87	7,440	0.87
Oyster Point Blvd Off to Oyster Point Blvd On	4 GP	7,600	7,409	0.97	7,600	1.00**	4 GP + 1 ML	7,600	6,997	0.92	7,214	0.95
Oyster Point Blvd On to Bayshore Blvd Off	4 GP + 1 Aux	8,600	8,244	0.96	8,600	1.00**	4 GP + 1 Aux + 1 ML	8,600	7,689	0.89	8,243	0.96
Bayshore Blvd Off to Sierra Point Pkwy Off	4 GP	7,600	7,410	0.97	7,600	1.00**	4 GP + 1 ML	7,600	6,975	0.92	7,535	0.99
Sierra Point Pkwy Off to Sierra Point Pkwy On	4 GP	7,600	7,257	0.95	7,292	0.96	4 GP + 1 ML	7,600	6,821	0.90	7,429	0.98
Sierra Point Pkwy On to Harney Way Off	4 GP + 1 Aux	8,600	7,335	0.85	7,694	0.89	4 GP + 1 Aux + 1 ML	8,600	6,885	0.80	7,614	0.89
Harney Way Off to Harney Way On	4 GP	7,600	7,019	0.92	7,190	0.95	4 GP + 1 ML	7,600	6,661	0.88	6,892	0.91
Harney Way On to 3rd St Off	4 GP	7,600	7,541	0.99	7,320	0.96	4 GP + 1 ML	7,600	7,194	0.95	7,498	0.99
3rd St Off to Bayshore Blvd/Paul Av Off	5 GP	9,500	7,185	Segment in Queue*	7,220	0.76	5 GP	9,500	8,221	0.87	8,768	0.92

Table 3-1: Northbound US-101 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Maximum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
Bayshore Blvd/Paul Av Off to Bayshore Blvd On	5 GP	9,500	7,036	Segment in Queue*	6,762	0.71	5 GP	9,500	8,027	0.84	8,335	0.88
Bayshore Blvd On to I-280 Off[4]	4 GP + 1 Aux	8,600	8,475	Segment in Queue*	7,892	0.92	4 GP + 1 Aux	8,600	8,027	0.93	8,335	0.97
I-280 Off to Bayshore Blvd/Silver Av Off	3 GP	5,700	4,695	Segment in Queue*	3,837	0.67	3 GP	5,700	4,475	0.79	4,071	0.71
Bayshore Blvd/Silver Av Off to Alemany Blvd Off	3 GP	5,700	4,537	Segment in Queue*	3,573	0.63	3 GP	5,700	4,295	Segment in Queue*	3,713	0.65
Alemany Blvd Off to Alemany Blvd On	3 GP	5,700	4,243	Segment in Queue*	2,875	0.50	3 GP	5,700	3,964	Segment in Queue*	2,942	0.52
Alemany Blvd On to I-280 N On	3 GP	5,700	5,121	Segment in Queue*	3,097	0.54	3 GP	5,700	5,391	Segment in Queue*	3,324	0.58
I-280 N On to Cesar Chavez St Off	4 GP + 1 Aux	8,600	8,526	Segment in Queue*	4,414	Segment in Queue*	4 GP + 1 Aux	8,600	8,600	1.00**	4,718	0.55
Cesar Chavez St Off to Cesar Chavez St On	4 GP	7,600	7,316	Segment in Queue*	3,637	Segment in Queue*	4 GP	7,600	7,356	Segment in Queue*	3,854	0.51

Notes:
1. Starting from the southernmost segment and going north.
2. GP = general purpose lane, AUX = auxiliary lane, ML = Managed Lane
3. Yellow cell shading indicates near-capacity operations, red cell shading indicates over-capacity operations, and blue cell shading indicates a managed lane is proposed.
Under Alternative 1, the Bayshore Boulevard on-ramp would be re-routed to provide access to I-280 only. Access to US-101 would no longer be permitted via this on-ramp location.
* Value shown based on INRIX data and field observations, which supersede the V/C results
** Controlling bottlenecks operate at V/C = 1.00 by definition. The segment demand is in excess of the volume presented as vehicles are in the queue approaching the bottleneck. Vehicles volumes downstream of this location represent the constrained flow based on the upstream bottleneck.
Source: Fehr & Peers, 2018

Table 3-2: Northbound US-101 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Minimum Footprint)					
	Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			General Purpose Volume	General Purpose V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
Airport Blvd Off to Airport Blvd On	4 GP + 1 Aux	8,600	8,920	Segment in Queue*	7,595	Segment in Queue*	3 GP + 1 Aux + 1 ML	6,700	7,202	Segment in Queue*	6,014	Segment in Queue*
Airport Blvd On to Grand Av Off	4 GP + 1 Aux	8,600	8,600	1.00**	8,057	Segment in Queue*	3 GP + 1 Aux + 1 ML	6,700	6,700	1.00**	6,293	Segment in Queue*
Grand Av Off to Grand Av On	4 GP	7,600	7,312	0.96	7,574	Segment in Queue*	3 GP + 1 ML	5,700	5,148	0.95	5,700	1.00**
Grand Av On to Oyster Point Blvd Off	4 GP + 1 Aux	8,600	7,890	0.92	8,098	Segment in Queue*	3 GP + 1 Aux + 1 ML	6,700	5,975	0.89	6,236	Segment in Queue*
Oyster Point Blvd Off to Oyster Point Blvd On	4 GP	7,600	7,409	0.97	7,600	1.00**	3 GP + 1 ML	5,700	5,515	0.97	5,700	1.00**
Oyster Point Blvd On to Bayshore Blvd Off	4 GP + 1 Aux	8,600	8,244	0.96	8,600	1.00**	3 GP + 1 Aux + 1 ML	6,700	6,335	0.95	6,700	1.00**
Bayshore Blvd Off to Sierra Point Pkwy Off	4 GP	7,600	7,410	0.97	7,600	1.00**	3 GP + 1 ML	5,700	5,538	0.97	5,700	1.00**
Sierra Point Pkwy Off to Sierra Point Pkwy On	4 GP	7,600	7,257	0.95	7,292	0.96	3 GP + 1 ML	5,700	5,349	0.94	5,431	0.95
Sierra Point Pkwy On to Harney Way Off	4 GP + 1 Aux	8,600	7,335	0.85	7,694	0.89	3 GP + 1 Aux + 1 ML	6,700	5,427	0.87	5,847	0.87
Harney Way Off to Harney Way On	4 GP	7,600	7,019	0.92	7,190	0.95	3 GP + 1 ML	5,700	5,141	0.90	5,372	0.94
Harney Way On to 3rd St Off	4 GP	7,600	7,541	0.99	7,320	0.96	3 GP + 1 ML	5,700	5,662	0.99	5,527	0.97
3rd St Off to Bayshore Blvd/Paul Av Off	5 GP	9,500	7,185	Segment in Queue*	7,220	0.76	4 GP + 1 ML	7,600	5,394	0.71	5,445	0.72

