Final Report

I-580 Design Alternatives Assessment

Alameda County, CA

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Submitted to:

Metropolitan Transportation Commission

Alameda County Transportation Commission

Executive Summary

Interstate 580 (I-580) is one of Alameda County's key transportation routes, carrying over 200,000 vehicles per day in its most heavily used segments and serving as a primary conduit to the Transbay/Bay Bridge corridor. Given worsening congestion associated with Bay Bridge traffic and constrained right-of-way, and anticipated population and employment growth in associated travel markets related to the corridor, the Metropolitan Transportation Commission (MTC) and the Alameda County Transportation Commission (CTC) have conducted the I-580 Design Alternatives Assessment (DAA). The DAA evaluates the traffic and throughput needs of the I-580 corridor between Interstate 238 (I-238) in Hayward/Castro Valley and Interstate 80 (I-80)/San Francisco-Oakland Bay Bridge (SFOBB) in Oakland, California (see Figure ES-1) and identifies a list of feasible, near- and mid-term project concepts that can be advanced to project development.

This area is generally characterized by a distinct peak period / peak direction travel demand from the largely residential southern and central parts of the corridor to the dense urban mixed-use and commercial areas of the northern part of the corridor. Transportation improvement projects and strategies developed through this DAA aim to improve the travel conditions of the people who use this corridor by providing more multimodal travel options and supporting improved transit operations to increase person throughput within the corridor.

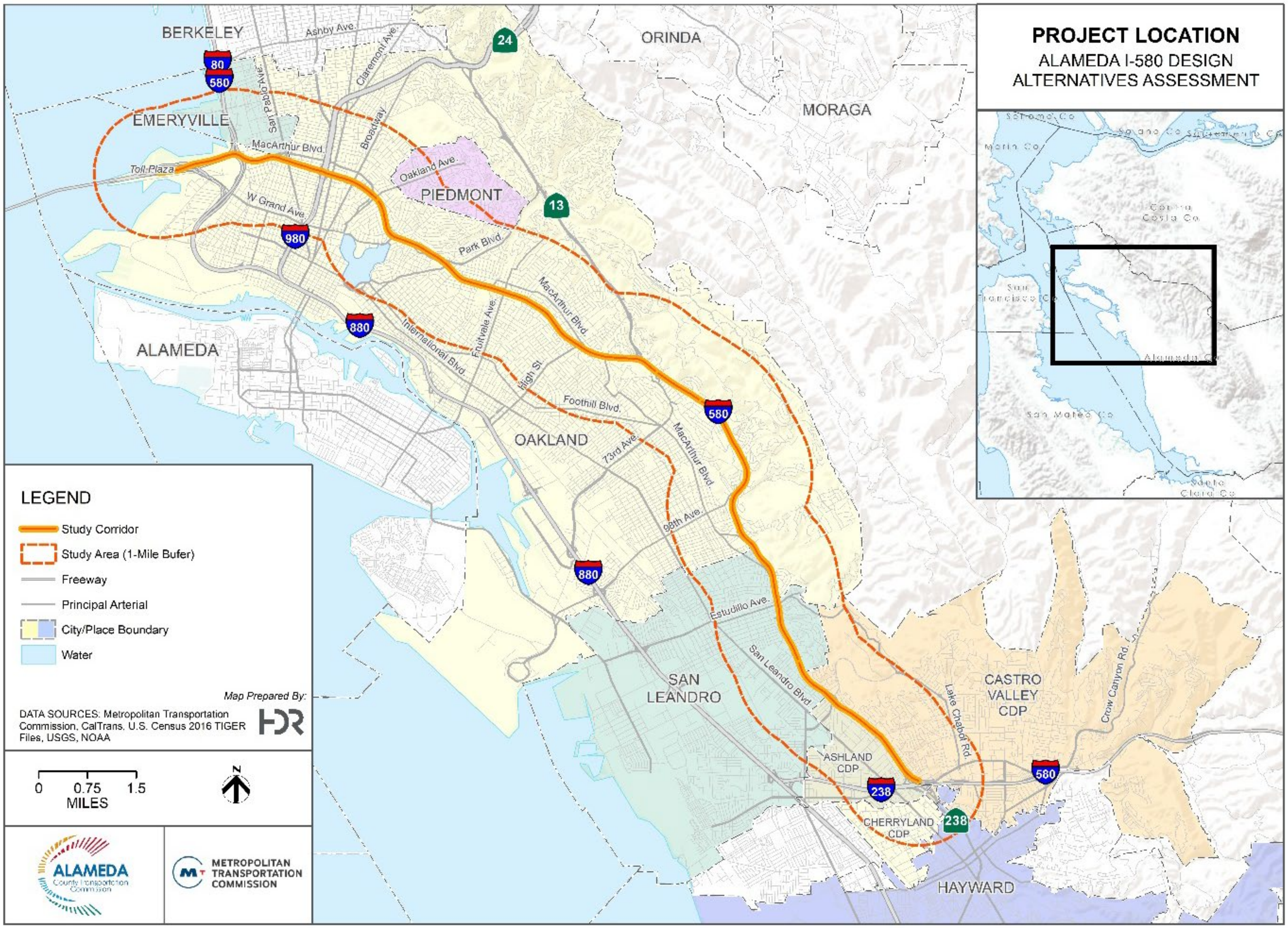
To help facilitate the process and identify appropriate improvement concepts, the project team worked closely with all public agency stakeholders along the corridor including a Technical Advisory Committee (TAC) consisting of Caltrans, AC Transit, the Cities of Oakland, Emeryville, and San Leandro, and Alameda County.

1.1 Goals and Need of the I-580 DAA

For the I-580 DAA, the goals of the project are to:

- ***Improve local and regional multimodal mobility for people***
- ***Focus on increasing person throughput, improving travel time reliability, offering travel time savings to support buses and high-occupancy vehicles***
- ***Identify a set of near-term (less than five years) operational improvement projects that could quickly advance into project development and delivery***
- ***Identify mid-term capital projects that may be further explored independently***

Figure ES-1. Project Location and Study Area



The development of the I-580 DAA is driven by the need to address:

- *Existing transportation bottlenecks and associated recurring and non-recurring congestion impacting the travel time reliability of inter-regional and local travelers (using all modes); and*
- *Existing limitations in the coverage, service, effectiveness, and use of multimodal travel alternatives and options.*

To meet the goals and need of the project, the I-580 DAA identifies mainline improvement and supplemental strategies including arterial improvement as described below.

1.2 Evaluation Framework

An Evaluation Framework was established in an effort to identify, screen, evaluate, and prioritize the strategies that meet the project goals and need. It consists of a five-step process:

1. *Identify transportation problems and issues within the project study area;*
2. *Clearly define the universe of potential multimodal projects and operational strategies that address transportation problems and issues;*
3. *Screen initial universe of multimodal projects and operational strategies;*
4. *Develop packages of multimodal projects and operational strategies; and*
5. *Perform detailed evaluation and prioritization of improvement packages.*

1.3 Types of Improvements and Strategies Considered

Universe of potential improvement concepts and operational strategies were identified and evaluated to determine their feasibility for implementation as part of the DAA. Improvement concepts and strategies were consequently advanced if they met the primary purpose of the project.

The mainline concepts that were considered include:

- *high occupancy vehicle (HOV) lanes;*
- *express lanes;*
- *bus on shoulder (BOS); and*
- *contra-flow managed lanes (including HOV and express lanes).*

Vehicle occupancy requirement is assumed to be 3+ for the HOV or express lane, which is consistent with the SFOBB toll plaza occupancy requirement.

Additionally, other complementary improvement concepts to better facilitate alternative modes of travel and person throughput were identified include:

- *park & ride facilities;*
- *arterial improvements for transit; and*
- *AC Transit express bus services.*

1.4 Freeway Mainline Improvement Alternatives

The following freeway mainline improvement alternatives were evaluated:

***Alternative 1A* – Westbound HOV Lane Extension**

- This alternative proposes to extend the existing left HOV lane at the westbound approach to the SFOBB Toll Plaza from the existing starting point towards eastern direction. This strategy would require converting approximately 1.2 miles of an existing general purpose lane to an HOV lane. Alternative 1A is included as part of the westbound mainline improvements in the subsequent alternatives listed below.

***Alternative 1B* – General Purpose Lane Conversion to HOV Lane**

- This alternative proposes to convert the left lane in both directions from a General Purpose lane to an HOV lane along the entire length of the corridor within the study area

***Alternative 1C* – General Purpose Lane Conversion to Express Lane**

- This alternative proposes to convert the left lane in both directions from a General Purpose lane to an Express Lane along the entire length of the corridor within the study area

***Alternative 2A* – Contra-flow HOV Lane**

- This alternative proposes a contra-flow HOV lane in both directions (6.0 miles westbound and 6.5 miles eastbound) during peak commuting periods by utilizing a general purpose lane in the off-peak direction

***Alternative 2B* – Contra-flow Express Lane**

- This alternative is similar to Alternative 2A, with the exception that the managed lane would be an express lane instead of an HOV lane

***Alternative 3A* – Bus on Shoulder (WB 4.5 miles/EB 6.0 miles)**

- This alternative proposes a Bus on Shoulder (BOS) option that utilizes the outside shoulder of the mainline corridor in both directions with segment limits primarily consistent with segments with heavier transit usage along I-580

***Alternative 3B* – Bus on Shoulder (WB 11.3 miles/EB 6.0 miles)**

- This alternative is to Alternative 3A with different starting and end points that accommodates all current freeway bus routes

1.5 Supplemental Strategies Considered

The DAA considered the following comprehensive supplemental strategies to improve transit travel, mode shift, and overall person throughput in order to achieve the established goals. It is recommended to add these strategies in conjunction with the final proposed set of mainline improvements for optimal effect and performance.

Arterial Improvements – Operational and transit improvements to parallel arterials all along the corridor, particularly to MacArthur Boulevard, so that transit travel along the arterial can be faster and reliable for both local and Transbay trips as buses can get to the freeways quickly. Additionally, it would provide safe access to bikes and pedestrians to bus transit.

Transit Improvements – Improvements to AC Transit Transbay bus service, including proposing new express bus options

Park and Ride Improvements – Reviewing available public and private spaces that can serve as park and ride lots to better facilitate carpooling and transit ridership for improved person throughput

1.6 Evaluation Results and Preferred Mainline Improvements

Based on traffic operations analysis results, geometric design assessment, high-level cost estimates, and input from the TAC members, Alternative 1A and Alternative 1C were deemed to be the most viable alternatives to advance to project development.

Alternative 1A – Westbound HOV Lane Extension

In comparison to the No Build scenario, Alternative 1A (see Figure ES-2) provides the following improvements in the peak direction:

- *Increases westbound person throughput at the SFOBB Toll Plaza, from approximately 23,000 to approximately 25,300 during the morning peak period from 6:00 AM to 10:00 AM*
- *Reduces travel time during the morning peak period by 1 minute for general purpose vehicles and by 4 minutes for HOVs*

Alternative 1A is a near-term improvement, and would be constructed in three to five years, with an estimated cost of approximately $8 million. Additional investment into express bus service are anticipated to supplement this improvement, which could include new pilot Transbay Routes from Oakland.

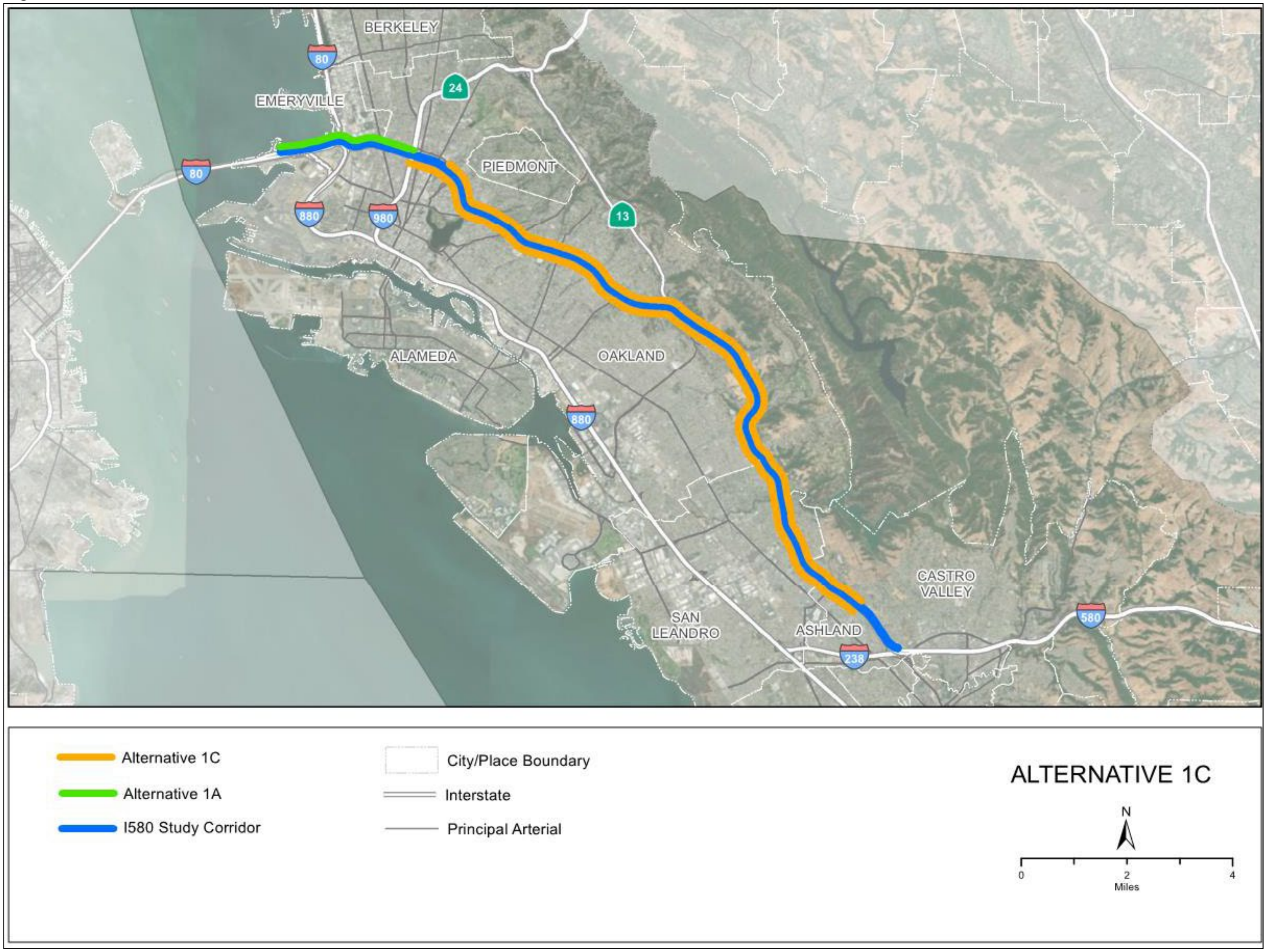
Alternative 1C – General Purpose Lane Conversion to Express Lane

In comparison to the No Build scenario, Alternative 1C (see Figure ES-3) provides the following improvements in the peak directions:

- *Increases westbound person throughput at Lakeshore Avenue, from approximately 37,800 to approximately 40,050 during the morning peak period from 6:00 AM to 10:00 AM*
- *Increases eastbound person throughput at Edwards Avenue, from approximately 26,500 to approximately 29,300 during the evening peak period from 4:00 PM to 7:00 PM*
- *Along the entire corridor, the average travel time for HOV vehicles reduces by 17 minutes during the morning peak period although the average travel time increases by 4 minutes for general purpose lanes.*
- *During the evening peak period, average travel time decreases by 12 minutes for HOVs while it increases by 5 minutes for general purpose lane vehicles.*

Figure ES-2. Alternative 1A

Figure ES-3. Alternative 1C



In the westbound direction, this alternative includes an intentional gap between the express lane and HOV extension designed for weaving purposes east of the I-980/SR 24 interchange. For example, this transitional zone will accommodate situations where a single occupancy vehicle using the express lane may exit the lane in advance of HOV restrictions approaching the SFOBB Toll Plaza, or where a carpool electing to forego using the express lane attempts to utilize the HOV lane approaching the SFOBB Toll Plaza.

This strategy aligns with an expected mode shift of around 8 percent, which could be accomplished with a combination of investments in additional express bus services (including Oakland-bound services), and facilitating new carpool formation. Alternative 1C is a mid-term improvement, and would be constructed in five to ten years, with an estimated cost of $100-120 million. An additional investment in an Oakland-bound express bus service is anticipated to supplement this improvement, since the DAA found that over half of the trips along this corridor include destinations in Downtown Oakland.

Other Supplemental Strategies

Additional supplemental strategies are recommended for further development.

Arterial Improvements: Regarding arterial improvements for bus transit, MacArthur Boulevard Smart City Corridor Project by the City of Oakland is currently in project development. This project with an approximate total cost of $13 million is expected to enhance the effectiveness of both alternatives 1A and 1C.

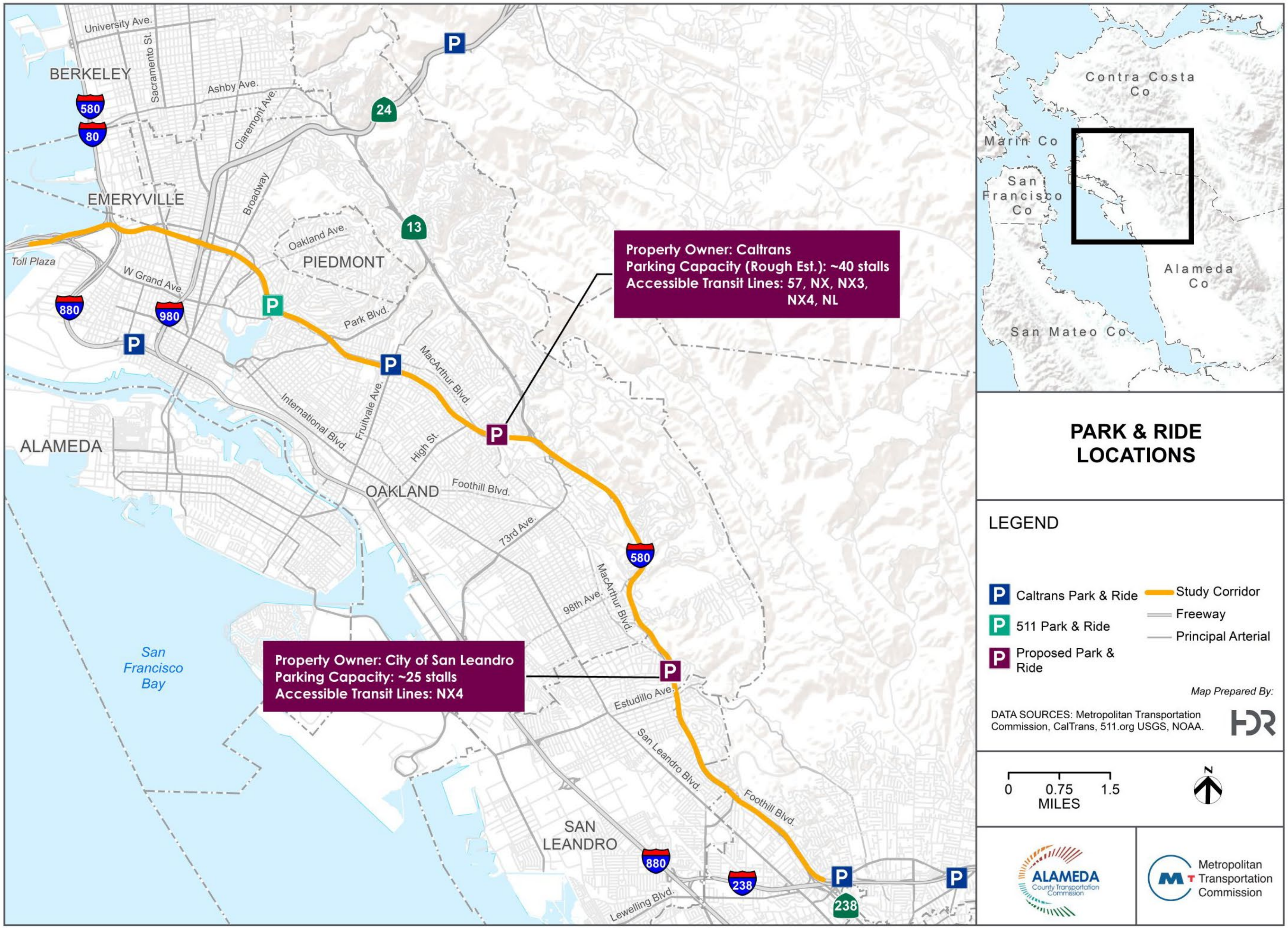
This project extends existing Intelligent Transportation System (ITS) network with fiber cable to 62 traffic signals along 13 miles of MacArthur Boulevard and adjacent roadways. The Project consists of transit enhancements, transit signage, traffic signal and operational improvements, pedestrian safety improvements, and communications infrastructure that will improve the overall performance and safety of this arterial. Example specific improvements include: queue jump lanes and transit signal priority for buses; pedestrian, bicycle and vehicle detection for enhanced signal performance; curb ramp, sidewalk for pedestrian accessibility; and communications for remote traffic operations, monitoring and signal maintenance.

