

# US-101 Express Bus Feasibility Study

## FINAL REPORT

November 2018



This project has been made possible by a grant from the California Department of Transportation and a grant from the Regional Planning grantmaking strategy of Silicon Valley Community Foundation.



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# ACKNOWLEDGEMENTS

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EXECUTIVE  
SUMMARY

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# EXECUTIVE SUMMARY

## Background

US-101 provides north-south vehicular connectivity in the San Francisco Bay Area and beyond. With the goals of improving long-haul mobility options and increasing the person throughput of US-101, San Mateo County Transit District (SamTrans) initiated the US-101 Express Bus Feasibility Study (the Study) to examine the financial and operational feasibility of a network of long-distance express buses operating in the US-101 corridor through San Mateo County, potentially integrated with proposed managed lanes.

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### EXPRESS BUS SERVICE

Express bus service typically offers point-to-point service to key commuter destinations during peak periods, making fewer stops and often operating at higher frequencies than local bus services.

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The Study considers north-south travel within San Mateo County and between San Mateo, San Francisco, and Santa Clara counties. The Study area, shown in Figure 2, spans more than 60 miles in length. Along the US-101 corridor, the counties of San Francisco, San Mateo, and Santa Clara are home to estimated 3.6 million people and 2.1 million jobs. Today, US-101 is one of the most congested corridors in the Bay Area. The freeway experiences moderate to heavy bi-directional traffic congestion through much of San Mateo County during the peak periods.

BART and Caltrain trains are at or over capacity during the peak periods. Public bus ridership in the study corridor has declined in recent years while privately-operated transportation services continue to proliferate.

The multi-faceted and multi-modal nature of the issues requires a diversified set of strategies spanning various modes. Several major projects will significantly improve throughput capacity and intermodal connectivity in the study area. To find a solution to the growing congestion and associated delays on US-101, the counties of San Francisco, San Mateo, and Santa Clara are evaluating or planning managed lanes on segments of US-101 within their jurisdiction. The proposed managed lanes would utilize operational strategies such as dynamic pricing and lane restrictions in response to changing conditions in real time.

SamTrans undertook a US-101 Proof of Concept (PoC) Study to analyze the unconstrained ridership potential of express bus services operating in high occupancy vehicle (HOV) managed lane on US-101 in San Mateo County and into both Santa Clara and San Francisco counties. The results from the study demonstrate that express bus routes can be designed to take advantage of faster travel speeds and improved travel times in the heavily congested US-101 corridor to produce ridership as well as mode split and increase person throughput in the corridor.

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## Project Purpose and Need

SamTrans operated a network of express bus services in the Study area until most service was cut around the time of the Great Recession in 2009. This US-101 Express Bus Feasibility Study is the next stage of the analysis to examine the viability of re-introducing a network of express bus routes on the Peninsula.

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### PROJECT PURPOSE

The purpose of the project is to provide a direct, fast, frequent and reliable choice of transportation for long distance commute trips within and between San Francisco, San Mateo and Santa Clara counties.

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The need is driven by a variety of land use challenges and transportation deficiencies including a jobs-housing imbalance spurred by employment opportunities and residential population growth and distribution, a lack of transportation connectivity, and limited availability of travel options along the Study corridor. It is vital to implement equity programs in concert with the managed lanes such that lower-income households benefit from both reduced congestion and increased transit investments from pricing revenues.

## Project Goals

The following project goals were developed based on the baseline conditions analysis, project purpose and needs, and public and stakeholder engagement.

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### PROJECT GOALS

Goal 1: Provide Mobility Options for Regional Trips

Goal 2: Increase Transit Market Share in the Corridor

Goal 3: Develop a Cost-effective Solution

Goal 4: Improve Transportation Equity

Goal 5: Enhance Access to Jobs and Population Centers

Goal 6: Support Sustainable Land Use and Transportation Policies

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## Market Analysis

One of the early activities of the Study was to assess the existing and potential market for express bus service in the study area. Nearly 1.4 million vehicle person trips (VPT) occur during the AM peak period within or between San Francisco, San Mateo, and Santa Clara counties. Most trips in the study area occur within the same county. Of the inter-county trips, about equal flows occur between San Francisco and San Mateo Counties and between Santa Clara and San Mateo counties. While there is substantial variation in commute times, most commutes are short in duration.

The market analysis considered two types of express bus services in the study area: limited service and express service. Limited services are freeway-based routes that serve origins and destinations throughout a corridor with intermediate stops (within the freeway or on parallel streets), while express services typically serve distinct clusters of origins and destinations without intermediate stops.

## Route Concepts

The travel market analysis identified 12 travel markets, including eight bidirectional markets and four one-directional markets. A total of 15 initial route concepts were developed based on the identified travel markets. The proposed route concepts are grouped by service characteristics into three categories.

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### INITIAL ROUTE CONCEPTS

#### Bidirectional Limited Stop Services

- Route 1 - San Bruno to/from Palo Alto
- Route 2 – San Bruno to/from Sunnyvale

#### Bidirectional Express Services

- Route 3 – San Francisco to/from Foster City
- Route 4 – San Francisco to/from Redwood Shores
- Route 5 – Foster City to/from Palo Alto
- Route 6A – Daly City BART to/from Palo Alto
- Route 6B – Western San Francisco to/from Palo Alto
- Route 7 – Redwood City to/from Sunnyvale
- Route 8 – Western San Francisco to/from San Mateo

#### One-directional Express Services

- Route 9 – Sunnyvale to Foster City
  - Route 10 – Sunnyvale to San Francisco
  - Route 11 – Burlingame to San Francisco
  - Route 12 – San Mateo to San Francisco
  - Route 13 – San Carlos/Belmont to San Francisco
  - Route 14 – Palo Alto to San Francisco
- 

## Screening and Evaluation

A two-step screening and evaluation methodology employing the strengths of both newer rapid analysis tools and the traditional travel demand model was established to develop and assess routes that meet the project's goals. A set of criteria was established in order to evaluate the route concepts side by side. Criteria were aligned with one of the project goals and each criterion was used during the initial screening process, detailed evaluation, or both. The full set of criteria is shown in Table 4 in Chapter 5.

An initial set of 15 route concepts were narrowed down to a shorter list of 10 route alternatives during the initial screening process. These 10 shortlisted routes were included in the detailed evaluation process. The detailed evaluation revealed a set of six top-performing routes which met the project goals, with special emphasis on the cost-effectiveness goal, which was determined to be of utmost importance when considering which routes to recommend. The routes were evaluated using 17 evaluation criteria using data points available from the travel demand model. The detailed evaluation and route refinement process are described in more detail in Chapter 5.

## Route Recommendations

The six top-performing routes out of the detailed evaluation are shown on the following page.

## ROUTE RECOMMENDATIONS

- Route 3 (Foster City to/from downtown San Francisco)
- Route 6 (Palo Alto to/from Western San Francisco)
- Route 2 (limited stop San Bruno BART to/from East Palo Alto)
- Route 12 (San Mateo to downtown San Francisco via park-and-ride)
- Route 8 (San Mateo to/from Western San Francisco)
- Route 11 (Burlingame to downtown San Francisco)

FIGURE ES 1: ROUTE RECOMMENDATIONS



## Phasing Plan

This Study recommends implementation of express bus service in three phases. The recommended phasing plan introduces and expands express bus service in the Study area over five years.

- **Phase 1 (Pilot project)** - There is an opportunity to introduce two recommended express bus routes in the immediate future, tentatively Summer 2019. Routes 3 and 6 would be implemented in this phase. This initial service could be rolled out with minimal infrastructure improvements and using existing SamTrans buses retrofitted to provide amenities. Once zero emission electric buses are procured and charging infrastructure is installed, the service could be transitioned to electric buses.
- **Phase 2 (with Managed Lanes Launch)** - Some of the recommended routes would benefit from the availability of managed lanes to offer competitive alternatives to private automobiles or existing transit services in the study area. Therefore, these routes – Routes 2 and 12 – would be implemented in coordination with the delivery of managed lanes on US-101 anticipated by 2022. The timeline of managed lanes provides an opportunity to procure zero emission vehicles and associated infrastructure and to improve the US-101/CA-92 park-and-ride lot.
- **Phase 3 (Future Growth)** - In addition to the routes included in earlier phases of implementation, some other routes serving focused markets may benefit from mature express bus services in the study area and from strategic partnerships. Routes 8 and 11 could be implemented after the first two

phases have been implemented or when such partnerships are realized. These routes could also be operated with or transition to zero emissions vehicles.

## Funding and Financing Strategies

Operating and Maintenance (O&M) and capital cost assumptions are based on the assumed operating plan for the six proposed Express Bus routes. The total estimated annual O&M cost for the full network of six routes is \$16.5 million per year. The total estimated capital cost is \$55.6 million inclusive of purchase of 40 electric vehicles to operate the entire network, professional services to support infrastructure projects, and a 30 percent contingency on all capital expenses. Descriptions of cost assumptions and related calculations are described further in Chapter 6, including a breakdown of cost by phase.

SamTrans was awarded \$15 million in capital funds through grants from state and federal agencies. SamTrans has developed four high-level funding strategies to identify the remaining funding needed.

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### FUNDING AND FINANCING STRATEGIES

Strategy 1 – Seek additional state, regional and local funding

Strategy 2 – Pursue federal grant funding and financing

Strategy 3 – Utilize farebox and toll revenues for operations and project financing

Strategy 4 – Explore value capture and public/private contributions

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## Moving Forward

As elected officials and agency staff from San Francisco, San Mateo, and Santa Clara counties advance the planning and implementation of public express service in the Study area, considering the following findings from the Study can help guide the next steps.

- **Work together with partner agencies in the Study area** to successfully build support and pursue potential funding for the implementation of express bus service.
- **Create a more detailed funding strategy** to leverage regional, state, and federal funds and refine the operating and capital cost estimates.
- **Determine a fare structure for express bus service** to ensure equitable distribution of associated benefits through the ongoing SamTrans Fare Study.
- **Develop partnerships with public and private entities** to jump-start plans for implementing express bus services.
- **Examine the existing SamTrans local route network** for opportunities to align with new express routes.
- **Retrofit existing fleet** to offer comfort and technological amenities which may include Wi-Fi, plugs, tables, and high-back seats.
- **Launch pilot express bus service** to lay the foundation and field-test the service for a positive rider experience.
- **Plan for infrastructure to support zero emission vehicles** to realize significant environmental benefits of express bus service.
- **Expand the network of park-and-ride facilities** to improve access to express bus services.
- **Seek opportunities to maximize impact of managed lanes projects** in San Mateo and San Francisco counties for express bus services.
- **Stay nimble in changing times** to spot opportunities to adjust and improve service in response to changes in land use, Caltrain service, and private express bus services.

A close-up photograph of the front of a white and blue bus. The bus has a white upper body and a blue lower body. The number '400' is printed in black on the white bumper area. There are several headlights and a fog light visible. A blue sticker is on the windshield. The background shows a street and a building.

01

INTRODUCTION

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# 1. INTRODUCTION

## 1.1. OVERVIEW

US-101 provides north-south vehicular connectivity through San Mateo County and throughout the San Francisco Bay Area and beyond. Over the years, traffic congestion on US-101, particularly during weekday commute periods, has intensified. Commuters in single occupancy vehicles, carpools, buses, and shuttles all contend with long and unpredictable travel times when making trips on the corridor.

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### SAMTRANS

San Mateo County Transit District (SamTrans) is the administrative body for the principal public transit and transportation program in San Mateo County. SamTrans operates local bus service throughout San Mateo County and parts of San Francisco and Palo Alto.

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As one way of addressing this, the San Mateo County Transit District (SamTrans) initiated the US-101 Express Bus Feasibility Study (Study) to examine the financial and operational feasibility of a network of long-distance express buses operating in the US-101 corridor through San Mateo County, potentially integrated with proposed managed lanes (described further in Section 1.4).

The Study was led by SamTrans and funded by the California Department of Transportation

(Caltrans) and Silicon Valley Community Foundation. Throughout the Study, SamTrans staff worked collaboratively with planning and transportation agencies from San Mateo County, Santa Clara County, and San Francisco County, as well as regional agencies.

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### EXPRESS BUS SERVICE

Express bus service typically offers point-to-point service to key commuter destinations, making fewer stops and sometimes operating at higher frequencies than traditional bus services.

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Making use of proposed managed lanes on US-101 provides an opportunity to overcome common challenges faced by buses such as slower speeds, lack of competitive travel times, and unreliability compared to fixed rail services like BART and Caltrain. Given the distance between the US-101 corridor and the BART and Caltrain corridors in many parts of the Study area, an opportunity exists to capture an untapped transit market of employees without access to private express bus services.

Presently, SamTrans provides limited bus service on the US-101 corridor through Route 398, which serves approximately 600 passengers daily. SamTrans previously operated express bus services connecting Peninsula residents with jobs

in San Francisco. Popular in the 1990s and early 2000s, express bus ridership declined after implementation of the BART extension to the San Francisco International Airport (SFO) and Millbrae in 2003 and the introduction of Caltrain's express (Baby Bullet) service in 2004. Ridership then grew slightly until the Great Recession in 2008. However, since many of the express routes were eliminated around the Great Recession in 2009, significant growth in population and employment has occurred in the Study area. The recent proliferation of private express bus service in the study corridor is also indicative of the underlying unmet long-haul transit need and opportunity for similar express bus service in the public domain.

Today, US-101 is one of the most congested corridors in the Bay Area. The freeway experiences moderate to heavy bi-directional traffic congestion through much of San Mateo County during the peak periods. BART and Caltrain trains are at or over capacity during the peak periods. Public bus ridership in the study corridor has declined in recent years.

This Study describes the team's work to develop new long-haul transit options aimed at strengthening transit connectivity to job and housing hubs and improving the operational performance of transit in one of the most congested corridors in the region. It focuses on north-south commute trips generally greater than ten miles in length along the US-101. It identifies key regional travel markets, develops conceptual operating plans, forecasts ridership, identifies infrastructure needs, estimates capital and operating costs, and lists potential funding sources.

The funding and implementation strategy outlined in Chapter 6 provides a framework for

SamTrans and its partner agencies and stakeholders to better position projects for transportation funding and to leverage outside funding sources. The results of the Study are intended to serve as a resource for SamTrans and its project partners to potentially implement long-distance express bus service in concert with other improvements and transportation demand management initiatives to meet the future transportation demands in the US-101 corridor.

## 1.2. STUDY PROCESS

The Study builds upon findings from the US-101 Express Bus Proof of Concept (PoC) study to examine the financial and operational feasibility of a network of long-distance express buses operating on US-101. SamTrans conducted an initial assessment of potential markets for express bus service, and identified a set of initial route concepts. The route concepts were screened down to a shortlist of potential routes based on criteria developed from project goals and objectives. A detailed evaluation, incorporating route refinements and travel demand model results, was then performed to identify recommended routes.

Preliminary cost and revenue estimates were prepared and refined to provide a relative comparison between the routes. An implementation plan and funding strategy was then prepared to introduce and expand the express bus service over time. Throughout the duration of the project and prior to the development of this Final Report, community and stakeholder input was sought and presentations were made to the Project Technical Advisory Committee and SamTrans Board. [Figure 1](#) on the following page summarizes the Express Bus Feasibility Study process and schedule.

**FIGURE 1: STUDY PROCESS AND SCHEDULE**



### 1.3. STUDY AREA

The Study considers north-south travel and between San Mateo, San Francisco, and Santa Clara counties. The Study area, shown in Figure 2, spans more than 60 miles in length. The study focuses on north-south commute trips generally greater than 10 miles in length along the US-101 corridor within San Mateo County, between San Mateo County and San Francisco or Santa Clara

Counties, or between San Francisco and Santa Clara Counties via San Mateo County.

#### KEY FINDINGS

- The US-101 corridor under study is home to over 3.5 million people and over two million jobs.
- Caltrain closely parallels US-101 along much of the study corridor within approximately 0.5 to 1.5 miles. Caltrain is generally less convenient for some dense areas east of US-101 in San Mateo County.
- An extensive network of private express buses serve major technology employers that are located farther from Caltrain and BART stations, especially in areas east of US-101.
- Communities of Concern underserved by existing or planned regional transit services include eastern San Mateo along US-101, eastern Redwood City and North Fair Oaks along US-101, East Palo Alto and eastern Menlo Park along US-101, southeastern San Jose along US-101, and western San Jose along I-280.

#### 1.3.1. Transportation Context

The Study area is served by five primary regional and local transit operators (see Figure 3), along with several specialized transit service providers.

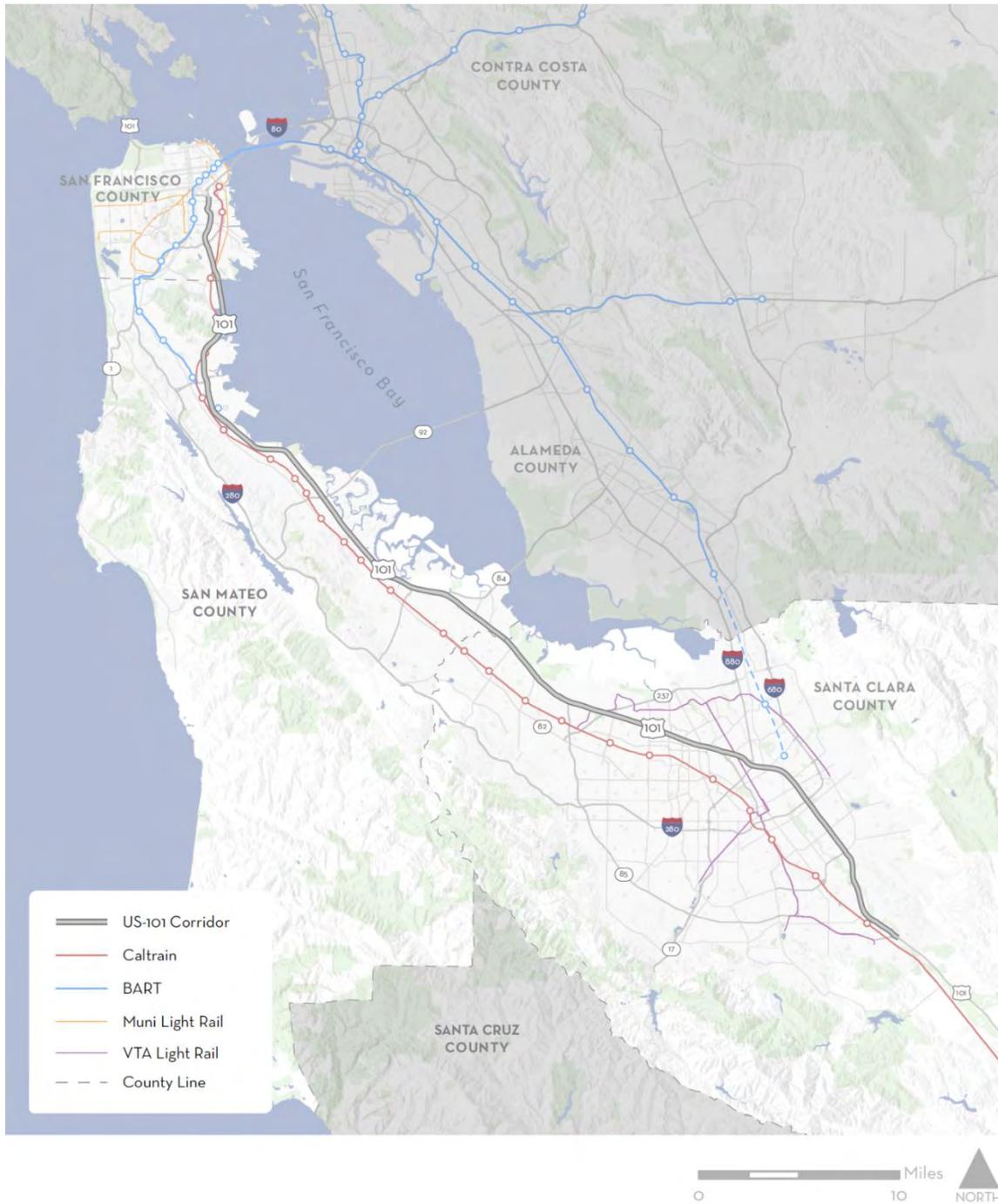
SamTrans operates local bus service throughout San Mateo County and parts of San Francisco and Palo Alto. San Francisco Municipal Transportation Agency (SFMTA) operates bus and light rail service in San Francisco and northern Daly City. Santa Clara Valley Transportation Authority (VTA) operates local and express bus service, as well as light rail service, within Santa Clara County and parts of

Fremont. Caltrain provides fixed rail service between San Francisco and Gilroy serving San Francisco, San Mateo, and Santa Clara counties. Caltrain closely parallels US-101 throughout the Study area and operates 92 weekday trips as either local, limited, or bullet trains. Finally, Bay Area Rapid Transit (BART) provides rail transit service between San Francisco, northern San Mateo County, and the East Bay.

Several agencies operate regional rail and express bus services connections in the Study

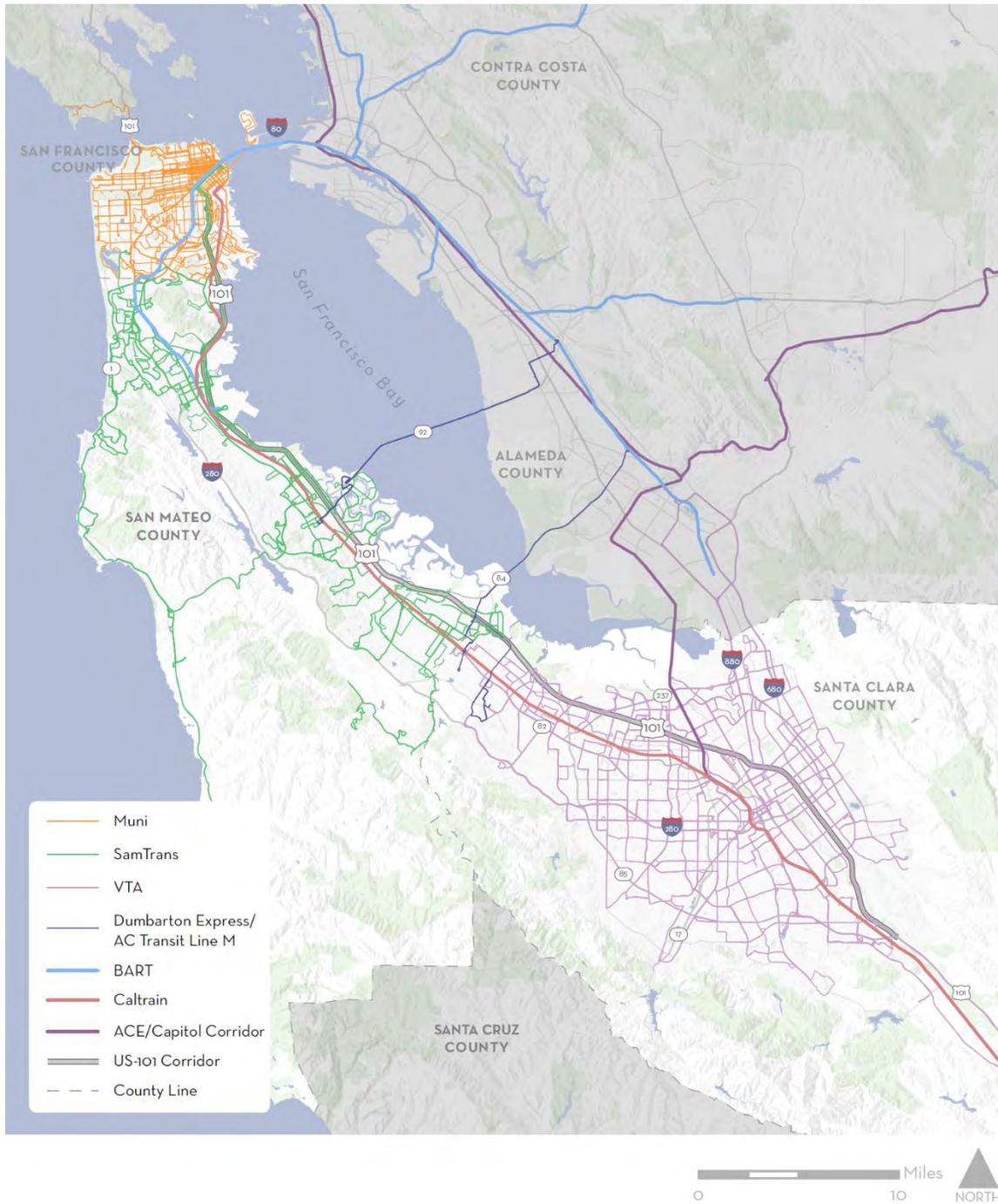
corridor. SamTrans currently operates one route using US-101, Route 398. The former KX and the current 398 were combined in August 2018. The Peninsula Traffic Congestion Relief Alliance ([commute.org](http://commute.org)) administers first-/last-mile shuttle routes in San Mateo County connecting BART and Caltrain stations with employment areas. Several cities, institutions, and employers also operate first-/last-mile shuttles, some of which are open to public while others are open to employees and affiliates only.

**FIGURE 2: US-101 EXPRESS BUS FEASIBILITY STUDY AREA**



Source: Fehr & Peers, 2017

**FIGURE 3: TRANSIT SERVICES, 2017**



Source: Fehr & Peers, 2017

## LEARNING FROM PAST SAMTRANS EXPRESS BUS SERVICE

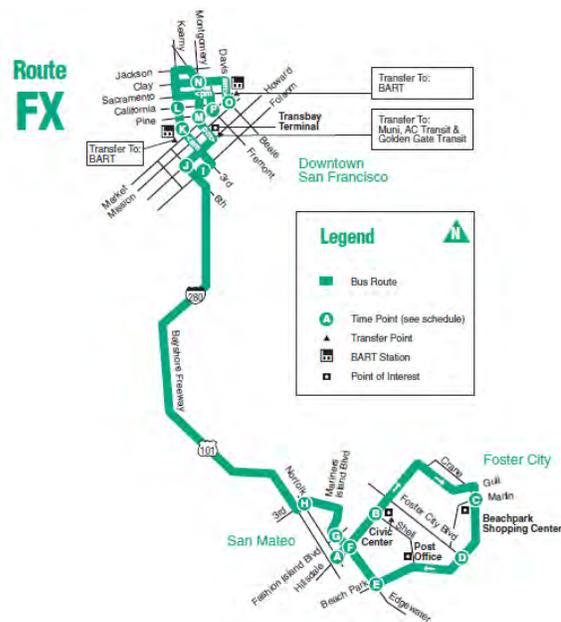
In 2008, SamTrans provided six express bus routes along the US-101 corridor which garnered about 3,200 daily boardings. One route (KX) provided all day bidirectional service between San Francisco and the Peninsula, while five routes (FX, MX, PX, NX, and RX) provided service during the AM and PM peak periods. Two routes, the CX and DX, also served trips from Pacifica to the Colma BART Station and Downtown San Francisco.

Standard express bus fares between the Peninsula and San Francisco were \$4.00. The KX and FX, which accounted for most express bus service, operated at 20- to 25-minute frequencies during the peak periods.

SamTrans' express buses served three distinct regional travel markets: Peninsula cities to San Francisco (approximately 1,300 weekday riders), Peninsula to SFO (approximately 300 daily riders), and San Francisco to SFO (approximately 200 daily riders). In addition, approximately 1,400 passengers used the KX route for local travel along El Camino Real between Palo Alto, Redwood City, and San Mateo.

Despite fares that were comparable or more affordable than BART and Caltrain, express bus service was far less productive, accounting for about four percent of all transit trips between San Francisco and the Peninsula. Buses averaged an occupancy rate under 50 percent and were costlier per passenger to operate than SamTrans' local bus service.

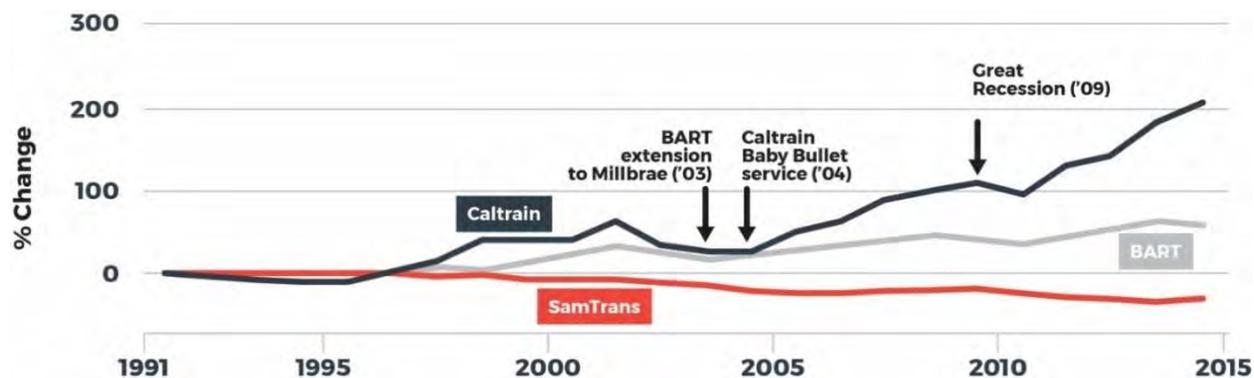
FIGURE 4: FORMER FX ROUTE MAP



Express bus service was less productive compared to Caltrain and BART service due to several challenging factors:

- Low service levels: express bus routes were less frequent and had more limited spans of service, limiting flexibility for riders
- Slower and less reliable service: express bus travel times were longer and less consistent due to traffic congestion and lack of continuous HOV lanes
- Lack of bidirectional service: except for the KX, all routes were one-way services and incurred substantial deadhead time
- Less comfortable ride: standard local buses were used despite the longer distance travel patterns

FIGURE 5: TRANSIT RIDERSHIP TREND IN THE STUDY CORRIDOR



Source: Vital Signs - Transit Ridership, MTC, accessed 23 August 2017. <http://www.vitalsigns.mtc.ca.gov/transit-ridership> (graphic adapted by WSP USA, August 2017)

Private express bus services have grown substantially over the past decade in the Bay Area, especially amongst technology companies along the US-101 corridor. In 2014, private express bus services accounted for approximately 37,000 daily riders across the Bay Area, including approximately 20,000-30,000 daily riders along the study corridor.<sup>1</sup> Private employers often operate their own express bus services to achieve reductions in single occupancy vehicle trips under campus transportation demand management (TDM) plans.

The role of transportation network companies (TNCs) such as Uber and Lyft is expanding throughout the Study area. TNCs primarily serve short- to mid-range trips; however, they are increasingly used as first-/last-mile connection to transit, an emergency ride home, or in some cases a mid- to long-range commute option. Lyft estimates approximately one quarter of trips

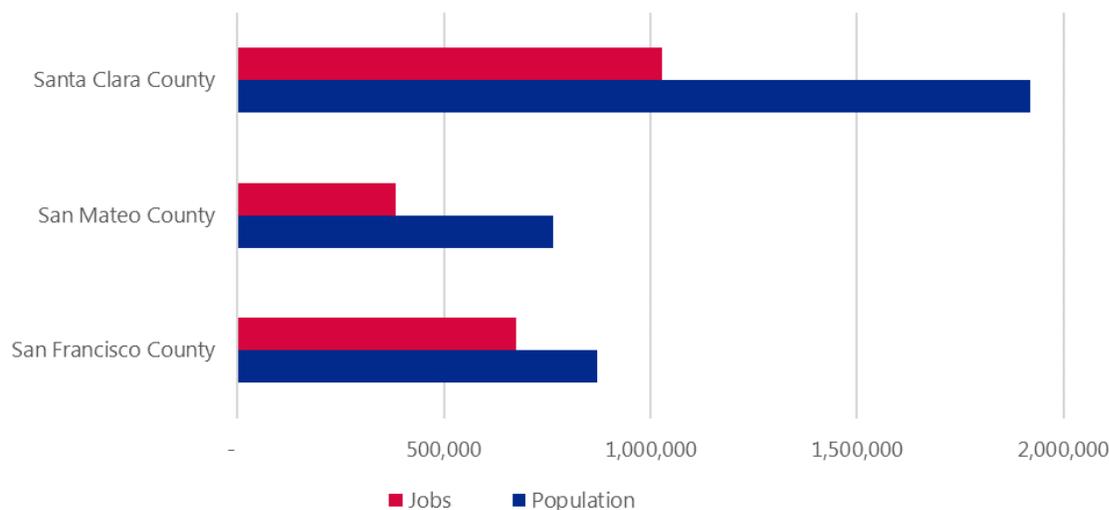
in the Bay Area are to or from transit stations.<sup>2</sup> Dynamic ridesharing applications, such as Scoop and Waze Carpool, comprise a growing long-distance commute option within the study corridor.

The study area includes several U.S., interstate, and California state highways. US-101 spans the study corridor between San Francisco, San Mateo, and Santa Clara counties, serving many of the study corridor's densest residential areas, job centers, and destinations. I-280 parallels US-101 between San Francisco and San Jose, and primarily serves lower density residential areas and open spaces in San Mateo County. I-380 connects US-101 and I-280 in San Bruno. San Mateo County has three east-west freeways (CA-1, CA-84, and CA-92), and Santa Clara County has three additional north-south freeways (CA-17/I-880, CA-85, and CA-87) and an east-west freeway (CA-237).

<sup>1</sup> Bay Area Shuttle Census, MTC, 2014, accessed 5 July 2017. <http://mtc.ca.gov/sites/default/files/2016%20Bay%20Area%20Shuttle%20Census.pdf>

<sup>2</sup> Friends with Transit, Lyft, accessed 5 July 2017 <https://take.lyft.com/friendswithtransit/>

**FIGURE 6: POPULATION AND JOBS IN STUDY CORRIDOR**



Source: ACS, 2015 and California Employment Development Department, 2015

### 1.3.2. Land Use

The US-101 corridor in the Study's three-county area is home to an estimated 3.6 million people and 2.1 million jobs. Population and employment densities are shown in Figure 7.

San Francisco has the highest density of population and employment in the study corridor. Outside of San Francisco, residential densities are generally highest along the BART and Caltrain corridors and mostly east of US-101. South of I-380 residential densities are substantially lower along the I-280 corridor and in the coastal areas of San Mateo and Santa Clara counties.

Similar to residential density, employment is concentrated mostly east of US-101 and in downtown areas near Caltrain stations. Employment centers in San Mateo and Santa Clara counties along US-101 are typically

characterized by automobile-oriented suburban office parks with plentiful free parking while downtown employment areas near Caltrain are more transit-oriented and parking-constrained.

The three counties in the study area experienced significant growth in population (+8 percent) and employment (+14 percent) between 2008 and 2015. The mobility needs associated with this continued population and employment growth have contributed to worsening congestion in the study corridor, including a significant increase in vehicle miles of travel, vehicle hours of travel and vehicle hours of delay on US-101.

Recent employment growth in the study area has exceeded the rate of growth forecasts and housing production. Consequently, the cost of living has increased substantially due to increased housing prices and longer commutes.



### 1.3.3. Equity

The Metropolitan Transportation Commission (MTC) Plan Bay Area 2040 Communities of Concern designation identifies population and communities that could be considered disadvantaged or vulnerable in terms of both current conditions and potential impacts of future growth. Figure 8 shows Communities of Concern in the study corridor. Communities of Concern underserved by existing or planned regional transit services include eastern San Mateo along US-101, Redwood City and North Fair Oaks along US-101, East Palo Alto and Menlo Park along U 101, southeastern San Jose along US-101, and Western San Jose along I-280.

## 1.4. RELATED PROJECTS AND STUDIES

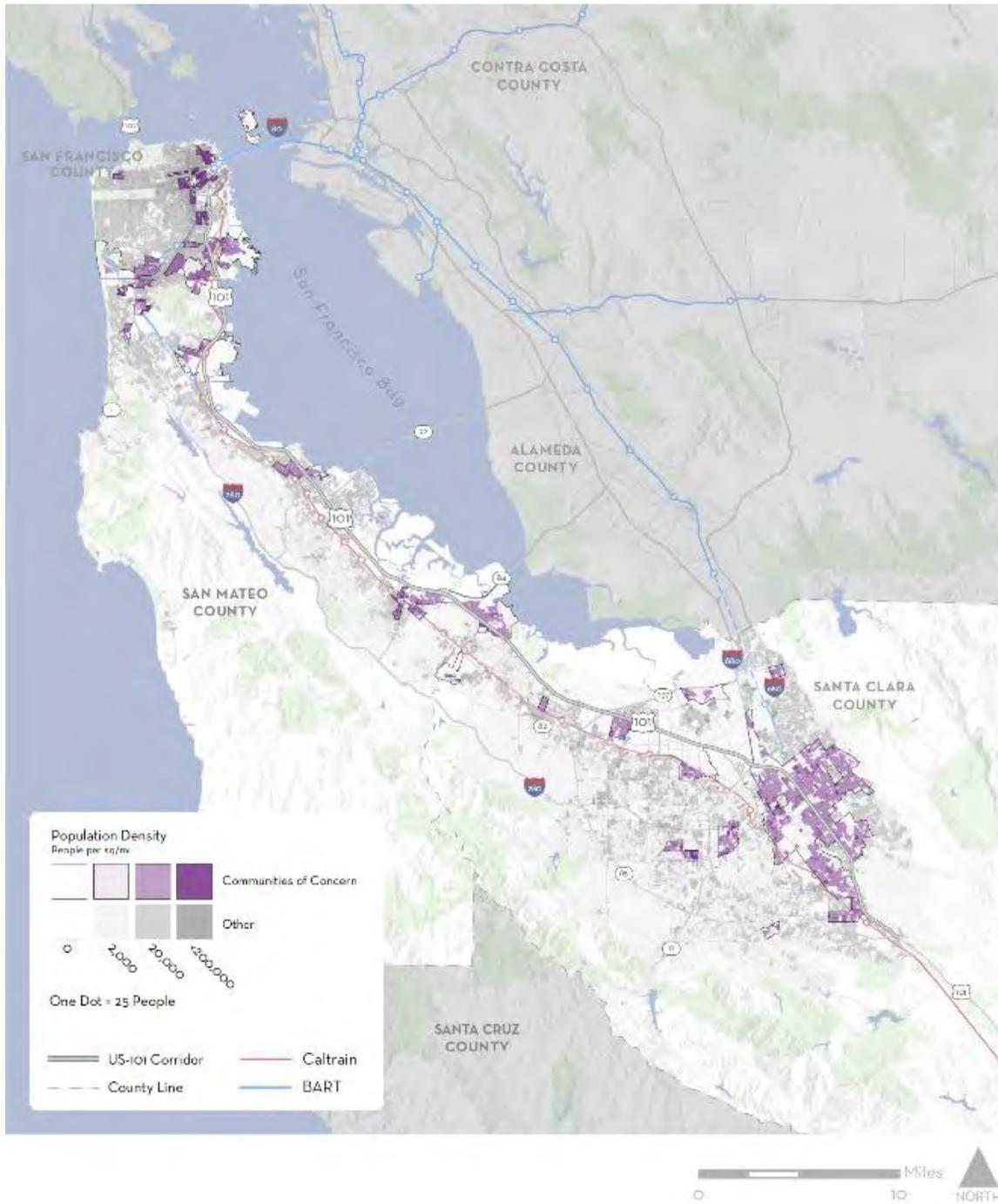
Overall, the average commute time for residents in all the three counties went up. The multi-faceted and multi-modal nature of the current conditions along the US-101 corridor require a diversified set of strategies spanning multiple modes. Several major projects will significantly improve throughput capacity and intermodal connectivity in the study area.