Table 3-2: Northbound US-101 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Minimum Footprint)					
	Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			General Purpose Volume	General Purpose V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
Bayshore Blvd/Paul Av Off to Bayshore Blvd On	5 GP	9,500	7,036	Segment in Queue*	6,762	0.71	4 GP + 1 ML	7,600	5,281	0.69	5,090	0.67
Bayshore Blvd On to I-280 Off	4 GP + 1 Aux	8,600	8,475	Segment in Queue*	7,892	0.92	4 GP + 1 Aux	8,600	6,751	0.78	6,242	0.73
I-280 Off to Bayshore Blvd/Silver Av Off	3 GP	5,700	4,695	Segment in Queue*	3,837	0.67	3 GP	5,700	3,733	0.65	2,973	0.52
Bayshore Blvd/Silver Av Off to Alemany Blvd Off	3 GP	5,700	4,537	Segment in Queue*	3,573	0.63	3 GP	5,700	3,615	0.63	2,787	0.49
Alemany Blvd Off to Alemany Blvd On	3 GP	5,700	4,243	Segment in Queue*	2,875	0.50	3 GP	5,700	3,372	0.59	2,213	0.39
Alemany Blvd On to I-280 N On	3 GP	5,700	5,121	Segment in Queue*	3,097	0.54	3 GP	5,700	4,244	0.74	2,446	0.43
I-280 N On to Cesar Chavez St Off	4 GP + 1 Aux	8,600	8,526	Segment in Queue*	4,414	Segment in Queue*	4 GP + 1 Aux	8,600	7,673	0.89	3,856	Segment in Queue*
Cesar Chavez St Off to Cesar Chavez St On	4 GP	7,600	7,316	Segment in Queue*	3,637	Segment in Queue*	4 GP	7,600	6,594	0.87	3,158	Segment in Queue*

Notes:
1. Starting from the southernmost segment and going north.
2. GP = general purpose lane, AUX = auxiliary lane, ML = Managed Lane
3. Yellow cell shading indicates near-capacity operations, red cell shading indicates over-capacity operations, and blue cell shading indicates a managed lane is proposed.
* Value shown based on INRIX data and field observations, which supersede the V/C results
** Controlling bottlenecks operate at V/C = 1.00 by definition. The segment demand is in excess of the volume presented as vehicles are in the queue approaching the bottleneck. Vehicles volumes downstream of this location represent the constrained flow based on the upstream bottleneck.
Source: Fehr & Peers, 2018

Table 3-3: Southbound US-101 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Maximum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
Cesar Chavez St On to I-280 S Off	3 GP + 2 Aux	8,600	7,311	Segment in Queue*	8,433	0.98	3 GP + 2 Aux	8,600	7,401	0.86	8,502	0.99
I-280 S Off to Alemany Blvd On	3 GP	5,700	4,893	Segment in Queue*	4,949	0.87	3 GP	5,700	5,045	0.89	5,116	0.90
Alemany Blvd On to San Bruno Av Off	3 GP + 1 Aux	6,700	5,264	Segment in Queue*	5,326	0.79	3 GP + 1 Aux	6,700	5,528	0.83	5,613	0.84
San Bruno Av Off to San Bruno Av On	3 GP	5,700	4,944	Segment in Queue*	4,759	0.83	3 GP	5,700	5,179	0.91	5,106	0.90
San Bruno Av On to I-280 N On	3 GP	5,700	5,248	Segment in Queue*	4,953	0.87	3 GP	5,700	5,498	0.96	5,309	0.93
I-280 On to San Bruno Av/Paul Av Off	5 GP	9,500	8,510	Segment in Queue*	8,294	0.87	5 GP + 1 ML	9,500	7,761	0.82	7,356	0.77
San Bruno Av/Paul Av Off to Bayshore Blvd Off	5 GP	9,500	7,959	Segment in Queue*	6,897	0.73	5 GP + 1 ML	9,500	7,295	0.77	5,655	0.60
Bayshore Blvd Off to Bayshore Blvd On	4 GP	7,600	7,092	Segment in Queue*	6,354	0.84	4 GP + 1 ML	7,600	6,078	0.80	5,313	0.70
Bayshore Blvd On to Alanna Way/Beatty Av Off	4 GP	7,600	7,600	1.00**	7,051	0.93	4 GP + 1 ML	7,600	7,129	0.94	5,944	0.78
Alanna Way/Beatty Av Off to Alanna Way/Beatty Av On	4 GP	7,600	7,328	0.96	6,815	0.90	4 GP + 1 ML	7,600	6,889	0.91	5,866	0.77
Alanna Way/Beatty Av On to Sierra Point Pkwy Off	4 GP + 1 Aux	8,600	7,913	Segment in Queue*	7,284	0.85	4 GP + 1 Aux + 1 ML	8,600	7,587	0.88	6,284	0.73

Table 3-3: Southbound US-101 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Maximum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
Sierra Point Pkwy Off to Sierra Point Pkwy On	4 GP	7,600	7,600	1.00**	7,078	0.93	4 GP + 1 ML	7,600	7,476	0.98	6,120	0.81
Sierra Point Pkwy On to Airport Blvd Off	4 GP + 1 Aux	8,600	7,718	0.90	7,472	0.87	4 GP + 1 Aux + 1 ML	8,600	7,595	0.88	6,526	0.76
Airport Blvd Off to Oyster Point Blvd Off	4 GP + 1 Aux	8,600	7,522	0.87	7,004	0.81	4 GP + 1 Aux + 1 ML	8,600	7,380	0.86	6,160	0.72
Oyster Point Blvd Off to Airport Blvd On	4 GP	7,600	6,457	0.85	6,060	0.80	4 GP + 1 ML	7,600	6,518	0.86	5,397	0.71
Airport Blvd On to Oyster Point Blvd On	4 GP	7,600	7,488	0.99	6,939	0.91	4 GP + 1 ML	7,600	7,421	0.98	6,115	0.80
Oyster Point Blvd On to Grand Av Off	4 GP + 1 Aux	8,600	8,128	0.95	7,965	0.93	4 GP + 1 Aux + 1 ML	8,600	8,029	0.93	7,019	0.82
Grand Av Off to Produce Av Off	4 GP	7,600	7,481	0.98	7,530	0.99	4 GP + 1 ML	7,600	7,397	0.97	6,612	0.87
Produce Av Off to Produce Av On	4 GP	7,600	7,172	0.94	7,411	0.98	4 GP + 1 ML	7,600	7,103	0.93	6,507	0.86
Produce Av On to I-380 Off	5 GP + 1 Aux	10,500	8,211	0.78	9,249	0.88	5 GP + 1 Aux + 1 ML	10,500	7,982	0.76	8,219	0.78

Notes:
1. Starting from the southernmost segment and going north.
2. GP = general purpose lane, AUX = auxiliary lane, ML = Managed Lane
3. Yellow cell shading indicates near-capacity operations, red cell shading indicates over-capacity operations, and blue cell shading indicates a managed lane is proposed.
* Value shown based on INRIX data and field observations, which supersede the V/C results
** Controlling bottlenecks operate at V/C = 1.00 by definition. The segment demand is in excess of the volume presented as vehicles are in the queue approaching the bottleneck. Vehicles volumes downstream of this location represent the constrained flow based on the upstream bottleneck.
Source: Fehr & Peers, 2018

