I-580/I-680 Interchange
Safety Improvements Pre-PID Project
EA 04-2X310

FINAL

CONCEPTUAL SCREENING STUDY

Prepared for:

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1 INTRODUCTION

Interstate 580 (I-580) is an east-west freeway that runs from San Joaquin County to Marin County in California, while Interstate 680 (I-680) is a north-south freeway that runs from Santa Clara County to Solano County. The I-580 and I-680 corridors in Alameda County are two of the county's significant interstate corridors serving inter-regional and inter-county commute trips. Both corridors are part of the National Highway Freight Network and are designated as part of the National Primary Highway Freight System. The I-580/I-680 interchange has a ripple effect on both corridors due to the current configuration and traffic volumes in the corridors. Traffic congestion and collisions are an ongoing challenge at this location.

The I-580/I-680 Interchange Safety Improvements Project ("Project") proposes improvements to be implemented in the Project study area, targeting near-term safety and corridor operations benefits. The study area includes:

- Eastbound (EB) and westbound (WB) I-580 spanning the Foothill Road/San Ramon Road to Hopyard Road/Dougherty Road interchanges
- Northbound (NB) and southbound (SB) I-680 spanning the Alcosta Boulevard to Stoneridge Boulevard interchanges

To prepare for the Project Initiation Document (PID) phase, Alameda County Transportation Commission (CTC) in collaboration with a Project Development Team (PDT) developed concepts to improve existing traffic and safety conditions through a collaborative process. The PDT consisted of representation from the cities of Dublin, Pleasanton, and Livermore and representation from Caltrans. Thirteen concepts were developed and evaluated using scoring criteria. Suggested improvements focus on improving safety and operational outcomes to the study area.

The purpose of this report is to document the concept development process and the results of an objective evaluation of the concepts against metrics related to safety and operations (also the Project purpose and need), cost and schedule (design considerations), and environmental considerations. This evaluation will inform future scoping decisions at the beginning of the PID-phase.

During the next phase, a PID will be completed by Caltrans and used to determine which concept improvements will advance to the Project Approval and Environmental Document (PA&ED) phase, in accordance with the Caltrans Project Development Procedures Manual (PDPM).

2 PLANNING HISTORY

The following is a timeline of planning efforts that have led up to this study:

- 2002: Construction on the I-680 SB to I-580 EB direct connector ramp was completed. This is the last time there was major construction at the interchange.
- 2008: A Project Study Report/Project Development Support (PSR/PDS) was completed for the construction of additional direct connectors at the interchange. The cost was estimated to be $1.2 billion in escalated dollars to reconstruct the interchange, assuming construction could start in 2014.
- 2010: *I-580 East Corridor System Management Plan* (Caltrans 2010)

- 2016: Alameda CTC opened the I-580 Express Lanes in eastern Alameda County through the Dublin-Pleasanton-Livermore area.
- 2018: I-580 Express Lanes After Study: Report to the California State Legislature (Alameda CTC 2018)
- 2020: I-580/I-680 Interchange (Phase 1) included in the 10-year priority project list in Alameda CTC's *Countywide Transportation Plan* (Alameda CTC 2020a).
- 2020: Final Initial Study (IS) with Mitigated Negative Declaration (MND)/Environmental Assessment (EA) with Finding of No Significant Impact (FONSI) for the *Interstate 680 Express Lanes from State Route 84 to Alcosta Boulevard Project* (Caltrans 2020a) is published.
- 2020: Project Report (PR) for *Interstate 680 Express Lanes from State Route 84 to Alcosta Boulevard Project* (Caltrans 2020b) is approved.
- 2020: *Alameda CTC I-680 Comprehensive Multimodal Corridor Plan* (Alameda CTC 2020b)
- 2024: Alameda CTC adopted an amendment to the Measure BB Transportation Expenditure Plan to allow $20 million committed to the I-580/I-680 interchange to be used for near-term safety improvements through and adjacent to the I-580/I-680 interchange in recognition of the large funding shortfall for a major reconstruction of the interchange and the urgent safety need. An initial allocation of $1.2M was approved in December 2024 for the planning/scoping phase.
- 2024: *Plan Bay Area 2050*, the Regional Transportation Program (RTP), includes the proposed Project (#21-T06-019) as a planning study to scope interchange improvements. MTC's Plan Bay Area 2050, adopted in 2021, serves as the region's Regional Transportation Plan (RTP), a financially constrained long-range programming report for the region. The plan also serves as the region's long-range plan for housing and economic development. MTC is currently undertaking an update to the RTP, referred to as Plan Bay Area 2050+. A project consisting of operational and safety improvements to the I-580/I-680 interchange has been submitted for inclusion in Plan Bay Area 2050+.
- 2025: Analysis conducted by Alameda CTC as part of the *I-580 Transit and Multimodal Strategy* (2025) study identified safety as a key issue around the interchange, with 185 injury collisions in the vicinity of the I-580/I-680 interchange over the 2016-2020 period, including six individuals killed and others seriously injured in the last six years. The study recommends safety improvements to the I-580/I-680 interchange.

Significant development in the vicinity of the interchange leaves limited ROW for construction, and state and federal policies make it challenging to fund such large-scale highway improvements, resulting in no significant progress being made to advance improvements to the I-580/I-680 interchange.

3 PROJECT LOCATION

The project is located in Alameda County in the cities of Dublin and Pleasanton. Project improvements are focused on the I-580 and I-680 interchange. The Project study area includes the four following mainline facilities, and all on- and off-ramps are included:

- EB I-580 from Foothill Road to Hopyard Road (PM R21.78 to PM R19.61)
- WB I-580 from Hopyard Road to Foothill Road (PM R19.61 to PM R21.78)
- NB I-680 from Stoneridge Drive to Alcosta Boulevard (PM R18.99 to PM R21.88)
- SB I-680 from Alcosta Boulevard to Stoneridge Drive (PM R21.88 to PM R18.99)

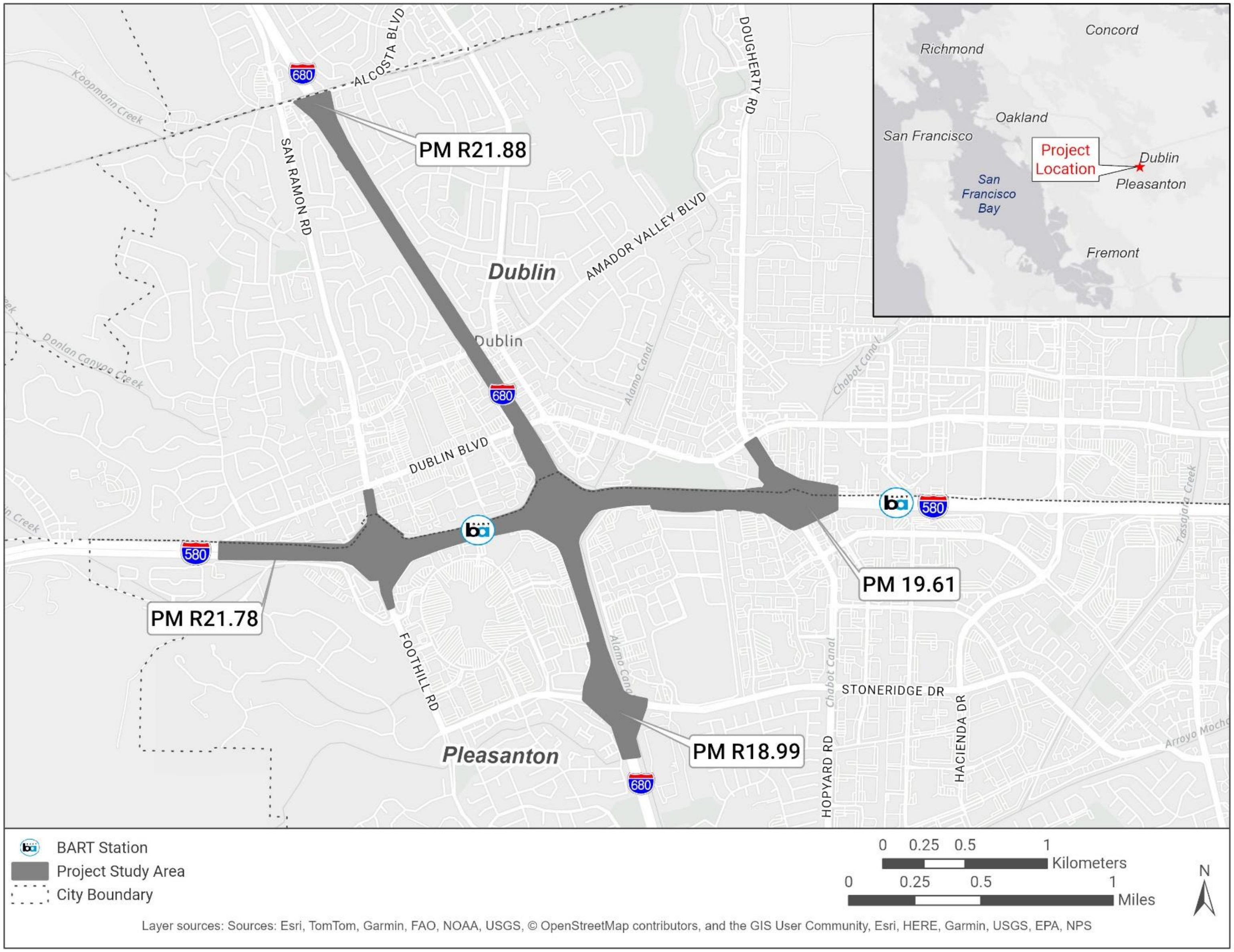
A Project Location Map is included as Figure 1.

Within Alameda County, I-580 is a critical 45-mile-long interregional gateway and multi-modal corridor that connects the Tri-Valley and San Joaquin County to Oakland and the Bay Bridge and is a heavily-used freight corridor between I-238 and the San Joaquin County line, ultimately connecting to the Port of Oakland and Central Valley. The corridor serves interregional and local commute traffic. The I-580 Express Lanes, Alameda-Contra Costa Transit District(AC Transit) and WHEELS bus services, and Bay Area Rapid Transit District (BART) all operate within I-580, while Altamont Commuter Express (ACE) rail service parallels to the south side of the corridor.

Within Alameda County, I-680 is a 21-mile corridor that connects the Tri-Valley, trips from the northern San Joaquin Valley, and Contra Costa County to southern Alameda County and Santa Clara County. The corridor currently has a SB express lane between SR-84 and the Alameda/Santa Clara County line and a northbound express lane between Auto Mall Parkway and SR-84. An extension of the southbound express lane is under construction between SR-84 and Alcosta Boulevard. To the north, there are express lanes in both directions in southern Contra Costa County. The I-680 corridor is limited by few transit options between the Tri-Valley and Silicon Valley, with the ACE train serving as the only long-distance public transit option. ACE parallels a short portion of I-680 near Pleasanton to Sunol, and I-680 is not served by other public transit services. There are several projects underway in Alameda County to address existing congestion and connectivity issues on I-680.

The I-580/I-680 interchange affects operations on both corridors. The current configuration of the interchange, including tight ramp radii and short merge distances between entering and exiting vehicles, causes queuing on both I-580 and I-680 as vehicles are required to slow down to navigate the ramps, most notably on I-580 in the WB AM peak period and the EB PM peak period. Existing deficiencies that contribute to congestion and collisions are described further in Section 6 Existing Conditions.

Figure 1. Project Location



4 METHODOLOGY

The process to develop and analyze effects of potential concepts is as follows:

1. Purpose and need
2. Field visit
3. Concept development
4. Public survey
5. Concept refinement
6. Developed evaluation metrics
7. Conducted screening analysis using selected metrics

Each of these steps are described below.

1. Purpose and Need

Alameda CTC with the PDT collaboratively developed the Project's purpose and need (Section 4) to focus concept design. The Project's purpose and need is included in Section 5.

2. Field Visit

A field visit was conducted on February 11, 2025. Representatives from Caltrans, the cities of Dublin and Pleasanton, and HNTB and Fehr & Peers attended. The Project team observed and confirmed several ongoing issues which are shown in Figure 2. Observed issues included:

- I-580 WB
    - From WB I-580, two lanes go to NB I-680 and only one lane goes to SB I-680. Currently there is a high demand for SB I-680 due to the number of commuters to Silicon Valley. The SB movement is further impeded by a short cloverleaf weave and single lane loop ramp.
    - A large spillback from the I-680 weave occurs beyond Dougherty Road.
    - Dougherty Road on-ramps have high traffic volumes and need to merge two lanes over to stay on WB I-580.
    - There is a high speed differential between exit lanes and through lanes, which lead to sudden stops. Traffic Accident Surveillance and Analysis System (TASAS) may indicate high rear-end and side-swipe rate here.
    - San Ramon Road exit appears to have low volume and may not need to be a 2-lane exit.
- I-580 EB
    - Complex braid already exists to allow access to Hopyard Road from three different streams.
- I-680 NB
    - The northern segment does not appear to have severe issues and has adequate spacing.

- I-680 SB
    - St. Patrick Way exit (signed as Dublin Boulevard) partially overlays the freeway-to-freeway (F-F) interchange and is poorly signed and hidden on the SB I-680 to EB I-580 connector. Signage is also confusing since Dublin Boulevard and Dublin (a control city) are listed and take separate ramps.
    - Three successive on-ramps (St. Patrick Way, WB I-580 to SB I-680 loop, and EB I-580 to SB I-680 diagonal) merging in a short distance is leading to unsafe driver behavior.
    - An auxiliary lane exists but the interchange spacing is substandard
    - Lane delineators are not working. Many are knocked down and allowing drivers to make unsafe, illegal movements.
    - There is temporary staging area in the SW quadrant of the interchange (former 4th quadrant loop) related to express lane construction.

Two types of concepts were developed – infrastructure improvements and programmatic improvements:

- Infrastructure improvements consist of focused civil improvements to specific parts of the study area. The improvements are intended to address issues such as weaving and speed differentials.
- Programmatic concepts are not specific to any one area of the interchange and seek to improve issues such as wayfinding, visibility, lighting, maintenance and enforcement.

The team developed 13 concepts, six infrastructure and seven programmatic, based on the following design goals, approach, standards, and geometric requirements:

- Caltrans Project Development Procedures Manual (PDPM)
- Caltrans Highway Design Manual (HDM)
- Caltrans Right of Way Manual
- Caltrans Standard Plans and Specifications
- Caltrans Ramp Metering Design Manual (RMDM)
- California Manual on Uniform Traffic Control Devices (MUTCD)

A brief overview of each concept is included in Section 9. Preliminary concept plans are included in Attachment A.

3. Public Survey

To inform the improvement plan, a survey was conducted to gain a comprehensive understanding of the challenges faced by I-580/I-680 commuters. The survey was open from April 23, 2025, to May 2, 2025. The survey responses were used to focus concept refinement. Survey results are discussed in Section 7.

4. Concept Refinement

Based on the public survey and feedback from the PDT, concepts that had major or fatal flaws were not moved forward to the evaluation phase. Concepts that were rejected are described further in Section 8. Concepts selected for subsequent screening were refined based on feedback from the PDT.

5. Evaluation Metrics

An evaluation matrix was developed with three main categories (metrics), each having criteria and sub-criteria (Table 2). The three metrics are:

1. Purpose and Need (P&N) – criteria related to safety and operations
2. Design – criteria related to cost and schedule
3. Environmental – criteria related to environmental permitting, approvals, impacts, and type and level of documentation

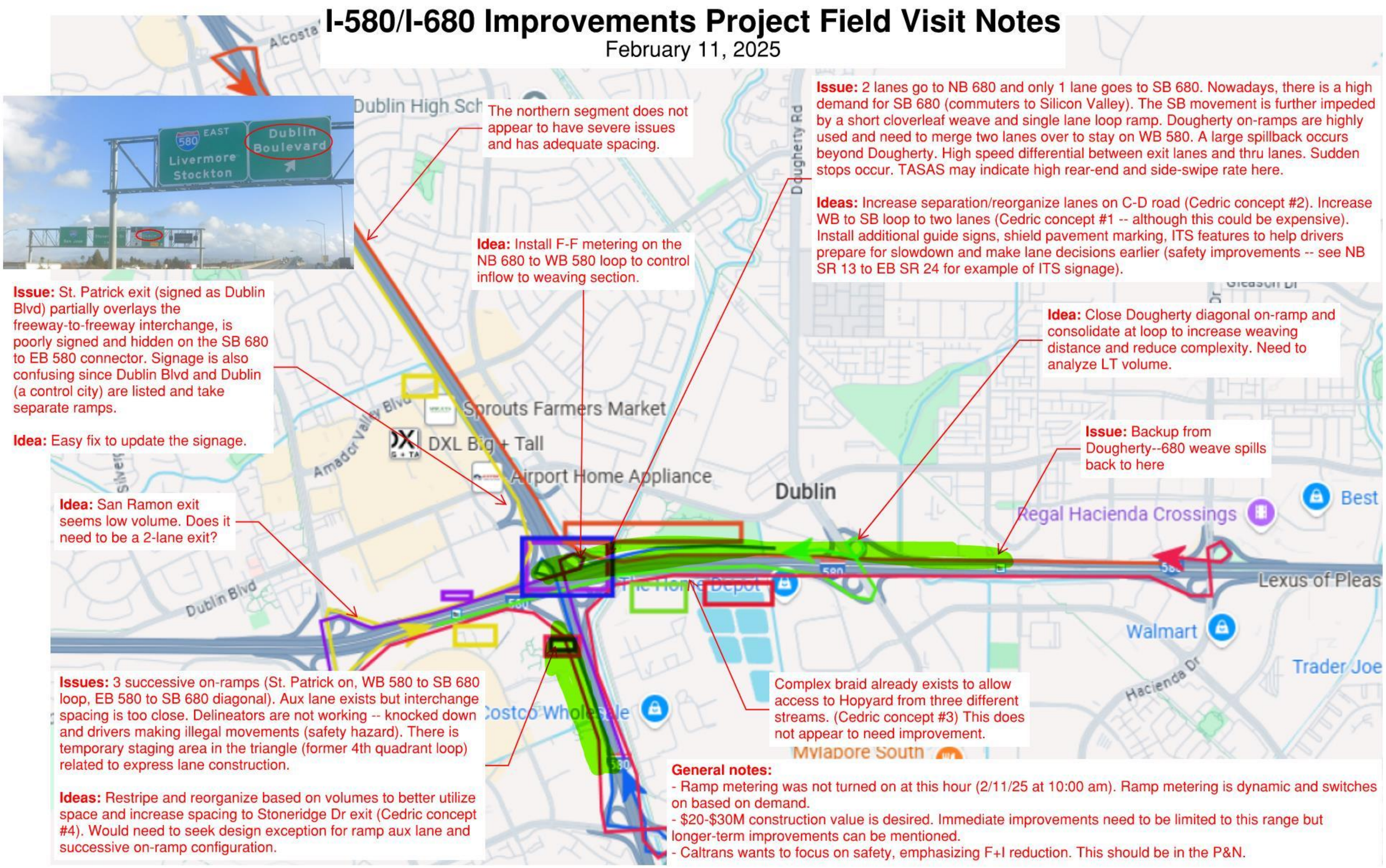
6. Concept Screening

The following general steps were taken to compare concepts:

1. Each sub-criterion was scored, with higher scores given for preferable concept features.
2. Sub-criteria were averaged to obtain a criterion score. Criteria scores are shown in Table 3.
3. Criteria scores were added to obtain a metric score.
4. Metric scores were weighted to obtain an overall score.
5. Concepts were ranked by score, with the best concept ranked first.

Tables showing the breakdown of scores for each concept as well as how each criterion was evaluated are included in Section 10.

Figure 2. Issues Observed in the Field



5 PURPOSE AND NEED

Purpose

The purpose of the proposed Project is to:

1. Improve safety for motor vehicles traveling through and adjacent to the I-580/I-680 interchange.
2. Improve vehicular and transit operations within the I-580/I-680 interchange by mitigating merging, queueing, and weaving conditions and improving wayfinding.
3. Implement near-term improvements consistent with regional and state priorities

The remainder of the section provides the specific need for each Project purpose, respectively.

Need

The need for the proposed Project is related to:

1. Between 2021 and 2024, 288 injury collisions were documented in the vicinity of the I-580/I-680 interchange (Caltrans Traffic Accident Surveillance and Analysis Systems). The vicinity is defined as along I-580 and I-680 from the I-580/I-680 interchange to the next adjacent full interchanges. These collisions included five fatalities and several serious injuries. Both freeway corridors have a higher collision rate resulting in fatalities than the statewide average. Collisions are primarily related to existing traffic congestion and unsafe traffic movements. Congestion related issues are described later in this section while unsafe traffic movements are described below.
   - Approximately 60% of collisions along the I-580 freeway corridor are rear-end and approximately 30% are sideswipe. This indicates speed differentials causing drivers to make unsafe merging movements.
   - The percentage of total collisions that occur during daytime periods (5 am to 8 pm) range from 77% on I-680 to 90% on I-580 and are attributable to speeding and other violations.
   - Traffic weave and merge zones at ramps cause congestion and associated rear-end collisions. Additionally, several ramps within the interchange are not metered resulting in uneven traffic flow into merge points.
   - Various ramp entrances throughout the interchange are separated from other ramps or mainline by flexible delineators. These barriers are susceptible to being knocked down. Once down, motorists have unrestricted opportunities to make illegal movements, resulting in increased rates of sideswipe and rear-end collisions.
2. The I-580 and I-680 corridors are highly congested, especially during peak hours. I-680 is used by commuters traveling between Alameda and Contra Costa Counties and Silicon Valley. I-580 connects the Bay Area with Tri-Valley and San Joaquin County housing while facilitating the movement of goods to/from Bay Area ports, airports, and freight rail terminals. Buses operated by County Connection and Livermore

Amador Valley Transit Authority also experience this congestion along I-580 and I-680.

- During afternoon peak hours, EB I-580 experiences high congestion resulting in a 270% increase in travel time through the interchange compared to morning peak hours. During morning peak hours, SB I-680 experiences a 30% increase in travel time compared to afternoon peak hours.
- WB I-580 experiences high queuing in the rightmost lanes during afternoon peak hours, while the left lanes travel at almost free-flow speed. The high difference in speed leads to unsafe merging and weaving.
- Tight ramp radii and closely spaced merge/diverge points within the interchange result in queuing along both I-580 and I-680 as vehicles slow down and navigate the ramps. Notably, there is a high demand and resulting traffic spillback from motorists connecting from WB I-580 to SB I-680. This movement is limited by a single-lane connector loop ramp and a short weaving distance afforded by the "cloverleaf" configuration (approximately 475 feet) with traffic from the NB I-680 connector loop ramp to westbound I-580.
- Motor vehicles entering WB I-580 from the I-580/Dougherty Road interchange must navigate across two travel lanes to remain on I-580. Meanwhile, westbound motorists connecting to both directions of I-680 must weave into these same two lanes to reach their exit ramp within the I-580/I-680 interchange. This mixing zone results in traffic congestion that extends back along I-580 beyond the I-580/Dougherty Road interchange.

3. Wayfinding issues within the I-580/I-680 interchange contribute to motorist confusion, unsafe lane movements, and/or travel delay when motorists miss their movement and take less direct routes. These issues may cause challenges for unfamiliar drivers, such as tourists and freight haulers, traveling through the interchange. Examples include:
   - Motorists using the WB and EB I-580 off-ramps to Hopyard Road make late lane changes near the ramp's intersection with Hopyard Road due to a lack of advance lane assignment striping warning motorists of turn-lane assignments.
   - On SB I-680, Exit 30A connects to Saint Patrick Way but is signed as Dublin Boulevard. Earlier signage for this exit only lists Livermore and Stockton connections despite this provided connection to Dublin. Motorists connecting to Dublin are routed instead to Exit 30B that connects to the San Ramon Road interchange. Additionally, having both "Dublin Boulevard" and "Dublin" as destinations while in the City of Dublin could lead to motorist confusion.
   - Along WB I-580, indicator signage for the interchange connectors to I-680 does not show up until Hopyard Road. This results in motorists making multiple late lane changes, adding to the queueing issues before the I-580/I-680 interchange.
4. Current priorities within the I-580 and I-680 corridors are documented by Caltrans in the *I-580 East Corridor System Management Plan* and the *Alameda I-680 Comprehensive Multimodal Corridor Plan*, which in turn reflect the goals and objectives outlined in *Caltrans Strategic Management Plan 2015-2020*, the *Solutions for Congested Corridors Program*, and other regional transportation planning policy

documents. These plans focus on multimodal solutions to manage traffic operations, increase throughput, reduce distressed lane miles, and improve safety, while tempering increases in vehicle miles traveled (VMT), greenhouse gases (GHG), and air pollution by limiting the extent of highway lane capacity-increasing projects. Comprehensive improvements to the I-580/I-680 interchange are considered a long-term (10+ years) project, but the need for short-term operational improvements to address safety and vehicular operations are recognized as Phase 1 improvements.

6 EXISTING CONDITIONS

Speed and Travel Time Reliability

As described in the *Traffic and Safety Technical Report* (Attachment A), during the AM peak period, travel speeds exceed 50 miles per hour (mph) for all mainline facilities.[1] Travel speed data along I-680 shows a decrease of more than 10 mph during the peak commute period compared to typical travel. During the PM peak period, travel speed data shows a steep decrease for EB and WB I-580, while typical travel speeds along I-680 remain above 60 mph. There is significantly high speed variability along EB I-580, as travel speeds differ by over 50 mph depending on time of day. This low travel time reliability leads to heightened frustration for drivers navigating the corridor, and drivers often make last-minute lane changes to exit the highway early when hitting the back of queue.

Traffic Volumes

Mainline and ramp AM and PM peak hour demand volumes were developed from reference volumes for the year 2020 from the Alameda CTC's Countywide Travel Demand Model and for the year 2025 from the *I-680 Express Lanes Traffic Operational Analysis Report* (TOAR, Alameda CTC 2019) and are included in Attachment B.

Traffic analysis of the Opening Year (2030) No Build condition (Attachment B), which includes operation of the SB I-680 express lanes, found that:

- During the AM peak hour:
    - The EB I-580 mainline would generally operate at level of service (LOS) D or above.
    - The WB I-580 mainline would experience congestion between Hopyard Road off-ramp and the ramp connectors to I-680, at the I-580/I-680 interchange.
    - The SB I-680 mainline would generally operate at LOS D or above.
    - The NB I-680 mainline would experience high congestion between ramp connectors at the I-580/I-680 interchange.
- During the PM peak hour:
    - The EB I-580 mainline would experience congestion between the Foothill Road off-ramp and SB I-680 ramp connector.

[1] For consistency with typical commute periods, the AM peak period is defined as 6 to 9 AM, and the PM peak period is defined as 3 to 7 PM.

- The WB I-580 mainline would generally operate at LOS D or above.
- The SB I-680 mainline would experience congestion between the successive on-ramps from I-580 and St. Patrick Way.
- The NB I-680 mainline would generally operate at LOS E or above.

Safety

Crash Data

Collision history for the study area for July 1, 2019 to June 31, 2024 was obtained from Caltrans' TASAS and UC Berkeley's Traffic Incident Management System (TIMS) database for both mainline freeways within the Project study area (described in Section 3). The results indicated that:

- All mainline facilities:
  - Rear-end collisions represent the most frequent type of collision, accounting for 55-60% of collisions along I-580 and approximately 35% of collisions along I-680.
  - Sideswipe collisions make up over 30% of all collisions.
  - Speeding is a primary collision factor for over a third of total collisions along I-680 and over half of total collisions along I-580.
  -
- I-580:
  - The EB and WB mainline facilities experience a higher fatal collision rate than the statewide average for similar facilities.
  - The WB mainline:
    - Experiences higher collision rates than average for all reported collision types.
    - For all collisions along I-580, WB accounts for nearly 60% of total collisions
  - There is a collision hotspot along I-580 between the I-580/I-680 interchange and the Hopyard Road/Dougherty Road interchange. This may be due to the short merging distances drivers experience when entering the WB mainline at the Hopyard/Dougherty interchange and having to weave to the leftmost lanes to stay on the freeway.
- I-680:
  - SB and NB mainline had a similar number of total collisions.
  - SB and NB had a notable number of hit object collisions, accounting for over a quarter of all collisions.
  - On SB and NB, improper turning is the reported primary collision factor for over 20% of total collisions.
  - Collisions along I-680 are spread out along the mainline with no apparent hotspot, although there is a noted collision density centered around the I-580/I-680 interchange connection points, particularly along the I-580 to SB I-680 connector ramps.

Deficiencies

Both the I-580 and I-680 corridors have numerous existing design deficiencies:

- The I-580/I-680 interchange is based on a modified full cloverleaf (Type F-2) configuration. This interchange type has certain benefits (such as low cost, compact footprint, low structure maintenance), however, it has drawbacks due to the weaving sections, low speeds required on loop ramps, and potential for queue spillback. The SB to EB connector was improved to a flyover. However, other loops, including the WB to SB connector (heavily used by commuters from the Tri-Valley and Central Valley to San Jose and Silicon Valley) are now over capacity and generate queue spillbacks. While the concepts do not propose a major reconstruction of the F-F interchange, they aim to reallocate existing space more efficiently or perform targeted improvements at the most problematic locations.
- Current HDM standards prescribe a 2-mile spacing between local road interchanges and a F-F interchange. All four directions from the I-580/I-680 interchange have substandard spacing. To the west (Foothill Road/San Ramon Road), south (Stoneridge Drive), and east (Hopyard Road/Dougherty Road), there is less than 1 mile of spacing. To the north (Alcosta Boulevard, if the overlapping access to Dublin Boulevard is ignored), there is more than 1 mile but less than 2 miles of spacing. The mainlines have several auxiliary lanes, however, these often experience backup and lead to large speed differentials between the auxiliary lane and mainline through-lanes. The Project concepts do not propose relocation or closure of any of the surrounding local road interchanges; however, in some cases, they propose reconstruction of ramps or lengthening of auxiliary lanes to incrementally improve spacing.

7 PROGRAMMED AND PLANNED PROJECTS BY OTHERS

Table 1 shows the planned and programmed projects within the vicinity of this project, including those that are included in the 2024 State Highway Operation and Protection Program (SHOPP; Caltrans 2024), State Transportation Improvement Program (STIP), and Plan Bay Area 2050. SHOPP is the State of California’s “fix-it-first” program that funds the repair and preservation of the State Highway System, safety improvements, and some highway operational improvements.

Table 1. Projects in the Vicinity of the I-580/I-680 Interchange

Name	EA/SHOPP ID/RTP ID	Location	Characteristics	Status
Dublin Boulevard Extension	N/A	Project proposes to extend Dublin Boulevard 1.5 miles east from Fallon Road to North Canyons Parkway in the City of Livermore, through an unincorporated portion of Alameda County.	The extension is planned to have four to six travel lanes, Class IV Bikeways, sidewalks, curb and gutter, traffic signals, street lighting, landscaped raised median islands, bus stops, and all city street utilities.	In design, with final design expected fall 2026
I-680 Express Lanes from SR-84 to Alcosta Boulevard	EA: 04-0Q3000 Project ID: 0418000069	04-Ala-680 – PM R10.6/R21.9 04-CC-680 – PM R0.0/R1.1 The project extends for approximately nine miles on northbound and southbound I-680 through Sunol, Pleasanton, Dublin and San Ramon. Between from 0.4 mile south of Calaveras Rd Undercrossing And 1.1 miles north of Alcosta Blvd Overcrossing	The Interstate 680 (I-680) Express Lanes from State Route (SR) 84 to Alcosta Boulevard Project will close the gap between existing and in-progress high-occupancy vehicle (HOV)/ express lane projects directly to the north and south.	Phase 1 under construction, Phase 2 pending final design
Valley Link	EA: 04-3Q820	Construction delivery will be phased, with the initial phase from Dublin/Pleasanton to Vasco Road (Phase 1A) and the subsequent phase from Vasco Road to Mountain House (Phase 1B)	Valley Link is a proposed 42-mile, passenger rail service connecting the over 105,000 Bay Area workers traveling daily over the Altamont Pass from their homes in the Northern San Joaquin Valley with fast, frequent, zero-emission service – providing a transit alternative to the highly congested Interstate 580 corridor and bringing new riders to the broader Bay Area transit system.	In PA/ED
Vasco Road – I-580 Interchange	N/A	Vasco Road/I-580 interchange in city of Livermore.	The Vasco Road/I-580 interchange currently experiences operational deficiencies resulting in significant traffic delays. Improvements will enhance operations, safety, and traffic capacity, mitigate future congestion, and accommodate the future Valley Link transit system in the median. The project will include: • Removal and replacement of the Vasco Road overcrossing with a wider bridge, • Reconstruction of the on and off ramps bridge structure, and • New traffic signals.	Environmental
RTP Projects				
Express Bus Service Expansion (I-680)	21-T12-122	I-680 between Martinez and San Jose	This program includes funding to implement new express bus service along I-680 on express lanes where available	

Name	EA/SHOPP ID/RTP ID	Location	Characteristics	Status
			(20-minute peak headways). Improvements include bus-on-shoulder and park-and-ride facilities.	
Corridor & Interchange Improvements (I-680, Contra Costa County)	21-T06-022	Auxiliary lanes between Rudgear Rd and El Cerro Blvd and between Bollinger Canyon Rd and Alcosta Blvd.	This program includes funding to implement interchange improvements at SR-4, as well as and new auxiliary lanes between Rudgear Rd and El Cerro Blvd and between Bollinger Canyon Rd and Alcosta Blvd.	
Corridor & Interchange Improvements (I-680 ,Alameda County)	21-T06-021	I-680 at Stoneridge Dr. and Sunol Blvd.	This program includes funding to implement interchange improvements at Stoneridge Dr and Sunol Blvd.	
Express Lanes (Regional)	2 21-T12-116	I-80 (ALA, CC), I-280 (SCL), I-680 (CC), I-880 (SCL), US-101 (SCL), SR-4 (CC), SR-84 (ALA), SR-85 (SCL), SR-87 (SCL), and SR-92 (ALA); partial HOV lane conversions on I-80 (SOL), I-280 (SF), I-680 (CC), and US-101 (SF); freeway lane conversions on I-80 (SOL), I-280 (SCL), I-580 (ALA), I-680 (SCL), and I-880 (ALA); new lanes on I80 (SOL), I-680 (ALA, CC), I-880 (ALA), and US-101 (SM); new dual lanes with HOV lane conversions on SR-85 (SCL); and new dual lanes on US-101 (SCL).	This program includes funding to implement express lanes through HOV lane conversions.	
Per-Mile Tolling (Regional)	21-T05-012	Toll corridors include: I-80 (ALA, CC, SOL); I-238 (ALA); I-280 (SF, SM, SCL); I380 (SM); I-580 (ALA); I-680 (ALA, CC, SCL); I-880 (ALA, SCL); US-101 (MRN, SF, SM, SCL, SON); SR-4 (CC); SR-17 (SCL); SR-24 (ALA, CC); SR-85 (SCL); SR-87 (SCL); SR-92 (SM); SR-237 (SCL); and SR-242 (CC).	This program includes funding to implement toll infrastructure, such as toll gantries, to collect per-mile tolls charged to vehicles on the Bay Area's congested freeway corridors with transit alternatives.	
SHOPP Projects				
Storm Water Mitigation	0420000167	In Alameda and Contra Costa Counties, on Routes 4, 13, 24, 61, 80, 84, 92, 112, 123, 185, 238, 242, 260, 262, 580, 680, 880, and 980 at various locations.	Install trash capture devices.	

Name	EA/SHOPP ID/RTP ID	Location	Characteristics	Status
Transportation Management Systems	0419000568	In Alameda, Contra Costa, Solano, and Sonoma Counties, on Routes 4, 13, 24, 37, 80, 84, 92, 101, 160, 238, 242, 580, 680, 780, and 880 at various locations.	Replace technology components of Transportation Management System (TMS) elements.	
Transportation Management Systems	0423000299	In Contra Costa County, on Route 680, at various locations (including within the Project's PM limits)	Install and upgrade ramp metering system and widen ramps to provide High Occupancy Vehicle (HOV) bypass ramp lanes.	

8 OUTREACH AND COORDINATION

Coordination with Local Partners

PDT meetings were held monthly from February 2025 to September 2025. These included representatives from Caltrans, Alameda CTC, the cities of Dublin, Pleasanton, and Livermore, and HNTB and Fehr & Peers.

Online Public Survey

To inform concept development and refinement, a survey was conducted to gain a comprehensive understanding of the challenges faced by I-580/I-680 commuters. The web-based survey collected a total of 1,282 responses. The survey responses provided valuable insights into the challenges and concerns of users navigating the I-580/I-680 interchange. Key themes across several areas emerged from the feedback received:

1. **High Frequency of Use**: The majority of respondents drive or ride through the interchange multiple times a week, with nearly 33% traveling 4-5 days per week. The interchange is a major route for commuters, residents, and those traveling for errands, appointments, and social visits. 61% of respondents use the interchange for their commute, and over half report living near the interchange. The most frequently reported ZIP codes were from the city of Dublin, representing 42% of total respondents, followed by the cities of Livermore (16%), San Ramon (10%), Pleasanton (9%), and Danville (3%).
2. **Comfort and Safety Concerns**: Despite a large portion of users being familiar with the interchange, a significant portion of respondents (82%) reported feeling uncomfortable or very uncomfortable when driving or riding through the interchange. Less than 10% of respondents indicate they are somewhat or very comfortable navigating the interchange.
3. **Traffic Congestion**: A central theme in respondents' comments is the persistent traffic congestion at the interchange, especially during peak hours. Respondents noted frequent traffic jams at the interchange and narrow merging widths leading to slowdown of traffic.
4. **Safety Hazards**: 93% of respondents indicate weaving and merging behaviors as a key challenge in navigating the interchange. Respondents also indicate speed differentials (69%) and undesirable travel speeds (71%) as other key challenges. Many respondents indicate experiences of near-misses and collisions in their comments.
5. **Infrastructure Improvements**: There was strong support for adding flyover ramps, extending merge lanes, and improving lane markings and signage. The cloverleaf interchange was frequently criticized for being outdated and not designed to handle modern traffic volumes. The short merge lanes, particularly at the connections between I-580 and I-680, were identified as unsafe, with drivers often forced to make last-minute lane changes. Many suggested a redesign of the interchange and separated directional ramps to address current and future traffic demands.
6. **Public Transportation and Alternative Routes**: Two-thirds of respondents report using alternate routes to avoid the interchange, such as local surface streets or rural roads, citing the interchange's congestion and safety concerns. These alternate routes range from local

parallel routes, such as Dublin Boulevard and Stoneridge Drive, to other freeways such as SR-84. Some respondents report taking earlier exits to avoid congestion on the highway.

7. **Construction and Road Maintenance**: Respondents noted that ongoing construction often led to confusing and hazardous conditions. While the survey was open, there was active construction related to the I-680 improvements.

9 CONCEPTS CONSIDERED

This section describes the concepts that were evaluated. Thirteen concepts were scored and ranked based on their design features, environmental impacts, and ability to meet the project's P&N. These concepts are described below under Screened Concepts. Attachment A includes the preliminary layouts for the six infrastructure concepts. Improvements that could be included with all six infrastructure alternatives are described under Programmatic Improvements; however, because these improvements are not defined in detail, preliminary layouts were not developed for these concepts. Several other concepts were considered but were not carried through the screening process; these are described under Concepts Considered but Not Evaluated.

Screened Concepts

Screened concepts are described in Table 2. The first three concepts are improvements to I-680, while concepts 4 through 6 are improvements to I-580, and programmatic improvements are numbered P1-P7.

Table 2. Screened Concepts

Concept	Concept Name	Description	Design Challenges	Non-Standard Design Features	ROW	Complete Streets	Utility Relocations	Ramp Metering
Improvements to I-680								
1	Barrier Hardening on SB I-680	* Harden separation on SB I-680 between WB I-580 to SB I-680 connector and St. Patrick Way on-ramp to provide separation between successive on-ramps and reduce sudden movements/queue jumping * Maintain existing merge between EB and WB I-580 to SB I-680 connectors and join SB I-680 mainline as an auxiliary lane.	No improvement to weaving condition on WB I-580 mainline or auxiliary lane	None	Not expected.	No. Concept limited to freeways.	Not expected since concept is in Caltrans ROW.	Can be adapted for F-F ramp metering
2	I-580 WB to I-680 SB Loop Ramp Widening	* Merge St. Patrick Way on-ramp earlier and harden separation between mainline and F-F connectors to provide separation between successive on-ramps and reduce sudden movements/queue jumping. * Widen WB I-580 to SB I-680 loop ramp to two lanes. This would provide more ramp storage for the F-F queues.	Requires widening of I-580 Overcrossing structure. May require ramp grade adjustment.	Loop connector does not include HOV lane which requires exception to Caltrans' Ramp Metering Policy	Not expected.	No. Concept limited to freeways.	Not expected since concept is in Caltrans ROW.	Can add ramp metering individually to the EB and WB I-580 connectors to SB I-680 to manage flow into SB I-680 auxiliary lane
3	Stoneridge Drive Off-Ramp Modification	* Reduce SB I-680 Stoneridge Drive off-ramp to single lane optional exit to increase merge distance for traffic coming from I-580 * Extend auxiliary lane beyond off-ramp as a run-out and then drop	Stoneridge Drive exit approaches threshold to be 2-lane exit due to volume exceeding 1500 vehicles per hour (vph)	None	Not expected.	No. Concept limited to freeways.	Not expected since concept is in Caltrans ROW.	None since concept improves off-ramp.
Improvements to I-580								
4	Foothill Road Interchange Modifications	EB: * Close EB diagonal on-ramp to increase weaving distance to I-580/I-680 * Widen EB loop on-ramp * Install new left turn (LT) pockets on NB Foothill Rd	Introduces signalized NB LT movements	On-ramp does not include HOV lane. Auxiliary lane is improved but not lengthened to full standard.	Not expected.	Complete streets improvements could be included as part of the improvements to Foothill Road/ San Ramon Road	Some utility relocations may be needed associated with the improvements on Foothill Road/ San Ramon Road	Can add ramp metering to the on-ramp
		WB * Close WB diagonal off-ramp and WB loop on-ramp to increase weaving distance to I-580/I-680 * Construct WB loop off-ramp on existing Caltrans ROW * Widen WB diagonal on-ramp to three lanes * Install new LT pockets on NB San Ramon Road	* Reduces storage capacity on WB exit ramp * Introduces signalized NB LT movements	Nonstandard divergence angle for exit to accommodate deceleration length	Not expected.			Can add ramp metering to the on-ramp
5	Dougherty Road Interchange Improvements	* Close WB diagonal on-ramp to increase weaving distance to I-580/I-680 * Widen WB loop on-ramp * Install new LT pockets on SB Dougherty Road	Difficult to manage grade break between diagonal off- and loop on-ramp	On-ramp does not include HOV lane.	Additional non-Caltrans ROW would be needed from 6300 Dublin Boulevard parking lot.	Complete streets improvements could be included as part of the improvements to Dougherty Road	Some utility relocations may be needed	Can add ramp metering to the on-ramp

Concept	Concept Name	Description	Design Challenges	Non-Standard Design Features	ROW	Complete Streets	Utility Relocations	Ramp Metering
6	Four Lanes on EB I-580	* Improves EB I-580 mainline by allowing four through lanes by eliminating lane drop on I-580 EB mainline (currently four through lanes dropping to three to accommodate the two lanes from the flyover). This also provides better balance in lane density. * Maintain two lanes on SB I-680 to EB I-580 flyover * Revise striping to meet mainline earlier with two auxiliary lanes, then merge to one lane with 50:1 taper prior to addition of NB I-680 to EB I-580 connector, thus increasing the lanes from five to six	Merge condition is non-typical but emulates existing merge on NB I-680 to EB I-580 connector. Ramp meter has been installed but appears not to be operational. Need to investigate ramp meter commissioning.	Lack of CHP enforcement area and maintenance vehicle pullout (MVP) area No downstream auxiliary lane provided F-F merge condition is non-typical (inner lanes merge)	Not expected	No. Concept limited to freeways.	Not expected since concept is in Caltrans ROW.	F-F metering could be implemented on flyover to help moderate flow given merge condition.
Programmatic Improvements - Common to all Concepts								
P1	Enhanced Maintenance Program	Various spot repairs and improvements: pothole repair, restriping, guardrail & other safety repairs, etc.	Not expected	Not expected	Not expected	Unlikely since improvements will target the mainline.	Likely no as concept would only repair existing facilities	Not expected
P2	Traffic Incident Management (TIM)	* Consists of a planned and coordinated multi-disciplinary process to detect, respond to, and clear traffic incidents so that traffic flow may be restored as safely and quickly as possible * Construct strategically placed MVPs for enhanced response for faster response to incidents, which reduces resulting congestion and greater likelihood of follow-on incidents	Requires dedicated incident response resources to be effective	Not expected	Not expected	Unlikely since improvements will target the mainline.	Concept will generally use existing utilities, but relocations or new utilities may be needed for operation.	Not expected
P3	High Performance Pavement Marking	Improve visibility and vehicular lane positioning by using high-contrast pavement markings with wet retroreflectivity for better visibility and vehicular guidance	Higher cost for implementation & maintenance	Not expected	Not expected	Unlikely since improvements will target the mainline.	Not expected	Not expected
P4	Lane Lighting	Use of lighted pavement markers or Smart-stud systems to guide and enforce the use of lanes as either optional or drop lanes, depending on demand. Dynamic system can monitor & respond to peak flows	Expense, maintenance, potential for driver confusion	Not expected	Not expected	Unlikely since improvements will target the mainline.	Concept would generally use existing utilities, but relocations or new utilities may be needed for operation.	Not expected
P5	Safety ITS Elements on WB I-580	* Addresses rear-end collision risk along WB I-580 approaching I-680 by adding activated blankout signage on WB I-580 mainline to warn drivers of stopped traffic ahead.	Would likely need multiple signage points along WB I-580	Not expected	Not expected	Unlikely since improvements will target the mainline.	If illuminated signs are installed, they would generally use existing utilities, but relocations or new utilities may be needed for operation.	Not expected

Concept	Concept Name	Description	Design Challenges	Non-Standard Design Features	ROW	Complete Streets	Utility Relocations	Ramp Metering
P6	NB I-680 to WB I-580 Loop Ramp Meter	* Use detectors to manage queues in weave area by controlling loop ramp demand. * Add ramp meter along loop connector from NB I-680 to WB I-580	* Loop ramp queue storage may be exceeded if queue detection not added * Caltrans may require loop ramp widening for HOV bypass lane (~1200 vph warrants standard configuration for metered ramp)	Not expected	Not expected	Unlikely since improvements will target the mainline.	Concept would generally use existing utilities, but relocations or new utilities may be needed for operation.	Yes
P7	SB I-680 Signage Improvements	Reduces driver confusion by: * Revise signs along SB I-680 to avoid "trap" condition for SB I-680 to WB I-580 connector; reduce confusion with "Dublin" as a control city * Improve signage for Dublin Boulevard exit ("hidden" on the SB I-680 to EB I-580 connector) * Improve warning for lane drop beyond WB I-580 connector.	None identified at this time.	Not expected	Not expected	Unlikely since improvements will target the mainline.	If illuminated signs are installed, they would generally use existing utilities, but relocations or new utilities may be needed for operation.	Not expected

Concepts Considered but Not Screened

The following concepts were considered but not evaluated further. The reason for rejection of each concept is provided below.

Separate WB I-580 Movements to I-680 NB and SB

This concept proposed to separate the WB I-580-to-NB I-680 and WB I-580-to-SB I-680 movements by elongating the gore between the two movements, which would require reducing the number of lanes on the WB I-580-to-NB I-680 connector from two to one. This was not evaluated further because structure modifications would be required (with work over a creek) to create a standard gore. Despite this concept being ruled out for further evaluation in this study, the PDT suggested that it be reviewed in the PID phase with further documentation on fatal flaws that would rule it out from the project development phase.

NB I-680 Dublin Blvd Direct On-ramp

This concept proposed to close the existing indirect NB on-ramp from Village Parkway to NB I-680 and construct new direct NB diagonal on-ramp from Dublin Boulevard. This was not evaluated further since it would require property acquisitions and a new bridge over an engineered channel.

SB Dublin Blvd/St. Patrick Way on-ramp elimination and SB aux lane improvement

This concept proposed to close the Dublin Boulevard/St. Patrick Way on-ramp. The WB I-580 to SB I-680 loop connector would merge onto SB I-680 earlier and generate an auxiliary lane on SB I-680. This was not evaluated further since the Dublin Boulevard (St. Patrick Way) on-ramp closure may be opposed by stakeholders, retail businesses, and the community.

10 CONCEPT SCREENING

The following section describes each of the three metrics used to evaluate concepts and their associated criteria and sub-criteria, followed by overall results. Detailed scoring is included in Attachment C.

Purpose and Need

A brief description of the P&N Metrics, Criteria, and Sub Criteria are included in Table 4 below. Results are summarized in Table 3 below. Out of the infrastructure concepts, Concept 6 (Four Lanes on EB I-580) scored the highest. Out of the programmatic concepts, Concept P4 (Lane Lighting) scored the highest.

Among the three alternatives focused on the I-680 corridor, Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening) achieves the highest average reduction in traffic density, although the Interchange Safety Analysis Tool (ISAT) analysis shows limited collision reduction potential due to the analyses' focus on geometric improvements. Concept 1 (Barrier Hardening on SB I-680) would improve weaving conditions between oncoming motorists and mainline traffic; however it scores low due to the lack of geometric changes (and therefore any collision reduction is not captured by the ISAT analysis) and the lack of mainline changes (and therefore changes in traffic density are not captured by the HCS analysis) Concept 3 (Stoneridge Drive Off-Ramp

Modification) achieves the highest reduction in collision potential, but limited reduction in traffic density.

Among the three alternatives focused on the I-580 corridor, Concept 5 (Dougherty Road Interchange Improvements) achieves a high collision reduction potential, but has limited impacts to traffic density. By consolidating the on-ramps onto I-580 from Hopyard Road and Dougherty Road and installing a signal for vehicles entering the mainline, the concept leads to fewer breaks to the mainline traffic and fewer weaving movements. Concept 6 (Four Lanes on EB I-580) achieves the highest reduction in traffic density and collision potential out of all six concepts. By extending the auxiliary lane along EB I-580 prior to the on-ramp from I-680, this leads to fewer lane change movements between mainline traffic and improved overall traffic conditions.