In San Mateo County, the Caltrain electrification project and the SamTrans rapid bus service on El Camino Real are two major projects that have the potential to significantly improve the passenger throughput in the study corridor over the next few years. In San Francisco, multiple major infrastructure projects are being planned or will soon be implemented. The Transbay Transit Center opened in August 2018 and the Central Subway project is under construction and scheduled to be operational by 2020/2021. Similarly, Santa Clara County will see significant improvements in multimodal connectivity due to the forthcoming VTA Next Network, and completion of the BART to Silicon Valley Extension and bus rapid transit (BRT) projects.

In the longer term, travel patterns in the Study area may change substantially due to high speed rail, autonomous vehicles, TNCs, and private express buses.

Over the years, mobility along the US-101 corridor has been the subject of numerous studies and plans. The Study considered the following plans in this planning effort.

**FIGURE 8: COMMUNITIES OF CONCERN**



Source: Fehr & Peers, 2017

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## PREVIOUS STUDIES

Documents reviewed to inform the Study:

- Project Study Report-Project Development Support to Request Approval to Program Capital Support for the Project Approval and Environmental Document (PA&ED) Phase, April 2015
- Express Lanes Concept of Operations, July 2015
- Interstate 280 Transportation Concept Report, July 2013
- State Highway System Congestion and Safety Performance Assessment – San Mateo County, January 2017
- Peninsula Corridor Electrification Project Final Environmental Impact Report, January 2015
- The Caltrain Corridor Vision Plan, February 2017
- SamTrans Service Plan, May 2013
- SamTrans El Camino Real Bus Rapid Transit Phasing Study, December 2014
- SamTrans Strategic Plan: 2015-2019, December 2014
- SamTrans Short Range Transit Plan: Fiscal Years 2017-2026, May 2017
- Plan Bay Area: Regional Transportation Plan and Sustainable Communities Strategy for the San Francisco Bay Area 2017–2040, March 2017.

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### 1.4.1. US-101 Managed Lanes Studies

In seeking a solution to growing congestion and associated delays on US-101, the counties of San Francisco, San Mateo, and Santa Clara are each evaluating or planning managed lanes on segments of US-101 within their jurisdiction. In San Mateo County, Caltrans, the San Mateo County Transportation Authority (SMCTA), and

the City/County Association of Governments of San Mateo County (C/CAG) are proposing to provide a continuous managed lane in each direction on US-101 from the terminus of the Santa Clara County Express Lanes near Whipple Road in Redwood City to the interchange of US-101 and I-380 in northern San Mateo County near the San Francisco International Airport. The proposed managed lanes would utilize operational strategies such as dynamic pricing and lane restrictions in response to changing conditions in real time. Revenue generated by the managed lanes could be used for express bus operations and highway maintenance in addition to operations of the lane.

North of the I-380/US-101 interchange, the San Francisco County Transportation Authority (SFCTA) is exploring ways to prioritize high occupancy vehicles (HOVs) in the US-101 corridor connecting downtown San Francisco to the Peninsula. South of San Mateo County, the VTA has developed the Silicon Valley Express Lanes Program - a network that includes the CA-237 and CA-85 / US-101 freeways. As part of the program, VTA has been operating express lanes on the SR-237/I-880 corridor since 2012. The program is currently authorized to extend CA-237 express lanes from North 1<sup>st</sup> Street to US-101 in Sunnyvale, and to create express lane on US-101 between San Mateo County line in Palo Alto and Fair Oaks Avenue in Sunnyvale.

### 1.4.2. US-101 Express Bus Proof of Concept Study

In 2015, SamTrans undertook a US-101 Express Bus Proof of Concept (PoC) Study to analyze the unconstrained ridership potential of express bus services operating in high occupancy vehicle (HOV) managed lanes on US-101 in San Mateo County and into both Santa Clara and San Francisco counties.

FIGURE 9: US-101 MANAGED LANES PROJECT



Source: Caltrans, 2017

The PoC study built off the ongoing San Mateo County US-101 Managed Lanes Project and provided an initial, unconstrained look into the potential for adding express bus services on US-101 operating in a managed lane. The Study demonstrated that express bus routes can be designed to take advantage of faster travel speeds and improved travel times in the heavily congested US-101 corridor to produce ridership as well as increase person throughput in the corridor. Adding public express buses would provide another viable mobility option with the ability to carry more people on US-101 than commuters driving alone.

## 1.5. REPORT STRUCTURE

The structure of this report structure generally follows the steps of the Study process. Subsequent chapters and content include:

- Chapter 2 describes the active public and stakeholder engagement conducted throughout the Study.
- Chapter 3 summarizes the project's purpose, need, constraints and goals.
- Chapter 4 explains the exiting conditions and market analysis process and identifies the initial route alternatives.
- Chapter 5 describes the two-step screening process that led the Study team from 15 route concepts to six top-performing recommended routes.
- Chapter 6 outlines the recommended phased strategy for funding and implementing express bus service in the Study corridor over time.
- Chapter 7 lays out the recommended next steps following the Study.



02  
PUBLIC AND  
STAKEHOLDER  
ENGAGEMENT

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# 2. PUBLIC AND STAKEHOLDER ENGAGEMENT

Multi-agency coordination took place in the form of a Technical Advisory Committee (TAC), an external stakeholder group, and two rounds of public outreach. The TAC, comprised of representatives from regional transit agencies, Caltrans and the Silicon Valley Community Foundation, convened regularly throughout the feasibility study to provide input on project progress and deliverables. The external stakeholder group, which met at the same intervals, included representatives from advocacy organizations and major employers in the Study area. A detailed summary of public and stakeholder engagement is included in Appendix A.

Public outreach was divided into two phases. The first phase took place in July and August 2017 and involved two pop-up events spread throughout the Study area and one community open house. The second phase took place in June 2018 and included four pop-up events and a community open house.

Each event provided an opportunity for participants to learn about and provide feedback on the Study, as well as SamTrans services. In addition to the outreach events, SamTrans created and maintained a project webpage to publicize the outreach events and provide a

repository for project information and a place for ongoing project updates for the duration of the Study.

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## TECHNICAL ADVISORY COMMITTEE

- California Department of Transportation – District 4
- California State Transportation Agency
- City/County Association of Governments
- Commute.org
- Metropolitan Transportation Commission
- San Francisco County Transportation Authority
- San Francisco Municipal Transportation Agency
- Santa Clara Valley Transportation Authority
- San Mateo County Transportation Authority
- Silicon Valley Community Foundation

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SamTrans engaged with more than 300 people over the course of two rounds of public outreach. The following are key observations derived from responses to exercises conducted in either Phase 1 or Phase 2 of outreach.

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## KEY TAKEAWAYS

- Respondents overwhelmingly prioritized frequent, quick, and reliable bus services with real-time information.
- In San Francisco, respondents expressed a desire for easy access to bus routes by walking or bicycling.
- Ability to transfer to or from other transit lines is very important.
- Many people would like express bus service to be cheaper than driving.
- Unpleasant conditions at stops influence the decision to drive rather than take transit.
- Most respondents preferred to walk, up to 10 minutes, to stops.
- Reliable service is a paramount requirement as respondents seek to know the schedule and take the same bus every time.
- Respondents expressed willingness to pay a premium fare if the service was frequent, reliable, and came with premium amenities.

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## 2.1. SPREADING THE WORD

To notify the public about the Study and upcoming outreach events, SamTrans undertook social media campaigns, distributed press releases, posted flyers at local businesses and libraries, and sent emails to the SamTrans email distribution list.

### 2.1.1. Social Media Campaign

SamTrans initiated a social media campaign to notify followers about upcoming outreach events and to engage with people about commuting along US-101. SamTrans employed Twitter, Facebook, Instagram, Nextdoor, Pinterest, YouTube, Snapchat, quarterly updates

via the Caltrain newsletter, and posts on the Peninsula Moves! blog.

### 2.1.2. Media Coverage

The outreach events received media coverage from the following media outlets:

- KQED radio
- Friends of Caltrain weekly email
- Streetsblog SF blog post

## 2.2. PHASE 1 OUTREACH

SamTrans launched the first outreach series with the goal of introducing stakeholders to the project and to gauge potential riders' wants and needs regarding expanded express bus service on the US-101 freeway. The pop-up outreach events featured a dot exercise where participants were asked to identify the top three factors they considered or would consider most important when selecting whether to use an express bus service, as well as a map where they shared origins and destinations of key trips they make. The results are shown in Table 1-1.

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### PHASE 1 OUTREACH EVENTS (2017)

- San Francisco Sunday Streets, Mission neighborhood (Booth)
- SamTrans Headquarters (Open House)
- San Jose Flea Market (Booth)

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### 2.2.1. Findings

In general, SamTrans learned that participants are interested in potential express bus service and are glad SamTrans is exploring the idea. Most participants agreed that traffic congestion along the US-101 corridor is a major issue that express bus service could help alleviate.

The dot ranking exercise revealed that participants placed the highest value on bus frequency (“Bus comes every fifteen minutes”), speed (“Bus gets me to my destination quickly”), and reliability (“Buses are on-time and reliable”),

followed closely by convenience factors such as real-time arrival information and ability to pay with a Clipper card. Table 1 shows the top six items responses emerging from the dot exercise.

**TABLE 1: TOP RESPONSES FROM PHASE 1 OUTREACH DOT EXERCISE**

Top responses in both San Francisco and San Jose	Top Responses in San Francisco	Unique top responses in San Jose
Bus comes every 15 minutes (48 total responses)	Buses are on time and reliable (46 total responses)	Clean, safe, pleasant conditions at stops (22 total responses)
Bus gets me to my destination quickly (42 total responses)	Pay with my Clipper Card (21 total responses)	Cheaper than driving (18 total responses)
Real-time arrival information (28 total responses)	Route is close to my home and/or office (19 total responses)	Buses run longer hours (7 total responses – write-in response in San Jose)

### 2.3. PHASE 2 OUTREACH

Building on the first phase of outreach, SamTrans initiated a second series of outreach events in June 2018 to inform potential users about the proposed express bus routes and gather feedback on express bus service features.

**FIGURE 10: BOOTH AT SAN MATEO FARMER’S MARKET**



SamTrans facilitated four pop-up outreach events in June 2018 to gauge the public on their views and ideas for express bus service. These pop-up events proved highly successful, attracting approximately over 250 people in total to the SamTrans booths.

#### PHASE 2 OUTREACH EVENTS (2018)

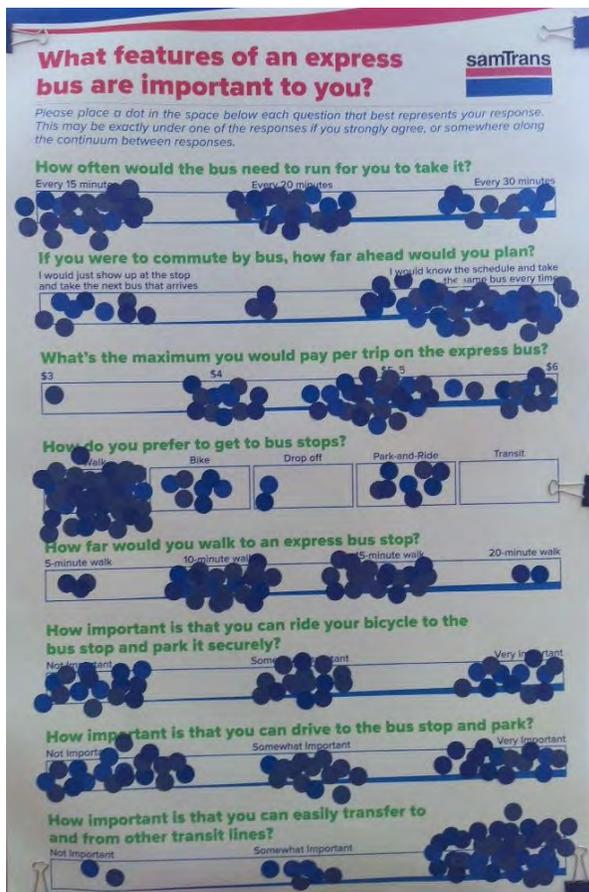
- San Mateo Farmers’ Market (Booth)
- San Francisco Sunday Streets, Golden Gate Park (Booth)
- Palo Alto Farmers’ Market (Booth)
- Facebook Festival “Bayou on the Bayfront” (Booth)
- SamTrans Headquarters (Open House)

The 2018 pop-up events were held throughout the Study area and featured an updated dot exercise activity where participants were asked to indicate their preferences on express bus service features being considered for implementation, including bus frequency, schedule, pricing, and how to get to the bus stop. The dot ranking exercise shown in Figure 11 asked the following questions:

- How often would the bus need to run for you to take it?

- If you were to commute by bus, how far ahead would you plan?
- What's the maximum you would pay per trip on the express bus?
- How do you prefer to get to bus stops?
- How far would you walk to an express bus stop?
- How important is it that you can ride your bicycle to the bus stop and park it securely?
- How important is it that you can drive to the bus stop and park?
- How important is it that you can easily transfer to and from other transit lines?

**FIGURE 11: INTERACTIVE BOARD FROM SAN MATEO FARMER'S MARKET OUTREACH**



### 2.3.1. Findings

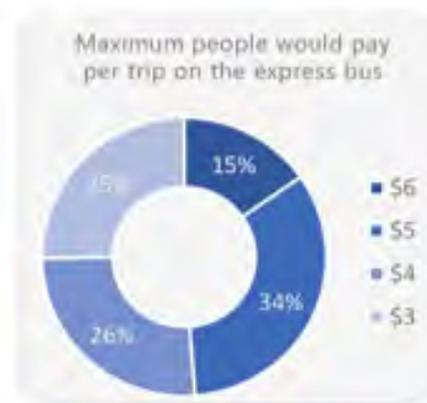
Like the results of the first phase of outreach in 2017, SamTrans learned that participants are excited about a potential express bus service as a commute option. With information on specific route options available for the second outreach series, most participants were interested in how the new service would impact existing express bus lines, details on where the express bus route would stop relative to their starting and ending points, and connections to other transit.



Participants expressed a preference for routine-based travel planning, inferring that reliability will be very important. Participants also expressed a preference for walking to the bus stop (67% of respondents) and willingness to walk 10 or more minutes (77% of respondents).



Most participants expressed willingness to pay a premium fare for this service, above the current SamTrans local fare.



## 2.4. SAMTRANS EMPLOYMENT CENTER SURVEY

SamTrans conducted an employment center survey in 2017 to better understand San Mateo County workers' travel habits, including origin and destination locations, the mode(s) of transportation used to commute to their worksites, and the time and distance of their daily commute trips. The survey also determined workers' likelihood and interest in using public transit, including potential express bus service offered by SamTrans. Employment centers adjacent to many of the proposed express bus routes were surveyed, including San Francisco International Airport and employers in Foster City, Redwood Shores, and Menlo Park.

Of about 800 respondents, 32% of respondents said they would be interested in a SamTrans freeway express bus if it was available for their current commute trip. Respondents commuting from Millbrae-San Francisco (39%) are slightly more interested in express service than those from San Jose/East Bay/Coastside (38%), and far more interested than those from San Mateo-Menlo Park (21%).

For those interested in express service, the provision of bus service outside of the typical peak hour (42%) and high frequency service (38%) would make respondents more likely to ride. Trip length is a good indicator of interest in express service – the longer the trip time, the higher the interest.

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The background image shows the interior of a bus. It features yellow handrails, black seats, and large windows. A person in the foreground is holding a newspaper. The bus is moving, as indicated by the blurred view through the windows.

03

PROJECT  
PURPOSE AND  
NEED

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# 3. PROJECT PURPOSE AND NEED

## 3.1. PURPOSE

The purpose of potential new express bus service is to provide a direct, fast, frequent, and reliable transportation options for long-distance commute trips within and between San Mateo, San Francisco, and Santa Clara counties.

The intent of the Study is to assess the financial and operational viability of long-distance, public express bus service, potentially integrated with managed lanes along the Study corridor.

## 3.2. NEED

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### PROJECT NEED

- Spatial Mismatch of Jobs and Housing
  - Constrained Existing Fixed Rail
  - Freeway Congestion
  - Worsening Regional Unaffordability
- 

**Recent and historic development patterns in San Mateo County and the greater Bay Area have resulted in a spatial mismatch of jobs and housing.**

The imbalance in development of new employment centers compared to new housing units in the three counties within the Study area has led to increased travel time and congestion throughout the region as employees travel longer distances to reach their jobs. Between 2008 and 2015, the three counties of San Francisco, San Mateo, and Santa Clara added more than 254,000 jobs<sup>3</sup>. This rapid employment growth has exceeded the rate of housing production.

During this period, the three counties permitted fewer than 70,000 housing units<sup>4</sup>. For every new housing unit permitted during this period, San Mateo and San Francisco counties added about five jobs each, whereas Santa Clara County added just under three jobs. A desirable jobs-to-housing ratio is a little less than 2 to 1 (or about two jobs or less for every home) in a community.

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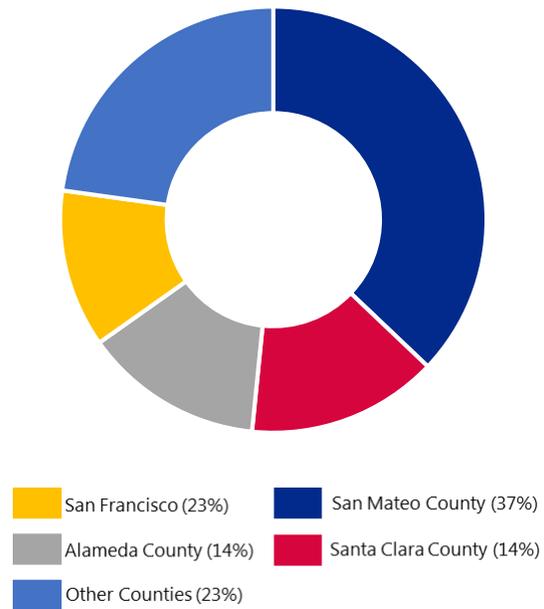
<sup>3</sup> Vital Signs – Jobs, MTC, accessed 2 October 2017. <http://www.vitalsigns.mtc.ca.gov/jobs>

<sup>4</sup> Vital Signs – Housing Growth, MTC, accessed 2 October 2017. <http://www.vitalsigns.mtc.ca.gov/housing-growth>

This jobs-housing imbalance has resulted in a significant number of people commuting into San Mateo County for work from surrounding areas. Per the Longitudinal Employer-Household Dynamics (LEHD, 2014) data, most of the 339,169 persons working in San Mateo County in 2014 lived elsewhere. An estimated 37.1 percent of San Mateo County workers lived within the County while the remainder of workers commuted mostly from Santa Clara (14.5 percent), Alameda (13.6 percent) and San Francisco (12.0 percent) counties. The remaining workers in San Mateo County commuted from other counties within and outside the Bay Area. Combined, more than 26.5 percent of San Mateo County workers live north or south of its borders. In addition, 9,570 of San Francisco County workers live in Santa Clara County, and 19,085 of Santa Clara County workers live in San Francisco County.<sup>5</sup>

Per the regional forecasts, employment growth will continue to outpace population growth, and this jobs-housing imbalance will continue to persist. Between 2010 and 2040, the three counties will see a 44 percent increase in number of jobs and only 38 percent increase in number of households. While Santa Clara County will experience an increase in number of households that is proportionate to job growth, San Francisco and San Mateo counties will see a 46 percent increase in number of jobs but only 33 percent increase in number of households<sup>6</sup>.

**FIGURE 12: WHERE DO SAN MATEO COUNTY'S WORKERS LIVE?**



Source: US Census, LEHD, 2014

**Existing fixed rail service in the corridor has capacity constraints and service limitations.**

Caltrain plays a crucial role in the movement of long-haul commuters making a north-south journey in the Study Area. However, today, the Caltrain express (Baby Bullet) and some semi-express (Limited) trains are typically at or over capacity during the morning and evening peak periods in both directions<sup>7</sup>. Though Caltrain has plans to increase capacity through the Caltrain Modernization Program's upcoming electrification efforts, forecasts show it may not increase capacity enough to meet future demand in some high growth scenarios.

<sup>5</sup> Vital Signs- Commute Patterns, MTC, accessed 29 August 2017. <http://www.vitalsigns.mtc.ca.gov/commute-patterns>

<sup>6</sup> Plan Bay Area 2040 – Land Use Modeling Report, MTC, accessed 28 September 2017. <http://2040.planbayarea.org/sites/default/files/2017->

[07/Land\\_Use\\_Modeling\\_PBA2040\\_Supplemental%20Report\\_7-2017.pdf](http://www.vitalsigns.mtc.ca.gov/commute-patterns)

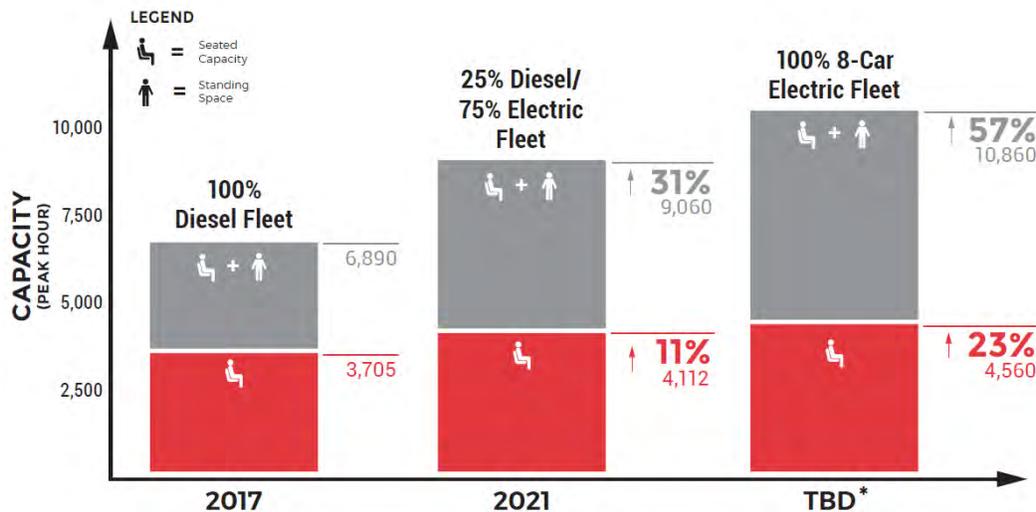
<sup>7</sup> Caltrain 2017 Annual Passenger Count – Key Findings, Caltrain, accessed 30 September 2017. [http://www.caltrain.com/Assets/\\_Marketing/caltrain/pdf/2016/2017+Annual+Count+Key+Findings+Report.pdf](http://www.caltrain.com/Assets/_Marketing/caltrain/pdf/2016/2017+Annual+Count+Key+Findings+Report.pdf)

Caltrain Electrification would provide a total peak hour capacity (seated and standing) of 9,060, an increase of about 31 percent over current total peak hour capacity of about 6,890 (see Figure 13). However, the project is expected to increase Caltrain daily ridership to 69,000 in the year 2020, an increase of about 15 percent over current daily ridership of about 60,000.<sup>8</sup> If 80 percent of the new ridership manifests during the peak period, as current ridership does, then there would be little spare capacity on peak period trains to accommodate any auto trips diverted from US-101 after accounting for existing overcrowding on these trains. In addition to capacity constraints, fixed rail service cannot be everywhere and service coverage is not easily malleable. While areas near BART and Caltrain stations continue to accommodate

denser development through intentional transit-oriented development strategies, some new development is taking place in areas farther away from these stations. It is difficult to access these areas using Caltrain or BART in the absence of a good first/last mile connection, particularly areas east of US-101 as indicated in the Baseline Conditions Report. Even then, such connections would require transfers.

Although both BART and Caltrain stations can be expected to serve a wider radius of potential riders than a bus stop, the gaps or deficiencies in service – whether in service coverage or in frequency – create a less viable travel option among transit-sensitive population groups that could benefit from a frequent, reliable, one-seat ride.

**FIGURE 13: PEAK HOUR CAPACITY ON CALTRAIN**



*\*The CalMod program lays the foundation for continued capacity growth on the corridor. Unlike diesel trains, electric trains can maintain performance while expanding to 8-cars. Eight car expansion is dependent on additional funding. Figures and percentages subject to changes as EMU design elements and new service schedules are finalized.*

Source: Peninsula Corridor Electrification Project, Caltrain, accessed 20 August 2017.

<http://www.caltrain.com/projectsplans/CaltrainModernization/Modernization/PeninsulaCorridorElectrificationProject/Capacity.html>

<sup>8</sup> Peninsula Corridor Electrification, Frequently Asked Questions, Spring 2014. Accessed on 23 August 2017.

<http://www.caltrain.com/Assets/Caltrain+Modernization+Program/Documents/PCEP+FAQ.pdf>

Implementing or changing fixed rail infrastructure projects in urban areas is expensive and time-consuming due to land use constraints. As a result, BART and Caltrain services are usually less nimble than bus-based services in adapting to evolving development patterns, creating an opportunity for express bus services to fill the gaps presented by either non-transit oriented development or lower quality fixed rail service. SamTrans will coordinate with Caltrain on planning effort, such as the current Caltrain Business Plan project, to identify future opportunities to supplement rail service in the Study area.

**Limited freeway capacity and current congestion require solutions facilitating higher person throughput.**

US-101 experiences moderate to heavy bi-directional traffic congestion through much of San Mateo County during the morning and evening peak periods.<sup>9</sup> There is no incentive for sharing a ride due to the lack of managed lanes along the entire length of the facility in San Francisco County, and most of the length of the facility in San Mateo County. Thus, the high-occupancy vehicles with multiple passengers experience the same delays as the single-occupancy vehicles. Peak period traffic

congestion regularly spills over into local streets within San Mateo County.

Going forward, vehicle trips in the US-101 corridor are expected to grow by four to seven percent by 2020. The total delay in the US-101 corridor could increase from 26,978 hours in 2009<sup>10</sup> to 120,600 hours in 2040<sup>11</sup> as the congestion worsens. The infrastructure planned is not commensurate with the anticipated growth; thus, strategies to increase the person throughput and make the most of limited capacity will be necessary.

**Growing unaffordability in the region requires attention toward provision of affordable, equitable long distance transit options.**

Transportation costs are the third largest expense for a low-income household in the Bay Area, after housing and food. For lower-income households, housing and transportation costs accounted for 54 percent of household income in 2005. The national average of the combined housing and transportation cost is about 10 percentage points lower. According to MTC's Plan Bay Area 2040, housing and transportation costs as a share of low-income household income are projected to increase to 67 percent of household income in 2040<sup>12</sup>. This could adversely affect certain Communities of

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<sup>9</sup> State Highway System Congestion and Safety Assessment – San Mateo County, City/County Association of Governments of San Mateo County (C/CAG) and San Mateo County Transportation Authority, 2015, accessed 5 July 2017, <http://ccag.ca.gov/wp-content/uploads/2017/01/SMC-State-Hwy-Performance-Assess.pdf>

<sup>10</sup> US 101 South Corridor System Management Plan, Caltrans, 2010, accessed 29 July 2017. [http://www.dot.ca.gov/dist4/systemplanning/docs/csmpl/US101S\\_CSMP\\_Fullldocument.pdf](http://www.dot.ca.gov/dist4/systemplanning/docs/csmpl/US101S_CSMP_Fullldocument.pdf)

<sup>11</sup> PSR-PDS to Request Approval to Program Capital Support for the Project Approval and Environmental Document (PA&ED) Phase on Route US-101 Between South of Whipple Avenue (Post Mile 6.3) And North of Interstate 380 (Post Mile 20.8), Caltrans, 2015, accessed 26 July 2017. <http://ccag.ca.gov/wp-content/uploads/2014/05/US-101-HOV-Hybrid-PSR-PDS-Complete-Signed-Approved-2015-05-04.pdf>

<sup>12</sup> Plan Bay Area 2040, MTC, accessed 22 September 2017. <https://mtc.ca.gov/our-work/plans-projects/plan-bay-area-2040>

Concern<sup>13</sup> with limited access to BART and Caltrain, such as East Palo Alto, North Fair Oaks, eastern Redwood City, eastern San Mateo, and eastern and southern San Jose.

Additionally, housing and transportation costs are interrelated. Low-income households that are unable to afford to live near transit and job centers commute farther from less urbanized areas and are more likely to require ownership of a vehicle, thereby increasing the amount of household budget they spend on transportation. The lack of affordable housing close to low- and moderate-wage jobs, which usually co-locate with high-wage jobs, creates an even bigger imbalance for low- and moderate-income households<sup>14</sup>. For low income drivers, their increased likelihood of having less scheduling flexibility (e.g., due to having to punch a time clock) and concern about daycare late fees cause them to place more value on reduced congestion and greater travel time reliability.

According to recent research by the UC Berkeley Institute of Governmental Studies, 65% of Bay Area voters think affordability is an extremely serious problem and half have considered leaving the Bay Area as a result.<sup>15</sup> Additional public transit options can support Bay Area residents and employers as they negotiate challenges with respect to affordability, housing, and commute options.

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<sup>13</sup> MTC defines Communities of Concern as census tracts that have a concentration of both minority and low-income residents, or that have a concentration of low-income residents and any three or more of the following six disadvantage factors: persons with limited English proficiency, zero-vehicle households, seniors aged 75 years and over, persons with one or more disability, single-parent

### 3.3. PROJECT CONSTRAINTS

While there is a significant need for public express bus service, implementation of such a service would require overcoming the following identified constraints.

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#### PROJECT CONSTRAINTS

- Lack of Managed Lane
- Limited Funding Availability
- Prevalence of Private Express Bus Services
- Financial Constraints of SamTrans Operating Budget

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**Managed lanes projects in the Study area are being planned but may not be in service for multiple years.**

Due to lack of managed lanes, both public and private bus services operate in shared road space and experience the same delay as all other vehicles. Bus service operating in managed lanes could make transit more effective, reliable, and travel-time competitive with automobile. While all three counties along the Study corridor are either studying or implementing managed lanes, the lanes are unlikely to be available for some time.

**Funding is in short supply for both ongoing operations and capital expenses.**

families, and renters paying more than 50 percent of their household income on housing.

<sup>14</sup> Regional Opportunity Index, Center for Regional Change, University of California Davis, accessed 1 October 2017. <http://interact.regionalchange.ucdavis.edu/roi/>

<sup>15</sup> Institute of Governmental Studies, UC Berkeley, accessed 17 October 2018, <https://escholarship.org/uc/item/65s716jf#page-4>

The operating costs of express bus services can be higher than those of local bus service because of relatively lower seat turn rates and more directional ridership. Alternative funding sources may be required to close any operating funding gaps. Toll revenue from the managed lanes could provide much needed funding but will only be available after managed lanes are implemented and toll revenues are programmed. In the near-term, other alternative sources would have to be identified.

### **The current SamTrans operating budget presents substantial financial constraints.**

SamTrans faces unprecedented financial challenges as its core budgets (excluding debt service and capital costs) face deficits and are projected to deplete further. Under such financial conditions, implementing new express bus service, especially one with potentially significant capital investments, could put additional financial strain on the agency.

### **The prevalence of private express bus services shows demand – how can we attract new customers?**

While the recent proliferation of private express bus and micro-transit services is a testament of the viability of express bus service in the Study area, it is reasonable to assume that some portion of the demand for express bus service is already addressed by these services. SamTrans will have to consider ways to ensure it can still appeal to this demand. SamTrans is also challenged by the prevalence of transportation options that are free to riders such as employer and private shuttles.

## **3.4. PROJECT GOALS**

Based on the baseline conditions, project purpose and needs, and public and stakeholder engagement, the following project goals have been identified to address the mobility concerns in the study area. These goals serve as the framework for the evaluation of route alternatives.

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### **PROJECT GOALS**

GOAL 1: PROVIDE MOBILITY OPTIONS FOR REGIONAL TRIPS

GOAL 2: INCREASE TRANSIT MARKET SHARE IN THE CORRIDOR

GOAL 3: DEVELOP A COST-EFFECTIVE SERVICE

GOAL 4: IMPROVE TRANSPORTATION EQUITY

GOAL 5: ENHANCE ACCESS TO JOBS AND POPULATION CENTERS

GOAL 6: SUPPORT SUSTAINABLE LAND USE AND TRANSPORTATION POLICIES

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### **GOAL 1: PROVIDE MOBILITY OPTIONS FOR REGIONAL TRIPS**

One of the foremost goals of introducing express bus service in the study area is to provide an additional mobility option for long-haul trips and to ensure the service offers connections between modes, reducing total travel time, and bringing transit options closer to major activity and population centers.



### **GOAL 2: INCREASE TRANSIT MARKET SHARE IN CORRIDOR**

The constrained peak period capacity of Caltrain and BART systems could suppress the recent growth in transit mode share in the Study area. Effectively

meeting the growing travel demand will require supplementing existing transit services with additional direct, fast, frequent, and reliable transit services that are easy to use and offers travel times competitive to driving. The goal is to not only increase transit ridership, but to increase person throughput of existing corridors by moving more people in fewer vehicles.



### **GOAL 3: DEVELOP A COST-EFFECTIVE SERVICE**

Transportation funding is scarce. As the demand for transit dollars increases and resources become increasingly competitive, a greater emphasis must be placed on ensuring that transit investments achieve the greatest returns for the dollars spent. Resources must be used as efficiently as possible to maintain current transit service levels, as well as to increase frequency and service hours. The goal is to develop and operate a cost-effective and productive service that merits investment and does not exacerbate the fiscal strain on SamTrans.



### **GOAL 4: IMPROVE TRANSPORTATION EQUITY**

Transportation affects access to economic and social opportunity.

Without adequate transportation, it is difficult to access jobs, basic services, and activity centers. The Study's goal is to ensure SamTrans is responsive to the distinct needs of each community and provides all residents options to move about the region using a variety of safe, efficient, convenient, and affordable modes of transportation.



### **GOAL 5: ENHANCE ACCESS TO JOBS AND POPULATION CENTERS**

This goal aligns closely with previously stated goals to provide

mobility options and develop a cost-effective service. By serving jobs and population centers, SamTrans can provide a crucial link for commonly-made trips. The goal is to make it easier for people to make these frequent or daily trips without having to rely on private automobiles. Integration with appropriate land use in ways that improve first- and last-mile connectivity will increase the overall accessibility to jobs and other opportunities.



### **GOAL 6: SUPPORT SUSTAINABLE LAND USE AND SUSTAINABLE TRANSPORTATION POLICIES**

Addressing the jobs-housing imbalance requires coordination of land use and transportation decisions through close collaboration with local governments, regional agencies, and others. Many communities and employers have plans and programs to strengthen their economies, revitalize community cores, attract and retain employees, better serve residents, and accommodate population growth through transportation demand management (TDM) or transit-oriented development (TOD) projects. SamTrans can be a resource and find new customers through partnership with these communities and organizations.

In addition, transportation is one of the largest contributors to emissions. Shifting travel from private automobile to environmentally-friendly transit services can help reduce emissions (greenhouse gases and air pollutants), provide a more environmentally sustainable transportation system, and enhance the quality of life and the environment in the Study area.

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# 4. TRAVEL MARKETS ANALYSIS AND ROUTE IDENTIFICATION

## 4.1. TRAVEL MARKET ANALYSIS

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### KEY FINDINGS

- Most commute and non-commute trips along the study corridor are short duration, single-occupancy vehicle trips which may pose challenges to transit service.
- Markets potentially suitable for transit along the US-101 corridor include residential and employment areas east of US-101 and near I-280 that are underserved by Caltrain, BART, and private express bus service.
- Eight bidirectional markets and four one-directional markets present opportunities for express bus services during the AM peak period. Of these, four markets present opportunities for service either to San Francisco or to BART.

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An early task in the Study included assessing the existing and potential markets for express bus service in the three-county Study area. The travel market analysis considered existing travel conditions and possible changes in near-term conditions over the next five years. This analysis

considers origin and destination pairs, commute characteristics, existing and future public and private transit services, and equity to identify potential markets where express bus service may achieve a mode shift from trips via single-occupancy vehicle to trips via transit.

The primary data source for the travel market analysis was origin/destination (O/D) GPS data purchased from StreetLight Data.

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### STREETLIGHT GPS DATA

StreetLight aggregates location data collected from GPS devices in smartphones and car navigation systems. StreetLight provides counts of the number of vehicle person trips (VPT) for people in cars between a set of origin and destination zones, optionally sub-selecting trips that pass through any of a given set of screenlines.

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To mitigate against potential sampling bias toward people who have a higher likelihood of owning a vehicle with embedded GPS, a smartphone, or handheld GPS device, the Streetlight data was adjusted using a combination of outputs from the San Mateo County City and County Association of

Governments (C/CAG) travel model, Metropolitan Transportation Commission (MTC) travel model, and the 2012 California Household Travel Survey (CHTS). Post-processing of the data also attempted to remove any trips made by private employer shuttle. The final dataset used for the travel market analysis combines a comprehensive representation of the study area with the spatial precision of StreetLight’s data to develop a comprehensive matrix of estimated trips made between each of 71 zones in the morning peak period. See Appendix B for a map of the zones used to spatially parse the data.

Following the preparation of the adjusted StreetLight dataset, the travel market analysis was an iterative process that included identifying prominent origin-destination pairs well-suited for express bus service, visualizing the distribution of trips originating in zones of interest, and calculating the total number of vehicle person trips (VPT) along a range of potential routes, excluding local trips between adjacent zones.

## 4.2. TRAVEL PATTERNS

Nearly 1.4 million vehicle person trips (VPT) occur during the AM peak period (6:00 AM to 10:00 AM) within or between San Francisco, San Mateo, and Santa Clara counties.<sup>16</sup> Most trips in the Study area occur within the same county, while 13 percent occur between counties, as shown in Table 2. Of the inter-county trips, about equal flows occur between San Francisco and San Mateo counties (80,000 VPT) and between Santa Clara and San Mateo counties (85,000 VPT). A smaller market of long-distance trips between San Francisco and Santa Clara County also occurs (15,000 VPT).

Among vehicles traveling on US-101 south of CA-92, 43 percent of trips occur between origins and destinations within San Mateo County, while a total of 36 percent occur between San Mateo County and San Francisco or Santa Clara counties. Eleven percent of trips occur between San Francisco and Santa Clara counties, and 11 percent have an origin or destination outside of the study corridor (such as the East Bay).