Table 3-4: Southbound US-101 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Minimum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
Cesar Chavez St On to I-280 S Off	3 GP + 2 Aux	8,600	7,311	Segment in Queue*	8,433	0.98	3 GP + 2 Aux	8,600	7,284	Segment in Queue*	8,563	0.99
I-280 S Off to Alemany Blvd On	3 GP	5,700	4,893	Segment in Queue*	4,949	0.87	3 GP	5,700	4,638	Segment in Queue*	4,898	0.86
Alemany Blvd On to San Bruno Av Off	3 GP + 1 Aux	6,700	5,264	Segment in Queue*	5,326	0.79	3 GP + 1 Aux	6,700	4,992	Segment in Queue*	5,280	0.79
San Bruno Av Off to San Bruno Av On	3 GP	5,700	4,944	Segment in Queue*	4,759	0.83	3 GP	5,700	4,672	Segment in Queue*	4,706	0.83
San Bruno Av On to I-280 N On	3 GP	5,700	5,248	Segment in Queue*	4,953	0.87	3 GP	5,700	4,968	Segment in Queue*	4,879	0.86
I-280 On to San Bruno Av/Paul Av Off	5 GP	9,500	8,510	Segment in Queue*	8,294	0.87	4 GP + 1 ML	7,600	6,204	Segment in Queue*	6,213	0.82
San Bruno Av/Paul Av Off to Bayshore Blvd Off	5 GP	9,500	7,959	Segment in Queue*	6,897	0.73	4 GP + 1 ML	7,600	6,155	Segment in Queue*	5,201	0.68
Bayshore Blvd Off to Bayshore Blvd On	4 GP	7,600	7,092	Segment in Queue*	6,354	0.84	3 GP + 1 ML	5,700	5,272	Segment in Queue*	4,671	0.82
Bayshore Blvd On to Alanna Way/Beatty Av Off	4 GP	7,600	7,600	1.00**	7,051	0.93	3 GP + 1 ML	5,700	5,700	1.00**	5,364	0.94
Alanna Way/Beatty Av Off to Alanna Way/Beatty Av On	4 GP	7,600	7,328	0.96	6,815	0.90	3 GP + 1 ML	5,700	5,466	0.96	5,137	0.90
Alanna Way/Beatty Av On to Sierra Point Pkwy Off	4 GP + 1 Aux	8,600	7,913	Segment in Queue*	7,284	0.85	3 GP + 1 Aux + 1 ML	6,700	6,017	Segment in Queue*	5,606	0.84

Table 3-4: Southbound US-101 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Minimum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
Sierra Point Pkwy Off to Sierra Point Pkwy On	4 GP	7,600	7,600	1.00**	7,078	0.93	3 GP + 1 ML	5,700	5,700	1.00**	5,391	0.95
Sierra Point Pkwy On to Airport Blvd Off	4 GP + 1 Aux	8,600	7,718	0.90	7,472	0.87	3 GP + 1 Aux + 1 ML	6,700	5,827	0.87	5,797	0.87
Airport Blvd Off to Oyster Point Blvd Off	4 GP + 1 Aux	8,600	7,522	0.87	7,004	0.81	3 GP + 1 Aux + 1 ML	6,700	5,636	0.84	5,329	0.80
Oyster Point Blvd Off to Airport Blvd On	4 GP	7,600	6,457	0.85	6,060	0.80	3 GP + 1 ML	5,700	4,606	0.81	4,401	0.77
Airport Blvd On to Oyster Point Blvd On	4 GP	7,600	7,488	0.99	6,939	0.91	3 GP + 1 ML	5,700	5,668	0.99	5,275	0.93
Oyster Point Blvd On to Grand Av Off	4 GP + 1 Aux	8,600	8,128	0.95	7,965	0.93	3 GP + 1 Aux + 1 ML	6,700	6,310	0.94	6,298	Segment in Queue*
Grand Av Off to Produce Av Off	4 GP	7,600	7,481	0.98	7,530	0.99	3 GP + 1 ML	5,700	5,691	1.00	5,700	1.00**
Produce Av Off to Produce Av On	4 GP	7,600	7,172	0.94	7,411	0.98	3 GP + 1 ML	5,700	5,463	0.96	5,700	1.00**
Produce Av On to I-380 Off	5 GP + 1 Aux	10,500	8,211	0.78	9,249	0.88	4 GP + 1 Aux + 1 ML	8,600	6,557	0.76	7,597	0.88

Notes:
1. Starting from the southernmost segment and going north.
2. GP = general purpose lane, AUX = auxiliary lane, ML = Managed Lane
3. Yellow cell shading indicates near-capacity operations, red cell shading indicates over-capacity operations, and blue cell shading indicates a managed lane is proposed.
* Value shown based on INRIX data and field observations, which supersede the V/C results
** Controlling bottlenecks operate at V/C = 1.00 by definition. The segment demand is in excess of the volume presented as vehicles are in the queue approaching the bottleneck. Vehicles volumes downstream of this location represent the constrained flow based on the upstream bottleneck.
Source: Fehr & Peers, 2018

Table 3-5: Northbound I-280 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Maximum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
Ocean Av On to San Jose Av Off	4 GP + 1 Aux	9,000	7,320	Segment in Queue*	6,368	0.71	4 GP + 1 Aux	9,000	7,178	0.80	6,217	0.69
San Jose Av Off to Monterey Blvd On	4 GP	8,000	5,635	Segment in Queue*	4,578	0.57	4 GP	8,000	5,475	0.68	4,446	0.56
Monterey Blvd On to Alemany Blvd Off	3 GP + 1 Aux	7,000	7,000	1.00**	5,280	0.75	3 GP + 1 Aux	7,000	6,935	0.99	5,107	0.76
Alemany Blvd Off to Alemany Blvd On	4 GP	8,000	6,311	Segment in Queue*	4,555	0.57	4 GP	8,000	6,242	Segment in Queue*	4,363	0.55
Alemany Blvd On to US-101 S Off	4 GP + 1 Aux	9,000	8,106	Segment in Queue*	5,320	0.59	4 GP + 1 Aux	9,000	7,996	Segment in Queue*	5,077	0.56
US-101 S Off to US-101 N Off	4 GP	8,000	7,002	Segment in Queue*	4,466	0.56	4 GP	8,000	6,861	Segment in Queue*	4,380	Segment in Queue*
US-101 N Off to US-101 N On	2 GP	4,000	3,260	Segment in Queue*	3,150	Segment in Queue*	2 GP	4,000	3,114	Segment in Queue*	2,986	Segment in Queue*
US-101 N On to Cesar Chavez St Off	3 GP	6,000	6,000	1.00**	6,000	1.00**	3 GP	6,000	6,000	1.00**	6,000	1.00**
Cesar Chavez St Off to 25th St On	3 GP	6,000	4,788	0.80	4,901	0.82	3 GP + 1 ML	6,000	4,800	0.80	4,903	0.82
25th St On to Mariposa St Off	3 GP + 1 Aux	7,000	5,213	0.74	5,331	0.76	3 GP + 1 Aux + 1 ML	7,000	5,100	0.73	5,350	0.76
Mariposa St Off to 18th St On	3 GP	6,000	3,425	Segment in Queue***	3,739	Segment in Queue***	3 GP + 1 ML	6,000	3,500	Segment in Queue***	3,268	Segment in Queue***

Table 3-5: Northbound I-280 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Maximum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
18th St On to 6th St Off	3 GP + 1 Aux	7,000	3,529	Segment in Queue***	3,952	Segment in Queue***	3 GP + 1 Aux + 1 ML	7,000	3,596	Segment in Queue***	3,431	Segment in Queue***
6th St Off to King St	2 GP	4,000	1,461	Segment in Queue***	1,812	Segment in Queue***	2 GP + 1 ML	4,000	1,326	Segment in Queue***	1,518	Segment in Queue***

Notes:
1. Starting from the southernmost segment and going north.
2. GP = general purpose lane, AUX = auxiliary lane, ML = Managed Lane
3. Yellow cell shading indicates near-capacity operations, red cell shading indicates over-capacity operations, and blue cell shading indicates a managed lane is proposed.
* Value shown based on INRIX data and field observations, which supersede the V/C results
** Controlling bottlenecks operate at V/C = 1.00 by definition. The segment demand is in excess of the volume presented as vehicles are in the queue approaching the bottleneck. Vehicles volumes downstream of this location represent the constrained flow based on the upstream bottleneck.
*** Freeway terminus metered by local street capacity. Segment in queue based on INRIX data and field observations which supersede the V/C results.
Source: Fehr & Peers, 2018