***Transit Improvements*:** Transit strategies include the following:

- *Additional Transbay transit services originating from east Oakland could provide attractive transit options for Transbay travel.*
- *Potential new express bus services from Castro Valley and Tri-Valley to downtown Oakland would provide congestion relief and better travel options to these travel markets. A pilot options can be explored initially.*

Park and Ride Lots: Five prospective park and ride locations were initially identified that can offer complementary benefits; Based on further review of feasibility, the list was narrowed down to two locations: the first is located in San Leandro on Dutton Avenue and MacArthur Boulevard and the second in Caltrans airspace under I-580 near MacArthur Boulevard (see Figure ES-4).

Figure ES-4. Park and Ride Facilities



1.7 Next Steps

The recommended improvements along I-580 are summarized below. Continued coordination among MTC, Alameda CTC, Caltrans, AC Transit, and each of the jurisdictions in subsequent phases of project development will be critical to ensure that all involved agencies and operators are working together to maximize the benefits of a fully integrated transportation network that connects people from their homes to their destinations.

Mainline Improvements

The DAA recommends advancement of the two preferred mainline alternatives as described above. Alternative 1A is a near-term improvement with a target timeline of Spring 2020 for commencement of the Caltrans project development process. Alternative 1C is a mid-term improvement, part of an over-arching I-580 Corridor Improvement Strategy, is anticipated to occur in coordination with subsequent DAAs on the eastern segments of the corridor between I-238 and the I-580/680 interchange as well as the section along the Altamont Pass.

Supplemental Strategies

The following suite of strategies are recommended to complement the mainline improvements to meet the DAA goals:

- ***Arterial Improvements*** *– The MacArthur Boulevard Smart City Corridor project is already funded by Alameda CTC and is in advanced project development*
- ***Transit Improvements*** *- Coordination with AC Transit and LAVTA for implementation of potential improved and new express bus services is suggested to complement both the near-term and mid-term mainline improvements*
- ***Park and Ride Lots*** *- Coordination with the City of San Leandro and Caltrans is suggested regarding the potential development of park and ride locations within their respective jurisdictions*

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1.0 Project Overview

The Metropolitan Transportation Commission (MTC) and the Alameda County Transportation Commission (CTC) have conducted the Alameda Interstate 580 (I-580) Design Alternatives Assessment (DAA) to identify a range of near- and mid-term, cost effective strategies to improve mobility and throughput along the I-580 corridor between I-238 in Hayward/Castro Valley and I-80/San Francisco-Oakland Bay Bridge (SFOBB) in Oakland, CA.

1.1 Goals and Need

For the Alameda I-580 DAA, the goals of the project are to:

- *Improve local and regional multimodal mobility for people*
- *Focus on increasing person throughput, improving travel time reliability, offering travel time savings to support buses and HOVs*
- *Identify a set of near-term (less than five years) operational projects that could quickly advance into project development and delivery*
- *Identify mid-term capital projects that may be further explored independently*

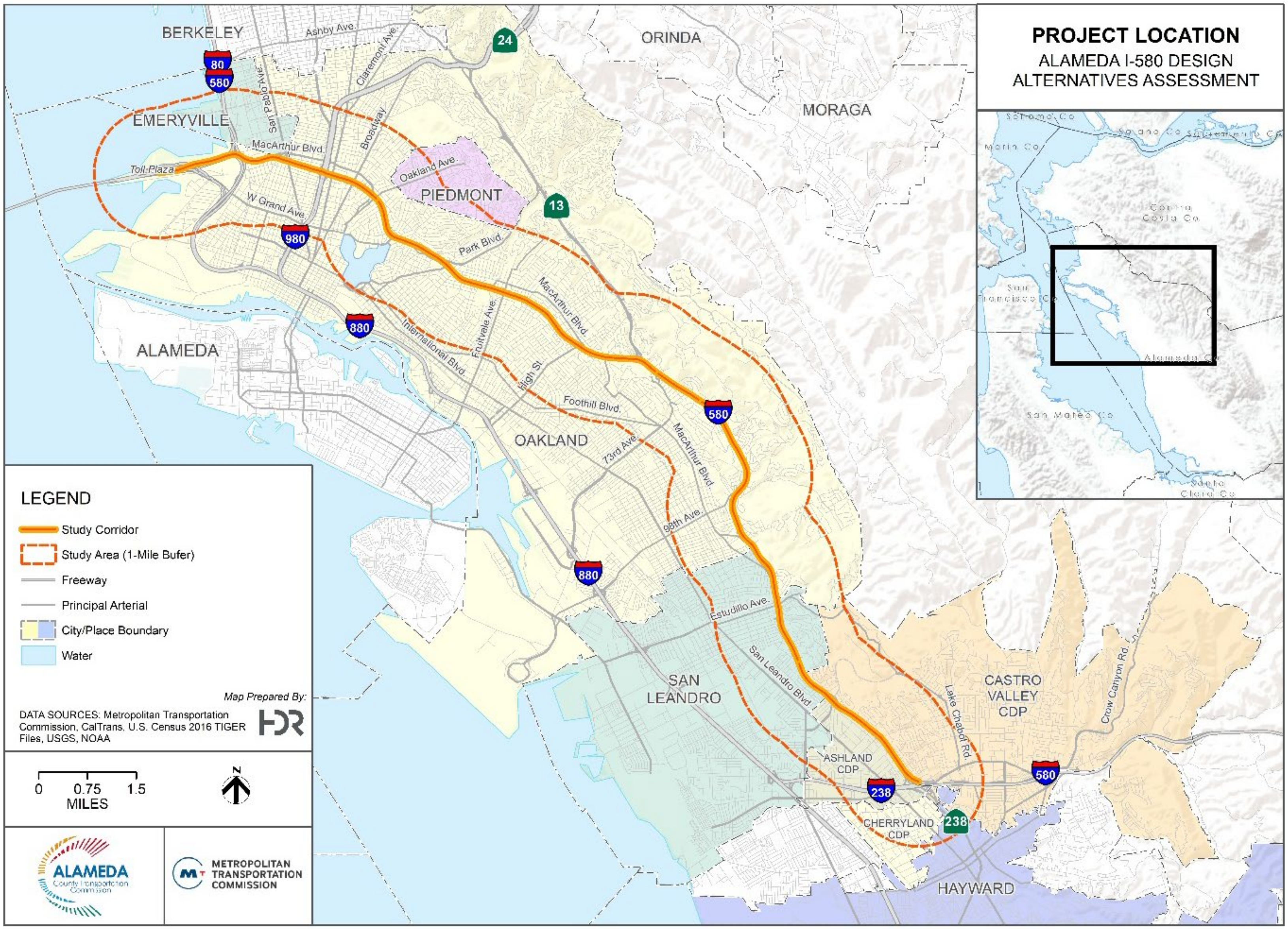
The development of the project is driven by the need to address:

- *Current transportation bottlenecks caused by recurring and non-recurring congestion impacting the travel time reliability of inter-regional and local travelers (using all modes); and*
- *Current limitations in the coverage, service, effectiveness, and use of multimodal travel alternatives and options*

1.2 Study Area

The project Study Area comprises a 1-mile buffer around the corridor limits along I-580 between I-238 and the Bay Bridge Toll Plaza. The Study Area transects the cities of Oakland, Piedmont, Emeryville, San Leandro, and Hayward, as well as the unincorporated Alameda County communities of Ashland, Cherryland, and Castro Valley, also referred to as Census Designated Places (CDPs). **Figure 1-1** provides an overview of the project Study Area and boundaries of the cities and CDPs.

Figure 1-1. Study Area



2.0 Evaluation Framework

In an effort to screen, evaluate, and prioritize the developed alternatives that meet the goals, purpose, and need for the corridor, an *Evaluation Framework* was established and agreed upon early in the Alameda I-580 DAA process. The Framework emphasized the following concepts:

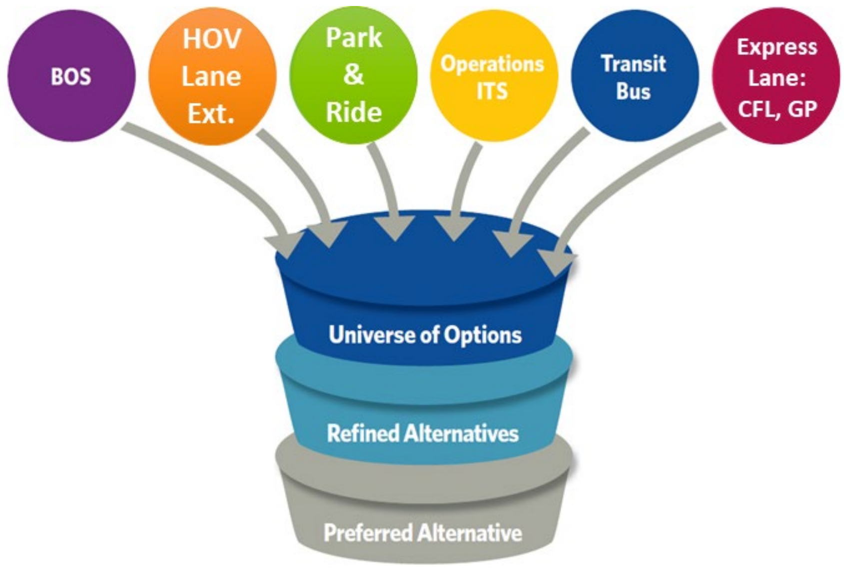
- *Operate as a **"living" process**, providing overall guidance to MTC, Alameda CTC, and the project's Technical Advisory Committee (TAC), by allowing for opportunities to refine or enhance the process throughout the study*
- *Operate with **flexibility**, bringing forward previously screened out strategies for more detailed analysis later in the planning process if necessary*
- *Strongly consider the **Study Area** as a key input in the evaluation process*
- *Advance the cost-effective alternatives that address the **goals and need** of the DAA with a keen focus on the corridor*

The Evaluation Framework consists of a five-step process for the development and assessment of alternatives to meet the project's purpose. These include:

1. ***Identify Transportation Problems and Issues within the Project Study Area**. In this initial step, an inventory of existing conditions within the Study Area was completed and documented (see **3 Existing Conditions**). These parameters were informed by Origin-Destination Information, Roadway Characteristics, Transit Services, Parking Facilities, and System Performance Data.*
2. ***Clearly Define the Universe of Potential Multimodal Projects and Operational Strategies that Address Transportation Problems/Issues.** After establishing the transportation concerns, the identification of potential improvement concepts and operational strategies that address or mitigate problems and issues was conducted in this step. Once defined, the characteristics of each concept or strategy were developed to determine the feasibility of its implementation.*
3. ***Screen Initial Universe of Multimodal Projects and Operational Strategies**. A qualitative assessment was used to screen potential improvement concepts and strategies developed from Step 2 to identify preferred solutions that meet the objectives of the DAA for more detailed evaluation. Screening matrix criteria includes focusing on the following project objectives: Improve mobility within Study Area; Increase convenient transit, carpool, and vanpool opportunities; Increase alternative mode share and transit ridership; and Implement cost-effective solutions.*
4. ***Develop Packages of Multimodal Project and Operational Strategies**. Packages were developed and concepts were combined for more in-depth analysis of improvements that could offer the highest potential network benefit.*
5. ***Advance Detailed Evaluation and Prioritization of Improvement Packages**. As developed in Step 4, the improvement packages were evaluated against modeled measures of effectiveness (MOEs) associated with each of the project's objectives. Pertaining to each of the four main goals, this discrete assessment criteria included: Travel times, travel time index, reduction in congestion; Number of available multimodal travel options, service to existing and growing markets, parking opportunities, ease of access to transit/carpool/vanpool opportunities, frequency of service; Person throughput, transit mode share, shared ride mode share, pedestrian and bicycle mode share; and Estimated project capital cost, estimated project operations and maintenance cost.*

This approach is depicted in **Figure 2-1,** and the resulting performance outputs of the prepared packages informed the recommended project.

Figure 2-1. Evaluation Process



3.0 Existing Conditions

This chapter summarizes the *Existing Conditions Memorandum* that expands upon the characteristics related to population, land use, roadways, facilities, and traffic performance within the Study Area. The complete *Existing Conditions Memorandum* can be found in **Appendix A**.

3.1 Study Area Overview

3.1.1 Community Profile

The Study Area[1] is highly diverse; according to the 2016 American Community Survey, 71.7 percent of the population living within the Study Area identifies as an ethnic minority. Moreover, there is a large percentage of low-income persons (36.1 percent), defined as people living in households with income below 200 percent of the Federal Poverty Level (see Table 3-1). The Study Area also has a higher percentage of people with limited mobility – that is, people with a disability, the elderly, and people without ready access to a vehicle – than the county across all categories. Oakland and Cherryland have the highest disability rates, at 12.6 percent and 13.1 percent, respectively, while Piedmont has the lowest at 4.7 percent. Cherryland has the highest share of people over 65 (19 percent), while Ashland has the lowest at 7.5 percent. Oakland and Emeryville have the highest rates of households with zero or one vehicle available (see Table 3-2).

Table 3-1. Minority and Low-Income Populations

Geography	Minority Percentage	Low-Income Percentage [1]
Alameda County	67.4%	26.1%
Study Area Jurisdictions		
Ashland	87.0%	42.1%
Castro Valley	55.8%	19.7%
Cherryland	81.6%	45.2%
Emeryville	57.8%	22.5%
Hayward	82.9%	31.3%
Oakland	72.7%	39.9%
Piedmont	31.0%	8.0%
San Leandro	76.2%	29.4%
Study Area	**71.7%**	**36.1%**

Source:
1.U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates
Notes:
2. MTC established the 200% threshold in 2001 to account for the Bay Area's high cost of living relative

Table 3-2. Limited Mobility Populations

Geography	Percent with a Disability	Percent Over 65	Percent with No Vehicle Available	Percent with 1 Vehicle Available
Alameda Co.	9.6%	12.4%	4.7%	22.6%
Study Area Jurisdictions				
Ashland	8.7%	7.5%	4.6%	23.1%
Castro Valley	9.9%	15.0%	2.0%	15.2%
Cherryland	13.1%	19.0%	2.4%	19.0%
Emeryville	11.0%	13.4%	7.4%	53.0%
Hayward	10.1%	11.2%	2.8%	15.7%
Oakland	12.6%	12.2%	7.6%	33.0%
Piedmont	4.7%	18.0%	1.1%	9.8%
San Leandro	10.4%	14.1%	2.7%	20.0%
Study Area	**11.9%**	**13.2%**	**6.4%**	**31.4%**

Source: U.S. Census Bureau, 2011-2015 American Community Survey 5-Year Estimates

The seven jurisdictions that comprise the Study Area have all experienced population growth between 2010 and 2016. The biggest surge in population occurred in Emeryville where the city's 18.3 percent population growth is largely attributed to new large multi-family developments; the slowest population growth occurred in Castro Valley which has retained its single-family

[1] For the purposes of demographic analysis, the "Study Area" described in this section represents an aggregate of all the Census Block Groups that lie completely within or intersect the Study Area boundary depicted in Figure 1-1.

residential character. The Study Area population grew by 7.3 percent, whereas Alameda County experienced 8.6 percent growth during this same period; however, the Study Area is almost four times as dense as the county as a whole.

3.1.2 Land Uses

Land uses in the eastern and southern communities are largely residential, but the neighborhoods become more compact and mixed-use north of Fruitvale Avenue in Central Oakland. Downtown Oakland is home to several high-rise office and apartment buildings. North and west of San Pablo Avenue, the land uses become more industrial and are largely oriented to activity to and from the Port of Oakland.

The northern part of the Study Area is also undergoing significant change, with several high-profile developments currently in the planning phase or under construction. Most of the higher-density development is centered in the downtown Oakland and Lake Merritt areas; there are several high-rise mixed-use development projects that are either planned or under construction within three blocks of I-580, signaling a northward development trend from Oakland's traditional downtown core.

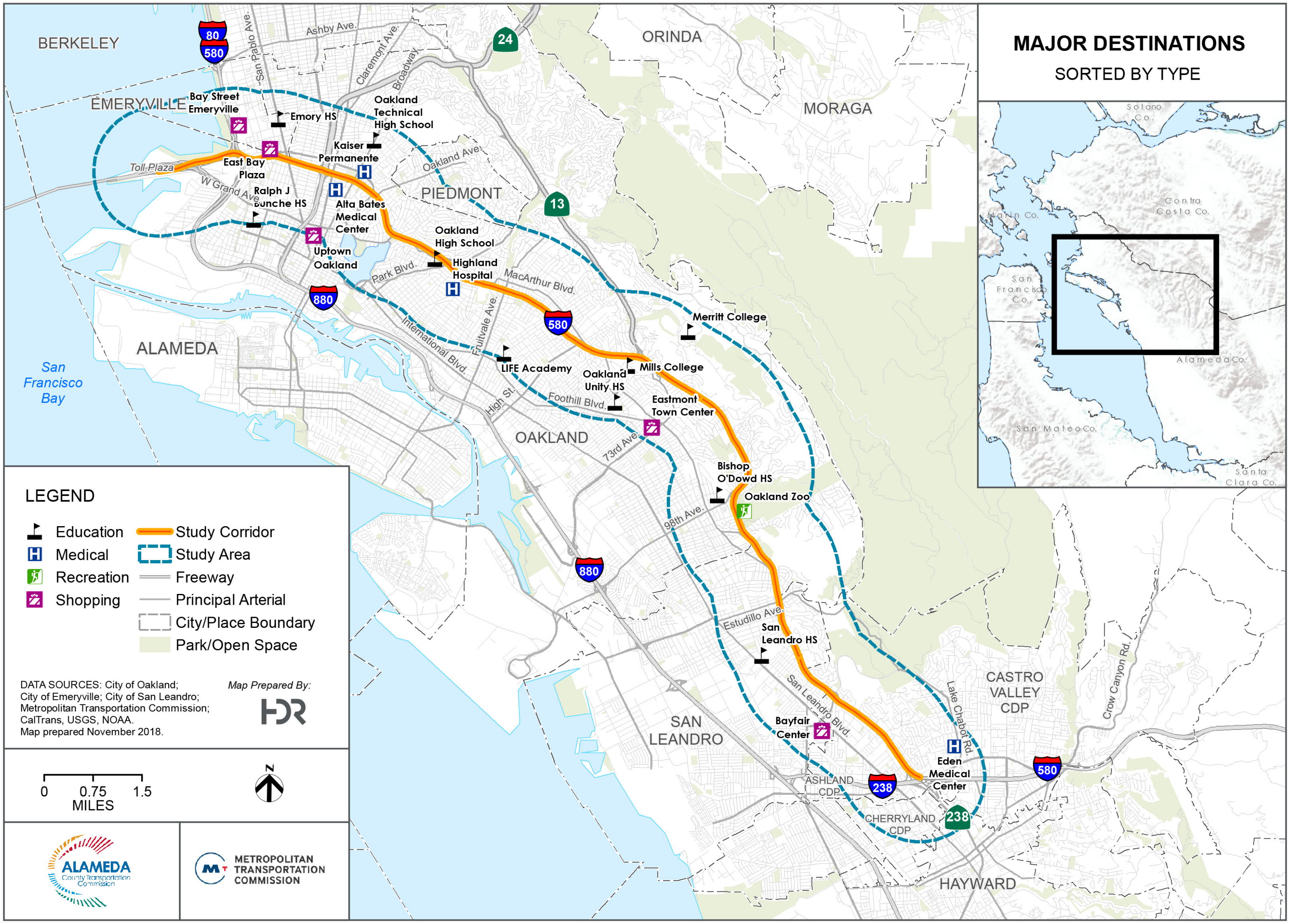
3.1.3 Commuting Patterns

There are several notable travel destinations along the corridor, as illustrated in **Figure 3-1**. These employment, educational, recreational, shopping, and health service destinations include the Eden Medical Center, the Oakland Zoo, Highland Hospital, Oakland High School, Oakland Technical High School, Kaiser and Alta Bates Medical Centers, Uptown Oakland, and the shopping hubs of East Bay Plaza and Bay Street in Emeryville.

According to the U.S. Census Longitudinal Employer-Household Dynamics (LEHD) program, there were 65,239 primary jobs[2] in the Study Area in 2015. This number comprises nearly one tenth (9.4 percent) of the primary jobs within the county. A little more than a quarter of all jobs in Alameda County (26.1 percent) are in Oakland. Commuters traveling in the Study Area tend to use automobiles to get to and from work, with 56.6 percent of commuters driving alone and 11.2 percent carpooling. Emeryville and Oakland have the highest percentages of transit use, at 25.5 percent and 20.8 percent, respectively, while Cherryland and Hayward have the lowest percentages of transit use (6.6 percent and 9.5 percent, respectively).

[2] The LEHD program defines a "Primary Job" as "the dominant job that earned the individual the most money."(https://lehd.ces.census.gov/doc/help/onthemap/OnTheMapDataOverview.pdf)

Figure 3-1. Major Destinations



3.2 Roadway Characteristics

3.2.1 Mainline Segments

Approximately 18 miles of I-580 are included in the Study Area, comprised of I-580 (also known as the MacArthur Freeway) between the I-238 interchange in Castro Valley and the I-80/580/880 interchange (MacArthur Maze) between Oakland and Emeryville, and a short segment of I-80 between the I-80/580/880 interchange and the SFOBB Toll Plaza.