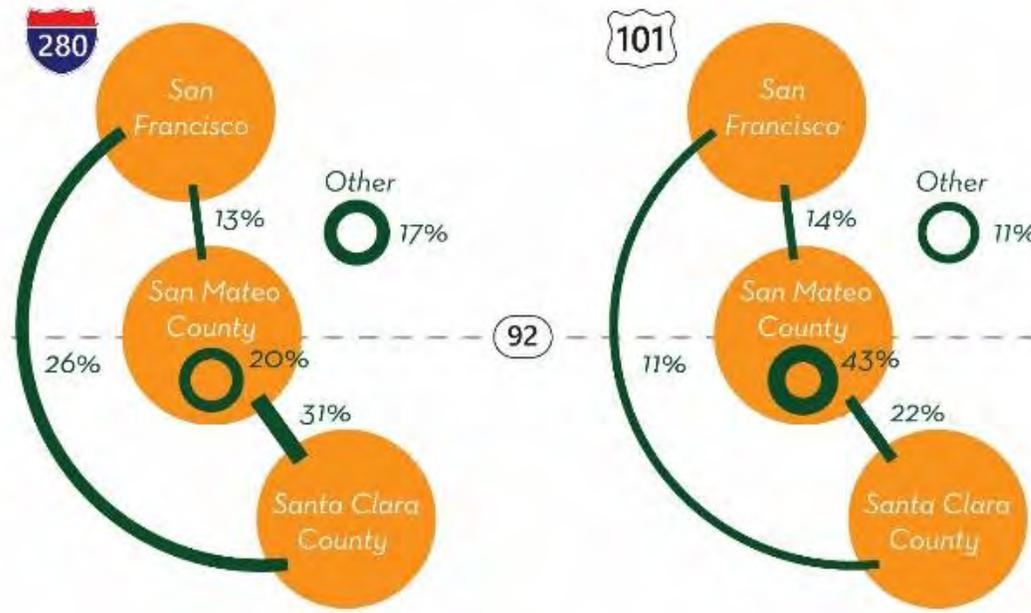
**TABLE 2: TOTAL AM PEAK PERIOD TRIPS BY COUNTY ALONG STUDY CORRIDOR**

Origin	Destination			
	Santa Clara County	San Mateo County	San Francisco County	Total
<b>Santa Clara County</b>	736,000	39,000	6,000	781,000
<b>San Mateo County</b>	46,000	246,000	44,000	336,000
<b>San Francisco County</b>	9,000	36,000	208,000	253,000
<b>Total</b>	791,000	321,000	258,000	1,370,000

Source: Fehr & Peers analysis, 2017

<sup>16</sup> This total excludes trips outside of the Study Corridor, such as the East Bay, North Bay, Santa Cruz County, southern Santa Clara County, or southern coastal San Mateo County.

**FIGURE 14: AM PEAK PERIOD FREEWAY ORIGINS AND DESTINATIONS, SOUTH OF CA-92 INTERCHANGE**



Source: Fehr & Peers analysis, 2017

I-280 serves longer distance trips compared to US-101. South of CA-92, 20 percent of trips on I-280 occur within San Mateo County, while 44 percent occur between San Mateo County and San Francisco or Santa Clara counties. Twenty-six percent of trips occur between San Francisco and Santa Clara Counties, while 17 percent have an origin or destination outside of the study corridor. I-280 serves about 20 to 25 percent fewer vehicles during peak hours than US-101

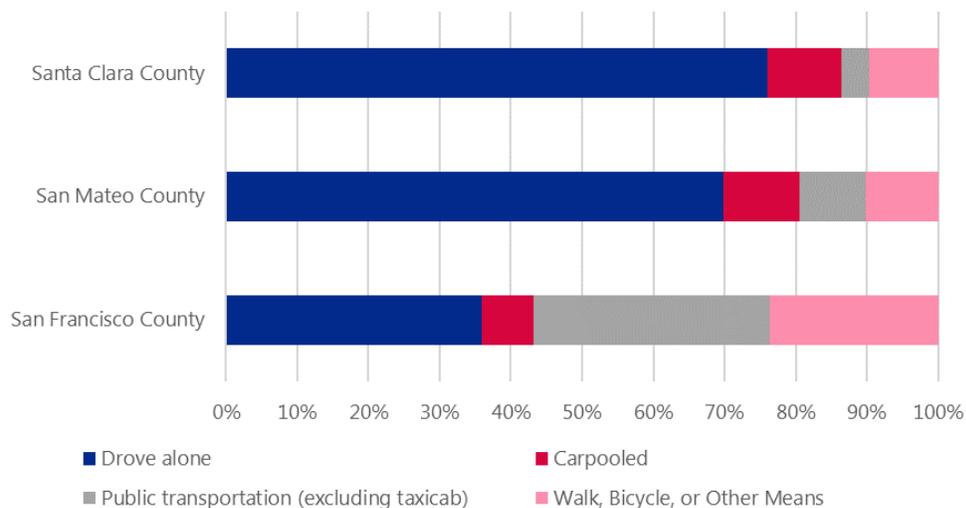
The 2015 American Community Survey provides further insights into commuting characteristics of workers in the Study area (see Figure 15). The ACS illustrates that commutes in San Mateo County and Santa Clara County are mostly short duration single-occupancy vehicle trips while San Francisco County has slightly longer commutes and more trips via transit. Commuters

leave for work at varying hours of the day, but mostly during the morning peak period.

Over 70 percent of commuters in San Mateo and Santa Clara counties drive alone to work, while only 36 percent of commuters in San Francisco drive alone. Transit plays a larger role in serving San Francisco commuters compared to San Mateo and Santa Clara counties.

While there is substantial variation in commute times, most commutes are short in duration. Peak period automobile trips of long distance and duration represent a relatively small share of total trips. In some cases, these markets are well served by existing and planned transit services. The strong performance of Caltrain, BART, and private express services amongst long-distance commutes suggests a relatively high transit mode share for such markets.

**FIGURE 15: MEANS OF TRAVEL TO WORK**



Source: American Community Survey, 2015

## 4.1. TRAVEL MARKETS

### 4.1.1. Travel Market Factors

The travel market analysis considered several factors when identifying potential express bus markets including origin and destination pairs, BART and Caltrain accessibility, private express bus services, likelihood of transit use, and equity.

#### CONSIDERATIONS FOR TRAVEL MARKET IDENTIFICATION

- Origin and Destination Pairs
- Existing Fixed Rail Service
- Private Express Bus Service
- Likelihood of Transit Use
- Equity

#### Origin and Destination Pairs

The market analysis considers intermediate-distance (five to ten miles) and long-distance (greater than ten miles) trips serving SamTrans'

core service area and the US-101 Managed Lanes corridor. These trips include those with either (or both) an origin or destination in San Mateo County, or trips which pass through San Mateo County between San Francisco and Santa Clara counties.

While the market analysis focuses on trips along the US-101 corridor, parallel north-south trips along the I-280 corridor are also considered. Trips that occur outside of SamTrans' core service area (e.g. within San Francisco or Santa Clara Counties) are excluded from this analysis. Separate studies evaluate transit service along the Coastside (CA-1) corridor and Dumbarton (CA-84) corridor; therefore, these corridors are also excluded from this study.

Considering that the study corridor's travel patterns vary from local- to long-distance trips, the market analysis identifies trips that may be served by intermediate stops along the US-101 corridor. The US-101 corridor already includes two bus pads; the US-101 Managed Lanes

project may present opportunities for improvements.

### Existing Fixed Rail Service

Markets were primarily identified based on their potential to serve new transit markets where BART and Caltrain accessibility is limited, where Caltrain service is less frequent, or where transit trips would require two transfers or more.

A review of AC Transit's services suggests that express bus service is most successful where regional rail service is less accessible, whereas services that compete with faster and more frequent rail services are typically less successful. Along the study corridor, such opportunity areas underserved by regional rail service include trips with origins and/or destinations east of US-101 in San Mateo and Santa Clara Counties and south of I-280 in Santa Clara County.

Express bus service may also serve two complementary functions to existing transit services. First, express bus service may supplement Caltrain service at stations with infrequent service (even after implementation of the CalMod program). Second, express bus service may streamline trips in which multiple transfers presents barriers to transit trips – specifically for trips where two or more transfers are necessary.

### Private Express Bus Service

As noted in Section 3.3, the study corridor is already served by a sizeable network of over 550 private express bus trips per day, primarily serving major corporate campuses in San Mateo and Santa Clara counties. Existing services have achieved a substantial mode shift for the campuses which they serve. The addition of managed lanes on the US-101 corridor may

support a further mode shift to such services. The market analysis considers the locations of these private express bus campus hubs and identifies markets that may be underserved by such services.

### Likelihood of Transit Use

Despite the high volume of trips across the study corridor, some travel markets lack sufficient density and walkability to support transit service. The market analysis considers the suitability and accessibility of potential origins and destinations for express bus service using a Transit Likelihood Index, shown in Figure 16. The Transit Likelihood Index combines variables known influence transit ridership including population density, employment density, intersection density, and transit dependence (zero car households), in order to identify areas with the highest propensity for transit use. While a high likelihood of transit use does not necessarily guarantee viable express bus markets, it helps identify origins and destinations for further consideration.

In addition to demographic and built environment factors, the market analysis considers the presence of transportation demand management (TDM) ordinances and programs along with parking constraints to incentivize transit ridership. Presently, San Francisco, Downtown Palo Alto, Stanford University, and the Stanford Research Park have robust TDM programs oriented around incentivizing transit use, while other major employers incentivize riding private express bus services. Cities such as Redwood City, Mountain View, South San Francisco, and Sunnyvale also have TDM ordinances or plans for new developments to encourage transit use.



## Equity

Special consideration was given to identifying opportunity travel markets serving Communities of Concern. In particular, Communities of Concern with limited access to BART and Caltrain present opportunities for express bus service, such as East Palo Alto, North Fair Oaks, eastern Redwood City, eastern San Mateo, and eastern and southern San Jose. See Appendix C for maps of the 10 shortlisted route concepts in the context of Communities of Concern.

### 4.1.2. Travel Markets

The travel market analysis identified 12 travel markets on the study corridor, including eight bidirectional markets (Markets 1 through 8) and

four one-directional markets (Markets 9 through 12). Figure 17 shows a sample market identification map. The initial travel markets list included variants on some markets, as shown in Table 3.

The market analysis considers two types of express bus services in the study area: limited service and express service. Limited service are freeway-based routes that serve origins and destinations throughout a corridor with intermediate stops (within the freeway or on parallel streets). Express service are freeway-based routes that serve distinct clusters of origins and destinations without intermediate stops.

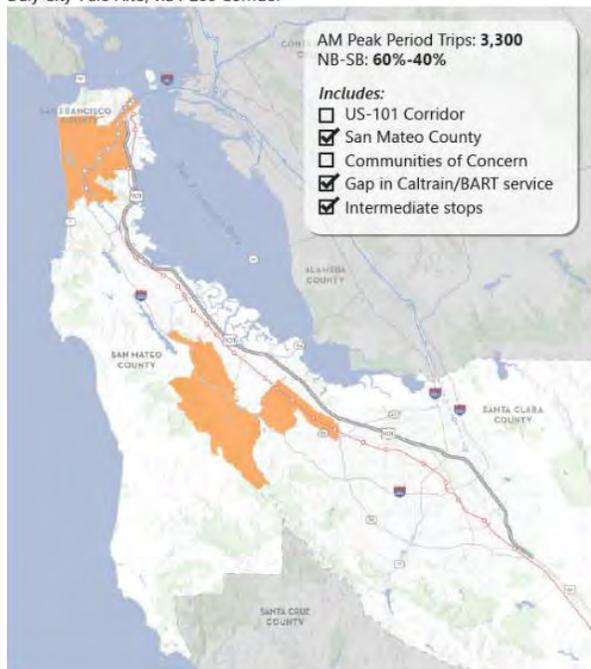
**TABLE 3: INITIAL EXPRESS BUS MARKETS**

Market Name		Total VPT	Percent NB- SB	Market Includes:		
				US-101 Corridor	San Mateo County Stop	Communities of Concern
1A	San Francisco - Palo Alto (Limited)	15,000	39%-61%	✓	✓	✓
1B	BART - Palo Alto (Limited)	15,000	46%-54%	✓	✓	✓
2A	San Francisco - Sunnyvale (Limited)	15,000	39%-61%	✓	✓	✓
2B	BART - Sunnyvale (Limited)	17,000	48%-52%	✓	✓	✓
3A	Foster City – San Francisco	1,600	64%-36%	✓	✓	✓
3B	Foster City – BART	5,200	66%-34%	✓	✓	✓
4A	Redwood Shores – San Francisco	1,300	51%-49%	✓	✓	✓
4B	Redwood Shores – BART	3,600	50%-50%	✓	✓	✓
5	Foster City/Redwood Shores – Palo Alto	1,800	49%-51%	✓	✓	
6	Daly City – Palo Alto	3,300	60%-40%		✓	✓
7	Redwood City – Sunnyvale	3,300	36%-64%	✓	✓	✓
8	Western San Francisco – San Carlos	2,300	34%-66%	✓	✓	✓
9	Western Santa Clara County – Foster City	2,900	83%-17%	✓	✓	✓
10	Western Santa Clara County – San Francisco	1,700	93%-7%	✓		✓
11	Burlingame/San Mateo – San Francisco	3,400	85%-15%	✓	✓	✓
12	Belmont/San Carlos – San Francisco	1,800	78%-22%	✓	✓	

**FIGURE 17: SAMPLE MARKET IDENTIFICATION MAP**

**Market 6**

Daly City-Palo Alto, via I-280 Corridor



**4.2. ROUTE CONCEPTS**

Based on the 12 travel markets described in the previous section, the team developed a set of 15 route concepts. For markets where express bus service either currently exists (e.g. San Carlos/Belmont-San Francisco market), or existed in the past (e.g. Foster City-San Francisco market), the alignments of the route concepts have been developed in light of the performance of and learnings from such past services. For some of the routes (e.g. San Francisco-Palo Alto), variations to serve the markets through a BART connection were also developed.

A map of the full set of initial route concepts is shown in Figure 18. The proposed route concepts are grouped by service characteristics into three route types.

**INITIAL ROUTE CONCEPTS**

**Bidirectional Limited Stop Services**

- Route 1 - San Bruno to Palo Alto
- Route 2 – San Bruno to Sunnyvale

**Bidirectional Express Services**

- Route 3 – San Francisco to Foster City
- Route 4 – San Francisco to Redwood Shores
- Route 5 – Foster City to Palo Alto
- Route 6A – Daly City BART to Palo Alto
- Route 6B – Western San Francisco to Palo Alto
- Route 7 – Redwood City to Sunnyvale
- Route 8 – Western San Francisco to San Mateo

**One-directional Express Services**

- Route 9 – Sunnyvale to Foster City
- Route 10 – Sunnyvale to San Francisco
- Route 11 – Burlingame to San Francisco
- Route 12 – San Mateo to San Francisco
- Route 13 – San Carlos/Belmont to San Francisco
- Route 14 – Palo Alto to San Francisco

Bidirectional Limited Stop Services close some of the connectivity gaps in the existing SamTrans network and serve predominantly intra-county markets located east of US-101. The size of the potential markets and anticipated ridership may warrant all-day service in both directions. These buses would not operate in the proposed managed lanes along US-101 because such

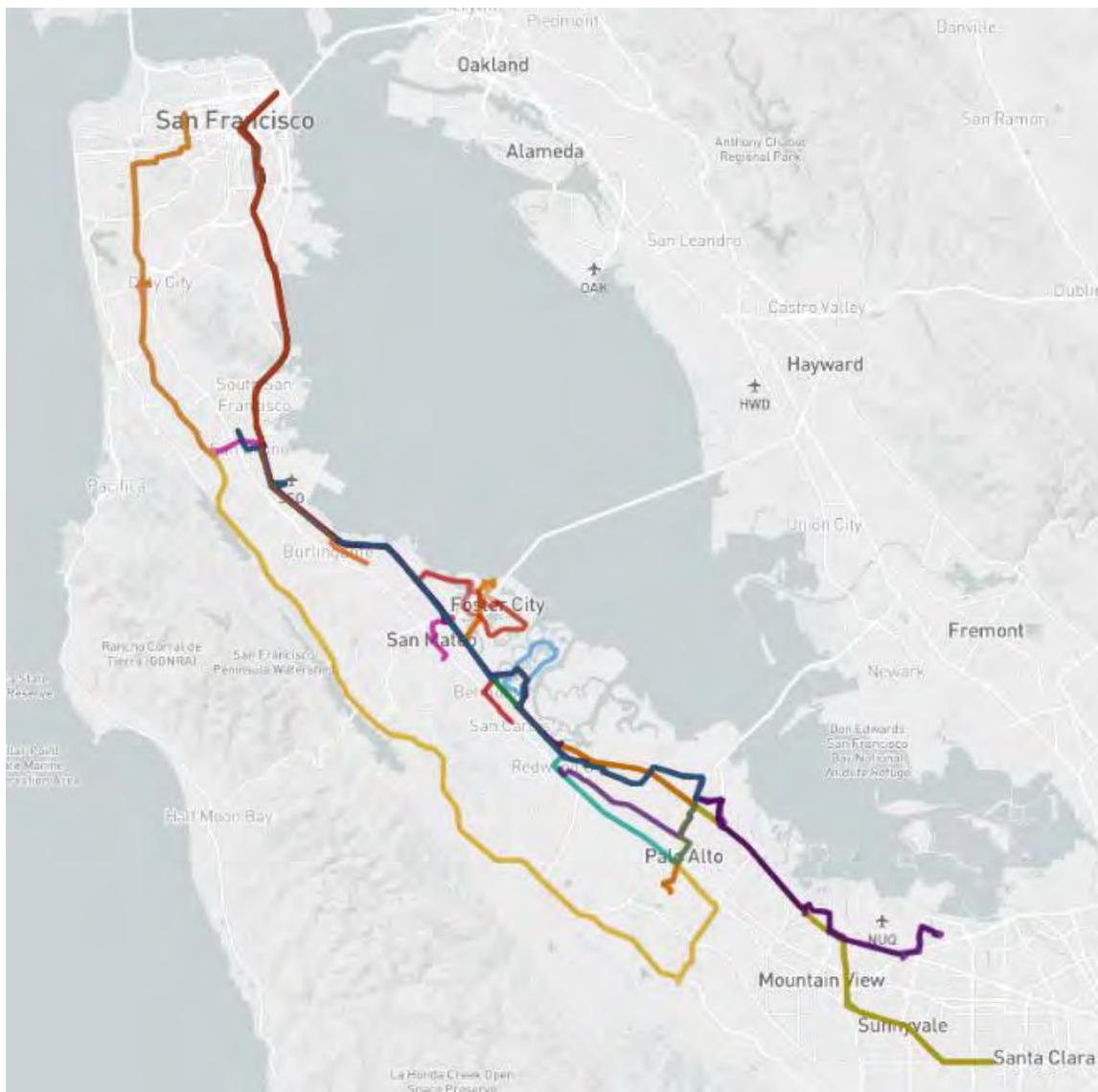
lanes are proposed to run along the median under every alternative in the San Mateo US-101 Managed Lane project.

Bidirectional Express Services operate in the proposed managed lanes along US-101 or in general purpose lanes on I-280 and would not have intermediate stops. The markets served by these services have sufficient demand to warrant

express bus service in both directions during peak periods.

One-directional Express Services operate in the proposed managed lanes along US-101 or in general purpose lane on I-280 and would not have intermediate stops. The markets served by these services have only sufficient demand to warrant express bus service in one direction during peak periods.

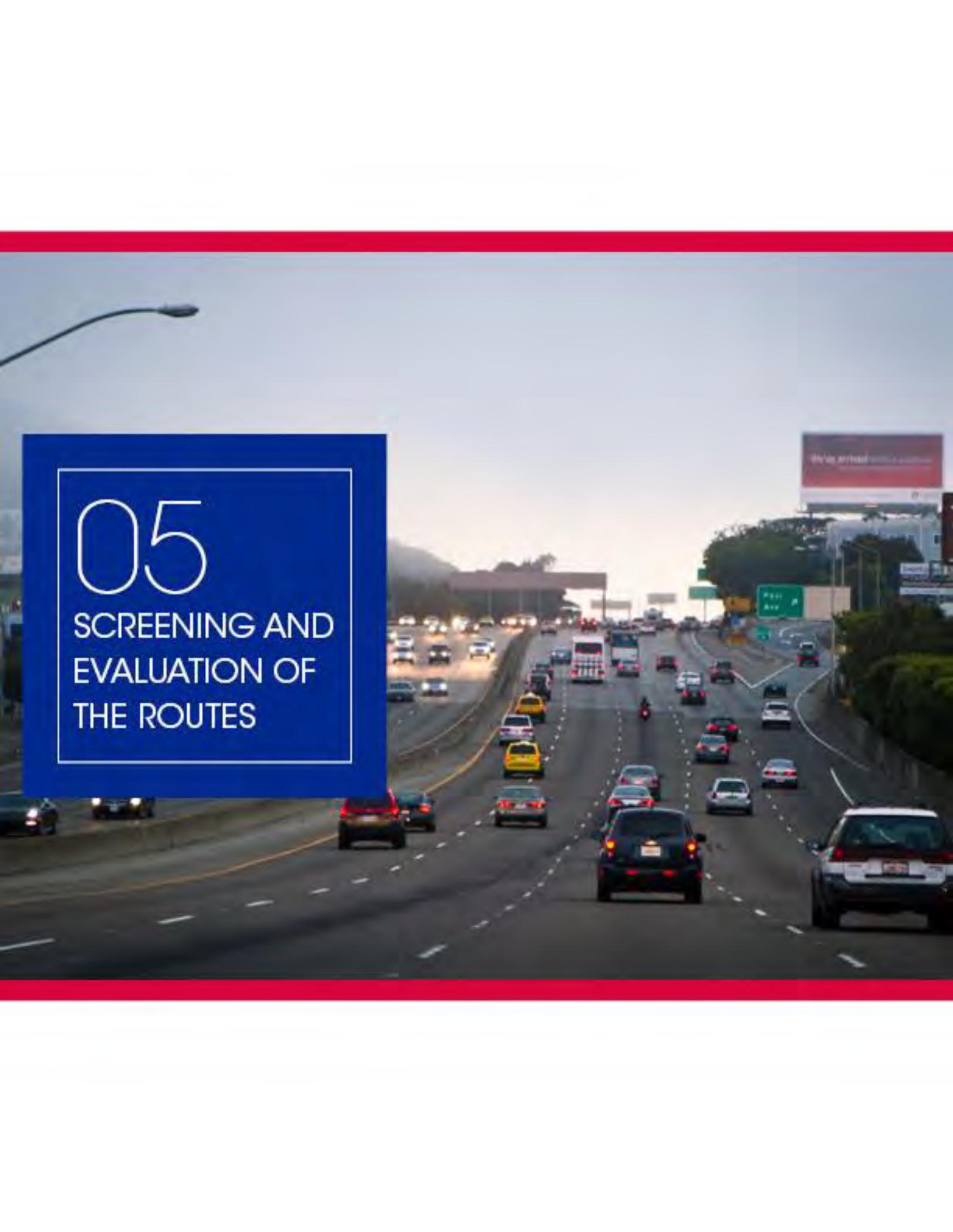
**FIGURE 18: INITIAL ROUTE CONCEPTS**



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# 05

## SCREENING AND EVALUATION OF THE ROUTES



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# 5. SCREENING AND EVALUATION OF THE ROUTES

## 5.1. EVALUATION PROCESS

This Study's route development and evaluation process included the following phases:

- Market Identification
- Screening of Initial Route Concepts
- Detailed Evaluation of Shortlisted Routes

### 5.1.1. Criteria

For each goal, a set of criteria was established to screen and evaluate the route concepts side by side. Criteria are aligned with one of the project goals and each criterion was used for evaluating either initial screening, detailed evaluation, or both. Table 4 lists the criteria for each identified goal, and shows the applicability of each criterion to one or both of the evaluation steps.

### 5.1.2. Methodology

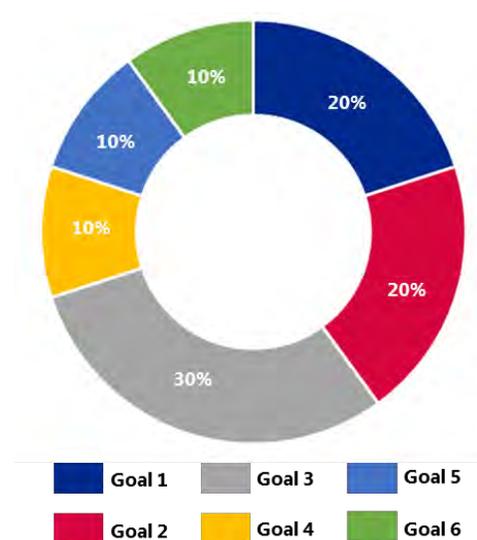
A two-step screening and evaluation methodology was established to assess multiple route options and develop routes that meet the project's goals. The initial screening was conducted primarily using the Remix scenario-planning tool, ArcGIS geospatial processing, and Microsoft Excel. The detailed evaluation used data from the travel demand model.

Data, assumptions, and outputs from Remix and ArcGIS were processed to calculate values and

ratings corresponding to each evaluation criteria. These values informed a five-point range based on the lowest and highest values for each evaluation criteria. Each route concept received a single score for each goal.

Finally, each route concept received an individual score for each of the six goals as well as an overall score that incorporated the assigned weight of each goal which was developed in consultation with project stakeholders. The weights assigned to each goal are shown below. The route concepts were then ranked based on their overall scores.

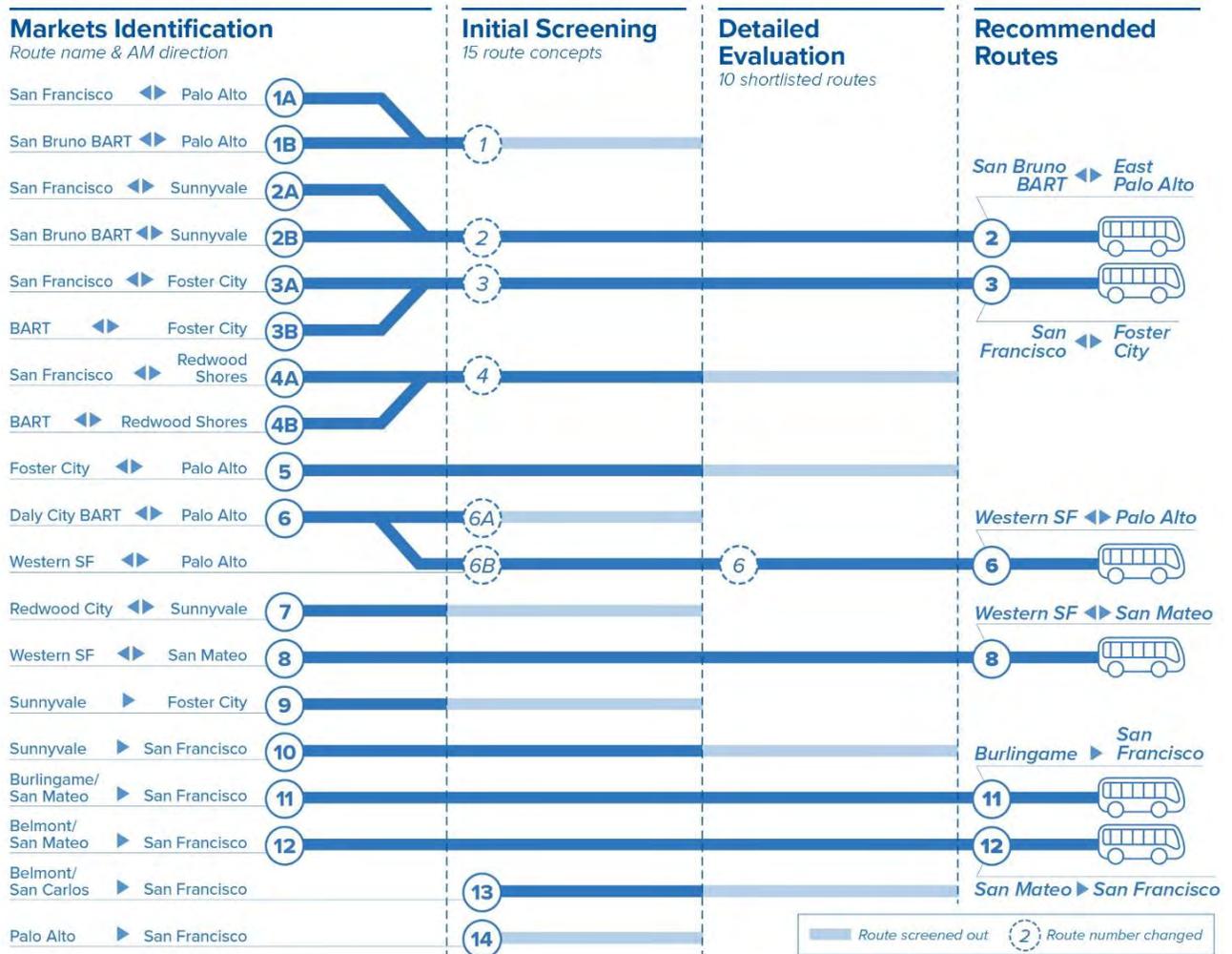
FIGURE 19: GOAL WEIGHTS APPLIED



Throughout this process, the naming or numbering convention for some routes concepts changed, as well as the route design and service area in some limited cases. The below graphic shows the progression of route concepts in

terms of names, as well as when each was dropped or retained during evaluation phases.

**FIGURE 20: PROGRESSION OF ROUTE NAMES AND SCREENING**



**TABLE 4: SCREENING AND EVALUATION CRITERIA BY PROJECT GOALS**

	Initial Screening	Detailed Evaluation
<b>Goal 1: Provide Mobility Options for Regional Trips</b>		
1A-Ridership Potential	•	
1B-Average Weekday Boardings		•
1C-Percentage of Revenue Route Length in Managed Lane	•	
1D-Reduction in Transit Travel Time		•
1E-Connectivity to Places (Isochrone)	•	•
1F-Number of Transit Lines Served	•	•
1G-Number of Park and Ride Lots/Spaces Served	•	•
<b>Goal 2: Increase Transit Market Share</b>		
2A-Transit Mode Shift	•	
2B-Ability to Serve New Transit Markets	•	
2C-Boardings per Revenue Service Hour		•
2D-Passenger Trips Per Revenue Vehicle Mile		•
<b>Goal 3: Develop a Cost-Effective Solution</b>		
3A-Capital Cost Per Route Mile	•	•
3B-Capital Cost Per Passenger	•	•
3C-Operating and Maintenance Cost Per Revenue Service Hour	•	•
3D-Operating and Maintenance Cost Per Passenger	•	•
<b>Goal 4: Improve Transportation Equity</b>		
4A-Ability to serve Communities of Concern	•	•
4B-Ability to Serve Communities Without Access to Frequent and Affordable Fixed Rail Service	•	•
4C-Percentage of Potential Riders Under 200% of Federal Poverty Level		•
<b>Goal 5: Enhance Access to Population and Employment Centers</b>		
5A-Number of Residents within Half-Mile of Stops	•	•
5B-Number of Jobs within Half-Mile of Stops	•	•
<b>Goal 6: Support Sustainable Land Use and Transportation Policies</b>		
6A-Ability to Serve Priority Development Areas	•	•
6B-Alignment with Environmental and Sustainability Policies and Practices	•	

## 5.2. STEP 1: INITIAL SCREENING

An initial screening was performed to narrow the 15 initial route concepts to a shorter list of 10 route alternatives for evaluation in the travel demand model. The initial screening was performed based on 16 quantitative and qualitative criteria across the six project goals. Please see Figure 20 for a reminder of the names and service areas for each route.

### 5.2.1. Initial Screening Results

#### **Goal 1 – Provide Mobility Options for Regional Trips:**

The two limited routes and the routes serving San Francisco performed best on criteria associated with improved mobility and connectivity due to their high market demand and ridership potential, ability to use managed lanes, and connectivity to other transit lines.

**Goal 2 – Increase Transit Market Share:** Since all the routes were designed to serve areas without access to long-haul transit options, most routes performed well on criteria associated with increasing transit mode share. Routes serving Western San Francisco, Foster City, and East Palo Alto performed particularly well on this criterion. In addition, the limited routes showed greater potential to shift trips onto transit.

#### **Goal 3 – Develop a Cost-Effective Service:**

Routes with strong ridership potential and those with proposed bi-directional revenue service were the top performers in this category. Though scheduling efficiencies can reduce the burden of long deadhead trips in practice, one-directional routes did not perform as well in this planning-level screening for that reason.

#### **Goal 4 – Improve Transportation Equity:**

Routes serving Communities of Concern and

those currently without a rail station within a half-mile of proposed express bus stops performed well on this criterion. Routes west of US-101 near Caltrain or those not serving Communities of Concern were not top performers in this category.

#### **Goal 5 – Enhance Access to Population and Employment Centers:**

Route concepts serving San Francisco performed well on criteria associated with accessibility because of much higher residential and employment densities than other parts of the Study area. Some of the route concepts with one-directional service to/from San Francisco scored higher than two-way route concepts not serving San Francisco.

#### **Goal 6 – Support Sustainable Transportation and Land Use Policies:**

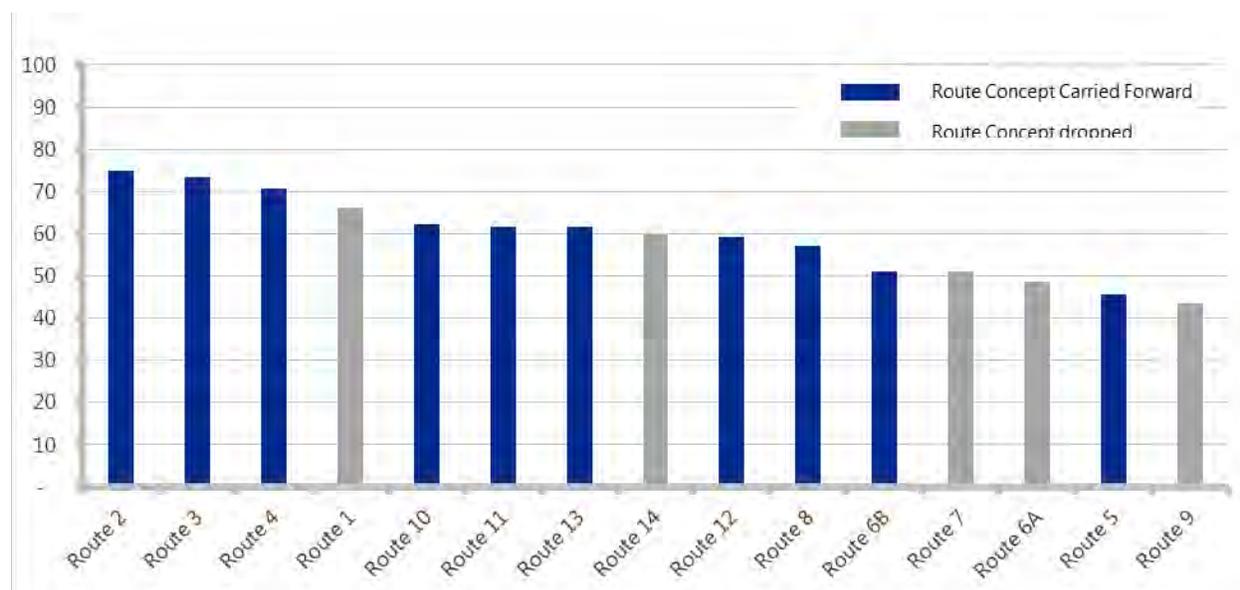
Many communities served by the proposed route concepts have sustainable land use and transportation policies in the form of TDM programs or include priority development areas. Route concepts serving multiple communities with sustainable policies performed better on this criterion, such as Palo Alto/Stanford and San Francisco.

### 5.2.2. Shortlisting 10 Routes

Following the initial screening, the 15 route concepts were reduced to 10 for inclusion in the detailed evaluation. Figure 21 on the next page shows the final ranking of the 15 route concepts.

- Route concepts 1 and 6A were dropped because of their largely duplicative routing with two variants that were carried forward (routes 2 and 6B, respectively).
- Route concepts 7, 9, and 14 performed poorly on key goals and criteria including potential ridership and cost-effectiveness and thus were not carried forward.

**FIGURE 21: INITIAL SCREENING – OVERALL SCORE AND RANKING**



### 5.3. STEP 2: DETAILED EVALUATION

The detailed evaluation built on the initial screening by incorporating travel demand model results which allowed for more precise ridership estimates, travel times, and system-wide metrics such as impact on person throughput and vehicle miles traveled. Data from ridership forecasts was used to refine capital cost, O&M, and revenue forecasts.

The detailed evaluation used the same scoring methodology as the initial screening and was performed based on 17 quantitative and qualitative criteria across the six project goals. Additional secondary data including demographic projections for years 2020 and 2040 was compiled for new evaluation metrics.

As part of the detailed evaluation, some operating plan assumptions were refined based on further discussion with SamTrans and project stakeholders. Unlike the initial screening, which assumed that each route concept would operate during peak periods on weekdays only, the detailed evaluation assumed that one route,

Route 2: San Bruno BART-Sunnyvale Limited, would operate all day (6:00 AM to 7:00 PM) on weekdays.

#### 5.3.1. Travel Demand Modeling

Ridership is one of the primary criteria for evaluating the viability of express bus service. The C/CAG model was used to generate ridership forecasts, building upon work recently completed for the US-101 Managed Lanes Study (ML) and Dumbarton Transportation Corridor Study (DTCS).

The Express Bus model combines the strengths of the ML and DTCS models, using the ML model steps for trip generation, distribution and traffic assignment, and using the transit network coding, mode choice, tech company express shuttle estimating methods and transit assignments from the DTCS modeling process. It benefits from the validation of the ML model with respect to forecasting highway volumes individually for SOV, HOV and solo users of the HOT lanes, and it takes advantage of the DTCS model's accuracy in estimating transit ridership.

The ten shortlisted routes were initially modeled under four scenarios at 15-minute frequency service levels and to operate during four-hour morning and evening peak periods, except for Route 2 which was assumed to operate during the midday as well. A \$3.25 average fare was assumed to account for a \$4.00 base fare as well as use of discounted fare products. Note that this fare was assumed for modeling purposes only; a new SamTrans express fare product will be established as part of the SamTrans Fare Study. A full description of the model's assumptions and limitations can be found in Appendix B.

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## MODELING SCENARIOS

Scenario A – Shortlisted routes without managed lanes in 2020

Scenario B – Shortlisted routes with San Mateo County managed lanes to I-380 in 2020

Scenario C – Shortlisted routes with San Mateo and San Francisco managed lanes in 2020

Scenario D – Shortlisted routes with San Mateo and San Francisco managed lanes in 2040

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One additional scenario was modeled to test the model's sensitivity to a lower 20-minute service frequency scenario for six of the ten shortlisted routes. This is discussed further in Section 5.4 Route Refinements and Recommendations.

### 5.3.2. Detailed Evaluation Results

The model results illuminate several themes about the role of express buses in the Peninsula's transportation system:

- Without express bus service, transit ridership is expected to increase by approximately

12,000 boardings (+19 percent) due to the modernization of Caltrain and completion of the Central Subway. Caltrain ridership would increase from 62,200 in 2017 to 73,900 in the 2020 base year with electrification. Employer shuttle ridership, which already serves nearly 30,000 riders on the US-101 corridor, could also continue to increase.