Table 3-6: Northbound I-280 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Minimum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
Ocean Av On to San Jose Av Off	4 GP + 1 Aux	9,000	7,320	Segment in Queue*	6,368	0.71	4 GP + 1 Aux	9,000	7,301	Segment in Queue*	6,511	0.72
San Jose Av Off to Monterey Blvd On	4 GP	8,000	5,635	Segment in Queue*	4,578	0.57	4 GP	8,000	5,623	Segment in Queue*	4,712	0.59
Monterey Blvd On to Alemany Blvd Off	3 GP + 1 Aux	7,000	7,000	1.00**	5,280	0.75	3 GP + 1 Aux	7,000	7,000	1.00**	5,407	0.77
Alemany Blvd Off to Alemany Blvd On	4 GP	8,000	6,311	Segment in Queue*	4,555	0.57	4 GP	8,000	6,302	Segment in Queue*	4,673	0.58
Alemany Blvd On to US-101 S Off	4 GP + 1 Aux	9,000	8,106	Segment in Queue*	5,320	0.59	4 GP + 1 Aux	9,000	8,084	Segment in Queue*	5,441	0.60
US-101 S Off to US-101 N Off	4 GP	8,000	7,002	Segment in Queue*	4,466	0.56	4 GP	8,000	7,044	Segment in Queue*	4,600	0.58
US-101 N Off to US-101 N On	2 GP	4,000	3,260	Segment in Queue*	3,150	Segment in Queue*	2 GP	4,000	3,267	Segment in Queue*	3,190	Segment in Queue*
US-101 N On to Cesar Chavez St Off	3 GP	6,000	6,000	1.00**	6,000	1.00**	3 GP	6,000	6,000	1.00**	6,000	1.00**
Cesar Chavez St Off to 25th St On	3 GP	6,000	4,788	0.80	4,901	0.82	3 GP	6,000	4,777	0.80	4,904	0.82
25th St On to Mariposa St Off	3 GP + 1 Aux	7,000	5,213	0.74	5,331	0.76	3 GP + 1 Aux	7,000	5,217	0.75	5,364	0.77
Mariposa St Off to 18th St On	3 GP	6,000	3,425	Segment in Queue***	3,739	Segment in Queue***	3 GP	6,000	3,448	Segment in Queue***	3,756	Segment in Queue***

Table 3-6: Northbound I-280 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Minimum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
18th St On to 6th St Off	3 GP + 1 Aux	7,000	3,529	Segment in Queue***	3,952	Segment in Queue***	3 GP + 1 Aux + 1 ML	7,000	2,999	Segment in Queue***	3,481	Segment in Queue***
6th St Off to King St	2 GP	4,000	1,461	Segment in Queue***	1,812	Segment in Queue***	2 GP + 1 ML	4,000	1,257	Segment in Queue***	1,636	Segment in Queue***

Notes:
1. Starting from the southernmost segment and going north.
2. GP = general purpose lane, AUX = auxiliary lane, ML = Managed Lane
3. Yellow cell shading indicates near-capacity operations, red cell shading indicates over-capacity operations, and blue cell shading indicates a managed lane is proposed.
* Value shown based on INRIX data and field observations, which supersede the V/C results
** Controlling bottlenecks operate at V/C = 1.00 by definition. The segment demand is in excess of the volume presented as vehicles are in the queue approaching the bottleneck. Vehicles volumes downstream of this location represent the constrained flow based on the upstream bottleneck.
*** Freeway terminus metered by local street capacity. Segment in queue based on INRIX data and field observations which supersede the V/C results.
Source: Fehr & Peers, 2018

Table 3-7: Southbound I-280 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Maximum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
King St to 6th St On	2 GP	4,000	1,023	0.27	1,330	0.35	2 GP + 1 ML	4,000	819	0.20	1,301	0.33
6th St On to 18th St Off	3 GP + 1 Aux	7,000	3,087	0.46	3,878	0.58	3 GP + 1 Aux + 1 ML	7,000	2,472	0.35	3,414	0.49
18th St Off to 18th St On	3 GP	6,000	2,756	0.48	3,573	0.63	3 GP + 1 ML	6,000	2,220	0.37	3,087	0.51
18th St On to Pennsylvania Av Off	3 GP	6,000	3,409	0.60	4,982	0.87	3 GP + 1 ML	6,000	2,716	0.45	4,246	0.71
Pennsylvania Av Off to Pennsylvania Av On	3 GP	6,000	2,983	0.52	4,372	0.77	3 GP + 1 ML	6,000	2,373	0.40	3,627	0.60
Pennsylvania Av On to US-101 S Off	3 GP	6,000	3,715	0.65	5,525	Segment in Queue*	3 GP + 1 ML	6,000	2,909	0.48	4,443	0.74
US-101 S Off to US-101 S On	2 GP	4,000	1,547	0.41	3,038	Segment in Queue*	2 GP	4,000	1,571	0.39	3,023	0.76
US-101 S On to US-101 N On	4 GP	8,000	3,656	0.46	6,520	Segment in Queue*	4 GP	8,000	3,628	0.45	6,172	0.77
US-101 N On to Alemany Blvd Off	4 GP + 1 Aux	8,600	4,350	0.51	7,944	Segment in Queue*	4 GP + 1 Aux	8,600	4,344	0.51	7,635	0.89
Alemany Blvd Off to Alemany Blvd On	4 GP	7,600	3,921	0.52	6,803	Segment in Queue*	4 GP	7,600	3,921	0.52	6,404	0.84
Alemany Blvd On to Monterey Blvd Off	4 GP	7,600	4,864	0.64	7,600	1.00**	4 GP	7,600	4,869	0.64	7,545	0.99
Monterey Blvd Off to San Jose Av On	4 GP	7,600	4,030	0.53	6,371	0.84	4 GP	7,600	4,026	0.53	6,233	0.82

Table 3-7: Southbound I-280 2020 No Build and Maximum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Maximum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
San Jose Av On to Ocean Av Off	4 GP + 1 Aux	8,600	5,536	0.64	8,400	0.98	4 GP + 1 Aux	8,600	5,534	0.64	8,263	0.96
Ocean Av Off to Ocean Av On	5 GP	9,500	4,762	0.50	7,229	0.76	5 GP	9,500	4,762	0.50	7,030	0.74

Notes:
1. Starting from the southernmost segment and going north.
2. GP = general purpose lane, AUX = auxiliary lane, ML = Managed Lane
3. Yellow cell shading indicates near-capacity operations, red cell shading indicates over-capacity operations, and blue cell shading indicates a managed lane is proposed.
* Value shown based on INRIX data and field observations, which supersede the V/C results
** Controlling bottlenecks operate at V/C = 1.00 by definition. The segment demand is in excess of the volume presented as vehicles are in the queue approaching the bottleneck. Vehicles volumes downstream of this location represent the constrained flow based on the upstream bottleneck.
Source: Fehr & Peers, 2018