3.2.1.1 I-580 BETWEEN I-238 AND SR-13

The southernmost section of the I-580 Study Area is typically comprised of eight 12-foot travel lanes, 10-foot inside and outside shoulders in each direction, and a 2-foot median barrier. At various locations, the configuration deviates for short distances due to constraining elements such as entrance and exit ramps, structural columns, sign posts, overpasses, and varying median widths.

There is a freeway-to-freeway junction with State Route 13 (SR-13, at PM 39.2, which is unique to this section. The westbound geometry on I-580 approaching this junction includes a two-lane direct connector exit ramp to northbound SR-13 with a short 350-foot pocket lane; however, all traffic for northbound SR-13 comes out of the right lane of westbound I-580. The eastbound geometry on I-580 includes a single-lane on-ramp that merges with mainline traffic and consolidates two southbound SR-13 lanes into one.

3.2.1.2 I-580 BETWEEN SR-13 AND SR-24/I-980

The segment between SR-13 and the State Route 24 (SR-24) / I-980 interchange retains a similar geometry to the adjacent segment to its south; however this segment includes more auxiliary lanes, more closely spaced interchanges, and several retaining walls.

3.2.1.3 I-580 BETWEEN SR-24/I-980 AND MACARTHUR MAZE

A four-level interchange with direct connectors exists at the junction of I-580 and SR-24/I-980. The existing configuration of the interchange ramps create merging and diverging areas along I-580, with lanes added and dropped to accommodate movements.

West of the SR-24/I-980 interchange, an elevated freeway viaduct supports traffic towards the MacArthur Maze, with separate structures carrying westbound and eastbound traffic. In each direction, there are five 12-foot travel lanes, varying width (2-foot to 8-foot) outside shoulders, a 2-foot median shoulder, and guard rails.

3.2.1.4 I-580 AT MACARTHUR MAZE

The MacArthur Maze includes flyover ramps directly connecting I-580 and the I-80 in the westbound and eastbound directions. In both directions, three westbound 12-foot travel lanes are flanked on both sides by 2-foot shoulders and guard rails.

3.2.1.5 I-80/SFOBB Approach

West of the MacArthur Maze, the three-lane I-580 westbound flyover touches down and converges with westbound I-80 traffic. At the touch-down point, an HOV 3+ lane and 10-foot outside shoulder begin. A maximum width of approximately 32 feet initially separates these incoming lanes until they merge.

Westbound at the SFOBB Toll Plaza, additional lanes are added with other connectors for a total of 20 vehicular lanes (four HOV3+ lanes, seven FasTrak-only lanes, and nine cash/FasTrak lanes) leading to the toll plaza**.**

In the eastbound direction, along I-80 and leading into the MacArthur Maze, there are six 12-foot travel lanes with an approximate 10-foot inside shoulder and 8-foot outside shoulder. Three right lanes exit from I-80 to the three-lane I-580 flyover connector ramp just past the I-880 exit ramp.

3.2.2 Key Arterials

Foothill Boulevard, MacArthur Boulevard, and E.14th Street /International Boulevard are arterials that parallel I-580, serving as alternate routes for connections between the southern and northern parts of the Study Area, as well as for transit routes. These are described below:

- ***Foothill Boulevard*** – Primarily one lane in each direction (limited portion with two lanes in each direction) and medians with alternating left turn lanes; transitions to a one-way westbound road prior to terminating at Lake Merritt
- ***MacArthur Boulevard*** – One, two, and three lanes in each direction at different locations and medians with left turn lanes; various segments of one-way traffic
- ***E 14th Street / International Boulevard*** – Primarily two lanes in each direction (portions with one lane in each direction) and medians with alternating left turn lanes; current improvements underway as part of the AC Transit East Bay Bus Rapid Transit Project to implement full-depth pavement reconstruction, grind and overlay, new traffic signals, curbside and median stations, and landscaping

In addition to the freeway sections and key arterials described above, several other major arterials that connect to I-580 at key locations are located within the Study Area, including:

- *Harrison Street / Oakland Avenue*
- *40th Street*
- *Grand Avenue / Lakeshore Avenue*
- *Park Boulevard*
- *Beaumont Avenue*
- *Fruitvale Avenue*
- *High Street*
- *Estudillo Avenue*
- *Golf Links Road / 98th Avenue*
- *150th Avenue / Fairmont Drive*
- *Foothill Boulevard*
- *Lake Chabot Road*

These arterials were identified based on a review of speed data during AM and PM peak periods and relevance to mainline operations on I-580.

3.3 Transportation Services and Facilities

The Study Area is served by several public transportation options, including regional rail service, Transbay bus, and local bus services as described below. However, the I-580 corridor is not adequately served by rail south of downtown Oakland. This section also provides existing bus travel times and ridership information by service in the Study Area.

3.3.1 Regional Rail Service

The majority of the study corridor is not close to Bay Area Rapid Transit (BART) stations. BART connects the East Bay to San Francisco and northern San Mateo County via an underground tube between West Oakland and Downtown San Francisco. Within the Study Area, the nearest BART stations are the MacArthur Station located in the median of SR-24 a quarter mile from I-580; the 19th Street Station located 1 mile south of I-580 in Uptown Oakland; and, the Bayfair Station located less than a mile south of I-580 in unincorporated San Lorenzo. Other stations are closer in proximity to I-880 than I-580 (i.e., Coliseum, Fruitvale, Lake Merritt, West Oakland, and 12th St/Oakland City Center).

Capitol Corridor operates a regional intercity passenger rail service between Auburn and San Jose, with trains serving stations in Emeryville (less than a mile north of the MacArthur Maze), Jack London Square (south of I-880), and Coliseum (north of I-880). Capitol Corridor does not provide Transbay service and its rail stations do not provide a convenient alternative to personal vehicle use shifting from I-580.

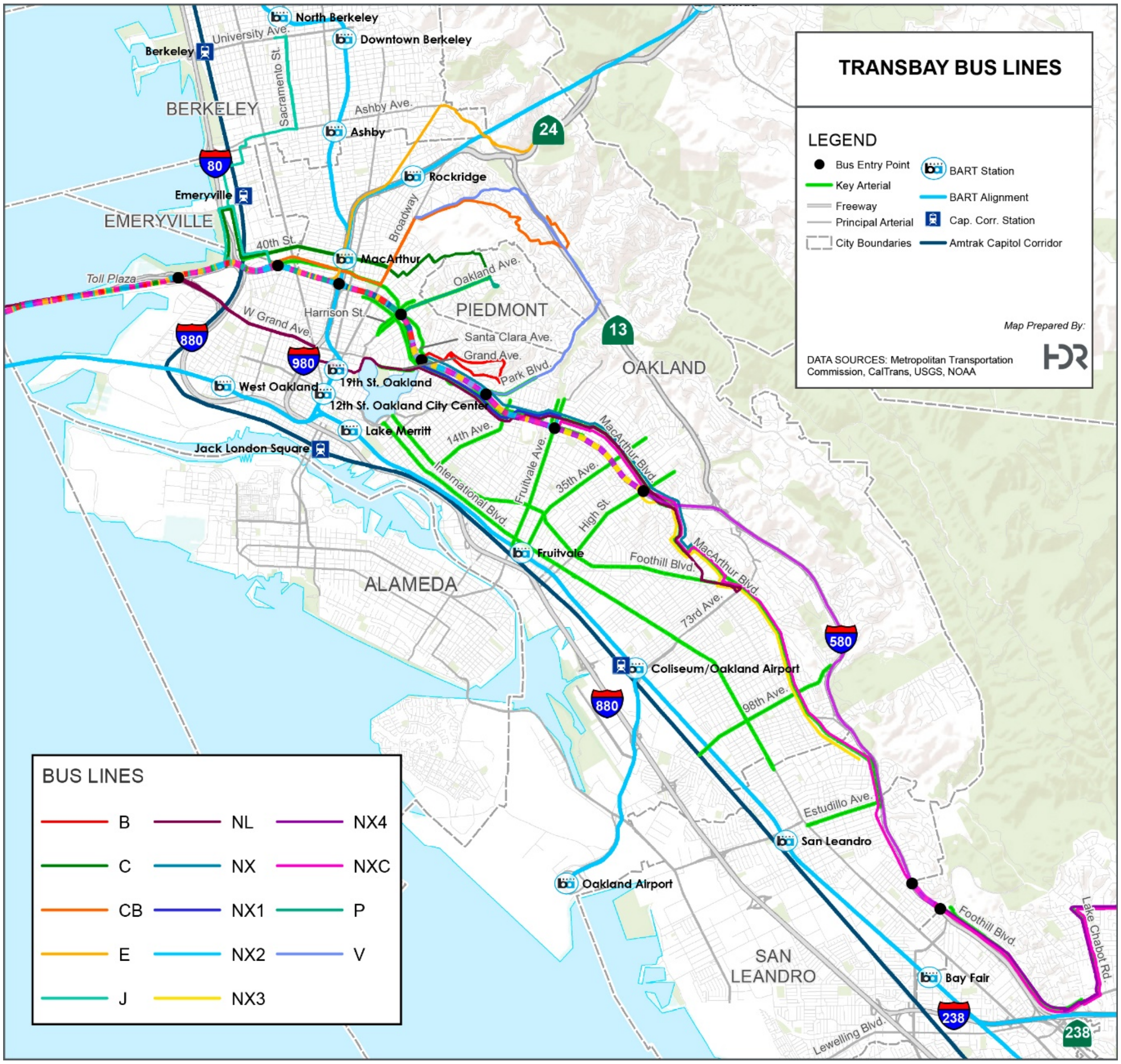
3.3.2 Transbay Bus Service

AC Transit operates several Transbay bus routes between the East Bay and San Francisco, including the following routes in the Study Area: B, C, CB, E, J, NL, NX, NX1, NX2, NX3, NX4, NXC, P, and V. As depicted in **Figure 3-2**, these Transbay routes largely operate on I-580 in some capacity and serve residents throughout the Study Area. These services typically operate on 15- to 40-minute headways during the peak periods. Table 3-3 identifies these bus routes, the length along I-580, and their origins and destinations. There are also private corporate shuttles with designated pick-up and drop-off areas that offer an alternate means of transportation for company employees.

Table 3-3. Transbay Bus Routes Operating Along I-580

Bus Line	Route Length along I-580 (mi)	Origin	Destination
B	4.1	Trestle Glen Rd & Lakeshore Ave	Salesforce Transit Center
C	1.6	Highland Ave & Highland Way	Salesforce Transit Center
CB	1.7	Warren Fwy & Broadway Terr	Salesforce Transit Center
E	2.5	Parkwood Community	Salesforce Transit Center
NL	N/A	Eastmont Transit Center	Salesforce Transit Center
NX	3.9	MacArthur Blvd & 56th Ave	Salesforce Transit Center
NX1	4.1	Salesforce Transit Center	Fruitvale Ave & MacArthur Blvd
NX2	6.1	Salesforce Transit Center	High St & MacArthur Blvd
NX3	7.5	Marlow Dr & Foothill Way	Salesforce Transit Center
NX4	15.0	Castro Valley Park & Ride	Salesforce Transit Center
NXC	15.0	Salesforce Transit Center	Castro Valley Park & Ride
P	3.4	Highland Ave & Highland Way	Salesforce Transit Center
V	4.9	College Ave & Broadway	Salesforce Transit Center

Figure 3-2. Transbay Bus Services in the Study Area and Operating on I-580 (2018)



All Transbay bus lines operate with slightly higher trip durations during the evening eastbound commute than during the morning westbound commute. For most lines, the difference is negligible; however, Line V experiences a 19.4 percent travel time increase in the evening. A full breakdown of travel times is shown in **Table 3-4.**

Ridership trends show that the most popular Transbay buses are Line E, which services the Oakland Hills, and Line P, which services the Piedmont area (see **Table 3-5**). Line P is distinctive in that it loses almost a half of its passenger base during the evening commute, whereas the CB, E, and NL all gain passengers. Seven Transbay bus lines enter I-580 in the westbound direction in the AM peak period at bottleneck locations at Fruitvale Avenue, Grand/Lakeshore Avenue, and West Grand Avenue in Oakland.

Table 3-4. Average Transbay Trip Duration

Bus Line	WB AM Peak	EB PM Peak	Change from AM to PM
B	42.1	44.8	2.7
C	45.8	50.3	4.5
CB	52.0	50.6	-1.4
E	37.9	40.4	2.5
NL	57.8	61.7	1.9
NX	50.8	X	0.0
NX1	X	37.5	0.0
NX2	X	44.7	0.0
NX3	54.8	57.9	3.1
NX4	71.2	73.2	1.9
NXC	X	70.4	0.0
P	33.9	38.1	4.2
V	47.0	56.1	9.1

Note: NX lines do not all run continuously throughout the day

Table 3-5. Average Transbay Passengers

Bus Line	WB AM Peak	EB PM Peak	Change from AM to PM
B	47	45	-2
C	45	37	-7
CB	34	40	5
E	61	68	6
NL	36	43	7
NX	41	X	0
NX1	X	52	0
NX2	X	38	0
NX3	39	27	-11
NX4	28	20	-8
NXC	X	14	0
P	96	54	-43
V	45	40	-5

Note: NX lines do not all run continuously throughout the day

3.3.3 Local Bus Service

AC Transit operates 67 local bus services, six of which connect transit users along the I-580 corridor to Oakland, including routes NL, 1, 14, 40, 57, and 62. Of these, the NL and the 57 provide the closest proximity to I-580, as they both travel along MacArthur Boulevard for much of their journey before crossing at Grand Avenue to their respective destination. Both the NL and the 57 bus routes operate on 15-minute headways during peak periods. Line 1 operates along International Boulevard, and despite its route not located within the immediate Study Area, it provides an important link for commuters traveling from San Leandro and East Oakland to the employment centers in downtown Oakland. Line 1 operates on 8- to 10-minute headways during peak periods. All other local routes operate on 15- to 20-minute headways.

3.3.4 Parking and Bicycle Facilities

There are five Caltrans-operated park-and ride facilities and 11 casual carpool pick-up locations located within or near the Study Area, as shown in **Figure 3-3**. The location, number of parking spaces, and nearby transit routes are presented in **Table 3-6**. The pick-up locations for casual carpooling, where commuters join to form carpools to take advantage of Transbay carpool benefits, and the nearby transit routes, are identified in **Table 3-7.**

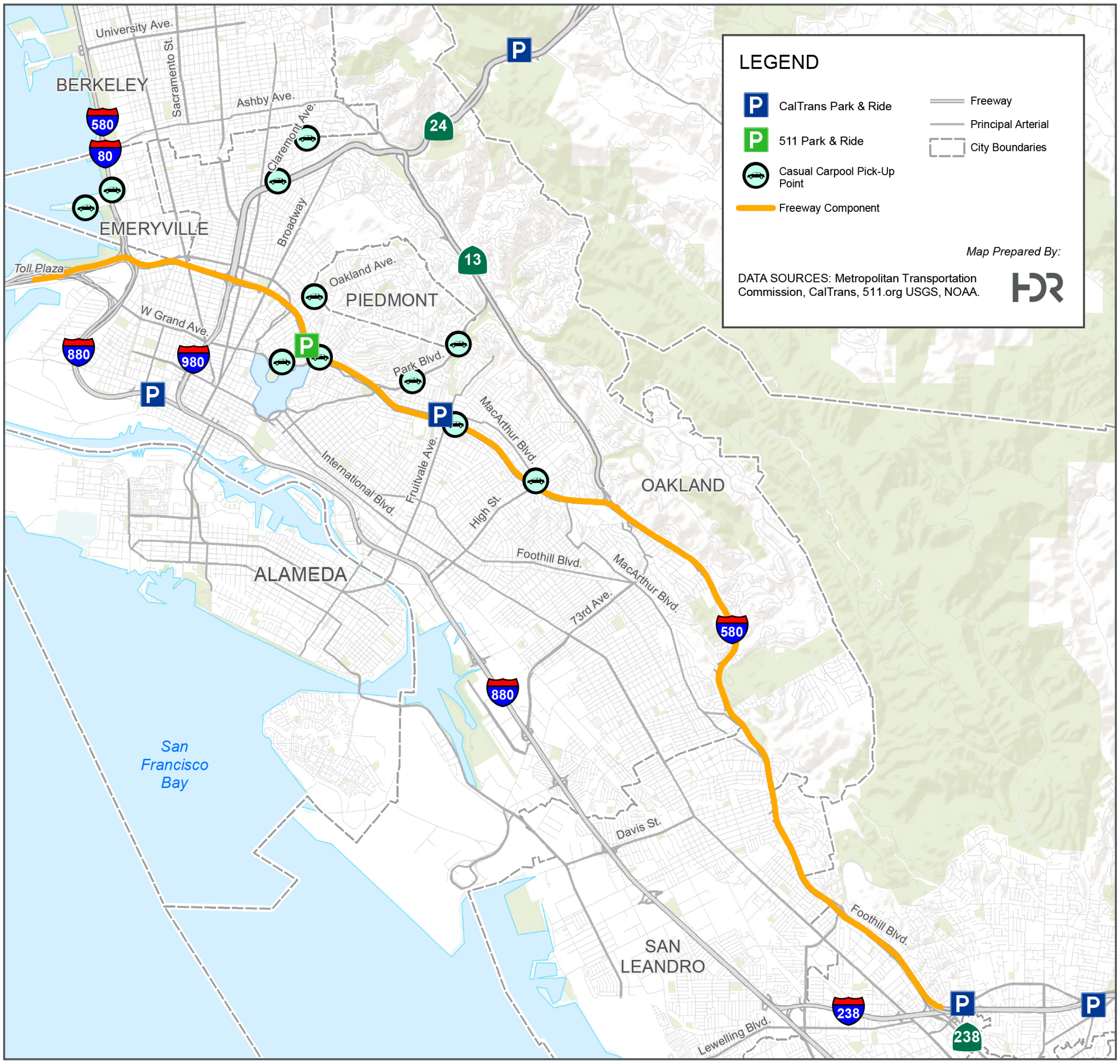
Table 3-6. Park and Ride Lots (2018)

Name	Location	Spaces	Nearby Transit Lines
Center Street	East of Center St at I-580	138 spaces 4 bike lockers	NX4, NXC, 48
John Drive	North of Foothill Blvd at John Dr (near I-580)	8 spaces	NX4, NXC, 48
I-580/ Fruitvale	Under I-580 at Fruitvale/ Champion St	178 spaces 10 bike lockers	NL, NX, NX1, NX2, NX3, NX4, NXC, 57, 96
7th and Linden	Under I-880 at 7th St/ Linden St	180 spaces	1, 3, 40, 62
720 Grand Avenue	Under I-580 at Grand Ave	151 spaces 36 bike lockers	B, R, N, K, V, A2, 12, 18, 57, 34, 34C

Table 3-7. Casual Pick-up Locations (2018)

Name / Location	Nearby Transit Lines
MacArthur x High	NL, NX, NX2, NX3, NX4, NXC, 3, 57
Fruitvale x Montana	NL, NX, NX1, NX2, NX3, NX4, NXC, 57, 96
Park x Hampel	V
Park x Hollywood	V
Grand x Lakeshore	B, NL, NX, NX1, NX2, NX3, NX4, NXC, V, 57
Grand x Perkins	NL
Oakland x Monte Vista	P
Claremont x Hudson	E
Claremont x College	E
Pacific Park Plaza	C, CB, J, 57
Emeryville Marina	C, CB, J

Figure 3-3. Park-and-Ride Facilities and Casual Carpooling Locations



Oakland has a substantial bicycle network within the Downtown and North Oakland Areas, while the bicycle network becomes sparser in the eastern and southern portions of the Study Area. The City of Oakland has planned for significant improvements to its bicycle network to allow for better connectivity among the communities of East Oakland, Downtown Oakland, and San Leandro while also improving last-mile connectivity for transit to San Francisco.

3.4 System Performance and Travel Patterns

3.4.1 Origin-Destination Patterns

Origin-Destination (OD) travel pattern data representing 2017 conditions were obtained through the location-based data service, Streetlight®.