Table 3. P&N (Safety and Operations) Metric Results

Concept Name	Improve Safety for Motor Vehicles	Improve Vehicular/ Freeway and Transit Operations	Improve Wayfinding	Metric Total
Infrastructure Improvements				
Concept 1 Barrier Hardening on SB I-680	1.5	1.2	2.0	**4.7**
Concept 2 I-580 WB to I-680 SB Loop Ramp Widening	2.3	4.2	3.0	**9.5**
Concept 3 Stoneridge Drive Off-Ramp Modification	4.5	2.6	2.0	**9.1**
Concept 4 Foothill Road Interchange Modifications	3.5	4.0	2.3	**9.8**
Concept 5 Dougherty Road Interchange Improvements	3.3	2.2	1.7	**7.1**
Concept 6 Four Lanes on EB I-580	4.8	3.8	2.3	**10.9**
Programmatic Improvements				
Concept P1 Enhanced Maintenance Program	5.0	4.7	2.7	**12.3**
Concept P2 Traffic Incident Management	1.0	3.7	1.7	**6.3**
Concept P3 High Performance Pavement Marking	5.0	4.3	3.0	**12.3**
Concept P4 Lane Lighting	5.0	4.7	3.3	**13.0**
Concept P5 Safety ITS Elements on WB I-580	3.0	4.3	3.3	**10.7**
Concept P6 Loop Ramp Meter	1.0	2.0	1.7	**4.7**
Concept P7 SB I-680 Signage Improvements	3.0	4.3	2.3	**9.7**

Table 4. P&N Metrics, Criteria, and Sub Criteria

Criterion	Sub Criterion	Evaluation Methodology	Scoring Summary	Limitations/Assumptions/ Considerations	Results
A - Improve Safety	Fatal Collision Reduction	Used Interchange Safety Analysis Tool (ISAT) to model the frequency of crashes with fatalities based on the concept's geometric design features. Programmatic concepts were assigned an overall score for Criteria A based on professional experience with their potential to reduce collisions.	Concepts were ranked based on the percent reduction in the number of collisions with fatalities, with 1 being lowest and 5 being highest. Concepts that address congestion and not collisions were given lower scores. Concepts that address weaving, merging, or safety issues were given higher scores. For example, Traffic Incident Management was given the lowest score of 1 because it targets responding to collisions, not preventing them.	ISAT does not cover all safety considerations, focuses on geometric improvements on freeways, and only considers legal movements. See the Driver Level of Comfort sub criterion below under criterion C - Driver Experience Programmatic scores were relative, not calculated.	Overall, the highest-scoring concepts target key weave segments along the corridor, specifically locations where successive on-ramps and lane drops are concentrated, leading to multiple last-minute lane changes between motorists. Out of the 6 infrastructure concepts, Concept 6 (Four Lanes on EB I-580) achieves the highest improvement in collision reduction potential. By eliminating the lane drop on EB I-580 before the two-lane flyover ramp from SB I-680, this improvement reduces weaving movements across the I-580/I-680 connectors and targets a key hotspot in the corridor. This extension of the 4th lane with ramp metering of the 2-lane connector may lead to a significant reduction in sideswipe collisions as drivers enter the mainline in more predictable gaps. Concept 1 (Barrier Hardening on SB I-680) and Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening) focus on installing hard separation between the successive on-ramps. Since the ISAT safety analysis focuses on geometric changes, these improvements do not score as highly in safety improvements.
	Fatal + Injury Collision Reduction	Used ISAT analysis to model the frequency of crashes with fatalities and/or injuries based on the concept's geometric design features.	Concepts were ranked based on percent reduction in collisions with fatal plus reductions in collisions with injuries, with 1 being lowest and 5 being highest	ISAT does not cover all safety considerations. Focuses on geometric improvements on freeways.	
	Total Collision Reduction	Used ISAT analysis to model the frequency of crashes (all severities) based on the concept's geometric design features.	Concepts were ranked based on the percent reduction in total collisions, with 1 being lowest and 5 being highest	ISAT does not cover all safety considerations. Focuses on geometric improvements on freeways.	
	Bike/ Pedestrian Safety	Qualitative assessment of improvements to bike/ped safety	Freeway concepts given score of 2; local interchange concepts given score of 4.	Freeway only concepts wouldn't directly improve bike ped/safety. Concepts with local road work could include features that improve bike/ped safety, e.g. striping, signage, curb ramps, signals.	Concept 4 (Foothill Road Interchange Modifications) and Concept 5 (Dougherty Road Interchange Improvements) could improve bicycle and pedestrian safety as part of the local road improvements.
B - Improve Vehicular/ Transit Operations	Change in Traffic Stream Density	Used HCS analysis to identify percentage change in stream density (number of vehicles per unit length of roadway)	Concepts were ranked based on % change in traffic stream	HCS operations analysis focuses on changes on the mainline, so changes to ramps may not be reflected in the percent change in stream density	• Overall, the operations analysis shows a similar theme with the safety analysis. The highest-scoring concepts target the hotspot weave segments along the corridor and aim to limit weaving movements. • For stream density, concepts that focus on the ramp terminals and ramp segments do not score as highly in operations improvements. • Concepts generally score under 2% traffic density reduction, except for Concept 6 (Four Lanes on EB I-580). • Under Concept 6 (Four Lanes on EB I-580), the extension of the fourth lane reduces lane change movements between motorists and allows for a more consistent flow pattern, achieving up to 28% reduction in traffic stream density.
	Estimated Benefited Motorists	Summed up all mainline and ramp vehicle counts (Fehr and Peers 2025) as a proxy for the number of daily motorists that would benefit from the concept improvement	Concepts were ranked with score of 1 benefiting the fewest motorists and score of 5 benefiting the most motorists		Concept 4 (Foothill Road Interchange Modifications) scored the highest, followed by Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening). Programmatic concepts scored well because the improvements would be spread throughout the study area.

Criterion	Sub Criterion	Evaluation Methodology	Scoring Summary	Limitations/Assumptions/ Considerations	Results
	Transit Benefits	Number of transit lines that utilize the area of improvements.	Concepts that benefit existing transit routes score higher than improvements that are not on existing bus routes.	Based off current transit maps.	Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening) and Concept 6 (Four Lanes on EB I-580) scored the highest. Programmatic concepts scored well because the improvements would be spread throughout the study area.
	Potential to Reduce Weaving/ Merging Conflicts	Number of locations/ directions improved.	Additional point for enforcing lane separation, additional ramp capacity, additional merge distance, reducing driver confusion, reduced safety hazards.	Congestion reduction assumed to not reduce weaving or merging conflicts.	Programmatic concepts scored best because the improvements would be spread throughout the study area.
	Lane Rebalance	Length of additional lane, including F-F lanes. Does not consider lanes lost by closing ramps.	No rebalancing given score of 1. Highest given score of 5.	Assuming this is not a net capacity inducing project. The net change will be rebalancing capacity so it remains under the half-mile threshold for VMT.	For lane rebalancing, none of these numbers are greater than 5,280 feet, so none of the alternatives on the table add more than 1.0 lane-mile and trigger VMT capacity-inducing studies. Having a negative amount of lane-miles (when local roads are considered – for Concept 4 [Foothill Road Interchange Modifications] for instance) is not necessarily detrimental to performance– it often means that the remaining capacity is being used more fully, while improving mainline operations and safety by reducing the number of conflict points.
C - Driver Experience	Number of Wayfinding Issues Resolved	Number of locations where wayfinding has been improved	Additional points for signage and lane visibility	Some programmatic concepts do not have the number of locations determined yet.	Concept P5 (Safety ITS Elements on WB I-580) scored the highest.
	Correlation to Issues Noted in Public Survey	Key survey themes: driver comfort, safety (speed differentials, weaving and merging), infrastructure improvements (flyover ramps, extended merge lanes, lane markings and signage, remove cloverleaf), use of alternate routes to avoid congestion and safety concerns (local routes, other freeways, earlier exits), construction and maintenance causing confusion, support for short term (striping, wayfinding, highway patrol, pavement maintenance, additional barriers to prevent merging) and long term (flyover ramps).	Additional points were given for each survey theme the concept improved		Concept P5 (Safety ITS Elements on WB I-580) scored the highest.
	Driver Level of Comfort (Qualitative)	Ease of use of the interchange, reduction in lane speed differentials or stopped traffic, and reduction in unsafe lane changes/cut-ins	Either some improvement (2), moderate improvement (3-4), or overall improvement (5).	Driver comfort level factors in safety considerations not otherwise covered in ISAT analysis.	Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening) scored highest of the infrastructure concepts. Concept P9 (High Performance Pavement Marking) and Concept P4 (Lane Lighting) scored the highest of the programmatic concepts.

Design

A brief description of the Design Metrics, Criteria, and Sub Criteria are included in Table 6 below. Results are summarized in Table 5 below. Out of the infrastructure concepts, Concept 1 (Barrier Hardening on SB I-680) scored the highest. Out of the programmatic concepts, Concepts P1 (Enhanced Maintenance Program) and P2 (Traffic Incident Management) tied for the highest score.

Table 5. Design Considerations (Cost and Schedule) Metric Results

Concept Name	Design Exceptions	Implementability	Metric Total
Infrastructure Improvements			
Concept 1 Barrier Hardening on SB I-680	4.8	5.0	**9.8**
Concept 2 I-580 WB to I-680 SB Loop Ramp Widening	2.5	2.3	**4.8**
Concept 3 Stoneridge Drive Off-Ramp Modification	3.8	4.8	**8.5**
Concept 4 Foothill Road Interchange Modifications	2.8	2.3	**5.0**
Concept 5 Dougherty Road Interchange Improvements	2.8	1.5	**4.3**
Concept 6 Four Lanes on EB I-580	1.3	3.3	**4.5**
Programmatic Improvements			
Concept P1 Enhanced Maintenance Program	5.0	5.0	**10.0**
Concept P2 Traffic Incident Management	5.0	5.0	**10.0**
Concept P3 High Performance Pavement Marking	5.0	4.3	**9.3**
Concept P4 Lane Lighting	5.0	4.3	**9.3**
Concept P5 Safety ITS Elements on WB I-580	5.0	4.3	**9.3**
Concept P6 Loop Ramp Meter	5.0	4.3	**9.3**
Concept P7 SB I-680 Signage improvements	5.0	4.3	**9.3**

Table 6. Design Metrics, Criteria, and Sub Criteria

Criterion	Sub Criterion	Evaluation Methodology	Scoring Summary	Limitations/Assumptions/ Considerations	Results
A - Design Exceptions	Number of Design Exceptions Required	Number of design exceptions required/ probable.	No design exceptions = 5 Existing design exceptions, but no new design exceptions = 4 1-2 new design exceptions = 3 3 or more new design exceptions = 2	Caltrans approval is required for all existing or new design exceptions. Exceptions to mandatory (boldface) standards require Caltrans Headquarters (HQ) concurrence. New or modified access on Interstate Highway System (IHS) requires FHWA concurrence.	Concept 6 (Four Lanes on EB I-580) has at least three new design exceptions and is rated the lowest. Concept 2 (I-580 WB to I-680 SB Loop Ramp) Widening, Concept 4 (Foothill Road Interchange Modifications), and Concept 5 (Dougherty Road Interchange Improvements) have one to two new design exceptions and are rated moderately. Other concepts have no new design exceptions and are rated high.
	Likelihood of Caltrans Approval	Likelihood of Caltrans Approval will be based on the type of exception - Mandatory (less likely to get an exception), Advisory (more flexibility in approving exemptions)	High = 5 Medium = 3 Low = 1	Caltrans approval is required for all existing or new design exceptions. Exceptions to mandatory (boldface) standards require Caltrans HQ concurrence.	Concept 6 (Four Lanes on EB I-580) has the highest number and severity of design exceptions and is rated the lowest. Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening), Concept 3 Stoneridge, Concept 4 Foothill, Concept 5 Hopyard are rated moderately. Concept 1 (Barrier Hardening on SB I-680) and the programmatic concepts (P1-P7) have no new design exceptions and are rated high.
	Ability to Implement Ramp Metering Policy	Considered feasibility of implementation of Ramp Metering Design Manual standards to full standard.	High = 5 Medium = 3 Low = 1	RMDM standards include placement and activation of ramp meter; allocation of standard amount of storage space on on-ramps; provision of HOV lane; provision of standard number of GP lanes in addition to HOV lane; tapers and geometric standards	Concept 6 (Four Lanes on EB I-580) has the lowest potential for implementation of standard ramp metering infrastructure. Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening), Concept 4 (Foothill Road Interchange Modifications), and Concept 5 (Dougherty Road Interchange Improvements) have moderate potential, but would require some exceptions due to existing constraints. Concept 1 (Barrier Hardening on SB I-680) and the programmatic concepts (P1-P7) have the highest potential for fully standard ramp metering infrastructure.
	Design Complexity	Considered scope and scale of proposed improvements and estimated time/cost to implement the proposed project through the traditional Caltrans design process (PID, PA&ED, PS&E, Bid, Construction).	More complex designs will involve additional design, analysis, cost and schedule, which are scored lower.	Comparative, based on professional judgement.	Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening) and Concept 6 (Four Lanes on EB I-580) were rated highly complex, so received a lower score. Concept 4 (Foothill Road Interchange Modifications) and Concept 5 (Dougherty Road Interchange Improvements) were rated medium-high complexity. Concept 3 (Stoneridge Drive Off-Ramp Modification) was rated moderate complexity. Concept 1 (Barrier Hardening on SB I-680) and the programmatic concepts (P1-P7) were the least complex and received the highest score.
B - Implementability	Estimated Construction Cost	Evaluated roadway, earthwork, structure, drainage, environmental, ROW, and incidental costs (e.g. electrical, striping, etc.)	All costs were within the targeted $20M range for the proposed project. A project exceeding this range would be eliminated. Costs below $1M were rated high. Costs between $1M to $13M were rated moderate.	A 30% contingency was applied to all costs. Environmental and drainage costs were estimated as a lump sum (% of roadway costs).	Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening) and Concept 4 (Foothill Road Interchange Modifications) were the most costly and received a low score. Concept 3 (Stoneridge Drive Off-Ramp Modification), Concept 5 (Dougherty Road Interchange Improvements), and Concept 6 (Four Lanes on EB I-580) were moderate in cost. Concept 1 (Barrier Hardening on SB I-680) was the least costly and received a high score.

Criterion	Sub Criterion	Evaluation Methodology	Scoring Summary	Limitations/Assumptions/ Considerations	Results
			Costs between $13M to $20M were rated low.		Programmatic concepts (P1-P7) were not evaluated.
	Schedule	Estimated duration of PA&ED, PS&E, and construction.	Slow = 1 Moderate = 3 Fast = 5	Comparative, based on professional judgement.	Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening), Concept 4 (Foothill Road Interchange Modifications), and Concept 5 (Dougherty Road Interchange Improvements) had the longest estimated schedule. Concept 6 (Four Lanes on EB I-580) had a moderate schedule. Concept 1 (Barrier Hardening on SB I-680) and Concept 3 (Stoneridge Drive Off-Ramp Modification) had a short schedule.
	Construction Impacts	Construction impacts include detours, lane reductions, etc.	Low impacts = 1 High impacts = 5	Comparative, based on professional judgement.	Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening), Concept 4 (Foothill Road Interchange Modifications), Concept 5 (Dougherty Road Interchange Improvements), and Concept 6 (Four Lanes on EB I-580) involve major ramp reconstruction and would potentially require temporary closures, so they had high impacts and potential for detours/lane reductions. Concept 1 Barrier Hardening on SB I-680 and Concept 3 (Stoneridge Drive Off-Ramp Modification) had low impacts.
	ROW Required?		No ROW required = 5 ROW required = 1	Based on preliminary layouts and estimated ROW lane obtained from GIS files.	Only Concept 5 (Dougherty Road Interchange Improvements) requires new ROW. All other concepts would occur on existing Caltrans ROW.

Environmental

A brief description of the Environmental Metrics, Criteria, and Sub Criteria are included in Table 8 below. Results are summarized in Table 7 below. Out of the infrastructure concepts, Concept 6 Four Lanes on EB I-580 scored the highest. Out of the programmatic concepts, Concepts 11 Safety ITS Elements on WB I-580 and 12 NB I-680 to WB 580 Loop Ramp Meter tied for the highest score.

Table 7. Environmental Considerations Metric Results

Concept Name	Hazardous Waste Contamination	Biological Resources	Community Resources	Other Environmental	Environmental Clearance Risk	Metric Total
Infrastructure Improvements						
Concept 1 Barrier Hardening on SB I-680	4.5	5.0	1.6	5.0	5.0	**11.1**
Concept 2 I-580 WB to I-680 SB Loop Ramp Widening	3.5	4.5	1.6	4.0	4.0	**9.6**
Concept 3 Stoneridge Drive Off-Ramp Modification	4.5	5.0	2.2	5.0	5.0	**11.7**
Concept 4 Foothill Road Interchange Modifications	4.5	3.0	2.6	3.3	5.0	**10.1**
Concept 5 Dougherty Road Interchange Improvements	2.5	4.5	2.8	4.0	5.0	**9.8**
Concept 6 Four Lanes on EB I-580	4.5	5.0	2.0	5.0	5.0	**11.5**
Programmatic Improvements						
Concept P1 Enhanced Maintenance Program	4.0	5.0	1.4	5.0	5.0	**10.4**
Concept P2 Traffic Incident Management	4.0	4.5	2.0	5.0	5.0	**10.5**
Concept P3 High Performance Pavement Marking	4.0	5.0	1.4	4.7	5.0	**10.4**
Concept P4 Lane Lighting	4.0	5.0	1.4	4.7	5.0	**10.4**
Concept P5 Safety ITS Elements on WB I-580	4.0	5.0	2.0	4.7	5.0	**11.0**
Concept P6 Loop Ramp Meter	4.0	5.0	2.0	4.7	5.0	**11.0**
Concept P7 SB I-680 Signage improvements	4.0	5.0	1.6	5.0	5.0	**10.6**

Table 8. Environmental Metrics, Criteria, and Sub Criteria

Criterion	Sub Criterion	Evaluation Methodology	Scoring Summary	Limitations/Assumptions/ Considerations	Results
A - Hazardous Waste Contamination	Adjacent Historic Release Sites	Hazardous release sites will be based on Cortese list	Yes (3) or No (5)	Cortese list does not include all release sites.	Concept 5 (Dougherty Road Interchange Improvements) is near two Cortese sites.
	Potential to Encounter Contamination	Potential for other types of hazardous materials to be on site.	Higher potential to encounter contamination is reflected in lower (less preferable) scores	Groundwater depth or flow direction not considered.	Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening) and Concept 5 (Dougherty Road Interchange Improvements) scored lower due to modifications to an old bridge and proximity to Cortese sites. All concepts have potential to disturb aerially deposited lead and yellow thermoplastic paint.
B - Biological Resources	Potential Impacts to Sensitive Habitat	Evaluated aerial imagery.	Low = 5 Moderate = 3	No habitat survey done.	Concept 4 (Foothill Road Interchange Modifications) has an MVP on the banks of Dublin Creek and scored lower.
	Potential Impacts to Jurisdictional Waterways	Based on National Wetlands Inventory (NWI)	Yes = 1 Maybe = 3 No = 5	NWI does not show all wetlands. NWI does not match	Concept 4 Foothill overlaps NWI wetlands; however, impacts are likely avoidable but require additional analysis and therefore scored lower.
	Potential for Special-Status Species	Based on California Natural Diversity Database (CNDDB) results.	Low (no nearby results or suitable habitat) = 5 Moderate (nearby results and/or suitable habitat) = 3	CNDDB is not comprehensive.	Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening), Concept 4 (Foothill Road Interchange Modifications), Concept 5 (Dougherty Road Interchange Improvements), Concept P2 (Traffic Incident Management) all have work in unpaved areas that are suitable habitat for Congdon's tarplant (rare plant, not federally or state listed).
	Permitting and Approvals	Extent and duration of permitting/ approval process for biological resources.	Low (few minor permits) = 5 Moderate (potential permits/approvals needed requiring some coordination = 3	Comparative, based on professional judgement.	Concept 4 (Foothill Road Interchange Modifications)may require design refinement and additional analysis and therefore scored lower.
C - Community Resources	CalEnviroScreen Pollution Burden Benefits	Does the concept help address a pollution burden identified by CalEnviroScreen. Traffic/diesel particulate matter (PM) identified in quadrants in the study area (Office of Environmental Health Hazard Assessment [OEHHA] 2025).	Concepts that address congestion are assumed to reduce PM, given a 5.	Population burden not considered since it was limited to low birthweight. Reduced congestion, improved safety are assumed to not affect birthweight.	All infrastructure concepts and programmatic Concepts P2 (Traffic Incident Management) and Concept P6 (Loop Ramp Meter) scored highest due to their congestion reduction effects.
	Access to Community Facilities	Community facilities identified on Google Earth. These include parks, community centers, libraries, medical centers. If the concept is on the section of highway/local road that drivers would take to get to the facility, it was counted.	Higher scores given to concepts that improve access (improve safety, reduce congestion).	Google Earth data not comprehensive and may not be accurate.	Concept 3 (Stoneridge Drive Off-Ramp Modification), Concept 4 (Foothill Road Interchange Modifications), Concept 5 (Dougherty Road Interchange Improvements), Concept P5 (Safety ITS Elements on WB I-580), Concept P6 (Loop Ramp Meter), and Concept P7 (SB I-680 Signage Improvements) scored higher due to their improvements to safety and congestion for traffic to various parks, recreation facilities, fire stations, medical facilities, and libraries.
	Operational and Multimodal Impacts to Local Roadways	Does the project improve operations and multimodal features on local roadways.	Concepts that modify local roads given higher score (5). Concepts that may indirectly improve local roads, e.g. improving highway operations may reduce local cut-through traffic, given a lower score (2).	Comparative, based on professional judgement.	Concept 4 (Foothill Road Interchange Modifications) and Concept 5 (Dougherty Road Interchange Improvements) scored highest as they directly improve local roadways.
D - Other Environmental Concerns	Visual Impacts	Level of effort needed for visual impact analysis.	The more extensive the visual changes, the more intensive the visual analysis (e.g. simulations), the lower the score.	Comparative, based on professional judgement.	Concepts 2 (I-580 WB to I-680 SB Loop Ramp Widening), Concept 4 (Foothill Road Interchange Modifications), Concept 5 (Dougherty Road Interchange Improvements)

Criterion	Sub Criterion	Evaluation Methodology	Scoring Summary	Limitations/Assumptions/ Considerations	Results
					scored lower due to bridge modifications and impacts to municipal gateways identified in general plans. programmatic Concepts P1-P7 have additional sources of glare and lighting and scored slightly lower.
	Traffic modelling LOE	Level of effort needed for traffic modelling.	The level of traffic operations analysis and modelling effort would depend on the extents of geometric changes and impacts on mainline volumes. The more extensive the geometric changes, the more intensive the traffic analysis, the lower the score.	Comparative, based on professional judgement.	Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening), Concept 4 (Foothill Road Interchange Modifications), Concept 5 (Dougherty Road Interchange Improvements), and Concept P6 (Loop Ramp Meter) may require additional modeling due to geometric changes and new F-F ramp meter. These scored lower than the other concepts.
	Other	Other environmental considerations that could require additional analysis, documentation, coordination.	Additional environmental considerations requiring additional analysis (e.g. geology, cultural) given lower scores.	Comparative, based on professional judgement.	
E - Environmental Clearance Risk Level	Likely California Environmental Quality Act (CEQA) Level	Probable level of CEQA documentation. Is the concept exempt from CEQA? Does the concept fit within a class of Categorical Exemptions (CEs)? Would the concept trigger any exceptions to the CE?	Concepts that fit into a CE class and do not trigger any exceptions, scored the highest (5). Concepts that may not qualify for a CE (e.g. do not fit within any CE classes, or may trigger an exception), scored lower (3).	Comparative, based on professional judgement.	Concept (I-580 WB to I-680 SB Loop Ramp Widening) (addition of ~1000ft of lane) may qualify as "negligible expansion of use." However, bridge was built in 1965. Additional evaluation is needed to confirm if a "substantial adverse change in the significance of an historical resource" exception can be avoided.
	Likely National Environmental Policy Act (NEPA) Level	Probable level of NEPA documentation. Is the concept excluded? Does the concept fit within a class of Categorical Exclusions (CATEXs)? Would the concept trigger any exceptions to the CATEX?	Concepts that fit into a CE class and do not trigger any exceptions, scored the highest (5). Concepts that may not qualify for a CE (e.g. do not fit within any CE classes, or may trigger an exception), scored lower (3).	Comparative, based on professional judgement.	Concept 2 (I-580 WB to I-680 SB Loop Ramp Widening) would fall under the 23 USC 326 "D List" of CATEXs, while the other concepts would fall under the "C list." Additional documentation will likely be needed for Concept 2. However, the bridge is likely exempt from Section 106 as it is part of the interstate system (Caltrans 2015)

Summary

Table 9 below provides a summary of the overall scores and ranks for each criterion and weighting scenario.

Four weighting scenarios are included:

1. Equal Focus Scenario – All three metrics weighted equally
2. P&N Focus Scenario 1 – P&N Metric weighted 50%, with the other two metrics weighted 25% each.
3. P&N Focus Scenario 2 – P&N Metric weighted 80%, with the other two metrics weighted 10% each.
4. P&N and Design Focus Scenario 3 – P&N and Design Metrics each weighted 40% and Environmental Metric weighted 20%.

Programmatic concepts were ranked separately from infrastructure improvements.

For infrastructure concepts, the same four concepts consistently ranked in the top four:

1. Concept 3 (Stoneridge Drive Off-Ramp Modification) – ranked first in three scenarios
2. Concept 6 (Four Lanes on EB I-580) – ranked second in three scenarios
3. Concept 4 (Foothill Road Interchange Modifications)– ranked varied second to fourth
4. Concept 1 (Barrier Hardening on SB I-680) – ranked third in two scenarios.

For programmatic concepts, the same three concepts consistently ranked in the top 3:

1. Concept P4 (Lane Lighting) consistently ranked first
2. Concept P1 (Enhanced Maintenance Program) ranked either first or second.
3. Concept P3 (High Performance Pavement Marking) consistently ranked third.

Table 9. Screening Summary Table

Concept Name	1-Purpose & Need (Safety and Operations) Metric				2-Design Considerations (Cost and Schedule) Metric			3-Environmental Considerations Metric						Weighting Scenarios								
	A	B	C		A	B		A	B	C	D	E										
	Improve Safety for Motor Vehicles	Improve Vehicular/ Freeway and Transit Operations	Improve Wayfinding	Metric Total	Design Exceptions	Implementability	Metric Total	Hazardous Waste Contamination	Biological Resources	Community Resources	Other Environmental	Environmental Clearance Risk	Metric Total	1 Equal Focus Scenario (33%/33% /33%)	Rank	2 P&N Focus Scenario 1 (50%/25% /25%)	Rank	3 P&N Focus Scenario 2 (80%/10% /10%)	Rank	4 P&N and Design Focus Scenario 3 (40%/40%/ 20%)	Rank	Rank range
Infrastructure Improvements																						
Concept 1 Barrier Hardening on SB 680	1.5	1.2	2.0	4.7	4.8	5.0	9.8	4.5	5.0	1.6	5.0	5.0	11.1	8.5	3rd	7.6	5th	5.8	6th	8.0	3rd	3-6
Concept 2 I-580 WB to I-680 SB Loop Ramp Widening	2.3	4.2	3.0	9.5	2.5	2.3	4.8	3.5	4.5	1.6	4.0	4.0	9.6	7.9	5th	8.3	4th	9.0	4th	7.6	5th	4-5
Concept 3 Stoneridge Drive Off-Ramp Modification	4.5	2.6	2.0	9.1	3.8	4.8	8.5	4.5	5.0	2.2	5.0	5.0	11.7	9.8	1st	9.6	1st	9.3	3rd	9.4	1st	1-3
Concept 4 Foothill Road Interchange Modifications	3.5	4.0	2.3	9.8	2.8	2.3	5.0	4.5	3.0	2.0	3.3	5.0	9.5	8.1	4th	8.5	3rd	9.3	2nd	7.8	4th	2-4
Concept 5 Dougherty Road Interchange Improvements	3.3	2.2	1.7	7.1	2.8	1.5	4.3	2.5	4.5	2.8	4.0	5.0	9.8	7.1	6th	7.1	6th	7.1	5th	6.5	6th	5-6
Concept 6 Four Lanes on EB 580	4.8	3.8	2.3	10.9	1.3	3.3	4.5	4.5	5.0	2.0	5.0	5.0	11.5	9.0	2nd	9.4	2nd	10.3	1st	8.5	2nd	1-2
Programmatic Improvements																						
Concept P1 Enhanced Maintenance Program	5.0	4.7	2.7	12.3	5.0	5.0	10.0	5.0	5.0	1.4	5.0	5.0	11.4	11.2	1st	11.5	2nd	12.0	2nd	11.2	1st	1-2
Concept P2 Traffic Incident Management	1.0	3.7	1.7	6.3	5.0	5.0	10.0	5.0	4.5	2.0	5.0	5.0	11.5	9.3	6th	8.5	6th	7.2	6th	8.8	6th	6
Concept P3 High Performance Pavement Marking	5.0	4.3	3.0	12.3	5.0	4.3	9.3	5.0	5.0	1.4	4.7	5.0	11.4	11.0	3rd	11.4	3rd	11.9	3rd	10.9	3rd	3
Concept P4 Lane Lighting	5.0	4.7	3.3	13.0	5.0	4.3	9.3	5.0	5.0	1.4	4.7	5.0	11.4	11.2	1st	11.7	1st	12.5	1st	11.2	1st	1
Concept P5 Safety ITS Elements on WB I-580	3.0	4.3	3.3	10.7	5.0	4.3	9.3	5.0	5.0	2.0	4.7	5.0	12.0	10.7	4th	10.7	4th	10.7	4th	10.4	4th	4
Concept P6 NB I-680 to WB I-580 Loop Ramp Meter	1.0	2.0	1.7	4.7	5.0	4.3	9.3	5.0	5.0	2.0	4.7	5.0	12.0	8.7	7th	7.7	7th	5.9	7th	8.0	7th	7
Concept P7 SB I-680 Signage improvements	3.0	4.3	2.3	9.7	5.0	4.3	9.3	5.0	5.0	1.6	5.0	5.0	11.6	10.2	5th	10.1	5th	9.8	5th	9.9	5th	5

11 CONCEPTUAL PROJECT COST ESTIMATES

Preliminary Conceptual Project Estimates for each infrastructure improvement concept are included as Attachment D. The capital outlay cost is based on conceptual level cost estimates completed prior to the PID. All costs are in current year (2025) dollars.

A summary of estimated cost ranges for each concept is provided in Table 10.

Table 10. Estimated Capital Outlay Cost Ranges

Concept	Order of Magnitude Capital Outlay Cost Estimate		
	Construction (Roadway + Structures)	ROW	Total
Concept 1 Barrier Hardening on SB 680	$581,000	-	$581,000
Concept 2 I-580 WB to I-680 SB Loop Ramp Widening	$13,818,000	-	$13,818,000
Concept 3 Stoneridge Drive Off-Ramp Modification	$927,000	-	$927,000
Concept 4 Foothill Road Interchange Modifications	$17,822,000	-	$17,822,000
Concept 5 Dougherty Road Interchange Improvements	$13,291,000	$845,000	$14,136,000
Concept 6 Four Lanes on EB 580	$1,568,000	-	$1,568,000

Unit costs for roadway, structures, and utilities were estimated from the *Caltrans Contract Cost Database* and *Caltrans Comparative Bridge Costs* guideline (Caltrans, 2023). A 30% contingency was applied to all costs.

Environmental and drainage costs were estimated as a lump sum (% of roadway costs).

The level of detail available to develop these capital outlay project estimates is only accurate to within the above ranges and is useful for long-range planning purposes only. The capital outlay estimates should not be used to program or commit state-programmed capital outlay funds.

12 FUNDING

The current pre-PID and future PID phases are funded through Measure BB. Measure BB includes $20M for near-term safety improvements approaching and through the I-580/I-680 interchange. Additionally, Tri-Valley Transportation Council (TVTC) has allocated $1M for project development for the I-580/I-680 interchange. The future PID will be used to seek additional funding.

Potential sources of additional funding include the following:

- Local/Regional Programs:

  - One Bay Area Grant (OBAG) program
  - Traffic Impact/Mitigation Fees
  - I-580 Express Lanes Toll Revenue
- State Programs
  - California STIP
  - Highway Safety Improvement Program (HSIP)
  - SHOPP
  - Senate Bill 1 (SB1) Programs
- Federal Funding Sources
  - Better Utilizing Investments to Leverage Development (BUILD)
  - Infrastructure for Rebuilding America (INFRA) Grant Program
  - Safe Streets and Roads for All Grant Program (SS4A)

Approval of a Project Report will be needed to program funds for ROW and construction. The Project will obtain NEPA environmental clearance to ensure eligibility for federal funding. Determination of the Project's eligibility for federal aid will be made at a later date once a preferred alternative has been established for the specific location near the interchange.

13 SUMMARY AND NEXT STEPS

This report describes a pre-PID development and screening study intended to identify safety and operations improvements in the vicinity of the I-580/I-680 interchange. These include defined physical improvements along the I-580 and I-680 corridors as well as programmatic concepts. Concept development and refinement was informed by traffic and safety data collection, a field survey, the results of a public survey of commuters, and input and review from the Project Development Team (PDT) that included representatives from the cities of Dublin, Pleasanton and Livermore, Alameda CTC, and Caltrans.

Commuter feedback received from the public survey highlighted a pressing need for improvements to address safety and overall operations of the interchange, including support for both short-term and long-term solutions. The cloverleaf interchange was frequently criticized for being outdated and not designed to handle modern traffic volumes. Survey respondents indicated weaving and merging behaviors, speed differentials, and undesirable travel speeds as key challenges associated with the interchange. There was strong support for adding flyover ramps, extending merge lanes, and improving lane markings and signage.

The PDT identified six improvement concepts and seven programmatic concepts that were scored and ranked based on their ability to meet the Project's Purpose and Need (generally related to near-term safety and operations improvements, but also including driver experience and correlation to survey results), how the design affects cost and schedule, and environmental considerations (such as permitting, approvals, impacts, and required documentation). The concepts seek to enhance operations and improve safety along the mainline by reducing last-minute lane changes and weaving movements, either through hardened barriers, extended auxiliary lanes, or modifications to on- and off-ramps.

The results of the scoring evaluation were reviewed with the PDT. The table below summarizes the takeaways from the evaluation and recommended next steps for the PID phase.

Table 11. Topics for Further Investigation

Concept	Description	PDT Observations	PID Recommendations
1 Barrier Hardening on SB I-680	Introduce hardened barrier between SB I-680 mainline and I-580 WB on-ramp to reduce friction and improve merging.	Evaluation results were not able to fully account for operational and safety benefits due to the limitations of the pre-PID analysis tools. However, there were no significant concerns identified with this concept.	Safety and operational benefits should be further evaluated to determine if this concept will result in meaningful improvements.
2 WB I-580 to SB I-680 Loop Ramp Widening	Increase the WB I-580-to-SB I-680 loop ramp from one lane to two lanes to improve capacity.	This concept scored well with the Purpose and Need evaluation metric but may require significant geometric and structural modifications and requires further traffic analysis to assess operational impacts. A geometric analysis.	A geometric analysis is recommended as a **first step** in the PID phase to determine if widening of the structure carrying I-680 traffic will be required to expand the loop ramp to two lanes. The analysis should also consider whether the St. Patrick’s way on-ramp would need to be modified and the feasibility of such modifications given geometric constraints.
3 SB I-680 Stoneridge Drive Off-Ramp Modification	Reduce Stoneridge Drive off-ramp to a single lane optional exit and extend auxiliary lane beyond off-ramp.	This concept scored well for all evaluation metrics. However, it was noted that peak demand for Stoneridge Drive may exceed the capacity of a single lane off-ramp.	An analysis of demand vs. capacity of a single lane off-ramp should be performed as a **first step** in the PID phase to determine if mitigations are possible or if the concept should be dropped from further consideration.
4 Foothill Road Interchange Modifications	Close the WB I-580 diagonal off-ramp to San Ramon/Foothill Rd and construct a new loop off-ramp to increase spacing between ramps on WB I-580. Close the diagonal on-ramp from Foothill Rd to EB I-580 and reconfigure loop on-ramp to increase spacing between ramps on EB I-580.	Concerns were raised about adverse impacts to local roads associated with elimination of the slip ramp and requiring all vehicles on SB Dougherty Rd. that are destined for WB I-580 to queue up at a signalized intersection.	

Concept	Description	PDT Observations	PID Recommendations
5 Dougherty Road Interchange Improvements	Close the diagonal on-ramp from Dougherty Road to WB I-580 to remove a merge conflict point and increase spacing between ramps on WB I-580.	Concerns were raised about adverse impacts to local roads associated with elimination of ramps and requiring vehicles on San Ramon/Foothill Rd. to queue up at a signalized intersections to enter the freeway.	As a **first step** in the PID phase, an assessment of traffic safety and traffic operations impacts associated with the interchange improvements should be conducted to determine if such impacts warrant dropping the concept from further consideration.
6 Four Lanes on EB I-580	Restripe to eliminate lane drop on EB I-580 mainline to provide 4 EB thru lanes	This concept scored very well with the Purpose and Need evaluation metric but may require design exceptions. As the only concept that seeks to address EB I-580 operational and safety issues, the PDT felt that this concept should be carried through the PID phase.	Required design exceptions and ramp metering impacts will be evaluated in the PID phase.
7 Separate WB I-580 Movements to I-680 NB and SB	Separate the WB I-580-to-NB I-680 and WB I-580-to-SB I-680 movements by elongating the gore between the two movements.	This concept as proposed would require reducing the number of lanes on the WB I-580-to-NB I-680 connector from two to one and would require structure modifications over a creek. Given these challenges, the concept was not evaluated as part of this study. However, the PDT recommends that this concept be further reviewed in the PID phase.	A further review of this concept is recommended in the PID phase with detailed documentation on aspects that would rule it out from further project development.

Concept	Description	PDT Observations	PID Recommendations
Programmatic Concepts	The following programmatic concepts were discussed: 1. Enhanced maintenance and repairs in the vicinity of the interchange (e.g., pothole, striping, guardrails) 2. Coordinated incident management program for enhanced response to incidents 3. High performance pavement markings to improve visibility of lane designation 4. Lighted pavement markers to guide traffic 5. Blankout signage on WB I-580 approaching the interchange to warn drivers of slowed/stopped traffic ahead 6. Ramp metering along the loop connector from NB I-680 to WB I-580 7. Update signage along SB I-680 to warn about lane drop and reduce confusion about destinations	Programmatic concepts can be paired with the improvement concepts or could serve as standalone projects. Some of the programmatic concepts have synergies with improvement concepts. For example, if Improvement Concept #6 (Four lanes on EB I-580) required repaving of all eastbound lanes, it introduces the possibility of pairing it with Programmatic Concept #1 (Enhanced Maintenance Program) or Programmatic Concept #3 (High Performance Pavement Markings) to improve pavement, striping and address other repair needs within the limits of the improvement. Other concepts could serve as standalone projects.	Opportunities to pair programmatic concepts with improvement concepts should be evaluated in the PID. Programmatic Concepts #2, #4 and #5 include ongoing operations that need to be considered in the PID.

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15 PROJECT PERSONNEL

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16 ATTACHMENTS

Attachment A. Preliminary Concept Layouts

Attachment B. Traffic and Safety Technical Report

Attachment C. Scoring Matrix

Attachment D. Conceptual Project Cost Estimates

Attachment A Preliminary Concept Layouts

Concept Description:

* Merge St. Patrick entrance into mainline
* Keep WB I-580 to SB I-680 connector separate
* Merge EB I-580 to SB I-680 connector into WB I-580 to SB I-680 connector (separate from SB I-680 mainline). Then, merge both connectors onto SB I-680 mainline as an aux lane.

PRELIMINARY CONCEPTUAL PLAN

SEPTEMBER 2025

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(925)977-3200

ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT 1: BARRIER HARDENING ON SB I-680

ALAMEDA County Transportation Commission

DATE: 09/10/2025	SCALE: 1"=120'
FILENAME:	
PROJECT:	
SHEET NO.	

Concept Description:

* Merge St. Patrick on-ramp ASAP, and harden separation between mainline and F-F connectors
* Add ramp metering individually on the EB I-580 to SB I-680 and WB I-580 to SB I-680 connectors to manage flow into aux lane and SB 680

HNTB
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(925)977-3200

ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT 2: LOOP WIDENING

ALAMEDA County Transportation Commission

DATE: 09/10/2025	SCALE: 1"=120'
FILENAME:	
PROJECT:	
SHEET NO.	

Concept Description:

* Reduce SB I-680 Stoneridge Dr off-ramp to single lane optional exit
* Extend aux lane beyond off-ramp as a run-out and then drop

PRELIMINARY CONCEPTUAL PLAN

SEPTEMBER 2025

HNTB
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ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT 3: STONERIDGE

ALAMEDA County Transportation Commission

DATE: 09/10/2025	SCALE: 1"=120'
FILENAME:	
PROJECT:	
SHEET NO.	

Concept Description:

South of I-580:

* Close EB diagonal on-ramp
* Widen EB loop on-ramp
* Install new LT pocket on NB Foothill Rd

North of I-580:

* Close WB diagonal off-ramp
* Close WB loop on-ramp
* Construct WB loop off-ramp
* Widen WB diagonal on-ramp to 3 lanes
* Install new LT pocket on NB San Ramon Rd and connector to WB diagonal on-ramp

HNTB

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ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT 4: FOOTHILL

ALAMEDA County Transportation Commission

DATE: 09/10/2025	SCALE: 1"=120'
FILENAME:	
PROJECT:	
SHEET NO.	

Concept Description:

* Close WB diagonal on-ramp
* Widen WB loop on-ramp
* Install new LT pocket on SB Dougherty Rd
* Install new RT pocket to the WB loop on-ramp

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ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT 5: HOPYARD

ALAMEDA County Transportation Commission

DATE: 09/10/2025	SCALE: 1"=120'
FILENAME:	
PROJECT:	
SHEET NO.	

Concept Description:

* Eliminate lane drop on I-580 EB mainline (currently 4 thru lanes dropping to 3 to accommodate the two lanes from the flyover)
* Maintain two lanes on SB I-680 to EB I-580 flyover
* Revise striping to meet mainline earlier with two lanes, then merging to one lane with 50:1 taper prior to addition of NB I-680 to EB I-580 connector (thus: 4+2--> 5)

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(925)977-3200

ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT 6: MAINTAIN FOUR LANES ON EB I-580

ALAMEDA County Transportation Commission

DATE: 09/10/2025
SCALE: 1"=120'
FILENAME:
PROJECT:
SHEET NO.

Concept Description:

Revise signs along SB I-680 to avoid "trap" condition for SB I-680 to WB I-580 connector; reduce confusion with "Dublin" as a control city; improve signage for Dublin Blvd exit ("hidden" on the SB I-680 to EB I-580 connector); improve warning for lane drop beyond WB I-580 connector.

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ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT P7: SB I-680 SIGNAGE IMPROVEMENTS

ALAMEDA County Transportation Commission

DATE: 09/10/2025	SCALE: NTS
FILENAME:	
PROJECT:	
SHEET NO.	

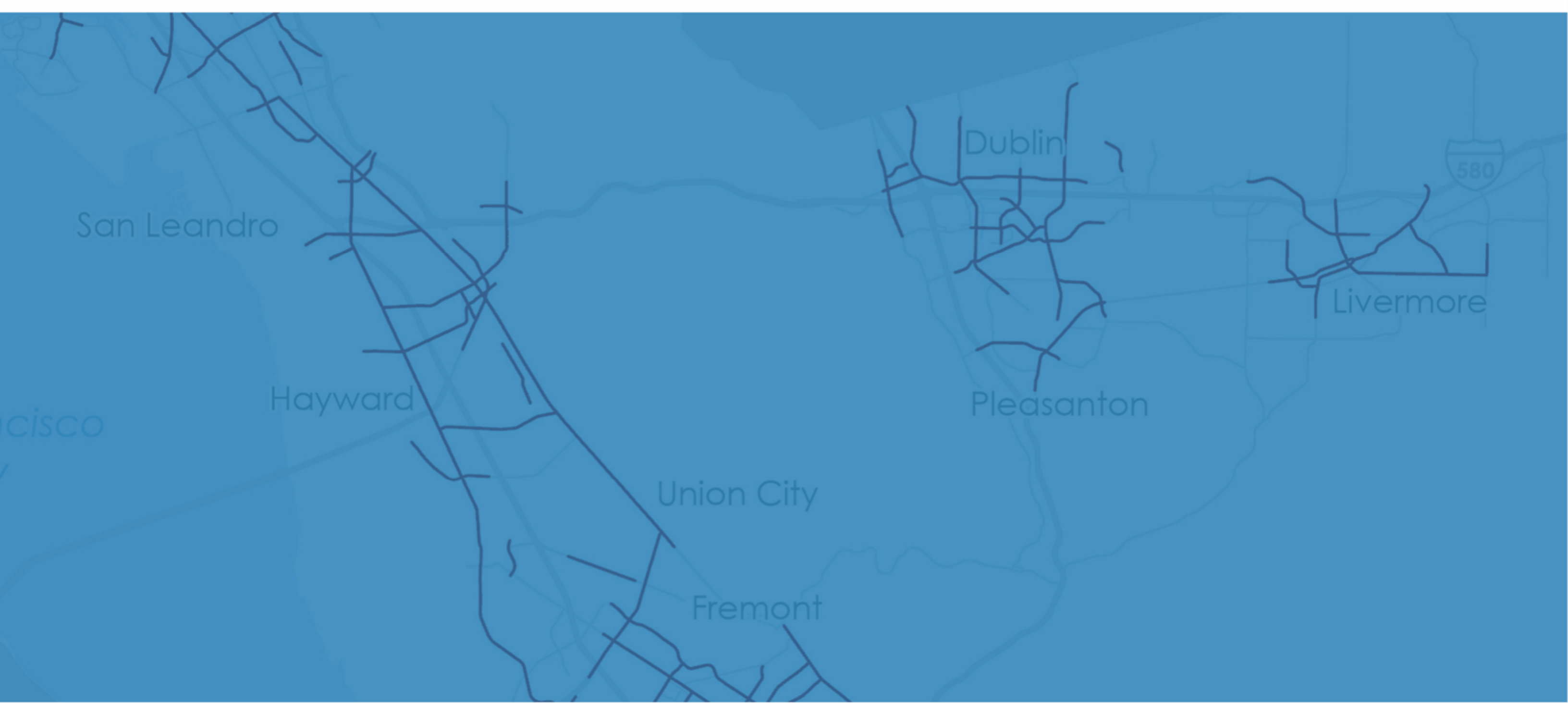
Attachment B Traffic and Safety Technical Report

Final

04-2X310: I-580/I-680 Interchange Safety Improvements

Traffic and Safety Technical Report for the Pre-PID Phase

SEPTEMBER 2025



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SUMMARY

Alameda County Transportation Commission (Alameda CTC) contracted Fehr & Peers to assist in developing near-term concept improvements for the area surrounding the I-580/I-680 interchange in Dublin and Pleasanton, California, including:

- Eastbound and westbound I-580 spanning the Foothill Road/San Ramon Road to Hopyard Road/Dougherty Road interchanges, and
- Northbound and southbound I-680 spanning the Alcosta Boulevard to Stoneridge Boulevard interchanges.

Suggested improvements focus on delivering improved safety and operational outcomes to the study area. The project—titled the I-580/I-680 Interchange Safety Improvements Project—developed and investigated six Build alternatives to improve existing traffic and safety conditions in the study area.

To study the impacts of the six proposed alternatives, Fehr & Peers prepared a macro-level traffic and safety analysis, using the University of Florida's Highway Capacity Software (HCS) and the Federal Highway Administration's (FHWA) Interchange Safety Analysis Tool (ISAT) methodologies. This analysis aims to quantitatively assess the concepts' effects on baseline conditions in the project study area and identify a short list of recommended high-impact concepts that can be carried into the Project Initiation Document (PID) and future phases.

This report summarizes Existing and Opening Year conditions, describes the Build alternatives and analysis methodologies, and presents findings from the macro-level safety and traffic analyses. The findings in this report serve as the basis for the traffic operations section of the Pre-PID Conceptual Screening Study for the project.

This report examines two analysis scenarios:

- Opening Year 2030 No Build
- Opening Year 2030 Build

While **Chapter 2** summarizes Existing Conditions collision and traffic data, the focus of the study is on Opening Year conditions and analysis findings related to traffic and safety benefits between No Build versus Build conditions.

1. Introduction

Interstate 580 (I-580) is an east-west interstate freeway that runs from San Joaquin County to Marin County in California, while Interstate 680 (I-680) is a north-south interstate freeway that runs from Santa Clara County to Solano County. The project study area includes the I-580 and I-680 corridors in Alameda County spanning the cities of Dublin and Pleasanton. The I-580/I-680 Interchange Safety Improvements Project ("Project") proposes development of concept improvements to be implemented in the project study area, targeting near-term safety and corridor operations benefits. The study area is divided into two segments:

- Eastbound and westbound I-580 from Foothill Road to Hopyard Road (PM R21.78 to PM R19.61)
- Northbound and southbound I-680 from Alcosta Boulevard to Stoneridge Drive (PM R18.99 to PM R21.88)

1.1. Report Purpose

The project development team (PDT) is investigating a set of concept improvements for implementation in the study area surrounding the I-580/I-680 interchange in Pleasanton, CA. During the next phase, a Project Initiation Document (PID) will be completed by Caltrans and used to determine which concept improvements will advance to the next stage of development, in accordance with the Caltrans Project Development Procedures Manual (PDPM). Consistent with the PDPM, this report serves as documentation of the safety and traffic analysis findings for the six proposed concept improvements. The intent of this report is to use readily available information and apply macro-level analysis and evaluation techniques to provide a technical foundation for advancing to a PID for the project.