Table 3-8: Southbound I-280 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Minimum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
King St to 6th St On	2 GP	4,000	1,023	0.27	1,330	0.35	2 GP	4,000	972	0.24	1,231	0.31
6th St On to 18th St Off	3 GP + 1 Aux	7,000	3,087	0.46	3,878	0.58	2 GP + 1 Aux + 1 ML	5,000	3,039	0.61	3,712	Segment in Queue*
18th St Off to 18th St On	3 GP	6,000	2,756	0.48	3,573	0.63	2 GP + 1 ML	4,000	2,213	0.55	2,842	Segment in Queue*
18th St On to Pennsylvania Av Off	3 GP	6,000	3,409	0.60	4,982	0.87	2 GP + 1 ML	4000	2,737	0.68	3,957	Segment in Queue*
Pennsylvania Av Off to Pennsylvania Av On	3 GP	6,000	2,983	0.52	4,372	0.77	2 GP + 1 ML	4,000	2,397	0.60	3,424	Segment in Queue*
Pennsylvania Av On to US-101 S Off	3 GP	6,000	3,715	0.65	5,525	Segment in Queue*	2 GP + 1 ML	4,000	2,972	0.74	4,000	1.00**
US-101 S Off to US-101 S On	2 GP	4,000	1,547	0.41	3,038	Segment in Queue*	2 GP	4,000	1,597	0.40	2,666	0.67
US-101 S On to US-101 N On	4 GP	8,000	3,656	0.46	6,520	Segment in Queue*	4 GP	8,000	3,932	0.49	6,349	Segment in Queue*
US-101 N On to Alemany Blvd Off	4 GP + 1 Aux	9,000	4,350	0.51	7,944	Segment in Queue*	4 GP + 1 Aux	8,600	4,605	0.54	7,770	Segment in Queue*
Alemany Blvd Off to Alemany Blvd On	4 GP	8,000	3,921	0.52	6,803	Segment in Queue*	4 GP	7,600	4,180	0.55	6,681	Segment in Queue*
Alemany Blvd On to Monterey Blvd Off	4 GP	8,000	4,864	0.64	7,600	1.00**	4 GP	7,600	5,146	0.68	7,600	1.00**
Monterey Blvd Off to San Jose Av On	4 GP	8,000	4,030	0.53	6,371	0.84	4GP	7,600	4,323	0.57	6,419	0.84

Table 3-8: Southbound I-280 2020 No Build and Minimum Build Traffic Volume-to-Capacity Analysis Summary

Segment[1]	2020 No Build Conditions						2020 Build Conditions (Minimum Footprint)					
	Number of Lanes[2]	Capacity	AM Peak Hour		PM Peak Hour		Number of Lanes[2]	General Purpose Capacity	AM Peak Hour		PM Peak Hour	
			Volume	V/C[3]	Volume	V/C[3]			General Purpose Volume	General Purpose V/C[3]	General Purpose Volume	General Purpose V/C[3]
San Jose Av On to Ocean Av Off	4 GP + 1 Aux	9,000	5,536	0.64	8,400	0.98	4 GP + 1 Aux	8,600	5,826	0.68	8,459	0.98
Ocean Av Off to Ocean Av On	5 GP	10,000	4,762	0.50	7,229	0.76	5 GP	9,500	5,067	0.53	7,338	0.77

Notes:
1. Starting from the southernmost segment and going north.
2. GP = general purpose lane, AUX = auxiliary lane, ML = Managed Lane
3. Yellow cell shading indicates near-capacity operations, red cell shading indicates over-capacity operations, and blue cell shading indicates a managed lane is proposed.
* Value shown based on INRIX data and field observations, which supersede the V/C results
** Controlling bottlenecks operate at V/C = 1.00 by definition. The segment demand is in excess of the volume presented as vehicles are in the queue approaching the bottleneck. Vehicles volumes downstream of this location represent the constrained flow based on the upstream bottleneck.
Source: Fehr & Peers, 2018

3.4 Travel Time Delay Analysis

Travel time delays in the general-purpose lanes were estimated based on the V/C calculations. Capacity assumptions described in Section 2.1 were supplemented by identifying existing bottlenecks and adjusting the available capacity based on the number of vehicles served at that location. Bottleneck delays were estimated based on the amount of "unserved" demand. Delays associated with locations outside the study corridor, such as delays from King Street at the I-280 northbound terminus, were accounted for based on existing available data.

Table 3-9 summarizes the general purpose travel time delay estimated for the 2020 No Build, 2020 Maximum Build Alternative 1 and 2020 Minimum Build Alternative 2 scenarios.

Table 3-9: 2020 No Build and 2020 Build Travel Time Delay

Corridor	General Purpose Lanes Travel Time Delay (minutes)		
	2020 No Build	2020 Maximum Build Alternative 1	2020 Minimum Build Alternative 2
AM Peak Hour			
Northbound US-101	6.8	2.7	9.0
Southbound US-101	4.4	0.0	6.5
Northbound I-280	7.2	2.7	6.9
Southbound I-280	0.0	0.0	0.0
PM Peak Hour			
Northbound US-101	5.5	0.0	9.1
Southbound US-101	0.0	0.0	1.1
Northbound I-280	0.7	1.6	0.6
Southbound I-280	5.7	0.0	6.3

Source: Fehr & Peers, 2018

3.5 Analysis Findings

This section describes findings from the V/C and travel time delay analysis described above. It should be emphasized that the analysis findings presented below are preliminary, and that the results only reflect the preliminary geometric designs developed thus far for each alternative. The geometrics for each alternative carried forward into the PA/ED stage of the process will be further refined based on more detailed traffic operations studies to better meet the objectives of the project.

3.5.1 2020 No Build Alternative

The No Build alternative assumes the same lane configurations for each of the study segments as Existing Conditions, such that no geometric changes are proposed. As described in the tables above, the following study segments are expected to operate at near-capacity or over-capacity conditions during Year 2020 No Build conditions.

AM Peak Hour

- Northbound US-101: The corridor generally operates at near capacity or over capacity conditions. Specific segments include:
    - Over-capacity operations between the Airport Boulevard on-ramp to the Grand Avenue off-ramp (one segment), resulting in a queue spillback past the Airport Boulevard off-ramp and outside the study area.
    - Near-capacity operations from the Grand Avenue off-ramp to the 3rd Street off-ramp (eight segments)
    - Over-capacity operations, north of the study area resulting in a queue spillback between the 3rd Street off-ramp to the end of the study area at the Cesar Chavez Street on-ramp (nine segments)
- Southbound US-101: The corridor operates near capacity or over capacity throughout the corridor. Specific segments along southbound US-101 anticipated to operate at near-capacity or over-capacity operations include:
    - Over-capacity operations between the Bayshore Boulevard on-ramp to the Alanna ay/Beatty Avenue on-ramp, resulting in a queue spillback past the Cesar Chavez Street on-ramp and outside the study area.
    - Over-capacity operations between the Sierra Point Parkway off-ramp to the Sierra Point Parkway on-ramp, resulting in a queue spillback to the Alanna Way/Beatty Avenue on-ramp.
    - Near-capacity operations between the Sierra Point Parkway on-ramp to the Airport Boulevard off-ramp (one segment) and the Airport Boulevard on-ramp to the Produce Avenue on-ramp (four segments)
- Northbound I-280: Operations are generally over-capacity or in queue throughout the corridor with exception to the segments between Cesar Chavez Street off-ramp to the Mariposa Street off-ramp. Additional queues are expected to operate at the freeway terminus due to signal metering from the local intersections. Segments expected to operate over-capacity and their corresponding queue, include:

  - Over-capacity operations between the Monterey Boulevard on-ramp to the Alemany Boulevard off-ramp, and the Northbound US-101 on-ramp to the Cesar Chavez Street off-ramp, resulting in a queue spillback past the Ocean Avenue on-ramp.

- Southbound I-280: Operations are generally under-capacity through the corridor and no segments are expected to operate near-capacity or over-capacity.

As shown in **Table 3-9**, the northbound corridor of US-101 and I-280 have a combined estimated delay of 14 minutes within the study area and the southbound corridor has an estimated delay of 4 minutes. The southbound US-101 corridor is not expected to experience delay as much of the demand is likely metered by an upstream bottleneck.