Table 3-8 provides an overview of the origin and destination pairs in the westbound direction in the AM peak period. The key findings include:

- *The majority of trips originate in Alameda County, regardless of location.*
- *About 39 percent of the trips in the northern end of the Study Area originate in Contra Costa County, consistent with heavy traffic movements at this location coming from SR-24 which connects Alameda County with Contra Costa County.*
- *The majority of the trips south of I-980/SR-24 end in Alameda County (mostly Oakland) with about two-thirds of the trips north of I-980/SR-24 destined for San Francisco.*

Table 3-8. OD Patterns – AM Westbound

Select Link Location	Origin				Destination			
	Alameda		Contra Costa	Santa Clara	Alameda		Contra Costa	San Francisco
	Oakland	Others			Oakland	Others		
West of I-238 (Castro Valley)	0%	83%	14%	3%	45%	34%	3%	18%
West of Estudillo Ave / Lake Chabot Rd (San Leandro)	0%	89%	8%	3%	56%	19%	5%	20%
West of Park Boulevard (Oakland)	62%	34%	4%	0%	53%	18%	3%	26%
West of I-980 / SR-24 (Oakland)	48%	13%	39%	0%	5%	23%	5%	67%

Table 3-9 provides an overview of the origin and destination pairs in the eastbound direction in the PM peak period. The key findings include:

- *West of I-980/SR-24, the majority of the trips started in San Francisco; from all other locations, the majority of the trips originate in Alameda County (mostly Oakland).*
- *West of Park Boulevard, the majority of the trips are destined for Alameda County (mostly Oakland).*
- *In the southern and eastern portions of the Study Area, more than 80% of the trips end in Alameda County locations other than Oakland.*

Table 3-9. OD Patterns – PM Eastbound

Select Link Location	Origin				Destination			
	Alameda		Contra Costa	San Francisco	Alameda		Contra Costa	Santa Clara
	Oakland	Others			Oakland	Others		
West of I-980 / SR-24 (Oakland)	3%	19%	6%	72%	55%	14%	31%	0%
West of Park Boulevard (Oakland)	56%	17%	4%	23%	56%	38%	6%	0%
West of Estudillo Ave / Lake Chabot Rd (San Leandro)	58%	17%	5%	20%	0%	87%	9%	4%
West of I-238 (Castro Valley)	42%	37%	3%	18%	0%	83%	14%	3%

A full breakdown of origin-destination travel patterns can be found in the *Existing Conditions Memorandum* (**Appendix A**).

3.4.2 Transit and Auto Travel Times

INRIX data reveal that transit is far more efficient in the morning than in the evening; the morning commute shows only three problematic areas on W. Grand Avenue, Martin Luther King Jr. Way, and University Avenue, whereas the evening commute includes more segments where the average transit speed is less than half of the average automotive speed. It can be concluded that transit in the study area is faster and more efficient in the morning peak hours than in the evening, which suggests that eastbound facilities might be less equipped to handle large volumes of traffic than westbound facilities.

3.4.3 Mainline and Ramp Volumes

Traffic counts were collected during AM and PM Peak periods at nine mainline locations, 11 freeway-to-freeway connectors, and 63 ramps during the weeks of May 7, 2018 and May 14, 2018. The sample depicts the peak commute directional movement characteristics of the corridor, with predominant eastbound movements in the PM peak period.

The majority of vehicles driving along I-580 were single occupancy vehicles (SOVs), comprising more than 80 percent of the total traffic, while buses account for only 0.4 percent. High occupancy vehicles (HOVs) with two persons (HOV2) varied from 11.4 percent to 19.1 percent. HOVs with three or more persons (HOV3+) were very minimal, varying from 0.6 percent to 1.2 percent, with an average of less than 1 percent. The truck percentage was low (varying from 0.6 percent to 1.6 percent, with an average of 1.1 percent), due to the fact that heavy trucks are prohibited between Foothill Boulevard in San Leandro and Grand Avenue in Oakland).

3.4.4 SFOBB Toll Plaza and Approach Traffic Counts

The SFOBB is the most congested bridge in the Bay Area and carries approximately 40 percent of total bridge traffic in the region, with traffic volumes peaking between 5:00 and 6:00 AM. After 6:00 AM, the vehicle throughput decreases steadily in the AM peak period, primarily due to congestion associated with the bridge. HOV volumes peak a little later, between 6:00 AM and 8:00 AM, with about 4,200 carpool vehicles per hour comprising almost 48 percent of the total traffic. HOV volumes are significantly lower in the PM peak period than in the AM peak period.

3.4.5 Delay, Travel Time and Reliability

Delay is the additional travel time above the free-flow travel time. Delays along the entire route, as well as for each of two segments (Segment #1 from I-238 to the I-980/SR-24 interchange, and Segment #2 from the I-980/SR-24 interchange to the SFOBB toll plaza) are shown and summarized below:

- *In the westbound AM peak period, the highest delay for the entire corridor is approximately 24 minutes at around 7:45 AM*
- *In the westbound AM peak period, the SFOBB toll plaza is a significant bottleneck in Segment #2; this segment has a longer congested time period (5:15 AM - 12:00 PM) than Segment #1 (7:00 - 10:00 AM)*
- *In the westbound PM peak period, Segment #1 experiences some level of congestion between 3:00 PM and 4:30 PM (i.e., before the PM peak period begins)*

- *In the eastbound PM peak period, the highest delay for the entire corridor is about 19 minutes which occurs around 5:15 PM*
- *In the eastbound PM peak period, both segments experience similar delay*

For this analysis, the corridor was divided into two segments:

- *Segment #1: Between I-238 and the I-980/SR-24 interchange*
- *Segment #2: Between the I-980/SR-24 interchange and the SFOBB toll plaza*

In the westbound direction, the expected free-flow travel time, i.e., travel time with vehicles driving at the speed limit, is 16.2 minutes for the full length of the I-580 corridor from I-238 to the SFOBB toll plaza. In the eastbound direction, the free-flow travel time is 15.3 minutes.

Existing travel time data were obtained in 15-minute intervals for typical weekdays in April and May 2018[3]. In the westbound direction during the AM peak period, Segment #2 experiences different traffic patterns than Segment #1. For example, Segment #2 has a longer congested time period in the morning (5:15 AM - 12:00 PM) than Segment #1 (7:00 - 10:00 AM). The longest AM peak period travel time for the entire corridor is approximately 40 minutes at around 7:45 AM. In the eastbound direction during the PM peak period, both segments experience similar congestion patterns between 3:30 PM and 7:00 PM. The longest PM peak period travel time for the entire corridor is approximately 34 minutes at around 5:15 PM.

Travel reliability was also determined. The 95th percentile travel times represent the travel times that a traveler should expect to arrive on time for 95 percent of all trips; this is also referred to as the “planning time”. Similarly, the 5th percentile travel time represent the duration of the trip 5 percent of the time. The highest 95th percentile travel time in the AM peak period is 56.9 minutes which occurs around 7:45 AM, about 3.5 times more than the 16.2 minutes of free-flow travel time. The highest 95th percentile travel times in the PM peak period is 46.5 minutes, about three times more than the 15.3 minutes of free-flow travel time, which occurs around 5:15 PM.

3.4.6 Existing Bottlenecks

Bottlenecks occur at segment locations with persistent and significant drops in speed between two locations on a freeway. The existing bottlenecks (using thresholds of 35 to 45 mph) along the I-580 corridor were identified using INRIX congestion scans and speed-based heat maps. **Figure 3-4** and **Figure 3-5** show the heat map and bottleneck locations during the AM peak in the westbound direction and **Table 3-10** provides a summary of these locations.

[3] INRIX travel times do not differentiate vehicles with different payment types; instead, they represent the “average” conditions of all types of vehicles. At the SFOBB toll plaza, there are three payment types: HOV, cash, and FasTrak. HOVs typically experience shorter travel time than cash and FasTrak vehicles; therefore, cash and FasTrak travel times would be higher than shown here.

Figure 3-4. INRIX Congestion Scans and Speed Heat Map, I-580 Westbound AM

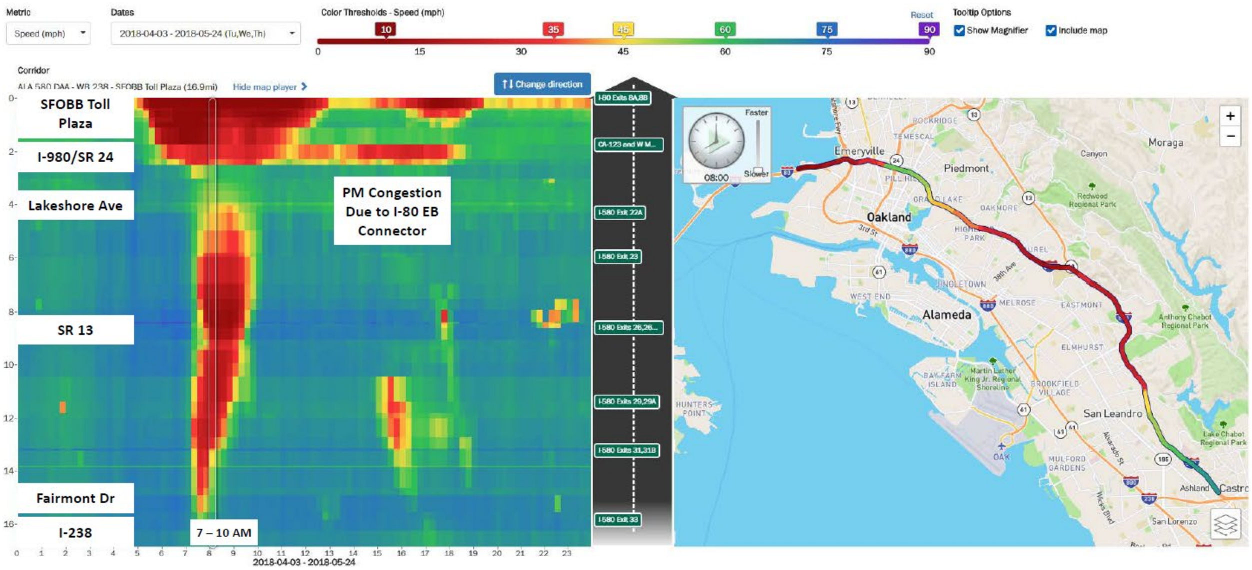
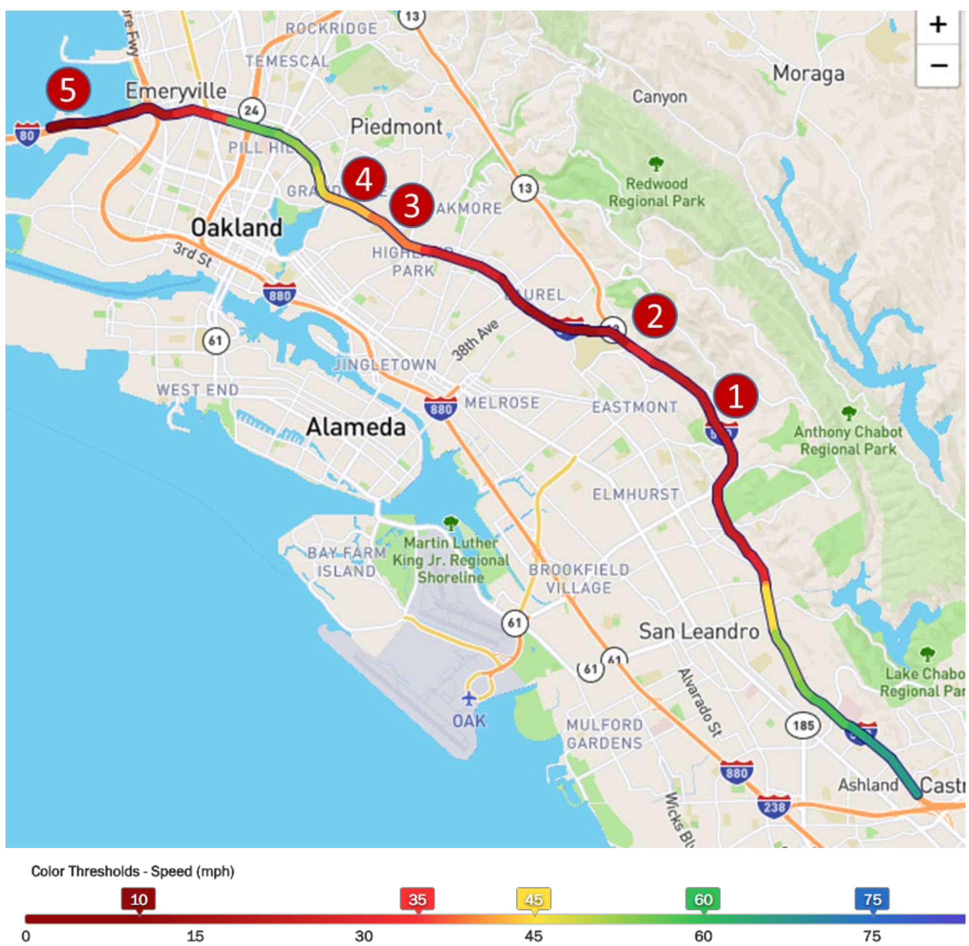


Figure 3-5. I-580 WB Bottleneck Locations



** 8:00-8:15 AM*

Table 3-1. Westbound Bottleneck Summary (2018)

No.	Bottleneck Location	Congested Time	Queue Length	Possible Causality
1	Golf Links Rd/98th Ave on-ramp to Keller Ave off-ramp	~7:15-8:45 AM	Typical queue extends 150th Ave/Fairmont Dr	Heavy on-ramp traffic from Golf Links Rd/98th on-ramp
2	Edwards Ave on-ramp to Seminary Dr/SR-13 off-ramp	~7:30-9:15 AM	Typical queue extends through upstream bottleneck at Golf Links Rd	Heavy on-ramp traffic from Edwards Ave & heavy off-ramp traffic to SR-13
3	Fruitvale Ave on-ramp to Beaumont Ave off-ramp	~ 7:30-9:30 AM	Typical queue extends through upstream bottleneck at Edwards Ave	Heavy on-ramp traffic from Fruitvale Ave & heavy off-ramp traffic to Beaumont Ave
4	Park Blvd on-ramp to Lakeshore Ave off-ramp	~ 8:00-9:15 AM	Typical queue extends through upstream bottleneck at Fruitvale Ave	Heavy on-ramp traffic from Park Blvd & heavy off-ramp traffic to Lakeshore Ave
5	SFOBB Toll Plaza	~ 5:00 AM-12:00 PM	Typical queue extends to I-980/SR-24 Additional recurring backup from I-80 EB Connector (AM & PM)	SFOBB metering lights and toll plaza & heavy off-ramp traffic to I-80 EB

Figure 3-6 and **Figure 3-7** show the heat map and bottleneck locations during the PM peak in the eastbound direction and **Table 3-11** provides a summary of these locations.

Figure 3-6. INRIX Congestion Scans and Speed Heat Map, I-580 Eastbound PM

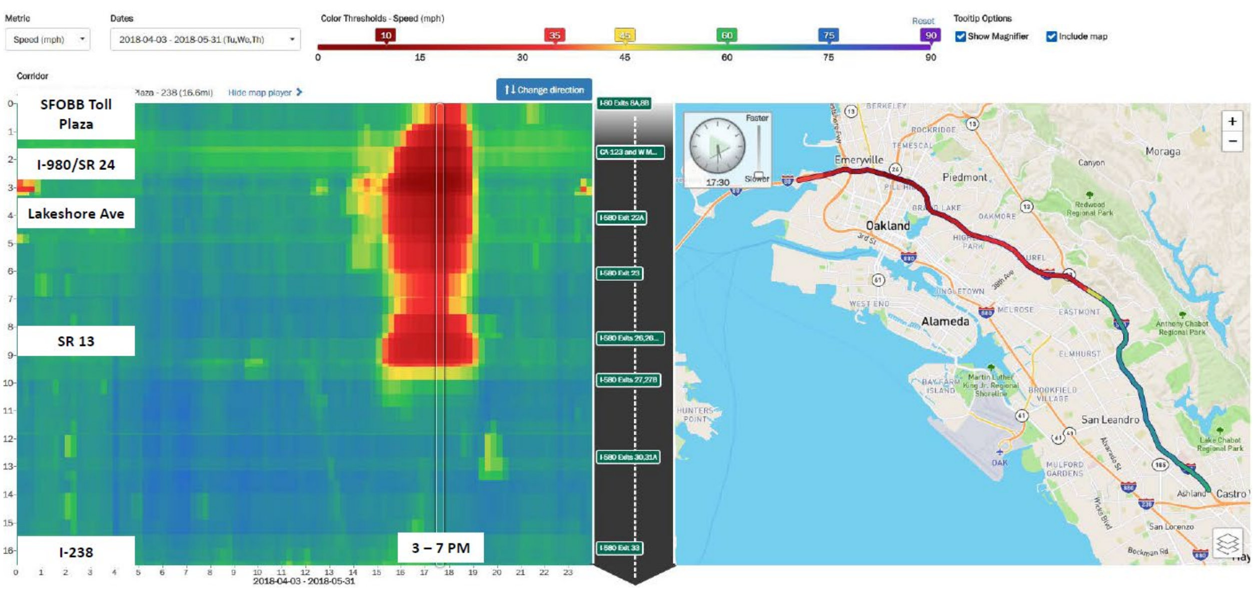


Figure 3-7. I-580 EB Bottleneck Locations

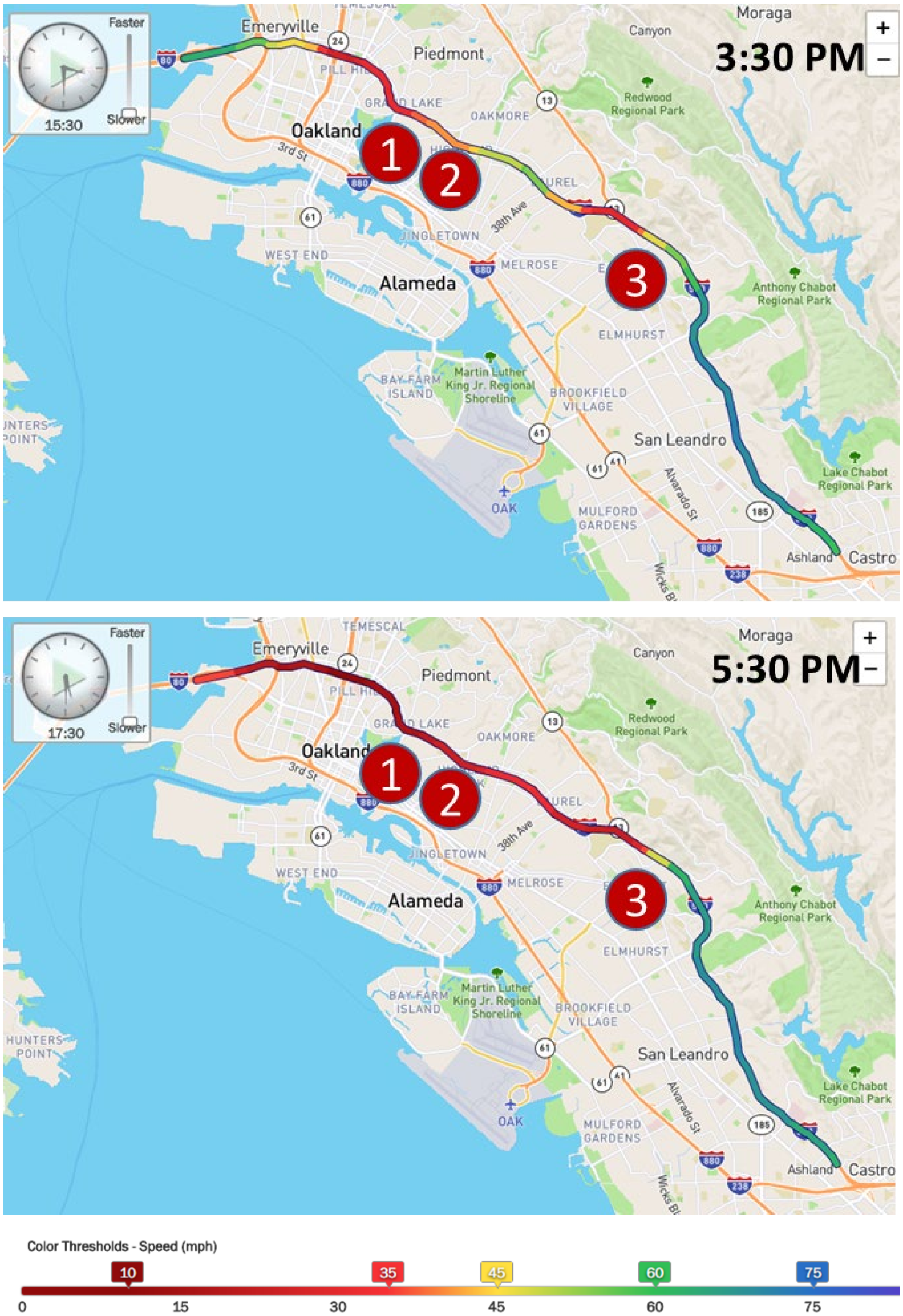


Table 3-2. Eastbound Bottleneck Summary (2018)

No.	Bottleneck Location	Congested Time	Queue Length	Possible Causality
1	Oakland Ave/Harrison St on-ramp to Grand Ave off-ramp	~3:15-7:00 PM	Typical queue extends to SFOBB toll plaza	Heavy on-ramp traffic from Oakland Ave/Harrison St & heavy off-ramp traffic to Grand Ave
2	Fruitvale Ave/Coolidge Ave on-ramp to 35th Ave off-ramp	~ 3:30-6:45 PM	Typical queue extends through upstream bottleneck at Oakland Ave/Harrison St	Heavy on-ramp traffic from Fruitvale Ave/Coolidge Ave & heavy off-ramp traffic to 35th Ave; A lane drop exists before Fruitvale Ave/Coolidge Ave on-ramp
3	SR-13/Seminary Ave on-ramps to Edwards Ave off-ramp	~ 3:15-7:00 PM	Typical queue extends through upstream bottleneck at Beaumont Ave	Heavy on-ramp traffic from SR-13 and Seminary Ave & heavy off-ramp traffic to Edwards Ave.