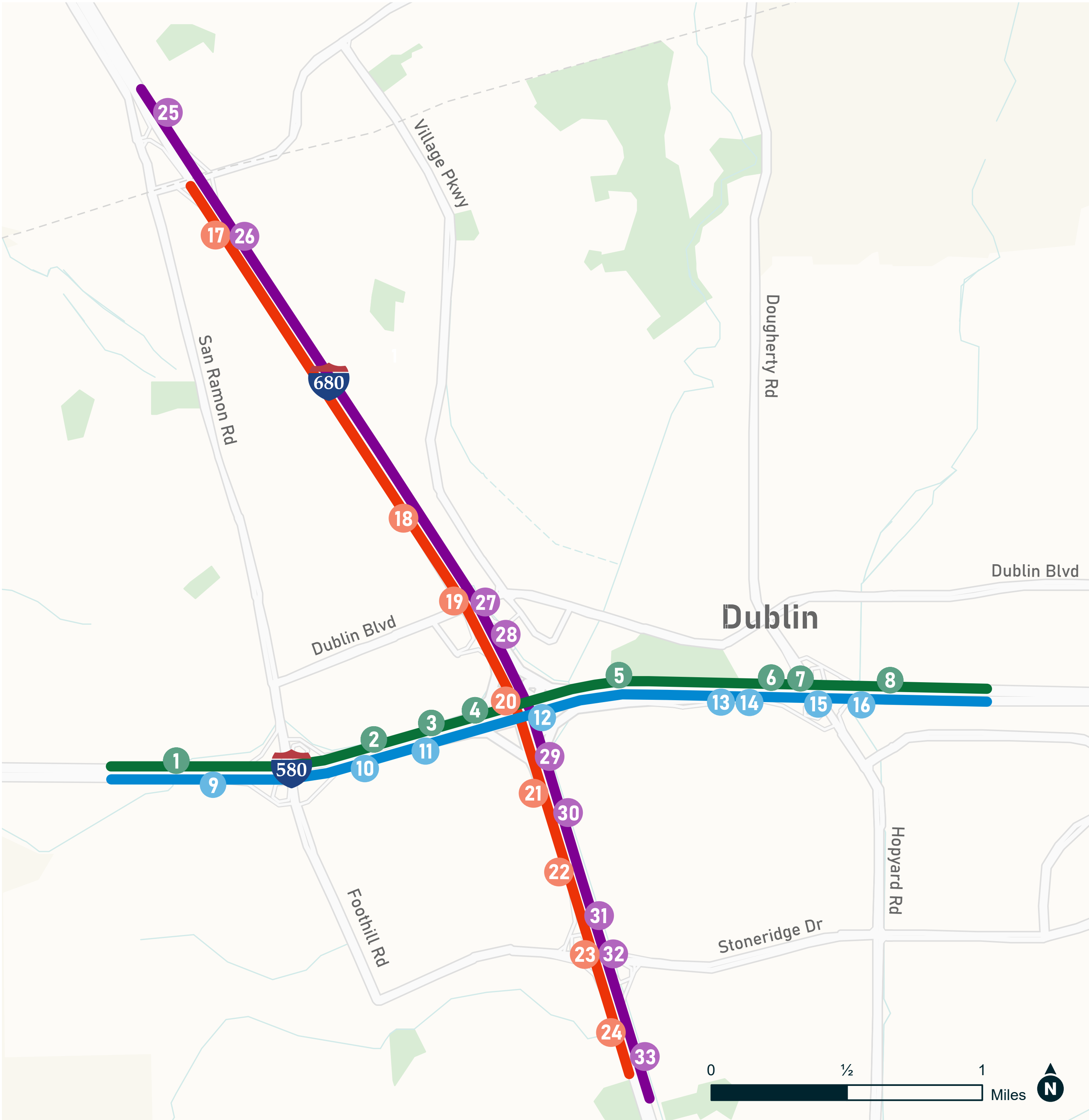
1.2. Traffic Study Area

The project study area includes the four following mainline facilities, and all study area on- and off-ramps are included:

- Eastbound I-580 from Foothill Road to Hopyard Road (PM R21.78 to PM R19.61[1])
- Westbound I-580 from Hopyard Road to Foothill Road (PM R19.61 to PM R21.78[1])
- Northbound I-680 from Stoneridge Drive to Alcosta Boulevard (PM R18.99 to PM R21.88)
- Southbound I-680 from Alcosta Boulevard to Stoneridge Drive (PM R21.88 to PM R18.99)

Figure 1 presents the project study area.

[1] Postmiles on I-580 run in reverse of the conventional west-to-east directionality due to a route numbering and directionality change in the 1960s and the extension of the route to San Rafael in the 1980s.



I-580 Westbound

1 Foothill Road on-ramp
2 Foothill Road off-ramp
3 I-680 Southbound on-ramp
4 I-680 Northbound on-ramp
5 I-680 off-ramp
6 Hopyard Road Southbound on-ramp
7 Hopyard Road Northbound on-ramp
8 Hopyard Road Northbound off-ramp

I-580 Eastbound

9 Foothill Road off-ramp
10 Foothill Road on-ramp
11 I-680 off-ramp
12 Hopyard Road off-ramp
13 I-680 Southbound on-ramp
14 I-680 Northbound on-ramp
15 Hopyard Road Southbound on-ramp
16 Hopyard Road Northbound on-ramp

I-680 Southbound

17 Alcosta Boulevard on-ramp
18 Amador Plaza Road off-ramp
19 I-580 Westbound off-ramp
20 St. Patrick Way on-ramp
21 I-580 on-ramp
22 Stoneridge Drive off-ramp
23 Stoneridge Drive Westbound on-ramp
24 Stoneridge Drive Eastbound on-ramp

I-680 Northbound

25 Alcosta Boulevard on-ramp
26 Alcosta Boulevard off-ramp
27 Village Parkway on-ramp
28 I-580 Westbound on-ramp
29 I-580 Westbound off-ramp
30 I-580 Eastbound off-ramp
31 Stoneridge Drive Westbound on-ramp
32 Stoneridge Drive Eastbound on-ramp
33 Stoneridge Drive off-ramp

Figure 1

Project Study Area

Fehr & Peers

1.3. Data Sources

Table 1 summarizes the data sources used to prepare this document. The data generally corresponds to weekdays, with INRIX travel time and delay data specifically sourced from May 2024 weekdays, and the collision data is collected from 2019 to 2024, to represent typical existing conditions. The data sources represent available data in the study area; future analysis work will be completed on the basis of an updated data set.

Table 1. Data Collection Summary

Data Description	Source	Dates
Corridor Travel Time **Reliability and Delay**	INRIX	Midweek days during May 2024
Mainline and ramp demand volumes	▪ I-680 Express Lanes Traffic Operational Analysis Report (2019) ▪ Alameda CTC's Countywide Travel Demand Model	Representative weekday
Collision Data	▪ Caltrans Traffic Accident Surveillance and Analysis System (TASAS) ▪ UC Berkeley Transportation Injury Mapping System (TIMS)	July 1, 2019 to June 31, 2024

Source: Fehr & Peers, 2025.

1.4. Report Organization

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

- ***Chapter 2: Existing Conditions Summary*** – summarizes weekday peak hour traffic and crash data for the study area.
- ***Chapter 3: Opening Year (2030) Conditions Summary*** – summarizes the traffic operations analysis and safety analysis conducted for freeway segments during Opening Year weekday peak hour under No Build and Build Alternatives.
- ***Chapter 4: Traffic Studies Scope for the PID and PA&ED Phase*** – describes the scope of work for potentially more detailed studies to be conducted during the Project Approval and Environmental Document (PA&ED) stage of project development.
- ***Chapter 5: Summary*** – recaps the key operational findings informing PID development.

2. Existing Conditions Summary

This section summarizes recent collision statistics in the study area and presents the current study area operating conditions using readily available data.

2.1. Collision Data

This section summarizes recent five-year collision history from Caltrans' Traffic Accident Surveillance and Analysis System (TASAS) and UC Berkeley's Traffic Incident Management System (TIMS) database.

Table 2 shows collision rates along mainline facilities within the study area and compares those rates against average collision rates for similar facilities. The 2019–2024 TASAS collision history indicates the eastbound and westbound I-580 mainline facilities experience a higher fatal collision rate than similar facilities. The westbound I-580 mainline also experiences higher collision rates than average for all reported collision types.

Table 2. TASAS Table B Collision Rates (July 1, 2019–June 30, 2024)

Mainline Facility within Project Study Area	Actual Collision Rate (per million vehicle miles)			Average Collision Rate (per million vehicle miles)		
	Fatal Collision Rate	Fatal + Injury Collision Rate	Total Collision Rate[1]	Fatal Collision Rate	Fatal + Injury Collision Rate	Total Collision Rate[1]
Eastbound I-580	**0.005**	0.31	0.98	0.004	0.36	1.13
Westbound I-580	**0.005**	**0.40**	**1.42**	0.004	0.36	1.13
Southbound I-680	0.003	0.20	0.60	0.005	0.37	1.14
Northbound I-680	0.003	0.17	0.62	0.005	0.37	1.14

Source: Traffic Accident Surveillance and Analysis (TASAS) Table B, Caltrans Public Records Request.
Notes:

1. Reported total collision includes Property Damage Only (PDO) Collisions.

Bolded values indicate that the actual collision rate exceeds the average collision rates for similar mainline facilities within the same time period.

Table 3 presents the number of collision along mainline facilities within the study area. The 2019-2024 TASAS data indicates that among all collisions along I-580, the westbound facility accounts for nearly 60% of total collisions. Along I-680, the northbound and southbound mainline has an approximately similar number of total collisions.

Table 3. TASAS Table B Collision Numbers (July 1, 2019–June 30, 2024)

Mainline Facility within Project Study Area	Number of Collisions				
	Total[1]	Fatal	Serious Injury	Other Injury	Property Damage Only (PDO)
Eastbound I-580	392	2	1	120	269
Westbound I-580	564	2	5	153	404
Southbound I-680	208	1	5	64	138
Northbound I-680	215	1	7	51	156

Source: Traffic Accident Surveillance and Analysis (TASAS) Table B, Caltrans Public Records Request.
Note:

1. Reported total collision includes Property Damage Only (PDO) Collisions.

Table 4 presents a detailed analysis of reported collision types. TASAS data indicates a high percentage of rear-end collisions across all mainline facilities, making up 55-60% of collisions along I-580 and approximately 35% of collisions along I-680. Sideswipe collisions make up over 30% of all collisions for all mainline facilities. Along southbound and northbound I-680, there is also a strong presence of hit object collisions, accounting for over a quarter of all collisions.

Table 4. TASAS Table B Collision Types (July 1, 2019–June 30, 2024)

Collision Types	Mainline Facility within Project study area			
	Eastbound I-580	Westbound I-580	Southbound I-680	Northbound I-680
Head-on	0.3%	0.0%	1.0%	0.9%
Sideswipe	33.4%	30.0%	32.2%	31.2%
Rear-end	55.6%	59.2%	35.6%	34.4%
Broadside	0.8%	0.5%	1.4%	0.9%
Hit Object	8.4%	9.4%	26.4%	27.0%
Overturn	1.3%	0.7%	2.9%	5.1%
Auto-Pedestrians	0.0%	0.2%	0.0%	0.5%
Other	0.3%	0.0%	0.5%	0.0%

Source: Traffic Accident Surveillance and Analysis (TASAS) Table B, Caltrans Public Records Request.
Note:

1. Reported as percentage of total collisions.

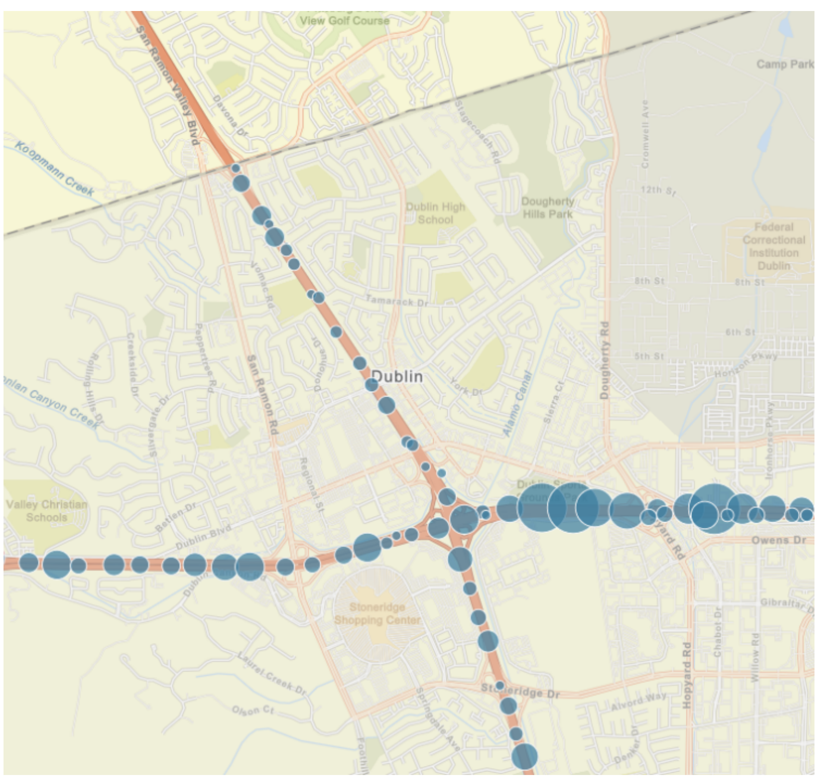
Table 5 shows a detailed analysis of primary collision factors. From 2019 to 2024, speeding is reported as a primary collision factor for over a third of total collisions along I-680 and over half of total collisions along I-580. Along southbound and northbound I-680, improper turning is the reported primary collision factor for over 20% of total collisions.

Table 5. TASAS Table B Primary Collision Factors (July 1, 2019–June 30, 2024)

Primary Collision Factor	Mainline Facility within Project Study Area			
	Eastbound I-580	Westbound I-580	Southbound I-680	Northbound I-680
Influence of alcohol	5.4%	2.5%	7.2%	11.6%
Follow too close	0.3%	0.9%	0.0%	0.0%
Failure to yield	0.0%	0.2%	0.0%	0.0%
Improper turn	12.0%	9.2%	**20.2%**	**20.9%**
Speeding	52.3%	**52.3%**	**35.6%**	**32.1%**
Other violation	27.3%	31.7%	31.3%	29.3%
Improper driving	0.0%	0.0%	0.0%	0.0%
Other	2.8%	2.7%	4.8%	5.6%
Unknown	1.0%	0.5%	1.0%	0.5%

Source: Traffic Accident Surveillance and Analysis (TASAS) Table B, Caltrans Public Records Request.
Note:
1. Reported as percentage of total collisions.

UC Berkeley's TIMS collision database shows collision locations along mainline facilities within the project study area. The collision cluster map in **Figure 2** indicates a collision hotspot along I-580 between the I-580/I-680 interchange and the Hopyard Road/Dougherty Road interchange. This may be due to the short merging distances drivers experience when entering the westbound mainline at the Hopyard/Dougherty interchange and having to weave to the leftmost lanes to stay on the freeway.



Collisions along I-680 are more spread out along the mainline, and there is no apparent hotspot, although there is a noted collision density centered around the I-580/I-680 interchange connection points, particularly along the I-580 to southbound I-680 connector ramps.

Figure 2. TIMS Collision Cluster map (July 1, 2019–June 30, 2024)

2.2. Travel Times and Speed Data

Existing travel times on the freeway corridors were determined based on INRIX travel speed data obtained for a typical midweek day during May 2024. **Table 6** and **Table 7** describe the average travel times and travel speeds along the corridor during the AM and PM peak periods, respectively. For consistency with typical commute periods, the AM peak period is defined as 6 to 9 AM, and the PM peak period is defined as 3 to 7 PM.

Table 6. Average Midweek Day Travel Times and Speeds during AM Peak Period

Time Period	Average Travel Time (minutes)	Average Speed (miles per hour)
Eastbound I-580		
6:00 AM	3.73	65.58
7:00 AM	3.78	64.64
8:00 AM	3.88	62.94
9:00 AM	3.90	62.69
Westbound I-580		
6:00 AM	4.07	56.25
7:00 AM	4.05	56.39
8:00 AM	4.15	54.92
9:00 AM	4.43	51.51
Southbound I-680		
6:00 AM	3.67	60.40
7:00 AM	4.35	50.87
8:00 AM	4.30	51.52
9:00 AM	3.77	58.84
Northbound I-680		
6:00 AM	3.37	66.21
7:00 AM	3.45	64.61
8:00 AM	3.55	62.74
9:00 AM	3.52	63.52

Source: INRIX, 2025.

Table 7. Average Midweek Day Travel Times and Speeds during PM Peak Period

Time Period	Average Travel Time (minutes)	Average Speed (miles per hour)
Eastbound I-580		
3:00 PM	14.28	17.17
4:00 PM	14.57	16.84
5:00 PM	13.13	18.68
6:00 PM	7.85	31.25
Westbound I-580		
3:00 PM	3.82	59.85
4:00 PM	4.30	53.19
5:00 PM	5.27	43.32
6:00 PM	3.62	63.12
Southbound I-680		
3:00 PM	3.45	64.15
4:00 PM	3.43	64.55
5:00 PM	3.42	64.88
6:00 PM	3.28	67.47
Northbound I-680		
3:00 PM	3.70	60.32
4:00 PM	3.50	63.84
5:00 PM	3.55	62.77
6:00 PM	3.45	64.49

Source: INRIX, 2025.

Figure 3 shows the average travel speed INRIX data along mainline facilities on a typical midweek day in May 2024.

During the AM peak period, between 6 to 10 AM, travel speeds exceed 50 miles per hour (mph) for all mainline facilities. Travel speed data along I-680 shows a more than 10 mph decrease during the peak commute period compared to typical travel.

During the PM peak period, between 3 and 7 PM, travel speed data shows a steep decrease for eastbound and westbound I-580, while typical travel speeds along I-680 remain above 60 mph. There is significantly high speed variability along eastbound I-580, as travel speeds differ by over 50 mph depending on time of day. This low travel time reliability leads to heightened frustration for drivers navigating the corridor, and drivers often make last-minute lane changes to exit the highway early when hitting the back of queue.

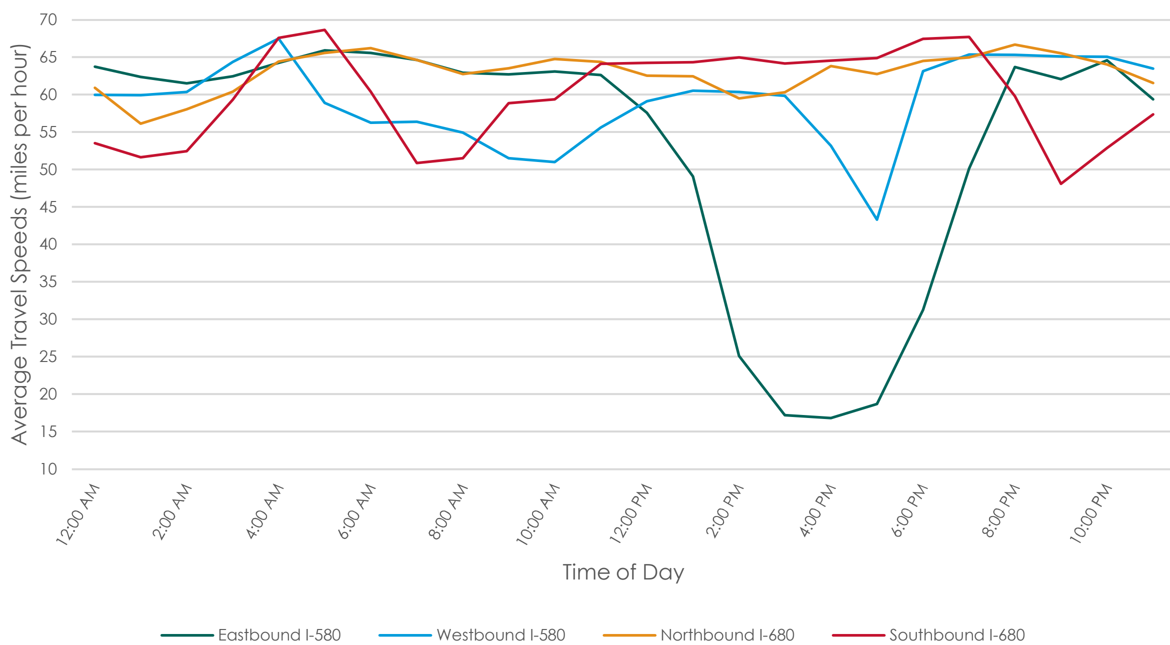


Figure 3. Average Travel Speeds along Mainline Facility during Midweek Day in May 2024

2.3. Traffic Data

Mainline and ramp AM and PM peak hour demand volumes were developed from reference volumes in Alameda CTC's off-the-shelf Countywide Travel Demand Model and the 2019 I-680 Express Lanes Traffic Operational Analysis Report (TOAR)'s Year 2025 scenario.

Appendix A describes the Year 2025 AM and PM peak hour volumes developed in the 2019 Express Lanes TOAR.

Appendix B describes the Existing Conditions mainline and ramp AM and PM peak hour demand volumes obtained from Alameda CTC's Countywide Travel Demand Model for Year 2020.

3. Opening Year (2030) Conditions Summary

This section describes the proposed conceptual improvements, also referred to as Build alternatives, and summarizes the preliminary assessment of traffic and safety impacts under the No Build alternative and each Build alternative.

3.1. Build Alternatives

Table 8 describes the concept improvements developed for the project study area. A total of six geometric concept improvements are proposed: three focusing on improvements to the I-680 mainline, and three focusing on I-580. These improvements are focused on an interchange or specific mainline segment within the study area to highlight hotspot treatments. Each concept improvement is considered as a separate and independent Build alternative under this analysis. **Appendix C** describes the concept improvements, also referred to as Build alternatives.

In addition, seven programmatic improvements were developed to improve visibility, wayfinding, and emergency response within the study area. The programmatic improvements are assumed to be implemented in parallel with the six previously mentioned concept improvements, and their impacts are not studied as separate Build alternatives under this analysis.

Table 8. Proposed Concept Improvements

Concept	Concept Description	Description of Improvements
Improvements to I-680		
1	Southbound I-680 merge improvements	▪ Harden separation between westbound I-580 to southbound I-680 connector and St. Patrick Way on-ramp. ▪ Maintain existing merge between eastbound and westbound I-580 to southbound I-680 connectors and join southbound I-680 mainline as an auxiliary lane.
2	Westbound I-580 to southbound I-680 loop ramp widening	▪ Merge St. Patrick Way on-ramp as soon as possible to maximize weave distance and install hardened separation between mainline and freeway-to-freeway connectors. ▪ Add second lane on loop ramp from westbound I-580 to southbound I-680. ▪ Add ramp metering individually to the eastbound and westbound I-580 connectors to southbound I-680 to manage flow into southbound I-680 auxiliary lane.
3	Southbound I-680/ Stoneridge Drive run-out lane	▪ Reduce southbound I-680 Stoneridge Drive off-ramp to single lane optional exit. ▪ Extend auxiliary lane beyond off-ramp as a run-out lane.
Improvements to I-580		
4	Eastbound I-580/ Foothill Road consolidation	▪ Close eastbound diagonal on-ramp. ▪ Widen eastbound loop on-ramp. ▪ Install dual left-turn pockets on northbound Foothill Road.

Concept	Concept Description	Description of Improvements
	Westbound I-580/ Foothill Road consolidation	▪ Close westbound diagonal off-ramp. ▪ Close westbound loop on-ramp. ▪ Construct westbound loop off-ramp. ▪ Widen westbound diagonal on-ramp to three lanes. ▪ Install dual left-turn pockets on northbound San Ramon Road.
5	Westbound I-580/ Hopyard/Dougherty Road consolidation	▪ Close westbound diagonal on-ramp. ▪ Widen westbound loop on-ramp. ▪ Install dual left-turn pockets on southbound Dougherty Road.
6	Maintain four lanes on eastbound I-580	▪ Eliminate lane drop on eastbound I-580 mainline and extend fourth lane. ▪ Maintain two lanes on flyover connector from southbound I-680 to eastbound I-580. ▪ Revise striping to meet mainline earlier with two auxiliary lanes, then merge to one lane with 50:1 taper prior to addition of northbound I-680 to eastbound I-580 connector.
Programmatic Improvements – Common to all Concepts		
P1	Enhanced Maintenance Program	▪ Specific funding source to allow for quick response to maintenance issues: pothole repair, restriping, guardrail and other safety repairs, etc.
P2	Traffic Incident Management (TIM)	▪ Consists of a planned and coordinated multi-disciplinary process to detect, respond to, and clear traffic incidents so that traffic flow may be restored as safely and quickly as possible. ▪ Construct strategically placed maintenance vehicle pull-outs (MVPs) for enhanced response.
P3	High Performance Pavement Marking	▪ Use of high-contrast and wet retro reflectivity pavement markings for better visibility and vehicular guidance.
P4	Lane Lighting	▪ Use of lighted pavement markers, or Smart-stud systems to guide and enforce the use of lanes as either optional or drop lanes, depending on demand.
P5	Safety ITS elements on westbound I-580	▪ Add activated blank-out signage on westbound I-580 mainline to warn drivers of stopped traffic ahead.
P6	Northbound I-680 to westbound I-580 loop ramp meter	▪ Add ramp metering along loop connector from northbound I-680 to westbound I-580.
P7	Southbound I-680 signage improvements	▪ Revise signs along southbound I-680 to avoid "trap" condition for southbound I-680 to westbound I-580 connector, reduce confusion with "Dublin" as a control city. ▪ Improve signage for Dublin Boulevard exit, currently low visibility on the southbound I-680 to eastbound I-580 connector. ▪ Improve warning for lane drop beyond westbound I-580 connector.

Source: Fehr & Peers and HNTB, 2025.

3.2. Future Traffic Forecasts

Opening Year traffic volumes were developed by applying a linear growth rate of 1% to the Existing Conditions volumes in order to achieve a set of Year 2030 peak hour demand volumes for the project. By using these forecast volume sets, the analysis takes impacts from the express lanes and near-term projects on mainline and ramp operations into consideration.

Appendix D describes the Opening Year 2030 mainline and ramp peak hour demand volumes used for the analysis.

3.3. Traffic Analysis

This section summarizes the HCS traffic analysis methodology and preliminary findings for the Opening Year No Build and Build conditions.

3.3.1. Traffic Analysis Methodology

Highway Capacity Software (HCS) uses concepts and guidelines from the Transportation Research Board (TRB)'s *Highway Capacity Manual* (HCM) to evaluate and analyze the capacity and level of service (LOS) for freeway facilities, including mainlines and interchanges. By taking into consideration geometric inputs such as number of lanes, lane width, and roadway curvature, and volume inputs such as demand volumes, the HCS method calculates the traffic stream density of the freeway segments and evaluates the segments' level of service based on the calculated density. Due to these inputs, HCS analysis is primarily used to analyze freeway mainline segments.

The HCS analysis method aims to compare the change in traffic density for impacted segments for each concept improvement under No Build and Build conditions.

3.3.2. Traffic Analysis Findings

No Build Conditions

Table 9 describes traffic density under No Build conditions during the AM and PM peak hour.

- During the AM peak hour:
  - The eastbound I-580 mainline generally operates at LOS D or above.
  - The westbound I-580 mainline experiences congestion between Hopyard Road off-ramp and the ramp connectors to I-680, at the I-580/I-680 interchange.
  - The southbound I-680 mainline generally operates at LOS D or above.
  - The northbound I-680 mainline experiences high congestion between ramp connectors at the I-580/I-680 interchange.
- During the PM peak hour:
  - The eastbound I-580 mainline experiences congestion between the Foothill Road off-ramp and southbound I-680 ramp connector.
  - The westbound I-580 mainline generally operates at LOS D or above.
  - The southbound I-680 mainline experiences congestion between the successive on-ramps from I-580 and St. Patrick Way.
  - The northbound I-680 mainline generally operates at LOS E or above.

Appendix E shows the HCS worksheets for all segments within the study area under Opening Year No Build conditions.

Table 9. Average Traffic Density and Level of Service (LOS) under Opening Year No Build Conditions

Freeway Corridor	Freeway Segment	Segment Type	Traffic Conditions during AM Peak Hour		Traffic Conditions during PM Peak Hour	
			Density (pc/mi/ln)[2]	LOS	Density (pc/mi/ln)[2]	LOS
Eastbound I-580	Foothill Road Off-ramp	Diverge	28	D	41	E
	Foothill Road Off-ramp to Foothill Road On-ramp	Basic	20	C	**47**	**F**
	Foothill Road On-ramp to Southbound I-680 Off-ramp[1]	Weaving	24	C	**47**	**F**
	Foothill Road Off-ramp to Hopyard Road Off-ramp	Diverge	20	C	**51**	**F**
	Hopyard Road Off-ramp to Southbound I-680 On-ramp	Basic	11	A	**77**	**F**
	Hopyard Road Off-ramp to Southbound I-680 On-ramp (after lane drop)	Basic	15	B	39	E
	Southbound I-680 On-ramp	Basic	19	C	29	D
	Southbound I-680 On-ramp (after lane add)	Basic	19	C	30	D
	Hopyard Southbound Loop On-ramp	Basic	18	B	23	C
	Hopyard Northbound Hook On-ramp	Basic	24	C	34	D
Westbound I-580	Hopyard Road Off-ramp	Diverge	25	C	20	C
	Hopyard Road Off-ramp to Hopyard Road Northbound On-ramp	Basic	**46**	**F**	29	D
	Hopyard Road Northbound On-ramp	Basic	**50**	**F**	19	C
	Hopyard Road Southbound On-ramp	Basic	28	D	22	C
	I-680 Off-ramps	Diverge	36	E	30	D
	I-680 Off-ramps to Express Lane End	Basic	39	E	22	C
	Express Lane End to I-680 Northbound On-ramp	Basic	25	C	16	B
	I-680 Northbound On-ramp	Basic	18	B	15	B

Freeway Corridor	Freeway Segment	Segment Type	Traffic Conditions during AM Peak Hour		Traffic Conditions during PM Peak Hour	
			Density (pc/mi/ln)[2]	LOS	Density (pc/mi/ln)[2]	LOS
	Southbound I-680 On-ramp to Foothill Road Off-ramp[1]	Weaving	33	D	25	C
	Foothill Road Off-ramp to Foothill Road On-ramp	Basic	27	D	19	C
	Foothill Road Off-ramp to Foothill Road On-ramp (after lane drop)	Basic	38	E	24	C
	Foothill Road On-ramp	Basic	28	D	19	C
Southbound I-680	Alcosta Boulevard Off-ramp to Alcosta Boulevard On-ramp	Basic	29	D	42	E
	Alcosta Boulevard hook On-ramp	Merge	23	C	26	C
	Alcosta Boulevard Diagonal On-ramp	Merge	21	C	24	C
	Alcosta Boulevard Diagonal On-ramp to Eastbound I-580 Off-ramp	Basic	30	D	36	E
	Alcosta Boulevard Diagonal On-ramp to Eastbound I-580 Off-ramp	Basic	24	C	27	D
	Eastbound I-580 Off-ramp & Dublin Boulevard Off-ramp	Diverge	28	D	31	D
	Westbound I-580 Off-ramp	Diverge	20	C	24	C
	Westbound I-580 Off-ramp to Dublin Boulevard On-ramp	Basic	13	B	**86**	**F**
	Westbound I-580 Off-ramp to Dublin Boulevard On-ramp (after lane drop)	Basic	17	B	**95**	**F**
	Dublin Boulevard On-ramp	Merge	23	C	30	D
	Westbound and Eastbound I-580 On-ramp to Stoneridge Drive Off-ramp[1]	Weaving	18	B	20	C
	Stoneridge Drive Off-ramp to Stoneridge Drive On-ramp	Basic	15	B	15	B
	Stoneridge Drive Loop On-ramp	Merge	21	C	26	C
	Stoneridge Drive Diagonal On-ramp	Merge	19	C	29	D
	Stoneridge Drive Off-ramp	Diverge	38	E	41	E

Freeway Corridor	Freeway Segment	Segment Type	Traffic Conditions during AM Peak Hour		Traffic Conditions during PM Peak Hour	
			Density (pc/mi/ln)[2]	LOS	Density (pc/mi/ln)[2]	LOS
Northbound I-680	Stoneridge Drive Off-ramp to Loop On-ramp	Basic	30	D	35	D
	Stoneridge Drive Loop On-ramp	Merge	34	D	45	E
	Stoneridge Drive Diagonal On-ramp	Merge	29	D	36	E
	Eastbound I-580 Off-ramp	Diverge	36	E	36	E
	Westbound I-580 Off-ramp	Diverge	29	D	34	D
	Westbound I-580 Off-ramp to Eastbound I-580 On-ramp	Basic	**91**	**F**	22	C
	Westbound I-580 Off-ramp to Eastbound I-580 On-ramp (after lane drop)	Basic	39	E	41	E
	Eastbound I-580 On-ramp	Basic	23	C	21	C
	Westbound I-580 On-ramp	Basic	19	C	25	C
	Dublin Boulevard On-ramp	Basic	34	D	32	D
	Dublin Boulevard On-ramp to Alcosta Boulevard Off-ramp	Basic	24	C	26	C
	Dublin Boulevard On-ramp to Alcosta Boulevard Off-ramp (after lane drop)	Basic	33	D	37	E
	Alcosta Boulevard Off-ramp	Diverge	29	D	36	E
	Alcosta Boulevard Off-ramp to Alcosta Boulevard On-ramp	Basic	29	D	23	C
	Alcosta Boulevard On-ramp	Merge	37	E	30	D

Source: Fehr & Peers, 2025.

Notes:

1. Weave segment LOS determined in Leisch analysis.
2. Traffic density is measured passenger car per mile per lane.

Weave segment analysis was also supplemented with Leisch analysis, as shown in **Table 10**. The Leisch analysis method was developed to evaluate the operational performance of weave segments, based on traffic volumes, segment lengths, and number of lanes available.

There are three weave segments in the study area, including the following:

- Eastbound I-580: between Foothill Road on-ramp to the southbound I-680 off-ramp
- Westbound I-580: between the southbound I-680 on-ramp to Foothill Road off-ramp
- Southbound I-680: between I-580 on-ramps to the Stoneridge Drive off-ramp

Appendix E also shows the Leisch worksheets for all three weave segments within the study area during AM and PM peak hour conditions. Since the Leisch method only considers number of lanes and demand volumes as inputs, there is no difference between Leisch results between Opening Year No Build and Build conditions.

Table 10. Leisch Method: Weave Segment Level of Service (LOS) under Opening Year No Build and Build Conditions

Freeway Corridor	Freeway Segment	Segment Type	LOS during AM Peak Hour	LOS during PM Peak Hour
Eastbound I-580	Foothill Road On-Ramp to Southbound I-680 Off-Ramp	Weaving	C	**F**
Westbound I-580	Southbound I-680 On-Ramp to Foothill Road Off-Ramp	Weaving	**F**	E
Southbound I-680	I-580 On-Ramps to Stoneridge Drive Off-Ramp	Weaving	**F**	**F**

Source: Fehr & Peers, 2025.

Build Conditions

Since each Build alternative focus on different key locations in the project study area, their effects are studied on different impacted segments. **Table 11** describes the average density and level of service for mainline segments impacted by each Build alternative.

Table 11. Average Traffic Density and Level of Service for Impacted Segments among Build Alternatives

Concept Improvement	Concept Description	Impacted Freeway Segments	AM Peak Hour		PM Peak Hour	
			Density (pc/mi/ln)[1]	LOS	Density (pc/mi/ln)[1]	LOS
Improvements to I-680						
1	Southbound I-680 merge improvements	N/A (no geometric changes)	N/A	N/A	N/A	N/A
2	Westbound I-580 to southbound I-680 loop ramp widening	Southbound I-680: Westbound and Eastbound I-580 On-ramp to Stoneridge Drive Off-ramp	14	B	18	C
3	Southbound I-680/ Stoneridge Drive run-out lane	Southbound I-680: Westbound and Eastbound I-580 On-ramp to Stoneridge Drive Off-ramp	18	B	20	C
Improvements to I-580						
4	I-580 / Foothill Road ramp consolidation	Eastbound I-580: Foothill Road Off-ramp to Foothill Road On-ramp	20	C	46	F

Concept Improvement	Concept Description	Impacted Freeway Segments	AM Peak Hour		PM Peak Hour	
			Density (pc/mi/ln)[1]	LOS	Density (pc/mi/ln)[1]	LOS
		Eastbound I-580: Foothill Road On-ramp to Southbound I-680 Off-ramp	24	C	43	F
		Westbound I-580: Foothill Road On-ramp	28	D	19	C
5	Westbound I-580 / Hopyard Road/Dougherty Road consolidation	Westbound I-580: Hopyard Road Off-ramp	25	C	20	C
		Westbound I-580: Hopyard Road Off-ramp to Hopyard Road Northbound On-ramp	46	F	29	D
6	Maintain four lanes on eastbound I-580	Eastbound I-580: Hopyard Road Off-ramp to Southbound I-680 On-ramp	11	A	28	D

Source: Fehr & Peers, 2025.
Note:
1. Traffic density is measured passenger car per mile per lane.

Table 12 describes the relative change in traffic density for each Build alternative between No Build and Build conditions during the AM and PM peak hour. **Appendix G** shows the HCS worksheets attached with each Build alternative.

Overall, the operations analysis shows the highest-scoring alternatives target the hotspot weave segments along the corridor and aim to limit weaving movements. Due to limitations within the HCS analysis, concepts that focus on ramp terminals and ramp segments and concepts that do not include geometric improvements on the mainline score lower impacts than those that focus on mainline segments. With the exceptions of Build alternatives 2 and 6, concepts generally score under 4% average traffic density reduction.

Table 12. Average Reduction in Traffic Density among Build Alternatives

Concept Improvement	Concept Description	Reduction in Traffic Density during AM Peak Hour	Reduction in Traffic Density during PM Peak Hour	Average Reduction in Traffic Density
Improvements to I-680				
1	Southbound I-680 merge improvements	0%	0%	0%
2	Westbound I-580 to southbound I-680 loop ramp widening	21%	11%	16%
3	Southbound I-680/ Stoneridge Drive run-out lane	0%	1%	1%

Improvements to I-580				
4	I-580 / Foothill Road ramp consolidation	2%	5%	4%
5	Westbound I-580 / Hopyard/Dougherty Road consolidation	1%	0%	1%
6	Maintain four lanes on eastbound I-580	27%	29%	28%

Source: Fehr & Peers, 2025.

Build Alternatives along I-680

Since alternative 1 focuses on installing hardened barriers between the westbound I-580 connector and St. Patrick Way on-ramp, there are no updates to mainline or ramp density and therefore zero reduction in traffic density on the mainline. However, the installation of hard separation between the ramp connectors will discourage last-minute lane changes and reduce weaving behaviors along this segment, therefore improving traffic conditions.

Similarly, alternative 2 proposes installation of hardened barriers, widens the westbound I-580 connector loop to two ramps, and adds ramp metering to the successive freeway connectors. This improves the ramp density and achieves 16% average reduction in traffic density.

Alternative 3 proposes to extend the auxiliary lane along southbound I-680 near the Stoneridge Drive off-ramp 900’ past the exit gore point and offers drivers a longer lane change distance to stay on the mainline. Since this is not a key congestion location, this achieves a less than 1% average reduction in traffic density.

Build Alternatives along I-580

Alternative 4 proposes to update ramp configurations at the San Ramon and Foothill Road interchange with westbound and eastbound I-580, respectively. This consolidates all ramps onto the west side of the local road and installs dual left-turn pockets along northbound Foothill Road for on-ramp access. This consolidation of on-ramp traffic achieves approximately 4% average reduction in traffic density.

Alternative 5 proposes to update ramp configurations at the Hopyard and Dougherty Road interchange with the westbound I-580 corridor by consolidating the on-ramp traffic to the east side of the local road and installing dual left-turn pockets on southbound Dougherty Road. Similar to alternative 4, this impacts ramp density but has minimal impact on mainline density; this alternative achieves a less than 1% average reduction in traffic density.

Under alternative 6, the extension of the fourth lane along I-580 reduces lane change movements between motorists approaching the southbound I-680 connector and allows for a more consistent flow pattern, achieving up to 28% average reduction in traffic stream density.

3.4. Safety Analysis

This section summarizes the ISAT safety analysis methodology and preliminary findings for the Opening Year No Build and Build conditions.

3.4.1. Safety Analysis Methodology

The Interchange Safety Analysis Tool uses predictive methods to assess safety impacts of proposed concepts on existing freeway segments, including mainlines, ramps segments, and ramp terminals. The ISAT method takes inputs such as mainline and ramp segments lane geometry, ramp configuration, ramp terminal intersection control, and collision data input, and evaluates the number of collisions under Build conditions. The ISAT method exclusively considers geometric improvements.

Through the ISAT method, the analysis aims to evaluate the average reduction in the number of total, fatal, and injury-inducing collisions for each concept improvement under No Build and Build conditions.

3.4.2. Safety Analysis Findings

No Build Conditions

Since the ISAT method is predictive based on geometric improvements, and Opening Year No Build conditions assumes zero changes to lane geometry, ramp intersection control, or any other inputs, there is zero reduction in collisions.

Build Conditions

Table 13 describes the relative reduction in collisions for each alternative under Build conditions. **Appendix G** shows the ISAT worksheets attached to each Build alternative.

Overall, the highest-scoring alternatives target auxiliary lane extensions along the I-680 and I-580 corridors near key ramp locations, leading to reduction in last-minute lane changes and weaving movements between vehicles staying on the mainline versus exiting and entering the highway.

Table 13. Average Reduction in Collisions among Build Alternatives

Concept Improvement	Concept Description	Average Reduction in Fatal Collisions	Average Reduction in Fatal + Injury-inducing Collisions	Average Reduction in Total Collisions
Improvements to I-680				
1	Southbound I-680 merge improvements	1%	0%	0%
2	Westbound I-580 to southbound I-680 loop ramp widening	2%	2%	1%

3	Southbound I-680/ Stoneridge Drive run-out lane	20%	19%	17%
Improvements to I-580				
4	I-580 / Foothill Road ramp consolidation	6%	5%	6%
5	Westbound I-580 / Hopyard/Dougherty Road consolidation	13%	7%	0%
6	Maintain four lanes on eastbound I-580	50%	19%	18%

Source: Fehr & Peers, 2025.

Build Alternatives along I-680

Alternatives 1 and 2 propose installation of hardened barriers between successive on-ramps along I-680 and focus on improving weaving behaviors between oncoming motorists and mainline traffic. Due to the ISAT safety analysis' focus on geometric improvements, these alternatives do not score as highly and are predicted to reduce total and fatal collisions by less than 1% and 2%, respectively.

Alternative 3 reduces the southbound I-680 Stoneridge Road exit to a single-lane optional exit. This allows for a longer merging distance for drivers trying to stay on the mainline after connecting from I-580 and has significant safety benefits for fatal and injury collision reduction, achieving up to 17% and 20% reductions in total and fatal collisions, respectively.

Build Alternatives along I-580

Alternatives 4 and 5 propose to re-construct ramp terminals along I-580 at San Ramon/Foothill Road and Hopyard/Dougherty Road, respectively. By consolidating on-ramp traffic to a single signalized entry point, these improvements break oncoming traffic into more manageable gaps and reduce mainline disruptions. These alternatives achieve between 6 to 13% average reduction in fatal collisions, and less than 6% average reduction in total collisions.

Out of all six Build alternatives, alternative 6 achieves the highest average reduction in fatal and total collisions. By eliminating the lane drop on eastbound I-580 before the southbound I-680 connector, this improvement reduces weaving movements across the I-580/I-680 connectors and targets a key segment, achieving up to 50% reduction in fatal collisions. This extension of the fourth lane with ramp metering installation along the freeway-to-freeway connectors may lead to a significant reduction in sideswipe collisions as drivers enter the freeway in more predictable breaks to the mainline traffic.

4. Traffic Studies Scope for the PID and PA&ED Phase

This report was developed per the PDPM to support the PID phase of this project. The next step will be to prepare a Traffic Operations Analysis Report (TOAR) for the Project Approval and Environmental Document (PA&ED) phase of the project. The scope of work, the technical approach, and alternatives for the TOAR will be developed through a series of discussions with the consultant team and Caltrans District 4 staff. The recommended scope of work represents an initial scoping of the traffic studies for the PID and PA&ED phase and will be refined at the start of the PID and PA&ED phase with input from the PDT and with consideration of other environmental studies at the I-580/I-680 interchange in Alameda County.

4.1. Traffic Operations Analysis Study Area and Analysis Year

The analysis will examine Existing Conditions and Opening Year Conditions. Considering the major project milestones and current schedule, the project team proposes a project Opening Year of 2030. The Traffic Operations Analysis Memorandum's Existing Year is 2026. The study area includes the following corridor segments that will be reported independently:

- Eastbound I-580 from Foothill Road to Hopyard Road (PM R21.78 to PM R19.61)
- Westbound I-580 from Hopyard Road to Foothill Road (PM R19.61 to PM R21.78)
- Northbound I-680 from Stoneridge Drive to Alcosta Boulevard (PM R21.88 to PM R18.99)
- Southbound I-680 from Alcosta Boulevard to Stoneridge Drive (PM R18.99 to PM R21.88)

The analysis will be performed in one model to consider impacts on both the I-580 and I-680 mainline corridors. Additionally, Fehr & Peers will analyze weekday AM and PM study period traffic operations using the data collected as outlined in the Data Collection section of this report. The study periods for the PA&ED phase focus on the following peak commute periods:

- AM Study Period: 5 AM to 11 AM
- PM Study Period: 3 PM to 8 PM

4.2. Data Collection

As noted in **Section 1.3**, the future traffic analysis will be based on an updated data set.

4.2.1. Travel Time/Speed Information

Travel time/speed information will be used to identify bottleneck locations and queue extents within the study area, and for traffic analysis model calibration and validation. INRIX provides a traffic flow archive with the ability to access speeds reported at the segment level for specific days and times of day. INRIX data is gathered from a variety of sources, including in-vehicle GPS systems, mobile smart phones, and roadway sensors. INRIX provides a much larger data set than could be collected by performing travel-time surveys utilizing the floating-car method and is therefore more reliable.

On freeways, INRIX speeds are an aggregate of speeds across all travel lanes (including HOV lanes, where provided). At locations where there are no HOV Lanes, INRIX speed data can be directly applied to represent traffic conditions on the general purpose (GP) lanes. At locations where an HOV lane is present, INRIX speed data can be adjusted to determine speeds on the GP Lanes. The following equation is used to estimate GP lane speeds at locations where an HOV lane is provided:

> *INRIX Speed = % GP Lane Traffic*GP Lane Speed + % HOV Lane Traffic*HOV Lane Speed; or*
>
> *GP Lane Speed = (INRIX Speed - % HOV Lane Traffic*HOV Lane Speed) / % GP Lane Traffic*

Percent GP lane traffic and percent HOV lane traffic are based on count data collected by a traffic count vendor or Caltrans Performance Measurement System (PeMS) data, and HOV lane speed data is based on field observations.

4.2.2. Traffic Volume Data

This section describes freeway mainline and ramps data collection locations.

Mainline Traffic Volumes

Mainline traffic volume data in the project study area will be provided through PeMS traffic count data obtained during spring 2026. Additionally, traffic volume data described in the previous section will be collected as displayed in **Figure 4** and listed below:

- All good data health and 100% observed PeMS mainline location on the project study area
- Westbound I-580 to Northbound I-680 connector
- Westbound I-580 to Southbound I-680 connector
- Eastbound I-580 to Northbound I-680 connector
- Eastbound I-580 to Southbound I-680 connector
- Northbound I-680 to Eastbound I-580 connector
- Northbound I-680 to Westbound I-580 connector
- Southbound I-680 to Eastbound I-580 connector

Occupancy and Clean Air Vehicles

Occupancy data and clean air vehicles (CAV) counts will be collected by traffic count vendor staff, positioned on overpasses overlooking the mainline in both directions, at the locations listed above. Unlike total vehicle traffic counts, which are ideally gathered at uncongested locations, occupancy and CAV are best collected at congested locations to allow more time to observe vehicle interiors. This data will be used as a percentage applied to mainline and ramp volumes as outlined above.

The following vehicle categories will be ascertained during two-hour AM/PM weekday periods (7–9 AM and 4–6 PM):

- SOV, HOV2, HOV3+, HOV two-seater with two persons, buses, CAVs that are not HOV3+

The project team is trying to maximize data collection resources for the project. It is in the project's best interest to collect multiple data locations instead of a few continuous data collection locations. The intent is to capture occupancy and CAV rates throughout the corridor. The variability by hour is normally small, such that it can be interpolated for a reasonable estimation. In addition, the data collection includes two-hour intervals in the middle of each of the peak periods to ensure coverage throughout the day.