- A majority of express bus riders would shift from Caltrain, primarily in areas with limited access to Caltrain stations or where the cost of express bus service is substantially lower than Caltrain. Routes 2 and 6 would also result in a slight increase in BART ridership.
- Even with projected population and employment growth and the extension of managed lanes into Downtown San Francisco, the long-term growth potential for express bus ridership is relatively modest compared to Caltrain. Between Scenarios C and E, the Downtown Extension (DTX) would increase Caltrain ridership by 46 percent (30,800 riders), while the extension of managed lanes to San Francisco would increase express bus ridership by 30 percent (3,400 riders).

As mentioned, each route was evaluated with respect to 17 evaluation criteria using new data points available from the travel demand model. Consistent with the initial screening, criteria are tied to each of the Study's six goals.

Findings with respect to key metrics are discussed below for the two model scenarios (Scenarios B and D) which are considered the Study's base scenarios for near-term (2020) and long-term (2040) study years. The baseline assumptions for these years include the presence of a managed lane in the near-term (2020, as proxy for the actual year of completion which is to be finalized) and a managed lanes

project north of I-380 into San Francisco in the longer-term (2040).

Radar charts shown in Figure 27 and Figure 28 display the score each route received on each goal for Scenarios B and D. These charts were used to quickly illuminate each route's performance with respect to the six goals.

### Average Weekday Boardings

The Express Bus Model showed ridership potential of nearly 11,000 daily boardings for the 10 shortlisted routes at 15-minute frequency in 2020 (scenario B) and nearly 15,000 daily boardings in year 2040 (scenario D). Estimated average daily boardings for each route during these years is shown on the following page.

Two additional model scenarios were conducted as sensitivity tests to the base scenarios. These include Scenario A, which explored the ridership potential without a managed lane in San Mateo County, and Scenario C, which explored the impact on ridership of a managed lane into San Francisco in the near-term.

Comparing the ridership change between Scenario A (no managed lane) and Scenario B (managed lane to I-380) shows a 5 percent increase in ridership with the managed lane. However, the Express Bus Study model only estimates peak period travel times and does not take into account traffic microsimulation tools used in the ML project to generate more precise peak hour travel times. The implication of this is that Express Bus Study model likely underestimates the travel time savings an express bus would experience by using the managed lane. Since the Express Bus model is sensitive to travel time in its ridership calculation process, the

Express Bus Model represents a generally conservative portrait of express bus ridership.

Overall, given the model's sensitivity and forecasted travel times, about 800-1,500 additional daily boardings may be attracted to express routes in managed lanes if actual peak hour travel time savings are consistent with traffic microsimulations. This reflects a change in daily boardings when comparing a pre- and post-ML project scenario to +13-20 percent with the ML project in place.

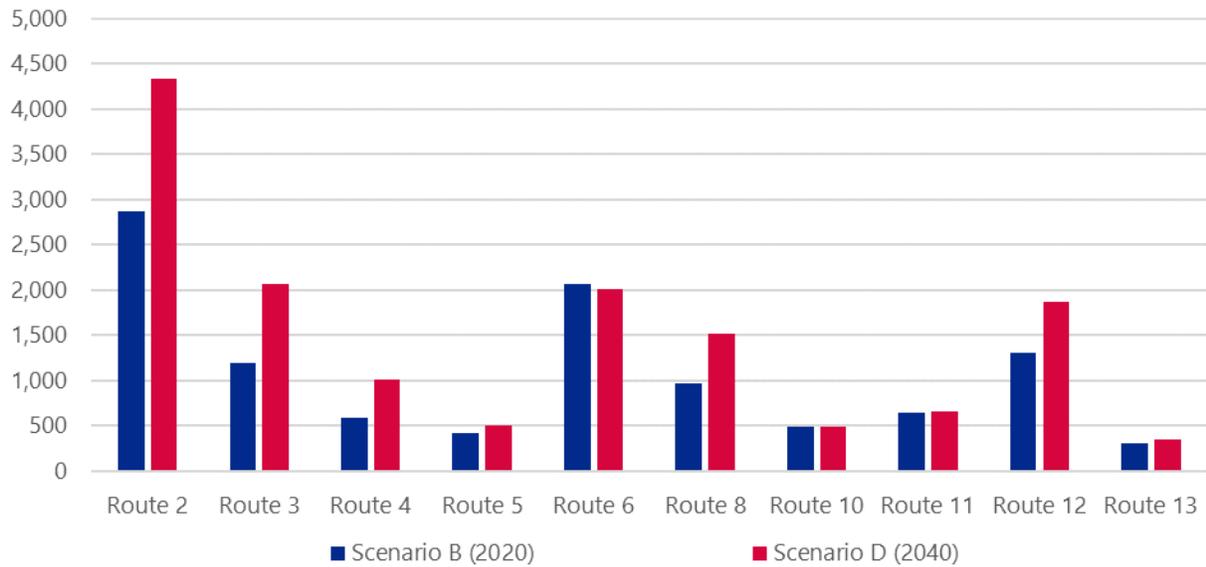
Finally, ridership demand may be understated due to the fact that the C/CAG Model assumes relatively conservative land use 2020 and 2040 forecasts and recent development has outpaced growth expectations.

### Reduction in Transit Travel Time

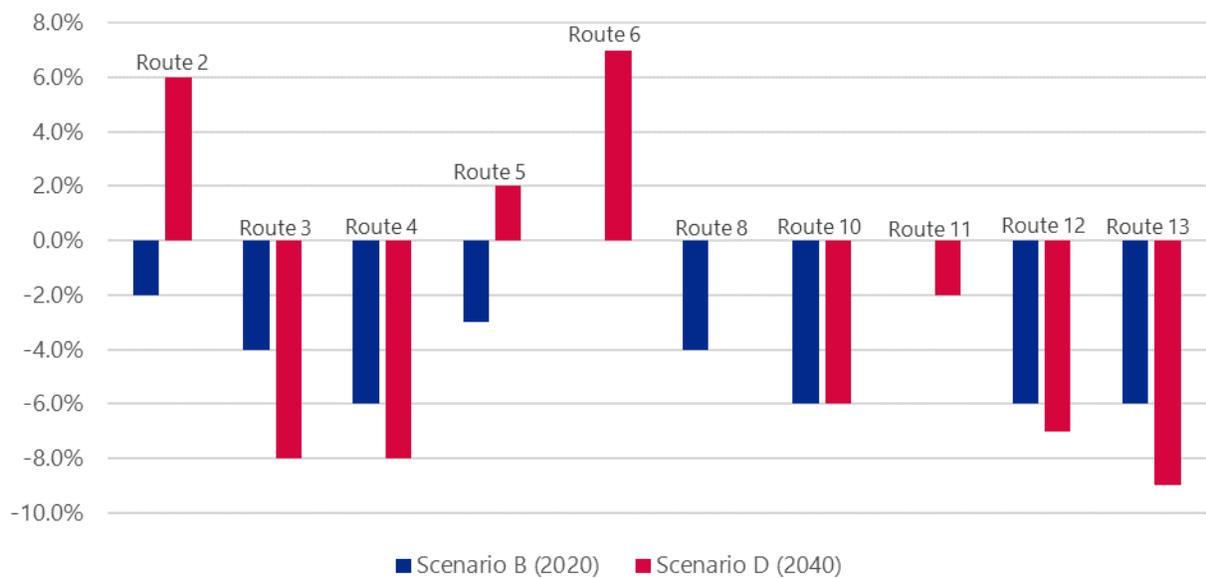
Percent change in transit travel time compared to a no managed lane scenario (Scenario A) is shown on the following page in Figure 22. The graph shows that travel time is reduced in Scenario B on all routes that would use the US-101 south managed lane facility. Many routes see a further reduction in Scenario D, except for routes that do not use US-101 such as Route 6 which operates on I-280 and Route 2 which was modeled as originally designed not to use the managed lanes.

As mentioned in the previous section, travel times were calculated using the C/CAG Model, which estimates average peak period travel times instead of simulating peak hour travel times. Consequently, the change in travel time may be greater depending on actual traffic patterns.

**FIGURE 22: ESTIMATED AVERAGE DAILY BOARDING**

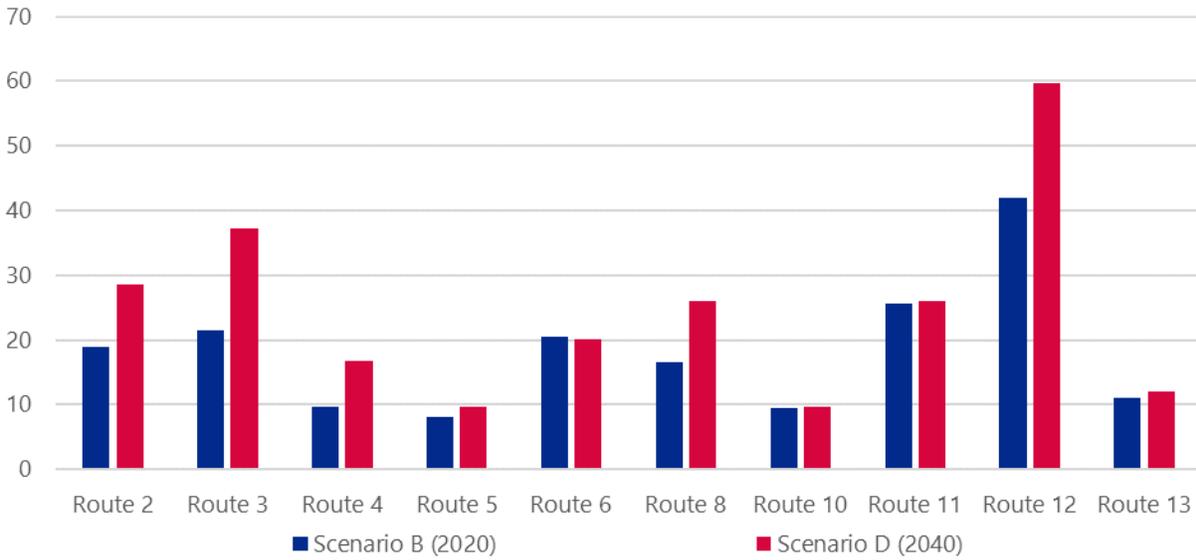


**FIGURE 23: PERCENTAGE CHANGE IN TRAVEL TIME**

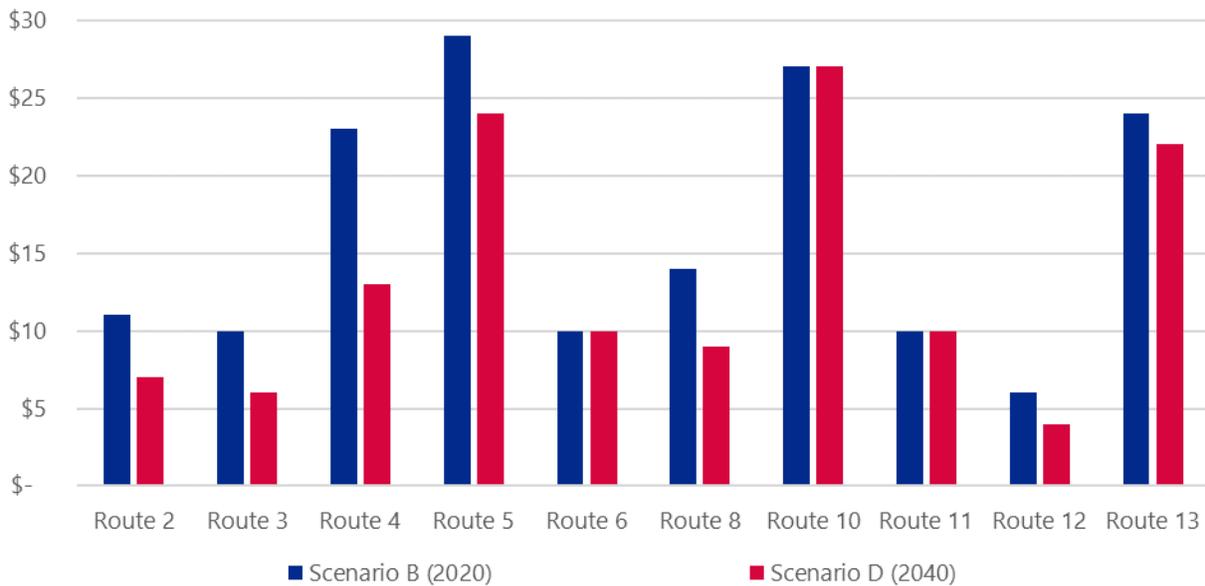


*Note: Where routes do not have bars on the above chart, the change in travel time is neutral.*

**FIGURE 24: BOARDINGS PER REVENUE HOUR**



**FIGURE 25: ESTIMATED O&M COST PER PASSENGER**



Boardings per Revenue Service Hour

The Study team used Boardings per Revenue Service Hour, along with Operating & Maintenance Cost per Passenger, as important productivity metrics for the potential routes. As shown in Figure 24, routes 4, 5, 10, and 13

presented only about 10 or fewer forecasted boardings per service hour.

Operating & Maintenance Cost per Passenger

Operating & Maintenance (O&M) Cost per Passenger was a key metric used to assess the

cost-effectiveness of each route. As shown in Figure 25 four of the 10 shortlisted routes clocked in at well over \$20 per passenger in O&M cost in the year 2020. Conversely, five of the 10 shortlisted routes were below \$15 per passenger. As discussed more in Section 5.4, this metric was a key component of the decision-making during the route refinement process.

O&M cost per passenger does fall significantly on multiple routes in scenario D due to the forecasted significant increase in ridership and demand in the year 2040.

### Farebox Recovery

Though not identified as an evaluation metric in the screening process, farebox recovery is an important measure by which the express routes meet SamTrans cost-effectiveness goals and when considering how these potential routes could perform in meeting any applicable funding requirements. SamTrans currently has a 20 percent farebox recovery goal and, trending

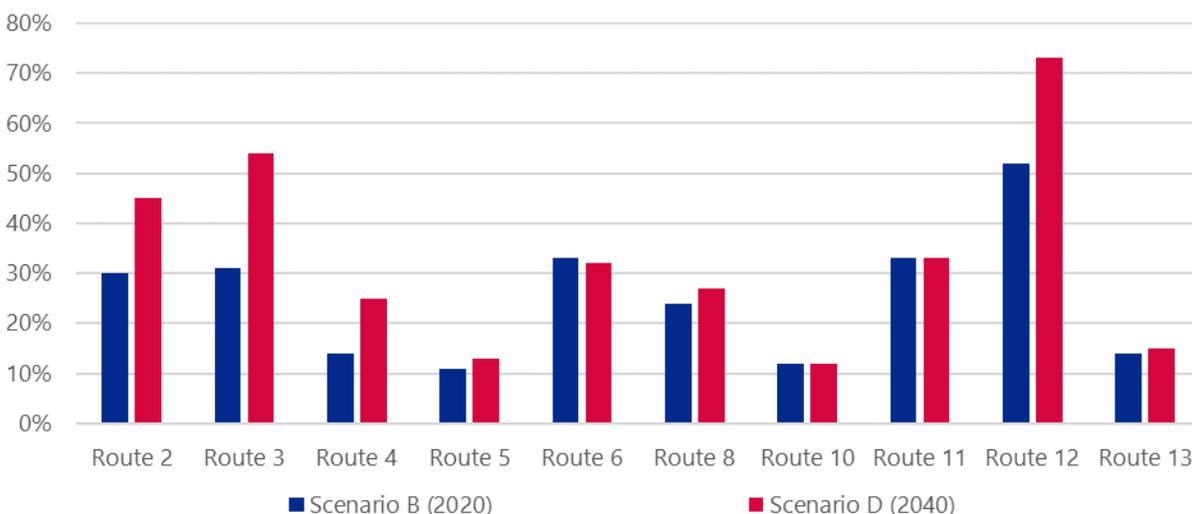
similarly to metrics previously discussed like O&M cost per passenger, some routes are falling far below this threshold. The top performing six routes are all above 20 percent farebox recovery in Scenario B, with most at or above 30 percent.

### Ability to Increase Person Throughput on US-101

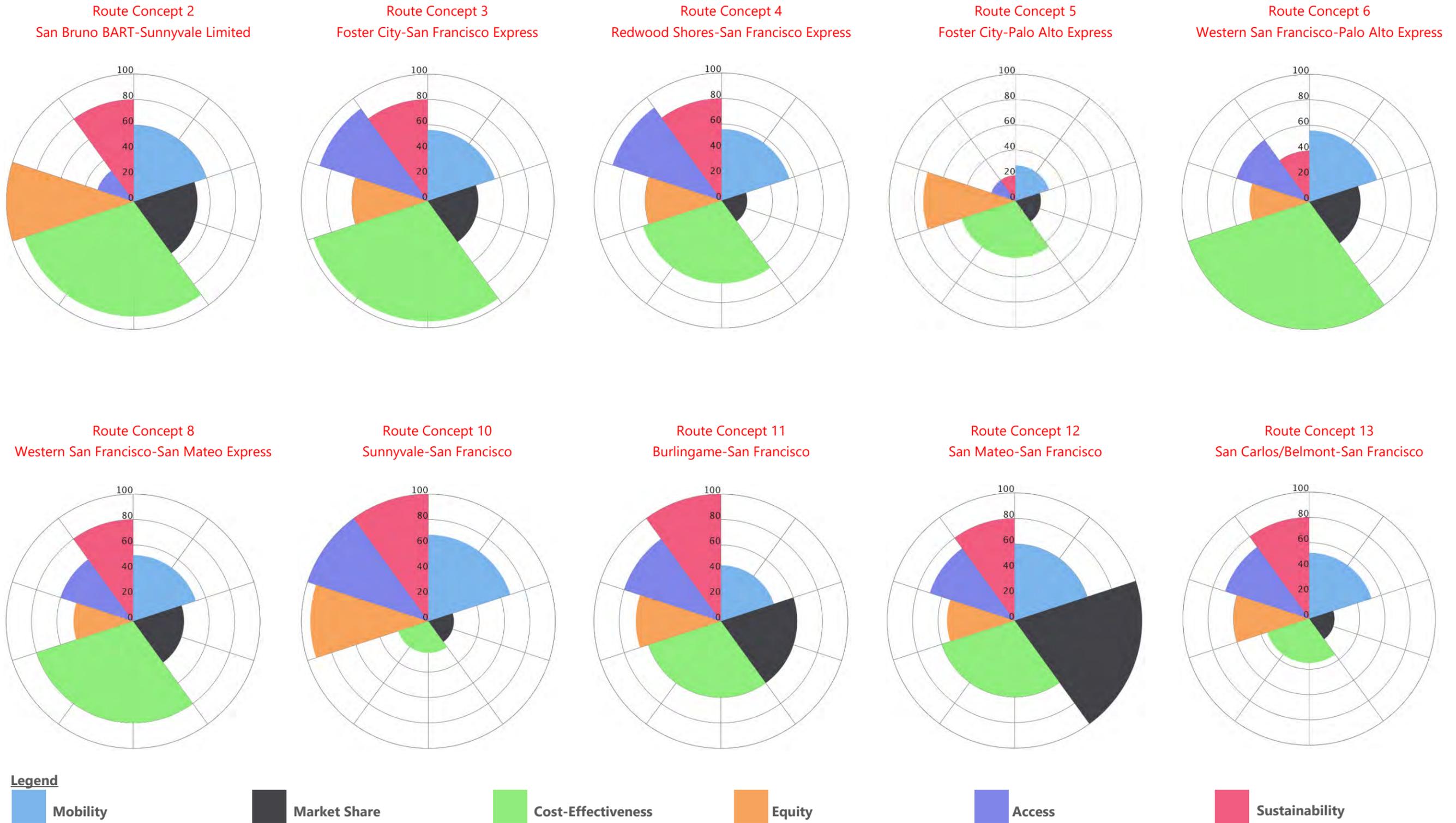
Though this criterion could not be used to evaluate routes individually, increasing the person throughput on US-101 is an important side effect of increasing express bus service on the corridor.

The Express Bus model shows that adding a managed lane along US-101 would increase person throughput by eight to 16 percent along US-101. Adding a full system of ten express bus routes would increase person throughput by up to an additional five percent. Combined, person throughput would increase by up to about 13 to 21 percent.

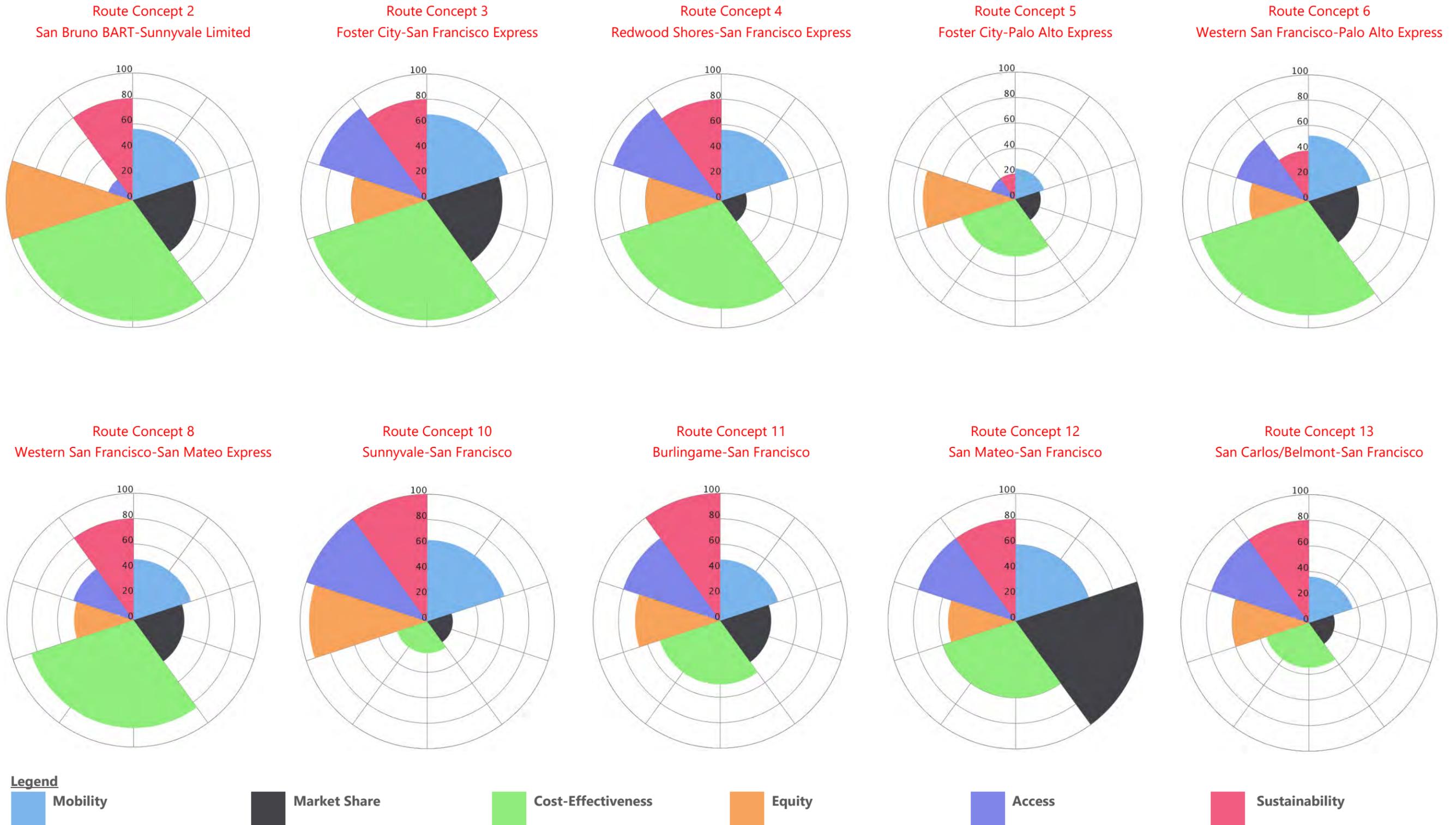
**FIGURE 26: ESTIMATED FAREBOX RECOVERY RATIO**



**FIGURE 27: ROUTE PERFORMANCE UNDER SCENARIO B**



**FIGURE 28: ROUTE PERFORMANCE UNDER SCENARIO D**



## 5.4. ROUTE REFINEMENTS AND RECOMMENDATIONS

Preliminary analysis of the detailed evaluation results revealed a clear set of six top-performing routes. The Study team re-modeled these six routes with the following changes:

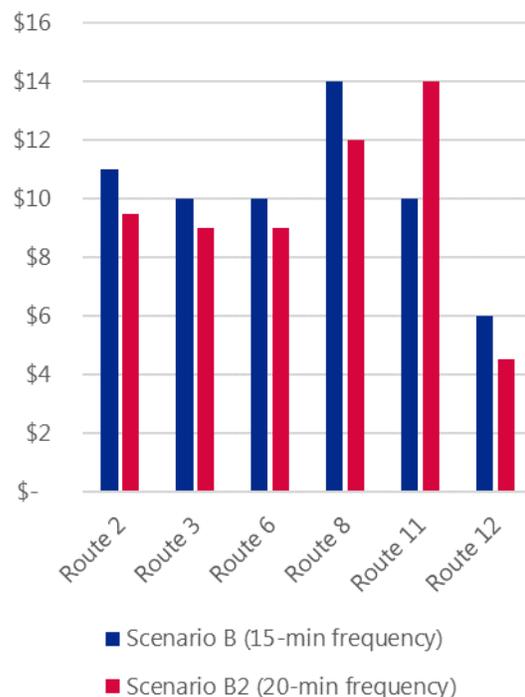
- Adjusted service frequency from 15-minute headways to 20-minute headways
- Truncated Route 2 in East Palo Alto, removing a segment in Santa Clara County
- Shortened Route 11 to terminate in Burlingame
- Shortened Route 12 to focus on service to the CA-92/US-101 park-and-ride

The results of Scenario B2 model run show that express bus ridership is generally resilient to a reduction in frequency, with the exception of Route 11, which may be affected by head-to-head competition with Caltrain as well as the truncated alignment.

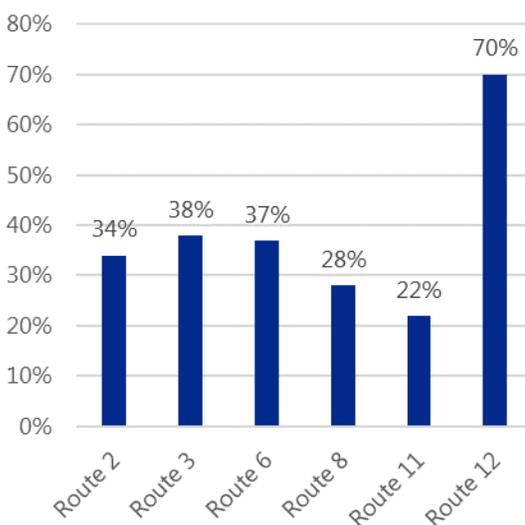
Revised calculation of the Operating & Maintenance Cost per Passenger metric show that though some routes experienced ridership loss in Scenario B2, cost-effectiveness improves on most routes (see Figure 29). Route 11 is the exception to this rule; extending the route alignment to Downtown San Mateo may most effectively balance ridership and route length. This adjustment is discussed further in Chapter 6.

A map of the six top-performing routes recommended for implementation is shown in Figure 31.

**FIGURE 29: ESTIMATED O&M COST PER PASSENGER (FREQUENCY COMPARISON)**



**FIGURE 30: ESTIMATED FAREBOX RECOVERY OF RECOMMENDED ROUTES**



**FIGURE 31: RECOMMENDED EXPRESS BUS ROUTES**



## 5.5. CONCEPTUAL OPERATING PLAN

A conceptual operating plan is presented in the following pages for the six express bus routes recommended for phased implementation.

### 5.5.1. Routing and stop locations

San Francisco-bound routes are assumed to start and end around either the Transbay Transit Center or in Western San Francisco near the Kaiser Permanente Medical Center. In the absence of managed lanes in San Francisco, routes serving the Transbay Transit Center follow the alignment SamTrans currently uses along Mission Street in order to serve the job-dense Civic Center area, with some routes serving Potrero Avenue and Bayshore Boulevard as part of providing bi-directional service.

Routes were designed with the intention of utilizing existing transit stops, whether SamTrans or another regional operator, to the extent possible. However, some stop locations may be new to the system or may not be in use at this time, such as former stops in Foster City for example. A field assessment of existing and necessary stop facilities will be conducted prior to implementation of any new route.

### 5.5.2. Service span and frequency

Each route concept, except for Route 2 – San Bruno BART to East Palo Alto, is assumed to operate for four hours during both morning (6 AM to 10 AM) and evening (3 PM to 7 PM) peak periods. Each route concept is assumed to operate at 20 minute-frequency. These assumptions are subject to change during implementation based on resources availability and other factors.

### 5.5.3. Vehicle characteristics

Climate change and particulate pollution are concerns worldwide. There is growing recognition of the need to operate cleaner and greener vehicles. The California Air Resources Board has a goal for transit agencies to operate all zero-emission vehicles (ZEVs) by 2040. As part of a separate zero-emission bus (ZEB) pilot, SamTrans is on schedule to receive 10 battery-electric buses by early 2020. Staff are also beginning to prepare a plan to transition the rest of the SamTrans fleet, which currently exceeds 300 buses.

If the recent trend of significant advancements in ZEB technology continues, SamTrans could operate ZEBs to provide express bus service. Partially using grant funds awarded by the State of California, SamTrans seeks to procure zero-emissions vehicles with long-haul amenities such as high-back seats, wireless connectivity, and device charging outlets with which to operate a new express bus network over the next five years.

Routes launched before then would utilize existing SamTrans fleet. Staff continue to seek opportunities to retrofit existing vehicles to include the comfort and technological amenities that attract potential riders with access to private vehicles to transit. High-back seats and tray tables are utilized on express, long-haul services throughout the region and Wi-Fi is increasingly expected as employees seek to use a portion of their commute time to complete work.

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## STATE OF ZERO EMISSION BUSES IN CALIFORNIA

ZEB technologies primarily include battery electric buses and fuel cell electric buses. The ZEB market has evolved significantly in recent years. Several bus manufacturers have started manufacturing multiple ZEB models. The currently-available ZEB types include standard municipal, articulated, and motor coach buses. Historically, the operating range of ZEBs has been a concern, but now several battery electric buses can operate up to 300 miles on a single charge, and a fuel cell bus power plant has exceeded 25,000 hours of operation. ZEBs continue to have slightly higher upfront capital costs compared to diesel vehicles, but these costs are gradually declining.

The California Air Resources Board (CARB) has concluded that the ZEB technology is commercially available and reliably operated now.<sup>17</sup> CARB is in the process of adopting the Innovative Clean Transit regulation with the goal of making a transition to an all ZEB transit fleet by 2040. According to CARB, at least seven transit agencies, representing about 25 percent of all buses in the state, have made a commitment for a full transition to ZEBs. As of May 2018, transit agencies in California have 132 battery or fuel cell electric buses in operation and 655 buses on order, awarded or planned.

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### 5.5.4. Fare policy

To facilitate comparison between route concepts, SamTrans assumed the existing flat fare policy for proposed express bus services. SamTrans currently has an out-of-San Francisco

bus fare of \$4.00 (one-way) which was utilized. For the purposes of this Study, an average fare of \$3.25 was assumed to account for discounted fare products. The fare structure used to implement any new express bus service will be determined as part of the ongoing SamTrans Fare Study.

Technology for fare payment will continue to evolve over time. The recently launched SamTrans Mobile ticketing app lets riders use their phone to pay for fare and plan their trips. This study assumes that all fare media provided by SamTrans for its other/local services will be accepted on express bus service as well.

### 5.5.5. Transit priority treatments

The speed and reliability of express bus services on local streets can be improved with transit priority treatments such as sidewalk extensions, transit signal priority, and/or adaptive signal control, queue jump lanes and signals, and longer and optimized bus stops. Such improvements should be implemented in strategic locations to maximize the benefits across the entire transit service network. This Study does not identify specific transit priority improvements but recommends that such opportunities be identified and implemented through agency-wide efforts in coordination with local jurisdictions as appropriate.

In the absence of infrastructure supporting transit priority, optimized scheduling and real-time arrival information can improve the perceived reliability of new express service. Real-time bus tracking for new express bus service

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<sup>17</sup> Status of Battery and Fuel Cell Electric Buses in California Transit Agencies  
<https://arb.ca.gov/msprog/ict/faqs/zbusmap.pdf>

should be made available on the new SamTrans mobile app.

### 5.5.6. Park-and-ride lots

The route concepts rely largely on walking, biking, drop-off, and transit connections for primary access, supplemented by park-and-ride facilities, where available. The route concepts would benefit from investment in transit facilities - such as improved access and upgraded bus stops at 3rd Avenue and Hillsdale Avenue – and park-and-ride facilities – such as direct access to the park-and-ride lot near US-101/CA-92 interchange.

Expansion of the existing park-and-ride at US-101/CA-92 to hold an additional 175 parking spaces was incorporated into the cost assumptions and estimates discussed in Chapter 6. Use of this park-and-ride is tied to the success of recommended Route Concept 12, especially in the year 2040.

Route Concept 6 was also designed to make use of the existing Caltrans-owned park-and-ride off I-280 at Hayne Road. Use and potential expansion of this facility should be considered compared to any adverse operational implications for the rest of the route.

### 5.5.7. First-and-last mile considerations

The potential new SamTrans express bus routes described in this report were designed in an effort to balance access with travel time and directness. Most routes do make some off-freeway travel in order to stop within reasonable walking, bicycling, or drop-off proximity to residential areas.

For this reason, investment in secure bicycle parking and improved walking conditions at or

near key stops is viewed as critical to the success of all new express bus routes. Secure bicycle parking costs are included in the overall project costs shown in Table 5, as well as improvements at the US-101/CA-92 park-and-ride.

Key potential areas for secure bicycle parking include:

- San Francisco: San Francisco State, UCSF Medical Center, Stonestown, Potrero Avenue
- Palo Alto: Stanford Research Park, Stanford University, Stanford Hospital, Palo Alto Transit Center
- Foster City: central Foster City or areas near the Bay Trail
- San Mateo: Hillsdale, CA-92 interchange park-and-ride

Additionally, SamTrans operates a robust network of local routes, many of which provide connections to Caltrain and BART. SamTrans will review its route network to identify opportunities to better connect with new express bus routes in terms of route design and schedules.

### 5.5.8. Branding and Marketing Approach

It is important to create a distinct identity for the new express bus service, one that recognizes the level of impact regionally, yet also promotes SamTrans as the operating agency.

An internal design team will be assembled between SamTrans Planning, Bus Operations, Communications and Marketing to strategize and develop a plan for identifying potential naming opportunities and promotional activities. SamTrans' past express bus service used a letter-based naming convention; this may be retained or the team may explore a new naming convention signifying a new service.

With the possibility of new equipment and/or amenities to enhance rider experience, the design team will take all options into consideration that are within budget and fall into established design standards. This may include external bus wraps or decals to draw attention to the buses as they operate in the SamTrans service area and new destinations.

SamTrans sees partnership with employers and other organizations in proximity to the new routes as key to the promotional and marketing efforts. In addition to media-based tools like earned and social media, SamTrans staff will engage with employers and community organizations along the new routes to get the word out to their employees and stakeholders.

06

IMPLEMENTATION  
STRATEGIES



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# 6. IMPLEMENTATION STRATEGY

## 6.1. PHASING PLAN

Implementing all the recommended express bus routes would require significant financial resources and both internal and external coordination. As these aspects are difficult to predict for each route, the Study recommends implementation of express bus service in three phases. The recommended phasing plan introduces and expands express bus service in the Study area over time. A proposed implementation schedule, including key activities associated with each phase, is shown in Figure 38.

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### PHASED IMPLEMENTATION

- Phase 1: Pilot (2019)
- Phase 2: With Managed Lanes Opening (2022)
- Phase 3: Further Growth (2023)

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#### 6.1.1. Phase 1 (Pilot, pre-Managed Lanes launch)

There is an opportunity to introduce two recommended express bus routes in the immediate future, tentatively Summer 2019. Routes 3 and 6 would be implemented in this phase. This initial service could be rolled out with minimal infrastructure improvements and using existing SamTrans buses retrofitted to provide comfort and technological amenities

that might include Wi-Fi, plugs, tables, and high-back seats. Once zero emission electric buses are procured and charging infrastructure is installed, the service could be transitioned to electric buses.

#### 6.1.2. Phase 2 (with Managed Lanes Opening)

Some of the recommended routes would benefit from the availability of managed lanes to offer competitive alternatives to private automobiles or existing transit services in the study area. Therefore, these routes – Routes 2 and 12 – would be implemented in coordination with the delivery of managed lanes on US-101 anticipated by 2022. The timeline of managed lanes provides an opportunity to procure zero emission vehicles and associated infrastructure and to improve or expand the US-101/CA-92 park-and-ride lot before launching this phase of service.

#### 6.1.3. Phase 3 (Future Growth)

In addition to the routes included in earlier phases of implementation, some other routes serving focused markets may benefit from mature express bus services in the study area and from strategic partnerships. Routes 8 and 11 could be implemented after the first two phases have been implemented or when such partnerships are realized. These routes have the potential to operate with zero emissions vehicles.

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## Phase 1: Pilot (2019)

### Route 3 - Foster City – Downtown San Francisco

This bi-directional route serves travel markets between Foster City and downtown San Francisco (see Figure 32) not directly served by Caltrain service. Previously, SamTrans' FX route in Foster City was the most productive of SamTrans' express bus routes. The route will serve neighborhoods in Foster City directly allowing for access to stops by walking, bicycling, or other SamTrans services. It is expected that potential time savings for the route relative to Caltrain may shift some Caltrain passengers and attract some passengers with origins or destinations beyond the South of Market neighborhood of San Francisco. The route also includes stops in Northern San Mateo, a Community of Concern. The route also provides service to VISA, Gilead, and other large employers in Foster City for San Francisco residents.