3.4.7 Interchange and Ramp Operations

There are several major interchanges along the I-580 corridor that experience substantial delay in the AM and PM peak periods along their ramps. Some key interchange and ramp operational issues are identified below:

Westbound:

- *I-80 Eastbound Connector – substantial AM and PM peak delay along connector ramp; exacerbated by westbound MacArthur Boulevard back-up*
- *Park Boulevard westbound on-ramp – substantial AM peak delay; this is a key casual carpool route and AC Transit Transbay Route V uses this on-ramp*
- *SR 24 Westbound Connector – substantial AM peak delay*

Eastbound:

- *MacArthur Boulevard eastbound off-ramp east of I-80 (left-hand side) – short weaving distance of ~ 950 feet for I-580 eastbound to complete two lane changes across the I-80 eastbound connector to exit to MacArthur Boulevard*
- *SR 24 / I-80 / West Street / 35th Street eastbound on-ramp – substantial PM peak delay*
- *Oakland Avenue eastbound on-ramp – substantial PM peak delay*
- *SR 13 Southbound Connector – lengthy PM peak queues and substantial delay*
- *Edwards Avenue off-ramp – lengthy queues during special events*
- *Golf Links Road eastbound off-ramp – lengthy PM peak queues; potential safety hazard with I-580 eastbound approach horizontal curb.*

4.0 Alternatives Development

4.1 Improvement Strategies Considered

Potential improvement concepts and operational strategies were identified and evaluated to determine their feasibility for implementation as part of the DAA. **Table 4-1** presents the strategies considered by the project team.

Table 4-1. List of Considered Strategies

Contraflow Managed Lane	*Reversible Lane*
Shoulder Running Bus Lane (BOS)	*GP Lane Conversion Managed Lane*
Construct New Managed Lane	*Auxiliary Lanes*
Branch Connector Merge/Geometry Enhancements	*Adaptive Ramp Metering*
Arterial Adaptive Signalization	*Arterial Transit Signal Prioritization (TSP)*
Express Bus Transit Route Effectiveness and Efficiency	*Arterial Bus Queue Jump Lanes*
Casual Carpool Locations	*Park-and-Ride Locations*

4.2 Freeway Mainline Concepts Evaluated

4.2.1 Concepts Advanced for Modeling

Throughout the DAA process, improvement concepts were assessed and vetted considering the *Evaluation Framework*. Strategies were consequently advanced if they met the primary purpose of the project, as expressed in **1.1 Goals and Need**. The mainline concepts that met these requirements, and considered feasible, are described in the following sections.

4.2.1.1 GENERAL PURPOSE LANE CONVERSION TO HOV/MANAGED LANES

The study evaluated the conversion of general purpose lanes to occupancy-restricted lanes, including the segment along I-580 westbound, the upstream extension of the *Buses and Carpools Only* lane that feeds into the two left toll lanes at the San Francisco-Oakland Bay Bridge (SFOBB) Toll Plaza. Currently, when westbound I-580 traffic approaches the toll plaza, a *Buses and Carpools Only* lane becomes available when the flyover through the MacArthur Maze touches down, around Post Mile (PM) 46.7. This improvement concept includes the conversion of the left general purpose lane from the location of the existing managed lane to nearly the I-980/SR-24 Interchange (at approximately PM 45.4). The HOV lane would be segmented into restricted and open access sections, in an attempt to discourage unsafe weaving from vehicles entering westbound I-580 from I-980/SR 24. This concept improvement is identified as Alternative 1A, Westbound HOV Lane Extension, and shown in **Figure 4-1**.

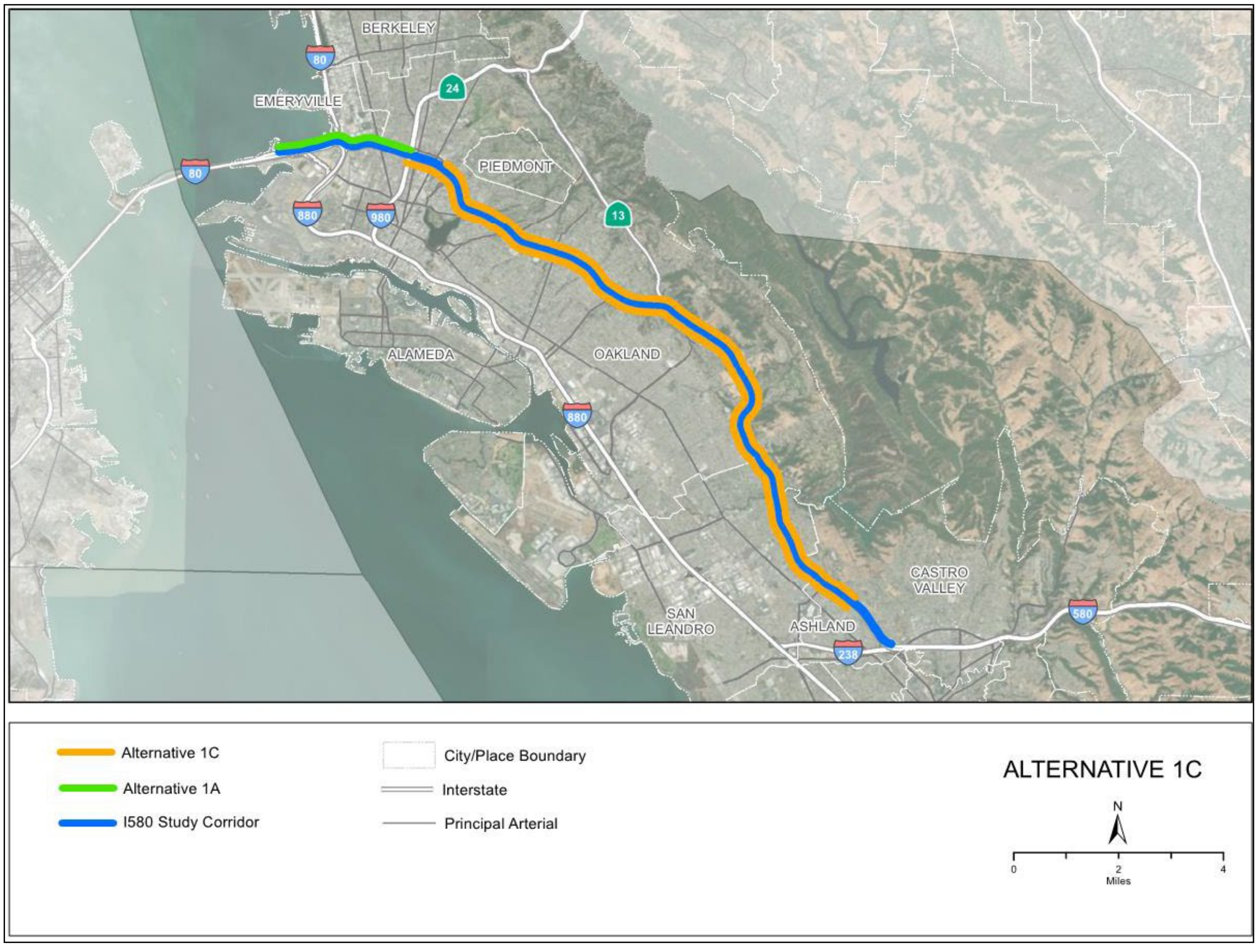
Figure 4-1. Alternative 1A

Another strategy involves a corridor-wide conversion of the left general purpose lane to a *Buses and Carpools Only* lane, in both westbound and eastbound directions. For the westbound route, the converted managed lane would commence around one mile north of the I-238 Interchange and span the corridor until reaching and connecting to the existing *Buses and Carpools Only* lane at the approach to the SFOBB Toll Plaza (from around PM 32.0 to around PM 46.7). Consequently, the length of converted lane equates to approximately 14.7 miles. For the eastbound route, the converted managed lane would originate in the area of the I-980/SR 24 Interchange (around PM 45.2) and conclude around one mile north of the I-238 Interchange, near PM 32.0. The length of converted lane in this direction is approximately 13.2 miles. This concept improvement is identified as Alternative 1B.

The associated infrastructural work consists of re-striping, pavement markings, and new signage. Within the limits of the converted lane, similar signs along the corresponding lane's approach to the toll plaza would be installed. Furthermore, per California MUTCD standards and guidelines, advanced signage must be installed up to a mile prior to the beginning of the converted *Buses and Carpools Only* lane; the signage plan would alert vehicles of the impending transition of the left lane from general purpose to occupancy-restricted.

The concept improvement identified as Alternative 1C (shown in **Figure 4-2**) proposes to implement an Express Lanes system, where additional signage, electrical and tolling equipment – such as dynamic message signs, sensors, and toll readers – would need to be installed along the corridor, mirroring the limits of the managed lane accordingly.

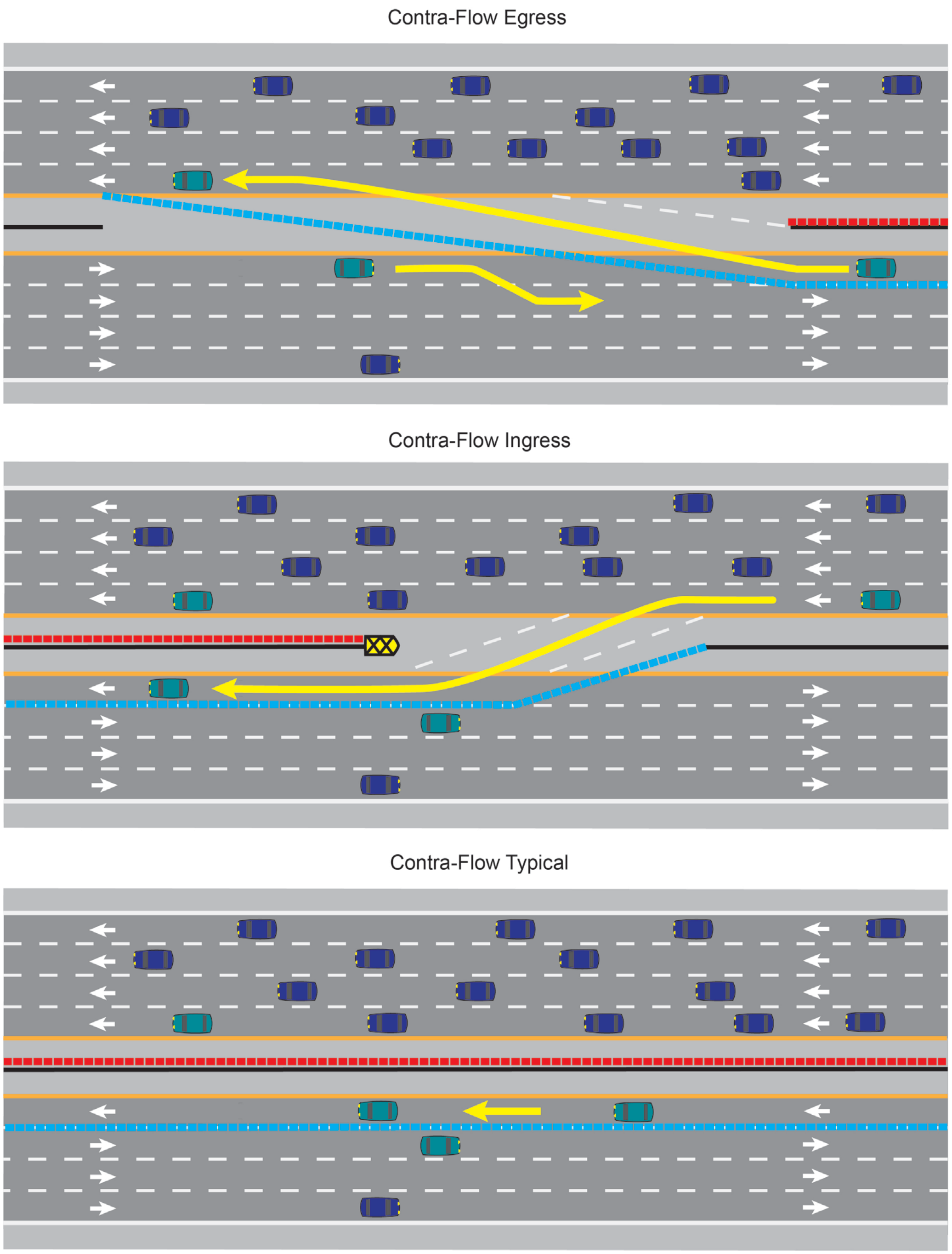
Figure 4-2. Alternative 1C



4.2.1.2 CONTRA-FLOW MANAGED LANE

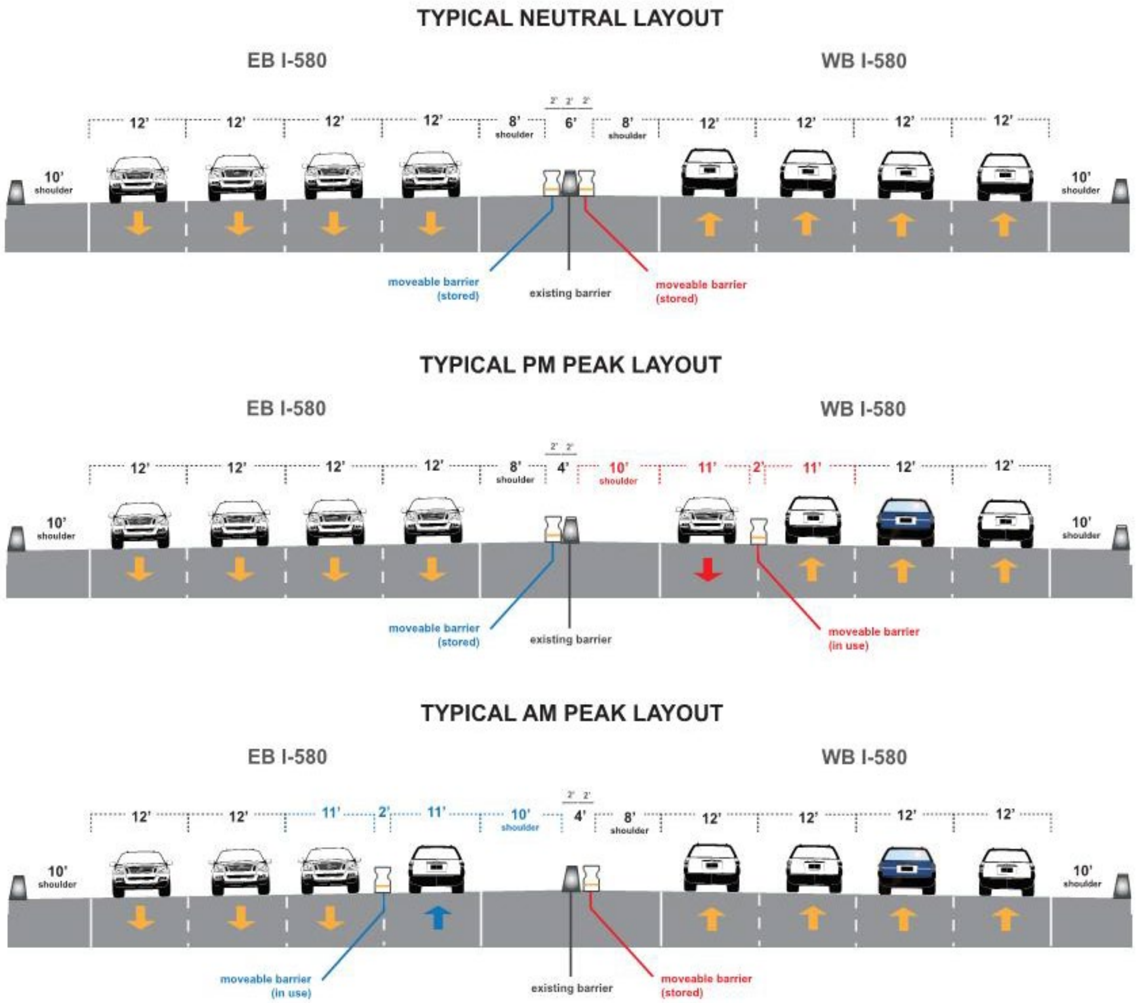
Another option involves the operation of a contra-flow lane during peak periods of traffic along I-580, where one direction utilizes the excess capacity in the opposing direction of travel. Unlike the alternatives for occupancy-restriction, which allow for accessibility at any point along the proposed route, the contra-flow lane proposed would have one ingress and one egress location, with no vehicular accessibility between these two endpoints. Therefore, the recommended limits for this option consider factors such as geometric feasibility (i.e. avoidance of median constraints like structural columns and design of acceptable merging movements), safety, level of effectiveness, vehicular participation, and other metrics to determine optimal placement. The proposed concept for I-580 considers the westbound ingress movement occurring near the Edwards Avenue interchange around PM 38.7, and the egress location occurring near the I-980/SR 24 Interchange around PM 44.7. Conversely, the eastbound ingress movement would occur near the Grand Avenue/Lakeshore Avenue interchange around PM 43.5, and the egress locations would occur in between the Fontaine Street and Oak Knoll Boulevard overcrossings near PM 37.0. This concept improvement is identified as Alternative 2. **Figure 4-3** illustrates the general layout for operation of the contra-flow lane.

Figure 4-3. Contra-flow Layout



The proposed work involved with this concept includes minor re-striping, new signage, removal of permanent barrier in areas earmarked for crossover actions, and installation of movable barriers and crash cushions. The main operability component of this option would be associated with movable barrier, required for both directions, placed in storage during off-peak hours (directly adjacent to the permanent median barrier, see **Figure 4-4**) and implemented during peak hours, as well as the machinery required to shift the barrier between these two modes. Additional considerations for operations and maintenance are needed for this concept. The contra-flow lane could be designated as an HOV lane (Alternative 2A), or as an express lane (Alternative 2B).

Figure 4-4. Contra-flow Cross Sections



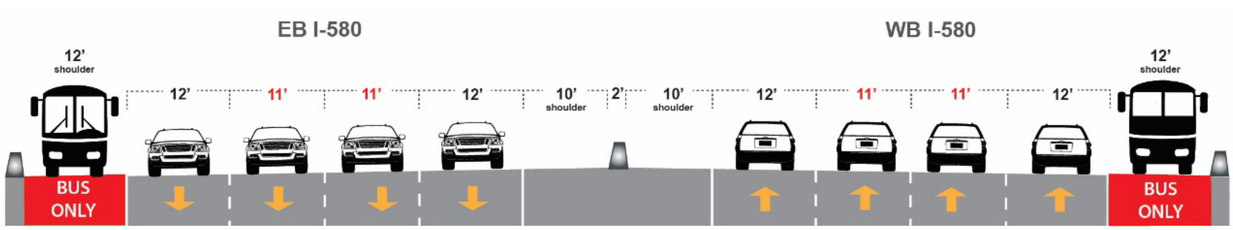
4.2.1.3 BUS ON SHOULDER PART-TIME USE LANE (OUTSIDE SHOULDER)

An additional conceptual improvement includes a BOS, or part-time-use lane along the outside shoulder within the I-580 corridor. The limits of this concept are informed by the entrance points of current transit routes and accommodating shoulder widths. In the westbound direction, the 4.5-mile BOS route would begin just downstream of the MacArthur Boulevard on-ramp (and the Birdsal Avenue Pedestrian Overcrossing) at PM 40.0, and would terminate at the Oakland Avenue/Harrison Street on-ramp at roughly PM 44.5. A second westbound option relocates the origin point to the 150th Avenue on-ramp, near PM 33.2, and extends the BOS route to an 11.3-mile course to account for all existing Transbay bus routes utilizing the freeway. In the eastbound direction, the 6.0-mile BOS route would start past the off-ramp for Harrison

Street/Oakland Avenue at PM 44.5, and would end near the Edwards Avenue off-ramp (around PM 38.5). This concept improvement is identified as Alternative 3.

The implementation of a BOS operation would entail large-scale re-striping efforts and replacement of shoulder structural section pavement. Typical travel lanes and shoulder widths along the corridor are 12 feet and 10 feet, respectively; however, 12-foot shoulder widths are recommended for the BOS route on I-580. Consequently, the middle two lanes would be re-striped to 11 feet each in order to accommodate a wider shoulder (see **Figure 4-5**). Additionally, due to the inadequate composition and characteristics of shoulder pavement structural sections, corridor-wide replacement of shoulder pavements would be necessary to accommodate bus loading. Relocation of conflicting elements (such as post-mounted signs), pavement markings, and new signage to indicate the buses permitted to use the lane during peak travel periods are also required. Moreover, proper training of operating staff is essential to the seamless and positive implementation of this pilot program to ensure correct handling of ambient traffic speeds and bus movements through gore transition zones.

Figure 4-5. Bus on Shoulder Re-striped Cross Section



4.2.2 Concepts Considered and Deemed Not Viable from the DAA

In addition to the aforementioned improvement concepts, the following strategies were considered as part of the DAA but were deemed not viable, due to their inability to meet the DAA's purpose.

4.2.2.1 CORRIDOR-WIDE REVERSIBLE LANE (MEDIAN)

The study initially considered a reversible managed lane within the I-580 corridor. This strategy entails the construction of a new managed lane in the median of the freeway (which includes construction areas for bi-directional ingress and egress locations) to be used in the westbound direction during peak morning travel and in the eastbound direction during peak evening travel.