Ramp Traffic Volumes

Ramp traffic volumes will be collected by tubes for all off- and on-ramps within the study area during spring 2026. It is proposed that these ramp volume data sets will be used to inform ramp volumes in the study area. The locations of on- and off-ramps where traffic counts will be collected can be found in **Figure 4** and listed below:

1. Westbound I-580: Foothill Road on-ramp
2. Westbound I-580: Foothill Road off-ramp
3. Westbound I-580: Southbound I-680 on-ramp
4. Westbound I-580: Northbound I-680 on-ramp
5. Westbound I-580: I-680 off-ramp
6. Westbound I-580: Hopyard Road southbound on-ramp
7. Westbound I-580: Hopyard Road northbound on-ramp
8. Westbound I-580: Hopyard Road northbound off-ramp
9. Eastbound I-580: Foothill Road off-ramp
10. Eastbound I-580: Foothill Road on-ramp
11. Eastbound I-580: I-680 off-ramp
12. Eastbound I-580: Hopyard Road off-ramp
13. Eastbound I-580: Southbound I-680 on-ramp
14. Eastbound I-580: Northbound I-680 on-ramp
19. Northbound I-680: Village Parkway on-ramp
20. Northbound I-680: Westbound I-580 on-ramp
21. Northbound I-680: Westbound I-580 off-ramp
22. Northbound I-680: Eastbound I-580 off-ramp
23. Northbound I-680: Stoneridge Drive westbound on-ramp
24. Northbound I-680: Stoneridge Drive eastbound on-ramp
25. Northbound I-680: Stoneridge Drive off-ramp
26. Southbound I-680: Alcosta Boulevard on-ramp
27. Southbound I-680: Amador Plaza Road off-ramp
28. Southbound I-680: Westbound I-580 off-ramp
29. Southbound I-680: St. Patrick Way on-ramp
30. Southbound I-680: I-580 on-ramp
31. Southbound I-680: Stoneridge Drive off-ramp

15. Eastbound I-580: Hopyard Road southbound on-ramp
16. Eastbound I-580: Hopyard Road northbound on-ramp
17. Northbound I-680: Alcosta Boulevard on-ramp
18. Northbound I-680: Alcosta Boulevard off-ramp
32. Southbound I-680: Stoneridge Drive westbound on-ramp
33. Southbound I-680: Stoneridge Drive westbound on-ramp

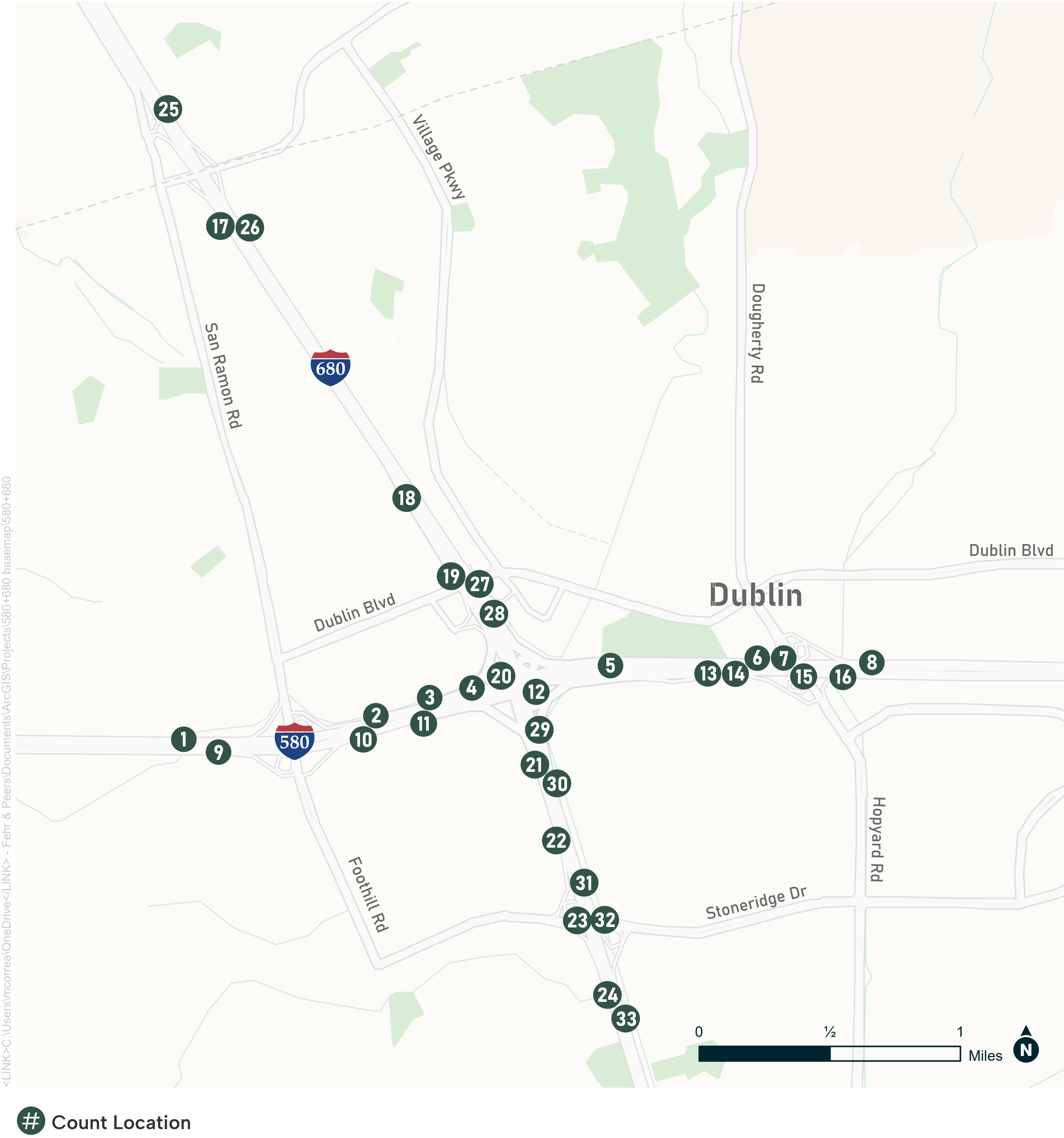


Figure 4

Traffic Count Locations

Fehr & Peers

4.3. Existing Conditions Traffic Operations Analysis

Generally speaking, an Existing Conditions Report outlining the traffic data collected as part of the PA&ED process must be completed. This report will ultimately be incorporated into the project TOAR. As part of the Existing Conditions analysis, weekday AM and PM peak periods operations analysis models will be developed for the study segments described above using a microsimulation software package, such as VISSIM. The microsimulation models will be calibrated and validated to existing conditions using typical District 4 standards for microsimulation model validation.

The measures of effectiveness (MOEs) include volume served, vehicle hours of delay (VHD), person hours of delay (PHD), density and level of service (LOS). GP average travel time, HOV average travel time, GP average travel speed, HOV average travel speed, GP maximum individual vehicle delay, and HOV maximum individual vehicle delay output will be provided based on *Highway Capacity Manual, 7th Edition* 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' comments; this report is to be submitted for final approval.

4.4. Traffic Forecasts

The adopted Plan Bay Area 2050 (2021) Regional Transportation Plan/Sustainable Communities Strategy improvement list prepared by MTC will be the primary source for determining which interstate and state route improvements to assume in the future.

The Opening Year (2030) traffic should be forecast by applying an average annual growth percentage to the Existing Conditions (2026) demand volume. The average annual growth percentage will be obtained from model outputs from either Alameda CTC's Countywide Travel Demand Model or MTC's Travel Demand Model One. The final annual growth factor will be developed in collaboration with Caltrans and Alameda CTC staff. No new forecast model runs or forecast model validation reports are anticipated to be prepared.

4.5. Vehicle Miles of Travel (VMT) Forecasts

The *Caltrans Transportation Analysis under CEQA* (TAC, September 2020) and *Caltrans Transportation Analysis Framework* (TAF, September 2020) were developed in response to Senate Bill (SB) 743 that changes the focus of transportation impact analysis in CEQA from level of service to vehicle miles traveled (VMT). The project is anticipated to be exempt from VMT evaluation since it is a non-capacity-increasing project. A Vehicle Miles Traveled Decision Document (VMTDD) will be prepared in accordance with the TAC and TAF VMT documents for submittal to the PDT and then on to district/headquarters review and approval.

4.6. Opening Year Operations Analysis

For Opening Year (2030) conditions, the microsimulation models will be updated to reflect expected future conditions, including the forecasted future traffic volumes and capital improvements anticipated to occur. The models will be used to determine the same MOEs as Existing Conditions for both the No Build and Build Alternatives.

4.7. Traffic Operations Analysis Report (TOAR) Documentation

The following deliverables will be provided to the project team for review and comment.

Traffic Analysis Assumption and Methodology Memorandum – A list of assumptions and recommended methodologies to use for traffic operational analysis and forecasting to support the Traffic Operations Analysis Report.

Existing Conditions Report – A summary of the data collection efforts, travel times, counts volumes, adjustments to count volumes to calculate demand volumes, crash rates, model calibrations, bottleneck observations (location, maximum queue, and duration), and observed existing traffic conditions within the study area (MOEs for intersections and corridors) will be presented for review and acceptance by Caltrans.

Travel Demand Forecasting Memorandum – The results of the traffic forecasting process will be presented in a Travel Demand Forecasting Memorandum for review and acceptance by Caltrans. The Travel Demand Forecasting Memorandum will present final forecasts to be used for the Opening Year traffic operations analysis.

Traffic Operations Analysis Report (TOAR) – The results of future year traffic operations analysis along with information contained in the deliverables discussed above will be presented in a standalone Draft Traffic Operations Analysis Report (Draft TOAR) for review and comment.

5. Summary

This report describes a pre-PID high-level evaluation of the Existing Conditions and Opening Year (2030) operating conditions along the I-580 and I-680 corridors within the I-580/I-680 interchange Safety Improvements Project study area located in Alameda County. It also includes a discussion of six proposed Build alternatives and a recommendation for the scope of more detailed traffic studies to be conducted as part of the PID phase. Although this analysis is only based on readily available information, the following general conclusions can be drawn:

- All Build alternatives would enhance operations along the mainline by reducing last-minute lane changes and weaving movements, either through hardened barriers, extended auxiliary lanes, or consolidated on-ramp traffic streams.
- Travel time improvements under the Build alternatives should be studied in future phases using a microsimulation model, with a focus on impacts on redirected traffic on local parallel corridors in Dublin and Pleasanton. If there is a travel time impact along the mainline, this differential in travel time would motivate users to choose to travel on local roads versus the freeway, leading to changes in local traffic patterns and volumes.

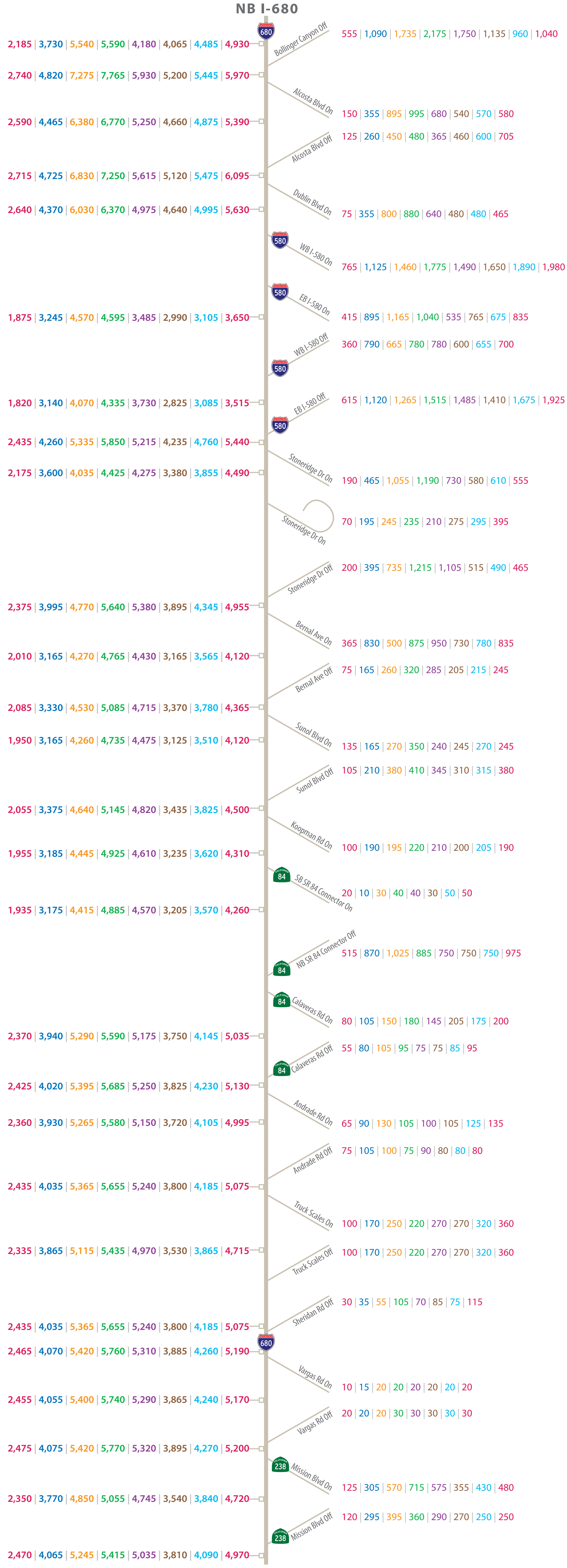
Through this traffic and safety analysis, the following concepts exhibit the potential to alleviate safety and traffic conditions within the project study area:

- Among the three alternatives focused on the I-680 corridor…
  - Alternative 1 proposes to install hardened barriers between the successive on-ramps along I-680 (St. Patrick Way and I-580 on-ramps) and is implicitly included in alternative 2 improvements.
  - Alternative 2 achieves the highest average reduction in traffic density. Although the ISAT analysis shows limited collision reduction potential, this is due to the analysis' focus on geometric improvements, and the installation of hardened barriers between successive I-680 on-ramps would improve weaving conditions between oncoming motorists and mainline traffic.
  - Alternative 3 achieves the highest reduction in collision potential, but limited reduction in traffic density.
- Among the three alternatives focused on the I-580 corridor…
  - Alternative 4 achieves medium impacts to collision potential and traffic density along the mainline. By consolidating and signalizing the on-ramp approaches at Foothill Road and San Ramon Road, this alternative leads to fewer breaks to the mainline traffic and fewer weaving movements.
  - Alternative 5 achieves a high collision reduction potential, but limited impacts to traffic density. By consolidating the on-ramps onto I-580 from Hopyard Road and Dougherty Road and installing a signal for vehicles entering the mainline, the alternative leads to fewer breaks to the mainline traffic and fewer weaving movements.

- Alternative 6 achieves the highest reduction in traffic density and collision potential out of all six Build alternatives. By extending the auxiliary lane along eastbound I-580 prior to the on-ramp from I-680, this leads to fewer lane change movements between mainline traffic and improved traffic conditions.

Appendix A: Year 2025 Opening Year Plus Project Demand Volumes from the 2019 TOAR for the I-680 Northbound Express Lanes Gap Project between SR-84 and Alcosta Boulevard

Year 2025 Conditions
NB I-680



5-6 AM | 6-7 AM | 7-8 AM | 8-9 AM | 9-10 AM | 10-11 AM | 11 AM-12 PM | 12-1 PM
Mainline Hourly Traffic Volumes (No Express Lane)

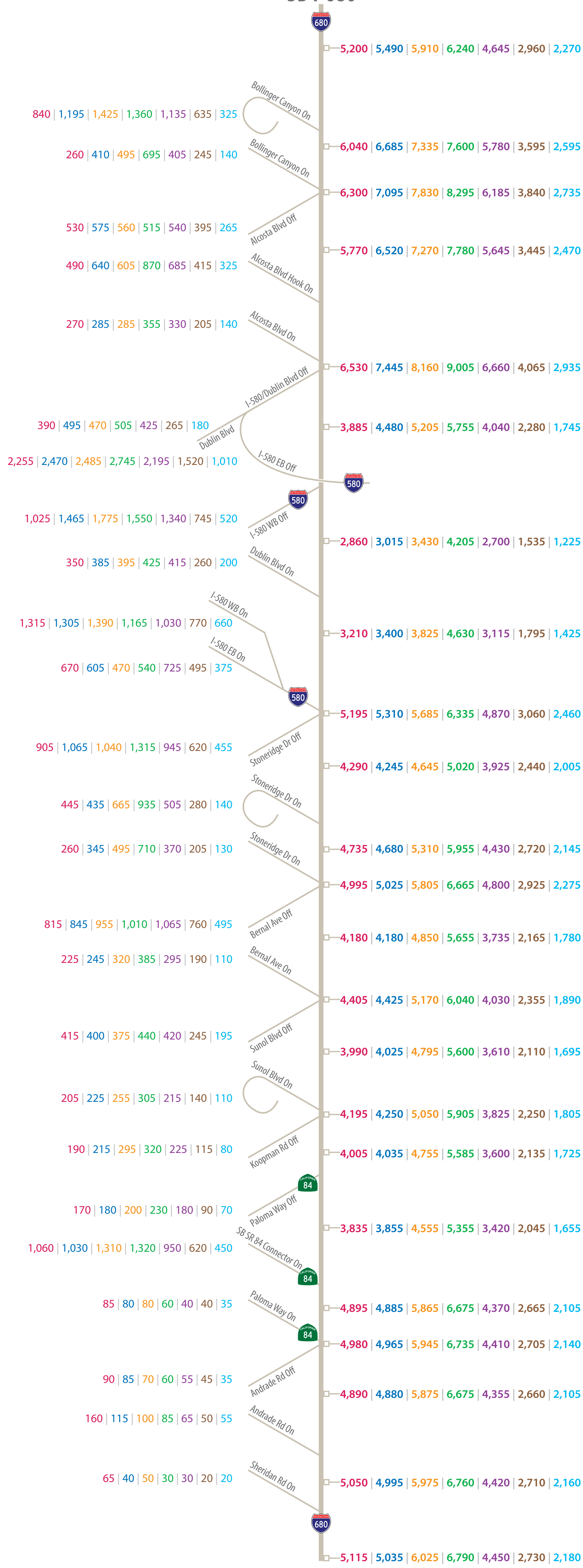
5-6 AM | 6-7 AM | 7-8 AM | 8-9 AM | 9-10 AM | 10-11 AM | 11 AM-12 PM | 12-1 PM
Ramp Hourly Traffic Volumes

Figure 5B

Year 2025 Plus Project I-680 Northbound AM Peak Period (5 AM-1 PM) Mainline and Ramp Demand Volumes

AM-PM-Count-Demand-Figures\WC17-3456_5A-B_2025-WP

Year 2025 Conditions
SB I-680



2-3 PM | 3-4 PM | 4-5 PM | 5-6 PM | 6-7 PM | 7-8 PM | 8-9 PM
Mainline Hourly Traffic Volumes (No Express Lane)

2-3 PM | 3-4 PM | 4-5 PM | 5-6 PM | 6-7 PM | 7-8 PM | 8-9 PM
Ramp Hourly Traffic Volumes

Figure 5C

Year 2025 Plus Project I-680 Southbound PM Peak Period (2 PM-9 PM) Mainline and Ramp Demand Volumes

AM-PM-Count-Demand-Figures\WC17-3456_5C-D_2025-WP-AM

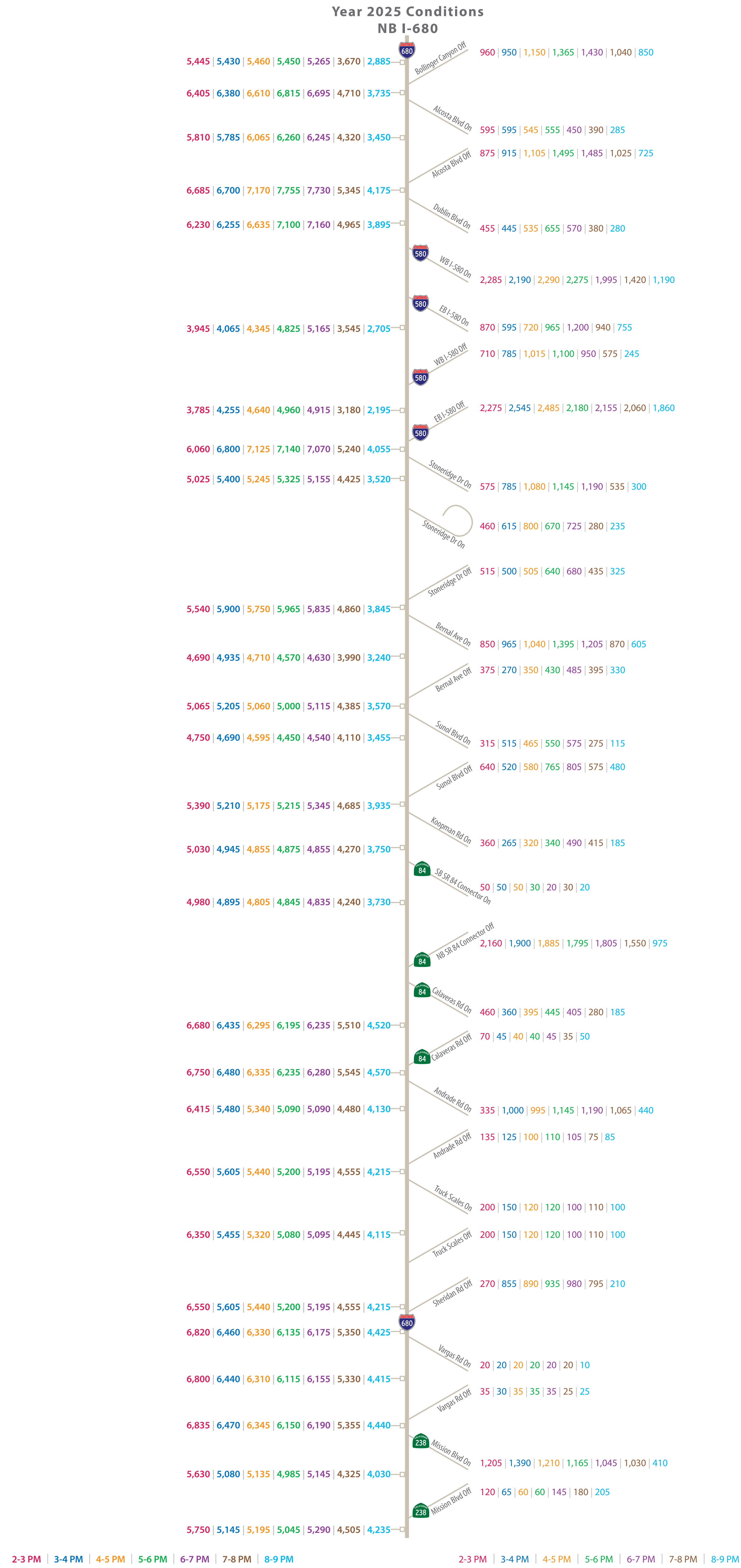
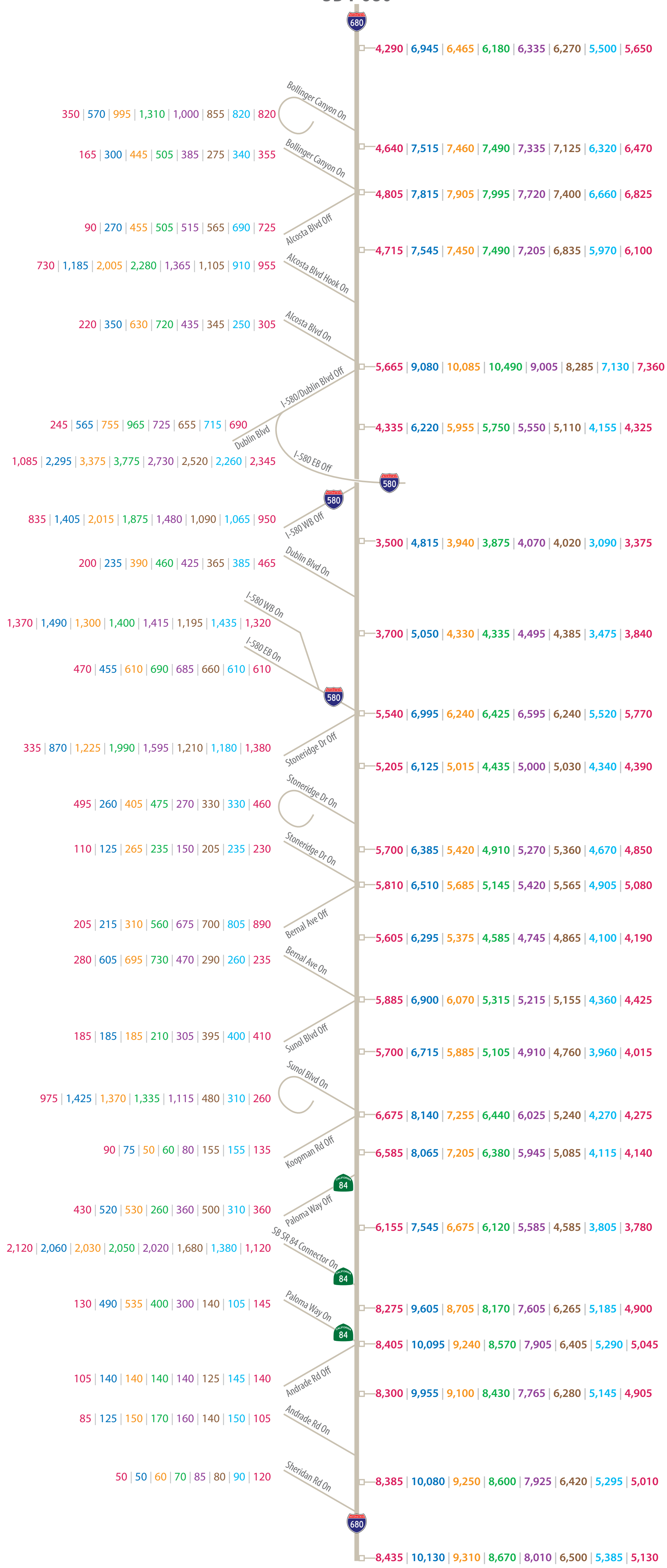


Figure 5D

Year 2025 Plus Project I-680 Northbound PM Peak Period (2 PM-9 PM) Mainline and Ramp Demand Volumes

AM-PM-Count-Demand-Figures\WC17-3456_5C-D_2025-WP-AM

Year 2045 Conditions
SB I-680



2-3 PM | 3-4 PM | 4-5 PM | 5-6 PM | 6-7 PM | 7-8 PM | 8-9 PM
Mainline Hourly Traffic Volumes (No Express Lane)

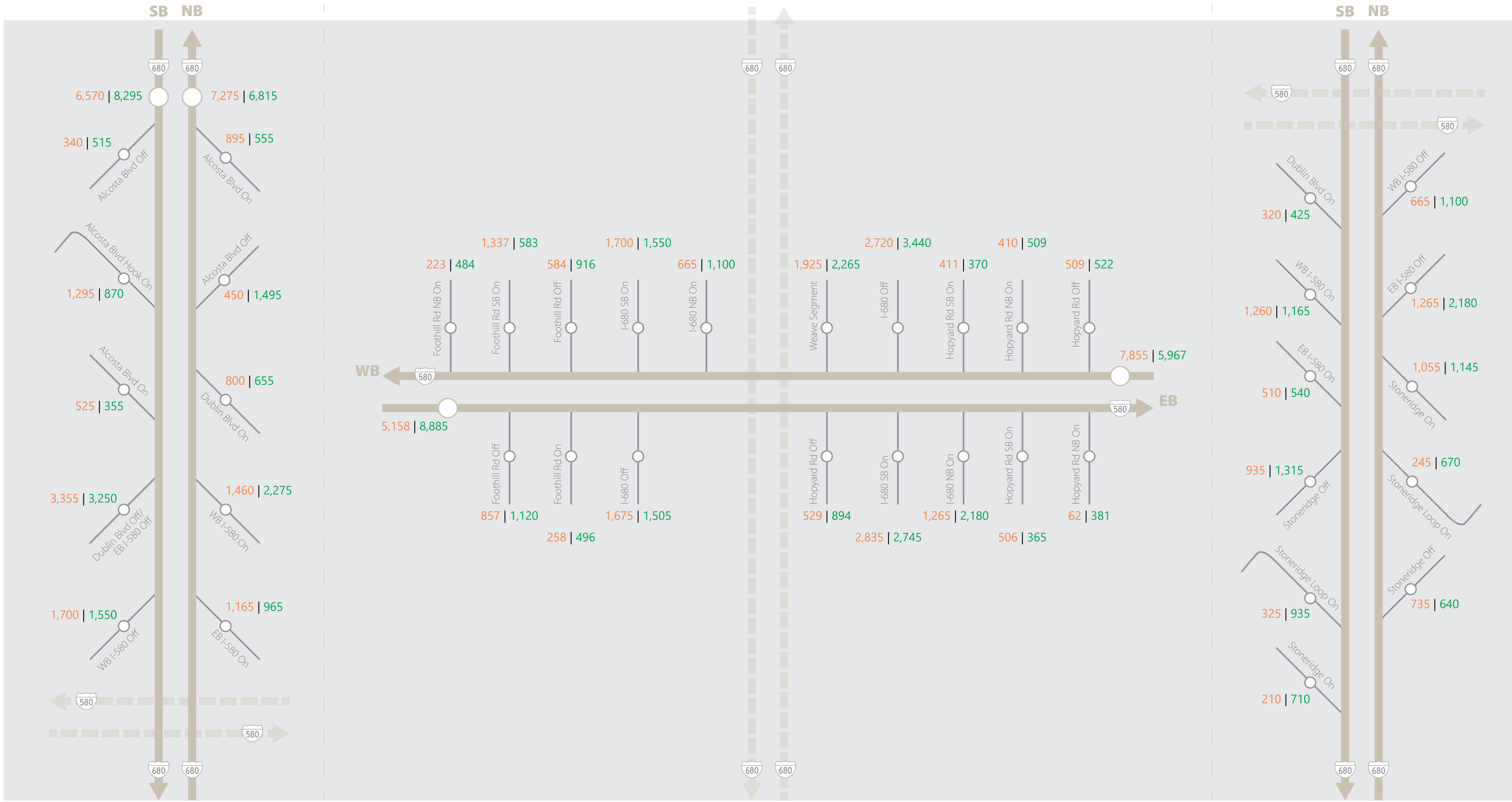
2-3 PM | 3-4 PM | 4-5 PM | 5-6 PM | 6-7 PM | 7-8 PM | 8-9 PM
Ramp Hourly Traffic Volumes

Figure 6A

Year 2045 Plus Project I-680 Southbound AM Peak Period (5 AM-1 PM) Mainline and Ramp Demand Volumes

AM-PM-Count-Demand-Figures\WC17-3456_6A-B_2045-WP-AM

Appendix B: Existing Conditions Demand Volumes from Alameda CTC's Countywide Travel Demand Model and the TOAR for the I-680 Northbound Express Lanes Gap Project between SR-84 and Alcosta Boulevard



Mainline Demand Volumes
AM Peak Hour | PM Peak Hour

Ramp Demand Volumes
AM Peak Hour | PM Peak Hour

N

APPENDIX B

Existing AM and PM Peak Hour Demand Volumes

Fehr & Peers

Appendix C: Concept Improvements/ Build Alternatives

Concept Description:

* Merge St. Patrick entrance into mainline
* Keep WB I-580 to SB I-680 connector separate
* Merge EB I-580 to SB I-680 connector into WB I-580 to SB I-680 connector (separate from SB I-680 mainline). Then, merge both connectors onto SB I-680 mainline as an aux lane.

PRELIMINARY CONCEPTUAL PLAN

SEPTEMBER 2025

HNTB
2101 WEBSTER ST, SUITE 1400
OAKLAND, CA 94612
(510) 208-4599

Fehr & Peers
100 PRINGLE AVE, SUITE 600
WALNUT CREEK, CA 94596
(925)977-3200

ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT 1: BARRIER HARDENING ON SB I-680

ALAMEDA County Transportation Commission

DATE: 09/10/2025	SCALE: 1"=120'
FILENAME:	
PROJECT:	
SHEET NO.	

Concept Description:

* Merge St. Patrick on-ramp ASAP, and harden separation between mainline and F-F connectors
* Add ramp metering individually on the EB I-580 to SB I-680 and WB I-580 to SB I-680 connectors to manage flow into aux lane and SB 680

PRELIMINARY CONCEPTUAL PLAN

SEPTEMBER 2025

HNTB
2101 WEBSTER ST, SUITE 1400
OAKLAND, CA 94612
(510) 208-4599

Fehr & Peers
100 PRINGLE AVE, SUITE 600
WALNUT CREEK, CA 94596
(925)977-3200

ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT 2: LOOP WIDENING

ALAMEDA County Transportation Commission

DATE: 09/10/2025	SCALE: 1"=120'
FILENAME:	
PROJECT:	
SHEET NO.	

Concept Description:

* Reduce SB I-680 Stoneridge Dr off-ramp to single lane optional exit
* Extend aux lane beyond off-ramp as a run-out and then drop

PRELIMINARY CONCEPTUAL PLAN

SEPTEMBER 2025

HNTB
2101 WEBSTER ST, SUITE 1400
OAKLAND, CA 94612
(510) 208-4599

Fehr & Peers
100 PRINGLE AVE, SUITE 600
WALNUT CREEK, CA 94596
(925)977-3200

ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT 3: STONERIDGE

ALAMEDA County Transportation Commission

DATE: 09/10/2025	SCALE: 1"=120'
FILENAME:	
PROJECT:	
SHEET NO.	

Concept Description:
South of I-580:
* Close EB diagonal on-ramp
* Widen EB loop on-ramp
* Install new LT pocket on NB Foothill Rd

North of I-580:
* Close WB diagonal off-ramp
* Close WB loop on-ramp
* Construct WB loop off-ramp
* Widen WB diagonal on-ramp to 3 lanes
* Install new LT pocket on NB San Ramon Rd and connector to WB diagonal on-ramp

PRELIMINARY CONCEPTUAL PLAN

SEPTEMBER 2025

HNTB
2101 WEBSTER ST, SUITE 1400
OAKLAND, CA 94612
(510) 208-4599

Fehr & Peers
100 PRINGLE AVE, SUITE 600
WALNUT CREEK, CA 94596
(925)977-3200

ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT 4: FOOTHILL

ALAMEDA County Transportation Commission

DATE: 09/10/2025	SCALE: 1"=120'
FILENAME:	
PROJECT:	
SHEET NO.	

Concept Description:

* Close WB diagonal on-ramp
* Widen WB loop on-ramp
* Install new LT pocket on SB Dougherty Rd
* Install new RT pocket to the WB loop on-ramp

PRELIMINARY CONCEPTUAL PLAN

SEPTEMBER 2025

HNTB
2101 WEBSTER ST, SUITE 1400
OAKLAND, CA 94612
(510) 208-4599

Fehr & Peers
100 PRINGLE AVE, SUITE 600
WALNUT CREEK, CA 94596
(925)977-3200

ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT 5: HOPYARD

ALAMEDA County Transportation Commission

DATE: 09/10/2025	SCALE: 1"=120'
FILENAME:	
PROJECT:	
SHEET NO.	

Concept Description:

* Eliminate lane drop on I-580 EB mainline (currently 4 thru lanes dropping to 3 to accommodate the two lanes from the flyover)
* Maintain two lanes on SB I-680 to EB I-580 flyover
* Revise striping to meet mainline earlier with two lanes, then merging to one lane with 50:1 taper prior to addition of NB I-680 to EB I-580 connector (thus: 4+2--> 5)

HNTB
2101 WEBSTER ST, SUITE 1400
OAKLAND, CA 94612
(510) 208-4599

Fehr & Peers
100 PRINGLE AVE, SUITE 600
WALNUT CREEK, CA 94596
(925)977-3200

ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT 6: MAINTAIN FOUR LANES ON EB I-580

ALAMEDA County Transportation Commission

DATE: 09/10/2025	SCALE: 1"=120'
FILENAME:	
PROJECT:	
SHEET NO.	

Concept Description:

Revise signs along SB I-680 to avoid "trap" condition for SB I-680 to WB I-580 connector; reduce confusion with "Dublin" as a control city; improve signage for Dublin Blvd exit ("hidden" on the SB I-680 to EB I-580 connector); improve warning for lane drop beyond WB I-580 connector.

HNTB
2101 WEBSTER ST, SUITE 1400
OAKLAND, CA 94612
(510) 208-4599

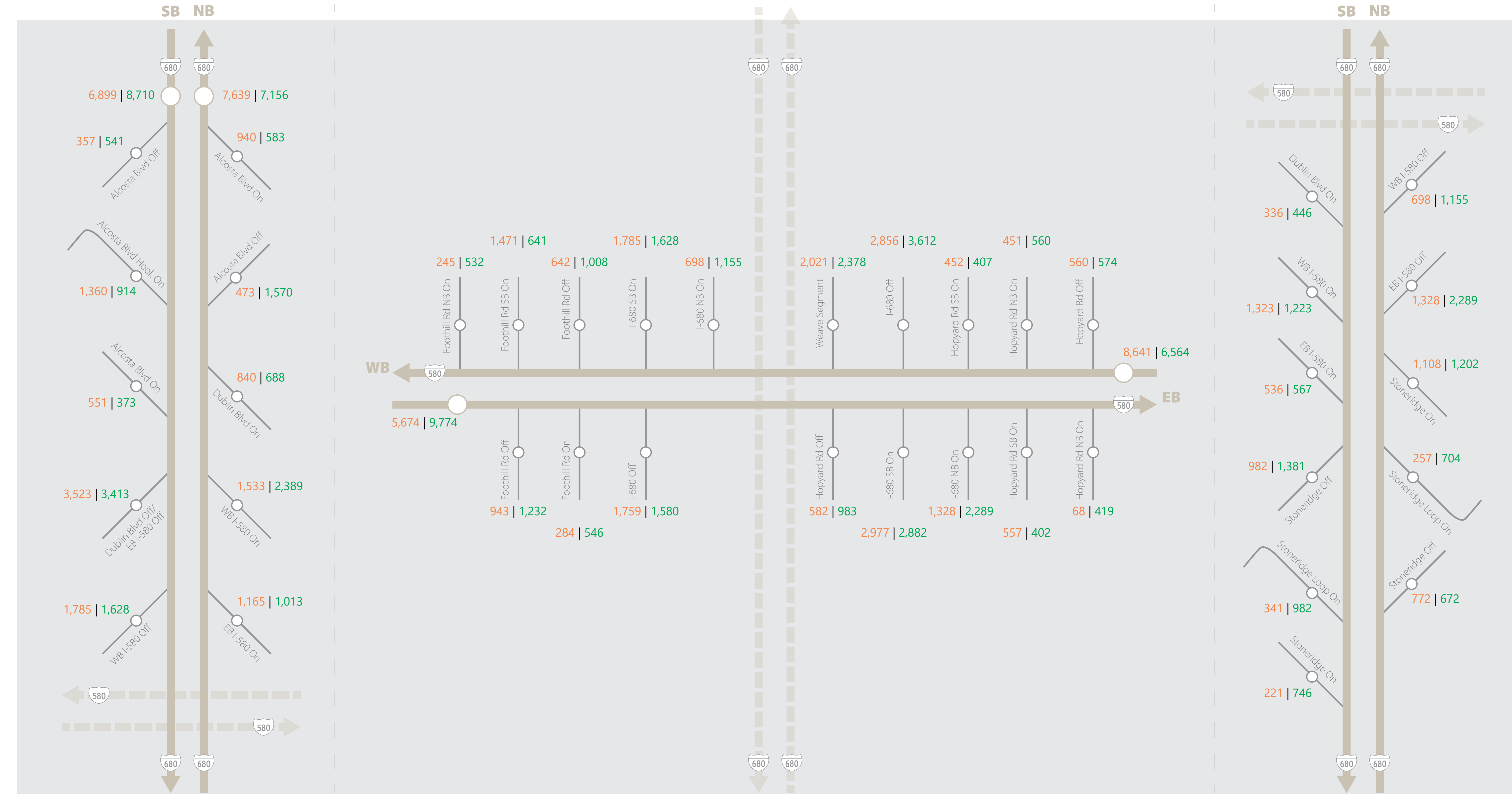
Fehr & Peers
100 PRINGLE AVE, SUITE 600
WALNUT CREEK, CA 94596
(925)977-3200

ALAMEDA COUNTY TRANSPORTATION COMMISSION
EA 04-2X310: I-580/I-680 INTERCHANGE SAFETY IMPROVEMENTS
CONCEPT P7: SB I-680 SIGNAGE IMPROVEMENTS

ALAMEDA County Transportation Commission

DATE: 09/10/2025	SCALE: NTS
FILENAME:	
PROJECT:	
SHEET NO.	

Appendix D: Opening Year 2030 Demand Volumes



Mainline Demand Volumes
AM Peak Hour | PM Peak Hour

Ramp Demand Volumes
AM Peak Hour | PM Peak Hour

N

APPENDIX D

Opening Year 2030 AM and PM Peak Hour Demand Volumes

Fehr & Peers

Appendix E: HCS and Leisch Worksheets under Opening Year No Build Conditions

HCS Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	4/3/2025
Agency		Analysis Year	Opening Year No Project AM Conditions
Jurisdiction		Time Analyzed	AM Peak Hour (7:00 to 8:00)
Project Description	I-580 & I-680 Pre PID	Units	U.S. Customary
Segment Number	1	Segment Name	EB I-580 Foothill Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	70.0	40.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	700
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	5674	943
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Flow Rate (v_i), pc/h	6512	1082
Capacity (c_{md}), pc/h	9600	2000
Initial Adjusted Capacity (c_{mda}), pc/h	9600	-
Final Adjusted Capacity (c_{mda}), pc/h	9600	2000
Volume-to-Capacity Ratio (v/c)	0.68	0.54

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1532
Downstream Equilibrium Distance (L_{EQ}), ft	-	Off-Ramp Infl. Area Speed (S_R), mi/h	57.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	3449	Outer Lanes Freeway Speed (S_O), mi/h	74.7
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	64.2
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	25.4

Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	27.6

HCS Basic Freeway Report

Project Information			
Segment Number	2	Segment Name	EB I-580 Foothill Rd Off-Ramp to Foothill Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	2000	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	4731	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1357
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.57
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	69.7
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	19.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Freeway Weaving Report

Project Information

Segment Number	3	Segment Name	EB I-580 Foothill Rd On-Ramp to I-680 SB Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

Number of Lanes (N), ln	5	Segment Type	CD Roadway
Segment Length (L_S), ft	945	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	-
Interchange Density (ID), int/mi	1.33	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2972	284	0	1759
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	7.90	7.90	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927	0.927	0.927
Flow Rate (v_i), pc/h	3411	326	0	2019
Weaving Flow Rate (v_W), pc/h	2345	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate (v_{NW}), pc/h	3411	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		9061
Total Flow Rate (v), pc/h	5756	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		5466
Volume Ratio (VR)	0.407	Weaving Area Capacity (c_W), veh/h		5466
Minimum Lane Change Rate (LC_{MIN}), lc/h	2345	Adjusted Weaving Area Capacity (c_{WA}), veh/h		5466
Maximum Weaving Length (L_{MAX}), ft	6760	Volume-to-Capacity Ratio (v/c)		0.98

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	430	Average Weaving Speed (S_W), mi/h	49.9
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	252	Average Non-Weaving Speed (S_{NW}), mi/h	47.6
Weaving Lane Change Rate (LC_W), lc/h	2833	Average Speed (S), mi/h	48.5
Total Lane Change Rate (LC_{All}), lc/h	3085	Density (D), pc/mi/ln	23.7
Weaving Intensity Factor (W)	0.575000	Level of Service (LOS)	B

HCS Freeway Diverge Report

Project Information			
Segment Number	4	Segment Name	EB I-580 Foothill Rd Off-Ramp to Hopyard Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	150
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i), veh/h	3256	582
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Flow Rate (v_i), pc/h	3737	668
Capacity (c_{md}), pc/h	9600	2000
Initial Adjusted Capacity (c_{mda}), pc/h	9600	-
Final Adjusted Capacity (c_{mda}), pc/h	9600	2000
Volume-to-Capacity Ratio (v/c)	0.39	0.33

Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	866
Downstream Equilibrium Distance (L_{EQ}), ft	-	Off-Ramp Infl. Area Speed (S_R), mi/h	56.3
Flow in Lanes 1 and 2 (v_{12}), pc/h	2006	Outer Lanes Freeway Speed (S_O), mi/h	76.8
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	64.2
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	14.6
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	20.2

HCS Basic Freeway Report

Project Information			
Segment Number	5	Segment Name	EB I-580 Hopyard Rd Off-Ramp to I-680 SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	1300	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	2674	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	767
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.32
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	69.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	11.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	6	Segment Name	EB I-580 Hopyard Rd Off-Ramp to I-680 SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1500	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	2674	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1023
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.43
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	69.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	14.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information

Segment Number	7	Segment Name	EB I-580 I-680 SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	2
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	260	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Two-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	2674	2977
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	3069 | 6485	3416
Capacity (c_{md}), pc/h	12000	4200
Adjusted Capacity (c_{mda}), pc/h	12000	4200
Volume-to-Capacity Ratio (v/c)	0.54	0.81

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	9999.0	Flow Outer Lanes (v_{OA}), pc/h/ln	0
Downstream Equilibrium Distance (L_{EQ}), ft	9999.0	On-Ramp Infl. Area Speed (S_R), mi/h	69.9
Flow in Lanes 1 and 2 (v_{12}), pc/h	0	Outer Lanes Freeway Speed (S_O), mi/h	75.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	0	Ramp Junction Speed (S), mi/h	69.9
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	18.6
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	18.6

HCS Basic Freeway Report

Project Information

Segment Number	8	Segment Name	EB I-580 I-680 SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	6	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1130	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	5651	1328
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	6485 | 8009	1524
Capacity (c_{md}), pc/h	14400	2000
Adjusted Capacity (c_{mda}), pc/h	14400	2000
Volume-to-Capacity Ratio (v/c)	0.56	0.76

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	9999.0	Flow Outer Lanes (v_{OA}), pc/h/ln	0
Downstream Equilibrium Distance (L_{EQ}), ft	9999.0	On-Ramp Infl. Area Speed (S_R), mi/h	69.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	0	Outer Lanes Freeway Speed (S_O), mi/h	75.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	0	Ramp Junction Speed (S), mi/h	69.8
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	19.1
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	19.1

HCS Basic Freeway Report

Project Information

Segment Number	9	Segment Name	EB I-580 Hopyard SB Loop On Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	7	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	670	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	6979	557
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	8009 | 8648	639
Capacity (c_{md}), pc/h	16800	1900
Adjusted Capacity (c_{mda}), pc/h	16800	1900
Volume-to-Capacity Ratio (v/c)	0.51	0.34

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	9999.0	Flow Outer Lanes (v_{OA}), pc/h/ln	0
Downstream Equilibrium Distance (L_{EQ}), ft	9999.0	On-Ramp Infl. Area Speed (S_R), mi/h	70.0
Flow in Lanes 1 and 2 (v_{12}), pc/h	0	Outer Lanes Freeway Speed (S_O), mi/h	75.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	0	Ramp Junction Speed (S), mi/h	70.0
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	17.6
Level of Service (LOS)	B	Density in Ramp Influence Area (D_R), pc/mi/ln	17.6

HCS Freeway Merge Report

Project Information

Segment Number	10	Segment Name	EB I-580 Hopyard NB Hook On Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	7	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	450
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	7536	68
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	8648 | 8726	78
Capacity (c_{md}), pc/h	16800	1900
Adjusted Capacity (c_{mda}), pc/h	16800	1900
Volume-to-Capacity Ratio (v/c)	0.52	0.04

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1946
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	60.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	2594	Outer Lanes Freeway Speed (S_O), mi/h	64.8
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2672	Ramp Junction Speed (S), mi/h	62.8
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	14.9
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	23.5

HCS Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/3/2025
Agency		Analysis Year	Opening Year No Project AM Conditions
Jurisdiction		Time Analyzed	AM Peak Hour (7:00 to 8:00)
Project Description	I-580 & I-680 Pre PID	Units	U.S. Customary
Segment Number	1	Segment Name	WB I-580 Hopyard Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

General Purpose Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	40.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

General Purpose Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity

Demand Volume (V_i), veh/h	8641	560
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Flow Rate (v_i), pc/h	10065	643
Capacity (c_{md}), pc/h	12000	2000
Initial Adjusted Capacity (c_{mda}), pc/h	12000	-
Final Adjusted Capacity (c_{mda}), pc/h	12000	2000
Volume-to-Capacity Ratio (v/c)	0.83	0.32

General Purpose Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2090
Downstream Equilibrium Distance (L_{EQ}), ft	-	Off-Ramp Infl. Area Speed (S_R), mi/h	64.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	3873	Outer Lanes Freeway Speed (S_O), mi/h	72.5

Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	64.8
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	24.9
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	24.9
Managed Lane Geometric Data			
Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0
Managed Lane Length, ft	1500	Terrain Type	Level
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Demand Volume (V_{ML}), veh/h	1382	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	1470
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	0
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	63.8
Speed 2 (S_2), mi/h	6.2	Density (D_{ML}), pc/mi/ln	23.0
Speed 3 (S_3), mi/h	11.7	Level of Service (LOS)	C

HCS Basic Freeway Report

Project Information			
Segment Number	2	Segment Name	WB I-580 Hopyard Rd Off-Ramp to Hopyard Rd NB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

General Purpose Geometric Data			
Number of General Purpose Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	1330	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000

General Purpose Demand and Capacity			
Demand Volume (V), veh/h	8081	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,GP}$), pc/h/ln	2318
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.98

General Purpose Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	50.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	46.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

Managed Lane Geometric Data			
Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0
Managed Lane Length, ft	1330	Terrain Type	Level

Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Demand Volume (V_{ML}), veh/h	1382	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	1470
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	1
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	52.1
Speed 2 (S_2), mi/h	6.2	Density (D_{ML}), pc/mi/ln	28.2
Speed 3 (S_3), mi/h	11.7	Level of Service (LOS)	D

HCS Basic Freeway Report

Project Information

Segment Number	3	Segment Name	WB I-580 Hopyard Rd NB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

General Purpose Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	450	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

General Purpose Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity

Demand Volume (V_i), veh/h	8081	451
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	9274 | 9810	518
Capacity (c_{md}), pc/h	12000	1900
Adjusted Capacity (c_{mda}), pc/h	12000	1900
Volume-to-Capacity Ratio (v/c)	0.82	0.27

General Purpose Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	9999.0	Flow Outer Lanes (v_{OA}), pc/h/ln	0
Downstream Equilibrium Distance (L_{EQ}), ft	9999.0	On-Ramp Infl. Area Speed (S_R), mi/h	39.6
Flow in Lanes 1 and 2 (v_{12}), pc/h	0	Outer Lanes Freeway Speed (S_O), mi/h	75.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	0	Ramp Junction Speed (S), mi/h	39.6
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	49.5
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	49.5

Managed Lane Geometric Data

Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0

Managed Lane Length, ft	450	Terrain Type	Level
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Demand Volume (V_{ML}), veh/h	1382	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	1470
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	0
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	63.8
Speed 2 (S_2), mi/h	6.2	Density (D_{ML}), pc/mi/ln	23.0
Speed 3 (S_3), mi/h	11.7	Level of Service (LOS)	C

HCS Freeway Merge Report

Project Information

Segment Number	4	Segment Name	WB I-580 Hopyard Rd SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

General Purpose Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	40.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1180	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

General Purpose Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity

Demand Volume (V_i), veh/h	8532	452
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	9791 | 10132	519
Capacity (c_{md}), pc/h	12000	2000
Adjusted Capacity (c_{mda}), pc/h	12000	2000
Volume-to-Capacity Ratio (v/c)	0.84	0.26

General Purpose Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2188
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	59.4
Flow in Lanes 1 and 2 (v_{12}), pc/h	2916	Outer Lanes Freeway Speed (S_O), mi/h	63.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3435	Ramp Junction Speed (S), mi/h	38.4
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	52.8
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	27.1

Managed Lane Geometric Data

Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0

Managed Lane Length, ft	1180	Terrain Type	Level
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Demand Volume (V_{ML}), veh/h	1382	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	1470
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	0
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	63.8
Speed 2 (S_2), mi/h	6.2	Density (D_{ML}), pc/mi/ln	23.0
Speed 3 (S_3), mi/h	11.7	Level of Service (LOS)	C

HCS Freeway Diverge Report

Project Information			
Segment Number	5	Segment Name	WB I-580 I-680 Off-Ramps
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

General Purpose Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	5	2
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1180	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

General Purpose Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity		
Demand Volume (V_i), veh/h	8984	2856
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Flow Rate (v_i), pc/h	9982	3278
Capacity (c_{md}), pc/h	12000	4000
Initial Adjusted Capacity (c_{mda}), pc/h	12000	-
Final Adjusted Capacity (c_{mda}), pc/h	12000	4000
Volume-to-Capacity Ratio (v/c)	0.83	0.82

Density and LOS			
Average Density (D), pc/mi/ln	65.6	Average Speed (S), mi/h	30.4
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	36.1	Level of Service (LOS)	F

Managed Lane Geometric Data			
Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0
Managed Lane Length, ft	1180	Terrain Type	Level

Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000

Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Demand Volume (V_{ML}), veh/h	1382	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	1470
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (C_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	1
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	52.1
Speed 2 (S_2), mi/h	6.2	Density (D_{ML}), pc/mi/ln	28.2
Speed 3 (S_3), mi/h	11.7	Level of Service (LOS)	D

HCS Basic Freeway Report

Project Information

Segment Number	6	Segment Name	WB I-580 I-680 Off-Ramps to Express Lane End
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	715	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000