### Route 6 - Palo Alto – Western San Francisco via Daly City

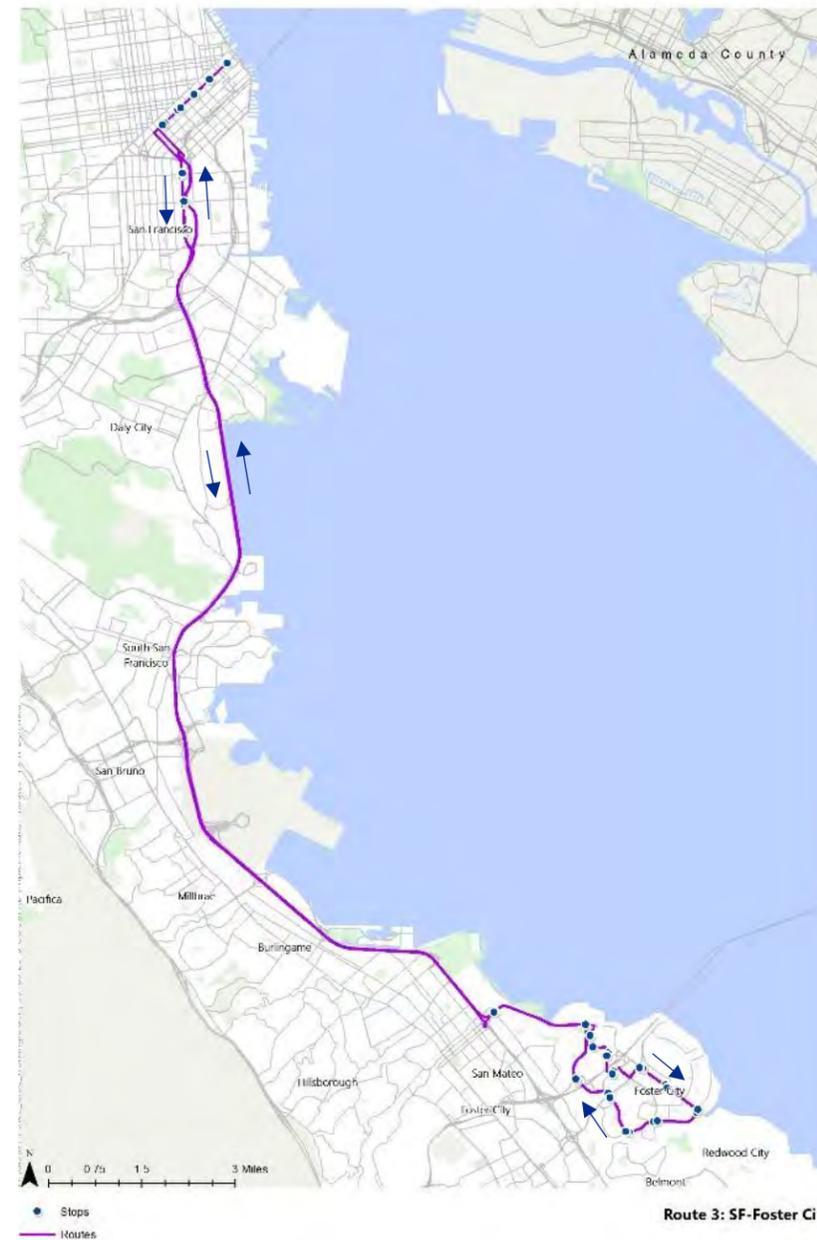
One of the most productive of the route concepts, this bidirectional route (see Figure 33) provides an opportunity to serve areas like Western San Francisco and the 19<sup>th</sup> Avenue corridor which have less access today to long-haul transit like Caltrain. The route also benefits from a bi-directional demand with employers like San Francisco State University, University of California at San Francisco Medical Center, and Kaiser Medical Center in San Francisco. There is potential for partnerships with large institutions like UCSF and San Francisco State University, and large employers like the Kaiser Medical Center and Stanford University, Stanford Health Care, and employers in the Stanford Research Park.

#### CONSIDERATIONS FOR ROUTE 6

This route was designed to serve Daly City BART; however, SamTrans operates a large park-and-ride facility at Colma BART, which can be considered in lieu of Daly City BART.

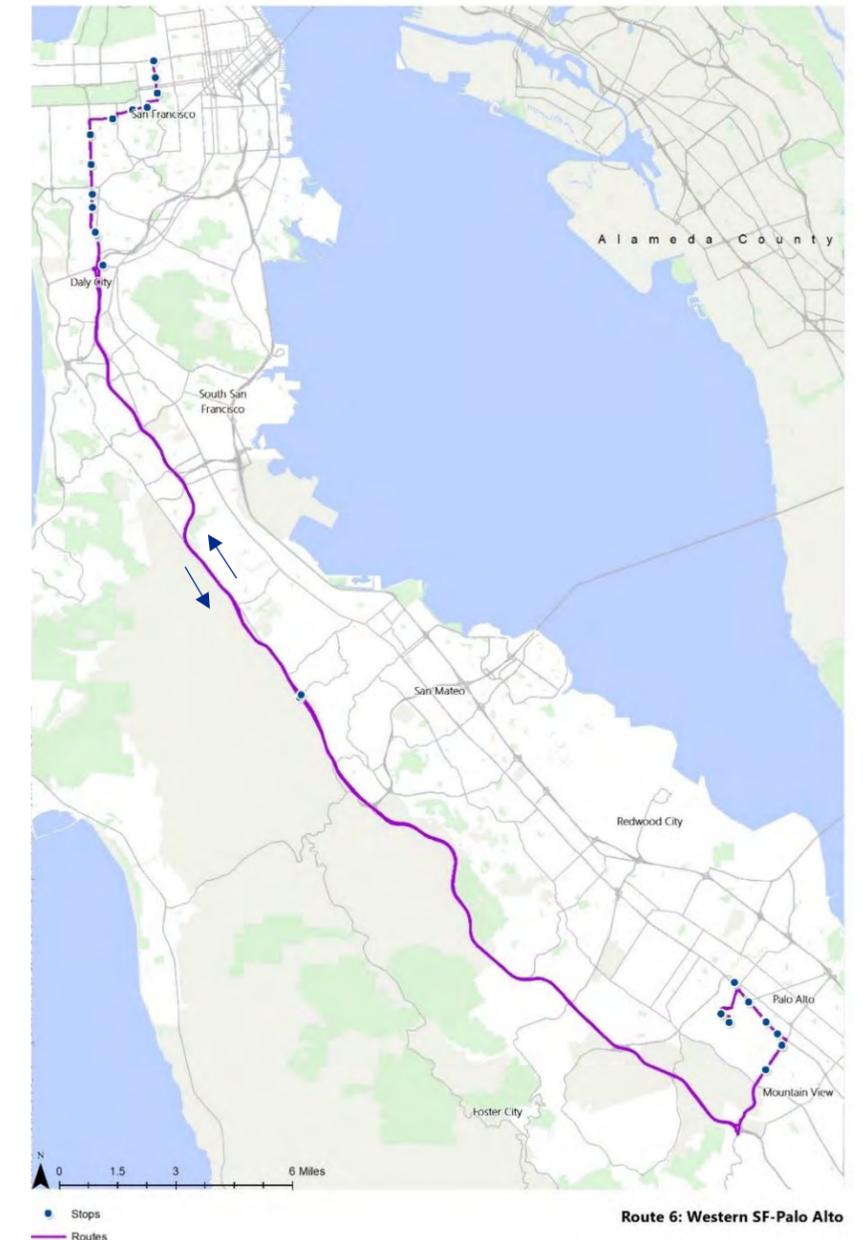
On the Palo Alto end, the route would benefit from serving the Stanford Hospital area in addition to or in lieu of the Stanford Oval. Parking facilities for north-bound passengers may be needed.

FIGURE 32: ROUTE 3 – FOSTER CITY – DOWNTOWN



<b>Service Type</b>	Bidirectional Express
<b>Estimated Daily Boardings (2019)</b>	1,100
<b>Daily Revenue Service Hours</b>	48
<b>Annual O&amp;M Cost</b>	\$1.9 million

FIGURE 33: ROUTE 6 – PALO ALTO – WESTERN SAN FRANCISCO VIA DALY CITY



<b>Service Type</b>	Bidirectional Express
<b>Estimated Daily Boardings (2019)</b>	1,760
<b>Daily Revenue Service Hours</b>	72
<b>Annual O&amp;M Cost</b>	\$3.2 million

## Phase 2: With Managed Lanes (2022)

### Route 2 - San Bruno BART – East Palo Alto, via SFO

This limited stop route (Figure 34) is an all-day route serving multiple communities between San Bruno BART and East Palo Alto, including Redwood City, Redwood Shores, and SFO. This market is not directly served by Caltrain or BART and trips along this route would require multiple transfers on other transit services today.

#### CONSIDERATIONS FOR ROUTE 2

The route has the potential to run a longer distance in managed lanes. Prior to implementation, elimination of three freeway ramp stops (at 3<sup>rd</sup> Avenue, Hillsdale Avenue, and Millbrae Avenue) should be considered as a trade-off for the travel time savings offered by using eight miles of managed lanes on US-101 instead.

Staff should also align the schedule of this proposed route with the Dumbarton Express in East Palo Alto and consider an extension north into South San Francisco's Oyster Point/East of 101 area, which is experiencing significant growth. Finally, this route may warrant service later than the modeled end time of 7 p.m.

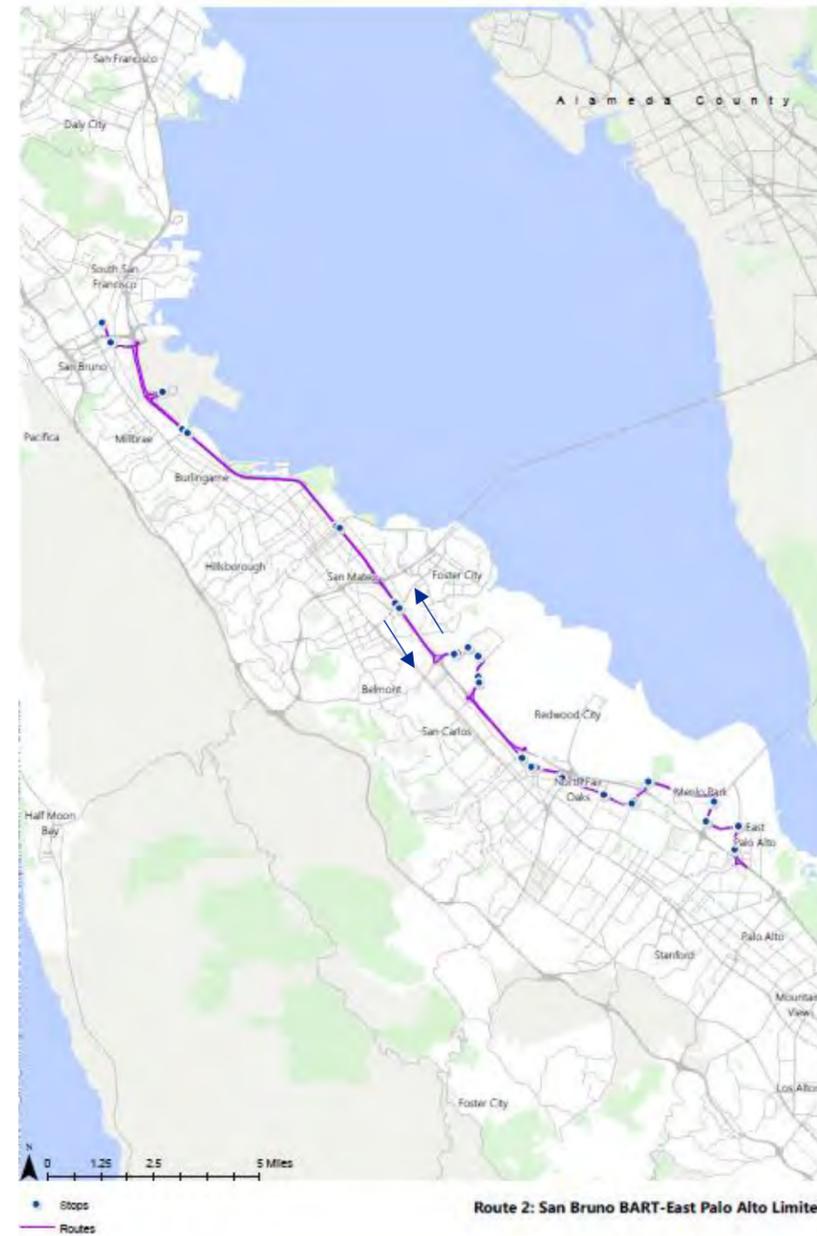
### Route 12 - San Mateo – Downtown San Francisco

This one-way route (Figure 35) connects San Mateo and surrounding residents to jobs in San Francisco via the park-and-ride at the US-101/CA-92 interchange. This route may rely on expansion of the park-and-ride and/or introduction of other first mile/last mile strategies such as better pedestrian and bicycle infrastructure connecting to the parking facility.

#### CONSIDERATIONS FOR ROUTE 12

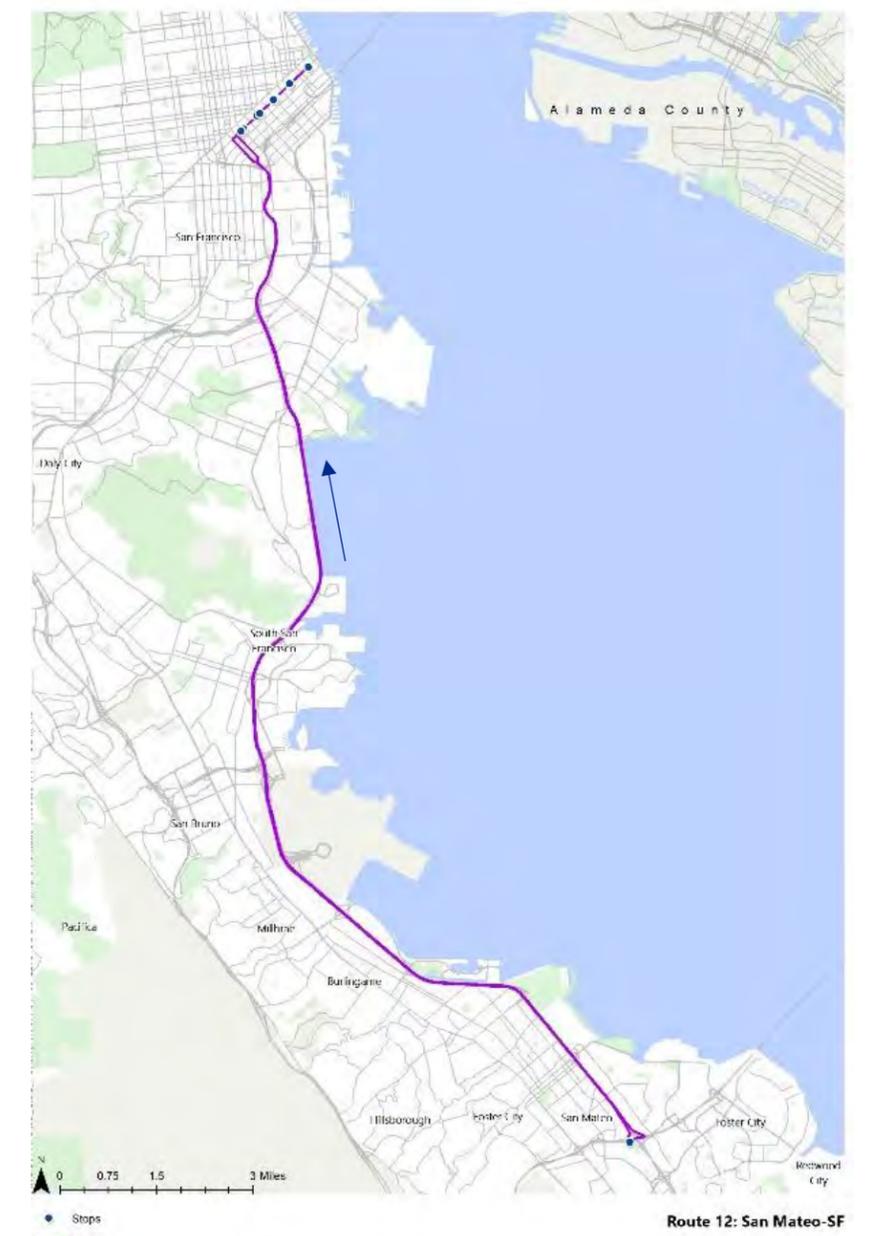
The route was designed to operate northbound in the morning, southbound in the evening; however, extending the route to employment centers in Redwood Shores could allow the service to be bidirectional. Such a variant should be evaluated from incremental ridership and operating cost perspectives before implementation. Partnerships with employers in Redwood Shores might make this a viable change.

FIGURE 34: ROUTE 2 – SAN BRUNO BART – EAST PALO ALTO



<b>Service Type</b>	Bidirectional Limited
<b>Estimated Daily Boardings</b>	1,860
<b>Daily Revenue Service Hours</b>	91
<b>Annual O&amp;M Cost</b>	\$4.1 million

FIGURE 35: ROUTE 12 – SAN MATEO – DOWNTOWN SAN FRANCISCO



<b>Service Type</b>	One-Directional
<b>Estimated Daily Boardings</b>	1,040
<b>Daily Revenue Service Hours</b>	40
<b>Annual O&amp;M Cost</b>	\$1.8 million

### Phase 3: Further Growth (2023/2024)

#### Route 8 - Western San Francisco – San Mateo

This route (see Figure 36) serves a San Mateo and western San Francisco market that is well-served by existing transit services but require transfers via Muni, BART, or Caltrain. The presence of major institutions such as San Francisco State University, University of California at San Francisco, and University of San Francisco in this corridor underscore the potential for strategic partnerships. The implementation timeline for these routes could be revised based on realization of such partnerships.

##### CONSIDERATIONS FOR ROUTE 8

This route was not designed to stop at SFO in order to maximize the distance the route travels in the managed lane. However, there may be potential to serve a significant market of SFO employees living in Western San Francisco. A variant of this route with a stop at SFO should be considered and partnership opportunities with SFO should be explored during further study of this potential route.

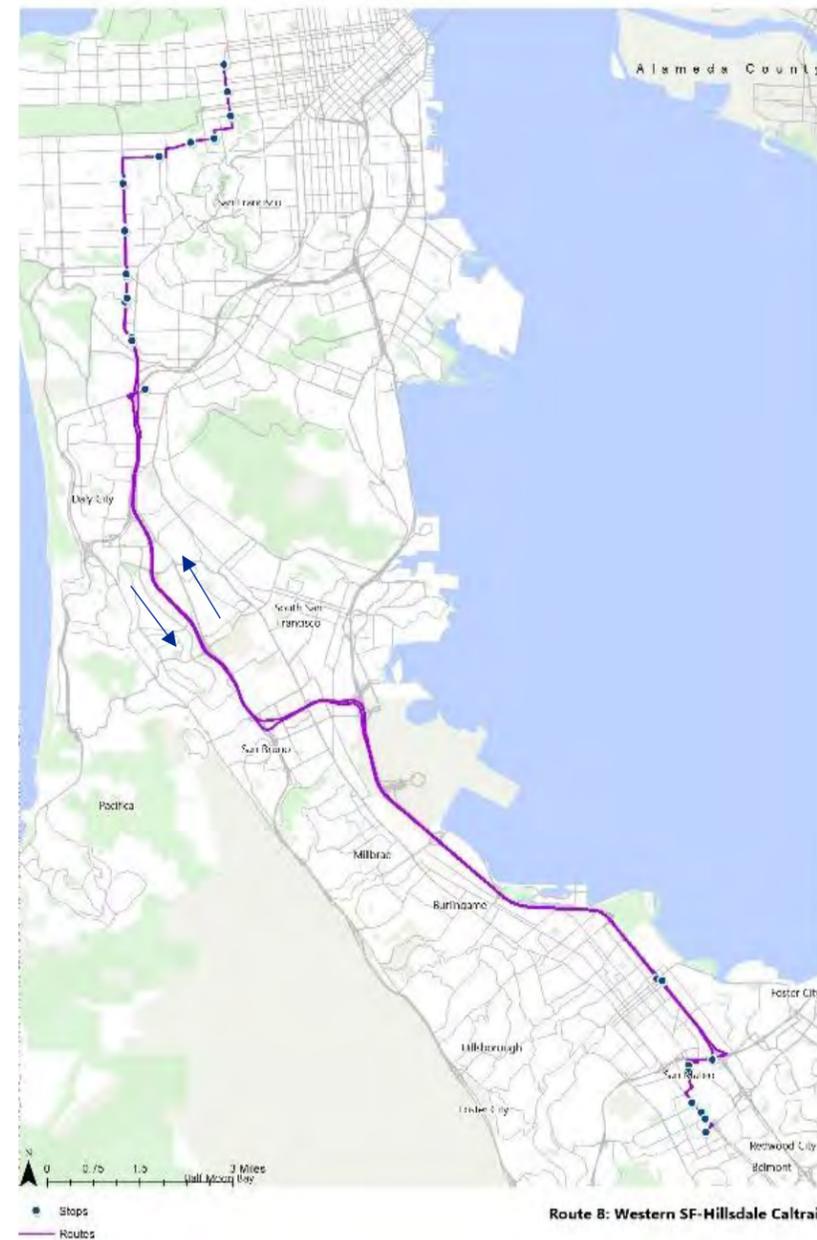
#### Route 11 - Burlingame – Downtown San Francisco

This route (see Figure 37) serves the mid-peninsula to San Francisco markets. Caltrain serves these markets currently, and is expected to offer the fastest transit option along the corridor. However, express bus service may supplement Caltrain in neighborhoods where lower Caltrain service levels may not be able to serve all potential demand. Moreover, if Caltrain ridership grows faster than expected, express bus service could supplement Caltrain bottlenecks in the mid-Peninsula.

##### CONSIDERATIONS FOR ROUTE 11

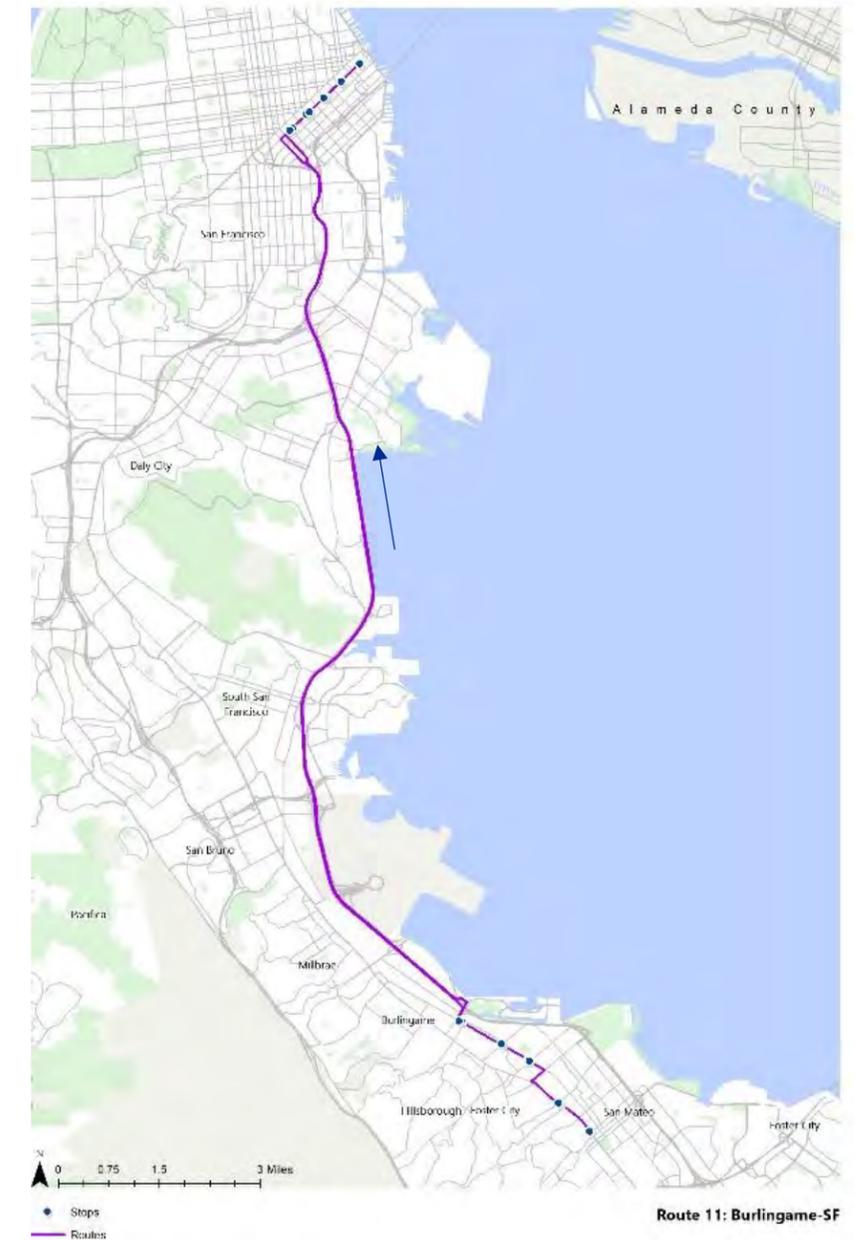
The focused nature of this express bus market warrants further evaluation and refinement of this route to ensure the service is cost-effective and effectively serves the market.

FIGURE 36: ROUTE 8 – WESTERN SAN FRANCISCO – SAN MATEO



<b>Service Type</b>	Bidirectional Express
<b>Estimated Daily Boardings</b>	880
<b>Daily Revenue Service Hours</b>	56
<b>Annual O&amp;M Cost</b>	\$2.5 million

FIGURE 37: ROUTE 11 – BURLINGAME – DOWNTOWN SAN FRANCISCO



<b>Service Type</b>	One Directional
<b>Estimated Daily Boardings</b>	270
<b>Daily Revenue Service Hours</b>	48
<b>Annual O&amp;M Cost</b>	\$2.1 million



TABLE 5: EXPRESS BUS PROJECT COST ESTIMATES

Category	Unit	Unit Capital Cost	Cost Source	Express Bus Project Costs									Total Cost (in millions)
				Routes		Cost (in millions)	Routes		Cost (in millions)	Routes		Cost (in millions)	
				Route 3	Route 6	Phase 1	Route 2	Route 12	Phase 2	Route 8	Route 11	Phase 3	
<b>Annual Service Costs</b>													
Annual Operating Costs	Per hour	\$ 172	National Transit Database	48	72	\$ 5.37	91	40	\$ 5.86	56	48	\$ 4.65	
Annual Maintenance Costs	Percentage of infrastructure costs	5%				\$ 0.21			\$ 0.28			\$ 0.14	
<b>Total Annual Costs</b>						<b>\$ 5.57</b>			<b>\$ 6.14</b>			<b>\$ 4.80</b>	<b>\$ 16.51</b>
<b>Capital Costs</b>													
Retrofitted Existing Transit Bus	Each	\$ 12,000	WSP	7	9	\$ 0.19	0	0	\$ -	0	0	\$ -	
New Battery Electric Bus	Each	\$ 730,000	Proterra	7	9	\$ 11.68	8	5	\$ 9.49	7	4	\$ 8.03	
Electric Bus Charging Infrastructure	Each bus	\$ 250,000	SamTrans facilities team	7	9	\$ 4.00	8	5	\$ 3.25	7	4	\$ 2.75	
Highway Ramp Bus Stop	Each	\$ 62,600	SamTrans El Camino BRT Study	0	0	\$ -	6	0	\$ 0.38	0	0	\$ -	
Street Bus Stop	Each	\$ 11,500	SamTrans El Camino BRT Study	6	0	\$ 0.07	12	0	\$ 0.14	0	8	\$ 0.09	
Bicycle Rack	per parking space	\$ 1,000	Dero	24	68	\$ 0.09	0	52	\$ 0.05	16	30	\$ 0.05	
Park-and-Ride Lot Expansion	per parking space	\$ 10,000	Victoria Transportation Institute			\$ -	175		\$ 1.75	0		\$ -	
Professional Services	Percentage	40%				\$ 0.06			\$ 0.93			\$ 0.06	
Unallocated Contingency	Percentage	30%				\$ 4.81			\$ 4.52			\$ 3.28	
<b>Total Capital Costs</b>						<b>\$ 20.91</b>			<b>\$ 20.50</b>			<b>\$ 14.25</b>	<b>\$ 55.65</b>

## 6.2. CAPITAL AND O&M COSTS

Operating and Maintenance (O&M) and Capital cost assumptions are based on the assumed operating plan for the six proposed Express Bus routes. The total estimated annual O&M cost for the full network of six routes is \$16.5 million per year. The total estimated capital cost is \$55.6 million inclusive of purchase of 40 electric vehicles to operate the entire network, professional services to support infrastructure projects, and a 30 percent contingency on all capital expenses. Descriptions of cost assumptions and related calculations are shown in [Table 5](#), as well as a breakdown by phase.

### 6.2.1. Operating Cost Assumptions<sup>18</sup>

For the purposes of cost estimating, five of the six recommended routes are assumed to operate on weekdays during the morning peak (6:00 AM to 10:00 AM) and the evening peak periods (3:00 PM to 7:00 PM) at 20-minute headways. Each express bus route is expected to make 26 round trips per weekday, except for Route 2, which will run all-day (6:00 AM to 7:00 PM) and make 40 trips per weekday. These service spans are subject to change during implementation but were assumed for modeling and cost estimation purposes.

### 6.2.2. Capital Costs

Capital costs are determined assuming purchase of electric vehicles for all routes as well as the estimated cost of additional improvements along the route, such as park-and-ride facility expansion, multimodal amenities like secure bike

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<sup>18</sup> Peak period vehicle requirements are determined by dividing the total travel time by the peak period headway. Planning-level total vehicle service hours per weekday are calculated by multiplying daily service span by the total number of vehicles required. O&M Cost per weekday is

parking, and bus stop improvements. Retrofit of 16 existing vehicles for the pilot project in Phase 1 is also included as a capital expense.

## 6.3. FUNDING AND FINANCING STRATEGIES

To complete a full plan of funding for the express bus service recommendations, \$55.6 million in capital and \$16.5 million in annual operating funding must be identified. SamTrans has been awarded a \$15 million grant to fund to fund capital needs through the State of California's Transit and Intercity Rail Program. To identify the remaining funding needs, SamTrans has developed four funding strategies.

---

### FUNDING AND FINANCING STRATEGIES

- Strategy 1 – Seek additional state, regional and local funding
- Strategy 2 – Pursue federal grant funding and financing
- Strategy 3 – Utilize farebox and toll revenues for operations and project financing
- Strategy 4 – Explore value capture and public/private contributions

---

### 6.3.1. Strategy #1: Seek additional state, regional, and local funding

This strategy focuses on seeking additional funds from state, regional, and local sources.

---

#### State Sources

calculated by multiplying the total vehicle service hours per weekday by \$172, an assumption for hourly cost based on SamTrans reporting to the National Transit Database. O&M cost per year assumes 260 weekdays per year.

The State of California funding programs administered by Caltrans, the California State Transportation Agency (CalSTA), or the California Transportation Commission (CTC) that could support the Project include:

#### TRANSPORTATION DEVELOPMENT ACT (TDA)

The TDA funds a wide variety of activities, including planning, pedestrian and bicycle facilities, community transit services, public transportation, and bus and rail projects.

SamTrans could rely on TDA funds to pay the operating costs associated with express bus services once implemented.

#### SENATE BILL 1 (SB 1)

SB1's Local Partnership Program (LPP) Formulaic Program funds can be used for improvements to transit facilities. SamTrans has budgeted \$2.0 million in future revenues from this program to fund capital costs of the SamTrans Express Bus Pilot Project.

#### CAP-AND-TRADE PROGRAM

The Transit and Intercity Rail Capital Program (TIRCP), supported by the cap-and-trade program, funds transformative capital improvements to reduce emissions of greenhouse gases by reducing congestion and vehicle miles traveled throughout California.

---

In April 2018, CalSTA awarded \$15 million in TIRCP funds for the SamTrans Express Bus Pilot project consisting of four limited-stop express bus routes using 37 new zero-emission electric buses. The SB1 funds for the US-101 Managed Lanes project are intended to provide the highway improvements necessary to offer this transit service.

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The Low Carbon Transit Operations Program (LCTOP), also funded by the cap-and-trade program, supports transit projects and operations that reduce GHG emissions.

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SamTrans has budgeted \$3.5 million in LCTOP funds to cover capital costs of the SamTrans Express Bus Pilot project.

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#### CARB FUNDING SOURCES

The California Air Resources Board's (CARB's) Volkswagen Environmental Mitigation Trust provides competitive grant funding opportunities that could go towards the electric bus purchase and charging components of the Project. Funding is anticipated to be made available through a call for projects as soon as late 2018/early 2019.

CARB's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) provides vouchers for purchasing or leasing hybrid or zero-emission trucks and buses and could be used for electric bus purchase and charging components of the Project.

#### Regional Sources

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Regional bridge toll revenues provide funding for transit projects that help to relieve bridge traffic and/or provide alternative public transit services. Bridge toll revenues normally serve as state and local match for SamTrans and other operators to leverage federal capital funds. In general, funding available from this source has not been sufficient to provide the match for all funded capital projects.

### REGIONAL MEASURE 3 (RM3)

Regional Measure 3, approved by the voters earlier this year, will generate \$4.45 billion in bridge toll funds and includes funding for transit operating assistance with \$60 million annually for regional express bus.

#### Local Sources

Local governments fund transportation projects through a range of revenue options, such as sales taxes, special assessments, parking and car rental fees, tax increment financing, and property taxes. These revenues can be applied directly to project costs or used as a repayment stream either for bonds or private investment.

The proceeds from the San Mateo County Transit District half-cent sales tax are used to underwrite the SamTrans operating budget, as well as a portion of the capital budget in the form of local match to leverage federal, state and regional funding sources.

#### **6.3.2. Strategy #2: Pursue Federal grant funding and financing**

This strategy focuses on pursuing federal funds authorized by the Fixing America's Surface Transportation Act (FAST Act) for funding surface transportation infrastructure.

### BETTER UTILIZING INVESTMENTS TO LEVERAGE DEVELOPMENT (BUILD; FORMERLY TIGER)

The purpose of the BUILD grant program is to support surface transportation projects that are difficult to fund through traditional federal programs and have a significant local or regional impact. The capital costs of the express bus project (e.g., planning, design, bus purchase, bus stops, traffic control systems, guideways, parking) are suitable candidates for the BUILD program. However, the likelihood of its

continued availability and an application's success in attaining grant funds from a future BUILD round is very limited due to its current focus on rural highway projects and its Congressional appropriation.

### URBANIZED AREA FORMULA FUNDS

Funding amounts for the FTA Urbanized Area Formula are calculated and administered by MTC, and could go towards the acquisition, construction, improvement, and maintenance of transit facilities and equipment.

### BUS AND BUS RELATED EQUIPMENT AND FACILITIES AND LOW-NO PROGRAMS

The grants for Bus and Bus Infrastructure program makes federal resources available to replace, rehabilitate and purchase buses and related equipment, and to construct bus-related facilities including technological changes or innovations to modify low- or no-emission vehicles or facilities. SamTrans won this funding for its San Carlos Transit Center and hybrid bus purchase projects. Future such funds could be used for bus purchase and bus-stop components of the Project.

A sub-program, the Low- or No-Emission Vehicle Program, provides competitive grants for projects that support low- and zero-emission vehicles. Future rounds of this program could be targeted for purchase or lease of low or no emission buses, power source, and maintenance facilities associated with the Project.

### STATE OF GOOD REPAIR GRANTS

State of Good Repair grant funding is limited to fixed guideway systems and high intensity bus. Projects are limited to replacement and rehabilitation or capital projects required to maintain public transportation systems in a state

of good repair, as well as development and implementation of transit asset management plans. This program would be applicable to operations and maintenance costs.

#### REVENUE BONDS

While not a federal funding source, revenue bonds are a source of project financing that may be applicable to the Project. Revenue bonds do not provide new funding; rather, as capital markets debt, they accelerate the availability of resources to meet construction needs through leveraging.

There are two types of revenue bonds that are generally used for public transit projects in the U.S. The first, farebox revenue bonds, use farebox revenues and anticipated grant receipts as collateral for revenue bonds. As such, both farebox revenue and GANs may have wide-ranging applicability to the Project. However, SamTrans is unlikely to take on new debt without additional local sales tax funds from the November 2018 ballot measure.

#### **6.3.3. Strategy #3: Utilize farebox and toll revenues for operations and project financing**

This strategy focuses on applying user fees such as transit fares and tolls as a funding source for project. Toll revenues from the US-101 Managed Lanes project will be made available for ongoing operations for routes utilizing the US-101 managed lanes. Toll revenues may also serve as state and local match for SamTrans to leverage federal capital funds.

Toll revenues should also be considered as a means of financing to cover capital costs of the Project. If the November 2018 local sales tax ballot measure garners enough votes, SamTrans or its local partners, including the San Mateo

County Transportation Authority, could issue debt against future US-101 toll revenues to finance the capital costs of the project.

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SamTrans' state and federal grant applications for the US-101 Express Bus Pilot Project included \$8.0 million in financing against such toll revenues.

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#### **6.3.4. Strategy #4: Explore value capture and private/public contributions**

##### VALUE CAPTURE

Local government revenues, such as sales taxes, special assessments, parking and car rental fees, tax increment financing, and property taxes, can be applied directly to project costs or used as a repayment stream either for bonds or private investment. Some of these options are value capture methods such as special assessment district financing, tax increment financing, and development impact fees. Traditionally, value capture is used more for rail transit projects than for bus transit projects. However, value capture tools may still play a part in project funding.

##### SPECIAL ASSESSMENT DISTRICT

A special assessment district is an officially designated area from which additional property taxes are collected for a specific use. The benefit of a special assessment district – in addition to the revenue raised from the new tax – is that the revenue stream would exist outside of SamTrans' or other government entities' existing budget structures, allowing for greater flexibility and independence in decisions about how the funds are used for the Project.

A shared business tax scheme could be an efficient solution for the US-101 Express Bus

Project corridor. In this instance, businesses across several jurisdictions would be taxed as part of one district or assessment area. Given the geographic scope of the US-101 corridor, a shared business special assessment district may raise additional revenue from private parties most likely to benefit from corridor improvements.

#### TAX INCREMENT FINANCING (TIF)

Tax increment financing (TIF) is a way of applying the additional property tax revenue generated by the surrounding land after a project is completed. The rise in property values resulting from transportation projects generates additional revenues that are dedicated to making payments on bonds to finance a project.

In California, concerns over the State's budgetary obligation to backfill diverted property tax funds for local school districts led to the dissolution of Redevelopment Agencies in 2011. As a result, cities and counties were left without a means of utilizing TIF. However, new forms of TIF have emerged to give local jurisdictions options to finance infrastructure and economic development projects.

#### DEVELOPER CONTRIBUTIONS

Development impact fees can be collected by a city or county to fund capital infrastructure costs. Direct developer contributions may result from a negotiation between a large developer and the project sponsor during the planning stages of development review or under an Adequate Public Facilities Ordinance. A developer may propose an extension to the new system, additional stops, or a change in alignment that will provide direct benefit to their property (as

well as generate additional ridership). In exchange, the project sponsor may request a financial contribution to balance the larger public benefits resulting from greater ridership with the private benefits to the developer.

Value capture methods could finance specific portions of the Project, such as bus stops and park-and-ride facilities. Possibly the largest challenge for using value capture is securing uniform political support for the revenue stream, particularly for the US-101 Express Bus Project area given that the impacts are spread over three counties. A private-sector champion or partnership for using this funding approach would be critical since they are influential in selling the value that these corridor improvements will provide to industry peers, who together can help generate the political will to support what is essentially a new tax.

#### PUBLIC AND PRIVATE CONTRIBUTIONS

SamTrans will continue to work with partner agencies and organizations throughout the three counties that stand to benefit from express bus routes serving their residents and employees. Contributions from a few key partners can build momentum with other governments, institutions and companies with an interest in providing enhanced mobility and access for employees. This effort could replicate the current example of Amazon buying transit assets (rail sets) for the City of Seattle and Sound Transit, in exchange for service improvements and advertising space (train cars).