Initial assessment of this concept revealed substantial physical obstacles to implementation. A reversible lane requires space and width for a new lane with minimal shoulders and barriers on either side. Detrimentally, there are locations along I-580 where both roadbeds are separated (horizontally or vertically), as well as locations where both roadbeds do not provide adequate width for feasible components of the reversible lane. Furthermore, in circumstances that do allow for a potential reversible lane in the median, numerous structural columns, overhead sign structures, and smaller sign posts are staggered along the route, creating significant conflicts with a potential reversible lane. In order to overcome these impediments, large and costly construction projects would be required; therefore, a reversible lane was determined to be impractical and the reversible lane option was retired.

4.2.2.2 ADDITIONAL GENERAL PURPOSE LANE

The study considered the possibility of adding a new general purpose lane in both directions (westbound and eastbound) along I-580. In this case, the existing facility typically including four lanes in each direction would expand to five lanes in each direction. An expansion project adding this capacity would require widening in many segments along I-580 (if not the entire corridor); therefore there would be right of way impacts and adverse environmental impacts. It would be very costly, due in part to the need to replace all overcrossing structures straddling the corridor, as well as retaining wall realignments caused by ramp readjustments. It would also entail a lengthy schedule to reach implementation. The addition of a general purpose lane would also induce new vehicular traffic demands, which would lead to substantial increase in vehicle miles of travel, and greenhouse gas emissions. This concept also does not meet the project's purpose to focus on increasing person throughput and offering travel time savings to support HOVs and buses. For these and other reasons, this improvement concept was retired.

4.2.2.3 BUS ON SHOULDER/PART-TIME TRAVEL LANE (MEDIAN SHOULDER)

Similar to the developed concept previously discussed for a BOS/part time travel lane, a variation considered includes running buses in the median shoulder rather than the outside shoulder. Ideally, this path would provide an unencumbered route spanning the corridor, with no disturbances like merging/diverging movements and the presence of gore zones. However, the median shoulder along the freeway frequently does not offer sufficient width to accommodate bus travel and is consistently constrained due to existing structural columns, retaining walls, and sign posts. As a result, this alternative was retired from consideration.

4.3 Complementary Strategies

During the DAA process, many complementary strategies were identified that will have independent benefits to meet the goals of the study and have the ability to enhance the benefits of the freeway corridor improvements. While these particular strategies were not evaluated or modeled as extensively as the alternatives in **Section 4.2.1** (also see **5 Traffic Analysis of Freeway Mainline Concepts**), they were investigated for planning purposes to determine their merits and to advance to the next phase.

A few of these strategies are recommended to move into the next phase of project development (see **Section 6.2.2**) due to the increased potential of their added value when coupled with mainline corridor improvements. Meanwhile, several complementary strategies are either being pursued via other avenues, require further investigation and evaluation, or are currently deemed to be of relative lower priority when compared to the listed options.

4.3.1 Strategies Recommended for Further Development

4.3.1.1 PARK & RIDE FACILITIES

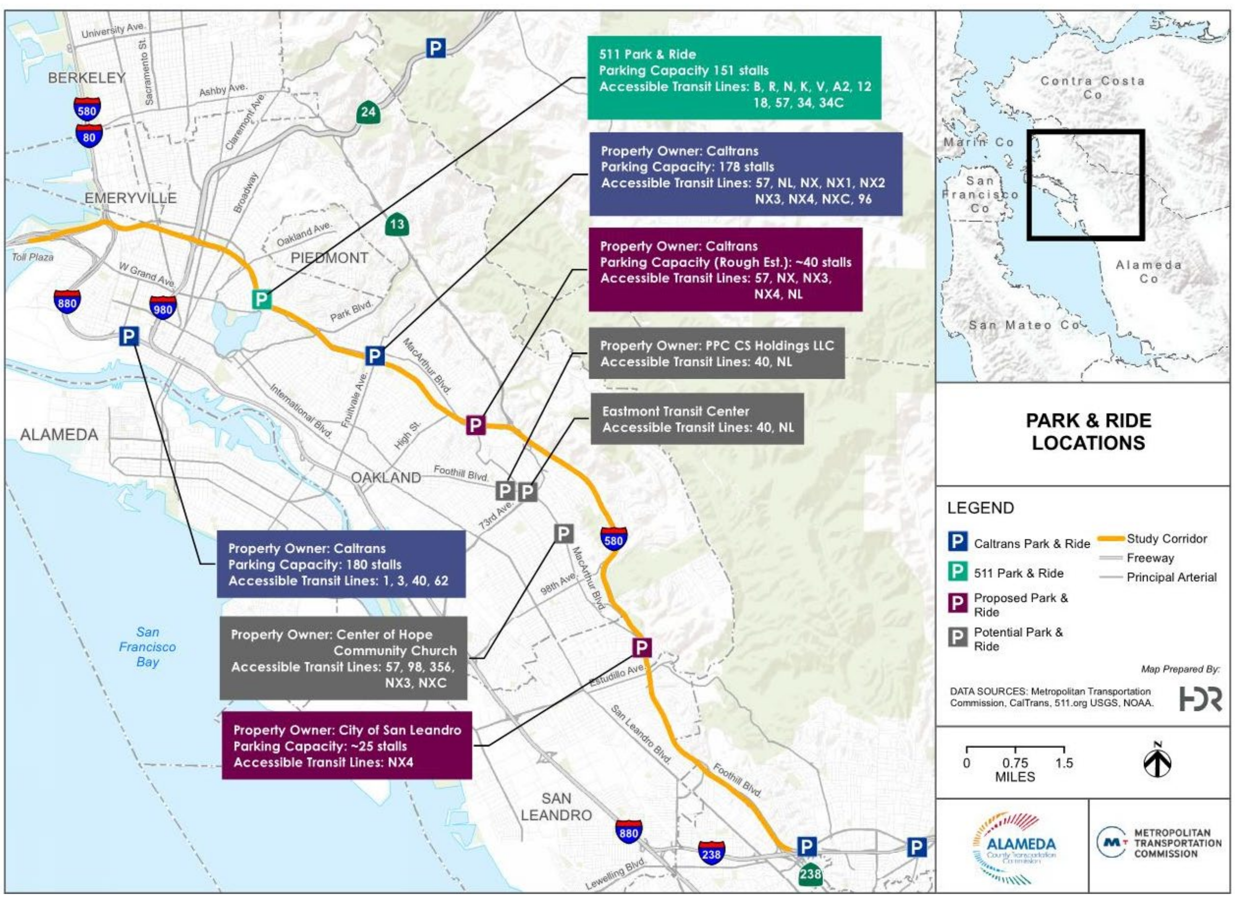
Currently, there are only two Park & Ride facilities along the I-580 corridor between the I-238 Interchange and SFOBB Toll Plaza; these are near Fruitvale Avenue and Grand Avenue. Another ancillary improvement strategy identifies a handful of additional proposed and potential parking lot locations.

New Park & Ride locations were assessed during the DAA. This process consisted of reviewing parcels of land generally adjacent to I-580 or major nearby parallel roadways (including MacArthur Boulevard, East 14th Street, International Boulevard, Foothill Boulevard, and Bancroft Avenue) for feasible lots. These prospective lots were then cross-referenced as viable opportunities for connectivity to existing transit routes.

Two new Park & Ride locations are proposed in very close proximity to the freeway facility. The first is found near Dutton Avenue, along MacArthur Boulevard. This property is owned by the City of San Leandro and offers accessibility to Transbay transit lines NX3 and NX4. A preliminary conceptual design indicates that around 25 new parking spaces can be added with relatively minor modifications (i.e. striping and minimal pavement). A second prospective lot is located within Caltrans right of way, in vacant land under I-580 and at the convergence of MacArthur Boulevard, Buell Street, and Calaveras Avenue. Transit lines 57, NL, NX, NX3, NX4, and NXC are accessible to this site.

Three other potential Park & Ride lot locations have been noted, though require more investigation as it pertains to their viability. These options are located farther from the freeway – west of I-580 and adjacent to MacArthur Boulevard or Foothill Boulevard – and owned by private entities. **Figure 4-6** shows the locations of these facilities.

Figure 4-6. Park & Ride Facilities



4.3.1.2 AC TRANSIT EXPRESS BUS SERVICES

As shown in the origin-destination (OD) travel pattern data for the broader study area, and as summarized in **3.4 System Performance and Travel Pattern**, the analysis revealed that a substantial amount of westbound morning peak period vehicle trips were destined for downtown Oakland. With no express bus service to downtown currently in operation, new express bus service to downtown Oakland is an opportunity worth exploring in the future to better serve the needs of the transit market.

Furthermore, depending on the effectiveness of proposed mainline improvements, modifications to routes and stops of existing or future express service may be considered to leverage the travel time savings with potential managed lane improvements. Additional and complementary transit service may be necessary to reach the mode shift goals of most mainline improvements and meet the increased demand caused by the resulting mode shift. For reasons such as these, ongoing coordination between AC Transit and involved agencies is essential to ensure bus services are able to maximize their fullest potential as it pertains to ridership and performance.

4.3.1.3 ARTERIAL IMPROVEMENTS FOR TRANSIT

A handful of transit-focused arterial operational improvements (such as transit signal prioritization, and bus queue jump lanes) were considered by the project team. MacArthur Boulevard is a major parallel arterial adjacent to I-580, it is heavily used by express buses, and currently experiences traffic congestion along various segments of the corridor. The City of Oakland is working in coordination with AC Transit on the MacArthur Boulevard Smart Corridor Project to extend existing Intelligent Transportation System (ITS) network with fiber cable to 62 traffic signals along 13 miles of this corridor. This project intends to improve transit performance, bike and pedestrian safety along the corridor. The project was approved in Alameda CTC's 2020 Comprehensive Investment Plan.

4.3.2 Other Complementary Strategies

4.3.2.1 NEW AUXILIARY LANES

An improvement concept identified and assessed during this project considered the construction of auxiliary lanes at bottleneck locations along the corridor. All access ramps were assessed considering criteria and standard requirements such as distances to successive off-ramps, threshold entrance ramp volumes, and physical viability; a handful of sites were isolated and subsequently suggested for auxiliary lane improvements. The two primary locations suggested were westbound between Park Boulevard on-ramp and Lakeshore Avenue off-ramp or eastbound between SR 13 on-ramp and Edwards Avenue off-ramp.

While these measures may offer minimal travel time benefits along the mainline corridor, they are largely tangential in their scope and effect when regarding the key purpose of the DAA. As such, the introduction of new auxiliary lanes was determined to be a possible subject for a future study or project.

4.3.2.2 ADAPTIVE RAMP METERING

A concept originally considered in this DAA entailed the implementation of adaptive ramp metering along the study corridor. The project team later found that Caltrans is currently working on a study to implement ramp metering on this corridor as a project in the State Highway Operation and Protection Program (SHOPP). Therefore, this concept is not further evaluated as part of the DAA.

4.3.2.3 BRANCH CONNECTOR MERGE/GEOMETRY ENHANCEMENTS

Several branch connectors within the corridor (those connecting I-980, SR 24, and SR 13) contain existing merges and geometry that do not meet modern Caltrans Highway Design Manual (HDM) requirements and standards. An early potential DAA strategy involved assessing reconfigurations for these connectors; however, the improvements were deemed to be outside the focus and purpose of this current DAA. The possibility exists of revisiting these measures in the future.

4.3.2.4 CASUAL CARPOOL LOCATIONS

In close proximity to the I-580 corridor and in the general Study Area, there are 11 pick-up locations where commuters meet to form carpools to take advantage of Transbay carpool incentives and benefits. The study considered a strategy to identify new locations, but was ultimately deemed to be a secondary consideration when compared to the DAA's primary goals and need; therefore, additional casual carpool locations is recommended to be investigated further alongside other transit service changes and mainline improvements.

5.0 Traffic Analysis of Freeway Mainline Concepts

5.1 Traffic Analysis Alternatives

The developed concepts described above have the potential to be implemented along the I-580 mainline corridor in a variety of ways. After review by the project team and TAC members, the following scenarios have underwent traffic modeling simulations to provide insight into their potential effectiveness when considering the roadway network's overall performance.

- ***Alternative 1A*** *– Westbound HOV Lane Extension*
- ***Alternative 1B*** *– General Purpose Lane Conversion to HOV Lane*
- ***Alternative 1C*** *– General Purpose Lane Conversion to Express Lane*
- ***Alternative 2A*** *– Contra-flow HOV Lane*
- ***Alternative 2B*** *– Contra-flow Express Lane*
- ***Alternative 3A*** *– Bus on Shoulder (WB 4.5 miles/EB 6.0 miles)*
- ***Alternative 3B*** *– Bus on Shoulder (WB 11.3 miles/EB 6.0 miles)*

Graphical representations of each of the alternatives listed immediately above can be found in **Appendix B**.

5.2 Model Development and Alternative Assessment

5.2.1 Modeling Tool

FREEVAL (FREeway EVALuation) was used for this project as the modeling tool. FREEVAL is a computational engine based on the Highway Capacity Manual (HCM) 6th Edition, Chapters 10 and 11, Freeway Facilities and Reliability Analysis. It also incorporates all of the freeway segment procedures outlined in Chapters 12, 13, and 14 for basic freeway segments, weaving segments, and merge and diverge segments, respectively. The user codes and defines each segment as a basic, on-ramp, off-ramp, weaving, or overlapping ramp segment following HCM conventions. Once calibrated, the model can be used to analyze various scenarios, including managed lanes. This tool allows the user to analyze the freeway as a system, as opposed to individual segments. Typical outputs include speed, travel time, density, V/C ratio, and vehicle hours of delay (VHD), and level of service (LOS).

5.2.2 Measures of Effectiveness

Measures of effectiveness (MOEs) are system performance statistics that quantify how well a particular alternative meets the project objectives. A number of MOEs generated based on FREEVAL model output and post-model data processing were used to quantify traffic operations for the project study area, as listed in **Table 5-1**.

Table 5-1. Reported Measures of Effectiveness (MOEs)

MOE	Unit	Description
Vehicle throughput	Vehicles per hour	Number of vehicles traversing the corridor in one direction at select locations, expressed as vehicles per hour.
Person throughput	Persons per hour	Number of persons traversing the corridor at select locations, expressed as persons per hour.
Vehicle hours of delay (VHD)	Vehicle-hours	Total vehicle hours of delay on the corridor (system-wide), expressed as vehicle-hours.
Person hours of delay (PHD)	Person-hours	Total person hours of delay on the corridor (system-wide), expressed as person-hours.
Average travel speed	mph	The average speed of vehicles traveling through the corridor, expressed in miles per hour (mph), for general purpose and managed lanes, separately.
Average travel time	Minutes	The average time required to traverse the entire corridor in a single direction, expressed in minutes, for general purpose and managed lanes, separately. Managed lane average travel time savings will also be calculated.
Maximum travel time	Minutes	The maximum time required to traverse the entire corridor in a single direction, expressed in minutes, for general purpose and managed lanes, separately. Managed lane maximum travel time savings will also be calculated.
Travel time reliability – Travel Time Index (TTI)	Ratio of corridor travel times (unit-less measure)	A measure of the dispersion of the travel time distribution.

5.2.3 Model Calibration

FREEVAL models were calibrated for existing conditions (i.e., 2018) in the westbound direction during the AM peak period and the eastbound direction during the PM peak period. The following calibration criteria were applied:

- *Travel Time – within 15%*
- *Congestion Pattern (bottleneck location, duration of congestion, and queue length) – Visual inspection to match observations*

All model calibrations were performed at the 15-minute level. **Table 5-2** presents the calibration summary for the AM and PM peak period FREEVAL models. Detailed model calibration results are available in **Appendix C**.

Table 5-2. FREEVAL Model Calibration Summary

Category	Criteria	Threshold	% Met Target Criteria	Calibration Statistics		
				Study Period	% Met	Pass/Fail
Travel Time	Travel Paths	+/- 15%	> 85%	AM PM	94% 100%	Pass Pass
Congestion Pattern	Bottleneck Location	Match Observations		Pass		
	Duration of Congestion	Match Observations		Pass		
	Queue Length	Match Observations		Pass		

5.2.4 Existing Measures of Effectiveness

MOEs were calculated for the models of existing conditions in 2018. The results are presented in **Table 5-3**.

Table 5-3. Existing I-580 Study Corridor Measures of Effectiveness

MOE	WB Corridor – AM Peak Period*		EB Corridor – PM Peak Period**	
Vehicle Throughput	Golf Links Rd/98th Ave on-ramp to Keller Ave off-ramp	32,276	Oakland Ave/Harrison St on-ramp to Grand Ave off-ramp	39,317
	Edwards Ave on-ramp to Seminary Dr/SR-13 off-ramp	37,016	Fruitvale Ave/Coolidge Ave on-ramp to 35th Ave off-ramp	39,642
	Fruitvale Ave on-ramp to Beaumont Ave off-ramp	41,963	SR-13/Seminary Ave on-ramps to Edwards Ave off-ramp	44,601
	Park Blvd on-ramp to Lakeshore Ave off-ramp	44,398		
	I-80/I-580 Split to Toll Plaza	18,916		
Person Throughput	Golf Links Rd/98th Ave on-ramp to Keller Ave off-ramp	37,764	Oakland Ave/Harrison St on-ramp to Grand Ave off-ramp	44,997
	Edwards Ave on-ramp to Seminary Dr/SR-13 off-ramp	43,141	Fruitvale Ave/Coolidge Ave on-ramp to 35th Ave off-ramp	45,130
	Fruitvale Ave on-ramp to Beaumont Ave off-ramp	49,248	SR-13/Seminary Ave on-ramps to Edwards Ave off-ramp	50,663
	Park Blvd on-ramp to Lakeshore Ave off-ramp	52,229		
	I-80/I-580 Split to Toll Plaza	32,126		
VHD (vehicle-hours)	22,358		19,953	
PHD (person-hours)	30,351		22,858	
Avg. Travel Speed (mph)	36.7		36.6	
Avg. Travel Time (minutes)	27.3		27.2	
Max. Travel Time (minutes)	39.7		34.9	
Travel Time Index (TTI)	1.91		1.91	

*AM Peak Period: 5-11 AM
**PM Peak Period: 2-8 PM

5.2.5 Traffic Demand Forecast

For the purpose of performing traffic operations analysis for the DAA, traffic forecast was developed for Year 2023, which reflects a near-term condition, or potential opening year of near-term improvements. Annual vehicular growth rates were developed using the latest adopted Alameda Countywide Travel Demand Model from Alameda CTC. Year 2010, 2020, and 2040 model outputs were obtained from Alameda CTC, annual growth rates were developed by interpolating model projected between Year 2020 and Year 2040 to obtain Year 2023 forecast. Overall, annual growth rate is projected to be about 1.3% to 1.6% on this corridor.

In consultation with Alameda CTC and based on planned growth, higher growth rates would be expected at ramps in the downtown Oakland and Golf Links/Keller areas. **Table 5-4** lists the total growth rates estimated for downtown Oakland, Golf Links/Keller, and all other areas. These growth rate assumptions reflected growth in traffic volumes based on regional planning. These growth rates were used to establish the 2023 conditions. Detailed traffic demand forecast results are available in **Appendix D**.

Table 5-4. Traffic Growth Rates on I-580 Study Corridor (2018-2023)

Area	Westbound AM Peak Period			Eastbound PM Peak Period		
	Location		Total Growth Rate (2018-2023)	Location		Total Growth Rate (2018-2023)
Downtown Oakland Area	On-Ramp	Oakland/Harrison	7.2%	On-Ramp	I-980 Connector	14.0%
		Grand			SR 24 Connector	
		Park/Beaumont			Oakland/Harrison	
		Fruitvale/Coolidge			Grand/Lakeshore	
	Off-Ramp	SR 24 Connector	11.7%		Beaumont	
		I-980 Connector			Fruitvale/Coolidge	
		Oakland/Harrison		Off-Ramp	Oakland/Harrison	6.7%
		Grand			Grand/Lakeshore	
		Lakeshore			Park	
		Park/Beaumont			Fruitvale/Coolidge	
		Fruitvale/Coolidge				
Golf Links/Keller Area	On-Ramp	Edwards	7.2%	On-Ramp	Keller	21.8%
		Keller			Golf Links Rd	
		Golf Links Rd		Off-Ramp	Edwards	14.5%
		106th			Keller	
	Off-Ramp	Keller	11.1%		Golf Links Rd	
		Golf Links Rd			106th	
All Other Areas			7.2%	All Other Areas		6.7%

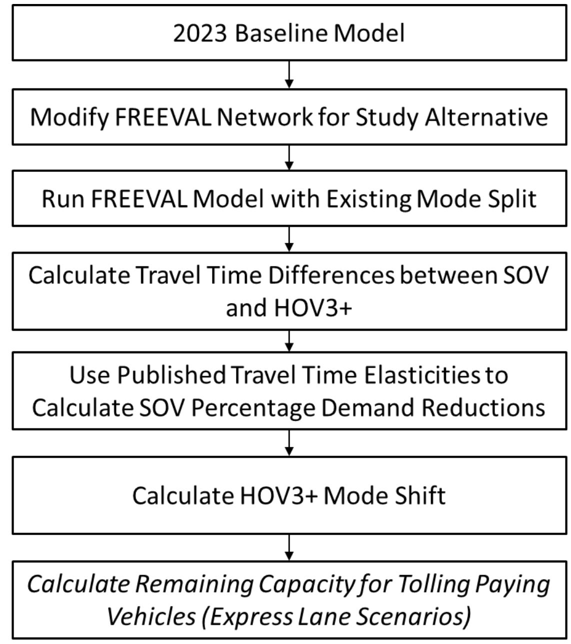
5.2.6 Mode Shift Assumptions

Most of the proposed alternatives were expected to have substantial improvements for the HOV/bus transit mode, resulting in mode shift away from SOVs.