PM Peak Hour

- Northbound US-101: Operations are generally under capacity downstream of the 3rd Street off-ramp through the I-280 interchange, with operations generally near-capacity or over-capacity upstream of the 3rd Street off-ramp. Specific segments anticipated to operate near-capacity or over-capacity and their corresponding queues include:
  - Over-capacity operations between the Oyster Point Boulevard off to the Sierra Point Parkway Off, resulting in a queue spillback past the Airport Boulevard off-ramp and outside the study area.
  - Near-capacity operations between the Sierra Point Parkway off-ramp to the Sierra Point Parkway on-ramp (one segment) and the Harney Way off-ramp to the 3rd Street off-ramp (two segments) and the Bayshore Boulevard on-ramp to the I-280 off-ramp (one segment).
  - Over-capacity operations, north of the study area result in a queue spillback between the I-280 north on-ramp through the end of the study area at the Cesar Chavez Street on-ramp (two segments)
- Southbound US-101: Operations are generally under-capacity or near-capacity throughout the corridor. No segments are expected to operate over-capacity. Specific segments anticipated to operate near-capacity include:
  - Cesar Chavez Street on-ramp to the I-280 south off-ramp (one segment)
  - Bayshore Boulevard on-ramp to the Alanna Way/Beatty on-ramp (two segments)
  - Sierra Point Parkway off-ramp to the Sierra Point Parkway on-ramp (one segment)
  - Airport Boulevard on-ramp to the Produce Avenue on-ramp (four segments)
- Northbound I-280: Operations are generally under-capacity between the Ocean Avenue on-ramp and the I-280 interchange. Like the AM peak hour, queues are expected near the freeway terminus due to the signals at the King Street and 6th Street off-ramps. Segments expected to operate over-capacity include:

  - Northbound US-101 on-ramp and the Cesar Chavez Street off-ramp (one segment), resulting in a queue spillback to the northbound US-101 off-ramp (one segment).

- Southbound I-280: Operations are generally under-capacity from the start of the corridor to the Pennsylvania Avenue on-ramp. Segments expected to operate over-capacity or near capacity include:
  - Over-capacity between the Alemany Boulevard on-ramp to the Monterey Boulevard off-ramp (one segment), resulting in a queue spillback to the Pennsylvania Avenue on-ramp (five segments).
  - Near capacity between the San Jose Avenue on-ramp to the Ocean Avenue off-ramp (one segment).

As shown in **Table 3-9**, the northbound corridor of US-101 and I-280 have a combined estimated delay of 6.2 minutes within the study area and the southbound corridor has an estimated delay of 5.7 minutes. There is no expected congestion along southbound I-280.

3.5.2 2020 Maximum Build – Alternative 1

The Maximum Build Alternative (Alternative 1) proposes to construct a managed lane in each direction of US-101 and I-280 from the terminus of the San Mateo 101 Express Lanes Project at I-380 and the I-280 terminus in San Francisco. Under Alternative 1, the managed lane will typically be provided in addition to the current general purpose lanes through shoulder conversions and freeway widening. As described in Section 3.1.2, a 2.3 mile gap would be present in the northbound direction between the Bayshore Boulevard overcrossing at US-101 and approximately 2,400 feet north of the US-101/I-280 connector along I-280. The southbound facility would be provided with a continuous managed lane. The V/C analysis for Alternative 1 is summarized in **Tables 3-1, 3-3, 3-5,** and **3-7**, and the travel time delay in **Table 3-9**.

AM Peak Hour

As shown in **Tables 3-1** and **3-3**, the additional capacity provided by the managed lane is anticipated to improve the future conditions and reduce congestion along freeway mainline segments for both directions. The additional capacity provided by the managed lane would reduce peak hour V/C ratios, which is indicative of improved operations. For example, the V/C ratios for US-101 are expected to reduce throughout the entire corridor in both directions. Under No Build conditions, much of the northern half of the segment is in queue due to a downstream bottleneck. With the project, it is expected that queue length would be reduced. In the southbound US-101 direction, the addition of Alternative 1 results in all segments operating near-capacity or under-capacity, such that no one segment in the study area operates over-capacity.

As shown in **Table 3-5**, the addition of the Alternative 1 managed lane results in reduced queue lengths along northbound I-280. Queues are still expected to form at the freeway terminus due to local signalized intersections metering the amount of freeway traffic onto local streets. In the southbound direction, the addition of the managed lane along I-280 continues to result under-capacity.

Alternative 1 adds capacity throughout the US-101 and I-280 corridors, thus, as expected, results in a decrease in travel time delay along the corridors during the AM peak hour, when compared to No Build Conditions.

PM Peak Hour

In the PM peak hour, the Alternative 1 scenario sees much of the same benefit as the AM peak hour. V/C ratios across the corridor are reduced in the northbound direction, though segments are still operating at near-capacity conditions. The addition of Alternative 1 results in better operations along southbound US-101 compared to the No Build scenario because the project would increase capacity across the corridor.

Along I-280, the addition of the Alternative 1 managed lane results in a longer queue in the northbound direction because the model assumes an increase in demand at the northbound US-101 on-ramp to Cesar Chavez off-ramp bottleneck location. Additionally, queues are still expected to form at the freeway terminus due to local signalized intersections metering exiting freeway traffic. The addition of the Alternative 1 project is expected to reduce the southbound bottlenecks to near-capacity, such that the No Build segments operating in queue are no longer present with the project.

As shown in **Table 3-9**, the addition of Alternative 1 results in a decrease in travel time along all the study segments, except for northbound I-280, where travel time slightly increases due to the increase in demand through the bottleneck.

3.5.2.1 2020 Maximum Build Alternative Variants

The above analysis was evaluated for the 2020 Maximum Build Alternative 1A. A variant to Alternative 1A includes removing the proposed C-D road along northbound US-101 (Station 15+76 to Station 16+18), to match existing conditions. The removal of the C-D road would likely yield a new bottleneck due to additional traffic from the Bayshore Boulevard on-ramp and the weave area between the Bayshore Boulevard on-ramp and I-280 off-ramp. The bottleneck is estimated to cause a queue back to the Sierra Point Parkway on-ramp during both peak hours.

Based on the above findings, Alternative 1B would yield similar or better results since the managed lane facility would include a continuous northbound managed lane from US-101 to I-280, such that the 2.3 mile gap would no longer be present. The southbound managed lane would operate similar to Alternative 1A as

both alternatives assume a continuous managed lane. Alternative 1C, which proposes a reversible direct-connector between US-101 and I-280, would likely perform similar to Alternative 1A during the off-peak direction and Alternative 1B in the peak direction.

3.5.3 2020 Minimum Build – Alternative 2

Similar to Alternative 1, the Minimum Build Alternative (Alternative 2) proposes to construct a managed lane in each direction of US-101 and I-280 from the terminus of the San Mateo 101 Express Lanes Project at I-380 and the I-280 terminus in San Francisco. However, the managed lane facility will be achieved through a lane conversion of an existing general purpose lane or conversion of shoulder. In most cases, the general purpose lane will be converting, resulting in a reduction in capacity along the study corridors. As described in Section 3.1.2, a 3.5 mile gap would be present in the northbound direction between the Bayshore Boulevard overcrossing at US-101 and the 18th Street overcrossing along I-280. The southbound facility would be provided a continuous managed lane. The V/C analysis for Alternative 2 is summarized in **Tables 3-2, 3-4, 3-6,** and **3-8**, and the travel time delay in **Table 3-9**.