Table 6 summarizes the applicability of potential key funding/financing sources.

**TABLE 6: APPLICABILITY OF POTENTIAL FUNDING/FINANCING SOURCES**

Potential Funding/Financing Source	Capital Improvements	Operations and Maintenance
<b>Federal Sources</b>		
Better Utilizing Investments to Leveraging Development (BUILD)	•	
Urbanized Area Formula Funds	•	
Bus and Bus Related Equipment and Facilities	•	
<i>Low- or No-Emission Vehicle Program</i>	•	
State of Good Repair Grants		•
Revenue Bonds	•	
<b>State Sources</b>		
Transportation Development Act (TDA)		•
Senate Bill 1 (SB1)	•	•
Cap-and-Trade Program	•	•
<i>Transit and Intercity Rail Capital Program (TIRCP)</i>	•	
<i>Low Carbon Transit Operations Program</i>		•
California Air Resources Board	•	
<i>Volkswagen Environmental Mitigation Trust</i>	•	
<i>Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project</i>	•	
<b>Regional Sources</b>		
Regional Measure 3	•	•
<b>Local Sources</b>		
Value Capture	•	•
<i>Special Assessment District</i>	•	•
<i>Tax Increment Financing</i>	•	•
<i>Developer Contributions</i>	•	
<i>Public and Private Contributions</i>	•	•
Toll Revenues	•	•
Farebox Revenue	•	•

## **6.4. PERFORMANCE EVALUATION**

Ongoing evaluation of route performance will be important to ensuring the responsible and efficient use of SamTrans resources, and that customers are receiving the best possible service and experience.

The following performance metrics are recommended for regular evaluation of the new express service. Baseline data points for each metrics should be established prior to the launch of new service; post-implementation metrics will be compared to pre-service levels where data is available.

SamTrans' Operations and Customer Service teams will undertake regular evaluation of the operations and productivity of the proposed express routes. The following metrics will be examined on the cadence described in Table 7.

### **6.4.1. Implement, Monitor, Scale or Adjust**

Travel demand modeling undertaken as part of this Study produced ridership estimates and other performance metrics that indicate a viable market potential for the re-introduction of express bus service in the Study area. That being said, actual ridership upon implementation may differ from the estimates produced through travel demand modeling.

Based on this understanding, staff will need to monitor and be prepared to scale or adjust service levels and other factors as appropriate. If ridership either exceeds or fails to meet the Study's estimates, staff may need to consider ways to right-size the service to maintain a cost-effective, such as reducing service frequency, span, or adjusting other operational levers that

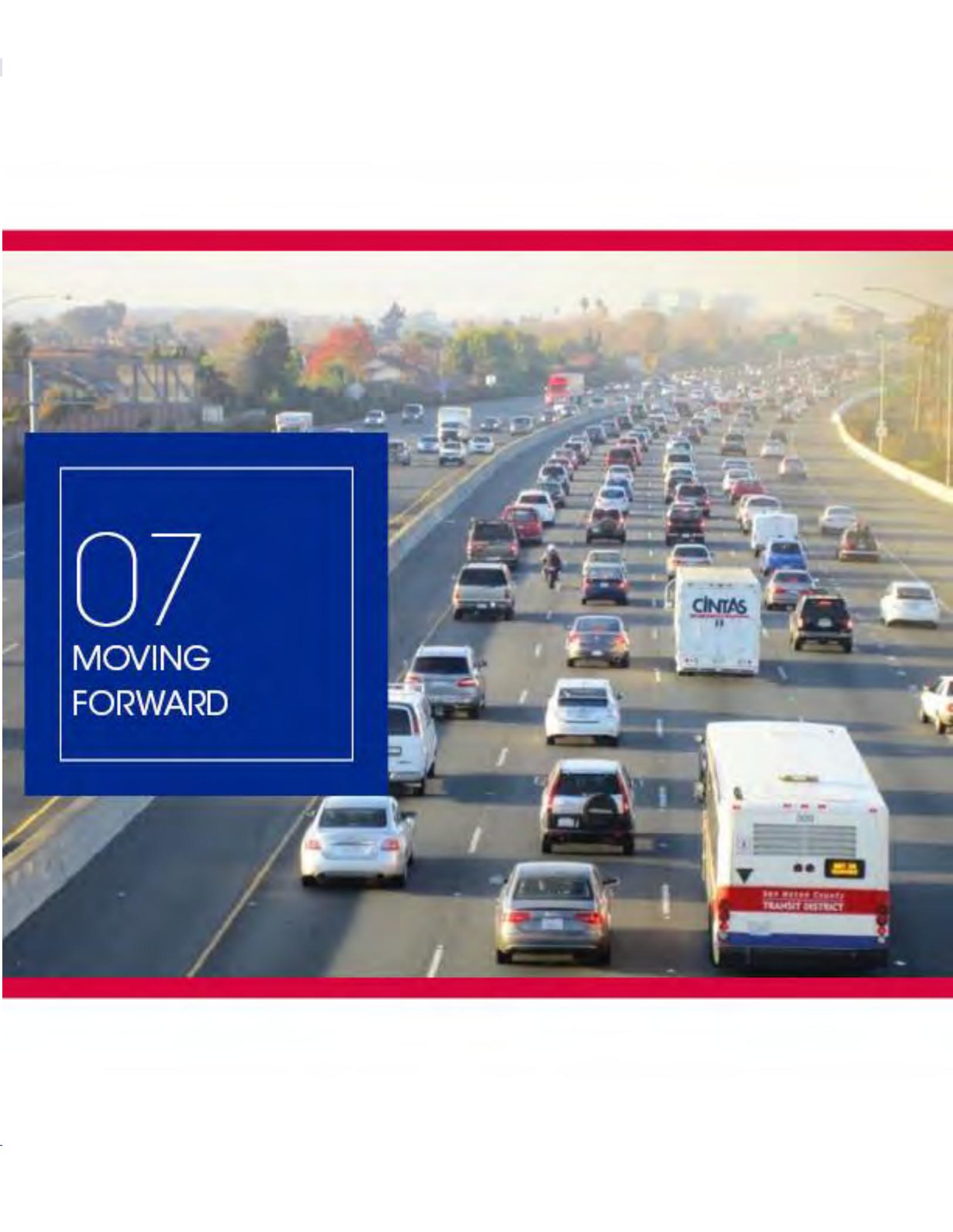
affect the cost to run the service. As outlined as a next step in Chapter 7, SamTrans should seek to stay nimble in adjusting service design and levels based on how the service in reality performs against the stated goals of this service defined in the Study and against the performance metrics discussed on the next page.

**TABLE 7: PERFORMANCE METRICS**

Metric	Success Criteria	Evaluation Cadence	Source
Cost per Passenger	Less than \$15/passenger	Monthly	SamTrans Operations; daily ridership and cost information
System-wide Ridership	Increase	Monthly	SamTrans Operations; monthly ridership totals
On-Time Performance	85%+ OTP	Monthly	SamTrans Operations; OTP data
Customer Feedback	Positive customer feedback to staff, customer service, BOD, CAC	Monthly	SamTrans customer service team, staff
	Positive customer feedback on on-board surveys	Annually	On-board surveys
Farebox Recovery	20%	Annually	SamTrans Operations; fare collection and service cost data
Greenhouse gas (GHG) emissions/vehicle miles traveled (VMT)	Reduction	Annually	On-board surveys
Project Partners	Support and promote the service to their communities and employers through transportation demand management (TDM) programs	Every two years	SamTrans Marketing or Planning teams

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07

MOVING  
FORWARD

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# 7. MOVING FORWARD

This Study is one of the early steps in the realization of express bus service in the US-101 corridor. As elected officials and agency staff from San Francisco, San Mateo, and Santa Clara counties advance the planning and implementation of public express service, the following findings from the feasibility study can help guide the next steps.

- **Work together with partner agencies in the Study area.** Regional support is critical for successful implementation of public express bus service. SamTrans has engaged extensively with transportation and planning agencies from adjacent counties over the course of this Study. The agencies will need to work together, think regionally, and advocate together for the significance of US-101 corridor and for express buses to successfully build support and pursue potential funding for the implementation of express bus service.
- **Create a more detailed funding strategy.** A more detailed funding strategy for each implementation phase will be needed to leverage state and federal funds. General funding strategies have been identified for each phase but they will need to be taken forward by more detailed plans for capital and operating improvements and refined cost estimates.
- **Develop partnerships with public and private entities.** Support from key stakeholders such as major employers and universities can jump-start plans for implementing express bus services by providing a large pool of potential riders, along with some potential funding and in-kind marketing support. The study area is rich in such potential partners.
- **Determine a fare structure for new express bus service.** The fare assumed in this Study was for modeling purposes only and a new fare product will be established through the ongoing SamTrans Fare Study. Such a fare structure should balance the operating cost and attractiveness of a fast, frequent, reliable, and direct express bus service as well as ensure equitable distribution of associated benefits.
- **Examine SamTrans local routes for opportunities to align with express routes.** This assessment will ensure SamTrans can provide a connection to express routes in cases where the express routes do not provide a one-seat ride from within San Mateo County. Prior to launch of any new express routes, examination of nearby SamTrans local routes, including Route 398 currently operating on US-101, should be undertaken and service, including schedules, adjusted as appropriate.
- **Retrofit existing fleet to offer comfort and technological amenities** which may include Wi-Fi, plugs, tables, and high-back seats. Such on-board amenities will allow SamTrans to compete with private long-haul bus services, which have proliferated on the

US-101 corridor and throughout the Study area in recent years.

- **Launch pilot express bus service.** Implementation of a pilot set of routes is a much-needed next step to field-test the service before a full-scale rollout. SamTrans has already secured significant grant funding to support the implementation of a pilot. It is important to design the pilot such that it lays the foundation for a positive rider experience.
- **Plan for infrastructure to support zero emission vehicles.** Realizing this infrastructure for express bus service will require agency-wide coordination between operations and facilities groups at SamTrans and its partner agencies. While the grant funds already secured for the express bus project include funding for procurement of zero emission vehicles and associated infrastructure, the deployment of new technology must be carried out after a careful review of its merits and challenges.
- **Expand the network of park-and-ride facilities as needed.** Conduct further study to identify needs for expanded park-and-ride facilities to improve access to express bus services, but would require close coordination with public and private owners of these facilities. The study recommends expansion of a couple of such facilities in the Study area. Further planning and engineering must be undertaken to bring these amenities online early.
- **Seek opportunities to maximize impact of managed lanes projects** in San Mateo and San Francisco counties for express bus services. This could include route re-design to maximize use of the managed lanes or implementation of programs that incentivize

the use of transit through connected fare and toll payment systems.

- **Stay nimble to spot opportunities to adjust service.** This Study identifies variations for some of the recommended routes that should be evaluated before implementation. As development patterns change, partnerships materialize, or funding sources become available, routes identified in this Study but not recommended for phased implementation may become more relevant. Re-introducing/realizing a successful express bus network on the Peninsula will require ongoing refinement and adjustments based on real-world experiences and changing mobility needs.



APPENDICES

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# APPENDIX A: PUBLIC AND STAKEHOLDER OUTREACH SUMMARY REPORT

# **SAMTRANS US-101 EXPRESS BUS FEASIBILITY STUDY**

## **TASK 2.0 – Public and Stakeholder Engagement**

**SAN MATEO COUNTY TRANSIT DISTRICT**

## PUBLIC AND STAKEHOLDER ENGAGEMENT

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**PUBLIC AND STAKEHOLDER ENGAGEMENT**

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## PUBLIC AND STAKEHOLDER ENGAGEMENT

### **1. Introduction**

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This chapter summarizes the two phases of public outreach undertaken for the SamTrans Express Bus Feasibility Study. The first phase took place during summer of 2017 and involved two pop-up events, one community open house, and a social media campaign. The second phase took place in summer of 2018 and involved four pop-up events and a community open house. This chapter describes both outreach series and then summarizes conclusions for both at the end.

Each interaction provided an opportunity for the participants to learn about the project and to provide feedback on the Study, as well as SamTrans services in general. SamTrans handed out a factsheet about the project to those participants who wished to learn more about the project.

In addition to the outreach events, SamTrans created and maintained a project webpage to publicize the outreach events and provide a repository for project information and a place for ongoing project updates for the duration of the Study. The Study's webpage can be found at:

[http://www.samtrans.com/Planning/Planning\\_and\\_Research/US-101\\_Express\\_Bus\\_Feasibility\\_Study.html](http://www.samtrans.com/Planning/Planning_and_Research/US-101_Express_Bus_Feasibility_Study.html)

### **2. Key Takeaways from Outreach**

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SamTrans engaged with more than 300 people over the course of two rounds of public outreach. Below are key observations derived from responses to exercises conducted in either Phase 1 or Phase 2 of outreach.

- Respondents in all locations overwhelmingly prioritized frequent, quick, and reliable bus services with real-time information. Responses received at Sunday Streets in San Francisco suggest a desire for easy access to the bus routes, and ability to transfer from other transit services, ideally using a Clipper Card. Responses received at events like the San Jose Flea Market and San Mateo Farmer's Market suggest that many people currently drive as their preferred mode of travel since they would like the bus service to be cheaper than driving, and that unpleasant conditions at transit stops may influence choices to drive rather than take transit.
- Most Phase 2 participants indicated they preferred to walk to stops (67%), and were willing to walk up to 10 minutes to do so. They also find the ability to transfer to or from other transit lines very important (86%), indicating a likely preference for express bus stops to be near their residences and/or workplaces. These findings support the need for ongoing efforts to improve pedestrian facilities in the Study Area and to schedule new routes to align with other transit services.
- Reliable service is a paramount requirement among outreach Phase 2 participants with 67% saying they would seek to know the schedule and take the same bus every time. Participants also selected "bus is on-time and reliable" the most of all answer choices to the exercise in Phase 1.

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## PUBLIC AND STAKEHOLDER ENGAGEMENT

- Overall, most Phase 2 participants were willing to pay a premium fare for this service with 75% of respondents selecting \$4, \$5, or \$6 for one-way fare if the service was frequent, reliable, and came with premium amenities.

### **3. *Spreading the Word***

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To notify the public about the US-101 Express Bus Feasibility Study (the Study) and the upcoming outreach events, SamTrans undertook a social media campaign, drafted a press release that provided an overview of the project and advertised the outreach events, posted flyers at local businesses, and sent emails to the SamTrans email distribution list.

#### **3.1 SOCIAL MEDIA CAMPAIGN**

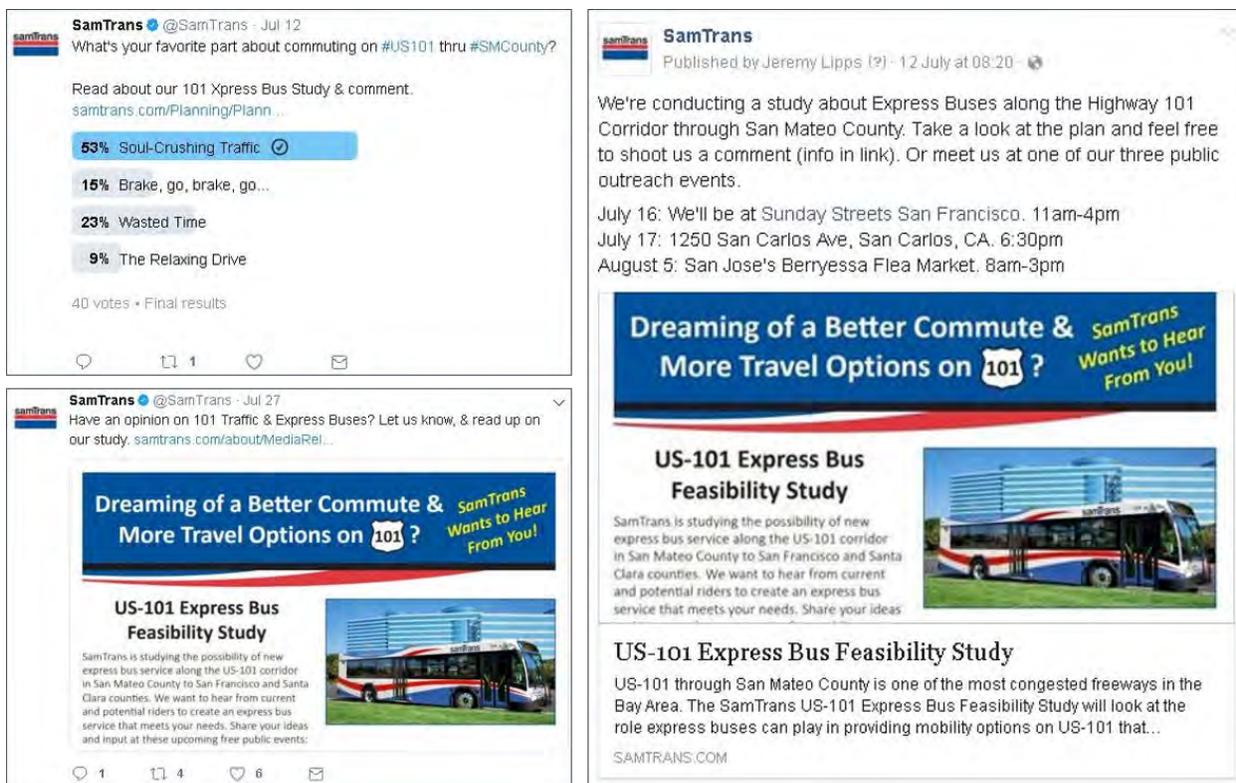
SamTrans initiated a social media campaign to notify followers about upcoming outreach events and to engage with people about commuting along US-101. SamTrans employed Twitter, Facebook, Instagram, Nextdoor, Pinterest, YouTube, Snapchat, quarterly updates via the Caltrain newsletter, and posts on the Peninsula Moves! blog. Examples of the social media posts are shown in Figure 1.

One strategy to engage Twitter followers and notify them about the Study was a humorous poll about commuting along US-101. As shown in Figure 1, the Twitter poll asked followers “What’s your favorite part about commuting on #US101 thru #SMCounty?” and also provided a link to the project site. Forty Twitter followers responded to the poll.

In addition, SamTrans created four Facebook posts and seven Twitter posts to notify people of the upcoming outreach events. The Facebook posts reached a total of 3,800 followers and the Twitter posts were viewed 89,650 times.

## PUBLIC AND STAKEHOLDER ENGAGEMENT

Figure 1- Examples of the Social Media Campaign



## 3.2 MEDIA COVERAGE

The outreach events received media coverage from the following media outlets:

- KQED radio
- Friends of Caltrain weekly email
- Streetsblog SF blog post

## 4. Phase 1 Outreach (Summer 2017)

SamTrans launched the first outreach series in summer 2017 to introduce stakeholders to the project newly underway and to gauge potential riders' wants and needs regarding expanded express bus service on the US-101 freeway through San Mateo, San Francisco, and Santa Clara counties. These events were held in July and August 2017 at locations throughout the study area:

- Booth at Sunday Streets SF in San Francisco (July 16, 2017)

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## PUBLIC AND STAKEHOLDER ENGAGEMENT

- Community Open House at SamTrans Headquarters in San Carlos (July 17, 2017)
- Booth at San Jose Flea Market in San Jose (August 5, 2017)

This section summarizes the intent, outcomes, and input received at the summer 2017 outreach events.

### 4.1 POP-UP OUTREACH EVENTS

SamTrans and PlaceWorks held two pop-up outreach events to gauge the public's views and ideas for express bus service along the US-101 corridor. While community workshops can be effective tools, SamTrans saw the importance of augmenting the community open house with events where people are rather than asking them to come to SamTrans. SamTrans interacted with more than 60 people at the two pop-up events held in both the northern and southern ends of the study area.

The 2017 pop-up outreach events featured the following interactive activities:

- A dot exercise where participants were asked to identify the top three factors they considered or would consider most important when selecting whether to use an express bus service (shown in Figure 2). The results of the dot exercise are shown in Table 1.
- A map exercise where participants identified the origin and destination of their primary daily trip as shown in Figure 3.

**PUBLIC AND STAKEHOLDER ENGAGEMENT**

Figure 2- Phase 1 Outreach Dot Exercise Poster

***What Would Make an Express Bus the Best Choice for Your Commute?  
¿Qué haría un Autobús Expreso la mejor opción para su viaje?***

Factors / Factores	Place Dot Here / Coloca el Punto Aqui
Bus comes every fifteen minutes <i>El autobús viene cada quince minutos</i>	
Bus gets me to my destination quickly <i>El autobús me llegue a mi destino rápidamente</i>	
Buses are on-time and reliable <i>Los autobuses son puntuales y fiables</i>	
Buses travel in carpool or express lanes <i>Los autobuses viajan en un carril de viajes compartido o carriles expresados</i>	
Open wi-fi and power outlets on board, so I can work on the bus <i>Wi-fi y tomas de corriente abiertos a bordo, para trabajar en el bus</i>	
Real-time arrival information <i>Información de llegada en tiempo real</i>	
Clean, safe, pleasant conditions at stops <i>Condiciones limpias, seguras y agradables en las paradas</i>	
Cheaper than driving <i>Más barato que conducir</i>	
Ability to get a seat on the bus <i>Capacidad de conseguir un asiento en el autobús</i>	
Less than ten minute walk to the stop <i>Menos de diez minutos a pie hasta la parada</i>	
Parking available at bus stop, for minimal fee <i>Estacionamiento en parada de autobús, de tarifa mínima</i>	
Comfortable seats and more leg room provided for a higher fare <i>Cómodos asientos y más espacio para las piernas por una tarifa más alta</i>	
Route is close to my home and/or office <i>La ruta está cerca de mi casa y/o oficina</i>	
Pay with my Clipper Card <i>Pagar con mi tarjeta Clipper</i>	
Bike racks available on bus <i>Bastidores de bicicletas disponibles en el autobús</i>	

**PUBLIC AND STAKEHOLDER ENGAGEMENT**

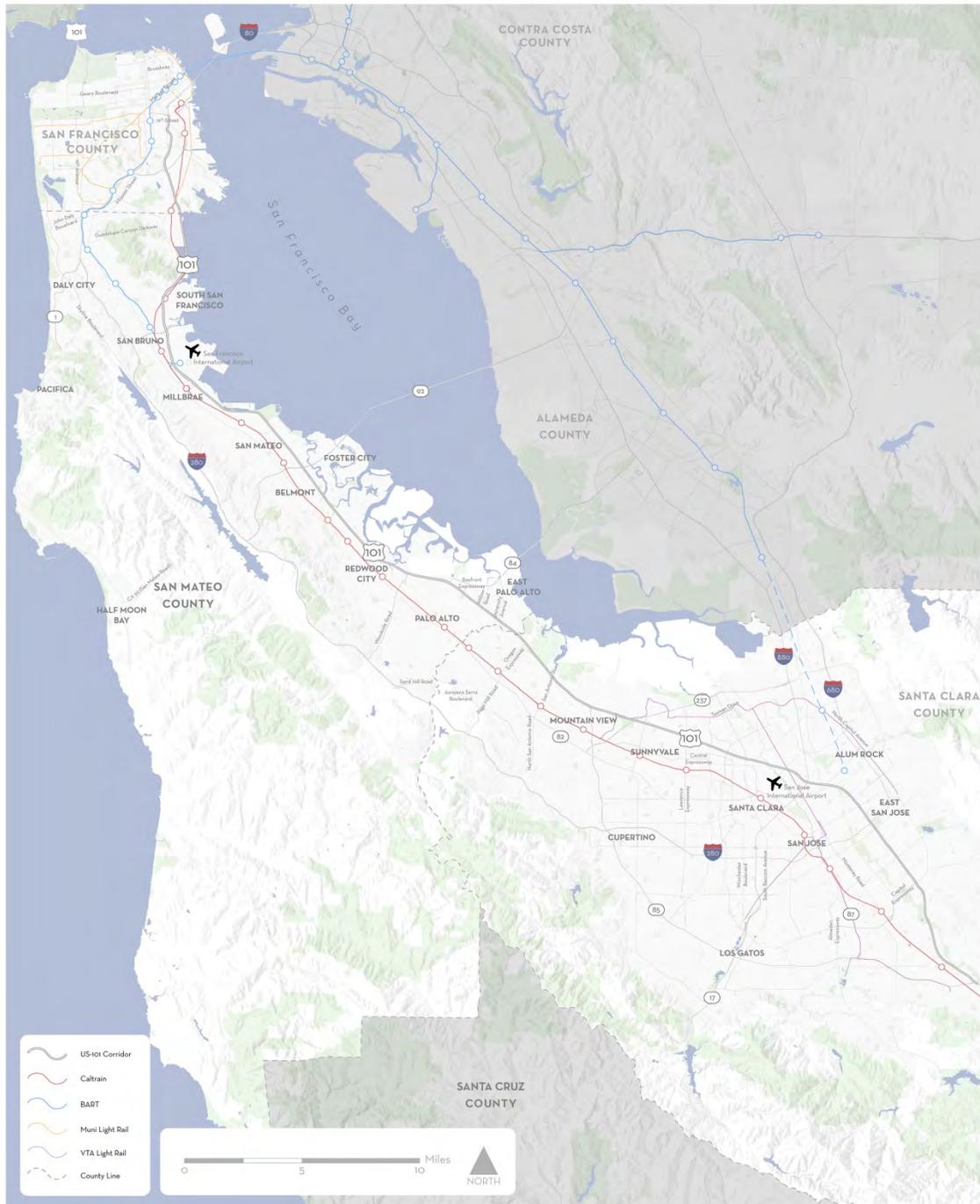
**Table 1- Summary of Phase 1 Outreach Dot Exercise Results**

<b>Dot Exercise Factor</b>	<b>Sunday Streets</b>	<b>Community Open House</b>	<b>San Jose Flea Market</b>
Bus comes every fifteen minutes	40	4	8
Bus gets me to my destination quickly	34	3	8
Buses are on-time and reliable	42	5	4
Buses travel in carpool or express lanes	8	2	4
Open Wi-Fi and power outlets on board, so I can work on the bus	16	1	4
Real-time arrival information	23	1	5
Clean, safe, pleasant conditions at stops	14	-	8
Cheaper than driving	10	-	8
Ability to get a seat on the bus	9	-	4
Less than ten minute walk to the stop	9	-	3
Parking available at bus stop, for minimal fee	5	1	4
Comfortable seats and more leg room provided for a higher fare	1	-	-
Route is close to my home and/or office	17	-	2
Pay with my Clipper Card	20	-	1
Bike racks available on bus	11	1	3
<i>Pay with phone (write-in)</i>	1	-	-
<i>Timed connections at BART/Caltrain/Other SamTrans routes (write-in)</i>	1	-	-
<i>Connection options such as shuttle service, bus, etc., Muni, &amp; Santa Clara County options (write-in)</i>	2	-	-
<i>All of the above (write-in)</i>	3	-	-
<i>Buses run longer hours (write-in)</i>	-	-	7

## PUBLIC AND STAKEHOLDER ENGAGEMENT

Figure 3- Phase 1 Outreach Origin/Destination Poster

**Where does your commute begin and end?  
¿Dónde comienza y termina su viaje?**



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## PUBLIC AND STAKEHOLDER ENGAGEMENT

The factsheet also provided visitors with the project website and contact information if they wanted to comment later. At the San Jose Flea Market, the outreach materials, including the dot exercise, origin/destination map, and factsheet, were provided in both English and Spanish. To attract as many visitors as possible, SamTrans offered free tote bags, pencil holders, pens, candy, and other trinkets.

### 4.2 COMMUNITY OPEN HOUSE

Approximately ten people attended the 2017 Community Open House on July 17, 2017 at SamTrans Headquarters in San Carlos, California from 6:30 to 8:00 p.m. Participants were invited to complete two interactive activities when they arrived: the dot exercise and origin and destination map exercise as described above. Table 1 show the results of these activities.

Following these exercises, Joanna Jansen, a Principal with PlaceWorks, introduced SamTrans staff, Lindsey Kiner, and Millie Tolleson, who welcomed attendees. Then, Ms. Jansen gave a presentation that provided an overview of the project. A question and answer period followed the presentation. See Appendix A for the comments and questions received during this meeting.

### 4.3 PHASE 1 OUTREACH FINDINGS

In general, SamTrans learned from the first outreach series that participants are interested in potential express bus service and are glad SamTrans is exploring the idea. Most participants agreed that traffic congestion along the US-101 corridor is a major issue that express bus service could help alleviate.

The dot ranking exercise revealed that participants placed the highest value on bus frequency (“Bus comes every fifteen minutes”), speed (“Bus gets me to my destination quickly”), and reliability (“Buses are on-time and reliable”), followed closely by convenience factors such as real-time arrival information and ability to pay with a Clipper card. Participants placed lower priorities on features such as Wi-Fi and bike racks. See Table 2 for a list of the top six items at each event: some items were identified as top priorities in both San Francisco and San Jose, while others emerged as unique priorities in each location.

The trip origin/destination map exercise showed that people travel throughout the US-101 corridor, but that the major starting points and destinations, unsurprisingly, are San Francisco and San Jose, both highly populated cities and major job centers. It should be noted that this study primarily draws on origin and destination data from regional traffic models, not from the responses at the outreach events.

## PUBLIC AND STAKEHOLDER ENGAGEMENT

Table 2- Top Responses from San Francisco and San Jose Phase 1 Dot Exercises

TOP RESPONSES IN BOTH SAN FRANCISCO AND SAN JOSE	UNIQUE TOP RESPONSES IN SAN FRANCISCO	UNIQUE TOP RESPONSES IN SAN JOSE
Bus comes every 15 minutes (48 total responses)	Buses are on time and reliable (46 total responses)	Clean, safe, pleasant conditions at stops (22 total responses)
Bus gets me to my destination quickly (42 total responses)	Pay with my Clipper Card (21 total responses)	Cheaper than driving (18 total responses)
Real-time arrival information (28 total responses)	Route is close to my home and/or office (19 total responses)	Buses run longer hours (7 total responses – write-in response in San Jose)

## 5. Phase 2 Outreach (Summer 2018)

Following Phase 1 outreach, SamTrans conducted transit modeling and developed potential express bus service route options for the Study. This resulted in the development of 15 route options, some of which explored not only traveling along US-101, but also along I-280. Modeling and demand forecasting further narrowed the list down to a set of 10 shortlisted routes and then six preferred route options by the second phase of outreach.

Building on outreach results from 2017, SamTrans initiated a second series of outreach events in June 2018 to inform users about the potential route options and gather feedback on express bus service features. This section summarizes the outcomes and input received at these events, which included four pop-up events located at various locations throughout the study area and a community open house.

- Booth at San Mateo Farmers’ Market (June 2, 2018)
- Booth at Sunday Streets SF in Golden Gate Park, San Francisco (June 3, 2018)
- Booth at Downtown Palo Alto Farmers’ Market (June 9, 2018)
- Booth at Facebook Festival “Bayou on the Bayfront” (June 9, 2018)
- Community Open House at SamTrans headquarters in San Carlos (June 16, 2018)

### 5.1 POP-UP OUTREACH EVENTS

SamTrans and PlaceWorks facilitated four pop-up outreach events in June 2018 to gauge the public on their views and ideas for express bus service. These pop-up events occurred as part of local community events where the chances of reaching residents would be high. They proved highly successful, attracting approximately over 250 people in total to the SamTrans booths. Staff sought to identify Event locations covering demographically-diverse areas that the express bus route options would potentially service, namely western San Francisco, San Mateo, Palo Alto, and East Palo Alto/Bell Haven/Menlo Park.

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## PUBLIC AND STAKEHOLDER ENGAGEMENT

SamTrans and PlaceWorks prepared the following materials for the June 2018 outreach events:

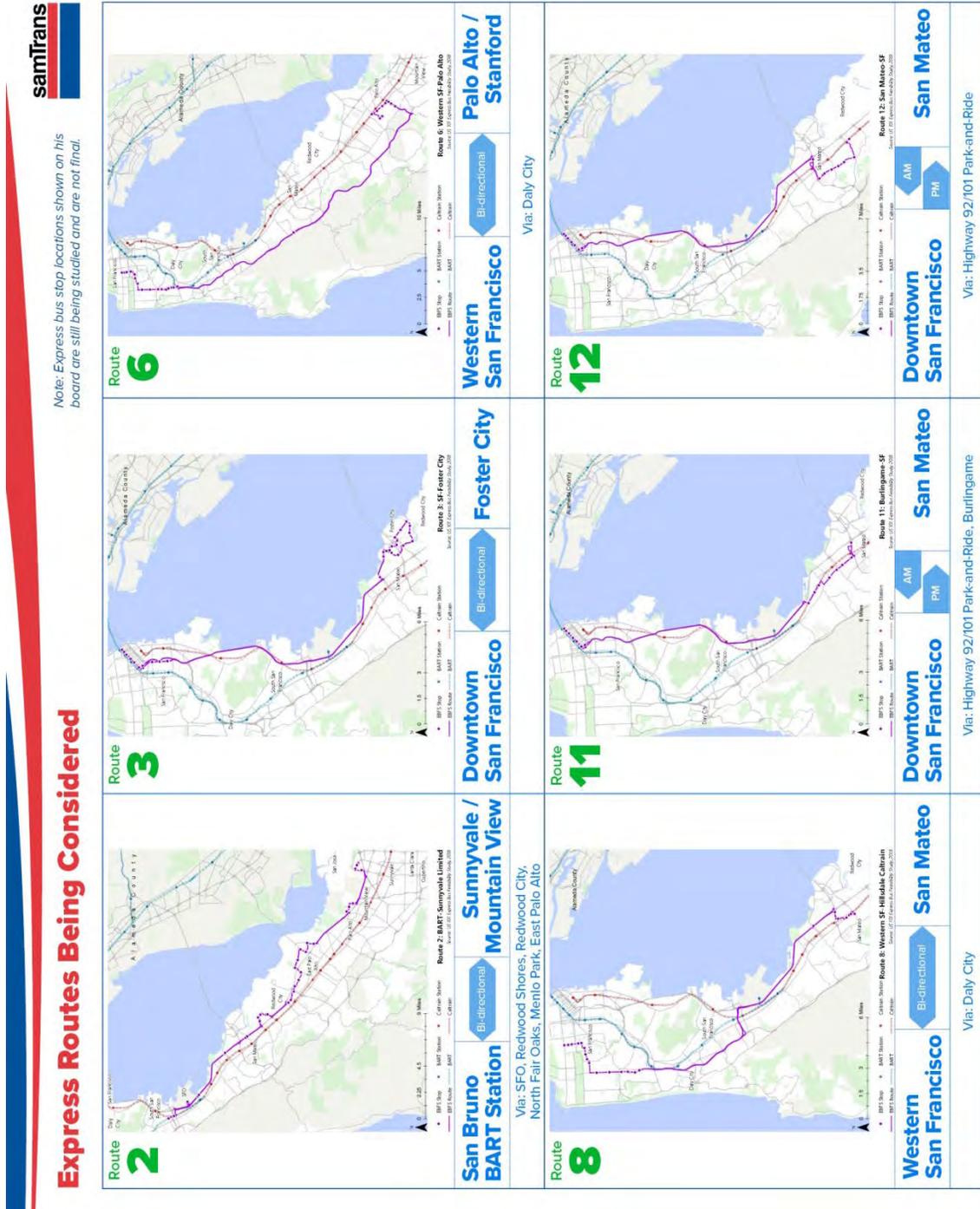
- Express Bus Routes Poster: Showed the six express routes being considered. (4)
- Dot Exercise Poster: Featured eight questions to gather input on bus features where participants placed dots to indicate their preferences. This poster was translated into four additional languages (Spanish, Tagalog, Simplified Chinese, and Traditional Chinese). (Figure 5)
- Language Assistance Poster: Accompanied other posters at outreach events and provided instruction to non-English speaking persons who wished to participate (specifically, Spanish-, Tagalog-, or Chinese-speaking persons). (Appendix B)
- Factsheet: Updated the factsheet from the 2017 outreach events, and which was translated into Spanish (Appendix C) and distributed to participants and passersby at the events.
- Flyer: Provided notice and date/location details of the June 2018 outreach events (Appendix D).

The outreach materials were translated to communicate to non-English speakers. The dot exercise poster and the title of the routes poster were translated into Spanish, Tagalog, and both Simplified and Traditional Chinese. The factsheet was provided in both English and Spanish. SamTrans also provided a language assistance flyer at the booth with free call-in numbers for speakers of 21 languages. To attract as many visitors as possible, SamTrans offered free tote bags, pencil holders, pens, and other trinkets.

Similar to the 2017 events, the 2018 pop-up events featured an updated dot exercise activity where participants were asked to indicate their preferences on express bus service features being considered for implementation, including bus frequency, schedule, pricing, and how to get to the bus stop. Several of the questions aimed to capture a range of responses by providing an empty bar where participants can place their dots anywhere along. 5 shows the dot exercise poster and Table 3 shows the results of the dot exercises from each event. Photos of completed dot exercise posters can be found in Appendix E.