General Purpose Demand and Capacity

Demand Volume (V), veh/h	6128	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,GP}$), pc/h/ln	2235
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.93

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	57.6
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	38.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

Managed Lane Geometric Data

Managed Lane Segment Type	ML Access	Separation Type	Continuous Access
Number of Lanes (N), ln	1	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

Managed Lane Adjustment Factors

Driver Population	All Familiar	Demand Adjustment Factor (DAF)	1.000
Final Speed Adjustment Factor (SAF)	1.000	Final Capacity Adjustment Factor (CAF)	1.000

Managed Lane Demand and Capacity

	FF	RF	RR	FR

Demand Volume ($V_{i,ML}$), veh/h	1382	0	0	1382
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	0.00	0.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	1.000	1.000	1.000	1.000
Flow Rate ($v_{i,ML}$), pc/h	1470	0	0	1470
Weaving Flow Rate ($v_{w,ML}$), pc/h	1470	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate ($v_{NW,ML}$), pc/h	1470	Density-Based Capacity (c_{IWL} × N × f_{HV}), veh/h		1856
Total Flow Rate (v_{ML}), pc/h	2940	Demand Flow-Based Capacity (c_{IW} × f_{HV}), veh/h		4800
Volume Ratio (VR)	0.500	Weaving Area Capacity (c_W), veh/h		1856
Minimum Lane Change Rate (LC_{MIN}), lc/h	0	Adjusted Weaving Area Capacity (c_{WA}), veh/h		1856
Maximum Weaving Length (L_{MAX}), ft	7826	Volume-to-Capacity Ratio (v/c)		1.00

Managed Lane Speed and Density

Non-Weaving Vehicle Index (I_{NW})	-	Average Weaving Speed (S_W), mi/h	-
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	-	Average Non-Weaving Speed (S_{NW}), mi/h	-
Weaving Lane Change Rate (LC_W), lc/h	-	Average Speed (S_{ML}), mi/h	-
Weaving Lane Change Rate (LC_{All}), lc/h	-	Density (D_{ML}), pc/mi/ln	-
Weaving Intensity Factor (W)	-	Level of Service (LOS_{ML})	F

HCS Basic Freeway Report

Project Information			
Segment Number	7	Segment Name	WB I-580 Express Lane End to I-680 NB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	1660	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	7510	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1676
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.70
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	24.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information

Segment Number	8	Segment Name	WB I-580 I-680 NB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	700	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	7510	698
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	8619 | 7505	801
Capacity (c_{md}), pc/h	12000	1900
Adjusted Capacity (c_{mda}), pc/h	12000	1900
Volume-to-Capacity Ratio (v/c)	0.63	0.42

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1468
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	63.9
Flow in Lanes 1 and 2 (v_{12}), pc/h	1958	Outer Lanes Freeway Speed (S_O), mi/h	66.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2759	Ramp Junction Speed (S), mi/h	63.9
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	17.8
Level of Service (LOS)	B	Density in Ramp Influence Area (D_R), pc/mi/ln	17.8

HCS Freeway Weaving Report

Project Information

Segment Number	9	Segment Name	WB I-580 I-680 SB On-Ramp to Foothill Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

Number of Lanes (N), ln	6	Segment Type	CD Roadway
Segment Length (L_S), ft	1260	Number of Maneuver Lanes (N_{WL}), ln	3
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	-
Interchange Density (ID), int/mi	1.33	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	7566	1785	0	642
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	7.90	7.90	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927	0.927	0.927
Flow Rate (v_i), pc/h	6919	2048	0	587
Weaving Flow Rate (v_W), pc/h	2635	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate (v_{NW}), pc/h	6919	Density-Based Capacity (c_{IWL} × N × f_{HV}), veh/h		12431
Total Flow Rate (v), pc/h	9554	Demand Flow-Based Capacity (c_{IW} × f_{HV}), veh/h		13352
Volume Ratio (VR)	0.243	Weaving Area Capacity (c_W), veh/h		12431
Minimum Lane Change Rate (LC_{MIN}), lc/h	2048	Adjusted Weaving Area Capacity (c_{WA}), veh/h		12431
Maximum Weaving Length (L_{MAX}), ft	3415	Volume-to-Capacity Ratio (v/c)		0.71

*Under oversaturated conditions, Volume Served is computed as Flow Rate

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	1162	Average Weaving Speed (S_W), mi/h	50.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	953	Average Non-Weaving Speed (S_{NW}), mi/h	47.6
Weaving Lane Change Rate (LC_W), lc/h	2905	Average Speed (S), mi/h	48.4
Total Lane Change Rate (LC_{All}), lc/h	3858	Density (D), pc/mi/ln	32.9
Weaving Intensity Factor (W)	0.546000	Level of Service (LOS)	D

HCS Basic Freeway Report

Project Information			
Segment Number	10	Segment Name	WB I-580 Foothill Rd Off-Ramp to Foothill Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	950	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	9351	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1763
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.73
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	66.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	26.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	11	Segment Name	WB I-580 Foothill Rd Off-Ramp to Foothill Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	1465	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	9351	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	2204
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.92
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	58.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	37.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information

Segment Number	12	Segment Name	WB I-580 Foothill Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	9351	1716
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	10731 | 10786	1969
Capacity (c_{md}), pc/h	12000	2100
Adjusted Capacity (c_{mda}), pc/h	12000	2100
Volume-to-Capacity Ratio (v/c)	0.90	0.94

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1895
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	59.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	2527	Outer Lanes Freeway Speed (S_O), mi/h	65.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4496	Ramp Junction Speed (S), mi/h	59.2
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	28.0
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	28.0

HCS Basic Freeway Report

Project Information			
Analyst	Fehr & Peers	Date	4/3/2025
Agency		Analysis Year	Opening Year No Project AM Conditions
Jurisdiction		Time Analyzed	AM Peak Hour (7:00 to 8:00)
Project Description	I-580 & I-680 Pre PID	Units	U.S. Customary
Segment Number	1	Segment Name	SB I-680 Alcosta Boulevard Off-Ramp to Alcosta Boulevard On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	2800	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	6542	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1861
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.78
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	64.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	28.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information

Segment Number	2	Segment Name	SB I-680 Alcosta Boulevard hook on-ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	375	150
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	6542	1360
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	7443 | 8990	1547
Capacity (c_{md}), pc/h	12000	2000
Adjusted Capacity (c_{mda}), pc/h	12000	2000
Volume-to-Capacity Ratio (v/c)	0.75	0.77

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1630
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	60.7
Flow in Lanes 1 and 2 (v_{12}), pc/h	2173	Outer Lanes Freeway Speed (S_O), mi/h	65.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3720	Ramp Junction Speed (S), mi/h	60.7
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	23.0
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	23.0

HCS Freeway Merge Report

Project Information			
Segment Number	3	Segment Name	SB I-680 Alcosta Boulevard diagonal on-ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i), veh/h	7902	551
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	8991 | 9617	627
Capacity (c_{md}), pc/h	12000	2000
Adjusted Capacity (c_{mda}), pc/h	12000	2000
Volume-to-Capacity Ratio (v/c)	0.80	0.31

Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1947
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	61.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	2596	Outer Lanes Freeway Speed (S_O), mi/h	64.8
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3223	Ramp Junction Speed (S), mi/h	63.1
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	22.6
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	21.0

HCS Basic Freeway Report

Project Information			
Segment Number	4	Segment Name	SB I-680 Alcosta Boulevard diagonal on-ramp to I-580 EB Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	1095	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	8453	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1923
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.80
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	63.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	30.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	5	Segment Name	SB I-680 Alcosta Boulevard diagonal on-ramp to I-580 EB Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	6	Terrain Type	Level
Segment Length (L), ft	1210	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	8453	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1603
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.67
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	68.1
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	23.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Freeway Diverge Report

Project Information			
Segment Number	6	Segment Name	SB I-680 I-580 EB Off-Ramp & Dublin Blvd Off Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	6	2
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge
Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand and Capacity		
Demand Volume (V_i), veh/h	8453	3523
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Flow Rate (v_i), pc/h	9617	4008
Capacity (c_{md}), pc/h	14400	4200
Initial Adjusted Capacity (c_{mda}), pc/h	14400	-
Final Adjusted Capacity (c_{mda}), pc/h	14400	4200
Volume-to-Capacity Ratio (v/c)	0.67	0.95

Density and LOS			
Average Density (D), pc/mi/ln	28.0	Average Speed (S), mi/h	57.1
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	28.0	Level of Service (LOS)	D

HCS Freeway Diverge Report

Project Information

Segment Number	7	Segment Name	SB I-680 WB I-580 off-ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	2
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1510	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	4930	1785
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Flow Rate (v_i), pc/h	5609	2031
Capacity (c_{md}), pc/h	12000	4000
Initial Adjusted Capacity (c_{mda}), pc/h	12000	-
Final Adjusted Capacity (c_{mda}), pc/h	12000	4000
Volume-to-Capacity Ratio (v/c)	0.47	0.51

Density and LOS

Average Density (D), pc/mi/ln	19.6	Average Speed (S), mi/h	57.1
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	19.6	Level of Service (LOS)	B

HCS Basic Freeway Report

Project Information			
Segment Number	8	Segment Name	SB I-680 WB I-580 off-ramp to Dublin Blvd On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	840	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	3145	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	895
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.37
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	68.1
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	12.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	9	Segment Name	SB I-680 WB I-580 off-ramp to Dublin Blvd On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1000	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	3145	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1193
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.50
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	69.6
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	17.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Freeway Merge Report

Project Information			
Segment Number	10	Segment Name	SB I-680 Dublin Blvd On- Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	350
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i), veh/h	3145	336
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	3578 | 3715	382
Capacity (c_{md}), pc/h	7200	2000
Adjusted Capacity (c_{mda}), pc/h	7200	2000
Volume-to-Capacity Ratio (v/c)	0.52	0.19

Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1478
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	60.4
Flow in Lanes 1 and 2 (v_{12}), pc/h	2100	Outer Lanes Freeway Speed (S_O), mi/h	66.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2482	Ramp Junction Speed (S), mi/h	20.5
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	60.4
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	22.5

HCS Freeway Weaving Report

Project Information

Segment Number	11	Segment Name	SB I-680 WB & EB I-580 On-Ramp to Stoneridge Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

Number of Lanes (N), ln	4	Segment Type	CD Roadway
Segment Length (L_S), ft	1220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	-
Interchange Density (ID), int/mi	1.50	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2499	1859	0	982
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	7.00	7.00	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935	0.935	0.935
Flow Rate (v_i), pc/h	2667	558	0	1048
Weaving Flow Rate (v_W), pc/h	1606	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate (v_{NW}), pc/h	2667	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		7009
Total Flow Rate (v), pc/h	4273	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		4291
Volume Ratio (VR)	0.523	Weaving Area Capacity (c_W), veh/h		4291
Minimum Lane Change Rate (LC_{MIN}), lc/h	558	Adjusted Weaving Area Capacity (c_{WA}), veh/h		4291
Maximum Weaving Length (L_{MAX}), ft	8097	Volume-to-Capacity Ratio (v/c)		0.93

*Under oversaturated conditions, Volume Served is computed as Flow Rate

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	488	Average Weaving Speed (S_W), mi/h	59.0
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	440	Average Non-Weaving Speed (S_{NW}), mi/h	60.9
Weaving Lane Change Rate (LC_W), lc/h	952	Average Speed (S), mi/h	60.2
Total Lane Change Rate (LC_{All}), lc/h	1392	Density (D), pc/mi/ln	17.7
Weaving Intensity Factor (W)	0.251000	Level of Service (LOS)	F

HCS Basic Freeway Report

Project Information			
Segment Number	12	Segment Name	SB I-680 Stoneridge Rd Off-Ramp to Stoneridge Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	860	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.50
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	4358	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1052
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.44
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	68.1
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	15.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Freeway Merge Report

Project Information			
Segment Number	13	Segment Name	SB I-680 Stoneridge Drive loop on-ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1250	300
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i), veh/h	4358	341
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	4958 | 3544	388
Capacity (c_{md}), pc/h	7200	1900
Adjusted Capacity (c_{mda}), pc/h	7200	1900
Volume-to-Capacity Ratio (v/c)	0.49	0.20

Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1307
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	60.4
Flow in Lanes 1 and 2 (v_{12}), pc/h	1849	Outer Lanes Freeway Speed (S_O), mi/h	67.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2237	Ramp Junction Speed (S), mi/h	62.7
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	18.8
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	20.9

HCS Freeway Merge Report

Project Information

Segment Number	14	Segment Name	SB I-680 Stoneridge Drive diagonal on-ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	55.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	4699	221
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	5346 | 3795	251
Capacity (c_{md}), pc/h	7200	2200
Adjusted Capacity (c_{mda}), pc/h	7200	2200
Volume-to-Capacity Ratio (v/c)	0.53	0.11

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1418
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	62.3
Flow in Lanes 1 and 2 (v_{12}), pc/h	2126	Outer Lanes Freeway Speed (S_O), mi/h	66.7
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2377	Ramp Junction Speed (S), mi/h	63.9
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	19.8
Level of Service (LOS)	B	Density in Ramp Influence Area (D_R), pc/mi/ln	19.0

HCS Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	4/3/2025
Agency		Analysis Year	Opening Year No Project AM Conditions
Jurisdiction		Time Analyzed	AM Peak Hour (7:00 to 8:00)
Project Description	I-580 & I-680 Pre PID	Units	U.S. Customary
Segment Number	1	Segment Name	NB I-680 Stoneridge Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	150
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	5009	772
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Flow Rate (v_i), pc/h	6577	878
Capacity (c_{md}), pc/h	7200	2100
Initial Adjusted Capacity (c_{mda}), pc/h	7200	-
Final Adjusted Capacity (c_{mda}), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.79	0.42

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2536
Downstream Equilibrium Distance (L_{EQ}), ft	1291.5	Off-Ramp Infl. Area Speed (S_R), mi/h	59.4
Flow in Lanes 1 and 2 (v_{12}), pc/h	4041	Outer Lanes Freeway Speed (S_O), mi/h	70.8
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	63.3

Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	34.6
Level of Service (LOS)	E	Density in Ramp Influence Area (D_R), pc/mi/ln	37.7

HCS Basic Freeway Report

Project Information			
Segment Number	2	Segment Name	NB I-680 Stoneridge Rd Off-Ramp to Loop On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1600	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.50
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	4237	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1900
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.79
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	64.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	29.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information

Segment Number	3	Segment Name	NB I-680 Stoneridge Rd Loop On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	640	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	4237	257
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	4821 | 5991	292
Capacity (c_{md}), pc/h	7200	1900
Adjusted Capacity (c_{mda}), pc/h	7200	1900
Volume-to-Capacity Ratio (v/c)	0.83	0.15

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	542.3	Flow Outer Lanes (v_{OA}), pc/h/ln	2160
Downstream Equilibrium Distance (L_{EQ}), ft	4072.8	On-Ramp Infl. Area Speed (S_R), mi/h	59.4
Flow in Lanes 1 and 2 (v_{12}), pc/h	3539	Outer Lanes Freeway Speed (S_O), mi/h	64.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3831	Ramp Junction Speed (S), mi/h	59.4
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	33.6
Level of Service (LOS)	D	Density in Ramp Influence Area (D_R), pc/mi/ln	33.6

HCS Basic Freeway Report

Project Information

Segment Number	4	Segment Name	NB I-680 Stoneridge Rd Diagnol On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	698	300
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	4494	1108
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	5113 | 7134	1261
Capacity (c_{md}), pc/h	9600	2000
Adjusted Capacity (c_{mda}), pc/h	9600	2000
Volume-to-Capacity Ratio (v/c)	0.74	0.63

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1762
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	61.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	2349	Outer Lanes Freeway Speed (S_O), mi/h	65.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3610	Ramp Junction Speed (S), mi/h	61.2
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	29.1
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	29.1

HCS Basic Freeway Report

Project Information			
Segment Number	5	Segment Name	NB I-680 I-580 EB Off Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	698	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i), veh/h	5602	1328
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Flow Rate (v_i), pc/h	6997	1511
Capacity (c_{md}), pc/h	9600	4200
Initial Adjusted Capacity (c_{mda}), pc/h	9600	-
Final Adjusted Capacity (c_{mda}), pc/h	9600	4200
Volume-to-Capacity Ratio (v/c)	0.73	0.36

Density and LOS			
Average Density (D), pc/mi/ln	48.8	Average Speed (S), mi/h	35.9
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	48.8	Level of Service (LOS)	F

HCS Freeway Diverge Report

Project Information			
Segment Number	6	Segment Name	NB I-680 I-580 WB Off Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	860	400
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i), veh/h	4274	698
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Flow Rate (v_i), pc/h	5372	794
Capacity (c_{md}), pc/h	7200	2100
Initial Adjusted Capacity (c_{mda}), pc/h	7200	-
Final Adjusted Capacity (c_{mda}), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.75	0.38

Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	10293.5	Flow Outer Lanes (v_{OA}), pc/h/ln	1619
Downstream Equilibrium Distance (L_{EQ}), ft	-	Off-Ramp Infl. Area Speed (S_R), mi/h	59.7
Flow in Lanes 1 and 2 (v_{12}), pc/h	3244	Outer Lanes Freeway Speed (S_O), mi/h	74.4
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	28.1
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	63.8
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	28.6

HCS Basic Freeway Report

Project Information			
Segment Number	7	Segment Name	NB I-680 I-580 WB Off Ramp to I-580 EB On Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	590	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.67
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	3576	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1356
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.62
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	16.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	90.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	8	Segment Name	NB I-680 I-580 WB Off Ramp to I-580 EB On Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1900	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.67
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	3576	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	2235
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.93
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	57.6
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	38.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information

Segment Number	9	Segment Name	NB I-680 I-580 EB on-ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	680	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Two-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	3576	1223
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	4069 | 5825	1392
Capacity (c_{md}), pc/h	9600	4000
Adjusted Capacity (c_{mda}), pc/h	9600	4000
Volume-to-Capacity Ratio (v/c)	0.61	0.35

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1330
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	63.5
Flow in Lanes 1 and 2 (v_{12}), pc/h	1773	Outer Lanes Freeway Speed (S_O), mi/h	67.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3165	Ramp Junction Speed (S), mi/h	63.5
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	22.9
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	22.9

HCS Basic Freeway Report

Project Information

Segment Number	10	Segment Name	NB I-680 I-580 WB on-ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	475	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	4799	1533
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	5460 | 7214	1744
Capacity (c_{md}), pc/h	12000	2100
Adjusted Capacity (c_{mda}), pc/h	12000	2100
Volume-to-Capacity Ratio (v/c)	0.60	0.83

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1286
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	62.6
Flow in Lanes 1 and 2 (v_{12}), pc/h	1714	Outer Lanes Freeway Speed (S_O), mi/h	67.2
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3458	Ramp Junction Speed (S), mi/h	62.6
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	19.3
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	19.3

HCS Freeway Merge Report

Project Information

Segment Number	11	Segment Name	NB I-680 Dublin Boulevard on-ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	6332	840
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	7204 | 7514	956
Capacity (c_{md}), pc/h	12000	2000
Adjusted Capacity (c_{mda}), pc/h	12000	2000
Volume-to-Capacity Ratio (v/c)	0.63	0.48

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1577
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	59.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	2104	Outer Lanes Freeway Speed (S_O), mi/h	66.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3060	Ramp Junction Speed (S), mi/h	29.7
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	50.6
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	27.7

HCS Basic Freeway Report

Project Information			
Segment Number	12	Segment Name	NB I-680 Dublin Boulevard on-ramp to Alcosta Boulevard Off Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	530	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.67
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	7172	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1632
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.61
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	21.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	68.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	13	Segment Name	NB I-680 Dublin Boulevard on-ramp to Alcosta Boulevard Off Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	2940	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.67
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	7172	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	2040
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.70
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	22.8
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	74.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	14	Segment Name	NB I-680 Dublin Boulevard on-ramp to Alcosta Boulevard Off Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	450	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.67
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	7172	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	2040
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.70
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	20.1
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	82.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Freeway Diverge Report

Project Information			
Segment Number	15	Segment Name	NB I-680 Alcosta Boulevard Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

General Purpose Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	150
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

General Purpose Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity		
Demand Volume (V_i), veh/h	7172	473
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Flow Rate (v_i), pc/h	6374	538
Capacity (c_{md}), pc/h	9600	2100
Initial Adjusted Capacity (c_{mda}), pc/h	9600	-
Final Adjusted Capacity (c_{mda}), pc/h	9600	2100
Volume-to-Capacity Ratio (v/c)	0.66	0.26

General Purpose Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2150
Downstream Equilibrium Distance (L_{EQ}), ft	-	Off-Ramp Infl. Area Speed (S_R), mi/h	60.3
Flow in Lanes 1 and 2 (v_{12}), pc/h	3861	Outer Lanes Freeway Speed (S_O), mi/h	72.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	17.9
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	88.8
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	36.1

Managed Lane Geometric Data			
Managed Lane Segment Type	ML Access	Separation Type	Continuous Access

Number of Lanes (N), ln	1	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

Managed Lane Adjustment Factors

Driver Population	All Familiar	Demand Adjustment Factor (DAF)	1.000
Final Speed Adjustment Factor (SAF)	1.000	Final Capacity Adjustment Factor (CAF)	1.000

Managed Lane Demand and Capacity

	FF	RF	RR	FR
Demand Volume ($V_{i,ML}$), veh/h	0	860	0	0
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	0.00	0.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	1.000	1.000	1.000	1.000
Flow Rate ($v_{i,ML}$), pc/h	0	915	0	0

Weaving Flow Rate ($v_{W,ML}$), pc/h	915	Ideal Conditions Capacity (c_{IFL}), pc/h/ln	2400
Non-Weaving Flow Rate ($v_{NW,ML}$), pc/h	0	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h	1426
Total Flow Rate (v_{ML}), pc/h	915	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h	2400
Volume Ratio (VR)	1.000	Weaving Area Capacity (c_W), veh/h	1426
Minimum Lane Change Rate (LC_{MIN}), lc/h	915	Adjusted Weaving Area Capacity (c_{WA}), veh/h	1426
Maximum Weaving Length (L_{MAX}), ft	14232	Volume-to-Capacity Ratio (v/c)	0.64

Managed Lane Speed and Density

Non-Weaving Vehicle Index (I_{NW})	0	Average Weaving Speed (S_W), mi/h	59.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	620	Average Non-Weaving Speed (S_{NW}), mi/h	59.0
Weaving Lane Change Rate (LC_W), lc/h	937	Average Speed (S_{ML}), mi/h	59.6
Weaving Lane Change Rate (LC_{All}), lc/h	1557	Density (D_{ML}), pc/mi/ln	15.4
Weaving Intensity Factor (W)	0.233000	Level of Service (LOS_{ML})	B

HCS Basic Freeway Report

Project Information

Segment Number	16	Segment Name	NB I-680 Alcosta Boulevard Off-Ramp to Alcosta Boulevard On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

General Purpose Geometric Data

Number of General Purpose Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	2300	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000

General Purpose Demand and Capacity

Demand Volume (V), veh/h	5839	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,GP}$), pc/h/ln	2215
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.78

General Purpose Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	25.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	74.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

Managed Lane Geometric Data

Managed Lane Segment Type	ML Access	Separation Type	Continuous Access
Number of Lanes (N), ln	1	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

Managed Lane Adjustment Factors

Driver Population	All Familiar	Demand Adjustment Factor (DAF)	1.000
Final Speed Adjustment Factor (SAF)	1.000	Final Capacity Adjustment Factor (CAF)	1.000

Managed Lane Demand and Capacity

	FF	RF	RR	FR
Demand Volume ($V_{i,ML}$), veh/h	860	0	0	0
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	0.00	0.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	1.000	1.000	1.000	1.000
Flow Rate ($v_{i,ML}$), pc/h	915	0	0	0
Weaving Flow Rate ($v_{w,ML}$), pc/h	0	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate ($v_{NW,ML}$), pc/h	915	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		2377
Total Flow Rate (v_{ML}), pc/h	915	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		-
Volume Ratio (VR)	0.000	Weaving Area Capacity (c_W), veh/h		2377
Minimum Lane Change Rate (LC_{MIN}), lc/h	0	Adjusted Weaving Area Capacity (c_{WA}), veh/h		2377
Maximum Weaving Length (L_{MAX}), ft	2596	Volume-to-Capacity Ratio (v/c)		0.38

Managed Lane Speed and Density

Non-Weaving Vehicle Index (I_{NW})	168	Average Weaving Speed (S_W), mi/h	63.2
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1242	Average Non-Weaving Speed (S_{NW}), mi/h	65.6
Weaving Lane Change Rate (LC_W), lc/h	28	Average Speed (S_{ML}), mi/h	65.6
Weaving Lane Change Rate (LC_{All}), lc/h	1270	Density (D_{ML}), pc/mi/ln	13.9
Weaving Intensity Factor (W)	0.141000	Level of Service (LOS_{ML})	B

HCS Freeway Merge Report

Project Information			
Segment Number	17	Segment Name	NB I-680 Alcosta Boulevard On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

General Purpose Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	300
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

General Purpose Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity		
Demand Volume (V_i), veh/h	5839	940
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	6644 | 6704	1070
Capacity (c_{md}), pc/h	7200	2100
Adjusted Capacity (c_{mda}), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.93	0.51

General Purpose Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	1519.3	Flow Outer Lanes (v_{OA}), pc/h/ln	2332
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	53.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	3302	Outer Lanes Freeway Speed (S_O), mi/h	63.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4372	Ramp Junction Speed (S), mi/h	56.3
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	39.7
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	37.3

Managed Lane Geometric Data			
Managed Lane Segment Type	ML Access	Separation Type	Continuous Access
Number of Lanes (N), ln	1	Number of Maneuver Lanes (N_{WL}), ln	2

Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

Managed Lane Adjustment Factors

Driver Population	All Familiar	Demand Adjustment Factor (DAF)	1.000
Final Speed Adjustment Factor (SAF)	1.000	Final Capacity Adjustment Factor (CAF)	1.000

Managed Lane Demand and Capacity

	FF	RF	RR	FR
Demand Volume ($V_{i,ML}$), veh/h	860	0	0	0
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	0.00	0.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	1.000	1.000	1.000	1.000
Flow Rate ($v_{i,ML}$), pc/h	915	0	0	0
Weaving Flow Rate ($v_{w,ML}$), pc/h	0	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate ($v_{NW,ML}$), pc/h	915	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		2316
Total Flow Rate (v_{ML}), pc/h	915	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		-
Volume Ratio (VR)	0.000	Weaving Area Capacity (c_W), veh/h		2316
Minimum Lane Change Rate (LC_{MIN}), lc/h	0	Adjusted Weaving Area Capacity (c_{WA}), veh/h		2316
Maximum Weaving Length (L_{MAX}), ft	2596	Volume-to-Capacity Ratio (v/c)		0.40

Managed Lane Speed and Density

Non-Weaving Vehicle Index (I_{NW})	110	Average Weaving Speed (S_W), mi/h	63.2
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	809	Average Non-Weaving Speed (S_{NW}), mi/h	65.6
Weaving Lane Change Rate (LC_W), lc/h	22	Average Speed (S_{ML}), mi/h	65.6
Weaving Lane Change Rate (LC_{All}), lc/h	831	Density (D_{ML}), pc/mi/ln	13.9
Weaving Intensity Factor (W)	0.142000	Level of Service (LOS_{ML})	B

HCS Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	4/3/2025
Agency		Analysis Year	Opening Year No Project PM Conditions
Jurisdiction		Time Analyzed	PM Peak Hour (5:00 to 6:00)
Project Description	I-580 & I-680 Pre PID	Units	U.S. Customary
Segment Number	1	Segment Name	EB I-580 Foothill Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	70.0	40.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	700
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	9774	1232
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Flow Rate (v_i), pc/h	9600	1414
Capacity (c_{md}), pc/h	9600	2000
Initial Adjusted Capacity (c_{mda}), pc/h	9600	-
Final Adjusted Capacity (c_{mda}), pc/h	9600	2000
Volume-to-Capacity Ratio (v/c)	1.17	0.71

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2309
Downstream Equilibrium Distance (L_{EQ}), ft	-	Off-Ramp Infl. Area Speed (S_R), mi/h	56.3
Flow in Lanes 1 and 2 (v_{12}), pc/h	4983	Outer Lanes Freeway Speed (S_O), mi/h	71.7
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	62.8
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	38.2

Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	40.8

HCS Basic Freeway Report

Project Information			
Segment Number	2	Segment Name	EB I-580 Foothill Rd Off-Ramp to Foothill Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	2000	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	8542	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	2451
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.99
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	51.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	46.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Freeway Weaving Report

Project Information

Segment Number	3	Segment Name	EB I-580 Foothill Rd On-Ramp to I-680 SB Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

Number of Lanes (N), ln	5	Segment Type	CD Roadway
Segment Length (L_s), ft	945	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	-
Interchange Density (ID), int/mi	1.33	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	6962	546	0	1580
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	7.90	7.90	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927	0.927	0.927
Flow Rate (v_i), pc/h	7990	627	0	1813
Weaving Flow Rate (v_W), pc/h	2440	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate (v_{NW}), pc/h	7990	Density-Based Capacity (c_{IWL} × N × f_{HV}), veh/h		9724
Total Flow Rate (v), pc/h	10430	Demand Flow-Based Capacity (c_{IW} × f_{HV}), veh/h		9508
Volume Ratio (VR)	0.234	Weaving Area Capacity (c_W), veh/h		9508
Minimum Lane Change Rate (LC_{MIN}), lc/h	2440	Adjusted Weaving Area Capacity (c_{WA}), veh/h		9508
Maximum Weaving Length (L_{MAX}), ft	4887	Volume-to-Capacity Ratio (v/c)		0.98

*Under oversaturated conditions, Volume Served is computed as Flow Rate

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	1007	Average Weaving Speed (S_W), mi/h	46.9
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1195	Average Non-Weaving Speed (S_{NW}), mi/h	42.4
Weaving Lane Change Rate (LC_W), lc/h	2928	Average Speed (S), mi/h	42.5
Total Lane Change Rate (LC_{All}), lc/h	4123	Density (D), pc/mi/ln	47.3
Weaving Intensity Factor (W)	0.723000	Level of Service (LOS)	F

HCS Freeway Diverge Report

Project Information

Segment Number	4	Segment Name	EB I-580 Foothill Rd Off-Ramp to Hopyard Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	150
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	7508	983
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Flow Rate (v_i), pc/h	8069	1128
Capacity (c_{md}), pc/h	9600	2000
Initial Adjusted Capacity (c_{mda}), pc/h	9600	-
Final Adjusted Capacity (c_{mda}), pc/h	9600	2000
Volume-to-Capacity Ratio (v/c)	0.84	0.56

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2112
Downstream Equilibrium Distance (L_{EQ}), ft	-	Off-Ramp Infl. Area Speed (S_R), mi/h	55.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	4393	Outer Lanes Freeway Speed (S_O), mi/h	72.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	39.3
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	51.3
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	40.7

HCS Basic Freeway Report

Project Information			
Segment Number	5	Segment Name	EB I-580 Hopyard Rd Off-Ramp to I-680 SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	1300	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	6525	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1872
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.70
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	21.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	76.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	6	Segment Name	EB I-580 Hopyard Rd Off-Ramp to I-680 SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1500	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	6525	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	2235
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.93
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	57.6
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	38.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	7	Segment Name	EB I-580 I-680 SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	5	2
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	260	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Two-Lane

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i), veh/h	6525	2882
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	7488 | 10011	3307
Capacity (c_{md}), pc/h	12000	4000
Adjusted Capacity (c_{mda}), pc/h	12000	4000
Volume-to-Capacity Ratio (v/c)	0.83	0.83

Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1468
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	56.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	1958	Outer Lanes Freeway Speed (S_O), mi/h	66.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	5265	Ramp Junction Speed (S), mi/h	56.8
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	28.9
Level of Service (LOS)	D	Density in Ramp Influence Area (D_R), pc/mi/ln	28.9

HCS Basic Freeway Report

Project Information

Segment Number	8	Segment Name	EB I-580 I-680 SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	6	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1130	1328
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	9407	2289
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	10796 | 12011	2627
Capacity (c_{md}), pc/h	14400	2000
Adjusted Capacity (c_{mda}), pc/h	14400	2000
Volume-to-Capacity Ratio (v/c)	0.83	1.00

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2253
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	57.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	3003	Outer Lanes Freeway Speed (S_O), mi/h	63.7
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	5630	Ramp Junction Speed (S), mi/h	57.1
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	29.6
Level of Service (LOS)	D	Density in Ramp Influence Area (D_R), pc/mi/ln	29.6

HCS Basic Freeway Report

Project Information			
Segment Number	9	Segment Name	EB I-580 I-680 SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	7	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	670	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i), veh/h	11150	402
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	12796 | 12472	461
Capacity (c_{md}), pc/h	16800	1900
Adjusted Capacity (c_{mda}), pc/h	16800	1900
Volume-to-Capacity Ratio (v/c)	0.74	0.24

Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2700
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	59.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	3608	Outer Lanes Freeway Speed (S_O), mi/h	61.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4069	Ramp Junction Speed (S), mi/h	59.1
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	22.9
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	22.9

HCS Freeway Merge Report

Project Information			
Segment Number	10	Segment Name	EB I-580 I-680 SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	7	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	450
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i), veh/h	11552	68
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	13257 | 12550	78
Capacity (c_{md}), pc/h	16800	1900
Adjusted Capacity (c_{mda}), pc/h	16800	1900
Volume-to-Capacity Ratio (v/c)	0.75	0.04

Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2700
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	55.5
Flow in Lanes 1 and 2 (v_{12}), pc/h	3954	Outer Lanes Freeway Speed (S_O), mi/h	61.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4032	Ramp Junction Speed (S), mi/h	58.6
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	23.0
Level of Service (LOS)	D	Density in Ramp Influence Area (D_R), pc/mi/ln	34.1

HCS Basic Freeway Report

Project Information

Analyst	Fehr & Peers	Date	4/3/2025
Agency		Analysis Year	Opening Year No Project PM Conditions
Jurisdiction		Time Analyzed	PM Peak Hour (5:00 to 6:00)
Project Description	I-580 & I-680 Pre PID	Units	U.S. Customary
Segment Number	1	Segment Name	WB I-580 Hopyard Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

General Purpose Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	40.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

General Purpose Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity

Demand Volume (V_i), veh/h	6564	574
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Flow Rate (v_i), pc/h	8192	659
Capacity (c_{md}), pc/h	12000	2000
Initial Adjusted Capacity (c_{mda}), pc/h	12000	-
Final Adjusted Capacity (c_{mda}), pc/h	12000	2000
Volume-to-Capacity Ratio (v/c)	0.63	0.33

General Purpose Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1662
Downstream Equilibrium Distance (L_{EQ}), ft	-	Off-Ramp Infl. Area Speed (S_R), mi/h	65.3
Flow in Lanes 1 and 2 (v_{12}), pc/h	3229	Outer Lanes Freeway Speed (S_O), mi/h	74.2

Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	65.3
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	20.1
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	20.1
Managed Lane Geometric Data			
Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0
Managed Lane Length, ft	1500	Terrain Type	Level
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Demand Volume (V_{ML}), veh/h	722	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	768
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	0
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	69.8
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	11.0
Speed 3 (S_3), mi/h	0.9	Level of Service (LOS)	A

HCS Basic Freeway Report

Project Information			
Segment Number	2	Segment Name	WB I-580 Hopyard Rd Off-Ramp to Hopyard Rd NB On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

General Purpose Geometric Data			
Number of General Purpose Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	1330	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		

General Purpose Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000

General Purpose Demand and Capacity			
Demand Volume (V), veh/h	5990	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,GP}$), pc/h/ln	1883
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.78

General Purpose Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	64.6
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	29.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

Managed Lane Geometric Data			
Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0
Managed Lane Length, ft	1330	Terrain Type	Level

Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		

Managed Lane Demand and Capacity

Demand Volume (V_{ML}), veh/h	722	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	768
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	0
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	69.8
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	11.0
Speed 3 (S_3), mi/h	0.9	Level of Service (LOS)	A

HCS Basic Freeway Report

Project Information

Segment Number	3	Segment Name	WB I-580 Hopyard Rd NB On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

General Purpose Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	450	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

General Purpose Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity

Demand Volume (V_i), veh/h	5990	560
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	6874 | 8176	643
Capacity (c_{md}), pc/h	12000	1900
Adjusted Capacity (c_{mda}), pc/h	12000	1900
Volume-to-Capacity Ratio (v/c)	0.68	0.34

General Purpose Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1616
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	63.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	2154	Outer Lanes Freeway Speed (S_O), mi/h	66.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2797	Ramp Junction Speed (S), mi/h	63.2
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	19.1
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	19.1

Managed Lane Geometric Data

Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0

Managed Lane Length, ft	450	Terrain Type	Level
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Demand Volume (V_{ML}), veh/h	722	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	768
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	0
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	69.8
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	11.0
Speed 3 (S_3), mi/h	0.9	Level of Service (LOS)	A

HCS Freeway Merge Report

Project Information

Segment Number	4	Segment Name	WB I-580 Hopyard Rd SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

General Purpose Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	40.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1180	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

General Purpose Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity

Demand Volume (V_i), veh/h	6550	407
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	7517 | 8643	467
Capacity (c_{md}), pc/h	12000	2000
Adjusted Capacity (c_{mda}), pc/h	12000	2000
Volume-to-Capacity Ratio (v/c)	0.72	0.23

General Purpose Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1754
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	61.0
Flow in Lanes 1 and 2 (v_{12}), pc/h	2338	Outer Lanes Freeway Speed (S_O), mi/h	65.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2805	Ramp Junction Speed (S), mi/h	63.4
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	19.9
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	22.2

Managed Lane Geometric Data

Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0

Managed Lane Length, ft	1180	Terrain Type	Level
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Demand Volume (V_{ML}), veh/h	722	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	768
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	0
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	69.8
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	11.0
Speed 3 (S_3), mi/h	0.9	Level of Service (LOS)	A

HCS Freeway Diverge Report

Project Information			
Segment Number	5	Segment Name	WB I-580 I-680 Off-Ramps
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

General Purpose Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	5	2
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1180	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

General Purpose Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity		
Demand Volume (V_i), veh/h	6957	3612
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Flow Rate (v_i), pc/h	8643	4145
Capacity (c_{md}), pc/h	12000	4000
Initial Adjusted Capacity (c_{mda}), pc/h	12000	-
Final Adjusted Capacity (c_{mda}), pc/h	12000	4000
Volume-to-Capacity Ratio (v/c)	0.67	1.04

Density and LOS			
Average Density (D), pc/mi/ln	30.3	Average Speed (S), mi/h	57.1
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	30.3	Level of Service (LOS)	F

Managed Lane Geometric Data			
Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0
Managed Lane Length, ft	1180	Terrain Type	Level

Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000

Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Demand Volume (V_{ML}), veh/h	722	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	768
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	1
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	68.9
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	11.1
Speed 3 (S_3), mi/h	0.9	Level of Service (LOS)	B

HCS Basic Freeway Report

Project Information			
Segment Number	6	Segment Name	WB I-580 I-680 Off-Ramps to Express Lane End
Analysis Period Number	1	Segment Analysis Period	17:00-17:15
General Purpose Geometric Data			
Number of General Purpose Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	715	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
General Purpose Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
General Purpose Demand and Capacity			
Demand Volume (V), veh/h	3345	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,GP}$), pc/h/ln	1499
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.62
General Purpose Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.2
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	21.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		
Managed Lane Geometric Data			
Managed Lane Segment Type	ML Access	Separation Type	Continuous Access
Number of Lanes (N), ln	1	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Demand Adjustment Factor (DAF)	1.000
Final Speed Adjustment Factor (SAF)	1.000	Final Capacity Adjustment Factor (CAF)	1.000

Managed Lane Demand and Capacity

	FF	RF	RR	FR

Demand Volume ($V_{i,ML}$), veh/h	722	0	0	722
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	0.00	0.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	1.000	1.000	1.000	1.000
Flow Rate ($v_{i,ML}$), pc/h	768	0	0	768
Weaving Flow Rate ($v_{w,ML}$), pc/h	768	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate ($v_{NW,ML}$), pc/h	768	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		1856
Total Flow Rate (v_{ML}), pc/h	1536	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		4800
Volume Ratio (VR)	0.500	Weaving Area Capacity (c_W), veh/h		1856
Minimum Lane Change Rate (LC_{MIN}), lc/h	768	Adjusted Weaving Area Capacity (c_{WA}), veh/h		1856
Maximum Weaving Length (L_{MAX}), ft	7826	Volume-to-Capacity Ratio (v/c)		0.83

Managed Lane Speed and Density

Non-Weaving Vehicle Index (I_{NW})	44	Average Weaving Speed (S_W), mi/h	56.5
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	353	Average Non-Weaving Speed (S_{NW}), mi/h	57.1
Weaving Lane Change Rate (LC_W), lc/h	781	Average Speed (S_{ML}), mi/h	56.8
Weaving Lane Change Rate (LC_{All}), lc/h	1134	Density (D_{ML}), pc/mi/ln	27.0
Weaving Intensity Factor (W)	0.325000	Level of Service (LOS_{ML})	C

HCS Basic Freeway Report

Project Information			
Segment Number	7	Segment Name	WB I-580 Express Lane End to I-680 NB On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	1660	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000

Demand and Capacity			
Demand Volume (V), veh/h	4067	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1125
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.47

Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	69.6
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	16.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information

Segment Number	8	Segment Name	WB I-580 I-680 NB On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	700	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	4067	1155
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	4667 | 5823	1325
Capacity (c_{md}), pc/h	12000	1900
Adjusted Capacity (c_{mda}), pc/h	12000	1900
Volume-to-Capacity Ratio (v/c)	0.49	0.70

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1053
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	64.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	1403	Outer Lanes Freeway Speed (S_O), mi/h	68.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2728	Ramp Junction Speed (S), mi/h	64.1
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	15.1
Level of Service (LOS)	B	Density in Ramp Influence Area (D_R), pc/mi/ln	15.1

HCS Freeway Weaving Report

Project Information

Segment Number	9	Segment Name	WB I-580 I-680 SB On-Ramp to Foothill Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

Number of Lanes (N), ln	6	Segment Type	CD Roadway
Segment Length (L_s), ft	1260	Number of Maneuver Lanes (N_{WL}), ln	3
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	-
Interchange Density (ID), int/mi	1.33	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	4214	1628	0	1008
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	7.90	7.90	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927	0.927	0.927
Flow Rate (v_i), pc/h	4699	1868	0	1124
Weaving Flow Rate (v_W), pc/h	2992	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate (v_{NW}), pc/h	4699	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		11780
Total Flow Rate (v), pc/h	7691	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		8427
Volume Ratio (VR)	0.385	Weaving Area Capacity (c_W), veh/h		8427
Minimum Lane Change Rate (LC_{MIN}), lc/h	1868	Adjusted Weaving Area Capacity (c_{WA}), veh/h		8427
Maximum Weaving Length (L_{MAX}), ft	4947	Volume-to-Capacity Ratio (v/c)		0.85

*Under oversaturated conditions, Volume Served is computed as Flow Rate

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	789	Average Weaving Speed (S_W), mi/h	52.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	495	Average Non-Weaving Speed (S_{NW}), mi/h	50.4
Weaving Lane Change Rate (LC_W), lc/h	2725	Average Speed (S), mi/h	51.1
Total Lane Change Rate (LC_{All}), lc/h	3220	Density (D), pc/mi/ln	25.1
Weaving Intensity Factor (W)	0.474000	Level of Service (LOS)	C

HCS Basic Freeway Report

Project Information			
Segment Number	10	Segment Name	WB I-580 Foothill Rd Off-Ramp to Foothill Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15
Geometric Data			
Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	950	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	5842	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1307
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.54
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.6
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	18.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	11	Segment Name	WB I-580 Foothill Rd Off-Ramp to Foothill Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	1465	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	5842	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1634
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.68
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.8
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	24.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information

Segment Number	12	Segment Name	WB I-580 Foothill Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	5842	1174
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	6704 | 7882	1347
Capacity (c_{md}), pc/h	12000	2100
Adjusted Capacity (c_{mda}), pc/h	12000	2100
Volume-to-Capacity Ratio (v/c)	0.66	0.64

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1431
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	64.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	1908	Outer Lanes Freeway Speed (S_O), mi/h	66.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3255	Ramp Junction Speed (S), mi/h	64.1
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	19.1
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	19.1

HCS Basic Freeway Report

Project Information			
Analyst	Fehr & Peers	Date	4/3/2025
Agency		Analysis Year	Opening Year No Project PM Conditions
Jurisdiction		Time Analyzed	PM Peak Hour (5:00 to 6:00)
Project Description	I-580 & I-680 Pre PID	Units	U.S. Customary
Segment Number	1	Segment Name	SB I-680 Alcosta Boulevard Off-Ramp to Alcosta Boulevard On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	2800	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000

Demand and Capacity			
Demand Volume (V), veh/h	8169	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	2324
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.97

Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	55.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	41.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information

Segment Number	2	Segment Name	SB I-680 Alcosta Boulevard hook on-ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	375	150
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	8169	914
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	9295 | 10335	1040
Capacity (c_{md}), pc/h	12000	2000
Adjusted Capacity (c_{mda}), pc/h	12000	2000
Volume-to-Capacity Ratio (v/c)	0.86	0.52

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2039
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	60.5
Flow in Lanes 1 and 2 (v_{12}), pc/h	2718	Outer Lanes Freeway Speed (S_O), mi/h	64.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3758	Ramp Junction Speed (S), mi/h	60.5
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	25.9
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	25.9

HCS Freeway Merge Report

Project Information

Segment Number	3	Segment Name	SB I-680 Alcosta Boulevard diagonal on-ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	9083	373
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	10335 | 10759	424
Capacity (c_{md}), pc/h	12000	2000
Adjusted Capacity (c_{mda}), pc/h	12000	2000
Volume-to-Capacity Ratio (v/c)	0.90	0.21

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2351
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	60.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	3134	Outer Lanes Freeway Speed (S_O), mi/h	63.2
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3558	Ramp Junction Speed (S), mi/h	61.8
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	26.7
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	23.7

HCS Basic Freeway Report

Project Information			
Segment Number	4	Segment Name	SB I-680 Alcosta Boulevard diagonal on-ramp to I-580 EB Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	1095	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.50
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	9456	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	2152
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.90
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	36.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	5	Segment Name	SB I-680 Alcosta Boulevard diagonal on-ramp to I-580 EB Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	6	Terrain Type	Level
Segment Length (L), ft	1210	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.50
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	9456	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1793
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.75
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	65.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	27.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Freeway Diverge Report

Project Information			
Segment Number	6	Segment Name	SB I-680 I-580 EB Off-Ramp & Dublin Blvd Off Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	6	2
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i), veh/h	9456	3413
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Flow Rate (v_i), pc/h	10672	3883
Capacity (c_{md}), pc/h	14400	4200
Initial Adjusted Capacity (c_{mda}), pc/h	14400	-
Final Adjusted Capacity (c_{mda}), pc/h	14400	4200
Volume-to-Capacity Ratio (v/c)	0.75	0.92

Density and LOS			
Average Density (D), pc/mi/ln	31.1	Average Speed (S), mi/h	57.1
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	31.1	Level of Service (LOS)	F

HCS Freeway Diverge Report

Project Information			
Segment Number	7	Segment Name	SB I-680 WB I-580 off-ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	5	2
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1510	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i), veh/h	6043	1628
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Flow Rate (v_i), pc/h	6217	1852
Capacity (c_{md}), pc/h	12000	4000
Initial Adjusted Capacity (c_{mda}), pc/h	12000	-
Final Adjusted Capacity (c_{mda}), pc/h	12000	4000
Volume-to-Capacity Ratio (v/c)	0.52	0.46

Density and LOS			
Average Density (D), pc/mi/ln	51.3	Average Speed (S), mi/h	24.2
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	24.1	Level of Service (LOS)	F

HCS Basic Freeway Report

Project Information			
Segment Number	8	Segment Name	SB I-680 WB I-580 off-ramp to Dublin Blvd On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	840	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.50
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	4415	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1256
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.42
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	11.8
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	86.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	9	Segment Name	SB I-680 WB I-580 off-ramp to Dublin Blvd On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1000	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.50
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	4415	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1674
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.54
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	13.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	95.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Freeway Merge Report

Project Information			
Segment Number	10	Segment Name	SB I-680 Dublin Blvd On- Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	350
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i), veh/h	4415	446
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	5023 | 4102	507
Capacity (c_{md}), pc/h	7200	2000
Adjusted Capacity (c_{mda}), pc/h	7200	2000
Volume-to-Capacity Ratio (v/c)	0.57	0.25

Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2074
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	58.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	2949	Outer Lanes Freeway Speed (S_O), mi/h	64.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3456	Ramp Junction Speed (S), mi/h	13.5
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	101.5
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	30.1

HCS Freeway Weaving Report

Project Information

Segment Number	11	Segment Name	SB I-680 WB & EB I-580 On-Ramp to Stoneridge Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

Number of Lanes (N), ln	4	Segment Type	CD Roadway
Segment Length (L_S), ft	1220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.50	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	3480	1790	0	1381
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	7.00	7.00	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935	0.935	0.935
Flow Rate (v_i), pc/h	2937	612	0	1165
Weaving Flow Rate (v_W), pc/h	1777	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate (v_{NW}), pc/h	2937	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		7173
Total Flow Rate (v), pc/h	4714	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		4734
Volume Ratio (VR)	0.474	Weaving Area Capacity (c_W), veh/h		4734
Minimum Lane Change Rate (LC_{MIN}), lc/h	612	Adjusted Weaving Area Capacity (c_{WA}), veh/h		4734
Maximum Weaving Length (L_{MAX}), ft	7524	Volume-to-Capacity Ratio (v/c)		0.93

*Under oversaturated conditions, Volume Served is computed as Flow Rate

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	537	Average Weaving Speed (S_W), mi/h	58.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	496	Average Non-Weaving Speed (S_{NW}), mi/h	59.9
Weaving Lane Change Rate (LC_W), lc/h	1006	Average Speed (S), mi/h	59.3
Total Lane Change Rate (LC_{All}), lc/h	1502	Density (D), pc/mi/ln	19.9
Weaving Intensity Factor (W)	0.266000	Level of Service (LOS)	F

HCS Basic Freeway Report

Project Information			
Segment Number	12	Segment Name	SB I-680 Stoneridge Rd Off-Ramp to Stoneridge Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	860	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.50
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	5270	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1048
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.44
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	15.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Freeway Merge Report

Project Information

Segment Number	13	Segment Name	SB I-680 Stoneridge Drive loop on-ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1250	300
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	5270	982
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	5996 | 4260	1117
Capacity (c_{md}), pc/h	7200	1900
Adjusted Capacity (c_{mda}), pc/h	7200	1900
Volume-to-Capacity Ratio (v/c)	0.59	0.59