AM Peak Hour

As shown in **Table 3-2**, northbound US-101 is expected to operate in better conditions than the No Build, between the Grand Avenue interchange and the 3rd Street off-ramp. However, queues and delay are expected to increase at the start of the study corridor as the removal of the general purpose lane would result in a bottleneck causing queue spillback, outside the project limits. Overall, the general purpose lanes perform worst with the addition of the Alternative 2 managed lane facility compared to the No Build scenario due to the heavy demand and decrease in overall capacity. Much like the northbound direction, the queues in the southbound direction worsen as the overall general purpose capacity decreases, resulting in longer queues that extend beyond the study area.

Along northbound I-280, the addition of the managed lane slightly improves the traffic operations, though study segments are generally operating the same as No Build conditions. Southbound I-280 would continue to operate like the No Build scenario with little to no congestion.

The addition of the Alternative 2 project increases the general purpose travel time delay along US-101 by 1.9 minutes in the northbound direction and 2.1 minutes in the southbound direction. Along I-280, the project slightly decreases the general purpose travel time delay in the northbound direction by 0.3 minutes and results in no change in the southbound direction. Overall, the projects worsens general purpose operations as the project reduces the capacity across the study corridors.

PM Peak Hour

During the PM peak hour, Alternative 2 would worsen northbound US-101 conditions. Specifically, the bottlenecks formed at the start of the corridor would increase the queue length, as the available general purpose capacity decreases. The resulting queue spills back past the project limits. Southbound US-101 is expected to worsen as a new bottleneck is formed at the end of the corridor near the Produce Avenue interchange as a result of a decrease in the available general purpose lane capacity.

Northbound I-280 generally operates the same with the addition of the managed lanes compared to No Build conditions. Southbound I-280 worsens as the lane conversion reduces the available general purpose capacity resulting in a new bottleneck between the Pennsylvania Avenue off-ramp and the southbound US-101 off-ramp. The bottleneck results in a queue expected to spillback to the 6th Street on-ramp.

Like the AM peak hour, the addition of the Alternative 2 project increases general purpose travel time delay along US-101 in both directions and I-280 in the northbound direction. Along US-101, the addition of Alternative 2 increases the travel time delay by 3.6 minutes and 1.1 minutes in the northbound and southbound direction, respectively. The northbound I-280 travel time delay is expected to decrease by 0.1 minutes while the southbound I-280 travel time delay is expected to increase by 0.6 minutes. Overall, the projects worsens general purpose operations as the project reduces the capacity across the study corridors.

3.5.3.1 2020 Minimum Build Alternative Variants

The above analysis was evaluated for the 2020 Minimum Build Alternative 2A. Based on these results, it is expected that Alternative 2B would yield similar or better results since under Alternative 2B, additional capacity would be proposed for the US-101/I-280 direct connector to facilitate the managed lane facilities. Like Alternative 1C, a continuous managed lane facility would be provided in the peak direction only. The off-peak direction would have a gap. Therefore, based on traffic operations, it's likely that Alternative 2B would operate better than Alternative 2A but worse than Alternative 1C.

3.6 Local Street Opportunities

The managed lane facilities provide a unique opportunity to improve mainline throughput as well as local street operations. As part of this process, Fehr & Peers met with SFMTA staff to discuss potential local street opportunities, as summarized below:

- I-280 Terminus: Approximately 40 buses per hour are expected to use the I-280 corridor. Consider terminating the managed lane before the freeway terminus and provide a transit queue jump lane. The transit queue jump lane would likely provide travel time savings for the bus and may encourage single occupant vehicles to shift modes.
- Transit only on-ramps: To maximize transit usage on the freeway, the project should consider on-ramp improvements where transit vehicles are provided a queue jump to the freeway mainline

and/or managed lane. Specific locations that could benefit from a transit queue jump include the Alemany on-ramp to northbound I-280 and the 3rd Street on-ramp to northbound US-101.

- Planned Corridor Improvements: Several corridors around the I-280 terminus are currently being analyzed and re-designed to improve transit operations by providing transit only lanes and increasing pedestrian safety by daylighting intersections. Corridors currently under evaluation or are planned for improvements near the study area include 6th Street, 5th Street, 3rd Street, and Brannan Street. The project should consider how the freeway terminus would impact these planned improvements, as many of these corridor projects result in a decrease in local street capacity.
- I-80 Bypass Traffic: Currently some drivers use I-280 and local streets in the SoMA neighborhood to bypass congestion on US-101 and I-80. The project should consider opportunities to disincentivize drivers from using local streets.

A quantitative local street analysis was not completed as part of the TEPA; therefore, the opportunities described above should be evaluated as part of the PA/ED. Just as mainline alternatives are considered, the local street opportunities should be assessed for feasibility and carried forward into the PA/ED stage of the process to be analyzed through detailed traffic operations studies.

.

4. Traffic Studies Scope for the PA&ED Phase

This TEPA has been developed per the Caltrans guidelines to support the PSR-PDS phase of this project. The next step will be to prepare a Traffic Operations Analysis Report (TOAR) for the PA/ED phase of the project. Below is the proposed scope of work and technical approach. Additional discussions with the consultant team and Caltrans District 4 staff should be considered prior to finalizing the scope of work and methodology.

4.1 Traffic Study Scope

4.1.1 Traffic Operations Analysis Study Area

Based on the initial analysis, the study area should be extended to include additional segments north and south of the existing project limits. The following mainline segments are proposed for the study area:

- US-101 from south of the Millbrae Avenue Interchange to the I-80 Interchange
- I-280 from the King Street and 6th Street freeway termini to the SR 1/John Daly Boulevard Interchange

This study area will be used as the basis for subsequent traffic forecasting and traffic operation analysis. The project study extents are beyond the project limits to more precisely reflect the traffic operations at the termini of the project limits. Note that the study area does not include local intersections at the ramp termini except on King Street at 5th Street, 4th Street, and 3rd Street as well as on 6th Street at Brannan Street and Bryant Street.

The initial traffic analysis completed in the FCMS Phase I and Phase II study only evaluated the AM and PM peak hours. However, existing levels of congestion suggest that additional hours of analysis should be included to capture the effects and benefits of the managed lane facility. Therefore, it is recommend that the propose study period extend to capture the following peak periods:

- AM peak period: 6:00 AM – 11:00 AM
- PM peak period: 1:00 PM – 8:00 PM

It is possible that the managed lanes may be operational beyond the peak period hours above; however, the focus of this analysis will be during the morning, afternoon and evening hours when freeway congestion occurs.

4.1.2 Data Collection

Several data sources will be used by Fehr & Peers including: traffic volume data from PeMS database, Caltrans census count database, Inrix speed data platform, and Caltrans TASAS collision database. Fehr & Peers will conduct additional data collection to supplement the available data including: freeway mainline volumes (SOV, HOV, buses, and trucks), ramp volumes, auto occupancy, travel speeds, and origin-destination patterns. The data will be used to: 1) establish freeway mainline and ramp demand volumes and HOV/SOV mode splits; 2) establish freeway travel speed profiles and corridor travel patterns; 3) validate the traffic forecasting model and calibrate the traffic operations tools; and 4) establish vehicle volumes and occupancy patterns. Each data collection component is described below:

Freeway Mainline Volumes

Vehicle counts (passenger vehicles, buses, and trucks) will be collected at up to four locations. Potential locations include: northbound and southbound US-101 south of the Millbrae interchange, northbound and southbound I-280 east of the John Daly Boulevard interchange, northbound and southbound I-280 east of the US-101 interchange, and northbound and southbound US-101 north of the I-280 interchange. These locations are generally not in queue during the study period. Mainline data will be collected using video cameras for up to three different weekdays (72 hours) and will be supplemented with available PeMS and Caltrans census data for these study segments.