PUBLIC AND STAKEHOLDER ENGAGEMENT

Figure 4- Phase 2 Outreach Potential Express Routes Poster



PUBLIC AND STAKEHOLDER ENGAGEMENT

Figure 5- Phase 2 Outreach Dot Exercise Poster

**What features of an express bus are important to you?** 

*Please place a dot in the space below each question that best represents your response. This may be exactly under one of the responses if you strongly agree, or somewhere along the continuum between responses.*

**How often would the bus need to run for you to take it?**  
Every 15 minutes                      Every 20 minutes                      Every 30 minutes

**If you were to commute by bus, how far ahead would you plan?**  
I would just show up at the stop and take the next bus that arrives                      I would know the schedule and take the same bus every time

**What's the maximum you would pay per trip on the express bus?**  
\$3                      \$4                      \$5                      \$6

**How do you prefer to get to bus stops?**  
Walk                      Bike                      Drop off                      Park-and-Ride                      Transit

**How far would you walk to an express bus stop?**  
5-minute walk                      10-minute walk                      15-minute walk                      20-minute walk

**How important is that you can ride your bicycle to the bus stop and park it securely?**  
Not Important                      Somewhat Important                      Very Important

**How important is that you can drive to the bus stop and park?**  
Not Important                      Somewhat Important                      Very Important

**How important is that you can easily transfer to and from other transit lines?**  
Not Important                      Somewhat Important                      Very Important

## PUBLIC AND STAKEHOLDER ENGAGEMENT

Table 3- Summary of Phase 2 Outreach Dot Exercise Results

Dot Exercise Question	San Mateo Farmers' Market	Sunday Streets SF	Downtown Palo Alto Farmers' Market	Facebook Festival	Community Open House	Total
<b>1</b> <i>How often would the bus need to run for you to take it?</i>						
Every 15 minutes	19	22	16	66	2	128
Every 20 minutes	14	19	6	49	1	89
Every 30 minutes	9	11	7	9	2	38
<b>2</b> <i>If you were to commute by bus, how far ahead would you plan?</i>						
I would just show up at the stop and take the next bus that arrives	8	9	5	12	1	35
Both/Either	8	3	5	13		29
I would know the schedule and take the same bus every time	26	37	19	61	2	145
<b>3</b> <i>What's the maximum you would pay per trip on the express bus?</i>						
\$3	7	1	6	37		51
\$4	8	12	9	23	2	53
\$5	12	26	10	20	2	68
\$6	12	9	4	6	1	31
<b>4</b> <i>How do you prefer to get to bus stops?</i>						
Walk	29	37	22	66	3	157
Bike	4	7	4	10	1	26
Drop off	1	2	1	6		10
Park-and-Ride	1	8	4	20		33
Transit	8				1	9

**PUBLIC AND STAKEHOLDER ENGAGEMENT**

Dot Exercise Question	San Mateo Farmers' Market	Sunday Streets SF	Downtown Palo Alto Farmers' Market	Facebook Festival	Community Open House	Total
<b>5</b> <i>How far would you walk to an express bus stop?</i>						
5-minute walk	6	3	5	36		50
10-minute walk	18	22	15	53	2	110
15-minute walk	9	17	6	9	3	44
20-minute walk	4	2	2	1		9
<b>6</b> <i>How important is that you can ride your bicycle to the bus stop and park it securely?</i>						
Not important	13	15	8	29	3	68
Somewhat important	12	16	8	37	1	74
Very important	7	12	9	21	1	50
<b>7</b> <i>How important is that you can drive to the bus stop and park?</i>						
Not important	26	19	10	24	4	83
Somewhat important	10	13	10	39	1	73
Very important		14	8	29		51
<b>8</b> <i>How important is that you can easily transfer to and from other transit lines?</i>						
Not important		2				2
Somewhat important	6	6	4	11		27
Very important	32	36	24	81	6	179

## PUBLIC AND STAKEHOLDER ENGAGEMENT

### 5.3 COMMUNITY OPEN HOUSE

Approximately eight people attended the Community Open House on June 13, 2018 at the SamTrans Headquarters in San Carlos, California from 6:00 to 7:30 pm. SamTrans and PlaceWorks staff greeted participants upon arrival and proceeded to introduce the project as well as answer any questions in one-on-one format. Participants were invited to complete the dot exercise activity as described above. Table 1 shows the results of the dot exercise from the Community Open House.

Following these exercises, Millie Tolleson, Principal Planner of SamTrans, gave a brief presentation about the project to the attendees and opened the floor to questions and answers. Joanna Jansen, Principal with PlaceWorks, assisted in answering questions and recording feedback received.

Participants gave the following comments during the Q&A period:

- Current transit to San Francisco State University is time prohibitive.
- Consider bus line from Palo Alto area to Downtown San Francisco would be more affordable than Caltrain.
- Express bus should connect with San Mateo shuttles.
- 19<sup>th</sup> Avenue (in San Francisco) congestion is increasing and will affect bus size.
- Ease of fare transfer should be improved (e.g., Clipper Card)
- Involve Risk Management Department in evaluation of route options.
- Prefer not to change the existing KX or 292 routes.
- Incorporate BikeLink at major stops.

### 5.4 PHASE 2 OUTREACH FINDINGS

Like the results of the first phase of outreach in 2017, SamTrans learned that participants are highly interested and excited about a potential express bus service as a commute option. With information on specific route options available for the second outreach series, most participants were interested in how the new service would impact existing express bus lines, details on where the express bus route would stop relative to their starting and ending points, and connections to other transit. Phase 2 feedback echoed Phase 1 feedback that traffic congestion along the US-101 corridor and Caltrain crowding during commute times are major issues which the express bus service could help alleviate. Some participants in San Francisco said that having a new, convenient express bus service would open the possibility of feasible job opportunities in San Mateo or Santa Clara counties.

The dot ranking exercise revealed the following user preferences below regarding express bus service features. Figure 6 to Figure 9 chart results of key questions from the Phase 2 exercise.

- A clear majority of participants preferred to be within a walkable distance to the express bus stop (67%). The next highest preferences were Park-and-Ride (14%) and bicycling to the stop (11%) (Figure 6).

## PUBLIC AND STAKEHOLDER ENGAGEMENT

- When asked how far they would walk, a majority of participants responded with a preferred maximum walk time of 10 minutes (52%), while the next highest responses were 5 minutes (23%) and 15 minutes (21%).
- Responses about the importance of bicycle access were evenly divided between Somewhat Important (39%), Not Important (35%), and Very Important (26%).
- When taken in total, the responses did not reveal a clear majority on the importance of being able to drive and park at the bus stop: overall, 40% of participants responded Not Important, 25% responded Very Important, and 35% responded Somewhat Important. However, this question had a high degree of variability among the locations. In San Francisco, only 10 respondents said driving was somewhat important, and zero identified it as very important. In contrast, at the Facebook Festival, 68 respondents said driving to and parking at the bus stop was somewhat or very important.
- An overwhelming majority of participants (86%) responded that it is Very Important to be able transfer to and from other transit lines via the express bus, while 13% responded that this was Somewhat Important. Only 1% thought this was not important (Figure 7).
- A clear majority of participants (69%) preferred a bus service with a regular schedule that they could plan for ahead of time and ensure they take the same bus each time (Figure 8).
- Most participants preferred a frequent bus service, as indicated with most dots placed under 15 minutes for the first question, the fastest frequency (50% of participants). However, a significant number of people were comfortable with a 20-minute bus frequency (35% of participants).
- Participants responded evenly regarding maximum fare. Out of the choice to pay \$3, \$4, \$5, or \$6, a majority expressed a willingness to pay up to \$5 for an express bus trip (34% of responses), while those willing to pay \$3 and \$4 were next highest responders (24% and 26%, respectively) (Figure 9).

Figure 6- Getting to Bus Stops

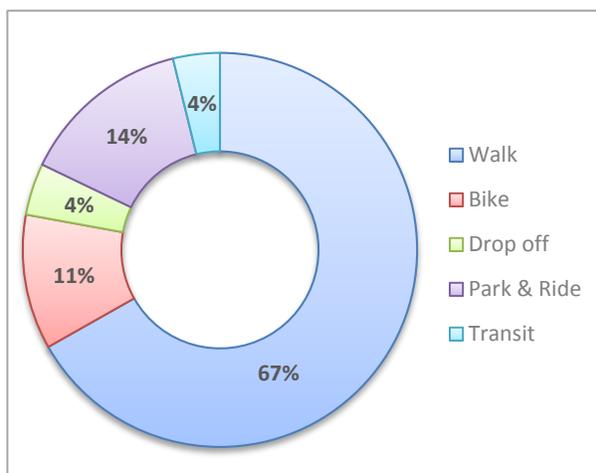
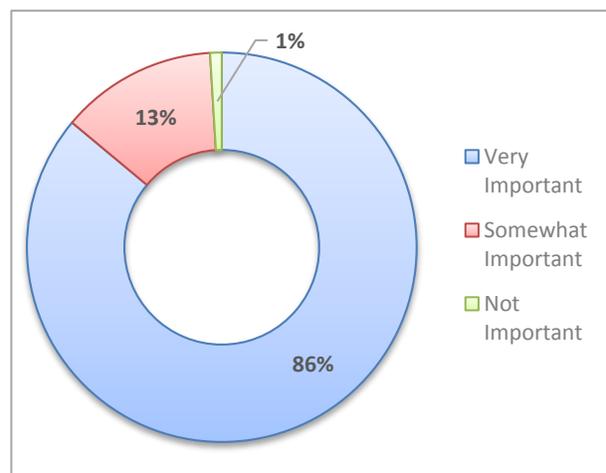


Figure 7- Important to Transfer to/from Other Transit



## PUBLIC AND STAKEHOLDER ENGAGEMENT

Figure 8- Show Up and Take Next Bus or Plan on Taking the Same Bus

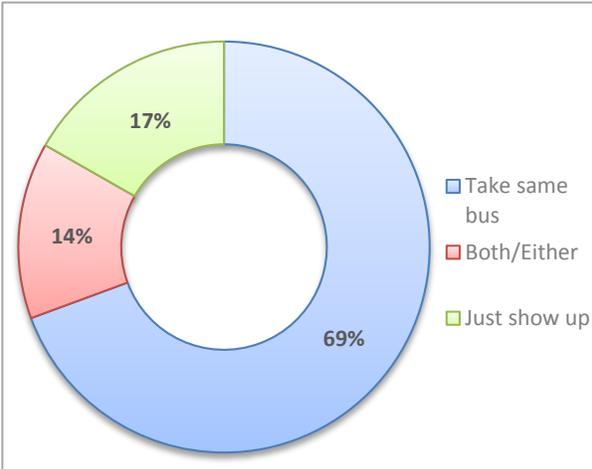
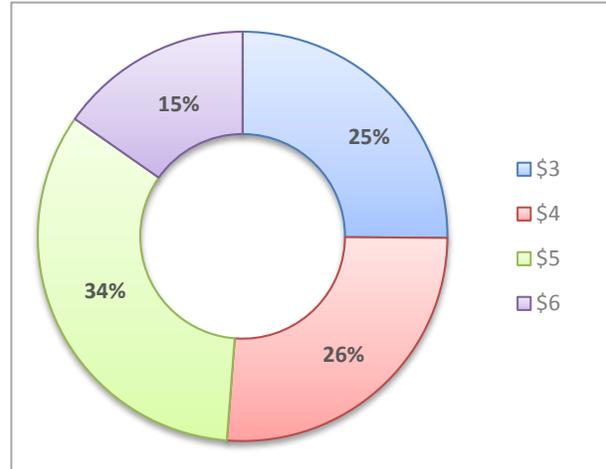


Figure 9- Maximum Fare Willing to Pay



## Appendix A- Q&A from Phase 1 Outreach Community Open House

Q: Will other agencies be involved in the project?

A: The following agencies will be part of the Technical Advisory Committee (TAC):

- Caltrans
- Metropolitan Transportation Commission (MTC)
- Silicon Valley Community Foundation (SVCF)
- San Mateo County Transportation Authority (SMCTA)
- City/County Association of Governments of San Mateo County (C/CAG)
- Santa Clara Valley Transportation Authority (VTA)
- San Francisco County Transportation Authority (SFCTA)
- San Francisco Municipal Transportation Agency (SFMTA)
- Commute.org

Q: Could the US-101 express bus route be passed off to other agencies?

A: SamTrans would be the operator of the US-101 express bus.

Q: Doesn't SamTrans have existing express bus routes?

A: Yes. The US-101 express bus would build upon existing bus service. The study will analyze robust trip data source to determine the best route for the potential US-101 express bus service.

Q: Has SamTrans considered using a fare structure to allow passengers to use other bus routes or Caltrain?

A: At this point in the project, SamTrans has not studied fare structure. However, fare structures will be studied as part of this project when evaluating implementation and phasing.

Q: Has SamTrans identified any potential bus stops for the US-101 express bus?

A: This project is in the initial phase and potential routes and bus stops are yet to be determined.

Q: Has SamTrans thought about how to overcome first mile/last mile transit gaps?

A: The study will look into the possibility of adding bike and vehicle parking as well as other multi-modal approaches.

Q: Has SamTrans reached out to emerging transportation management agencies such as those from Palo Alto, Redwood City, San Mateo, and Menlo Park?

A: Yes, we've invited all the Cities to participate in the project.

In addition, participants provided the following comments:

- None of the Peninsula transit centers are close to the freeway. SamTrans should consider adding a shuttle service to pick up passengers from freeway drop-off points and dropping them off at the closest transit center. This way the express bus can avoid getting bogged down on surface streets.
- There needs to be sufficient parking at future express bus stops.
- Cities throughout the United States have transit stops along the freeway or in the freeway median. The US-101 express bus should have bus stops along the freeway, but the facilities need to be designed so they are pleasurable places to wait.

## **PUBLIC AND STAKEHOLDER ENGAGEMENT**

- Traffic from the Central Valley is an issue. SamTrans should study the daily number of trips undertaken from the Central Valley to San Mateo County.
- SamTrans should prioritize the number of buses over a bus loaded with extra features.
- Service levels are important as are having Wi-Fi and power outlets on the bus.
- Extended bus schedules should be considered.
- SamTrans should study the bus service operated by tech firms as they are quite popular.
- SamTrans should look into off-board payment if a rider needs to pay with cash.

Appendix B- Phase 2 Outreach Language Assistance Poster

**Language  
Assistance**



*Come to speak to us if you require translation  
in any of the following languages!*

**Si desea estos materiales  
traducidos al español, por favor  
acérquese a nosotros en persona.**

**Kung kailangan mo mga  
materyales sa Tagalog, mangyaring  
makipag-usap sa sa amin**

**如果你需要 中文材料请来说  
说 我们**

**如果你需要 中文材料請來說  
說 我們**

## PUBLIC AND STAKEHOLDER ENGAGEMENT

### Appendix C – Fact Sheet



# Fast Facts: SamTrans US-101 Express Bus Feasibility Study

#### What is an express bus?

An express bus is a transit service that is designed to travel faster than traditional “local” services to popular commuter destinations. They typically offer faster travel times by traveling on freeways and making fewer stops. The most likely passengers of express buses are weekday commuters or other passengers traveling somewhat long distances between cities. The express bus services SamTrans is exploring would be open to all passengers.

#### What is this study?

SamTrans is studying the possibility of new express bus service through San Mateo County, to San Francisco and Santa Clara counties, with some routes potentially running in a managed lane on US-101. This study includes research and analysis of the potential bus service, as well as a public engagement process to hear from potential riders, advocacy organizations, and other local stakeholders. The study team will compile research, analysis, and the results of the community input into a Final Report, anticipated in Fall 2018.



**Goal 1** Provide **Mobility Options** and Improved **Connections** for **Regional Trips**



**Goal 2** Increase **Transit Market Share** in Corridor



**Goal 3** Develop a **Cost-Effective Service**



**Goal 4** Improve **Transportation Equity**



**Goal 5** Enhance **Access to Jobs** and Population Centers



**Goal 6** Support Sustainable **Land Use** and **Transportation Policies**

#### Why are we doing this study?

US-101 is one of the most congested freeways in the Bay Area, and express buses can play a role in providing an easy alternative to driving alone and strengthening connectivity to jobs and housing hubs. Express buses would be just one part of the solution to easing commutes on US-101. Together with other transportation improvements along the corridor, express bus service has the potential to help improve travel conditions and options.

#### Is this the same as the San Mateo US-101 Managed Lanes Project?

No. While the projects are related, the US-101 Express Bus Feasibility Study complements but is separate from the San Mateo US-101 Managed Lanes Project. The San Mateo US-101 Managed Lanes Project is a feasibility study for implementing a continuous managed traffic lane along the US-101 corridor, whereas the US-101 Express Bus Feasibility Study will examine the financial and operational feasibility of long-distance express buses operating on US-101, serving San Mateo County and adjacent counties. Ultimately, new express bus services along US-101 might be one of several transportation options that helps to maximize the benefit of managed lanes on 101.

## samTrans

#### What is a Managed Lane, also known as an Express Lane?

- » Carpools, buses, motorcycles and eligible clean air vehicles free
- » Other drivers can choose to pay
- » Electronic toll collection using transponders in vehicle
- » Dynamic tolls (congestion pricing) keep lane free flowing



Para traducción llama al 1.800.660.4287.

如需翻譯,請電 1.800.660.4287.

Para sa pagsasalin sa ibang wika, mangyaring tumawag sa 1.800.660.4287.

2018 Factsheet (front)

## PUBLIC AND STAKEHOLDER ENGAGEMENT





**How can I find out more or submit a comment?**

Visit our project website:  
[www.samtrans.com/expressbusstudy](http://www.samtrans.com/expressbusstudy)

Email:  
[expressbusstudy@samtrans.com](mailto:expressbusstudy@samtrans.com)

Telephone:  
**1-800-660-4287**

### Upcoming Events

#### Booth at San Mateo Farmers' Market

**Saturday, June 2**  
**9 AM - Noon**  
College of San Mateo, 1700 West Hillsdale Boulevard, San Mateo

#### Booth at Sunday Streets SF in the Sunset / Golden Gate Park

**Sunday, June 3**  
**11 AM - 4 PM**  
Spreckels Lake Activity Hub at JFK Drive and 36th Avenue, by Spreckels Lake, Golden Gate Park, San Francisco

#### Booth at Palo Alto Downtown Farmers' Market

**Saturday, June 9**  
**10 AM - Noon**  
601 Gilman Street, Palo Alto

#### Booth at Facebook Festival "Bayou on the Bayfront"

**Saturday, June 9**  
**1 PM - 3 PM**  
1 Hacker Way, Menlo Park (Lot 14)

#### Community Open House

**Wednesday, June 13**  
**6 PM - 7:30 PM**  
SamTrans Headquarters, 1250 San Carlos Avenue, San Carlos

### What's happening and when?

SamTrans launched this study in April 2017. The Study team has since completed a detailed market analysis and identified an initial set of 15 potential express bus routes throughout the three-county study area. The initial routes were evaluated against a set of goals and performance metrics such as anticipated ridership.

The study team is currently completing a detailed evaluation process of the routes, after which the team anticipates recommending a network of four to six express bus routes to be implemented in phases. The study's final report is anticipated to be published in Fall 2018. SamTrans is exploring a potential pilot launch of express buses prior to the year 2021 with a full launch in conjunction with the completion of the US-101 Managed Lanes project. The new express service will be funded in part through SB1 funds.

We welcome stakeholder input throughout the project. The study team held a round of outreach in Summer 2017 and is holding a second round in Summer 2018 with the events to the right.

This project has been made possible by a grant from the California Department of Transportation and a grant from the Regional Planning grantmaking strategy of Silicon Valley Community Foundation.



2018 Factsheet (back)

PUBLIC AND STAKEHOLDER ENGAGEMENT

Appendix D – 2018 Flyer

**Curious about potential new express bus services in San Mateo County?**  
*SamTrans wants to hear from you!*



Para traducción llama al 1.800.660.4287.

如需翻譯，請電 1.800.660.4287.

Para sa pagsasalín sa ibang wika, mangyaring tumawag sa 1.800.660.4287.

*This project has been made possible by a grant from the California Department of Transportation and a grant from the Regional Planning grantmaking strategy of Silicon Valley Community Foundation.*



2018 Flyer

**US-101 Express Bus Feasibility Study**

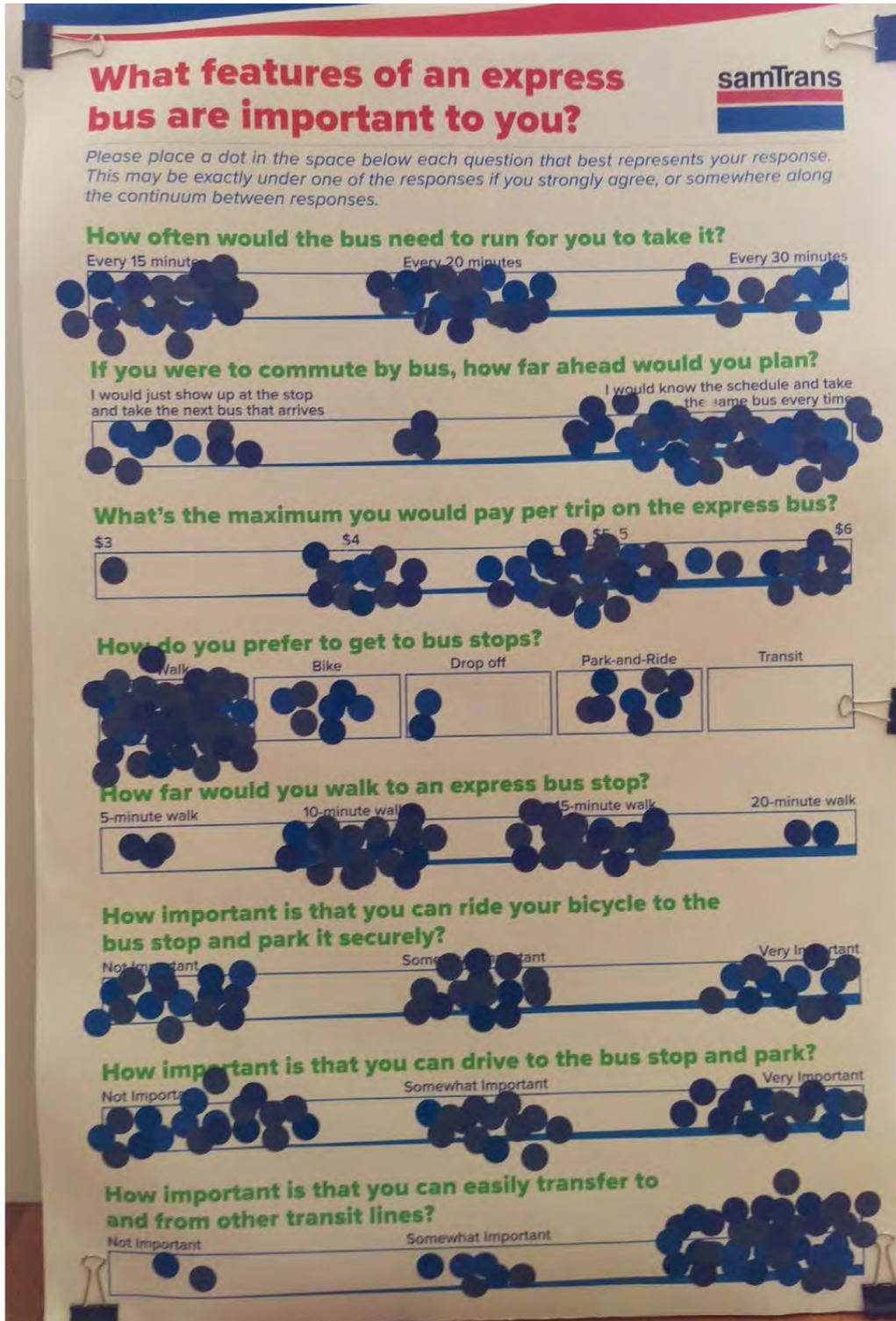
SamTrans is studying the possibility of new express bus service through San Mateo County, to San Francisco and Santa Clara counties, with some routes potentially running in a managed lane on US-101. We want to hear from current and potential riders to create an express bus service that meets your needs. Please attend our community open house or visit our booth at one of the following events:

- 📅 June 2<sup>nd</sup> | 9 AM -- Noon  
**San Mateo Farmers' Market**  
College of San Mateo  
1700 W Hillsdale Blvd, San Mateo
- 📅 June 3<sup>rd</sup> | 11 AM -- 4 PM  
**Sunday Streets SF Sunset / GGP**  
Sprekels Lake Activity Hub at JFK Dr and 36th Ave,  
by Sprekels Lake, Golden Gate Park, San Francisco
- 📅 June 9<sup>th</sup> | 10 AM -- Noon  
**Palo Alto Downtown Farmers' Market**  
601 Gilman St, Palo Alto
- 📅 June 9<sup>th</sup> | 1 PM -- 3 PM  
**Facebook Festival**  
**"Bayou on the Bayfront"**  
1 Hacker Way, Menlo Park
- 📅 June 13<sup>th</sup> | 6 PM -- 7:30 PM  
**Community Open House**  
SamTrans Headquarters  
1250 San Carlos Ave, San Carlos

**Contact SamTrans**  
Email: [expressbusstudy@samtrans.com](mailto:expressbusstudy@samtrans.com)  
Call: 1-800-660-4287  
[www.samtrans.com/expressbusstudy](http://www.samtrans.com/expressbusstudy)

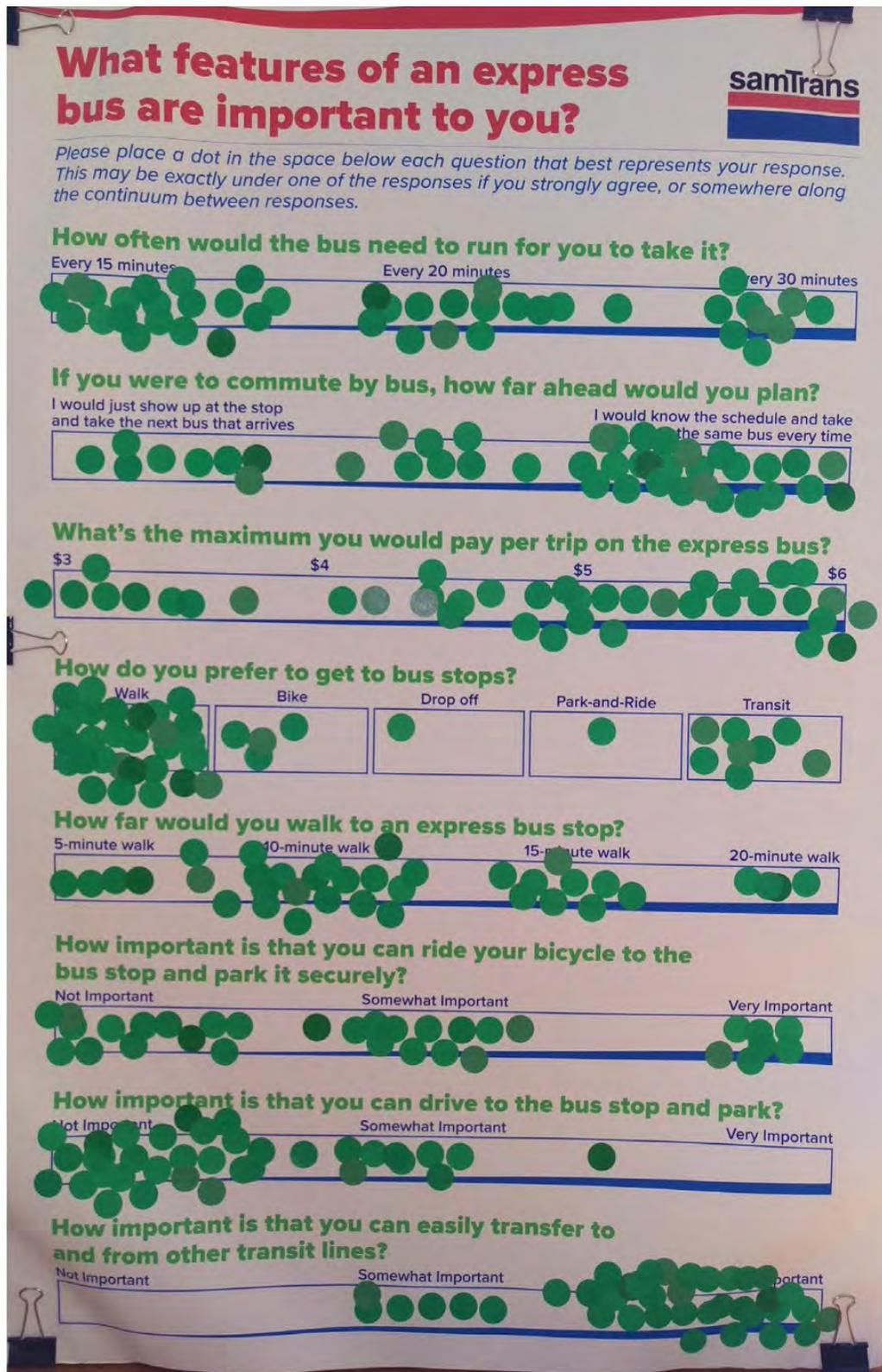
PUBLIC AND STAKEHOLDER ENGAGEMENT

Appendix E- Photos of completed dot exercise posters



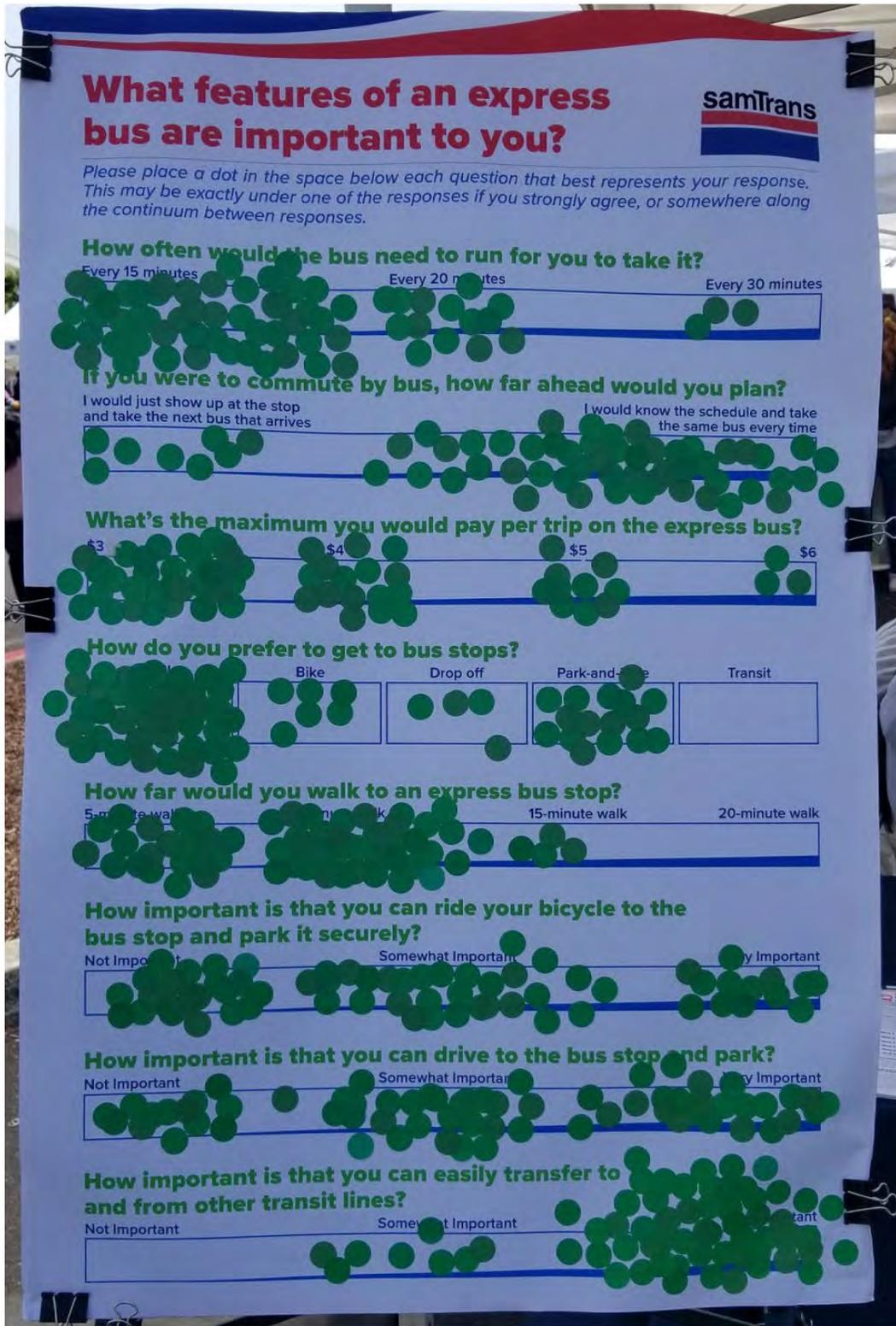
June 2, 2018: Dot Exercise from booth at San Mateo Farmers' Market

## PUBLIC AND STAKEHOLDER ENGAGEMENT



June 3, 2018: Dot Exercise from booth at Sunday Streets San Francisco

PUBLIC AND STAKEHOLDER ENGAGEMENT



June 9, 2018: Dot Exercise from booth at Facebook Festival

## PUBLIC AND STAKEHOLDER ENGAGEMENT

**What features of an express bus are important to you?** **samTrans**

Please place a dot in the space below each question that best represents your response. This may be exactly under one of the responses if you strongly agree, or somewhere along the continuum between responses.

**How often would the bus need to run for you to take it?**  
Every 15 minutes      Every 20 minutes      Every 30 minutes

**If you were to commute by bus, how far ahead would you plan?**  
I would just show up at the stop and take the next bus that arrives      I would know the schedule and take the bus every time

**What's the maximum you would pay per trip on the express bus?**  
\$3      \$4      \$5      \$6

**How do you prefer to get to bus stops?**  
Walk      Bike      Drop off      Park-and-Ride      Transit

**How far would you walk to an express bus stop?**  
5-minute walk      10-minute walk      15-minute walk      20-minute walk

**How important is that you can ride your bicycle to the bus stop and park it securely?**  
Not Important      Somewhat Important      Very Important

**How important is that you can drive to the bus stop and park?**  
Not Important      Somewhat Important      Very Important

**How important is that you can easily transfer to and from other transit lines?**  
Not Important      Somewhat Important      Very Important

June 9, 2018: Dot Exercise from booths at Downtown Palo Alto Farmers' Market and Facebook Festival

PUBLIC AND STAKEHOLDER ENGAGEMENT

**What features of an express bus are important to you?** 

Please place a dot in the space below each question that best represents your response. This may be exactly under one of the responses if you strongly agree, or somewhere along the continuum between responses.

**How often would the bus need to run for you to take it?**  
Every 15 minutes      Every 20 minutes      Every 30 minutes

**If you were to commute by bus, how far ahead would you plan?**  
I would just show up at the stop and take the next bus that arrives      I would know the schedule and take the same bus every time

**What's the maximum you would pay per trip on the express bus?**  
\$3      \$4      \$5      \$6

**How do you prefer to get to bus stops?**  
Walk      Bike      Drop off      Park-and-Ride      Transit

**How far would you walk to an express bus stop?**  
5-minute walk      10-minute walk      15-minute walk      20-minute walk

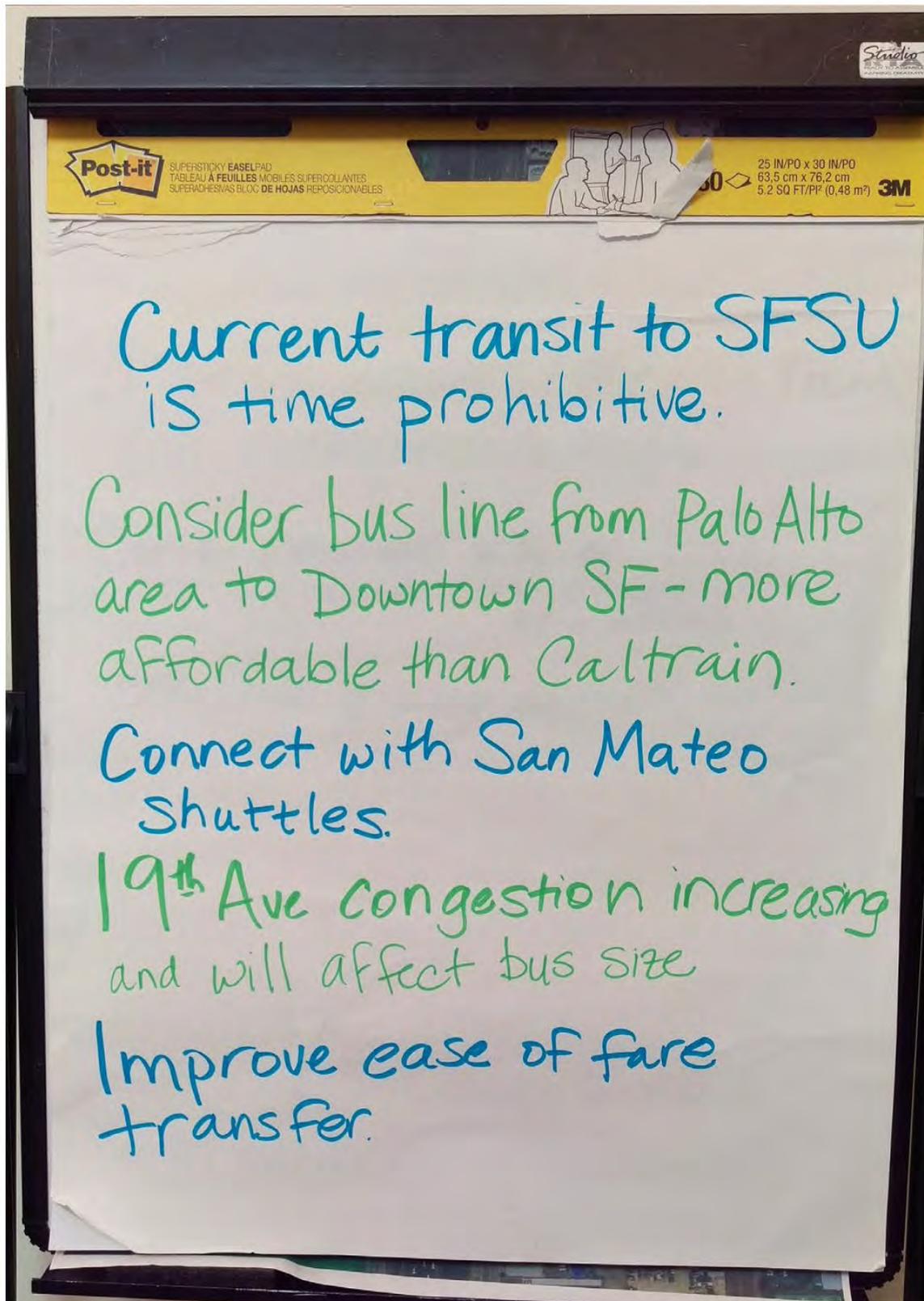
**How important is that you can ride your bicycle to the bus stop and park it securely?**  
Not Important      Somewhat Important      Very Important

**How important is that you can drive to the bus stop and park?**  
Not Important      Somewhat Important      Very Important

**How important is that you can easily transfer to and from other transit lines?**  
Not Important      Somewhat Important      Very Important