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1301
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	59.3
Flow in Lanes 1 and 2 (v_{12}), pc/h	1842	Outer Lanes Freeway Speed (S_O), mi/h	67.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2959	Ramp Junction Speed (S), mi/h	61.5
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	23.1
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	26.2

HCS Freeway Merge Report

Project Information

Segment Number	14	Segment Name	SB I-680 Stoneridge Drive diagonal on-ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	55.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	300
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	6252	746
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	7113 | 5109	849
Capacity (c_{md}), pc/h	7200	2200
Adjusted Capacity (c_{mda}), pc/h	7200	2200
Volume-to-Capacity Ratio (v/c)	0.71	0.39

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1764
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	58.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	2496	Outer Lanes Freeway Speed (S_O), mi/h	65.4
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3345	Ramp Junction Speed (S), mi/h	60.9
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	28.0
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	29.4

HCS Freeway Diverge Report

Project Information			
Analyst	Fehr & Peers	Date	4/3/2025
Agency		Analysis Year	Opening Year No Project PM Conditions
Jurisdiction		Time Analyzed	PM Peak Hour (5:00 to 6:00)
Project Description	I-580 & I-680 Pre PID	Units	U.S. Customary
Segment Number	1	Segment Name	NB I-680 Stoneridge Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	150
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i), veh/h	6263	672
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Flow Rate (v_i), pc/h	7126	765
Capacity (c_{md}), pc/h	7200	2100
Initial Adjusted Capacity (c_{mda}), pc/h	7200	-
Final Adjusted Capacity (c_{mda}), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.99	0.36

Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2700
Downstream Equilibrium Distance (L_{EQ}), ft	2055.7	Off-Ramp Infl. Area Speed (S_R), mi/h	59.7
Flow in Lanes 1 and 2 (v_{12}), pc/h	4426	Outer Lanes Freeway Speed (S_O), mi/h	70.2
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	63.3

Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	37.5
Level of Service (LOS)	E	Density in Ramp Influence Area (D_R), pc/mi/ln	41.0

HCS Basic Freeway Report

Project Information			
Segment Number	2	Segment Name	NB I-680 Stoneridge Rd Off-Ramp to Loop On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15
Geometric Data			
Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1600	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.50
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	5591	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	2120
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.88
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	60.2
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	35.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information

Segment Number	3	Segment Name	NB I-680 Stoneridge Rd Loop On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	640	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	5591	704
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	6361 | 7162	801
Capacity (c_{md}), pc/h	7200	1900
Adjusted Capacity (c_{mda}), pc/h	7200	1900
Volume-to-Capacity Ratio (v/c)	0.99	0.42

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	694.9	Flow Outer Lanes (v_{OA}), pc/h/ln	1960
Downstream Equilibrium Distance (L_{EQ}), ft	6736.7	On-Ramp Infl. Area Speed (S_R), mi/h	53.7
Flow in Lanes 1 and 2 (v_{12}), pc/h	3943	Outer Lanes Freeway Speed (S_O), mi/h	64.7
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4744	Ramp Junction Speed (S), mi/h	53.7
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	44.5
Level of Service (LOS)	E	Density in Ramp Influence Area (D_R), pc/mi/ln	44.5

HCS Basic Freeway Report

Project Information

Segment Number	4	Segment Name	NB I-680 Stoneridge Rd Diagnol On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	698	300
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	6295	1202
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	7162 | 8530	1368
Capacity (c_{md}), pc/h	9600	2000
Adjusted Capacity (c_{mda}), pc/h	9600	2000
Volume-to-Capacity Ratio (v/c)	0.89	0.68

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2011
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	59.9
Flow in Lanes 1 and 2 (v_{12}), pc/h	2682	Outer Lanes Freeway Speed (S_O), mi/h	64.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4050	Ramp Junction Speed (S), mi/h	59.9
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	35.6
Level of Service (LOS)	E	Density in Ramp Influence Area (D_R), pc/mi/ln	35.6

HCS Basic Freeway Report

Project Information

Segment Number	5	Segment Name	NB I-680 I-580 EB Off Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	698	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	7497	2289
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Flow Rate (v_i), pc/h	8530	2604
Capacity (c_{md}), pc/h	9600	4200
Initial Adjusted Capacity (c_{mda}), pc/h	9600	-
Final Adjusted Capacity (c_{mda}), pc/h	9600	4200
Volume-to-Capacity Ratio (v/c)	0.89	0.62

Density and LOS

Average Density (D), pc/mi/ln	35.6	Average Speed (S), mi/h	59.9
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	35.6	Level of Service (LOS)	E

HCS Freeway Diverge Report

Project Information

Segment Number	6	Segment Name	NB I-680 I-580 WB Off Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	860	400
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	5208	1155
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Flow Rate (v_i), pc/h	5926	1314
Capacity (c_{md}), pc/h	7200	2100
Initial Adjusted Capacity (c_{mda}), pc/h	7200	-
Final Adjusted Capacity (c_{mda}), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.82	0.63

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	12733.4	Flow Outer Lanes (v_{OA}), pc/h/ln	2071
Downstream Equilibrium Distance (L_{EQ}), ft	-	Off-Ramp Infl. Area Speed (S_R), mi/h	58.4
Flow in Lanes 1 and 2 (v_{12}), pc/h	3855	Outer Lanes Freeway Speed (S_O), mi/h	72.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	62.7
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	31.5
Level of Service (LOS)	D	Density in Ramp Influence Area (D_R), pc/mi/ln	33.8

HCS Basic Freeway Report

Project Information			
Segment Number	7	Segment Name	NB I-680 I-580 WB Off Ramp to I-580 EB On Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15
Geometric Data			
Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	590	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.67
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	4053	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1537
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.64
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	67.7
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	22.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	8	Segment Name	NB I-680 I-580 WB Off Ramp to I-580 EB On Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15
Geometric Data			
Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1900	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.67
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	4053	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	2306
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.96
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	55.8
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	41.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information

Segment Number	9	Segment Name	NB I-680 I-580 EB on-ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	680	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Two-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	4053	1013
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	4611 | 5764	1153
Capacity (c_{md}), pc/h	9600	4000
Adjusted Capacity (c_{mda}), pc/h	9600	4000
Volume-to-Capacity Ratio (v/c)	0.60	0.29

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1246
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	69.3
Flow in Lanes 1 and 2 (v_{12}), pc/h	1662	Outer Lanes Freeway Speed (S_O), mi/h	67.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2815	Ramp Junction Speed (S), mi/h	68.2
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	20.8
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	20.8

HCS Basic Freeway Report

Project Information

Segment Number	10	Segment Name	NB I-680 I-580 WB on-ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	475	400
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	5066	2389
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	5764 | 8482	2718
Capacity (c_{md}), pc/h	12000	2100
Adjusted Capacity (c_{mda}), pc/h	12000	2100
Volume-to-Capacity Ratio (v/c)	0.71	1.00

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1242
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	67.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	1656	Outer Lanes Freeway Speed (S_O), mi/h	67.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4374	Ramp Junction Speed (S), mi/h	67.1
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	25.3
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	25.3

HCS Freeway Merge Report

Project Information

Segment Number	11	Segment Name	NB I-680 Dublin Boulevard on-ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	6912	688
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	7864 | 8647	783
Capacity (c_{md}), pc/h	12000	2000
Adjusted Capacity (c_{mda}), pc/h	12000	2000
Volume-to-Capacity Ratio (v/c)	0.72	0.39

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1687
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	59.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	2249	Outer Lanes Freeway Speed (S_O), mi/h	65.7
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3032	Ramp Junction Speed (S), mi/h	62.4
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	20.5
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	27.6

HCS Basic Freeway Report

Project Information			
Segment Number	12	Segment Name	NB I-680 Dublin Boulevard on-ramp to Alcosta Boulevard Off Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data			
Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	530	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000

Demand and Capacity			
Demand Volume (V), veh/h	7600	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1729
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.72

Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	66.8
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	25.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	13	Segment Name	NB I-680 Dublin Boulevard on-ramp to Alcosta Boulevard Off Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	2940	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	7600	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	2162
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.90
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	36.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Basic Freeway Report

Project Information			
Segment Number	14	Segment Name	NB I-680 Dublin Boulevard on-ramp to Alcosta Boulevard Off Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	450	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	7600	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	2162
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.90
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	59.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	36.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Freeway Diverge Report

Project Information			
Segment Number	15	Segment Name	NB I-680 Alcosta Boulevard Off-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

General Purpose Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	400
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

General Purpose Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity		
Demand Volume (V_i), veh/h	7600	1570
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Flow Rate (v_i), pc/h	8647	1786
Capacity (c_{md}), pc/h	9600	2100
Initial Adjusted Capacity (c_{mda}), pc/h	9600	-
Final Adjusted Capacity (c_{mda}), pc/h	9600	2100
Volume-to-Capacity Ratio (v/c)	0.90	0.85

General Purpose Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1935
Downstream Equilibrium Distance (L_{EQ}), ft	-	Off-Ramp Infl. Area Speed (S_R), mi/h	57.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	4777	Outer Lanes Freeway Speed (S_O), mi/h	73.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	63.3
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	34.2
Level of Service (LOS)	E	Density in Ramp Influence Area (D_R), pc/mi/ln	41.7

Managed Lane Geometric Data			
Managed Lane Segment Type	ML Access	Separation Type	Continuous Access

Number of Lanes (N), ln	1	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

Managed Lane Adjustment Factors

Driver Population	All Familiar	Demand Adjustment Factor (DAF)	1.000
Final Speed Adjustment Factor (SAF)	1.000	Final Capacity Adjustment Factor (CAF)	1.000

Managed Lane Demand and Capacity

	FF	RF	RR	FR
Demand Volume ($V_{i,ML}$), veh/h	0	916	0	0
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	0.00	0.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	1.000	1.000	1.000	1.000
Flow Rate ($v_{i,ML}$), pc/h	0	974	0	0

Weaving Flow Rate ($v_{W,ML}$), pc/h	974	Ideal Conditions Capacity (c_{IFL}), pc/h/ln	2400
Non-Weaving Flow Rate ($v_{NW,ML}$), pc/h	0	Density-Based Capacity (c_{IWL} × N × f_{HV}), veh/h	1426
Total Flow Rate (v_{ML}), pc/h	974	Demand Flow-Based Capacity (c_{IW} × f_{HV}), veh/h	2400
Volume Ratio (VR)	1.000	Weaving Area Capacity (c_W), veh/h	1426
Minimum Lane Change Rate (LC_{MIN}), lc/h	974	Adjusted Weaving Area Capacity (c_{WA}), veh/h	1426
Maximum Weaving Length (L_{MAX}), ft	14232	Volume-to-Capacity Ratio (v/c)	0.68

Managed Lane Speed and Density

Non-Weaving Vehicle Index (I_{NW})	0	Average Weaving Speed (S_W), mi/h	59.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	620	Average Non-Weaving Speed (S_{NW}), mi/h	58.3
Weaving Lane Change Rate (LC_W), lc/h	996	Average Speed (S_{ML}), mi/h	59.4
Weaving Lane Change Rate (LC_{All}), lc/h	1616	Density (D_{ML}), pc/mi/ln	16.4
Weaving Intensity Factor (W)	0.240000	Level of Service (LOS_{ML})	B

HCS Basic Freeway Report

Project Information			
Segment Number	16	Segment Name	NB I-680 Alcosta Boulevard Off-Ramp to Alcosta Boulevard On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15
General Purpose Geometric Data			
Number of General Purpose Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	2300	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.50
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
General Purpose Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
General Purpose Demand and Capacity			
Demand Volume (V), veh/h	5114	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,GP}$), pc/h/ln	1940
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.81
General Purpose Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	63.7
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	30.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		
Managed Lane Geometric Data			
Managed Lane Segment Type	ML Access	Separation Type	Continuous Access
Number of Lanes (N), ln	1	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Demand Adjustment Factor (DAF)	1.000
Final Speed Adjustment Factor (SAF)	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Managed Lane Demand and Capacity			

	FF	RF	RR	FR
Demand Volume ($V_{i,ML}$), veh/h	916	0	0	0
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	0.00	0.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	1.000	1.000	1.000	1.000
Flow Rate ($v_{i,ML}$), pc/h	974	0	0	0
Weaving Flow Rate ($v_{w,ML}$), pc/h	0	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate ($v_{NW,ML}$), pc/h	974	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		2377
Total Flow Rate (v_{ML}), pc/h	974	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		-
Volume Ratio (VR)	0.000	Weaving Area Capacity (c_W), veh/h		2377
Minimum Lane Change Rate (LC_{MIN}), lc/h	0	Adjusted Weaving Area Capacity (c_{WA}), veh/h		2377
Maximum Weaving Length (L_{MAX}), ft	2596	Volume-to-Capacity Ratio (v/c)		0.41

Managed Lane Speed and Density

Non-Weaving Vehicle Index (I_{NW})	179	Average Weaving Speed (S_W), mi/h	67.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1255	Average Non-Weaving Speed (S_{NW}), mi/h	70.7
Weaving Lane Change Rate (LC_W), lc/h	28	Average Speed (S_{ML}), mi/h	70.7
Weaving Lane Change Rate (LC_{All}), lc/h	1283	Density (D_{ML}), pc/mi/ln	13.8
Weaving Intensity Factor (W)	0.143000	Level of Service (LOS_{ML})	B

HCS Freeway Merge Report

Project Information			
Segment Number	17	Segment Name	NB I-680 Alcosta Boulevard On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

General Purpose Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	300
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

General Purpose Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity		
Demand Volume (V_i), veh/h	5114	583
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	5819 | 6482	663
Capacity (c_{md}), pc/h	7200	2100
Adjusted Capacity (c_{mda}), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.90	0.32

General Purpose Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	1471.8	Flow Outer Lanes (v_{OA}), pc/h/ln	2409
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	55.4
Flow in Lanes 1 and 2 (v_{12}), pc/h	3410	Outer Lanes Freeway Speed (S_O), mi/h	62.8
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4073	Ramp Junction Speed (S), mi/h	57.9
Number of Outer Lanes on Freeway (N_O), ln	1	Average Density (D), pc/mi/ln	37.3
Level of Service (LOS)	E	Density in Ramp Influence Area (D_R), pc/mi/ln	35.1

Managed Lane Geometric Data			
Managed Lane Segment Type	ML Access	Separation Type	Continuous Access
Number of Lanes (N), ln	1	Number of Maneuver Lanes (N_{WL}), ln	2

Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

Managed Lane Adjustment Factors

Driver Population	All Familiar	Demand Adjustment Factor (DAF)	1.000
Final Speed Adjustment Factor (SAF)	1.000	Final Capacity Adjustment Factor (CAF)	1.000

Managed Lane Demand and Capacity

	FF	RF	RR	FR
Demand Volume ($V_{i,ML}$), veh/h	916	0	0	0
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	0.00	0.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	1.000	1.000	1.000	1.000
Flow Rate ($v_{i,ML}$), pc/h	974	0	0	0
Weaving Flow Rate ($v_{w,ML}$), pc/h	0	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate ($v_{NW,ML}$), pc/h	974	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		2316
Total Flow Rate (v_{ML}), pc/h	974	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		-
Volume Ratio (VR)	0.000	Weaving Area Capacity (c_W), veh/h		2316
Minimum Lane Change Rate (LC_{MIN}), lc/h	0	Adjusted Weaving Area Capacity (c_{WA}), veh/h		2316
Maximum Weaving Length (L_{MAX}), ft	2596	Volume-to-Capacity Ratio (v/c)		0.42

Managed Lane Speed and Density

Non-Weaving Vehicle Index (I_{NW})	117	Average Weaving Speed (S_W), mi/h	67.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	821	Average Non-Weaving Speed (S_{NW}), mi/h	70.7
Weaving Lane Change Rate (LC_W), lc/h	22	Average Speed (S_{ML}), mi/h	70.7
Weaving Lane Change Rate (LC_{All}), lc/h	843	Density (D_{ML}), pc/mi/ln	13.8
Weaving Intensity Factor (W)	0.143000	Level of Service (LOS_{ML})	B

Leisch Method for Weaving Analysis

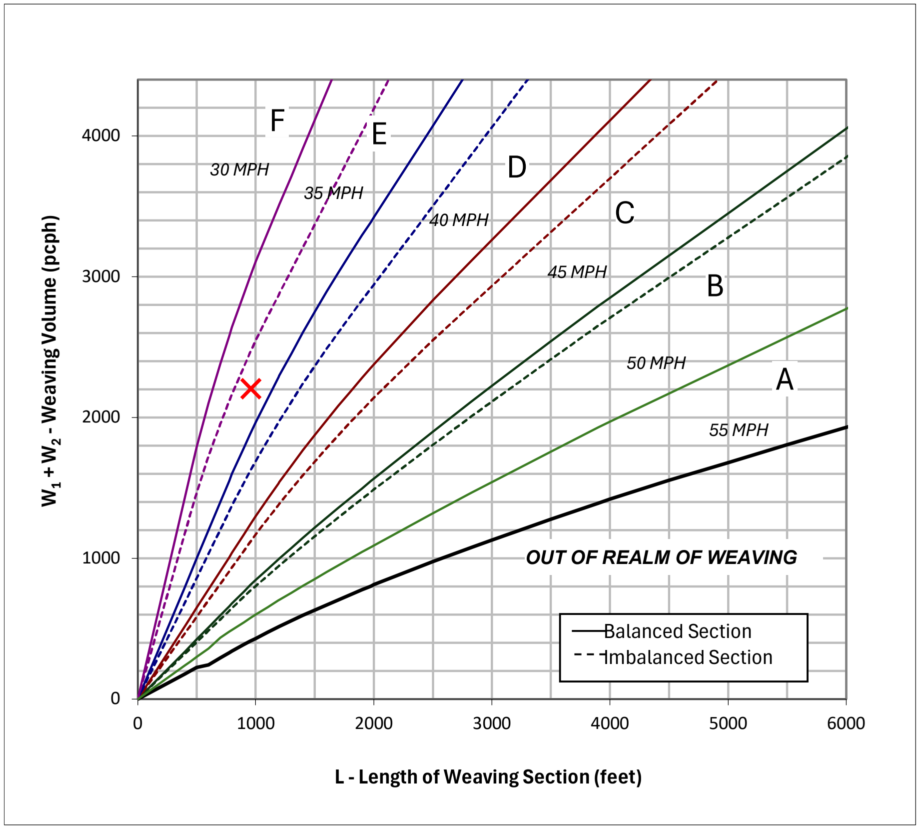
Data Input

Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	960

Project Information

Project	I-580/I-680 Pre PID
Scenario	Opening Year AM Conditions
Freeway	Eastbound I-580
On-ramp	Foothill Road On-ramp
Off-ramp	Southbound I-680 Off-ramp

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,015	Volume (vph)*	284	Volume (vph)*	1,759
Truck Percentage	7.9%	Truck Percentage	7.9%	Truck Percentage	7.9%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	5,411	Volume (pcph)	306	Volume (pcph)	1,898



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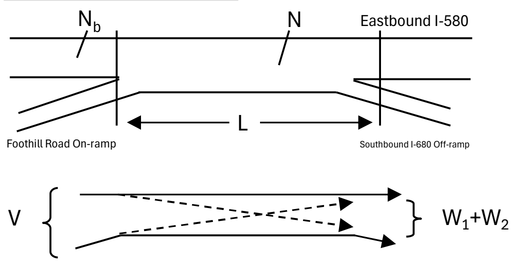


Capacity Analysis

1. Is the weaving section balanced (Y / N)? N

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 29.3
4. Weaving Intensity Factor (k) 3.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,205
6. Level of Service (LOS) C

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

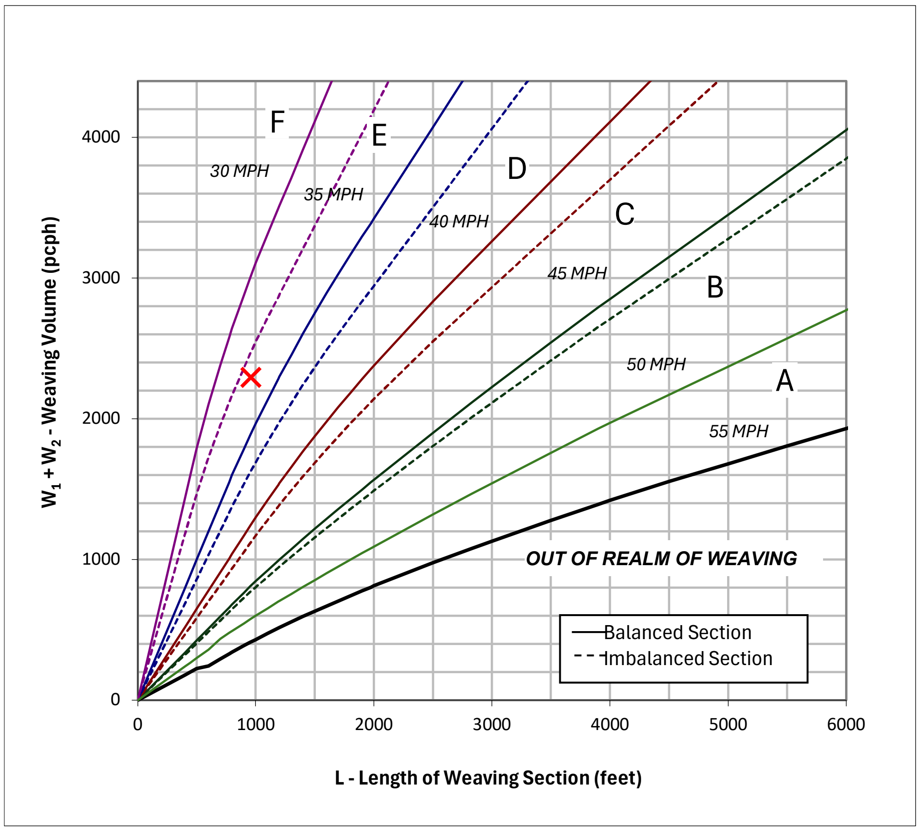
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	960

Project Information	
Project	I-580/I-680 Pre PID
Scenario	Opening Year PM Conditions
Freeway	Eastbound I-580
On-ramp	Foothill Road On-ramp
Off-ramp	Southbound I-680 Off-ramp

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,088	Volume (vph)*	546	Volume (vph)*	1,580
Truck Percentage	7.9%	Truck Percentage	7.9%	Truck Percentage	7.9%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	9,806	Volume (pcph)	589	Volume (pcph)	1,705



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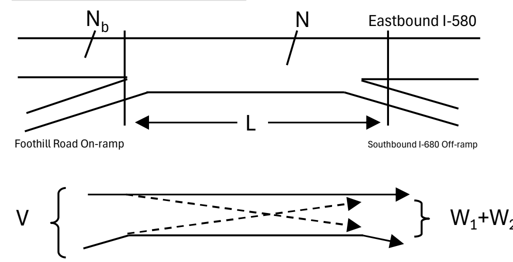


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   35 MPH and **40 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 28.4
4. Weaving Intensity Factor (k) 3.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 2,197
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

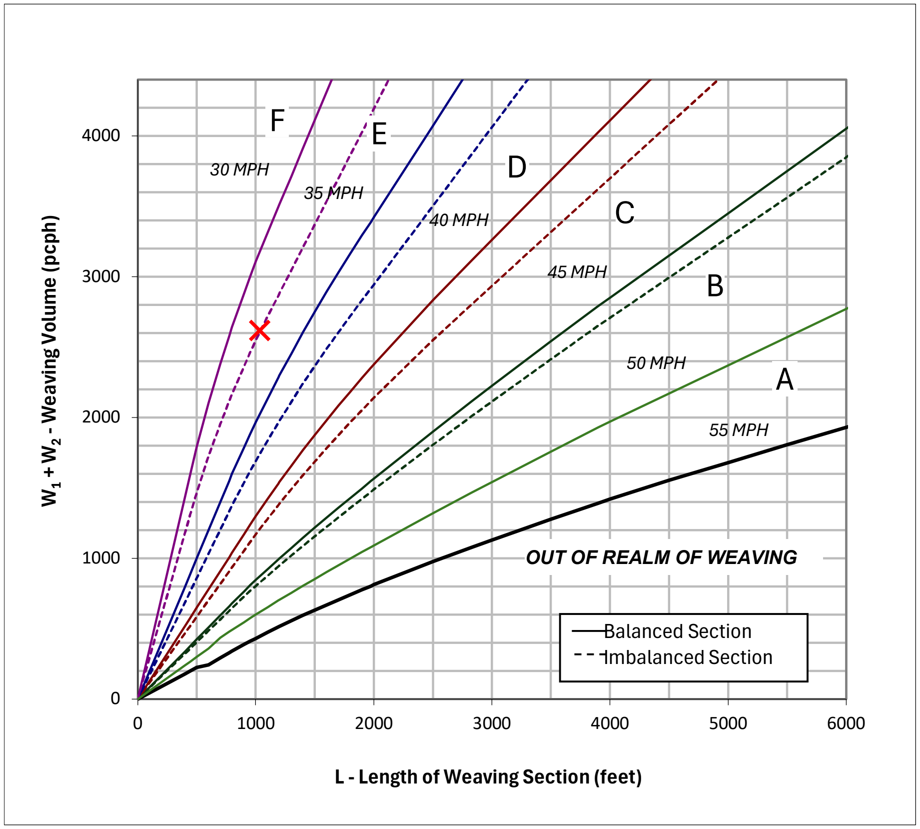
Data Input

Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	1,035

Project Information

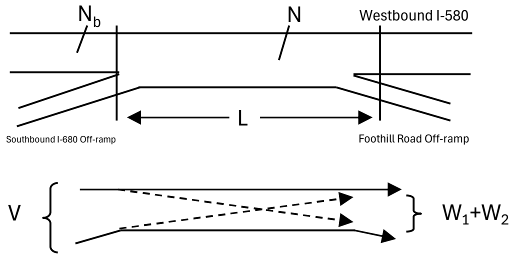
Project	I-580/I-680 Pre PID
Scenario	Opening Year AM Conditions
Freeway	Westbound I-580
On-ramp	Southbound I-680 Off-ramp
Off-ramp	Foothill Road Off-ramp

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	8,276	Volume (vph)*	1,785	Volume (vph)*	642
Truck Percentage	7.9%	Truck Percentage	7.9%	Truck Percentage	7.9%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	8,930	Volume (pcph)	1,926	Volume (pcph)	693



The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

30 MPH and **35 MPH**

If left of the 30 MPH curve, LOS is F. Select "-".

If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph): 32.4
4. Weaving Intensity Factor (k): 2.89
5. Service Volume (SV, pcph)

$SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$: 2,048

6. Level of Service (LOS): F

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Leisch Method for Weaving Analysis

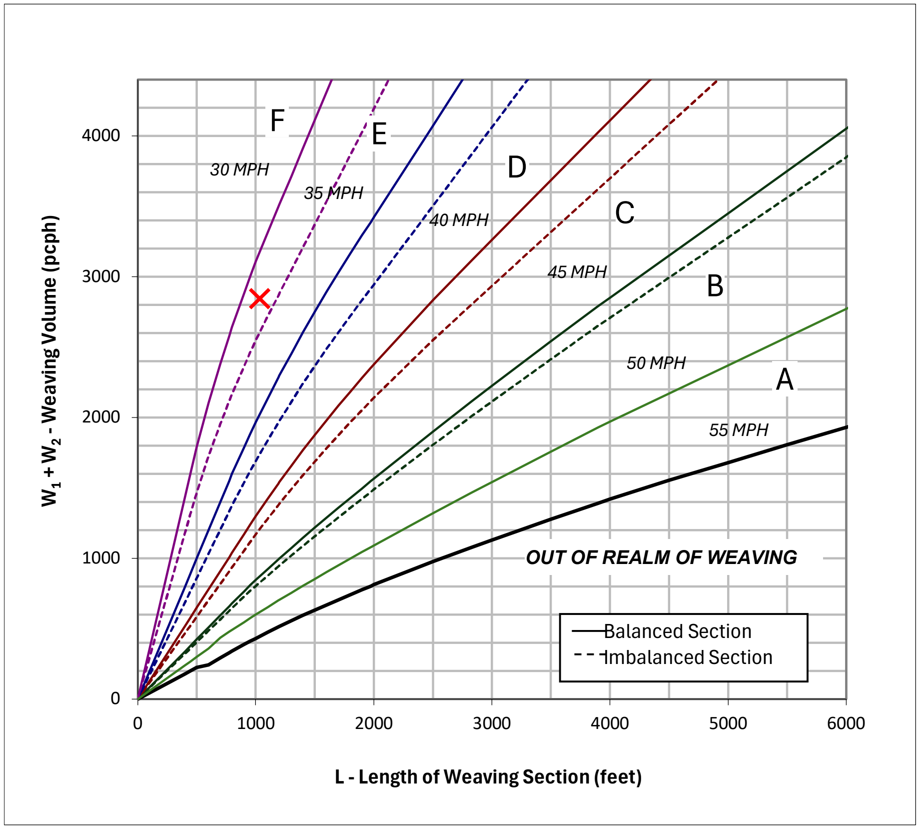
Data Input

Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	1,035

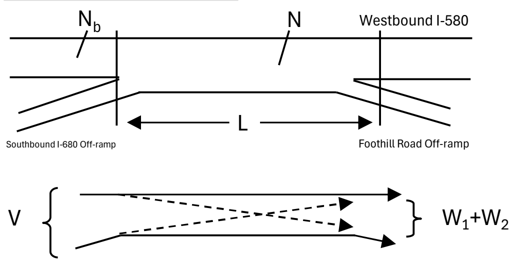
Project Information

Project	I-580/I-680 Pre PID
Scenario	Opening Year PM Conditions
Freeway	Westbound I-580
On-ramp	Southbound I-680 Off-ramp
Off-ramp	Foothill Road Off-ramp

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,085	Volume (vph)*	1,628	Volume (vph)*	1,008
Truck Percentage	7.9%	Truck Percentage	7.9%	Truck Percentage	7.9%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	6,566	Volume (pcph)	1,757	Volume (pcph)	1,088



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

30 MPH and **35 MPH**

If left of the 30 MPH curve, LOS is F. Select "-".

If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_W, mph) 31.4
4. Weaving Intensity Factor (k) 2.92
5. Service Volume (SV, pcph)

$SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,731

6. Level of Service (LOS) E

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

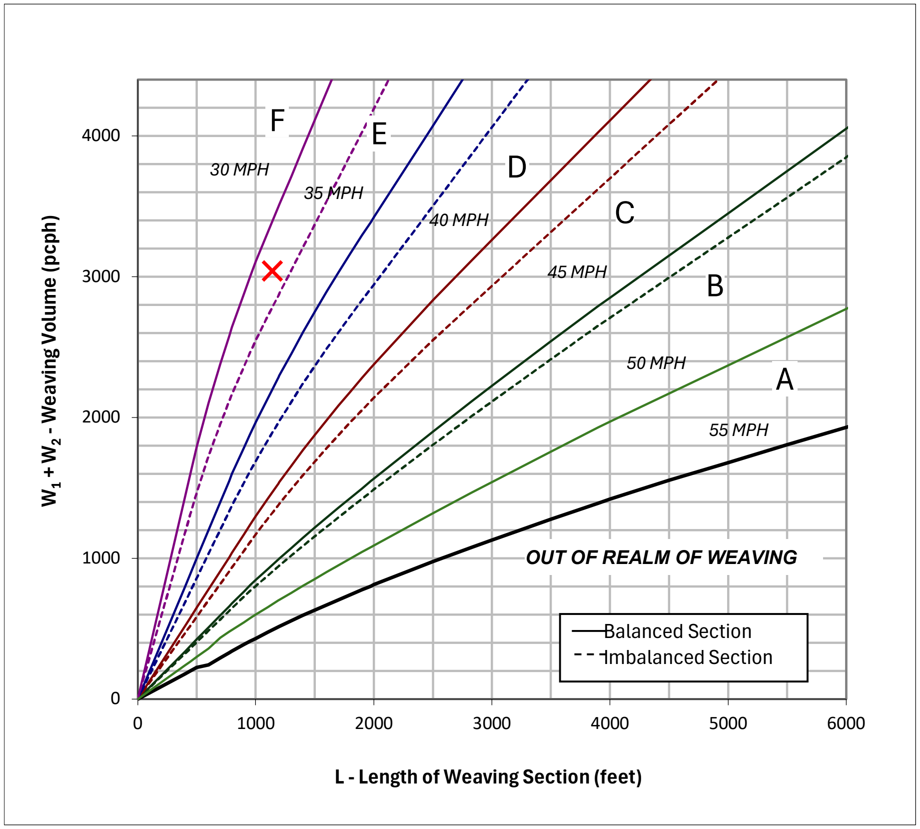
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Leisch Method for Weaving Analysis

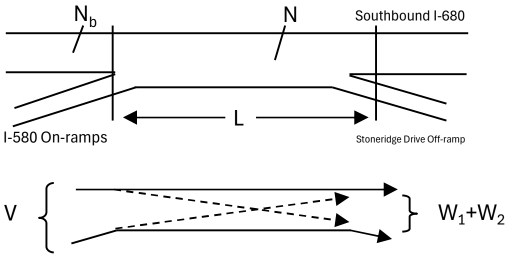
Data Input		
Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	1,140

Project Information	
Project	I-580/I-680 Pre PID
Scenario	Opening Year AM Conditions
Freeway	Southbound I-680
On-ramp	I-580 On-ramps
Off-ramp	Stoneridge Drive Off-ramp

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,340	Volume (vph)*	1,859	Volume (vph)*	982
Truck Percentage	7.0%	Truck Percentage	7.0%	Truck Percentage	7.0%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	5,714	Volume (pcph)	1,989	Volume (pcph)	1,051



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   30 MPH and **35 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph): **31.5**
4. Weaving Intensity Factor (k): **2.92**
5. Service Volume (SV, pcph)

   SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]: **1,932**
6. Level of Service (LOS): **F**

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

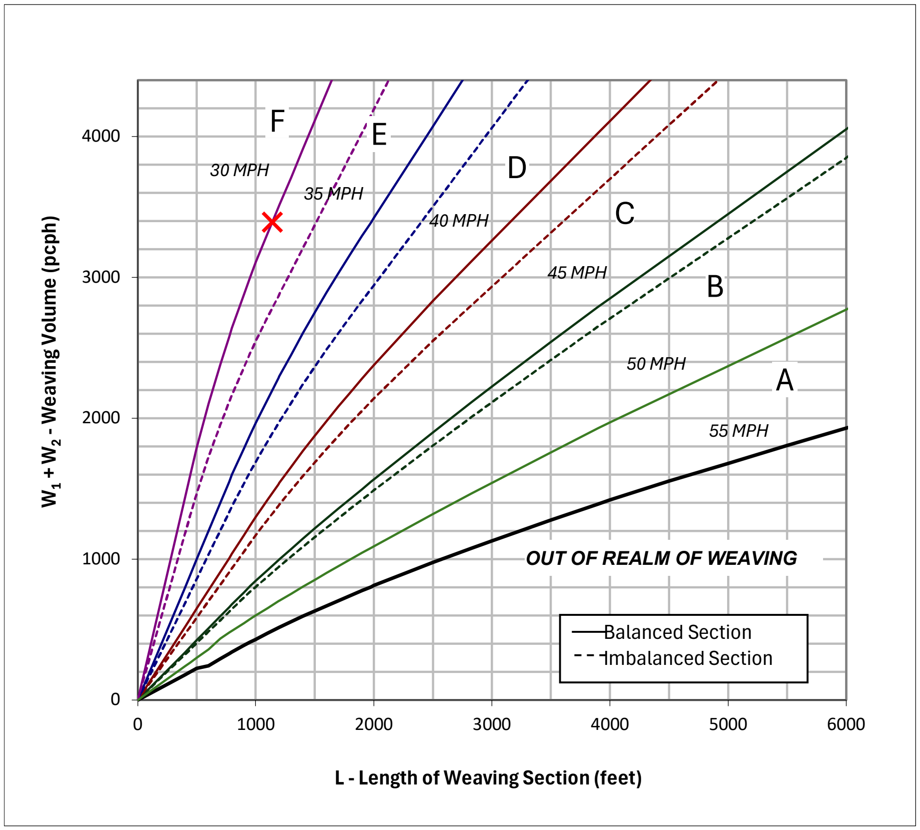
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	1,140

Project Information	
Project	I-580/I-680 Pre PID
Scenario	Opening Year PM Conditions
Freeway	Southbound I-680
On-ramp	I-580 On-ramps
Off-ramp	Stoneridge Drive Off-ramp

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,651	Volume (vph)*	1,790	Volume (vph)*	1,381
Truck Percentage	7.0%	Truck Percentage	7.0%	Truck Percentage	7.0%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	7,117	Volume (pcph)	1,915	Volume (pcph)	1,478

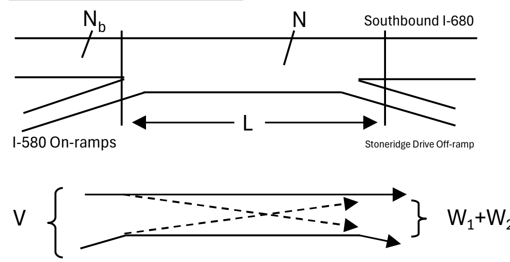


The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   30 MPH and **35 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 30.0
4. Weaving Intensity Factor (k) 2.95
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 2,501

6. Level of Service (LOS) F

Appendix F: HCS Worksheets under Opening Year Build Conditions

AM Peak Hour under Alternative KF2

HCS Freeway Weaving Report

Project Information

Segment Number	11	Segment Name	SB I-680 WB & EB I-580 On-Ramp to Stoneridge Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

Number of Lanes (N), ln	4	Segment Type	Freeway
Segment Length (L_S), ft	500	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.50	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	3481	0	0	0
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	7.00	0.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	1.000	1.000	1.000
Flow Rate (v_i), pc/h	3961	0	0	0

Weaving Flow Rate (v_W), pc/h	0	Ideal Conditions Capacity (c_{IFL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	3961	Density-Based Capacity (c_{IWL} × N × f_{HV}), veh/h	8378
Total Flow Rate (v), pc/h	3961	Demand Flow-Based Capacity (c_{IW} × f_{HV}), veh/h	-
Volume Ratio (VR)	0.000	Weaving Area Capacity (c_W), veh/h	8378
Minimum Lane Change Rate (LC_{MIN}), lc/h	0	Adjusted Weaving Area Capacity (c_{WA}), veh/h	8378
Maximum Weaving Length (L_{MAX}), ft	2596	Volume-to-Capacity Ratio (v/c)	0.44

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	297	Average Weaving Speed (S_W), mi/h	64.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	317	Average Non-Weaving Speed (S_{NW}), mi/h	70.6
Weaving Lane Change Rate (LC_W), lc/h	184	Average Speed (S), mi/h	70.6
Total Lane Change Rate (LC_{All}), lc/h	501	Density (D), pc/mi/ln	14.0
Weaving Intensity Factor (W)	0.226000	Level of Service (LOS)	B

AM Peak Hour under Alternative KF4

HCS Freeway Weaving Report

Project Information

Segment Number	11	Segment Name	SB I-680 WB & EB I-580 On-Ramp to Stoneridge Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

Number of Lanes (N), ln	4	Segment Type	CD Roadway
Segment Length (L_S), ft	1220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.50	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2499	1859	0	982
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	7.00	7.00	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935	0.935	0.935
Flow Rate (v_i), pc/h	2667	558	0	1048

Weaving Flow Rate (v_W), pc/h	1606	Ideal Conditions Capacity (c_{IFL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	2667	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h	7009
Total Flow Rate (v), pc/h	4273	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h	4291
Volume Ratio (VR)	0.523	Weaving Area Capacity (c_W), veh/h	4291
Minimum Lane Change Rate (LC_{MIN}), lc/h	558	Adjusted Weaving Area Capacity (c_{WA}), veh/h	4291
Maximum Weaving Length (L_{MAX}), ft	8097	Volume-to-Capacity Ratio (v/c)	0.93

*Under oversaturated conditions, Volume Served is computed as Flow Rate

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	488	Average Weaving Speed (S_W), mi/h	59.0
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	440	Average Non-Weaving Speed (S_{NW}), mi/h	60.9
Weaving Lane Change Rate (LC_W), lc/h	952	Average Speed (S), mi/h	60.2
Total Lane Change Rate (LC_{All}), lc/h	1392	Density (D), pc/mi/ln	17.7
Weaving Intensity Factor (W)	0.251000	Level of Service (LOS)	F

AM Peak Hour under Alternative KF1

HCS Basic Freeway Report

Project Information			
Segment Number	2	Segment Name	EB I-580 Foothill Rd Off-Ramp to Foothill Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	1300	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	4731	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1357
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.57
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	69.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	19.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Freeway Weaving Report

Project Information

Segment Number	3	Segment Name	EB I-580 Foothill Rd On-Ramp to I-680 SB Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

Number of Lanes (N), ln	5	Segment Type	CD Roadway
Segment Length (L_S), ft	945	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.33	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2972	284	0	1759
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	7.90	7.90	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927	0.927	0.927
Flow Rate (v_i), pc/h	3411	326	0	2019
Weaving Flow Rate (v_W), pc/h	2345	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate (v_{NW}), pc/h	3411	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		9061
Total Flow Rate (v), pc/h	5756	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		5466
Volume Ratio (VR)	0.407	Weaving Area Capacity (c_W), veh/h		5466
Minimum Lane Change Rate (LC_{MIN}), lc/h	2345	Adjusted Weaving Area Capacity (c_{WA}), veh/h		5466
Maximum Weaving Length (L_{MAX}), ft	6760	Volume-to-Capacity Ratio (v/c)		0.98

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	430	Average Weaving Speed (S_W), mi/h	49.9
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	252	Average Non-Weaving Speed (S_{NW}), mi/h	47.6
Weaving Lane Change Rate (LC_W), lc/h	2833	Average Speed (S), mi/h	48.5
Total Lane Change Rate (LC_{All}), lc/h	3085	Density (D), pc/mi/ln	23.7
Weaving Intensity Factor (W)	0.575000	Level of Service (LOS)	B

HCS Basic Freeway Report

Project Information

Segment Number	12	Segment Name	WB I-580 Foothill Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	2
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Two-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	9351	1716
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	10731 | 10786	1969
Capacity (c_{md}), pc/h	12000	4200
Adjusted Capacity (c_{mda}), pc/h	12000	4200
Volume-to-Capacity Ratio (v/c)	0.90	0.47

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1895
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	58.7
Flow in Lanes 1 and 2 (v_{12}), pc/h	2527	Outer Lanes Freeway Speed (S_O), mi/h	65.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4496	Ramp Junction Speed (S), mi/h	58.7
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	28.2
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	28.2

AM Peak Hour under Alternative KF3

HCS Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	4/3/2025
Agency		Analysis Year	Opening Year No Project AM Conditions
Jurisdiction		Time Analyzed	AM Peak Hour (7:00 to 8:00)
Project Description	I-580 & I-680 Pre PID	Units	U.S. Customary
Segment Number	1	Segment Name	WB I-580 Hopyard Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15

General Purpose Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	2
Free-Flow Speed (FFS), mi/h	70.0	40.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Two-Lane

General Purpose Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity

Demand Volume (V_i), veh/h	8641	560
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Flow Rate (v_i), pc/h	10053	643
Capacity (c_{md}), pc/h	12000	4000
Initial Adjusted Capacity (c_{mda}), pc/h	12000	-
Final Adjusted Capacity (c_{mda}), pc/h	12000	4000
Volume-to-Capacity Ratio (v/c)	0.83	0.16

General Purpose Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2413
Downstream Equilibrium Distance (L_{EQ}), ft	-	Off-Ramp Infl. Area Speed (S_R), mi/h	58.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	3217	Outer Lanes Freeway Speed (S_O), mi/h	71.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	65.4
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	24.6

Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	21.1
Managed Lane Geometric Data			
Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0
Managed Lane Length, ft	1500	Terrain Type	Level
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Demand Volume (V_{ML}), veh/h	1382	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	1470
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	0
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	63.8
Speed 2 (S_2), mi/h	6.2	Density (D_{ML}), pc/mi/ln	23.0
Speed 3 (S_3), mi/h	11.7	Level of Service (LOS)	C

HCS Basic Freeway Report

Project Information			
Segment Number	2	Segment Name	WB I-580 Hopyard Rd Off-Ramp to Hopyard Rd NB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
General Purpose Geometric Data			
Number of General Purpose Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	1030	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
General Purpose Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
General Purpose Demand and Capacity			
Demand Volume (V), veh/h	8081	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,GP}$), pc/h/ln	2318
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.98
General Purpose Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	50.8
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	46.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		
Managed Lane Geometric Data			
Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0
Managed Lane Length, ft	1030	Terrain Type	Level
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			

Demand Volume (V_{ML}), veh/h	1382	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	1470
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	1
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	52.1
Speed 2 (S_2), mi/h	6.2	Density (D_{ML}), pc/mi/ln	28.2
Speed 3 (S_3), mi/h	11.7	Level of Service (LOS)	D

AM Peak Hour under Alternative CN3-MOD

HCS Basic Freeway Report

Project Information			
Segment Number	6	Segment Name	EB I-580 Hopyard Rd Off-Ramp to I-680 SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	07:00-07:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	1500	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	2674	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	767
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.32
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	69.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	11.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

PM Peak Hour under Alternative KF2

HCS Freeway Weaving Report

Project Information

Analyst	Fehr & Peers	Date	4/3/2025
Agency		Analysis Year	Opening Year Plus Project PM Conditions
Jurisdiction		Time Analyzed	PM Peak Hour (5:00 to 6:00)
Project Description	I-580 & I-680 Pre PID	Units	U.S. Customary
Segment Number	11	Segment Name	SB I-680 WB & EB I-580 On-Ramp to Stoneridge Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

Number of Lanes (N), ln	4	Segment Type	CD Roadway
Segment Length (L_S), ft	1220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.50	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2100	1790	0	1381
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	7.00	0.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	1.000	1.000	1.000
Flow Rate (v_i), pc/h	2056	501	0	1264
Weaving Flow Rate (v_W), pc/h	1765	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate (v_{NW}), pc/h	2056	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		7072
Total Flow Rate (v), pc/h	3821	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		3992
Volume Ratio (VR)	0.585	Weaving Area Capacity (c_W), veh/h		3992
Minimum Lane Change Rate (LC_{MIN}), lc/h	1765	Adjusted Weaving Area Capacity (c_{WA}), veh/h		3992
Maximum Weaving Length (L_{MAX}), ft	8837	Volume-to-Capacity Ratio (v/c)		0.93

*Under oversaturated conditions, Volume Served is computed as Flow Rate

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	376	Average Weaving Speed (S_W), mi/h	54.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	314	Average Non-Weaving Speed (S_{NW}), mi/h	52.7
Weaving Lane Change Rate (LC_W), lc/h	2159	Average Speed (S), mi/h	53.5

Total Lane Change Rate (LC_{All}), lc/h	2473	Density (D), pc/mi/ln	17.9
Weaving Intensity Factor (W)	0.395000	Level of Service (LOS)	F

PM Peak Hour under Alternative KF4

HCS Freeway Weaving Report

Project Information

Segment Number	11	Segment Name	SB I-680 WB & EB I-580 On-Ramp to Stoneridge Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

Number of Lanes (N), ln	4	Segment Type	CD Roadway
Segment Length (L_S), ft	1220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.50	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	3480	1790	0	1381
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	7.00	7.00	7.00	7.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.935	0.935	0.935
Flow Rate (v_i), pc/h	2937	612	0	1165
Weaving Flow Rate (v_W), pc/h	1777	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate (v_{NW}), pc/h	2937	Density-Based Capacity (c_{IWL} × N × f_{HV}), veh/h		7173
Total Flow Rate (v), pc/h	4714	Demand Flow-Based Capacity (c_{IW} × f_{HV}), veh/h		4734
Volume Ratio (VR)	0.474	Weaving Area Capacity (c_W), veh/h		4734
Minimum Lane Change Rate (LC_{MIN}), lc/h	612	Adjusted Weaving Area Capacity (c_{WA}), veh/h		4734
Maximum Weaving Length (L_{MAX}), ft	7524	Volume-to-Capacity Ratio (v/c)		0.93

*Under oversaturated conditions, Volume Served is computed as Flow Rate

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	537	Average Weaving Speed (S_W), mi/h	58.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	496	Average Non-Weaving Speed (S_{NW}), mi/h	59.9
Weaving Lane Change Rate (LC_W), lc/h	1006	Average Speed (S), mi/h	59.3
Total Lane Change Rate (LC_{All}), lc/h	1502	Density (D), pc/mi/ln	19.9
Weaving Intensity Factor (W)	0.266000	Level of Service (LOS)	F

PM Peak Hour under Alternative KF1

HCS Basic Freeway Report

Project Information			
Segment Number	2	Segment Name	EB I-580 Foothill Rd Off-Ramp to Foothill Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	1300	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	8542	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	2451
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.99
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	51.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	46.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS Freeway Weaving Report

Project Information

Segment Number	3	Segment Name	EB I-580 Foothill Rd On-Ramp to I-680 SB Off-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

Number of Lanes (N), ln	5	Segment Type	CD Roadway
Segment Length (L_s), ft	945	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.33	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	6962	546	0	1580
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	7.90	7.90	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927	0.927	0.927
Flow Rate (v_i), pc/h	7990	627	0	1813
Weaving Flow Rate (v_W), pc/h	2440	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2400
Non-Weaving Flow Rate (v_{NW}), pc/h	7990	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		9724
Total Flow Rate (v), pc/h	10430	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		9508
Volume Ratio (VR)	0.234	Weaving Area Capacity (c_W), veh/h		9508
Minimum Lane Change Rate (LC_{MIN}), lc/h	2440	Adjusted Weaving Area Capacity (c_{WA}), veh/h		9508
Maximum Weaving Length (L_{MAX}), ft	4887	Volume-to-Capacity Ratio (v/c)		0.98

*Under oversaturated conditions, Volume Served is computed as Flow Rate

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	1007	Average Weaving Speed (S_W), mi/h	46.9
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1195	Average Non-Weaving Speed (S_{NW}), mi/h	42.4
Weaving Lane Change Rate (LC_W), lc/h	2928	Average Speed (S), mi/h	42.7
Total Lane Change Rate (LC_{All}), lc/h	4123	Density (D), pc/mi/ln	47.1
Weaving Intensity Factor (W)	0.723000	Level of Service (LOS)	F

HCS Basic Freeway Report

Project Information

Segment Number	12	Segment Name	WB I-580 Foothill Rd On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	2
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Lane Length (L_A), ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Two-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i), veh/h	5842	1174
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Demand Flow Rate (v_i), pc/h | Total Flow Rate (v_{FO}), pc/h	6704 | 7882	1347
Capacity (c_{md}), pc/h	12000	4200
Adjusted Capacity (c_{mda}), pc/h	12000	4200
Volume-to-Capacity Ratio (v/c)	0.66	0.32