Freeway Ramp Volumes

Vehicle counts (passenger vehicles, buses, and trucks) will be collected at all off-ramps and on-ramps along the study area. Data at the ramps will be collected using tubes and/or cameras for the same weekday period that mainline counts are collected, for a total of up to 72 hours of data.

Local Intersection Volumes

Vehicle counts (passenger vehicles, buses, pedestrians, bicyclists, and trucks) will be collected at five intersections including 6th Street with Brannan Street and with Bryant Street as well as King Street at 5th Street, 4th Street and 3rd Street. Turning movement data at the intersections will be collected using cameras or personnel for the same weekday period mainline counts are collected. Counts will only be collected for the AM and PM peak period.

Occupancy Volumes

Occupancy counts will be visually sampled with one person for each lane at up to three freeway mainline locations. Samples will be between 7:00 AM and 9:00 AM and between 4:00 and 6:00 PM. Potential locations include: US-101 overcrossing at 23rd Street, I-280 at King Street approaching 5th Street, and US-101 overcrossing at San Bruno Avenue.

Travel Speeds

Vehicle travel speeds along the study corridor will be collected through the Inrix platform. Along US-101, the Millbrae Avenue and I-80 interchanges will be used as the start-end points. Along I-280, the John Daly Boulevard interchange and King Street terminus will be used as the start-end points. The Inrix data will be used to determine travel times, bottleneck locations, and queue lengths. Inrix data can be used since neither corridor contains an existing managed lane (HOV lane). No supplemental travel speed surveys will be prepared as part of this task. All data will be based on the Inrix platform.

Collision History

Collision history has been provided by Caltrans as part of the PSR/PDS phase. The available data will be used for this phase of this analysis and no new data will be collected.

Streetlight Data

Fehr & Peers will purchase Streetlight data to establish the major origin-destination pairs through the study area including:

- Northbound US 101 to Northbound US 101 just prior Eastbound I-80 (and vice-versa)
- Northbound US 101 to Eastbound I-280 (and vice-versa)
- Northbound US 101 to Westbound I-280 (and vice-versa)
- Eastbound I-380 to Eastbound I-280 (and vice-versa)
- Eastbound I-380 to Northbound US 101 just prior Eastbound I-80 (and vice-versa)

4.1.3 Existing Conditions Analysis

Fehr & Peers will complete an Existing Conditions Report outlining the traffic data collected as part of the PA/ED process. This report will ultimately be incorporated into the TOAR for the project. As part of the Existing Conditions analysis, AM and PM peak period microsimulation models will be developed for the study segments described above using the VISSIM software package. The micro-simulation models will be

calibrated and validated to existing conditions. Measures of Effectiveness (MOEs) to be output include total vehicle-hours of delay, total vehicle-miles traveled, corridor travel times, corridor travel speeds and corridor maximum individual delays. Level of Service (LOS) outputs will be provided based on 2010 Highway Capacity Manual methodologies. Weave area analysis will be supplemented using the Leisch method. A draft version of the report will be submitted to Caltrans for review and comment. A final version of the report will be prepared after addressing Caltrans's comments; this report will be submitted for final approval.

4.1.4 Project Alternative Analysis

The existing conditions calibrated/validated Vissim models will be used for scenario testing. The corridor is currently congested and can provide a baseline of understand the impact and effectiveness of each design scenario. Up to five project scenarios will be analyzed and may include a combination of geometric changes as well as operational changes i.e., HOV2+, HOV3+, and Express Lane with HOV3+. The changes will not address potential mode shifts as these require travel demand forecasting. The Vissim model will also be used to investigate ingress/egress options - weave zones, weave lanes, and merge lanes – in terms of congestion and operational characteristics.

Fehr & Peers will summarize findings from the above alternatives analysis in a technical memorandum. The technical memorandum will include tables and figures that describe the operational differences between the various designs. Fehr & Peers will meet with reviewers prior to submitting the memorandum to discuss and agree on the technical findings. The memorandum will be submitted to Caltrans for review and comments, a final version of the report will be prepared after addressing Caltrans's comments; this report will be submitted for final approval.

4.1.5 Traffic Forecasts

The traffic forecast methodology will be discussed with Caltrans and the project team prior at the project kick-off. Three regional models may be used to develop traffic forecasts: SFCTA's SF-Champ model, MTC's Travel Model 1, and San Mateo County's C/CAG model. Typically, because the majority of the project is included in San Francisco, SFCTA's SF-Champ model would be used; however, because the project limits include a substantial portion of San Mateo County, the C/CAG model should be considered. Additionally, future year volumes should correspond to forecast prepared as part of the San Mateo County Express Lanes Project which used the C/CAG model.

Each model includes the extent of the study area proposed in Section 4.1.1; however, the level of detail varies. Prior to meeting with Caltrans and the project team, we proposed to review the base year (2015)

models to determine how well each model replicates Existing Condition volumes to understand which model would be best used to prepare future forecast.

Once a model is selected, the base year travel model will be reviewed in further detailed. Calibration adjustments for the base year model may be made to improve the validation of the base year model (versus existing conditions volumes). A base year model validation memorandum will be prepared and submitted for Caltrans review, comment and approval.

Available ABAG/Plan Bay Area land use projections will be used to prepare design year forecasts. The forecasts prepared for the TOAR will be based in part on the forecasts prepared for the San Mateo County Express Lanes Project. A future year forecasting memorandum will be prepared and submitted for Caltrans review, comment and approval.

4.1.6 Future Year Operations Analysis

For both the construction year and design year, the VISSIM models will be updated to reflect the expected future conditions, including the forecasted future traffic volumes and any capital improvements anticipated to occur. The models will be used to evaluate the MOEs of the No Build and Build alternatives. Results from the analysis of the Build alternative may be used to define further improvements needed to fulfill the purpose and need of the project.

A qualitative assessment of pedestrian, bicycle, and transit facilities will be performed to determine if either of the proposed build alternatives hinder or eliminate existing or proposed bikeways, result in unsafe conditions for bicyclists or pedestrians, or cause a substantial delay in transit service.

4.1.7 Traffic Analysis Report

Fehr & Peers will prepare a draft TOAR summarizing the results and findings from the analysis described above. The draft TOAR will be submittal for Caltrans review and comment. After addressing Caltrans comments, a final TOAR will be prepared. The final TOAR shall be submitted to Caltrans staff for review and approval.

5. Summary

This TEPA has provided a general evaluation of the existing operating conditions within the vicinity of the *US-101/I-280 Managed Lanes* project in San Francisco and San Mateo County. It also included a discussion of potential opening year conditions with and without proposed improvements and a recommendation for the scope of more detailed traffic studies to be conducted as part of the PA/ED phase. Although this analysis is only based on readily available information, the following general conclusions can be made:

- The current roadway system does not include sufficient capacity to serve the near-term demand. Further improvements over existing conditions will therefore be required to meet the purpose and need of the project.
- The Maximum Build, Alternative 1 proposed managed lane would add capacity to segments along US-101 and I-280 which are anticipated to operate in over-capacity conditions in Year 2020. The addition of this alternative would decrease travel time delay and improve general operational conditions for both the general purpose lanes and managed lanes.
- The Minimum Build, Alternative 2, proposed managed lane would decrease capacity to segments along US-101 and I-280, which are anticipated to operate over-capacity by Year 2020. The addition of the project may slightly worsen the travel time delay for the general purpose lanes but improve travel in the managed lanes.
- The recent collision history of this corridor indicates a number of locations where accidents have occurred at rates that warrant consideration of possible counteractive measures as part of the improvement alternatives.
- More detailed studies to be conducted as part of the PA/ED phase of the work will be important to define the specific geometric improvements associated with each alternative in order to maximize the benefit it can achieve.