The proposed mode shift analysis is based on the following procedure that takes into account the relative travel time savings between the SOV and HOV3+, as well as published mode choice elasticity data. The goal of this calculation is to estimate the number of vehicles that would shift to higher-occupancy modes with the implementation of the proposed alternatives. **Figure 5-1** illustrates the process and it involves the following steps:

- Step 1: Modify the 2023 Baseline FREEVAL network to reflect the study alternative.
- Step 2: Run the modified FREEVAL model with existing mode split. Existing HOV3+/buses and clean air vehicles (CAVs) comprised about 2.1% and 2.0% of the total traffic, respectively, based on vehicle occupancy surveys at a couple of locations on this corridor east of I-980/SR 24 interchange. With more than 1,000 HOV3+ vehicles at the San Francisco-Oakland Bay Bridge (SFOBB) toll plaza coming from I-580 westbound between 6:00 and 9:00 AM, a higher percentage of HOV3+ was assumed when getting closer to the I-980/SR 24 interchange.
- Step 3: Calculate travel time differences between SOV and HOV 3+. Ideally, a mode shift is performed for each origin-destination (OD) pair. Considering the size of the network and lack of such OD data, the mode shift analysis was performed for the entire corridor.

Figure 5-1 Mode Shift Analysis



- Step 4: Convert percentage travel time differences to SOV percentage demand reductions by applying travel time elasticities published by Victoria Transport Policy Institute, 2017[4]. Generally, for every 1% of potential travel time savings between SOV and HOV 3+, forecasted SOV demand is reduced by 0.225% and 0.151% during the AM Peak and PM Peak, respectively.

  Example: If the calculated travel time differences between SOV and HOV 3+ is 40%, then the forecasted SOV demand is reduced by:

  - *AM Peak: 40*0.225% = 9.00%*
  - *PM Peak: 40*0.151% = 6.04%*

- Step 5: Calculate HOV3+ mode shift. For the HOV3+ vehicle shift, new HOV3+ vehicles were assumed by combining one SOV with one HOV2. This removes two vehicles from the general purpose lanes and adds one vehicle into the HOV3+ lane, with a net reduction of one vehicle in the system. This conservative assumption is made in lieu of an assumption whereby three SOVs are combined into one HOV3+, which would result in two vehicles being removed from the system.
- Step 6: For the Express Lane (EL) scenarios, calculate the remaining capacity for toll-paying vehicles using the following equation. It was assumed that future dynamic pricing could be set to maximize throughput on this corridor, and HOV2s would be tolled at a discounted rate.

$$\text{Remaining Capacity for Toll Paying Vehicles} = \text{EL Capacity} - (\text{Existing HOV3}+) - (\text{New HOV3}+)$$

Where:

$$\text{EL Capacity} = 1{,}650 \text{ vehicles/hour}$$

[4] Litman, T., *Understanding Transport Demands and Elasticities*, Victoria Transport Policy Institute, November 2018.

5.2.7 Year 2023 Conditions Analysis

Future year (2023) conditions were analyzed under No Build conditions and the project alternatives. The calibrated models were updated to reflect the future baseline conditions in 2023 (i.e., 2023 baseline models) using annual growth rates as discussed in the Traffic Demand Forecast section. The roadway network for the Year 2023 No Build FREEVAL model remained the same as existing conditions. All proposed improvement alternatives were then developed based on the 2023 baseline models, except for the Bus on Shoulder (BOS) alternatives. BOS cannot be modeled directly in the FREEVAL models. To estimate bus speed along the BOS section under the BOS alternatives, an offline spreadsheet-based tool was developed separately.

Table 5-5 and **Table 5-6** list the corridor MOEs for Alternatives 1A, 1B, 1C, 2A and 2B for the westbound and eastbound directions, respectively. The percent changes for each alternative compared to No Build are presented in parenthesis. The MOE results reveal that the westbound Alternatives 1A, 2A, and 2B would reduce the VHD, PHD, and travel times compared to the westbound No Build, while the eastbound Alternatives 2A and 2B would reduce the VHD, PHD, and travel times compared to the eastbound No Build. The speed contour maps for each of the alternatives are presented in **Appendix E**.

Table 5-7 and **Table 5-8** present the average and maximum travel times using general purpose lanes and the managed lane for each alternative for the westbound and eastbound directions, respectively. Note that the proposed managed lanes do not run through either the entire westbound or eastbound corridor. Therefore, the corridor-wide managed lane travel time for each alternative was calculated as the travel time in the managed lane plus the travel time in the general purpose lanes along the non-managed-lane sections.

- ***Westbound Direction**: Alternatives 1A through 2B would result in reduced average and maximum travel times in the managed lane; however, only Alternatives 1A, 2A, and 2B would see reduced average and maximum travel times in the general purpose lanes.*
- ***Eastbound Direction:** Alternatives 1B through 2B would result in reduced average and maximum travel times in the managed lane; however, only Alternatives 2A and 2B would result in reduced travel times in the general purpose lanes.*

Figure 5-2 and **Figure 5-3** provide visualizations of travel times in general purpose lanes and the managed lane by alternative for the westbound and eastbound directions, respectively. It can be found that managed lanes would experience shorter travel times than general purpose lanes for all the study alternatives involving managed lanes.

Table 5-1. Year 2023 Westbound I-580 AM Study Period Measures of Effectiveness

MOE		Alternative 0	1A	1B	1C	2A	2B
Vehicle Throughput	Golf Links Rd/98th Ave on-ramp to Keller Ave off-ramp	33,454	33,211	25,187	32,358	33,982	33,982
			(-1%)	(-25%)	(-3%)	(2%)	(2%)
	Edwards Ave on-ramp to Seminary Dr/SR-13 off-ramp	38,524	38,271	29,927	37,378	37,780	37,780
			(-1%)	(-22%)	(-3%)	(-2%)	(-2%)
	Fruitvale Ave on-ramp to Beaumont Ave off-ramp	43,369	42,677	36,694	41,239	43,087	42,918
			(-2%)	(-15%)	(-5%)	(-1%)	(-1%)
	Park Blvd on-ramp to Lakeshore Ave off-ramp	44,900	44,205	38,789	42,843	45,919	45,842
			(-2%)	(-14%)	(-5%)	(2%)	(2%)
	I-80/I-580 Split to Toll Plaza	18,377	18,425	17,433	17,426	18,073	18,150
			(0%)	(-5%)	(-5%)	(-2%)	(-1%)
Person Throughput	Golf Links Rd/98th Ave on-ramp to Keller Ave off-ramp	39,148	39,624	34,330	42,133	40,537	40,537
			(1%)	(-12%)	(8%)	(4%)	(4%)
	Edwards Ave on-ramp to Seminary Dr/SR-13 off-ramp	44,907	45,375	39,677	47,747	47,826	47,826
			(1%)	(-12%)	(6%)	(7%)	(7%)
	Fruitvale Ave on-ramp to Beaumont Ave off-ramp	50,913	50,854	47,526	52,230	53,109	53,755
			(0%)	(-7%)	(3%)	(4%)	(6%)
	Park Blvd on-ramp to Lakeshore Ave off-ramp	52,847	52,760	50,340	54,265	56,240	57,197
			(0%)	(-5%)	(3%)	(6%)	(8%)
	I-80/I-580 Split to Toll Plaza	32,070	34,641	36,491	35,805	34,508	36,027
			(8%)	(14%)	(12%)	(8%)	(12%)
VHD (vehicle-hours)		34,915	32,868	55,927	33,549	11,181	9,158
			(-6%)	(60%)	(-4%)	(-68%)	(-74%)
PHD (person-hours)		45,617	38,910	69,610	40,775	12,795	10,775
			(-15%)	(53%)	(-11%)	(-72%)	(-76%)
Average Travel Speed (mph)		28.2	30.3	13.7	27.5	49.7	52.1
			(7%)	(-52%)	(-3%)	(76%)	(85%)
Average Travel Time (minutes)		35.5	33.0	73.3	36.4	20.1	19.2
			(-7%)	(107%)	(3%)	(-43%)	(-46%)
Maximum Travel Time (minutes)		61.9	60.1	134.5	72.8	29.8	31.9
			(-3%)	(117%)	(18%)	(-52%)	(-48%)
Travel Time Index (TTI)		2.48	2.31	5.12	2.55	1.41	1.34
			(-7%)	(107%)	(3%)	(-43%)	(-46%)

Notes: Numbers presented in parenthesis show the percentage change for the alternative compared to No Build.

Table 5-2. Year 2023 Eastbound I-580 PM Study Period Measures of Effectiveness

MOE		Alternative				
		0	1B	1C	2A	2B
Vehicle Throughput	Oakland Ave/Harrison St on-ramp to Grand Ave off-ramp	38,241	29,232	36,257	41,501	43,697
			(-24%)	(-5%)	(9%)	(14%)
	Fruitvale Ave/Coolidge Ave on-ramp to 35th Ave off-ramp	40,860	33,204	38,599	43,018	45,789
			(-19%)	(-6%)	(5%)	(12%)
	SR-13/Seminary Ave on-ramps to Edwards Ave off-ramp	46,500	40,602	44,992	47,981	50,987
			(-13%)	(-3%)	(3%)	(10%)
Person Throughput	Oakland Ave/Harrison St on-ramp to Grand Ave off-ramp	43,743	38,094	46,196	50,348	52,767
			(-13%)	(6%)	(15%)	(21%)
	Fruitvale Ave/Coolidge Ave on-ramp to 35th Ave off-ramp	46,492	42,452	48,644	51,927	54,988
			(-9%)	(5%)	(12%)	(18%)
	SR-13/Seminary Ave on-ramps to Edwards Ave off-ramp	52,802	50,787	55,799	57,423	60,746
			(-4%)	(6%)	(9%)	(15%)
VHD (vehicle-hours)		43,401	68,871	46,641	30,002	19,590
			(59%)	(7%)	(-31%)	(-55%)
PHD (person-hours)		49,786	79,515	52,572	34,053	22,270
			(60%)	(6%)	(-32%)	(-55%)
Average Travel Speed (mph)		30.2	18.6	29.4	34.3	45.5
			(-38%)	(-3%)	(14%)	(51%)
Average Travel Time (minutes)		33.0	53.5	33.9	29.1	21.9
			(62%)	(3%)	(-12%)	(-34%)
Maximum Travel Time (minutes)		41.4	72.2	42.1	36.8	28.8
			(74%)	(2%)	(-11%)	(-30%)
Travel Time Index (TTI)		2.32	3.76	2.38	2.04	1.54
			(62%)	(3%)	(-12%)	(-34%)

Notes: Numbers presented in parenthesis show the percentage change for the alternative compared to No Build.

Table 5-3. Year 2023 Westbound I-580 AM Study Period Travel Times

Alternative	Average Travel Time (minutes)				Max Travel Time (minutes)			
	GP Lanes	% Change	Managed Lane	% Change	GP Lanes	% Change	Managed Lane	% Change
0	35				62			
1A	34	-5%	31	-13%	61	-1%	57	-8%
1B	80	125%	26	-27%	152	146%	33	-46%
1C	39	10%	18	-49%	81	32%	20	-68%
2A	20	-44%	18	-51%	33	-46%	26	-57%
2B	19	-47%	18	-50%	34	-46%	27	-57%

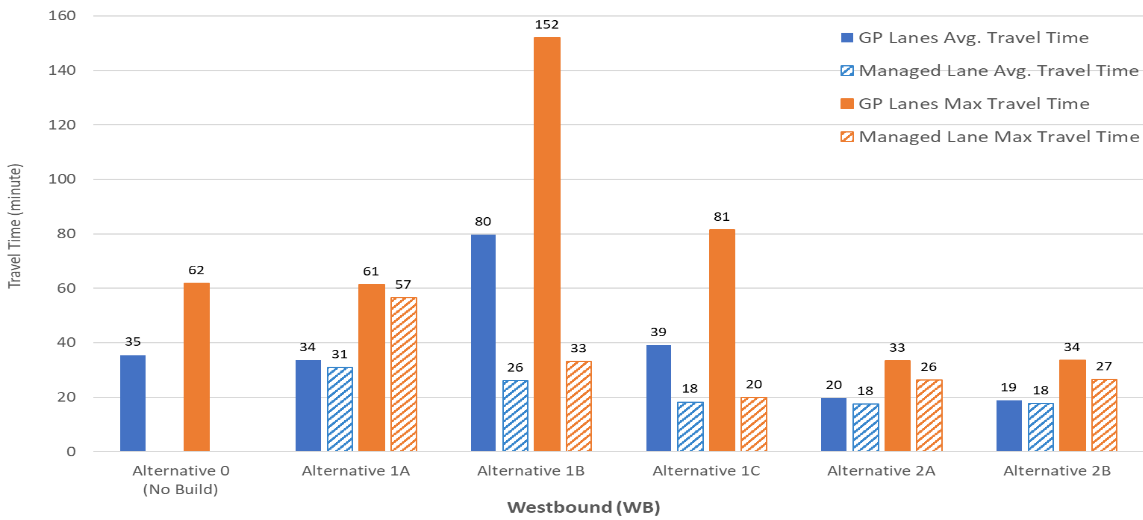
Notes: 1. Managed Lane travel time is the summation of travel times in the managed lane and in the general purpose lanes along the non-managed-lane sections for the alternative.
2. "% Change" shows the percentage change in travel time for the alternative compared to the general purpose Lane travel time in No Build.

Table 5-4. Year 2023 Eastbound I-580 PM Study Period Travel Times

Alternative	Average Travel Time (minutes)				Max Travel Time (minutes)			
	GP Lanes	% Change	Managed Lane	% Change	GP Lanes	% Change	Managed Lane	% Change
0	33				41			
1B	56	69%	31	-6%	74	80%	40	-4%
1C	38	14%	21	-37%	47	14%	23	-44%
2A	29	-11%	22	-33%	37	-10%	27	-35%
2B	22	-32%	18	-44%	30	-28%	20	-52%

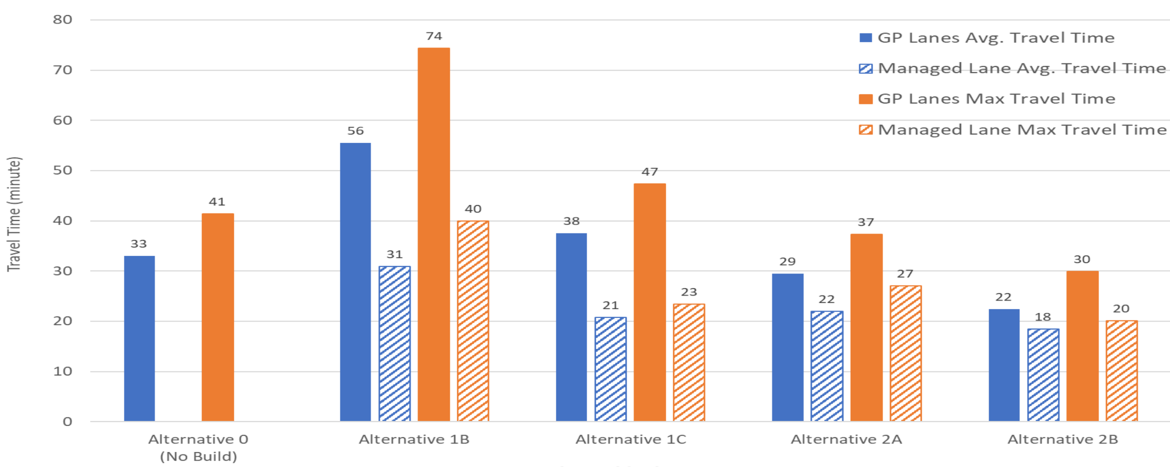
Notes: 1. Managed Lane travel time is the summation of travel times in the managed lane and in the general purpose lanes along the non-managed-lane sections for the alternative.
2 "% Change" shows the percentage change in travel time for the alternative compared to the general purpose Lane travel time in No Build.

Figure 5-2. Westbound I-580 Corridor Travel Times – General Purpose Lanes vs. Managed Lane



Note: Managed lanes are assumed to operate at or above 45 MPH to meet federal degradation requirements. Actual managed lane speeds may be lower depending on the adjacent general purpose lane speeds and the friction between the two types of lanes.

Figure 5-3. Eastbound I-580 Corridor Travel Times – General Purpose Lanes vs. Managed Lane



Note: Managed lanes are assumed to operate at or above 45 MPH to meet federal degradation requirements. Actual managed lane speeds may be lower depending on the adjacent general purpose lane speeds and the friction between the two types of lanes.

5.2.7.1 BUS ON SHOULDER (BOS)

BOS cannot be modeled directly in the FREEVAL models. To estimate bus speed along the BOS section under each BOS alternatives, an offline spreadsheet-based tool was developed following the steps below:

- Step 1: Extract the average and peak 15-minute speeds of general purpose lane segments from the FREEVAL model outputs where BOS is present.
- Step 2: Calculate bus speed on each segment using the BOS rules:
  - If the GP Lane speed is no less than 35 mph, the bus speed equals to the GP Lane speed. In other words, BOS is not activated and buses would stay in the general purpose lanes under this situation.
  - If the general purpose lane speed is less than 35 mph and greater than or equal to 25 mph, the bus speed is 35 mph. In this case, BOS is activated and buses would travel on the shoulder.
  - If the general purpose lane speed is less than 25 mph, the bus speed in calculated in two ways: 1) under the conservative scenario, bus speed equals to the general purpose lane speed plus 10 mph; 2) under the aggressive scenario, bus speed equals to 35 mph. In this case, BOS is activated and buses would travel on the shoulder.
- Step 3: Calculate the average and maximum travel time for buses along the BOS section.
- Step 4: Calculated travel time index for buses.

Table 5-9 and **Table 5-10** lists the westbound BOS performance for Alternative 3A and 3B, respectively.

- *For **Alternative 3A**, the average travel time for buses along the BOS section would be reduced by 13% to 14%, and the maximum travel time would be reduced by 20% to 22% when compared to using the general purpose lanes. The travel time index (TTI) would drop from 1.69 to 1.46, indicating improved travel time reliability for buses.*
- *For **Alternative 3B**, the average travel time for buses along the BOS section would be reduced by 17% to 18%, and the maximum travel time would be reduced by 41% to 56% when compared to using the general purpose lanes. TTI would drop from 1.96 to around 1.61, indicting improved travel time reliability for buses.*

Table 5-11 presents the eastbound BOS performance for Alternative 3A and 3B, which are the same scenario for the eastbound direction.

- *The average travel time for buses along the BOS section would be reduced by 17% to 19%, and the maximum travel time would be reduced by 37% to 49% when compared to using the general purpose lanes. TTI would drop from 2.02 to around 1.66, indicting improved travel time reliability for buses.*

Table 5-5. I-580 Westbound Bus-on-Shoulder Service Performance for Alternative 3A

	Average (5-11 AM)				Peak (8:15-8:30 AM)				Travel Time Index (TTI)
	Travel Time (Minutes)	Speed (mph)	Travel Time Savings (Minutes)	% Travel Time Savings	Travel Time (Minutes)	Speed (mph)	Travel Time Savings (Minutes)	% Travel Time Savings	
GP Lane	6.9	35.5	-	-	7.6	32.2	-	-	1.69
BOS - Conservative	6.0	41.0	0.9	**13%**	6.1	40.2	1.5	**20%**	1.46
BOS - Aggressive	6.0	41.1	1.0	**14%**	6.0	41.1	1.7	**22%**	1.46

Table 5-6. I-580 Westbound Bus-on-Shoulder Service Performance for Alternative 3B

	Average (5-11 AM)				Peak (8:15-8:30 AM)				Travel Time Index (TTI)
	Travel Time (Minutes)	Speed (mph)	Travel Time Savings (Minutes)	% Travel Time Savings	Travel Time (Minutes)	Speed (mph)	Travel Time Savings (Minutes)	% Travel Time Savings	
GP Lane	22.5	30.6	-	-	42.2	16.3	-	-	1.96
BOS - Conservative	18.6	37.0	3.9	**17%**	25.0	27.6	17.3	**41%**	1.62
BOS - Aggressive	18.5	37.3	4.0	**18%**	18.6	37.0	23.6	**56%**	1.61

Table 5-7. I-580 Eastbound Bus-on-Shoulder Service Performance for Alternative 3A and 3B

	Average (2-8 PM)				Peak (5:30-5:45 PM)				Travel Time Index (TTI)
	Travel Time (Minutes)	Speed (mph)	Travel Time Savings (Minutes)	% Travel Time Savings	Travel Time (Minutes)	Speed (mph)	Travel Time Savings (Minutes)	% Travel Time Savings	
GP Lane	12.4	29.7	-	-	20.5	18.0	-	-	2.02
BOS - Conservative	10.3	35.8	2.1	**17%**	12.9	28.5	7.5	**37%**	1.68
BOS - Aggressive	10.1	36.5	2.3	**19%**	10.4	35.3	10.0	**49%**	1.64

5.2.8 Summary of Alterative Assessment

The key findings from the alternative assessment are summarized below.