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1431
Downstream Equilibrium Distance (L_{EQ}), ft	-	On-Ramp Infl. Area Speed (S_R), mi/h	63.6
Flow in Lanes 1 and 2 (v_{12}), pc/h	1908	Outer Lanes Freeway Speed (S_O), mi/h	66.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3255	Ramp Junction Speed (S), mi/h	63.6
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	19.2
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	19.2

PM Peak Hour under Alternative KF3

HCS Freeway Diverge Report

Project Information

Analyst	Fehr & Peers	Date	4/3/2025
Agency		Analysis Year	Opening Year No Project PM Conditions
Jurisdiction		Time Analyzed	PM Peak Hour (5:00 to 6:00)
Project Description	I-580 & I-680 Pre PID	Units	U.S. Customary
Segment Number	1	Segment Name	WB I-580 Hopyard Rd Off-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15

General Purpose Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	2
Free-Flow Speed (FFS), mi/h	70.0	40.0
Segment Length (L) / Deceleration Lane Length (L_D), ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Two-Lane

General Purpose Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs (CAF_{CAV})	1.000	-
Final Capacity Adjustment Factor (CAF)	1.000	1.000

General Purpose Demand and Capacity

Demand Volume (V_i), veh/h	6564	574
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	7.90	7.90
Heavy Vehicle Adjustment Factor (f_{HV})	0.927	0.927
Flow Rate (v_i), pc/h	8192	659
Capacity (c_{md}), pc/h	12000	4000
Initial Adjusted Capacity (c_{mda}), pc/h	12000	-
Final Adjusted Capacity (c_{mda}), pc/h	12000	4000
Volume-to-Capacity Ratio (v/c)	0.63	0.16

General Purpose Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1966
Downstream Equilibrium Distance (L_{EQ}), ft	-	Off-Ramp Infl. Area Speed (S_R), mi/h	58.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	2621	Outer Lanes Freeway Speed (S_O), mi/h	73.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Ramp Junction Speed (S), mi/h	66.3
Number of Outer Lanes on Freeway (N_O), ln	2	Average Density (D), pc/mi/ln	19.8

Level of Service (LOS)	B	Density in Ramp Influence Area (D_R), pc/mi/ln	16.0
Managed Lane Geometric Data			
Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0
Managed Lane Length, ft	1500	Terrain Type	Level
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			
Demand Volume (V_{ML}), veh/h	722	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	768
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	0
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	69.8
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	11.0
Speed 3 (S_3), mi/h	0.9	Level of Service (LOS)	A

HCS Basic Freeway Report

Project Information			
Segment Number	2	Segment Name	WB I-580 Hopyard Rd Off-Ramp to Hopyard Rd NB On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15
General Purpose Geometric Data			
Number of General Purpose Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	1030	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
General Purpose Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
General Purpose Demand and Capacity			
Demand Volume (V), veh/h	5990	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,GP}$), pc/h/ln	1883
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.78
General Purpose Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	64.6
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D_{GP}), pc/mi/ln	29.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		
Managed Lane Geometric Data			
Managed Lane Segment Type	ML Basic	Separation Type	Continuous Access
Number of Managed Lanes, ln	1	Free-Flow Speed (FFS), mi/h	70.0
Managed Lane Length, ft	1030	Terrain Type	Level
Managed Lane Adjustment Factors			
Driver Population	All Familiar	Driver Population CAF	1.000
Weather Type	Non-Severe Weather	Weather Type CAF	1.000
Driver Population SAF	1.000	Final Speed Adjustment Factor (SAF)	1.000
Weather Type SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Demand Adjustment Factor (DAF)	1.000		
Managed Lane Demand and Capacity			

Demand Volume (V_{ML}), veh/h	722	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor (PHF)	0.94	Flow Rate ($v_{p,ML}$), pc/h/ln	768
Total Trucks, %	0.00	Capacity (c), pc/h/ln	1750
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	1750
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.00		
Managed Lane Speed and Density			
Breakpoint (BP_{ML}), pc/h/ln	500	Indicator Variable (I_c)	0
Speed 1 (S_1), mi/h	70.0	Average Speed (S_{ML}), mi/h	69.8
Speed 2 (S_2), mi/h	0.2	Density (D_{ML}), pc/mi/ln	11.0
Speed 3 (S_3), mi/h	0.9	Level of Service (LOS)	A

PM Peak Hour under Alternative CN3-MOD

HCS Basic Freeway Report

Project Information			
Segment Number	6	Segment Name	EB I-580 Hopyard Rd Off-Ramp to I-680 SB On-Ramp
Analysis Period Number	1	Segment Analysis Period	17:00-17:15
Geometric Data			
Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	1500	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	1.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	70.0
Right-Side Lateral Clearance, ft	-		
Adjustment Factors			
Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Final Capacity Adjustment Factor (CAF)	1.000
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs (CAF_{CAV})	1.000
Demand and Capacity			
Demand Volume (V), veh/h	6525	Heavy Vehicle Adjustment Factor (f_{HV})	0.927
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1821
Total Trucks, %	7.90	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Initial Adjusted Capacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Final Adjusted Capacity (c_{adj}), pc/h/ln	2400
Passenger Car Equivalent (E_T)	2.00	Volume-to-Capacity Ratio (v/c)	0.76
Speed and Density			
Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	65.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	27.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

Appendix G: ISAT Worksheets

CN4-MOD

Output Summary

General Information

Project description:	I-580/I-680 Interchange Safety Improvements				
Analyst:	LN	Date:	7/28/2025	Area type:	Urban
First year of analysis:	2019				
Last year of analysis:	2030				

Crash Data Description

Freeway segments	Segment crash data available?	Yes	First year of crash data:	2019
	Project-level crash data available?	No	Last year of crash data:	2023
Ramp segments	Segment crash data available?	Yes	First year of crash data:	2019
	Project-level crash data available?	No	Last year of crash data:	2023
Ramp terminals	Segment crash data available?	Yes	First year of crash data:	2019
	Project-level crash data available?	No	Last year of crash data:	2023

Estimated Crash Statistics

Crashes for Entire Facility	Total	K	A	B	C	PDO
Estimated number of crashes during Study Period, crashes:	298.5	0.7	9.9	43.8	94.2	150.0
Estimated average crash freq. during Study Period, crashes/yr:	24.9	0.1	0.8	3.6	7.9	12.5

Crashes by Facility Component	Nbr. Sites	Total	K	A	B	C	PDO
Freeway segments, crashes:	2	22.2	0.2	0.5	2.5	3.8	15.3
Ramp segments, crashes:	1	6.3	0.0	0.1	0.6	1.6	4.0
Crossroad ramp terminals, crashes:	6	269.9	0.4	9.3	40.7	88.8	130.7

Crashes for Entire Facility by Year	Year	Total	K	A	B	C	PDO
Estimated number of crashes during the Study Period, crashes:	2019	24.8	0.1	0.8	3.6	7.9	12.5
	2020	24.9	0.1	0.8	3.6	7.9	12.5
	2021	24.9	0.1	0.8	3.6	7.9	12.5
	2022	24.9	0.1	0.8	3.6	7.9	12.5
	2023	24.9	0.1	0.8	3.6	7.9	12.5
	2024	24.9	0.1	0.8	3.6	7.9	12.5
	2025	24.9	0.1	0.8	3.7	7.9	12.5
	2026	24.9	0.1	0.8	3.6	7.9	12.5
	2027	24.9	0.1	0.8	3.6	7.8	12.5
	2028	24.8	0.1	0.8	3.6	7.8	12.5
	2029	24.8	0.1	0.8	3.6	7.8	12.5
	2030	24.8	0.1	0.8	3.6	7.8	12.5
	2031						
	2032						
	2033						
	2034						
	2035						
	2036						
	2037						
	2038						
	2039						
	2040						
	2041						
	2042						

Distribution of Crashes for Entire Facility

Crash Type	Crash Type Category	Estimated Number of Crashes During the Study Period					
		Total	K	A	B	C	PDO
Multiple vehicle	Head-on crashes:	2.6	0.0	0.1	0.5	1.1	1.0
	Right-angle crashes:	70.8	0.1	2.5	11.1	25.4	31.6
	Rear-end crashes:	161.4	0.3	5.9	25.8	54.4	74.9
	Sideswipe crashes:	26.8	0.0	0.4	1.9	3.9	20.6
	Other multiple-vehicle crashes:	4.4	0.0	0.1	0.4	1.0	2.8
	Total multiple-vehicle crashes:	266.0	0.5	9.1	39.8	85.8	130.8
Single vehicle	Crashes with animal:	0.2	0.0	0.0	0.0	0.0	0.2
	Crashes with fixed object:	24.0	0.1	0.6	2.7	5.7	15.0
	Crashes with other object:	1.6	0.0	0.0	0.1	0.2	1.3
	Crashes with parked vehicle:	0.7	0.0	0.0	0.1	0.1	0.5
	Other single-vehicle crashes	6.0	0.0	0.2	1.1	2.4	2.1
	Total single-vehicle crashes:	32.5	0.1	0.8	4.0	8.4	19.1
	Total crashes:	298.5	0.7	9.9	43.8	94.2	150.0

KF2

Output Summary

General Information

Project description:	I-580/I-680 Interchange Safety Improvements				
Analyst:	LN	Date:	7/28/2025	Area type:	Urban
First year of analysis:	2019				
Last year of analysis:	2030				

Crash Data Description

Freeway segments	Segment crash data available?	Yes	First year of crash data:	2019
	Project-level crash data available?	No	Last year of crash data:	2023
Ramp segments	Segment crash data available?	Yes	First year of crash data:	2019
	Project-level crash data available?	No	Last year of crash data:	2023
Ramp terminals	Segment crash data available?	Yes	First year of crash data:	2019
	Project-level crash data available?	No	Last year of crash data:	2023

Estimated Crash Statistics

Crashes for Entire Facility	**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during Study Period, crashes:	53.0	0.3	0.9	5.8	11.5	34.5
Estimated average crash freq. during Study Period, crashes/yr:	4.4	0.0	0.1	0.5	1.0	2.9

Crashes by Facility Component	**Nbr. Sites**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Freeway segments, crashes:	3	0.0	0.0	0.0	0.0	0.0	0.0
Ramp segments, crashes:	3	53.0	0.3	0.9	5.8	11.5	34.5
Crossroad ramp terminals, crashes:	4	0.0	0.0	0.0	0.0	0.0	0.0

Crashes for Entire Facility by Year	**Year**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during the Study Period, crashes:	2019	4.3	0.0	0.1	0.5	0.9	2.8
	2020	4.4	0.0	0.1	0.5	1.0	2.8
	2021	4.4	0.0	0.1	0.5	1.0	2.9
	2022	4.5	0.0	0.1	0.5	1.0	2.9
	2023	4.5	0.0	0.1	0.5	1.0	2.9
	2024	4.6	0.0	0.1	0.5	1.0	3.0
	2025	4.6	0.0	0.1	0.5	1.0	3.0
	2026	4.5	0.0	0.1	0.5	1.0	2.9
	2027	4.4	0.0	0.1	0.5	1.0	2.9
	2028	4.3	0.0	0.1	0.5	0.9	2.8
	2029	4.3	0.0	0.1	0.5	0.9	2.8
	2030	4.3	0.0	0.1	0.5	0.9	2.8
	2031						
	2032						
	2033						
	2034						
	2035						
	2036						
	2037						
	2038						
	2039						
	2040						
	2041						
	2042						

Distribution of Crashes for Entire Facility

Crash Type	**Crash Type Category**	**Estimated Number of Crashes During the Study Period**					
		Total	**K**	**A**	**B**	**C**	**PDO**
Multiple vehicle	Head-on crashes:	0.3	0.0	0.0	0.0	0.1	0.2
	Right-angle crashes:	0.2	0.0	0.0	0.0	0.1	0.1
	Rear-end crashes:	18.7	0.1	0.3	1.9	3.8	12.5
	Sideswipe crashes:	8.8	0.0	0.1	0.4	0.7	7.6
	Other multiple-vehicle crashes:	3.5	0.0	0.1	0.4	0.7	2.3
	Total multiple-vehicle crashes:	31.5	0.1	0.4	2.7	5.4	22.8
Single vehicle	Crashes with animal:	0.1	0.0	0.0	0.0	0.0	0.1
	Crashes with fixed object:	16.8	0.1	0.3	2.2	4.4	9.7
	Crashes with other object:	0.4	0.0	0.0	0.0	0.1	0.3
	Crashes with parked vehicle:	0.3	0.0	0.0	0.0	0.1	0.1
	Other single-vehicle crashes	3.9	0.0	0.1	0.8	1.6	1.5
	Total single-vehicle crashes:	21.5	0.2	0.5	3.0	6.2	11.7
	Total crashes:	53.0	0.3	0.9	5.8	11.5	34.5

KF4

Output Summary								
General Information								
Project description:	I-580/I-680 Interchange Safety Improvements							
Analyst:	LN	Date:	7/28/2025		Area type:		Urban	
First year of analysis:	2019							
Last year of analysis:	2030							
Crash Data Description								
Freeway segments	Segment crash data available?		Yes		First year of crash data:			2019
	Project-level crash data available?		No		Last year of crash data:			2023
Ramp segments	Segment crash data available?		Yes		First year of crash data:			2019
	Project-level crash data available?		No		Last year of crash data:			2023
Ramp terminals	Segment crash data available?		Yes		First year of crash data:			2019
	Project-level crash data available?		No		Last year of crash data:			2023
Estimated Crash Statistics								
Crashes for Entire Facility		**Total**	**K**	**A**	**B**	**C**	**PDO**	
Estimated number of crashes during Study Period, crashes:		37.6	0.3	1.0	4.9	8.4	23.0	
Estimated average crash freq. during Study Period, crashes/yr:		3.1	0.0	0.1	0.4	0.7	1.9	
Crashes by Facility Component	**Nbr. Sites**	**Total**	**K**	**A**	**B**	**C**	**PDO**	
Freeway segments, crashes:	2	22.2	0.2	0.5	2.5	3.8	15.3	
Ramp segments, crashes:	1	13.2	0.1	0.4	1.8	3.3	7.6	
Crossroad ramp terminals, crashes:	6	2.1	0.0	0.2	0.6	1.3	0.1	
Crashes for Entire Facility by Year	**Year**	**Total**	**K**	**A**	**B**	**C**	**PDO**	
Estimated number of crashes during the Study Period, crashes:	2019	3.3	0.0	0.1	0.4	0.7	2.0	
	2020	3.3	0.0	0.1	0.4	0.7	2.0	
	2021	3.3	0.0	0.1	0.4	0.7	2.0	
	2022	3.3	0.0	0.1	0.4	0.7	2.0	
	2023	3.3	0.0	0.1	0.4	0.8	2.0	
	2024	3.3	0.0	0.1	0.4	0.8	2.0	
	2025	3.4	0.0	0.1	0.4	0.8	2.0	
	2026	3.2	0.0	0.1	0.4	0.7	1.9	
	2027	2.9	0.0	0.1	0.4	0.7	1.8	
	2028	2.7	0.0	0.1	0.4	0.6	1.7	
	2029	2.7	0.0	0.1	0.4	0.6	1.7	
	2030	2.7	0.0	0.1	0.4	0.6	1.7	
	2031							
	2032							
	2033							
	2034							
	2035							
	2036							
	2037							
	2038							
	2039							
	2040							
	2041							
	2042							

Distribution of Crashes for Entire Facility

Crash Type	Crash Type Category	Estimated Number of Crashes During the Study Period					
		Total	**K**	**A**	**B**	**C**	**PDO**
Multiple vehicle	Head-on crashes:	0.1	0.0	0.0	0.0	0.0	0.0
	Right-angle crashes:	0.8	0.0	0.0	0.2	0.4	0.2
	Rear-end crashes:	10.1	0.1	0.3	1.4	2.4	6.0
	Sideswipe crashes:	3.2	0.0	0.1	0.3	0.4	2.4
	Other multiple-vehicle crashes:	0.5	0.0	0.0	0.1	0.1	0.3
	Total multiple-vehicle crashes:	14.6	0.1	0.4	1.9	3.4	8.8
Single vehicle	Crashes with animal:	0.2	0.0	0.0	0.0	0.0	0.2
	Crashes with fixed object:	17.2	0.2	0.4	2.1	3.6	10.9
	Crashes with other object:	1.4	0.0	0.0	0.1	0.1	1.2
	Crashes with parked vehicle:	0.3	0.0	0.0	0.0	0.1	0.2
	Other single-vehicle crashes	3.7	0.0	0.1	0.7	1.2	1.6
	Total single-vehicle crashes:	22.9	0.2	0.6	2.9	5.0	14.1
	Total crashes:	37.6	0.3	1.0	4.9	8.4	23.0

KF1

Output Summary

General Information

Project description:	I-580/I-680 Interchange Safety Improvements				
Analyst:	LN	Date:	7/28/2025	Area type:	Urban
First year of analysis:	2019				
Last year of analysis:	2030				

Crash Data Description

Freeway segments	Segment crash data available?	Yes	First year of crash data:	2019
	Project-level crash data available?	No	Last year of crash data:	2023
Ramp segments	Segment crash data available?	Yes	First year of crash data:	2019
	Project-level crash data available?	No	Last year of crash data:	2023
Ramp terminals	Segment crash data available?	Yes	First year of crash data:	2019
	Project-level crash data available?	No	Last year of crash data:	2023

Estimated Crash Statistics

Crashes for Entire Facility		**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during Study Period, crashes:		112.7	0.6	2.0	11.7	33.8	64.6
Estimated average crash freq. during Study Period, crashes/yr:		9.4	0.1	0.2	1.0	2.8	5.4
Crashes by Facility Component	**Nbr. Sites**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Freeway segments, crashes:	2	78.9	0.5	1.3	7.6	25.4	44.2
Ramp segments, crashes:	2	23.3	0.2	0.5	3.2	6.1	13.3
Crossroad ramp terminals, crashes:	6	10.5	0.0	0.2	0.9	2.3	7.1
Crashes for Entire Facility by Year	**Year**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during the Study Period, crashes:	2019	9.9	0.1	0.2	1.0	3.0	5.7
	2020	8.9	0.1	0.2	0.9	2.7	5.1
	2021	9.2	0.1	0.2	1.0	2.8	5.3
	2022	9.4	0.1	0.2	1.0	2.8	5.4
	2023	9.5	0.1	0.2	1.0	2.8	5.4
	2024	9.5	0.1	0.2	1.0	2.8	5.4
	2025	9.5	0.1	0.2	1.0	2.9	5.5
	2026	9.5	0.1	0.2	1.0	2.8	5.4
	2027	9.4	0.1	0.2	1.0	2.8	5.4
	2028	9.3	0.1	0.2	1.0	2.8	5.3
	2029	9.3	0.1	0.2	1.0	2.8	5.3
	2030	9.3	0.1	0.2	1.0	2.8	5.3
	2031						
	2032						
	2033						
	2034						
	2035						
	2036						
	2037						
	2038						
	2039						
	2040						
	2041						
	2042						

Distribution of Crashes for Entire Facility

Crash Type	Crash Type Category	Estimated Number of Crashes During the Study Period					
		Total	**K**	**A**	**B**	**C**	**PDO**
Multiple vehicle	Head-on crashes:	0.4	0.0	0.0	0.1	0.2	0.1
	Right-angle crashes:	3.6	0.0	0.1	0.4	1.1	2.0
	Rear-end crashes:	41.4	0.2	0.8	4.4	14.0	22.1
	Sideswipe crashes:	12.7	0.1	0.2	0.9	3.1	8.5
	Other multiple-vehicle crashes:	2.0	0.0	0.0	0.2	0.7	1.0
	Total multiple-vehicle crashes:	60.0	0.3	1.0	5.9	19.0	33.7
Single vehicle	Crashes with animal:	0.6	0.0	0.0	0.0	0.1	0.5
	Crashes with fixed object:	39.0	0.2	0.7	4.1	10.7	23.3
	Crashes with other object:	3.9	0.0	0.0	0.2	0.6	3.1
	Crashes with parked vehicle:	0.8	0.0	0.0	0.1	0.2	0.5
	Other single-vehicle crashes	8.4	0.1	0.2	1.3	3.3	3.5
	Total single-vehicle crashes:	52.7	0.3	0.9	5.8	14.8	30.8
	Total crashes:	112.7	0.6	2.0	11.7	33.8	64.6

KF3

Output Summary

General Information

Project description:	I-580/I-680 Interchange Safety Improvements				
Analyst:	LN	Date:	7/28/2025	Area type:	Urban
First year of analysis:	2019				
Last year of analysis:	2030				

Crash Data Description

Freeway segments	Segment crash data available?	Yes	First year of crash data:	2019
	Project-level crash data available?	No	Last year of crash data:	2023
Ramp segments	Segment crash data available?	Yes	First year of crash data:	2019
	Project-level crash data available?	No	Last year of crash data:	2023
Ramp terminals	Segment crash data available?	Yes	First year of crash data:	2019
	Project-level crash data available?	No	Last year of crash data:	2023

Estimated Crash Statistics

Crashes for Entire Facility	Total	K	A	B	C	PDO
Estimated number of crashes during Study Period, crashes:	11.7	0.0	0.2	1.0	2.4	8.1
Estimated average crash freq. during Study Period, crashes/yr:	1.0	0.0	0.0	0.1	0.2	0.7

Crashes by Facility Component	Nbr. Sites	Total	K	A	B	C	PDO
Freeway segments, crashes:	0	0.0	0.0	0.0	0.0	0.0	0.0
Ramp segments, crashes:	1	3.5	0.0	0.1	0.4	0.8	2.3
Crossroad ramp terminals, crashes:	6	8.1	0.0	0.1	0.6	1.6	5.8

Crashes for Entire Facility by Year	Year	Total	K	A	B	C	PDO
Estimated number of crashes during the Study Period, crashes:	2019	1.0	0.0	0.0	0.1	0.2	0.7
	2020	1.0	0.0	0.0	0.1	0.2	0.7
	2021	1.0	0.0	0.0	0.1	0.2	0.7
	2022	1.0	0.0	0.0	0.1	0.2	0.7
	2023	1.0	0.0	0.0	0.1	0.2	0.7
	2024	1.0	0.0	0.0	0.1	0.2	0.7
	2025	1.0	0.0	0.0	0.1	0.2	0.7
	2026	1.0	0.0	0.0	0.1	0.2	0.7
	2027	1.0	0.0	0.0	0.1	0.2	0.7
	2028	1.0	0.0	0.0	0.1	0.2	0.7
	2029	1.0	0.0	0.0	0.1	0.2	0.7
	2030	1.0	0.0	0.0	0.1	0.2	0.7
	2031						
	2032						
	2033						
	2034						
	2035						
	2036						
	2037						
	2038						
	2039						
	2040						
	2041						
	2042						

Distribution of Crashes for Entire Facility

Crash Type	Crash Type Category	Estimated Number of Crashes During the Study Period					
		Total	K	A	B	C	PDO
Multiple vehicle	Head-on crashes:	0.1	0.0	0.0	0.0	0.0	0.0
	Right-angle crashes:	1.9	0.0	0.0	0.2	0.4	1.3
	Rear-end crashes:	5.4	0.0	0.1	0.5	1.2	3.6
	Sideswipe crashes:	1.3	0.0	0.0	0.0	0.1	1.2
	Other multiple-vehicle crashes:	0.3	0.0	0.0	0.0	0.0	0.2
	Total multiple-vehicle crashes:	8.9	0.0	0.2	0.7	1.7	6.3
Single vehicle	Crashes with animal:	0.0	0.0	0.0	0.0	0.0	0.0
	Crashes with fixed object:	2.2	0.0	0.0	0.2	0.4	1.5
	Crashes with other object:	0.1	0.0	0.0	0.0	0.0	0.0
	Crashes with parked vehicle:	0.0	0.0	0.0	0.0	0.0	0.0
	Other single-vehicle crashes	0.5	0.0	0.0	0.1	0.2	0.2
	Total single-vehicle crashes:	2.7	0.0	0.1	0.3	0.6	1.7
	Total crashes:	11.7	0.0	0.2	1.0	2.4	8.1

CN3-MOD

Output Summary

Output Summary							
General Information							
Project description:	I-580/I-680 Interchange Safety Improvements						
Analyst:	LN	Date:	7/28/2025	Area type:	Urban		
First year of analysis:	2019						
Last year of analysis:	2030						
Crash Data Description							
Freeway segments	Segment crash data available?		Yes	First year of crash data:		2019	
	Project-level crash data available?		No	Last year of crash data:		2023	
Ramp segments	Segment crash data available?		Yes	First year of crash data:		2019	
	Project-level crash data available?		No	Last year of crash data:		2023	
Ramp terminals	Segment crash data available?		Yes	First year of crash data:		2019	
	Project-level crash data available?		No	Last year of crash data:		2023	

Estimated Crash Statistics

Crashes for Entire Facility		Total	K	A	B	C	PDO
Estimated number of crashes during Study Period, crashes:		88.2	0.2	1.4	9.5	29.6	47.4
Estimated average crash freq. during Study Period, crashes/yr:		7.4	0.0	0.1	0.8	2.5	4.0
Crashes by Facility Component	**Nbr. Sites**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Freeway segments, crashes:	0	0.0	0.0	0.0	0.0	0.0	0.0
Ramp segments, crashes:	1	14.0	0.1	0.3	2.2	4.1	7.3
Crossroad ramp terminals, crashes:	4	74.3	0.1	1.1	7.3	25.6	40.1
Crashes for Entire Facility by Year	**Year**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during the Study Period, crashes:	2019	7.8	0.0	0.1	0.9	2.6	4.2
	2020	7.8	0.0	0.1	0.9	2.6	4.2
	2021	7.8	0.0	0.1	0.9	2.6	4.2
	2022	7.9	0.0	0.1	0.9	2.6	4.2
	2023	7.9	0.0	0.1	0.9	2.6	4.2
	2024	7.9	0.0	0.1	0.9	2.6	4.2
	2025	7.9	0.0	0.1	0.9	2.7	4.2
	2026	7.3	0.0	0.1	0.8	2.4	4.0
	2027	6.8	0.0	0.1	0.7	2.3	3.7
	2028	6.4	0.0	0.1	0.6	2.2	3.4
	2029	6.4	0.0	0.1	0.6	2.2	3.4
	2030	6.4	0.0	0.1	0.6	2.2	3.4
	2031						
	2032						
	2033						
	2034						
	2035						
	2036						
	2037						
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	2042						

Distribution of Crashes for Entire Facility

Crash Type	Crash Type Category	Estimated Number of Crashes During the Study Period					
		Total	**K**	**A**	**B**	**C**	**PDO**
Multiple vehicle	Head-on crashes:	0.9	0.0	0.0	0.1	0.4	0.4
	Right-angle crashes:	23.3	0.0	0.4	2.4	8.9	11.5
	Rear-end crashes:	41.9	0.1	0.7	4.7	14.6	21.7
	Sideswipe crashes:	7.5	0.0	0.1	0.4	1.1	5.9
	Other multiple-vehicle crashes:	2.0	0.0	0.0	0.2	0.6	1.1
	Total multiple-vehicle crashes:	75.5	0.2	1.2	7.9	25.6	40.7
Single vehicle	Crashes with animal:	0.0	0.0	0.0	0.0	0.0	0.0
	Crashes with fixed object:	9.9	0.0	0.2	1.1	2.9	5.7
	Crashes with other object:	0.2	0.0	0.0	0.0	0.0	0.1
	Crashes with parked vehicle:	0.2	0.0	0.0	0.0	0.0	0.2
	Other single-vehicle crashes	2.4	0.0	0.1	0.4	1.1	0.8
	Total single-vehicle crashes:	12.7	0.1	0.2	1.6	4.1	6.8
	Total crashes:	88.2	0.2	1.4	9.5	29.6	47.4

Attachment C Scoring Matrix

1-P&N (Safety and Operations)

A-Improve Safety for Motor Vehicles

Concept	Fatal Collision Reduction (from ISAT analysis)	Score	Fatal + Injury Collision Reduction (from ISAT analysis)	Score	Total Collision Reduction (from ISAT analysis)	Score	Bike/Ped Safety	Score	Assigned Score (Avg)
Concept 1 (CN4-mod) Barrier hardening on SB 680	1%	1	0%	1	0%	2	All freeway, less local road traffic	2	**2**
Concept 2 (KF2) Loop widening	2%	2	2%	2	1%	3	All freeway, less local road traffic	2	**2**
Concept 3 (KF4) Stoneridge	20%	5	19%	6	17%	5	All freeway, less local road traffic	2	**5**
Concept 4 (KF1) Foothill	6%	3	5%	3	6%	4	Opportunity with local road improvements	4	**4**
Concept 5 (KF3) Hopyard	13%	4	7%	4	0%	1	Opportunity with local road improvements	4	**3**
Concept 6 (CN3-mod) 4 lanes on EB 580	50%	6	19%	5	18%	6	All freeway, less local road traffic	2	**5**
Concept 7 (P1) Enhanced Maintenance Program	Fixing maintenance issues would reduce collisions								**5**
Concept 8 (P2) Traffic Incident Management	Response to collisions to reduce congestion (no direct collision reduction)								**1**
Concept 9 (P3) High Performance Pavement Marking	Improved visibility would reduce collisions								**5**
Concept 10 (P4) Lane Lighting	Improved visibility would reduce collisions								**5**
Concept 11 (FP1) Safety ITS Elements on WB I-580	Reduction in sudden stops may reduce collisions.								**3**
Concept 12 (FP2) NB I-680 to WB I-580 loop ramp meter	Congestion reduction, no direct collision reduction.								**1**
Concept 13 (KF5) SB I-680 Signage improvements	Reduction in sudden movements may reduce collisions.								**3**

B-Improve Vehicular/Freeway and Transit Operations

Concept	Change in Traffic Stream Density (from HCS analysis)	Score	Estimated Benefited Motorists	Ramp motorists	Freeway to Freeway	Mainline motorists	Total	Score	Transit Benefits (lines that use area of improvement)	Score	Potential to Reduce Weaving/Merging Conflicts	Score	Lane Rebalance (length of additional lane)	Score	Assigned Score (Avg)
Concept 1 (CN4-mod) Barrier hardening on SB 680	0.0%	1	SB 680 on ramps: St Patrick Way, WB 580	745	2,425	7,200	10,370	1	680 (Tri 3B, 54, CC 92X, CC 97X	1	Enforces lane separation	2	0	1	**1**
Concept 2 (KF2) Loop widening	1.9%	5	SB 680 on ramps: St Patrick Way, WB 580, EB 580	745	2,425	15,531	18,701	5	680 (Tri 3B, 54, CC 92X, CC 97X) and 580 WB buses (AC 703, Tri 501-4, Tri 54)	4	Enforces lane separation, additional ramp capacity	3	822	4	**4**
Concept 3 (KF4) Stoneridge	1.1%	4	SB 680 between 580 and Stoneridge	0	0	11,420	11,420	2	680 (Tri 3B, 54, CC 92X, CC 97X	1	Additional merge distance	2	900	4	**3**
Concept 4 (KF1) Foothill	1.0%	3	Foothill/San Ramon, EB and WB 580	3,381	0	27,389	30,770	6	580 buses (AC 703, Tri 501-4, Tri 54), BART, Foothill (Tri 3A)	3	Additional merge distance in both directions on 580	3	1,469	5	**4**
Concept 5 (KF3) Hopyard	0.4%	2	Dougherty/Hopyard, WB 580	1,700	0	13,822	15,522	4	580 buses (AC 703, Tri 501-4, Tri 54, Amtrak Thruway Motorcoach 6, County Connection 97X), BART	2	Additional merge distance from Hopyard to 580 W	2	0	1	**2**
Concept 6 (CN3-mod) 4 lanes on EB 580	27.7%	6	SB 680 to EB 580 ramps and mainline (680 to Dougherty)	0	5,580	8,217	13,797	3	580 buses (AC 703, Tri 501-4, Tri 54, Amtrak Thruway Motorcoach 6, County Connection 97X), Dougherty (Tri 4), BART	4	Additional merge distance 580 EB	2	900	4	**4**
Concept 7 (P1) Enhanced Maintenance Program			All interchange users.					5	All	5	Reduces need to avoid safety hazards	4			**5**
Concept 8 (P2) Traffic Incident Management			All interchange users.					5	All	5	Congestion reduction	1			**4**
Concept 9 (P3) High Performance Pavement Marking			All interchange users.					5	All	5	Reduces weaving/merging due to	3			**4**
Concept 10 (P4) Lane Lighting			All interchange users.					5	All	5	Reduces driver confusion	4			**5**
Concept 11 (FP1) Safety ITS Elements on WB I-580	N/A					21399	21399	5	580 buses (AC 703, Tri 501-4, Tri 54, Amtrak Thruway Motorcoach 6, County Connection 97X), BART	4	Reduces driver confusion	4	N/A		**4**
Concept 12 (FP2) NB I-680 to WB I-580 loop ramp meter						1765	1765	1	580 buses (AC 703, Tri 501-4, Tri 54, Amtrak Thruway Motorcoach 6, County Connection 97X), BART	4	Congestion reduction	1			**2**
Concept 13 (KF5) SB I-680 Signage improvements						24310	24310	5	680 (Tri 3B, 54, CC 92X, CC 97X	3	Reduces driver confusion	5			**4**

C-Driver Experience

Concept	Number of Wayfinding Issues Resolved	Score	Correlation to Issues Noted in Public Survey	Score	Driver Level of Comfort (Qualitative)	Score	Assigned Score (Avg)
Concept 1 (CN4-mod) Barrier hardening on SB 680	Enforces lane separation	2	Merging	2	Some improvement	2	**2**
Concept 2 (KF2) Loop widening	Enforces lane separation	2	Merging, CHP/maintenance pullouts	3	Improves WB 580	4	**3**
Concept 3 (KF4) Stoneridge	Stoneridge signage improved	2	Merging	2	Some improvement	2	**2**
Concept 4 (KF1) Foothill	None	1	Weaving in both directions	3	Moderate improvement	3	**2**
Concept 5 (KF3) Hopyard	None	1	Weaving	2	Some improvement	2	**2**
Concept 6 (CN3-mod) 4 lanes on EB 580	Improved merging from 680 to EB 580	2	Improved lane balancing where merging/weaving is an issue	2	Moderate improvement	3	**2**
Concept 7 (P1) Enhanced Maintenance Program	None	1	Multiple maintenance issues	4	Moderate improvement	3	**3**
Concept 8 (P2) Traffic Incident Management	None	1	Congestion	2	Some improvement	2	**2**
Concept 9 (P3) High Performance Pavement Marking	Improved lane visibility	2	Visibility	2	Overall improvement	5	**3**
Concept 10 (P4) Lane Lighting	Improved lane visibility	2	Visibility, weaving/merging	3	Overall improvement	5	**3**
Concept 11 (FP1) Safety ITS Elements on WB I-580	Multiple	4	Reduces sudden movements	2	Improves WB 580	4	**3**
Concept 12 (FP2) NB I-680 to WB I-580 loop ramp meter	None	1	Congestion	2	Some improvement	2	**2**
Concept 13 (KF5) SB I-680 Signage improvements	3 (* Revise signs along SB I-680 to avoid "trap" condition for SB I-680 to WB I-580 connector; reduce confusion with "Dublin" as a control city * Improve signage for Dublin Blvd exit ("hidden" on the SB I-680 to EB I-580 connector) * Improve warning for lane drop beyond WB I-580 connector.)	3	Signage	2	Some improvement	2	**2**

2 -Design (Cost and Schedule)

A-Design Exceptions

Concept	Number of Design Exceptions Required	Score	Likelihood of Caltrans Approval	Score	Ability to Implement Ramp Metering Policy	Score	Design Complexity	Score	Assigned Score (Avg)
Concept 1 (CN4-mod) Barrier hardening on SB 680	0	4	High (No new design exceptions. Existing nonstandard geometry on St. Pat.)	5	High	5	Low	5	**5**
Concept 2 (KF2) Loop widening	1	3	Medium (Loop connector does not have HOV lane (2+0 config))	3	Moderate	3	High	1	**3**
Concept 3 (KF4) Stoneridge	0	4	Medium (EB on-ramp proposes 2+0 configuration (should be 2+1))	3	High	5	Medium	3	**4**
Concept 4 (KF1) Foothill	1	3	Medium (EB on-ramp proposes 2+0 configuration (should be 2+1); lengthens aux lane but does not make standard)	3	Moderate	3	Medium-High	2	**3**
Concept 5 (KF3) Hopyard	1	3	Medium (WB Loop on-ramp does not have HOV lane (2+0 config))	3	Moderate	3	Medium-High	2	**3**
Concept 6 (CN3-mod) 4 lanes on EB 580	3	2	Low (Note - at least 3 design exceptions - lack of CHP area, lack of MVP, no downstream aux lane provided)	1	Low	1	High	1	**1**
Concept 7 (P1) Enhanced Maintenance Program	0	5	High	5	High	5	Low	5	**5**
Concept 8 (P2) Traffic Incident Management	0	5	High	5	High	5	Low	5	**5**
Concept 9 (P3) High Performance Pavement Marking	0	5	High	5	High	5	Low	5	**5**
Concept 10 (P4) Lane Lighting	0	5	High	5	High	5	Low	5	**5**
Concept 11 (FP1) Safety ITS Elements on WB I-580	0	5	High	5	High	5	Low	5	**5**
Concept 12 (FP2) NB I-680 to WB I-580 loop ramp meter	0	5	High	5	High	5	Low	5	**5**
Concept 13 (KF5) SB I-680 Signage improvements	0	5	High	5	High	5	Low	5	**5**

B-Implementability

Concept	Estimated Construction Cost	Rounded costs	Score	Schedule	Score	Construction Impacts	Score	Right of Way Required?	Score	Assigned Score (Avg)
Concept 1 (CN4-mod) Barrier hardening on SB 680	$580k	$600k	5	Fast	5	Low	5	No	5	**5**
Concept 2 (KF2) Loop widening	$13.8M	$14M	2	Slow	1	High	1	No	5	**2**
Concept 3 (KF4) Stoneridge	$930k	$1M	4	Fast	5	Low	5	No	5	**5**
Concept 4 (KF1) Foothill	$17.7M	$17.7M	2	Slow	1	High	1	No	5	**2**
Concept 5 (KF3) Hopyard	$13.3M	$13.3M	3	Slow	1	High	1	Yes	1	**2**
Concept 6 (CN3-mod) 4 lanes on EB 580	$1.6M	$1.6M	4	Moderate	3	High	1	No	5	**3**
Concept 7 (P1) Enhanced Maintenance Program	N/A			Fast	5	Low	5	No	5	**5**
Concept 8 (P2) Traffic Incident Management				Fast	5	Low	5	No	5	**5**
Concept 9 (P3) High Performance Pavement Marking				Moderate	3	Low	5	No	5	**4**
Concept 10 (P4) Lane Lighting				Moderate	3	Low	5	No	5	**4**
Concept 11 (FP1) Safety ITS Elements on WB I-580				Moderate	3	Low	5	No	5	**4**
Concept 12 (FP2) NB I-680 to WB I-580 loop ramp meter				Moderate	3	Low	5	No	5	**4**
Concept 13 (KF5) SB I-680 Signage improvements				Moderate	3	Low	5	No	5	**4**

3-Environmental

A-Hazardous Waste Contamination

Concept	Adjacent Historic Release Sites	Score	Potential to Encounter Contamination	Score	Assigned Score (Avg)
Concept 1 (CN4-mod) Barrier hardening on SB 680	N	5	Moderate (ADL, paint striping)	4	**5**
Concept 2 (KF2) Loop widening	N	5	Moderately high (asbestos, ADL, paint striping)	2	**4**
Concept 3 (KF4) Stoneridge	N	5	Moderate (ADL, paint striping)	4	**5**
Concept 4 (KF1) Foothill	N	5	Moderate (ADL, paint striping)	4	**5**
Concept 5 (KF3) Hopyard	Y - 6341 Scarlett Court, 6622 Dublin Boulevard (Geotracker)	3	Moderately high due to adjacent Cortese site	2	**3**
Concept 6 (CN3-mod) 4 lanes on EB 580	N	5	Moderate (ADL, paint striping)	4	**5**
Concept 7 (P1) Enhanced Maintenance Program					**4**
Concept 8 (P2) Traffic Incident Management					**4**
Concept 9 (P3) High Performance Pavement Marking					**4**
Concept 10 (P4) Lane Lighting					**4**
Concept 11 (FP1) Safety ITS Elements on WB I-580					**4**
Concept 12 (FP2) NB I-680 to WB I-580 loop ramp meter					**4**
Concept 13 (KF5) SB I-680 Signage improvements					**4**

B-Biological Resources

Concept	Potential Impacts to Sensitive Habitat	Score	Potential Impacts to Jurisdictional Waterways	Score	Potential for Special-Status Species	Score	Permitting and Approvals	Score	Assigned Score (Avg)
Concept 1 (CN4-mod) Barrier hardening on SB 680	Low - all work on structures or existing road	5	N	5	Low - work limited to paved roadway	5	Low	5	**5**
Concept 2 (KF2) Loop widening	Low - all work on structures or existing road	5	N	5	Moderate (Congdon's tarplant), low potential for nests/roosts in exisitng bridge to be widened	3	Low	5	**5**
Concept 3 (KF4) Stoneridge	Low - all work within existing road	5	N	5	Low - work limited to paved roadway	5	Low	5	**5**
Concept 4 (KF1) Foothill	Moderate - Pullout on bank of Dublin Creek	3	Riparian impacts likely avoidable. NWI does not match aerial imagery.	3	Moderate (Congdon's tarplant)	3	Moderate	3	**3**
Concept 5 (KF3) Hopyard	Low - all work on structures or existing road	5	N	5	Moderate (Congdon's tarplant)	3	Low	5	**5**
Concept 6 (CN3-mod) 4 lanes on EB 580	Low - all work on structures or existing road	5	N	5	Low - work limited to paved roadway	5	Low	5	**5**
Concept 7 (P1) Enhanced Maintenance Program	Low - all work on structures or existing road	5	N	5	Low - work limited to paved roadway	5	Low	5	**5**
Concept 8 (P2) Traffic Incident Management	Low - all work on structures or existing road	5	N	5	Moderate (Congdon's tarplant)	3	Low	5	**5**
Concept 9 (P3) High Performance Pavement Marking	Low - all work on structures or existing road	5	N	5	Low - work limited to paved roadway	5	Low	5	**5**
Concept 10 (P4) Lane Lighting	Low - all work on structures or existing road	5	N	5	Low - work limited to paved roadway	5	Low	5	**5**
Concept 11 (FP1) Safety ITS Elements on WB I-580	Low - all work on structures or existing road	5	N	5	Low - work limited to paved roadway	5	Low	5	**5**
Concept 12 (FP2) NB I-680 to WB I-580 loop ramp meter	Low - all work on structures or existing road	5	N	5	Low - work limited to paved roadway	5	Low	5	**5**
Concept 13 (KF5) SB I-680 Signage improvements	Low - all work on structures or existing road	5	N	5	Low - work limited to paved roadway	5	Low	5	**5**

C-Community Resources

Concept	CalEnviroScreen Pollution Burden Benefits	Score	CalEnviroScreen Population Burden Benefits	Score	Access to Community Facilities	Score	Operational and Multimodal Impacts to Local Roadways	Score	Assigned Score (Avg)
Concept 1 (CN4-mod) Barrier hardening on SB 680	General improvements for I-580 traffic, likely some will address pollution burden for all quadrants	3	Would not improve low birth weight	1	No nearby facilities	1	Indirect - Improved weaving may reduce cut through traffic	2	**2**
Concept 2 (KF2) Loop widening	General improvements for I-580 traffic, likely some will address pollution burden for all quadrants	3	Would not improve low birth weight	1	No nearby facilities	1	Indirect -Additional SB 680 on-ramp capacity, general improved interchange function may reduce local cut through traffic.	2	**2**
Concept 3 (KF4) Stoneridge	Improve traffic/diesel PM for the south quadrants	4	Would not improve low birth weight	1	Laurel Creek Park, The Preserve, Val Vista, Muirwood, Fire Station No. 2	3	Indirect - Extended aux lane capacity, reduced off ramp by 1 lane, general improved interchange function may reduce local cut through traffic.	2	**2**
Concept 4 (KF1) Foothill	Traffic/diesel PM improvements for the west quadrants	3	Would not improve low birth weight	1	Nearby Dublin Historic Parks and Museums, Tri Valley Medical Park, Don Biddle Community Park	3	Improved interchange function, local road improvements (reduced number of vehicle movements), greatest additional lane length	5	**3**
Concept 5 (KF3) Hopyard	Traffic/diesel PM improvements for all Dougherty/Hopyard quadrants	4	Would not improve low birth weight	1	Nearby Dublin Sports Grounds, Fire Department, Library	3	Improved interchange function, local road improvements (reduced number of vehicle movements)	5	**3**
Concept 6 (CN3-mod) 4 lanes on EB 580	General traffic/diesel PM improvements, likely will address local pollution burden	3	Would not improve low birth weight	1	No nearby facilities	1	Indirect - Improved interchange function, greatest reduction in stream density.	2	**2**
Concept 7 (P1) Enhanced Maintenance Program	None	1	Would not improve low birth weight	1	Nonspecific	2	Indirect - Less hwy avoidance = reduced cut through traffic	2	**1**
Concept 8 (P2) Traffic Incident Management	Reduced congestion overall	4	Would not improve low birth weight	1	Nonspecific	2	Indirect - Less hwy avoidance = reduced cut through traffic	2	**2**
Concept 9 (P3) High Performance Pavement Marking	None	1	Would not improve low birth weight	1	Nonspecific	2	Indirect - Less hwy avoidance = reduced cut through traffic	2	**1**
Concept 10 (P4) Lane Lighting	None	1	Would not improve low birth weight	1	Nonspecific	2	Indirect - Less hwy avoidance = reduced cut through traffic	2	**1**
Concept 11 (FP1) Safety ITS Elements on WB I-580	None	1	Would not improve low birth weight	1	Same as Foothill and Hopyard	5	Indirect - Less hwy avoidance = reduced cut through traffic	2	**2**
Concept 12 (FP2) NB I-680 to WB I-580 loop ramp meter	Reduced congestion on WB I-580	3	Would not improve low birth weight	1	Same as Foothill	3	Indirect - Less hwy avoidance = reduced cut through traffic	2	**2**
Concept 13 (KF5) SB I-680 Signage improvements	None	1	Would not improve low birth weight	1	Same as Stoneridge	3	Indirect - Less hwy avoidance = reduced cut through traffic	2	**2**

D-Other Environmental Concerns

	Visual impacts	Score	Traffic modelling LOE	Score	Other	Score	Assigned Score (Avg)
Concept 1 (CN4-mod) Barrier hardening on SB 680		5		5		5	**5**
Concept 2 (KF2) Loop widening	Visual change from widened bridge may require more detailed impact analysis and visualizations.	4	Additional LOE	3		5	**4**
Concept 3 (KF4) Stoneridge	Gateway (Pleasanton GP), but project likely has no visual impacts.	5		5		5	**5**
Concept 4 (KF1) Foothill	Gateway (Dublin/Pleasanton general plan). Potential tree removals. Additional city coordination likely for tree removals around city gateways.	4	Additional LOE	3	Next to Dublin Village Historic Area (Section 106), also on Calaveras Fault	3	**3**
Concept 5 (KF3) Hopyard	Gateway (Dublin/Pleasanton general plan). Potential tree removals.	4	Additional LOE	3		5	**4**
Concept 6 (CN3-mod) 4 lanes on EB 580		5		5		5	**5**
Concept 7 (P1) Enhanced Maintenance Program		5		5		5	**5**
Concept 8 (P2) Traffic Incident Management		5		5		5	**5**
Concept 9 (P3) High Performance Pavement Marking	Additional source of glare?	4		5		5	**5**
Concept 10 (P4) Lane Lighting	Additional source of lighting	4		5		5	**5**
Concept 11 (FP1) Safety ITS Elements on WB I-580	Additional source of lighting	4		5		5	**5**
Concept 12 (FP2) NB I-680 to WB I-580 loop ramp meter		5	May require additional modelling to confirm it doesn't back up to NB 680	4		5	**5**
Concept 13 (KF5) SB I-680 Signage improvements		5		5		5	**5**

E-Environmental Clearance Risk Level

Concept	Likely CEQA Level	Exceptions?	Score	Likely NEPA Level	Exceptions?	Score	Assigned Score (Avg)
Concept 1 (CN4-mod) Barrier hardening on SB 680	CE Class 1 existing facilities (negligible or no expansion in use)	No	5	CE (23 USC 326 CE c list: 22 within ROW, 26 road modernization, or 27 highway safety). Complies with 771.117e.	No	5	**5**
Concept 2 (KF2) Loop widening	Potentially CE Class 1 existing facilities (negligible or no expansion in use). Less than 1000 feet of new lane could qualify as "negligible expansion of use."	Although bridge was constructed in 1965, it has subsequently been modified. It is the first example of an orthotropic steel deck built bridge in California. Additional evaluation is needed to confirm if a "substantial adverse change in the significance of an historical resource" exception can be avoided.	3	CE (23 USC 326 CE c list 22 within ROW, or d list 13 projects excluded by 771.117e). Can't use c26 or c27 because of changes to access control (771.117e).	No. Bridge appears to be exempt from Section 106 per Caltrans Bridge Inventory since it is part of the interstate system.	5	**4**
Concept 3 (KF4) Stoneridge	CE Class 1 existing facilities (negligible or no expansion in use)	No	5	CE (23 USC 326 CE c list 22 within ROW, 26 road modernization, or 27 highway safety). Complies with 771.117e.	No	5	**5**
Concept 4 (KF1) Foothill	CE Class 1 existing facilities (negligible or no expansion in use)	No	5	CE (23 USC 326 CE c list 22 within ROW, or d list 13 projects excluded by 771.117e). Can't use c26 or c27 because of ramp closure (771.117e).	No	5	**5**
Concept 5 (KF3) Hopyard	CE Class 1 existing facilities (negligible or no expansion in use)	ROW acquisition does not trigger exceptions. ROW is not from Cortese site. Sliver take would fall under negligible expansion of use. No full parcel takes or relocations.	5	CE (23 USC 326 CE d list 13 projects excluded by 771.117e). Can't use c26 or c27 because of ramp closure (771.117e)	No. No environmental impacts, controversy, Section 106 or 4f impacts, no policy inconsistency.	5	**5**
Concept 6 (CN3-mod) 4 lanes on EB 580	CE Class 1 existing facilities (negligible or no expansion in use)	No	5	CE (23 USC 326 CE c list 22 within ROW, d13 projects excluded by 771.117e). Can't use c26 or c27 because of changes to access control (771.117e)	No	5	**5**
Concept 7 (P1) Enhanced Maintenance Program	CE Class 1 existing facilities (negligible or no expansion in use)	No	5	CE (23 USC 326 CE c list 22 within ROW)	No	5	**5**
Concept 8 (P2) Traffic Incident Management	CE Class 1 existing facilities (negligible or no expansion in use)	No	5	CE (23 USC 326 CE c list 22 within ROW)	No	5	**5**
Concept 9 (P3) High Performance Pavement Marking	CE Class 1 existing facilities (negligible or no expansion in use)	No	5	CE (23 USC 326 CE c list 22 within ROW)	No	5	**5**
Concept 10 (P4) Lane Lighting	CE Class 1 existing facilities (negligible or no expansion in use)	No	5	CE (23 USC 326 CE c list 22 within ROW)	No	5	**5**
Concept 11 (FP1) Safety ITS Elements on WB I-580	CE Class 1 existing facilities (negligible or no expansion in use)	No	5	CE (23 USC 326 CE c list 22 within ROW)	No	5	**5**
Concept 12 (FP2) NB I-680 to WB I-580 loop ramp meter	CE Class 1 existing facilities (negligible or no expansion in use)	No	5	CE (23 USC 326 CE c list 22 within ROW)	No	5	**5**
Concept 13 (KF5) SB I-680 Signage improvements	CE Class 1 existing facilities (negligible or no expansion in use)	No	5	CE (23 USC 326 CE c list 22 within ROW)	No	5	**5**