<u>**Westbound Direction**</u>:

- ***No Build*** *– For No Build, vehicle hours of delay would grow from 22,358 to 34,915 (56% increase) while the person hours of delay would grow from 30,351 to 45,617 (50% increase) when compared to the existing conditions in 2018. The average travel time would grow from 27.3 minutes in 2018 to 35.5 minutes in 2023 (30% increase), and the maximum travel time would increase from 39.7 minutes in 2018 to 61.9 minutes in 2023 (56% increase).*
- ***Alternative 1A*** *– Alternative 1A would reduce vehicle hours of delay by 6% and person hours of delay by 15% when compared to No Build. The average and maximum travel times of general purpose lanes would reduce by approximately 5% and 1%, respectively. The average and maximum travel times of the managed lane would reduce by 13% and 8%, respectively.*
- ***Alternative 1B*** *– Alternative 1B would result in 60% increase in vehicle hours of delay and 53% increase in person hours of delay when compared to No Build. The average and maximum travel times of general purpose lanes would increase by over 120%. However, the average and maximum travel times of the managed lane would decrease by 27% and 46%, respectively.*
- ***Alternative 1C*** *– Alternative 1C would result in a slight reduction (4%) in vehicle hours of delay and 11% reduction in person hours of delay when compared to No Build. The average and maximum travel times of general purpose lanes would increase by 10% and 32%, respectively. However, the average and maximum travel times of the managed lane would reduce by 49% and 68%, respectively.*
- ***Alternative 2A*** *– Alternative 2A would reduce both vehicle and person hours of delay by about 70% when compared to No Build. The average and maximum travel times of general purpose lanes would reduce by approximately 45%. The average and maximum travel times of the managed lane would reduce by 51% and 57%, respectively.*
- ***Alternative 2B*** *– Alternative 2A would reduce both vehicle and person hours of delay by about 75% when compared to No Build. The average and maximum travel times of general purpose lanes would reduce by approximately 46%. The average and maximum travel times of the managed lane would reduce by 50% and 57%, respectively.*
- ***Alternative 3A*** *– Alternative 3A would reduce the average travel time for buses along the BOS section by 13% to 14% and the maximum travel time by 20% to 22% when compared to the general purpose lanes.*
- ***Alternative 3B*** *– Alternative 3B would reduce the average travel time for buses along the BOS section by 17% to 18% and the maximum travel time by 41% to 56% when compared to the general purpose lanes.*

<u>**Eastbound Direction:**</u>

- ***No Build*** *– For No Build, vehicle hours of delay would grow from 19,953 to 43,401 (118% increase) while the person hours of delay would grow from 22,858 to 49,786 (118% increase) when compared to the existing conditions in 2018. The average travel time would grow from 27.2 minutes in 2018 to 33 minutes in 2023 (21% increase), and the maximum travel time would increase from 34.9 minutes in 2018 to 41.4 minutes in 2023 (19% increase).*
- ***Alternative 1B*** *– Alternative 1B would result in 59% increase in vehicle hours of delay and 60% increase in person hours of delay when compared to No Build. The average and maximum travel times of general purpose lanes would increase by 69% and 80%, respectively. However, the average and maximum travel times of the managed lane would decrease by 6% and 4%, respectively.*

- ***Alternative 1C*** *– Alternative 1C would result in about 7% increase in vehicle and person hours of delay when compared to No Build. The average and maximum travel times of general purpose lanes would increase by about 14%. However, the average and maximum travel times of the managed lane would reduce by about 40%.*
- ***Alternative 2A*** *– Alternative 2A would reduce both vehicle and person hours of delay by about 31% when compared to No Build. The average and maximum travel times of general purpose lanes would reduce by approximately 10%. The average and maximum travel times of the managed lane would reduce by about 34%.*
- ***Alternative 2B*** *– Alternative 2B would reduce both vehicle and person hours of delay by about 55% when compared to No Build. The average and maximum travel times of general purpose lanes would reduce by about 30%. The average and maximum travel times of the managed lane would reduce by 44% and 52%, respectively.*
- ***Alternative 3A/3B*** *– Alternative 3A/3B would reduce the average travel time for buses along the BOS section by 17% to 19% and the maximum travel time by 37% to 49% when compared to the general purpose lanes.*

Graphical representations of forecasted traffic conditions for each of the modeled alternatives can be found in **Appendix F**.

6.0 Conclusions and Recommendations

6.1 Preliminary Construction Cost Estimates

High-level construction cost estimates were developed for the I-580 mainline alternatives that exhibited promising or favorable modeling results as described in the previous section – these being Alternatives 1A, 1C, 2, and 3A. Alternative 1B was not advanced as modeling results indicated substantial and unacceptable impacts to General Purpose lanes as a consequence of the strategy. Based on 2019 dollars, **Table 6-1** includes the total high-level construction cost estimate ranges for Alternatives 1A, 1C, 2, and 3A. It is important to note that these figures do not account for additional services or contingencies, such as support costs, development costs, escalation, or other complementary improvements that may be required to obtain mode shift goals.

Table 6-1. High-Level Cost Estimate Ranges for Mainline Improvements

Mainline Improvements		Construction Cost Estimate Range – 2019 Dollars *(in millions)*
Alternative 1A	HOV Lane Extension (Westbound only)	$4 to $6
Alternative 1C	General Purpose Lane to Express Lane Conversion	$70 to $90
Alternative 2	Contra-flow HOV/Express Lane	$100 to $130
Alternative 3A	Bus-on-Shoulder	$40 to $50

In addition to the total construction cost estimates indicated in **Table 6-1**, Alternatives 2 and 3A have other cost considerations. With regards to the overall construction cost estimate for Alternative 2, this value can be halved to approximate an estimate that may apply to an option to implement a contraflow lane in one direction only. Therefore, while the total construction cost estimate for Alternative 2 is shown as $100 - $130 million, if only one direction (westbound or eastbound) is desired for advancement, the approximate construction cost estimate for this improvement can be roughly represented as $50 - $65 million.

Similarly, the overall construction cost estimate for Alternative 3A can be split to produce a more versatile bus-on-shoulder costing rate in the form of a cost-per-mile statistic. A general “per mile” construction cost estimate of around $4 - $5 million per mile would indicate the approximate overall cost of a bus-on-shoulder project of variable length along the corridor.

6.2 Projects Recommended to Move Forward

6.2.1 Mainline Operations

When considering the evaluated mainline alternatives, two are proposed by the DAA to be considered for project delivery:

6.2.1.1 PROJECT 1: I-580 WESTBOUND HOV LANE EXTENSION (ALTERNATIVE 1A)

The first recommended project includes the westbound general purpose lane conversion from PM 45.4 to PM 46.7 to an HOV3+/Bus-Only lane. This lane would have operating hours that mirror the operating hours for the SFOBB Toll Plaza, i.e., Monday through Friday between 5:00 AM and 10:00 AM and between 3:00 PM and 7:00 PM. Project 1 assumes standalone operational benefits for westbound buses, and yet does not preclude other projects from advancement. Project 1 also assumes a short-term implementation schedule and lower costs (when compared to other project recommendations). **Figure 6-1** on the following page illustrates the elements of Project 1 and **Appendix G** includes a more detailed exhibit. **Figure 6-2** and **Table 6-2** present an additional summary of traffic analysis results for Alternative 1A (Year 2023, includes a 2% expected mode shift).

Figure 6-2. Alternative 1A: I-580 Westbound Person Throughput at Toll Plaza

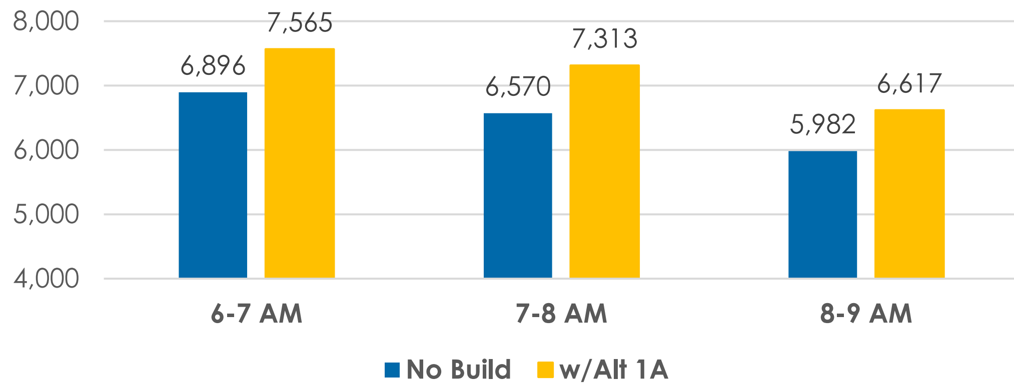


Table 6-2. Alternative 1A: AM Peak Period Average Travel Time – Entire Corridor (minutes)

No Build	35	
Alternative 1A	GP	HOV
	34	31
Travel Time Difference	-1	-4

Note: HOV lane is assumed to operate at or above 45 MPH.

Figure 6-1. Alternative 1A

6.2.1.2 PROJECT 2: I-580 GENERAL PURPOSE LANE CONVERSION TO EXPRESS LANE (ALTERNATIVE 1C)

The second recommended project includes a general purpose lane conversion to Express Lane. In the eastbound direction, the conversion limits would span from PM 45.2 to PM 32.0. In the westbound direction, the limits would span from PM 32.0 to PM 44.5. The hours of operation would be determined by the express lane operator, assumed to be Alameda CTC. **Figure 6-3** on the following page illustrates the elements of Project 2 and **Appendix H** includes a more detailed exhibit. **Figure 6-3, Figure 6-4, Table 6-3,** and **Table 6-4** present an additional summary of traffic analysis results for Alternative 1C (Year 2023, includes an 8% expected mode shift).

Figure 6-4. Alternative 1C: I-580 Westbound Person Throughput at Lakeshore Ave

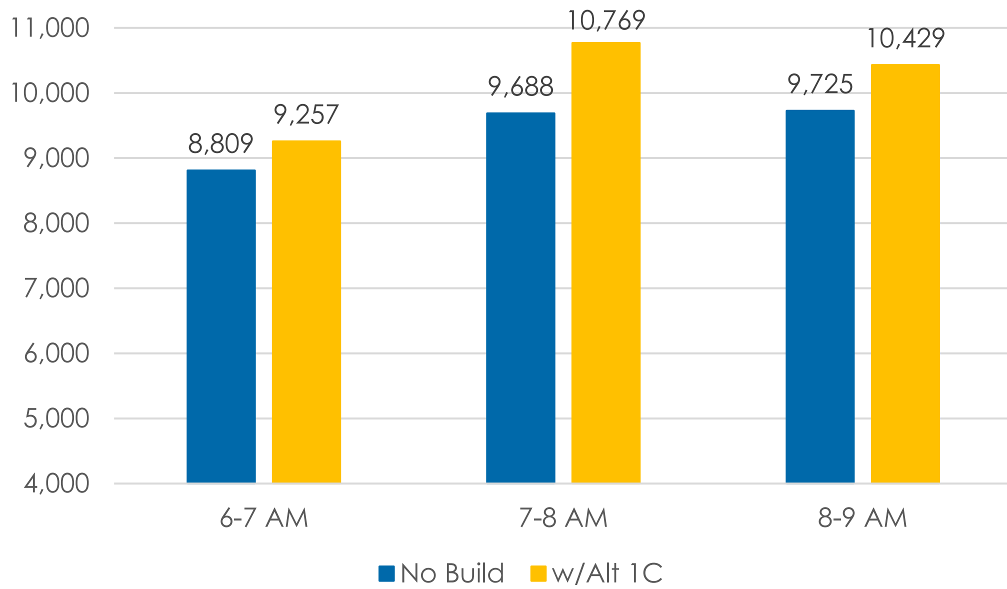


Table 6-3. Alternative 1C: AM (WB) Peak Period Average Travel Time – Entire Corridor (minutes)

No Build	35	
Alternative 1C	**GP**	**HOV**
	39	18
Travel Time Difference	+4	-17

Note: HOV/Express lane is assumed to operate at or above 45 MPH. Includes time savings from Alt 1A.

Figure 6-3. Alternative 1C

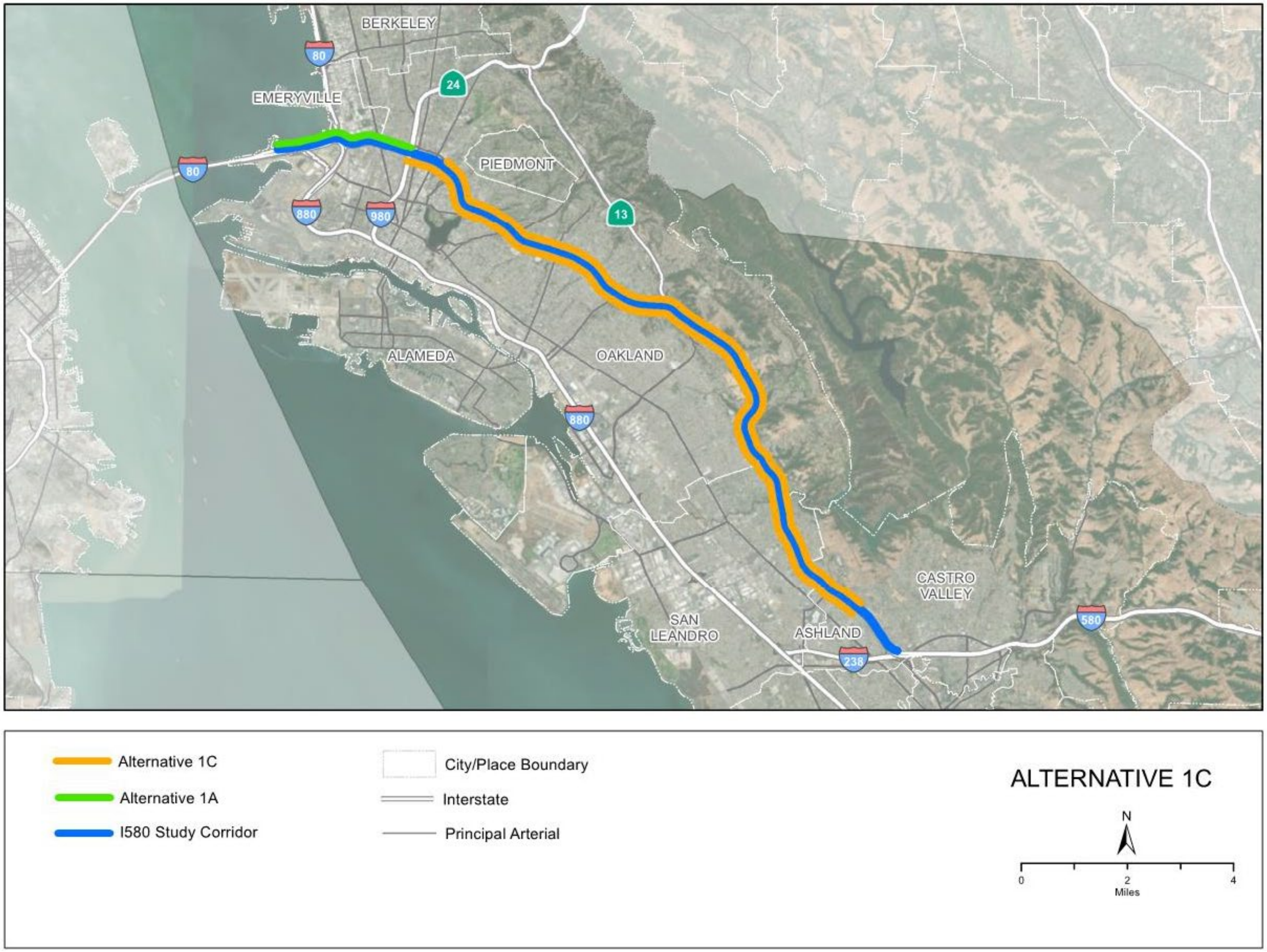


Figure 6-5. Alternative 1C: I-580 Eastbound Person Throughput at Edwards Ave

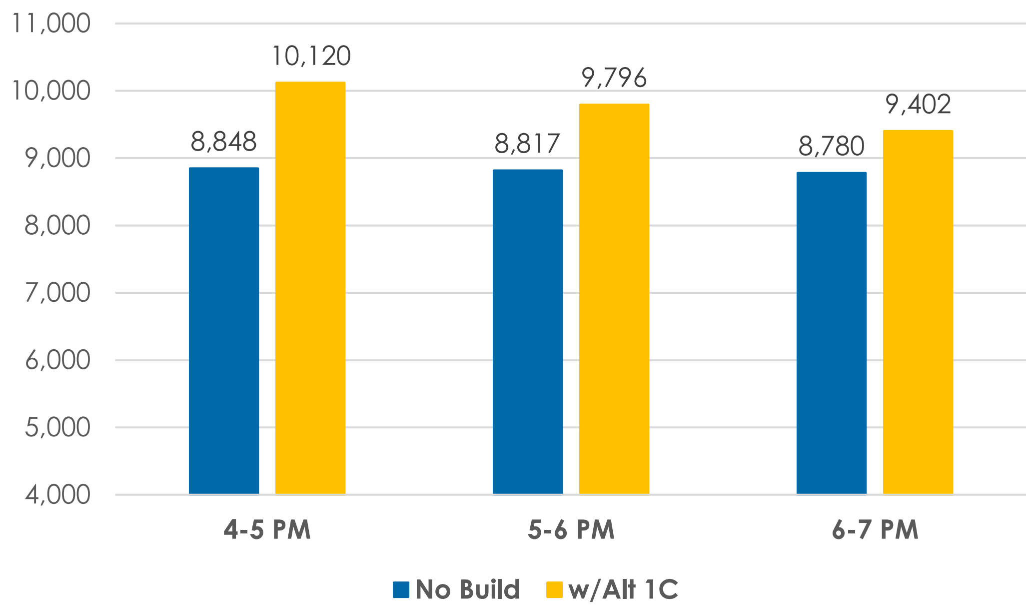


Table 6-4. Alternative 1C: PM (EB) Peak Period Average Travel Time – Entire Corridor (minutes)

No Build	33	
Alternative 1C	GP	HOV
	38	21
Travel Time Difference	+5	-12

Note: HOV/Express lane is assumed to operate at or above 45 MPH.

6.2.1.3 REASONS FOR NOT RECOMMENDING CONTRA FLOW LANES AND BOS FOR PROJECT DELIVERY

The Contra Flow Lane, Alternative 2, includes a relatively high price tag, largely attributed to the procurement of specialized equipment and costs supporting operations and maintenance throughout the strategy's lifetime. Additionally, there are many risks associated with design standard approvals for non-standard features such as modifications to stopping sight distance, negligible (if any) shoulder width, and insufficient horizontal clearance to objects. Furthermore, the alternative exhibits negative operational impact to the off-peak direction when operating in the EB direction. For these reasons, the DAA concludes that implementing a contra flow lane only in the westbound direction would not be a prudent use of funds and the Alternative would likely not gain approval in PA&ED from Caltrans for safety considerations when comparing other viable alternatives.

The BOS part-time use lanes, Alternative 3, have substantial costs associated with upgrading the pavement structural section and shoulder width. Due to these costs and the relative travel time savings associated with the proposed Alternative, the DAA has determined that advancing the alternative further into project delivery is not warranted. Although the investments into the shoulder areas would benefit the corridor for the short and long-term transit needs, current legislation only allows BOS projects to operate as a pilot program. If other regional corridors implement BOS and the concept is deemed successful along with passage of legislation for permanent implementation, it would be worth reconsidering the I-580 corridor for BOS improvements. However, the current landscape does not warrant the investment into the shoulders for a pilot-level project.

6.2.2 Complementary Improvements

As indicated in **4.3 Complementary Strategies**, there is a variety of supplemental strategies aimed to improve transit travel, mode shift, and overall person throughput in order to achieve the established goals. It is recommended to add these strategies in conjunction with the final proposed set of mainline improvements for optimal effect and performance.

Arterial Improvements – Operational and transit improvements to parallel arterials all along the corridor, particularly to MacArthur Boulevard, so that transit travel along the arterial can be faster and reliable for both local and Transbay trips as buses can get to the freeways quickly. Additionally, it would provide safe access to bikes and pedestrians to bus transit.

Transit Improvements – Improvements to AC Transit Transbay bus service, including proposing new express bus options.

Park and Ride Improvements – Reviewing available public and private spaces that can serve as park and ride lots to better facilitate carpooling and transit ridership for improved person throughput.

Appendices

Appendix A. Existing Conditions Memorandum

Appendix B. Traffic Analysis Alternatives

Appendix C. Model Calibration Results

Appendix D. Traffic Demand Forecast

Appendix E. Speed Contour Maps

Appendix F. Modeled Traffic Conditions

Appendix G. Alternative 1A Exhibit

Appendix H. Alternative 1A and 1C Exhibit