Attachment D Conceptual Project Cost Estimates

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission
Project Description:	Concept 1 - Barrier Hardening on SB I-680
Location:	I-580/I-680 Interchange
Type of Estimate:	Pre-PID Level Estimate
Prepared by:	HNTB

SUMMARY OF PROJECT OUTLAY COSTS

			Current Year Cost
I	ROADWAY	$	581,284
II	STRUCTURES	$	-
III	RIGHT OF WAY	$	-
	TOTAL CAPITAL OUTLAY COST	**$**	**581,284**
IV	PRELIMINARY ENGINEERING/ENVIRONMENTAL	$	46,503
V	DESIGN ENGINEERING	$	58,128
VI	DESIGN SERVICES DURING CONSTRUCTION	$	17,439
VII	CONSTRUCTION MANAGEMENT	$	87,193
	TOTAL SUPPORT COST	**$**	**209,262**
	DIRECT PROJECT COST	**$**	**790,547**
VIII	AGENCY MANAGEMENT	$	87,193
	TOTAL PROJECT COST	**$**	**877,739**

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission	Concept 1
Project Description:	Barrier Hardening on SB I-680	
Location:	I-580/I-680 Interchange	

Item code	Description	Unit	Quantity	Unit Price ($)	Cost	
I. Roadway						
01 Earthwork						
1.1	Clearing & Grubbing	LS			$ -	
1.2	Roadway Excavation	CY			$ -	
1.3	Roadway Borrow Material	CY			$ -	
				Subtotal for Item 01 Earthwork	**$ -**	
02 Pavement Structural Section						
2.1	Remove Curb and Gutter	LF			$ -	
2.2	Remove Curb	LF			$ -	
2.3	Remove Concrete Sidewalk	SF			$ -	
2.4	Remove Base and Surfacing	SF			$ -	
2.5	Remove Concrete Island	SF			$ -	
2.6	Pavement Section (Local road assumed - 0.35' HMA, 0.57' AB, 1' AS)	SF			$ -	
2.7	Pavement Section (Ramps assumed - 0.20' Rubberized HMA, 0.55' HMA, 0.50' Cl 2 AB)	SF			$ -	
2.8	Mill and Overlay	SF			$ -	
2.9	Curb and Gutter	LF			$ -	
2.10	Sidewalk (assume 4" concrete, 4" base)	SF			$ -	
2.11	Multi-Use Path (assume 0.5' concrete, 4" base)	SF			$ -	
2.12	Concrete Island/Median	SF			$ -	
2.13	Driveway (assume - 6" concrete, 4" base)	SF			$ -	
		Subtotal for Item 02 Pavement Structural Section			**$ -**	
03 Drainage						
3.1	Drainage (assume % of Roadway Cost Items 1 through 2)		25%		$ -	
3.2	Stormwater Treatment (from SWDR)	LS			$ -	
				Subtotal of Item 03 Drainage	**$ -**	
04 Specialty Items						
4.1	Metal Beam Guard Railing	LF			$ -	
4.2	ADA Curb Ramps	EA			$ -	
4.3	Roadway Concrete Barrier	LF	1,260	210.00	$ 264,600	
4.4	Retaining Barrier	LF			$ -	
4.5	Retaining Wall (Caltrans Type 1) (H=4'-10')	SQFT			$ -	
4.6	Retaining Wall (Caltrans Type 1) (H=10'-20')	SQFT			$ -	
4.7	Remove Metal Beam Guard Railing	LF			$ -	
4.8	Remove Roadway Concrete Barrier	LF			$ -	
4.9	Remove Delineator	EA	275	35.00	$ 9,625	
4.10	Fence (Height = 6')	LF			$ -	
4.11	Bike Ramp	EA			$ -	
			Subtotal for Items 04 Specialty Items		**$ 274,225**	
05 Environmental						
5.1	Environmental (assume % of Roadway Cost items 1 thru 4)		30%		$ 82,268	
			Subtotal for Item 05 Environmental		**$ 82,268**	
06 Traffic						
06a Traffic Items						
6a.1	Traffic Signal and lighting (Upgrade, per intersection)	EA			$ -	
6a.2	Traffic Signal and lighting (New, per intersection)	EA			$ -	
6a.3	Pedestrian Hybrid Beacon (PHB)	EA			$ -	
6a.4	Rapid Reflective Flashing Beacons (one pair)	EA			$ -	
6a.5	Traffic Signal Priority	EA			$ -	
6a.6	Traffic Operations Systems (Ramp Metering)	EA			$ -	
6a.7	Modify Traffic Operations Systems (Ramp Metering)	EA			$ -	
6a.8	Remove Traffic Operations Systems (Ramp Metering)	EA			$ -	
			Subtotal for Item 06a Traffic Items		**$ -**	
					Subtotal Sections 1 through 6a	**$ 356,493**
06b Additional Traffic Items						
6b.1	Highway Signage Structure	EA			$ -	
6b.2	Signing and Striping (Includes Removal)		0%		$ -	
6b.3	Roadway Lighting	LS			$ -	
6b.4	Stage Construction and Traffic Handling	LS	1	50,000.00	$ 50,000	
			Subtotal for Item 06b Traffic Items		**$ 50,000**	
					Subtotal Sections 1 through 6	**$ 406,493**
07 Minor Items						
7.1	American with Disabilities Act Items		0%		$ -	
7.2	Bike Path Items		0%		$ -	
7.3	Other Minor Items		0%		$ -	
				Subtotal of Item 07 Minor Items	**$ -**	
08 Roadway Mobilization						
8.1	Roadway Mobilization		10%		$ 40,649	
		Subtotal for Item 08 Roadway Mobilization			**$ 40,649**	
09 Roadway Contingency						
9.1	Roadway Contingency (assume % of total cost of Section Items 01-08)		30%		$ 134,143	
		Subtotal for Item 09 Roadway Contingency			**$ 134,143**	
					Subtotal for Items 1-9 (Roadway)	**$ 581,284**

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission	Concept 1
Project Description:	Barrier Hardening on SB I-680	
Location:	I-580/I-680 Interchange	

Item code	Description	Unit	Quantity	Unit Price ($)	Cost	
II. Structures						
10 Structures						
10.1	Bridge Demolition	SF			$ -	
10.2	New Bridge Structure	LS			$ -	
10.3	Bridge Widening	LS			$ -	
10.4	Pedestrian Overcrossing (including ramp)	LS			$ -	
10.5	Pedestrian Undercrossing (including ramp)	LS			$ -	
10.6	Tunnel	SF			$ -	
10.7	Structure modification	SF			$ -	
10.8	Soil Nail Wall	SF			$ -	
10.9	Soldier Pile Wall	SF			$ -	
10.10	Tie-back Wall	LS			$ -	
			Subtotal for Item 10 Structures		**$ -**	
10.11	Structure Contingency		30%		$ -	
					Subtotal for Structures	**$ -**
	TOTAL CONSTRUCTION COST (TCC) - SUM OF ITEMS 1-10 (ROADWAY AND STRUCTURES)					**$ 581,284**
III. Right of Way						
III.1	Right of Way Acquisition	LS			$ -	
III.2	Title & Escrow	LS			$ -	
III.3	Right of Way Support Costs	LS			$ -	
III.4	Utility Relocation	LS			$ -	
			Subtotal for Item 11 Right of Way		**$ -**	
III.5	Right of Way Contingency		30%		$ -	
					Subtotal for Right of Way	**$ -**
Engineering and Management Costs						
			TCC		**Unescalated Risk Loaded**	
IV	**Preliminary Engineering/Environmental**	8%	***$ 581,284***		$ 46,502.74	
V	**Design Engineering**	10%	***$ 581,284***		$ 58,128.43	
VI	**Design Services During Construction**	3%	***$ 581,284***		$ 17,438.53	
VII	**Construction Management**	15%	***$ 581,284***		$ 87,192.64	
VIII	**Agency Management**	15%	***$ 581,284***		$ 87,192.64	
					Current Year Cost	
			Roadway Cost		**$ 581,284**	

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission
Project Description:	Concept 2 - Widen Diagonal and Loop Connectors to SB I-680
Location:	I-580/I-680 Interchange
Type of Estimate:	Pre-PID Level Estimate
Prepared by:	HNTB

SUMMARY OF PROJECT OUTLAY COSTS

			Current Year Cost
I	ROADWAY	$	8,468,370
II	STRUCTURES	$	5,323,500
III	RIGHT OF WAY	$	26,000
	TOTAL CAPITAL OUTLAY COST	**$**	**13,817,870**
IV	PRELIMINARY ENGINEERING/ENVIRONMENTAL	$	1,103,350
V	DESIGN ENGINEERING	$	1,379,187
VI	DESIGN SERVICES DURING CONSTRUCTION	$	413,756
VII	CONSTRUCTION MANAGEMENT	$	2,068,780
	TOTAL SUPPORT COST	**$**	**4,965,073**
	DIRECT PROJECT COST	**$**	**18,782,943**
VIII	AGENCY MANAGEMENT	$	2,068,780
	TOTAL PROJECT COST	**$**	**20,851,723**

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission	Concept 2
Project Description:	Widen Diagonal and Loop Connectors to SB I-680	
Location:	I-580/I-680 Interchange	

Item code	Description	Unit	Quantity	Unit Price ($)	Cost	
I. Roadway						
01 Earthwork						
1.1	Clearing & Grubbing	LS	1	40,000.00	$ 40,000	
1.2	Roadway Excavation	CY	2,517	200.00	$ 503,400	
1.3	Roadway Borrow Material	CY	289	210.00	$ 60,690	
				Subtotal for Item 01 Earthwork	**$ 604,090**	
02 Pavement Structural Section						
2.1	Remove Curb and Gutter	LF	991	31.00	$ 30,721	
2.2	Remove Curb	LF			$ -	
2.3	Remove Concrete Sidewalk	SF			$ -	
2.4	Remove Base and Surfacing	SF	11,633	7.00	$ 81,431	
2.5	Remove Concrete Island	SF			$ -	
2.6	Pavement Section (Local roads assumed - 0.35' HMA, 0.57' AB, 1' AS)	SF			$ -	
2.7	Pavement Section (Ramps assumed - 0.20' Rubberized HMA, 0.55' HMA, 0.50' Cl 2 AB)	SF	55,032	18.00	$ 990,576	
2.8	Mill and Overlay	SF	98,515	10.00	$ 985,150	
2.9	Curb and Gutter	LF	597	61.00	$ 36,417	
2.10	Sidewalk (assume 4" concrete, 4" base)	SF			$ -	
2.11	Multi-Use Path (assume 0.5' concrete, 4" base)	SF			$ -	
2.12	Concrete Island/Median	SF			$ -	
2.13	Driveway (assume - 6" concrete, 4" base)	SF			$ -	
				Subtotal for Item 02 Pavement Structural Section	**$ 2,124,295**	
03 Drainage						
3.1	Drainage (assume % of Roadway Cost Items 1 through 2)		25%		$ 682,096.25	
3.2	Stormwater Treatment (from SWDR)	LS			$ -	
				Subtotal of Item 03 Drainage	**$ 682,096**	
04 Specialty Items						
4.1	Metal Beam Guard Railing	LF	126	60.00	$ 7,560	
4.2	ADA Curb Ramps	EA			$ -	
4.3	Roadway Concrete Barrier	LF	1,129	210.00	$ 237,090	
4.4	Retaining Barrier	LF			$ -	
4.5	Retaining Wall (Caltrans Type 1) (H=4'-10')	SQFT			$ -	
4.6	Retaining Wall (Caltrans Type 1) (H=10'-20')	SQFT			$ -	
4.7	Remove Metal Beam Guard Railing	LF	61	20.00	$ 1,220	
4.8	Remove Roadway Concrete Barrier	LF			$ -	
4.9	Remove Delineator	EA	275	35.00	$ 9,625	
4.10	Fence (Height = 6')	LF			$ -	
4.11	Bike Ramp	EA			$ -	
				Subtotal for Items 04 Specialty Items	**$ 255,495**	
05 Environmental						
5.1	Environmental (assume % of Roadway Cost items 1 thru 4)		30%		$ 1,099,793	
				Subtotal for Item 05 Environmental	**$ 1,099,793**	
06 Traffic						
06a Traffic Items						
6a.1	Traffic Signal and lighting (Upgrade, per intersection)	EA			$ -	
6a.2	Traffic Signal and lighting (New, per intersection)	EA			$ -	
6a.3	Pedestrian Hybrid Beacon (PHB)	EA			$ -	
6a.4	Rapid Reflective Flashing Beacons (one pair)	EA			$ -	
6a.5	Traffic Signal Priority	EA			$ -	
6a.6	Traffic Operations Systems (Ramp Metering)	EA	2	330,000.00	$ 660,000	
6a.7	Modify Traffic Operations Systems (Ramp Metering)	EA	1	91,000.00	$ 91,000	
6a.8	Remove Traffic Operations Systems (Ramp Metering)	EA			$ -	
				Subtotal for Item 06a Traffic Items	**$ 751,000**	
					Subtotal Sections 1 through 6a	**$ 5,516,769**
06b Additional Traffic Items						
6b.1	Highway Signage Structure	EA			$ -	
6b.2	Signing and Striping (Includes Removal)		1%		$ 55,168	
6b.3	Roadway Lighting	LS	1	150,000.00	$ 150,000	
6b.4	Stage Construction and Traffic Handling	LS	1	200,000.00	$ 200,000	
				Subtotal for Item 06b Traffic Items	**$ 405,168**	
					Subtotal Sections 1 through 6	**$ 5,921,937**
07 Minor Items						
7.1	American with Disabilities Act Items		0%		$ -	
7.2	Bike Path Items		0%		$ -	
7.3	Other Minor Items		0%		$ -	
				Subtotal of Item 07 Minor Items	**$ -**	
08 Roadway Mobilization						
8.1	Roadway Mobilization		10%		$ 592,194	
				Subtotal for Item 08 Roadway Mobilization	**$ 592,194**	
09 Roadway Contingency						
9.1	Roadway Contingency (assume % of total cost of Section Items 01-08)		30%		$ 1,954,239	
				Subtotal for Item 09 Roadway Contingency	**$ 1,954,239**	
					Subtotal for Items 1-9 (Roadway)	**$ 8,468,370**

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission	Concept 2
Project Description:	Widen Diagonal and Loop Connectors to SB I-680	
Location:	I-580/I-680 Interchange	

Item code	Description	Unit	Quantity	Unit Price ($)	Cost	
II. Structures						
10 Structures						
10.1	Bridge Demolition	SF			$ -	
10.2	New Bridge Structure	LS			$ -	
10.3	Bridge Widening	SF	3,900	1,050.00	$ 4,095,000	
10.4	Pedestrian Overcrossing (including ramp)	LS			$ -	
10.5	Pedestrian Undercrossing (including ramp)	LS			$ -	
10.6	Tunnel	SF			$ -	
10.7	Structure modification	SF			$ -	
10.8	Soil Nail Wall	SF			$ -	
10.9	Soldier Pile Wall	SF			$ -	
10.10	Tie-back Wall	LS			$ -	
			Subtotal for Item 10 Structures		**$ 4,095,000**	
10.11	Structure Contingency		30%		$ 1,228,500.00	
					Subtotal for Structures	**$ 5,323,500**
	TOTAL CONSTRUCTION COST (TCC) - SUM OF ITEMS 1-10 (ROADWAY AND STRUCTURES)					**$ 13,791,870**
III. Right of Way						
III.1	Right of Way Acquisition	LS			$ -	
III.2	Title & Escrow	LS			$ -	
III.3	Right of Way Support Costs	LS			$ -	
III.4	Utility Relocation	LS	1	20,000.00	$ 20,000	
			Subtotal for Item 11 Right of Way		**$ 20,000**	
III.5	Right of Way Contingency		30%		$ 6,000.00	
					Subtotal for Right of Way	**$ 26,000**
Engineering and Management Costs						
			TCC		**Unescalated Risk Loaded**	
IV	**Preliminary Engineering/Environmental**	8%	***$ 13,791,870***		$ 1,103,349.57	
V	**Design Engineering**	10%	***$ 13,791,870***		$ 1,379,186.96	
VI	**Design Services During Construction**	3%	***$ 13,791,870***		$ 413,756.09	
VII	**Construction Management**	15%	***$ 13,791,870***		$ 2,068,780.45	
VIII	**Agency Management**	15%	***$ 13,791,870***		$ 2,068,780.45	
					Current Year Cost	
			Roadway Cost		**$ 8,468,370**	

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission
Project Description:	Concept 3 - I-680/Stoneridge Dr Interchange
Location:	I-580/I-680 Interchange Improvements
Type of Estimate:	Pre-PID Level Estimate
Prepared by:	HNTB

SUMMARY OF PROJECT OUTLAY COSTS

			Current Year Cost
I	ROADWAY	$	926,970
II	STRUCTURES	$	-
III	RIGHT OF WAY	$	-
	TOTAL CAPITAL OUTLAY COST	**$**	**926,970**
IV	PRELIMINARY ENGINEERING/ENVIRONMENTAL	$	74,158
V	DESIGN ENGINEERING	$	92,697
VI	DESIGN SERVICES DURING CONSTRUCTION	$	27,809
VII	CONSTRUCTION MANAGEMENT	$	139,046
	TOTAL SUPPORT COST	**$**	**333,709**
	DIRECT PROJECT COST	**$**	**1,260,680**
VIII	AGENCY MANAGEMENT	$	139,046
	TOTAL PROJECT COST	**$**	**1,399,725**

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission	Concept 3
Project Description:	I-580/I-680 Interchange Improvements	
Location:	I-680/Stoneridge Dr Interchange	

Item code	Description	Unit	Quantity	Unit Price ($)	Cost	
I. Roadway						
01 Earthwork						
1.1	Clearing & Grubbing	LS	1	10,000.00	$ 10,000	
1.2	Roadway Excavation	CY	305	200.00	$ 61,000	
1.3	Roadway Borrow Material	CY			$ -	
			Subtotal for Item 01 Earthwork		**$ 71,000**	
02 Pavement Structural Section						
2.1	Remove Curb and Gutter	LF			$ -	
2.2	Remove Curb	LF			$ -	
2.3	Remove Concrete Sidewalk	SF			$ -	
2.4	Remove Base and Surfacing	SF			$ -	
2.5	Remove Concrete Island	SF			$ -	
2.6	Pavement Section (Local roads assumed - 0.35' HMA, 0.57' AB, 1' AS)	SF			$ -	
2.7	Pavement Section (Ramps assumed - 0.20' Rubberized HMA, 0.55' HMA, 0.50' Cl 2 AB)	SF	4,107	18.00	$ 73,926	
2.8	Mill and Overlay	SF	23,785	10.00	$ 237,850	
2.9	Curb and Gutter	LF			$ -	
2.10	Sidewalk (assume 4" concrete, 4" base)	SF			$ -	
2.11	Multi-Use Path (assume 0.5' concrete, 4" base)	SF			$ -	
2.12	Concrete Island/Median	SF			$ -	
2.13	Driveway (assume - 6" concrete, 4" base)	SF			$ -	
		Subtotal for Item 02 Pavement Structural Section			**$ 311,776**	
03 Drainage						
3.1	Drainage (assume % of Roadway Cost Items 1 through 2)		25%		$ 95,694.00	
3.2	Stormwater Treatment (from SWDR)	LS			$ -	
			Subtotal of Item 03 Drainage		**$ 95,694**	
04 Specialty Items						
4.1	Metal Beam Guard Railing	LF			$ -	
4.2	ADA Curb Ramps	EA			$ -	
4.3	Roadway Concrete Barrier	LF			$ -	
4.4	Retaining Barrier	LF			$ -	
4.5	Retaining Wall (Caltrans Type 1) (H=4'-10')	SQFT			$ -	
4.6	Retaining Wall (Caltrans Type 1) (H=10'-20')	SQFT			$ -	
4.7	Remove Metal Beam Guard Railing	LF			$ -	
4.8	Remove Roadway Concrete Barrier	LF			$ -	
4.9	Fence (Height = 6')	LF			$ -	
4.10	Bike Ramp	EA			$ -	
			Subtotal for Items 04 Specialty Items		**$ -**	
05 Environmental						
5.1	Environmental (assume % of Roadway Cost items 1 thru 4)		30%		$ 143,541	
			Subtotal for Item 05 Environmental		**$ 143,541**	
06 Traffic						
06a Traffic Items						
6a.1	Traffic Signal and lighting (Upgrade, per intersection)	EA			$ -	
6a.2	Traffic Signal and lighting (New, per intersection)	EA			$ -	
6a.3	Pedestrian Hybrid Beacon (PHB)	EA			$ -	
6a.4	Rapid Reflective Flashing Beacons (one pair)	EA			$ -	
6a.5	Traffic Signal Priority	EA			$ -	
6a.6	Traffic Operations Systems (Ramp Metering)	EA			$ -	
6a.7	Relocate Traffic Operations Systems (Ramp Metering)	EA			$ -	
6a.8	Remove Traffic Operations Systems (Ramp Metering)	EA			$ -	
6a.9	Remove Sign Panel	EA	2	900.00	$ 1,800	
6a.10	Install Sign Panel On Existing Frame	SF	240	150.00	$ 36,000	
			Subtotal for Item 06a Traffic Items		**$ -**	
					Subtotal Sections 1 through 6a	**$ 622,011**
06b Additional Traffic Items						
6b.1	Highway Signage Structure	EA			$ -	
6b.2	Signing and Striping (Includes Removal)		1%		$ 6,220	
6b.3	Roadway Lighting	LS			$ -	
6b.4	Stage Construction and Traffic Handling	LS	1	20,000.00	$ 20,000	
			Subtotal for Item 06b Traffic Items		**$ 26,220**	
					Subtotal Sections 1 through 6	**$ 648,231**
07 Minor Items						
7.1	American with Disabilities Act Items		0%		$ -	
7.2	Bike Path Items		0%		$ -	
7.3	Other Minor Items		0%		$ -	
			Subtotal of Item 07 Minor Items		**$ -**	
08 Roadway Mobilization						
8.1	Roadway Mobilization		10%		$ 64,823	
		Subtotal for Item 08 Roadway Mobilization			**$ 64,823**	
09 Roadway Contingency						
9.1	Roadway Contingency (assume % of total cost of Section Items 01-08)		30%		$ 213,916	
		Subtotal for Item 09 Roadway Contingency			**$ 213,916**	
					Subtotal for Items 1-9 (Roadway)	**$ 926,970**

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission	Concept 3
Project Description:	I-580/I-680 Interchange Improvements	
Location:	I-680/Stoneridge Dr Interchange	

Item code	Description	Unit	Quantity	Unit Price ($)	Cost	
II. Structures						
10 Structures						
10.1	Bridge Demolition	SF			$ -	
10.2	New Bridge Structure	LS			$ -	
10.3	Bridge Widening	LS			$ -	
10.4	Pedestrian Overcrossing (including ramp)	LS			$ -	
10.5	Pedestrian Undercrossing (including ramp)	LS			$ -	
10.6	Tunnel	SF			$ -	
10.7	Structure modification	SF			$ -	
10.8	Soil Nail Wall	SF			$ -	
10.9	Soldier Pile Wall	SF			$ -	
10.10	Tie-back Wall	LS			$ -	
			Subtotal for Item 10 Structures		**$ -**	
10.11	Structure Contingency		30%		$ -	
					Subtotal for Structures	**$ -**
	TOTAL CONSTRUCTION COST (TCC) - SUM OF ITEMS 1-10 (ROADWAY AND STRUCTURES)					**$ 926,970**
III. Right of Way						
III.1	Right of Way Acquisition	LS			$ -	
III.2	Title & Escrow	LS			$ -	
III.3	Right of Way Support Costs	LS			$ -	
III.4	Utility Relocation	LS			$ -	
			Subtotal for Item 11 Right of Way		**$ -**	
III.5	Right of Way Contingency		30%		$ -	
					Subtotal for Right of Way	**$ -**
Engineering and Management Costs						
			TCC	**Duration (Year)**	**Unescalated Risk Loaded**	
IV	**Preliminary Engineering/Environmental**	8%	***$ 926,970***		$ 74,157.64	
V	**Design Engineering**	10%	***$ 926,970***		$ 92,697.05	
VI	**Design Services During Construction**	3%	***$ 926,970***		$ 27,809.11	
VII	**Construction Management**	15%	***$ 926,970***		$ 139,045.57	
VIII	**Agency Management**	15%	***$ 926,970***		$ 139,045.57	
					Current Year Cost	
			Roadway Cost		**$ 926,970**	

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission
Project Description:	Concept 4 - I-580/Foothill Rd/San Ramon Rd Interchange
Location:	I-580/I-680 Interchange Improvements
Type of Estimate:	Pre-PID Level Estimate
Prepared by:	HNTB

SUMMARY OF PROJECT OUTLAY COSTS

			Current Year Cost
I	ROADWAY	$	17,691,756
II	STRUCTURES	$	-
III	RIGHT OF WAY	$	130,000
	TOTAL CAPITAL OUTLAY COST	**$**	**17,821,756**
IV	PRELIMINARY ENGINEERING/ENVIRONMENTAL	$	1,415,341
V	DESIGN ENGINEERING	$	1,769,176
VI	DESIGN SERVICES DURING CONSTRUCTION	$	530,753
VII	CONSTRUCTION MANAGEMENT	$	2,653,763
	TOTAL SUPPORT COST	**$**	**6,369,032**
	DIRECT PROJECT COST	**$**	**24,190,789**
VIII	AGENCY MANAGEMENT	$	2,653,763
	TOTAL PROJECT COST	**$**	**26,844,552**

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission	Concept 4
Project Description:	I-580/Foothill Rd/San Ramon Rd Interchange	
Location:	I-580/I-680 Interchange	

Item code	Description	Unit	Quantity	Unit Price ($)	Cost	
I. Roadway						
01 Earthwork						
1.1	Clearing & Grubbing	LS	1	40,000.00	$ 40,000	
1.2	Roadway Excavation	CY	545	200.00	$ 109,000	
1.3	Roadway Borrow Material	CY	1,551	210.00	$ 325,710	
				Subtotal for Item 01 Earthwork	**$ 474,710**	
02 Pavement Structural Section						
2.1	Remove Curb and Gutter	LF	159	31.00	$ 4,929	
2.2	Remove Curb	LF	529	31.00	$ 16,399	
2.3	Remove Concrete Sidewalk	SF	3,097	11.00	$ 34,067	
2.4	Remove Base and Surfacing	SF	222,627	7.00	$ 1,558,389	
2.5	Remove Concrete Island	SF	6,521	10.00	$ 65,210	
2.6	Pavement Section (Local roads assumed - 0.35' HMA, 0.57' AB, 1' AS)	SF	7,773	14.00	$ 108,822	
2.7	Pavement Section (Ramps assumed - 0.20' Rubberized HMA, 0.55' HMA, 0.50' Cl 2 AB)	SF	120,954	18.00	$ 2,177,172	
2.8	Mill and Overlay	SF	135,651	10.00	$ 1,356,510	
2.9	Curb and Gutter	LF	571	61.00	$ 34,831	
2.10	Sidewalk (assume 4" concrete, 4" base)	SF	3,712	15.00	$ 55,680	
2.11	Multi-Use Path (assume 0.5' concrete, 4" base)	SF			$ -	
2.12	Concrete Island/Median	SF	254	14.00	$ 3,556	
2.13	Driveway (assume - 6" concrete, 4" base)	SF			$ -	
				Subtotal for Item 02 Pavement Structural Section	**$ 5,415,565**	
03 Drainage						
3.1	Drainage (assume % of Roadway Cost Items 1 through 2)		25%		$ 1,472,568.75	
3.2	Stormwater Treatment (from SWDR)	LS			$ -	
				Subtotal of Item 03 Drainage	**$ 1,472,569**	
04 Specialty Items						
4.1	Metal Beam Guard Railing	LF			$ -	
4.2	ADA Curb Ramps	EA			$ -	
4.3	Roadway Concrete Barrier	LF	136	210.00	$ 28,560	
4.4	Retaining Barrier	LF			$ -	
4.5	Retaining Wall (Caltrans Type 1) (H=4'-10')	SQFT			$ -	
4.6	Retaining Wall (Caltrans Type 1) (H=10'-20')	SQFT			$ -	
4.7	Remove Metal Beam Guard Railing	LF	1,382	20.00	$ 27,640	
4.8	Remove Roadway Concrete Barrier	LF	2,167	100.00	$ 216,700	
4.9	Fence (Height = 6')	LF			$ -	
4.10	Bike Ramp	EA			$ -	
				Subtotal for Items 04 Specialty Items	**$ 272,900**	
05 Environmental						
5.1	Environmental (assume % of Roadway Cost items 1 thru 4)		30%		$ 2,290,723	
				Subtotal for Item 05 Environmental	**$ 2,290,723**	
06 Traffic						
06a Traffic Items						
6a.1	Traffic Signal and lighting (Upgrade, per intersection)	EA	2	650,000.00	$ 1,300,000	
6a.2	Traffic Signal and lighting (New, per intersection)	EA			$ -	
6a.3	Pedestrian Hybrid Beacon (PHB)	EA			$ -	
6a.4	Rapid Reflective Flashing Beacons (one pair)	EA			$ -	
6a.5	Traffic Signal Priority	EA			$ -	
6a.6	Traffic Operations Systems (Ramp Metering)	EA			$ -	
6a.7	Modify Traffic Operations Systems (Ramp Metering)	EA	2	91,000.00	$ 182,000	
6a.8	Remove Traffic Operations Systems (Ramp Metering)	EA	2	19,000.00	$ 38,000	
				Subtotal for Item 06a Traffic Items	**$ 1,520,000**	
					Subtotal Sections 1 through 6a	**$ 11,446,467**
06b Additional Traffic Items						
6b.1	Highway Signage Structure	EA			$ -	
6b.2	Signing and Striping (Includes Removal)		1%		$ 114,465	
6b.3	Roadway Lighting	LS	1	90,000.00	$ 90,000	
6b.4	Stage Construction and Traffic Handling	LS	1	500,000.00	$ 500,000	
				Subtotal for Item 06b Traffic Items	**$ 704,465**	
					Subtotal Sections 1 through 6	**$ 12,150,932**
07 Minor Items						
7.1	American with Disabilities Act Items		1%		$ 121,509.32	
7.2	Bike Path Items		1%		$ 121,509	
7.3	Other Minor Items		0%		$ -	
				Subtotal of Item 07 Minor Items	**$ 243,019**	
08 Roadway Mobilization						
8.1	Roadway Mobilization		10%		$ 1,215,093	
				Subtotal for Item 08 Roadway Mobilization	**$ 1,215,093**	
09 Roadway Contingency						
9.1	Roadway Contingency (assume % of total cost of Section Items 01-08)		30%		$ 4,082,713	
				Subtotal for Item 09 Roadway Contingency	**$ 4,082,713**	
					Subtotal for Items 1-9 (Roadway)	**$ 17,691,756**

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission	Concept 4
Project Description:	I-580/Foothill Rd/San Ramon Rd Interchange	
Location:	I-580/I-680 Interchange	

Item code	Description	Unit	Quantity	Unit Price ($)	Cost	
II. Structures						
10 Structures						
10.1	Bridge Demolition	SF			$ -	
10.2	New Bridge Structure	LS			$ -	
10.3	Bridge Widening	LS			$ -	
10.4	Pedestrian Overcrossing (including ramp)	LS			$ -	
10.5	Pedestrian Undercrossing (including ramp)	LS			$ -	
10.6	Tunnel	SF			$ -	
10.7	Structure modification	SF			$ -	
10.8	Soil Nail Wall	SF			$ -	
10.9	Soldier Pile Wall	SF			$ -	
10.10	Tie-back Wall	LS			$ -	
			Subtotal for Item 10 Structures		**$ -**	
10.11	Structure Contingency		30%		$ -	
					Subtotal for Structures	**$ -**
	TOTAL CONSTRUCTION COST (TCC) - SUM OF ITEMS 1-10 (ROADWAY AND STRUCTURES)					**$ 17,691,756**
III. Right of Way						
III.1	Right of Way Acquisition	LS			$ -	
III.2	Title & Escrow	LS			$ -	
III.3	Right of Way Support Costs	LS			$ -	
III.4	Utility Relocation	LS	1	100,000.00	$ 100,000	
			Subtotal for Item 11 Right of Way		**$ 100,000**	
III.5	Right of Way Contingency		30%		$ 30,000.00	
					Subtotal for Right of Way	**$ 130,000**
Engineering and Management Costs						
			TCC		**Unescalated Risk Loaded**	
IV	**Preliminary Engineering/Environmental**	8%	***$ 17,691,756***		$ 1,415,340.51	
V	**Design Engineering**	10%	***$ 17,691,756***		$ 1,769,175.63	
VI	**Design Services During Construction**	3%	***$ 17,691,756***		$ 530,752.69	
VII	**Construction Management**	15%	***$ 17,691,756***		$ 2,653,763.45	
VIII	**Agency Management**	15%	***$ 17,691,756***		$ 2,653,763.45	
					Current Year Cost	
			Roadway Cost		**$ 17,691,756**	

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission
Project Description:	Concept 5 - I-580/Dougherty Rd/Hopyard Rd Interchange
Location:	I-580/I-680 Interchange
Type of Estimate:	Pre-PID Level Estimate
Prepared by:	HNTB

SUMMARY OF PROJECT OUTLAY COSTS

		Current Year Cost
I ROADWAY	$	13,291,019
II STRUCTURES	$	-
III RIGHT OF WAY	$	845,000
TOTAL CAPITAL OUTLAY COST	**$**	**14,136,019**
IV PRELIMINARY ENGINEERING/ENVIRONMENTAL	$	1,063,282
V DESIGN ENGINEERING	$	1,329,102
VI DESIGN SERVICES DURING CONSTRUCTION	$	398,731
VII CONSTRUCTION MANAGEMENT	$	1,993,653
TOTAL SUPPORT COST	**$**	**4,784,767**
DIRECT PROJECT COST	**$**	**18,920,786**
VIII AGENCY MANAGEMENT	$	1,993,653
TOTAL PROJECT COST	**$**	**20,914,439**

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission	Concept 5
Project Description:	I-580/Dougherty Rd/Hopyard Rd Interchange	
Location:	I-580/I-680 Interchange	

Item code	Description	Unit	Quantity	Unit Price ($)	Cost	
I. Roadway						
01 Earthwork						
1.1	Clearing & Grubbing	LS	1	40,000.00	$ 40,000	
1.2	Roadway Excavation	CY	334	200.00	$ 66,800	
1.3	Roadway Borrow Material	CY	3,353	210.00	$ 704,130	
				Subtotal for Item 01 Earthwork	**$ 810,930**	
02 Pavement Structural Section						
2.1	Remove Curb and Gutter	LF	1,699	31.00	$ 52,669	
2.2	Remove Curb	LF	400	31.00	$ 12,400	
2.3	Remove Concrete Sidewalk	SF	12,560	11.00	$ 138,160	
2.4	Remove Base and Surfacing	SF	45,128	7.00	$ 315,896	
2.5	Remove Concrete Island	SF	4,855	10.00	$ 48,550	
2.6	Pavement Section (Local road assumed - 0.35' HMA, 0.57' AB, 1' AS)	SF	15,146	14.00	$ 212,044	
2.7	Pavement Section (Ramps assumed - 0.20' Rubberized HMA, 0.55' HMA, 0.50' Cl 2 AB)	SF	21,013	18.00	$ 378,234	
2.8	Mill and Overlay	SF	167,252	10.00	$ 1,672,520	
2.9	Curb and Gutter	LF	1,495	61.00	$ 91,195	
2.10	Sidewalk (assume 4" concrete, 4" base)	SF			$ -	
2.11	Multi-Use Path (assume 0.5' concrete, 4" base)	SF	11,686	22.00	$ 257,092	
2.12	Concrete Island/Median	SF	9,089	14.00	$ 127,246	
2.13	Driveway (assume - 6" concrete, 4" base)	SF			$ -	
		Subtotal for Item 02 Pavement Structural Section			**$ 3,306,006**	
03 Drainage						
3.1	Drainage (assume % of Roadway Cost Items 1 through 2)		25%		$ 1,029,234.00	
3.2	Stormwater Treatment (from SWDR)	LS	0	0.00	$ -	
				Subtotal of Item 03 Drainage	**$ 1,029,234**	
04 Specialty Items						
4.1	Metal Beam Guard Railing	LF			$ -	
4.2	ADA Curb Ramps	EA	5	3,500.00	$ 17,500	
4.3	Roadway Concrete Barrier	LF	233	210.00	$ 48,930	
4.4	Retaining Barrier	LF			$ -	
4.5	Retaining Wall (Caltrans Type 1) (H=4'-10')	SQFT	3,772	200.00	$ 754,400	
4.6	Retaining Wall (Caltrans Type 1) (H=10'-20')	SQFT			$ -	
4.7	Remove Metal Beam Guard Railing	LF	111	20.00	$ 2,220	
4.8	Remove Roadway Concrete Barrier	LF	66	100.00	$ 6,600	
4.9	Fence (Height = 6')	LF			$ -	
4.10	Bike Ramp	EA	1	3,500.00	$ 3,500	
			Subtotal for Items 04 Specialty Items		**$ 833,150**	
05 Environmental						
5.1	Environmental (assume % of Roadway Cost items 1 thru 4)		30%		$ 1,793,796	
			Subtotal for Item 05 Environmental		**$ 1,793,796**	
06 Traffic						
06a Traffic Items						
6a.1	Traffic Signal and lighting (Upgrade, per intersection)	EA	1	650,000.00	$ 650,000	
6a.2	Traffic Signal and lighting (New, per intersection)	EA			$ -	
6a.3	Pedestrian Hybrid Beacon (PHB)	EA			$ -	
6a.4	Rapid Reflective Flashing Beacons (one pair)	EA			$ -	
6a.5	Traffic Signal Priority	EA			$ -	
6a.6	Traffic Operations Systems (Ramp Metering)	EA			$ -	
6a.7	Modify Traffic Operations Systems (Ramp Metering)	EA	1	91,000.00	$ 91,000	
6a.8	Remove Traffic Operations Systems (Ramp Metering)	EA	1	19,000.00	$ 19,000	
			Subtotal for Item 06a Traffic Items		**$ 760,000**	
					Subtotal Sections 1 through 6a	**$ 8,533,116**
06b Additional Traffic Items						
6b.1	Highway Signage Structure	EA			$ -	
6b.2	Signing and Striping (Includes Removal)		1%		$ 85,331	
6b.3	Roadway Lighting	LS	1	210,000.00	$ 210,000	
6b.4	Stage Construction and Traffic Handling	LS	1	300,000.00	$ 300,000	
			Subtotal for Item 06b Traffic Items		**$ 595,331**	
					Subtotal Sections 1 through 6	**$ 9,128,447**
07 Minor Items						
7.1	American with Disabilities Act Items		1%		$ 91,284.47	
7.2	Bike Path Items		1%		$ 91,284	
7.3	Other Minor Items		0%		$ -	
			Subtotal of Item 07 Minor Items		**$ 182,569**	
08 Roadway Mobilization						
8.1	Roadway Mobilization		10%		$ 912,845	
		Subtotal for Item 08 Roadway Mobilization			**$ 912,845**	
09 Roadway Contingency						
9.1	Roadway Contingency (assume % of total cost of Section Items 01-08)		30%		$ 3,067,158	
		Subtotal for Item 09 Roadway Contingency			**$ 3,067,158**	
					Subtotal for Items 1-9 (Roadway)	**$ 13,291,019**

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission	Concept 5
Project Description:	I-580/Dougherty Rd/Hopyard Rd Interchange	
Location:	I-580/I-680 Interchange	

Item code	Description	Unit	Quantity	Unit Price ($)	Cost	
II. Structures						
10 Structures						
10.1	Bridge Demolition	SF			$ -	
10.2	New Bridge Structure	LS			$ -	
10.3	Bridge Widening	LS			$ -	
10.4	Pedestrian Overcrossing (including ramp)	LS			$ -	
10.5	Pedestrian Undercrossing (including ramp)	LS			$ -	
10.6	Tunnel	SF			$ -	
10.7	Structure modification	SF			$ -	
10.8	Soil Nail Wall	SF			$ -	
10.9	Soldier Pile Wall	SF			$ -	
10.10	Tie-back Wall	LS			$ -	
			Subtotal for Item 10 Structures		**$ -**	
10.11	Structure Contingency		30%		$ -	
					Subtotal for Structures	**$ -**
	TOTAL CONSTRUCTION COST (TCC) - SUM OF ITEMS 1-10 (ROADWAY AND STRUCTURES)					**$ 13,291,019**
III. Right of Way						
III.1	Right of Way Acquisition	LS	1	450,000.00	$ 450,000	
III.2	Title & Escrow	LS			$ -	
III.3	Right of Way Support Costs	LS			$ -	
III.4	Utility Relocation	LS	1	200,000.00	$ 200,000	
			Subtotal for Item 11 Right of Way		**$ 650,000**	
III.5	Right of Way Contingency		30%		$ 195,000.00	
					Subtotal for Right of Way	**$ 845,000**
Engineering and Management Costs						
			TCC		**Unescalated Risk Loaded**	
IV	**Preliminary Engineering/Environmental**	8%	***$ 13,291,019***		$ 1,063,281.53	
V	**Design Engineering**	10%	***$ 13,291,019***		$ 1,329,101.91	
VI	**Design Services During Construction**	3%	***$ 13,291,019***		$ 398,730.57	
VII	**Construction Management**	15%	***$ 13,291,019***		$ 1,993,652.86	
VIII	**Agency Management**	15%	***$ 13,291,019***		$ 1,993,652.86	
					Current Year Cost	
			Roadway Cost		**$ 13,291,019**	

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission
Project Description:	Concept 6 - Maintain Four Lanes on EB I-580
Location:	I-580/I-680 Interchange
Type of Estimate:	Pre-PID Level Estimate
Prepared by:	HNTB

SUMMARY OF PROJECT OUTLAY COSTS

			Current Year Cost
I	ROADWAY	$	1,567,951
II	STRUCTURES	$	-
III	RIGHT OF WAY	$	-
	TOTAL CAPITAL OUTLAY COST	**$**	**1,567,951**
IV	PRELIMINARY ENGINEERING/ENVIRONMENTAL	$	125,436
V	DESIGN ENGINEERING	$	156,795
VI	DESIGN SERVICES DURING CONSTRUCTION	$	47,039
VII	CONSTRUCTION MANAGEMENT	$	235,193
	TOTAL SUPPORT COST	**$**	**564,462**
	DIRECT PROJECT COST	**$**	**2,132,413**
VIII	AGENCY MANAGEMENT	$	235,193
	TOTAL PROJECT COST	**$**	**2,367,606**

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission	Concept 6
Project Description:	Maintain Four Lanes on EB I-580	
Location:	I-580/I-680 Interchange	

Item code	Description	Unit	Quantity	Unit Price ($)	Cost	
I. Roadway						
01 Earthwork						
1.1	Clearing & Grubbing	LS			$ -	
1.2	Roadway Excavation	CY			$ -	
1.3	Roadway Borrow Material	CY			$ -	
				Subtotal for Item 01 Earthwork	**$ -**	
02 Pavement Structural Section						
2.1	Remove Curb and Gutter	LF			$ -	
2.2	Remove Curb	LF			$ -	
2.3	Remove Concrete Sidewalk	SF			$ -	
2.4	Remove Base and Surfacing	SF			$ -	
2.5	Remove Concrete Island	SF			$ -	
2.6	Pavement Section (Local roads assumed - 0.35' HMA, 0.57' AB, 1' AS)	SF			$ -	
2.7	Pavement Section (Ramps assumed - 0.20' Rubberized HMA, 0.55' HMA, 0.50' Cl 2 AB)	SF			$ -	
2.8	Mill and Overlay	SF	58,113	10.00	$ 581,130	
2.9	Curb and Gutter	LF			$ -	
2.10	Sidewalk (assume 4" concrete, 4" base)	SF			$ -	
2.11	Multi-Use Path (assume 0.5' concrete, 4" base)	SF			$ -	
2.12	Concrete Island/Median	SF			$ -	
2.13	Driveway (assume - 6" concrete, 4" base)	SF			$ -	
				Subtotal for Item 02 Pavement Structural Section	**$ 581,130**	
03 Drainage						
3.1	Drainage (assume % of Roadway Cost Items 1 through 2)		0%		$ -	
3.2	Stormwater Treatment (from SWDR)	LS			$ -	
				Subtotal of Item 03 Drainage	**$ -**	
04 Specialty Items						
4.1	Metal Beam Guard Railing	LF			$ -	
4.2	ADA Curb Ramps	EA			$ -	
4.3	Roadway Concrete Barrier	LF			$ -	
4.4	Retaining Barrier	LF			$ -	
4.5	Retaining Wall (Caltrans Type 1) (H=4'-10')	SQFT			$ -	
4.6	Retaining Wall (Caltrans Type 1) (H=10'-20')	SQFT			$ -	
4.7	Remove Metal Beam Guard Railing	LF			$ -	
4.8	Remove Roadway Concrete Barrier	LF			$ -	
4.9	Fence (Height = 6')	LF			$ -	
4.10	Bike Ramp	EA			$ -	
				Subtotal for Items 04 Specialty Items	**$ -**	
05 Environmental						
5.1	Environmental (assume % of Roadway Cost items 1 thru 4)		30%		$ 174,339	
				Subtotal for Item 05 Environmental	**$ 174,339**	
06 Traffic						
06a Traffic Items						
6a.1	Traffic Signal and lighting (Upgrade, per intersection)	EA			$ -	
6a.2	Traffic Signal and lighting (New, per intersection)	EA			$ -	
6a.3	Pedestrian Hybrid Beacon (PHB)	EA			$ -	
6a.4	Rapid Reflective Flashing Beacons (one pair)	EA			$ -	
6a.5	Traffic Signal Priority	EA			$ -	
6a.6	Traffic Operations Systems (Ramp Metering)	EA			$ -	
6a.6	Traffic Operations Systems (Ramp Metering)	EA			$ -	
6a.7	Modify Traffic Operations Systems (Ramp Metering)	EA	1	91,000.00	$ 91,000	
6a.8	Remove Traffic Operations Systems (Ramp Metering)	EA			$ -	
				Subtotal for Item 06a Traffic Items	**$ 91,000**	
					Subtotal Sections 1 through 6a	**$ 846,469**
06b Additional Traffic Items						
6b.1	Highway Signage Structure	EA			$ -	
6b.2	Signing and Striping (Includes Removal)	LS	1	50,000.00	$ 50,000	
6b.3	Roadway Lighting	LS			$ -	
6b.4	Stage Construction and Traffic Handling	LS	1	200,000.00	$ 200,000	
				Subtotal for Item 06b Traffic Items	**$ 250,000**	
					Subtotal Sections 1 through 6	**$ 1,096,469**
07 Minor Items						
7.1	American with Disabilities Act Items		0%		$ -	
7.2	Bike Path Items		0%		$ -	
7.3	Other Minor Items		0%		$ -	
				Subtotal of Item 07 Minor Items	**$ -**	
08 Roadway Mobilization						
8.1	Roadway Mobilization		10%		$ 109,647	
				Subtotal for Item 08 Roadway Mobilization	**$ 109,647**	
09 Roadway Contingency						
9.1	Roadway Contingency (assume % of total cost of Section Items 01-08)		30%		$ 361,835	
				Subtotal for Item 09 Roadway Contingency	**$ 361,835**	
					Subtotal for Items 1-9 (Roadway)	**$ 1,567,951**

Project Cost Estimate

Project Owner:	Alameda County Transportation Commission	Concept 6
Project Description:	Maintain Four Lanes on EB I-580	
Location:	I-580/I-680 Interchange	

Item code	Description	Unit	Quantity	Unit Price ($)	Cost	
II. Structures						
10 Structures						
10.1	Bridge Demolition	SF			$ -	
10.2	New Bridge Structure	LS			$ -	
10.3	Bridge Widening	LS			$ -	
10.4	Pedestrian Overcrossing (including ramp)	LS			$ -	
10.5	Pedestrian Undercrossing (including ramp)	LS			$ -	
10.6	Tunnel	SF			$ -	
10.7	Structure modification	SF			$ -	
10.8	Soil Nail Wall	SF			$ -	
10.9	Soldier Pile Wall	SF			$ -	
10.10	Tie-back Wall	LS			$ -	
				Subtotal for Item 10 Structures	**$ -**	
10.11	Structure Contingency		30%		$ -	
					Subtotal for Structures	**$ -**
	TOTAL CONSTRUCTION COST (TCC) - SUM OF ITEMS 1-10 (ROADWAY AND STRUCTURES)					**$ 1,567,951**
III. Right of Way						
III.1	Right of Way Acquisition	LS			$ -	
III.2	Title & Escrow	LS			$ -	
III.3	Right of Way Support Costs	LS			$ -	
III.4	Utility Relocation	LS			$ -	
				Subtotal for Item 11 Right of Way	**$ -**	
III.5	Right of Way Contingency		30%		$ -	
					Subtotal for Right of Way	**$ -**
Engineering and Management Costs						
			TCC		**Unescalated Risk Loaded**	
IV	**Preliminary Engineering/Environmental**	8%	***$ 1,567,951***		$ 125,436.05	
V	**Design Engineering**	10%	***$ 1,567,951***		$ 156,795.07	
VI	**Design Services During Construction**	3%	***$ 1,567,951***		$ 47,038.52	
VII	**Construction Management**	15%	***$ 1,567,951***		$ 235,192.60	
VIII	**Agency Management**	15%	***$ 1,567,951***		$ 235,192.60	
					Current Year Cost	
			Roadway Cost		**$ 1,567,951**	