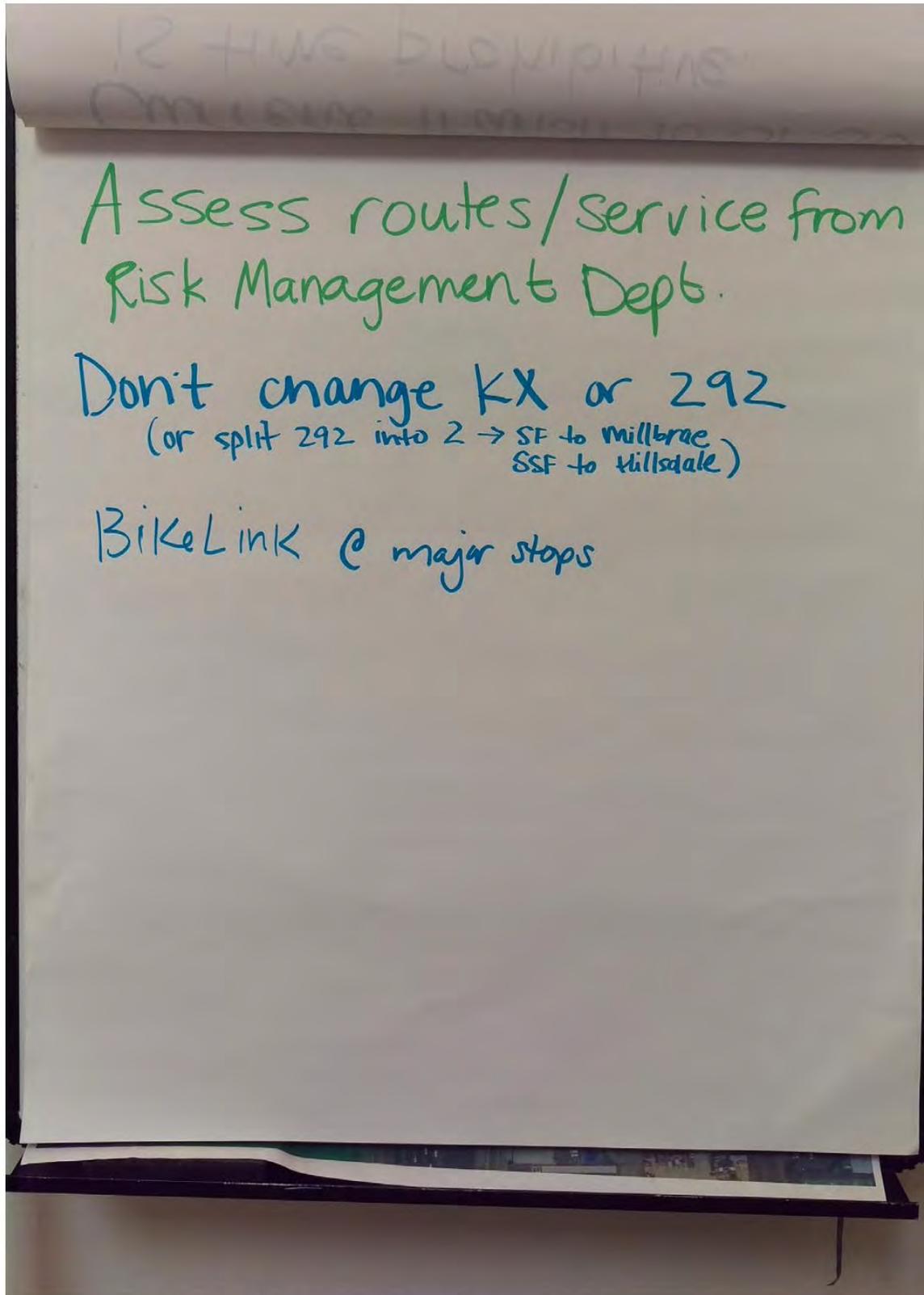
June 13, 2018: Dot Exercise from Community Open House

PUBLIC AND STAKEHOLDER ENGAGEMENT



June 13, 2018: Comments from Community Open House, sheet 1

PUBLIC AND STAKEHOLDER ENGAGEMENT

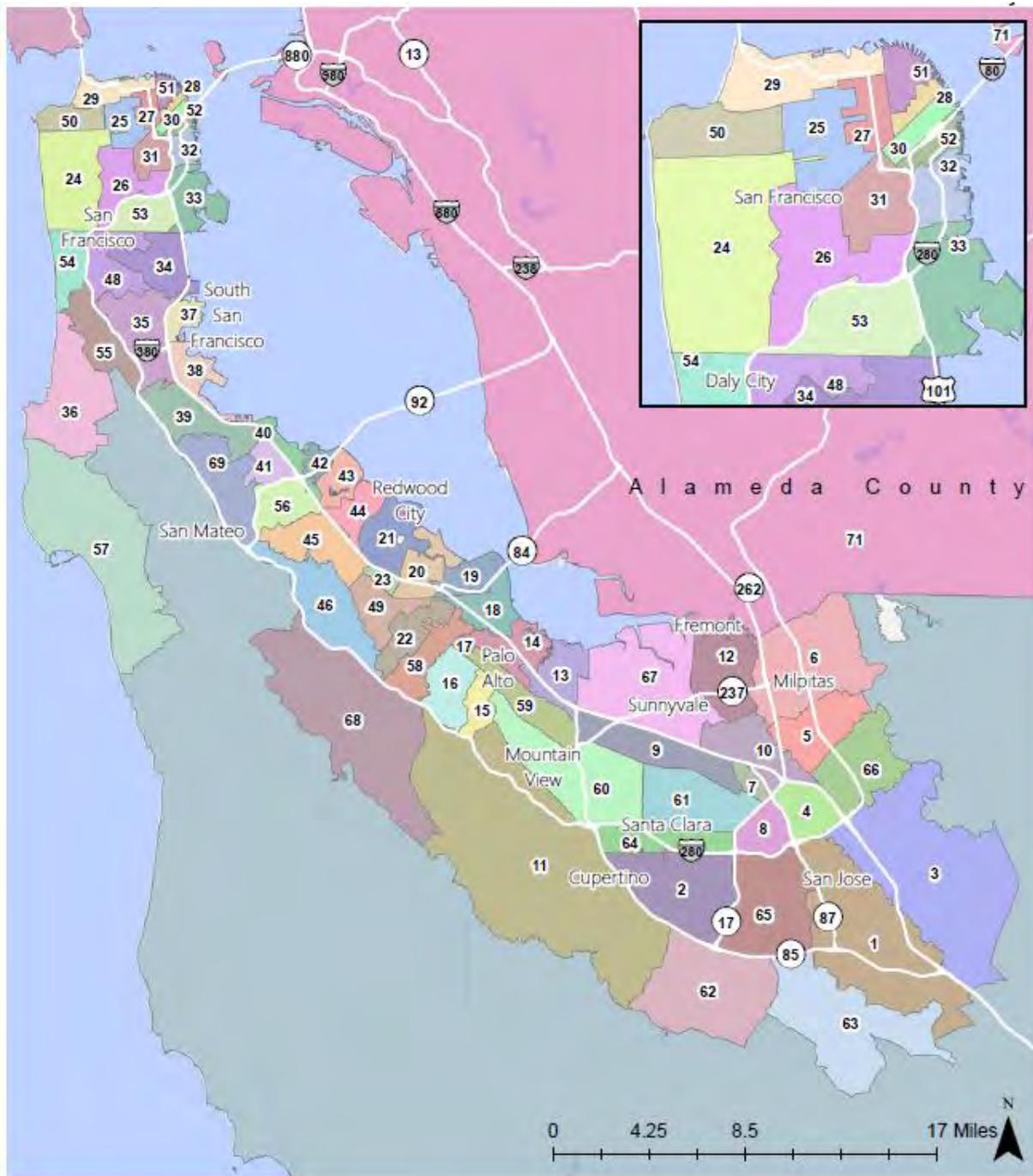


June 13, 2018: Comments from Community Open House, sheet 2

## **PUBLIC AND STAKEHOLDER ENGAGEMENT**

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# APPENDIX B: TRAVEL MARKET ANALYSIS AND MAPS



**SamTrans US 101 Express Bus Feasibility Study  
Market Analysis Zones**



SamTrans, 2018

## 6. TRAVEL MARKET ANALYSIS

### 6.1 Key Findings

1. Most commute and non-commute trips along the study corridor are short duration, single-occupancy vehicle trips which may pose challenges to transit service.
2. Markets potentially suitable for transit along the US-101 corridor include residential and employment areas east of US-101 and near I-280 that are underserved by Caltrain, BART, and private express bus service.
3. Eight bidirectional markets and four one-directional markets present opportunities for express bus services during the AM peak period. Of these, four markets present opportunities for service either to San Francisco or to BART.

### 6.2 Methodology

The travel market analysis considers existing travel conditions and possible changes in near-term conditions over the next five years. This analysis considers origin and destination pairs, commute characteristics, existing and future public and private transit services, and equity to identify potential markets where express bus service may achieve a mode shift from trips via single-occupancy vehicle to trips via transit. The analysis focuses on identifying potential markets by focusing on trips during the AM peak period (6:00 AM to 10:00 AM) as the time period most representative of regular everyday travel, though express bus service may also provide service during midday (10:00 AM to 3:00 PM), PM peak (3:00 PM to 7:00 PM) and evening periods (7:00 PM to 11:00 PM).

The primary data source for the travel market analysis was origin/destination (O/D) GPS data purchased from StreetLight Data. StreetLight aggregates location data collected from GPS devices in smartphones and car navigation systems. StreetLight provides counts of the number of vehicle person trips (VPT) for people in cars between a set of origin and destination zones, optionally sub-selecting trips that pass through any of a given set of screenlines. A set of 71 origin/destination zones and eight screenlines were included in the StreetLight dataset.

StreetLight's GPS data has benefits and drawbacks. It offers a large sample of recent empirical origin-destination data with a high level of spatial resolution. However, it introduces some sampling bias toward higher income persons who have a higher likelihood of owning a vehicle with embedded GPS, a smartphone, or handheld GPS device. Other potential sources of error include possible double-counting of people with multiple GPS devices (such as a phone and navigation device), imperfect sampling of cell phone providers, sampling of people in buses and shuttles (who may not be totally excluded), and undercounting of people with GPS or phones turned off. Furthermore, due to privacy concerns, StreetLight's trip values

represent relative rather than absolute trips: showing the relationship of trips between zones but not the total number of trips in a given zone.

For these reasons, the travel market analysis adjusted the StreetLight data using a combination of outputs from the C/CAG travel model, MTC travel model, and 2012 California Household Travel Survey (CHTS). Total trip generation by zone was calculated by incorporating data from each of these sources, while trip distribution was based on StreetLight data. The final dataset used for the travel market analysis combines a comprehensive representation of the study area with the spatial precision of StreetLight’s GPS data.

Following the preparation of the adjusted StreetLight dataset, the travel market analysis consisted of an iterative process that included identifying prominent origin-destination pairs well-suited for express bus service, visualizing the distribution of trips originating in zones of interest, and calculating the total number of VPT along each of a range of potential routes, excluding local trips between adjacent zones. Because the StreetLight data measure VPT (person trips in cars or other private vehicles), existing public transit riders are not accounted for in this market analysis. However, some of these riders may shift from BART or Caltrain to express bus service if it provides a more appealing trip.

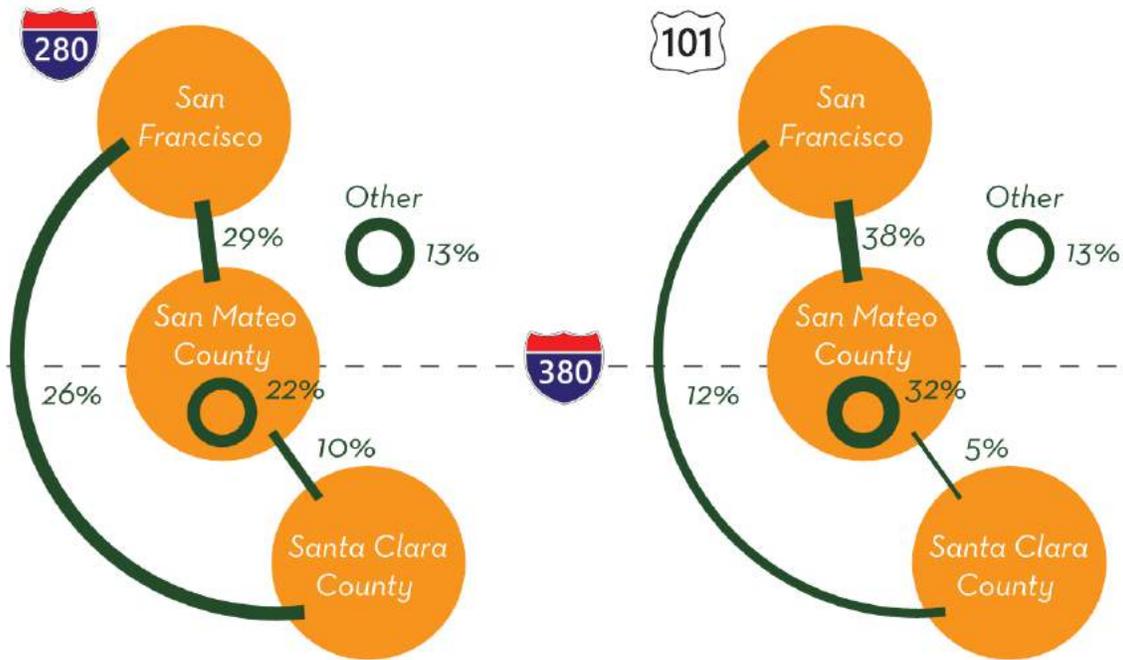
### 6.3 Regional Travel Patterns

Nearly 1.4 million VPT occur during the AM peak period (6:00 AM to 10:00 AM) within or between San Francisco, San Mateo, and Santa Clara Counties.<sup>12</sup> Most trips in the study area occur within the same county (87 percent), while 13 percent occur between counties, as shown in **Table 7**. Of the inter-county trips, about equal flows occur between San Francisco and San Mateo Counties (80,000 VPT) and between Santa Clara and San Mateo Counties (85,000 VPT). A smaller market of long-distance trips between San Francisco and Santa Clara County also occurs (15,000 VPT).

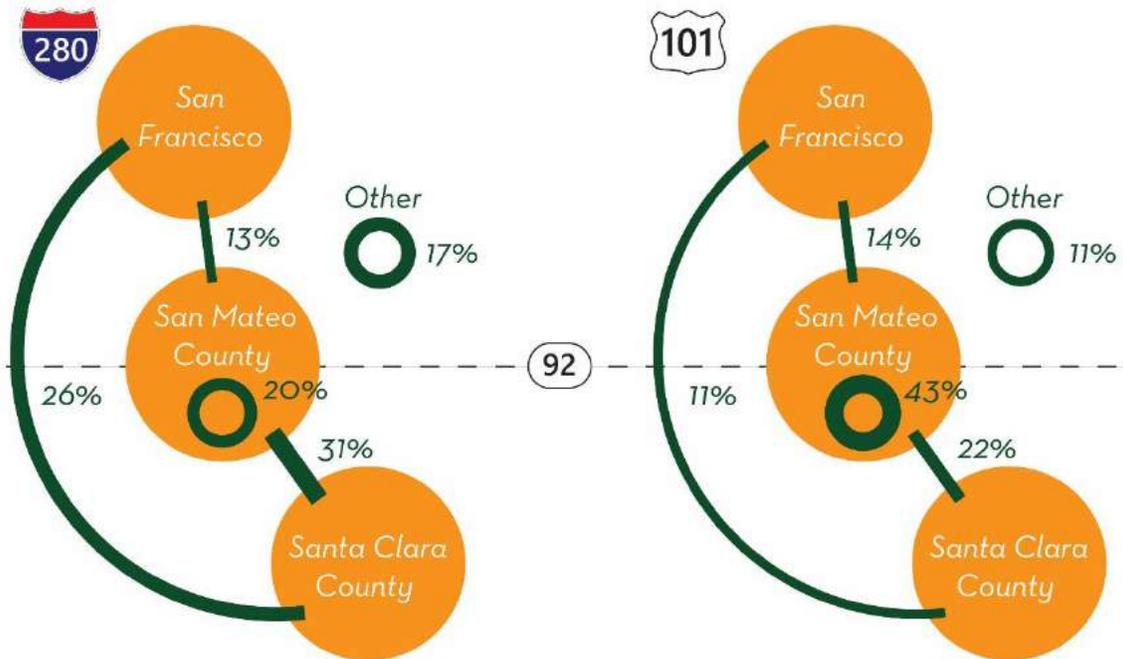
**Table 7: Total AM Peak Period Trips By County Along Study Corridor**

Origin	Destination			
	Santa Clara County	San Mateo County	San Francisco County	Total
<b>Santa Clara County</b>	736,000	39,000	6,000	781,000
<b>San Mateo County</b>	46,000	246,000	44,000	336,000
<b>San Francisco County</b>	9,000	36,000	208,000	253,000
<b>Total</b>	791,000	321,000	258,000	1,370,000

<sup>12</sup> This total excludes trips outside of the Study Corridor, such as the East Bay, North Bay, Santa Cruz County, southern Santa Clara County, or southern coastal San Mateo County.



Inset 18: AM Peak Period Freeway Origins and Destinations, South of I-380 Interchange



Inset 19: AM Peak Period Freeway Origins and Destinations, South of CA-92 Interchange

US-101 serves mostly short and intermediate-distance trips during the AM peak period. Among vehicles traveling on US-101 south of I-380 (**Inset 18**), 32 percent of trips occur between origins and destinations within San Mateo County, while 43 percent occur between San Mateo County and San Francisco or Santa

Clara Counties. Twelve percent of trips occur between San Francisco and Santa Clara Counties, and 13 percent have an origin or destination outside of the study corridor (such as the East Bay). Among vehicles traveling on US-101 south of CA-92 (**Inset 19**), 43 percent of trips occur between origins and destinations within San Mateo County, while 36 percent occur between San Mateo County and San Francisco or Santa

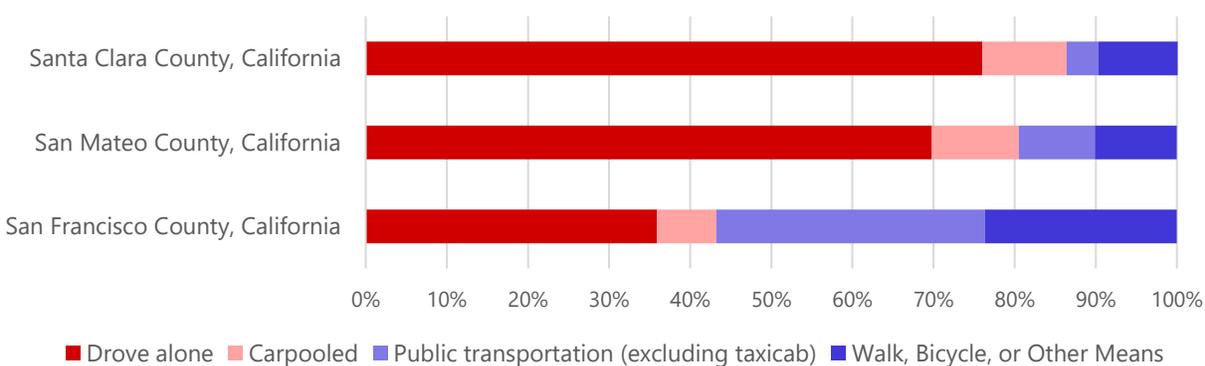
Clara Counties. Eleven percent of trips occur between San Francisco and Santa Clara Counties, and 11 percent have an origin or destination outside of the study corridor (such as the East Bay). I-280 serves longer distance trips compared to US-101. South of CA-92, 20 percent of trips on US-101 occur between origins and destinations within San Mateo County, while 44 percent occur between San Mateo County and San Francisco or Santa Clara Counties. Twenty-six percent of trips occur between San Francisco and Santa Clara Counties, while 17 percent have an origin or destination outside of the study corridor. I-280 serves about 20 to 25 percent fewer vehicles during the peak hour than US-101.

### 6.4 Commute Characteristics

The American Community Survey (ACS, 2015) provides further insights to commuting characteristics for workers living in the study corridor. While express bus service would not only serve commute trips, strong commute markets provides the basis for a productive service. The ACS illustrates that commutes in San Mateo County and Santa Clara County are mostly short duration single-occupancy vehicle trips while San Francisco County has slightly longer commutes and more trips via transit. Commuters leave for work at varying hours of the day, but mostly during the morning peak period.

A majority of commuters in the study area drive alone to work. As shown in **Inset 20**, over 70 percent of commuters in San Mateo and Santa Clara Counties drive alone to work, while 36 percent of commuters in San Francisco drive alone. Transit plays a larger role in serving San Francisco commuters (33 percent) compared to San Mateo and Santa Clara Counties (nine and four percent, respectively).

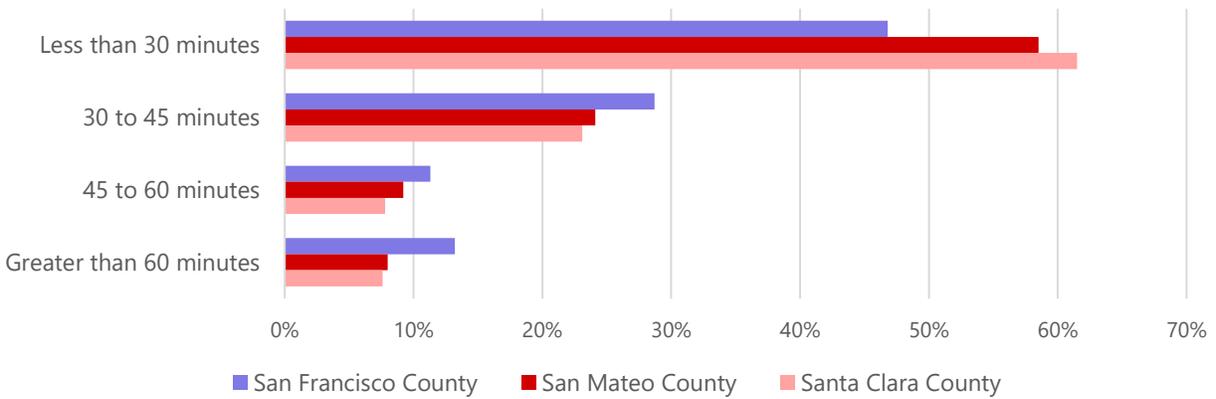
**Inset 20: Means of Travel to Work**



Source: American Community Survey, 2015

While there is substantial variation in commute times, most commutes are short in duration. Approximately half of all home-based commutes in San Francisco and 60 percent of all home-based commutes in San Mateo and Santa Clara Counties are less than 30 minutes long, as shown in **Inset 21**. The median home-based commute time in San Mateo and Santa Clara Counties (27 and 26 minutes, respectively) is slightly below the statewide median of 28 minutes, while the median commute time in San Francisco (32 minutes) is higher. Approximately 25 percent of commutes in San Francisco and 16 percent of commutes in San Mateo and Santa Clara Counties are greater than 45 minutes in duration.

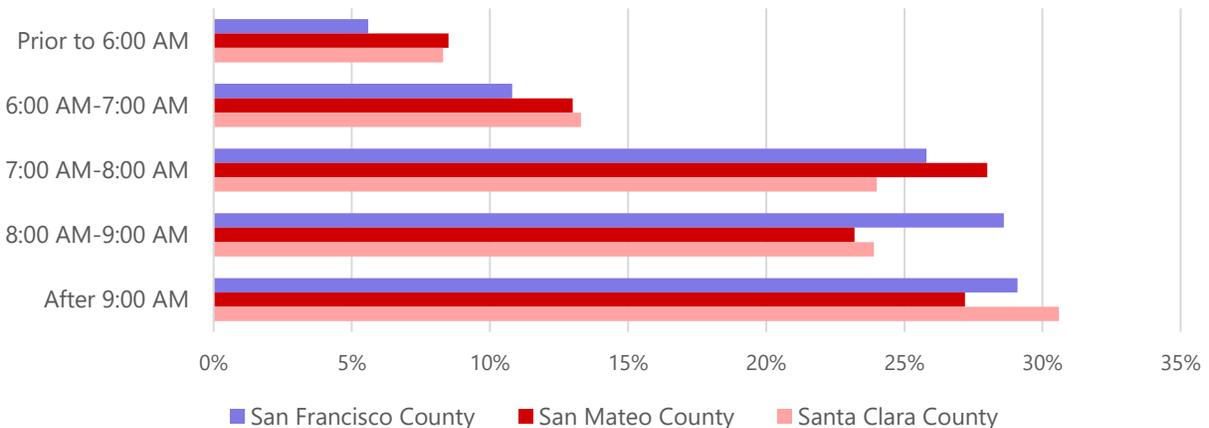
**Inset 21: Travel Time to Go to Work**



Source: American Community Survey, 2015

Approximately half of all commuters leave for work between the hours of 7:00 AM and 9:00 AM, as shown in **Inset 22**. Eight percent of commuters leave before 6:00 AM while 29 percent leave after 9:00 AM.

**Inset 22: Time Leaving Home to Go to Work**



Source: American Community Survey, 2015

This review of regional travel patterns and commute characteristics in the study area suggests that peak period automobile trips of long distance and duration represent a relatively small share of total trips. In some cases, these markets are well served by existing and planned transit services. The strong performance of Caltrain, BART, and private express services amongst long-distance commutes suggests a relatively high transit mode share for such markets. The following sections identify potential underserved markets.

## 6.5 Travel Market Identification Considerations

The travel market analysis considers several factors in identifying potential express bus markets, including origin and destination pairs, BART and Caltrain accessibility, private express bus services, likelihood of transit use, and equity. These considerations are detailed below.

### Origin and Destination Pairs

The market analysis considers intermediate-distance (five to ten miles) and long-distance (greater than ten miles) trips serving SamTrans' core service area and the US-101 Managed Lanes corridor. These trips include those with either (or both) an origin or destination in San Mateo County, or trips which pass through San Mateo County between San Francisco and Santa Clara Counties. While the market analysis focuses on trips along the US-101 corridor, parallel north-south trips along the I-280 corridor are also considered. Trips that occur outside of SamTrans' core service area (e.g. within San Francisco or Santa Clara Counties) are excluded from this analysis. Separate studies evaluate transit service along the Coastside (CA-1) corridor and Dumbarton (CA-84) corridor; therefore, these corridors are also excluded from this study.

Considering that the study corridor's travel patterns vary from local- to long-distance trips, the market analysis identifies trips that may be served by intermediate stops along the US-101 corridor. The US-101 corridor already includes two bus pads (discussed in **Section 3.6**); the US-101 Managed Lanes project may present opportunities for improvements.

### BART and Caltrain Service

The market analysis focuses on travel markets that are underserved by regional transit services and present the greatest opportunity for mode shift. As detailed in **Sections 2.3** and **4.2**, improvements to BART and Caltrain service and connecting local transit services are expected to improve frequency and travel times while alleviating near-term capacity constraints through 2030-2035. Moreover, a review of AC Transit's services (**Section 5**) suggests that express bus service is most successful when serving markets where regional rail service is less accessible, whereas services that compete with faster and more frequent rail services are typically less successful. Along the study corridor, such opportunity areas underserved by regional rail service include trips with origins and/or destinations east of US-101 in San Mateo and Santa Clara Counties and south of I-280 in Santa Clara County, which account for approximately 43 percent of

VPT crossing the San Mateo-San Francisco county line and 75 percent of trips crossing the San Mateo-Santa Clara county line.

Express bus service may also serve two complementary functions to existing transit services. First, express bus service may supplement Caltrain service at stations with infrequent service (even after implementation of the CalMod program). Second, express bus service may streamline trips in which multiple transfers presents barriers to transit trips – specifically for trips where two or more transfers are necessary. In each case, a strong travel market would be needed to overlay additional transit service beyond current levels.

Therefore, markets were primarily identified based on their potential to serve new transit markets where BART and Caltrain accessibility is limited, where Caltrain service is anticipated to be less frequent, or where transit trips would require two transfers or more. In each case, express bus service may also be considered in comparison to expansions in first/last mile shuttle and TNC services for BART and Caltrain stations.

### Private Express Bus Service

As noted in **Section 1.5**, the study corridor is already served by a sizeable network of over 550 private express bus trips per day, primarily serving major corporate campuses in San Mateo and Santa Clara Counties. In particular, existing services between San Francisco and San Mateo or Santa Clara Counties have already achieved a substantial mode shift for the campuses which they serve. The addition of managed lanes on the US-101 corridor may support a further mode shift to such services. The market analysis considers the locations of these private express bus campus hubs (major locations shown in **Figure 7**) and identifies markets that may be underserved by such services.

### Likelihood of Transit Use

Despite the high volume of trips across the study corridor, some travel markets lack sufficient density and walkability to support transit service. The market analysis considers the suitability and accessibility of potential origins and destinations for express bus service using a Transit Likelihood Index, shown in **Figure 10**. The Transit Likelihood Index combines variables known influence transit ridership including population density, employment density, intersection density, and transit dependence (zero car households), in order to identify areas with the highest propensity for transit use. While a high likelihood of transit use does not necessarily guarantee viable express bus markets, it helps identify origins and destinations for further consideration.

In addition to demographic and built environment factors, the market analysis considers the presence of TDM ordinances and programs along with parking constraints to incentivize transit ridership. Presently, San Francisco, Downtown Palo Alto, Stanford University, and the Stanford Research Park have robust TDM programs oriented around incentivizing transit use, while other major employers incentivize riding private

express bus services. Cities such as Redwood City, Mountain View, South San Francisco, and Sunnyvale also have TDM ordinances or plans for new developments to encourage transit use.

## Equity

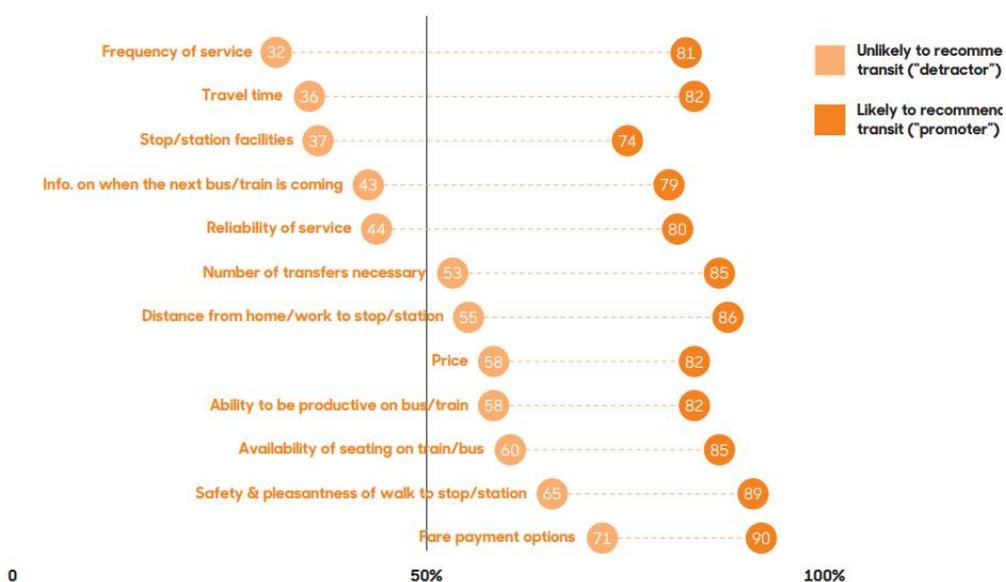
Special consideration was given to identifying opportunity travel markets serving Communities of Concern identified in **Section 1.7**. In particular, Communities of Concern with limited access to BART and Caltrain present opportunities for express bus service, such as East Palo Alto, North Fair Oaks, eastern Redwood City, eastern San Mateo, and eastern and southern San Jose.

### ***What Factors Influence Transit Rider Satisfaction?***

The *Who's On Board 2016 Survey* by TransitCenter provides a snapshot of behavior, needs, and attitudes of transit riders in the U.S.<sup>1</sup> The survey was based on six focus groups and over 3,000 survey responses in 17 U.S. metropolitan areas with varying levels of transit service and ridership. The survey illustrates the relative importance of service attributes for transit riders.

The survey found that the most important determinants of rider satisfaction are a service's frequency and travel time. These factors exhibited the greatest gap in rider satisfaction amongst those who would recommend their regional transit service ("transit promoters") and those who would not recommend their service ("transit detractors"), as shown in **Inset 23**. Other drivers of rider satisfaction include stop facilities, real-time arrival information, and reliability. Attributes such as price, ability to be productive, and available seating were less likely to affect rider satisfaction.

**Satisfaction With Transit Service Attributes**



**Inset 23: Satisfaction with Transit Service Attributes.** Source: *TransitCenter, 2016*

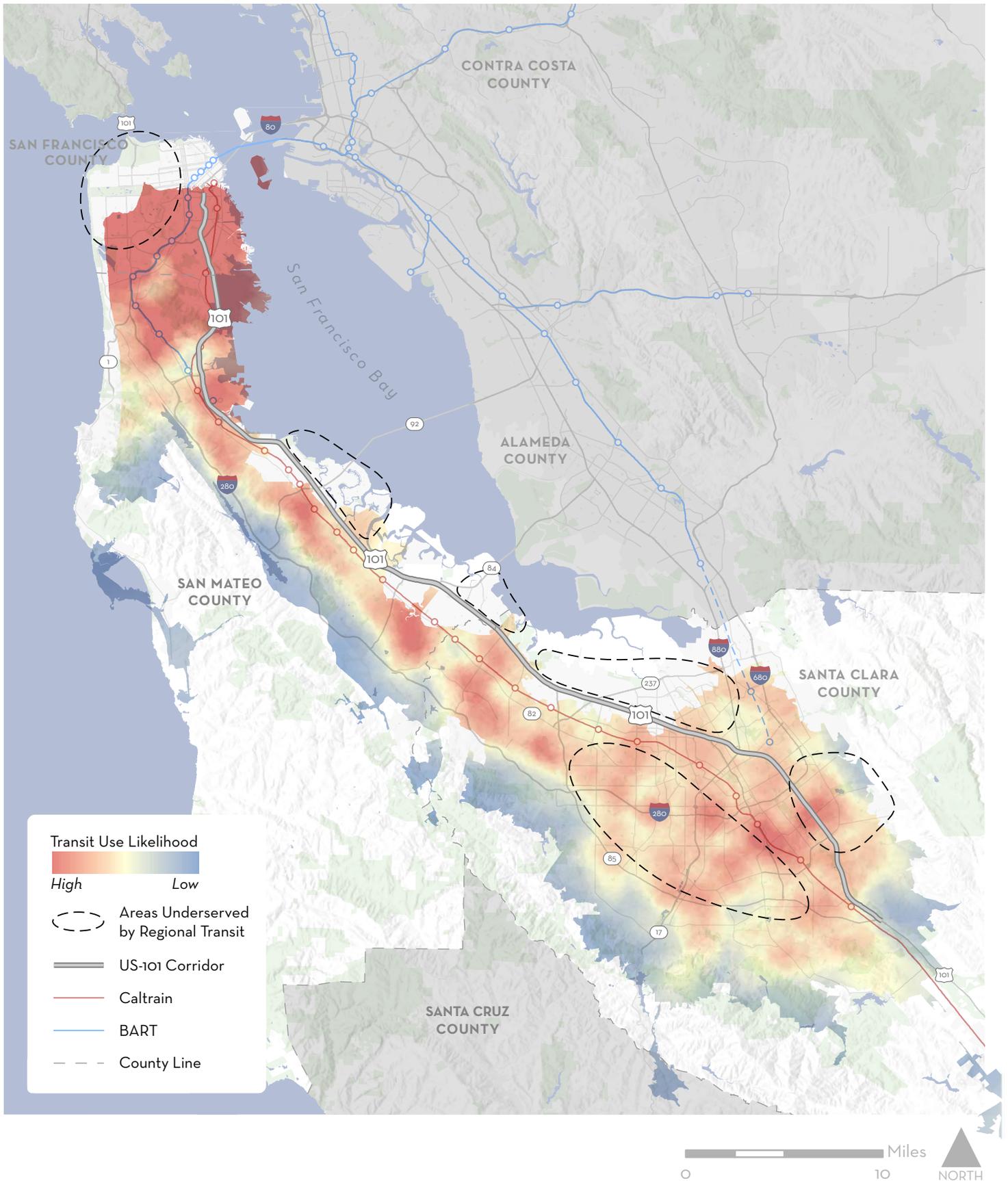


Figure 10  
Transit Use Likelihood



## 6.6 Opportunity Travel Markets: Summary

The travel market analysis identifies 12 travel markets on the study corridor, including eight bidirectional markets (Markets 1 through 8) and four one-directional markets (Markets 9 through 12), as shown in **Table 8**. Markets 1-4 each include variations to serve Downtown San Francisco or BART.

The market analysis considers two types of transit services along the Study Corridor: limited service and express service. Limited service (Markets 1 and 2) are freeway-based routes that serve origins and destinations throughout a corridor with intermediate stops (within the freeway or on parallel streets). Express service (Markets 3 through 12) are freeway-based routes that serve distinct clusters of origins and destinations without intermediate stops.

For each market, VPT is estimated between corresponding analysis zones and presented as a total market size. The capture rate (the potential mode shift to a new transit service) for each market may vary widely depending on route factors (e.g. quality and accessibility of service and facilities) and market factors (e.g. presence of free parking, TDM programs, or traffic congestion).

**Table 8: Total AM Peak Period Trips By County Along Study Corridor**

#	Market Name	Total VPT	Percent NB- SB	Market Includes:		
				US-101 Corridor	San Mateo County	Communities of Concern
1A	San Francisco - Palo Alto (Limited)	15,000	39%-61%	✓	✓	✓
1B	BART - Palo Alto (Limited)	15,000	46%-54%	✓	✓	✓
2A	San Francisco - Sunnyvale (Limited)	15,000	39%-61%	✓	✓	✓
2B	BART - Sunnyvale (Limited)	17,000	48%-52%	✓	✓	✓
3A	Foster City – San Francisco	1,600	64%-36%	✓	✓	✓
3B	Foster City – BART	5,200	66%-34%	✓	✓	✓
4A	Redwood Shores – San Francisco	1,300	51%-49%	✓	✓	✓
4B	Redwood Shores – BART	3,600	50%-50%	✓	✓	✓
5	Foster City/Redwood Shores – Palo Alto	1,800	49%-51%	✓	✓	
6	Daly City – Palo Alto	3,300	60%-40%		✓	
7	Redwood City – Sunnyvale	3,300	36%-64%	✓	✓	✓
8	Western San Francisco – San Carlos	2,300	34%-66%	✓	✓	✓
9	Western Santa Clara County – Foster City	2,900	83%-17%	✓	✓	✓
10	Western Santa Clara County – San Francisco	1,700	93%-7%	✓		✓
11	Burlingame/San Mateo – San Francisco	3,400	85%-15%	✓	✓	✓
12	Belmont/San Carlos – San Francisco	1,800	78%-22%	✓	✓	

## 6.7 Opportunity Travel Markets: Bidirectional Limited Service

Several variations of a bidirectional limited stop bus service may serve travel markets along the US-101 corridor between San Francisco or BART stations and Palo Alto or Mountain View and Sunnyvale. Some of these markets overlap with other opportunity markets identified and may be overlaid with express routes.

### Market 1A (San Francisco to Palo Alto Limited via US-101 Corridor) or Market 1B (BART to Palo Alto Limited via US-101 Corridor)

Limited stop service between San Francisco (Market 1A) or San Bruno/Millbrae BART (Market 1B) and Palo Alto would serve a large travel market of approximately 15,000 VPT during the AM peak period with a relatively equal balance of northbound and southbound trips. The market includes a range of short-, intermediate-, and long-distance trips along the US-101 corridor – similar to previous KX service, though with a stronger focus on serving areas east of 101. The potential capture rate may be low given the potential access challenges associated with current interchange facilities and extended travel times due to frequent stops. Market 1B also requires a transfer to BART at either Millbrae or San Bruno Stations. The market includes parking-constrained employment centers with robust TDM programs in San Francisco and Palo Alto/Stanford, other employment hubs in Downtown Redwood City, Redwood Shores, Foster City, and Oyster Point, and Communities of Concern in East Palo Alto, Menlo Park, North Fair Oaks, San Mateo, South San Francisco, and San Francisco. Many of these origins and destinations are not directly served by existing transit service and require one or multiple transfers. Limited bus service to either market may be implemented through serving neighborhoods directly with limited park-and-ride use; however, a substantial investment in transit facilities and access would be needed along the US-101 corridor to address challenging pedestrian and transit conditions. Markets 1A and 1B are shown in **Figure 11**.

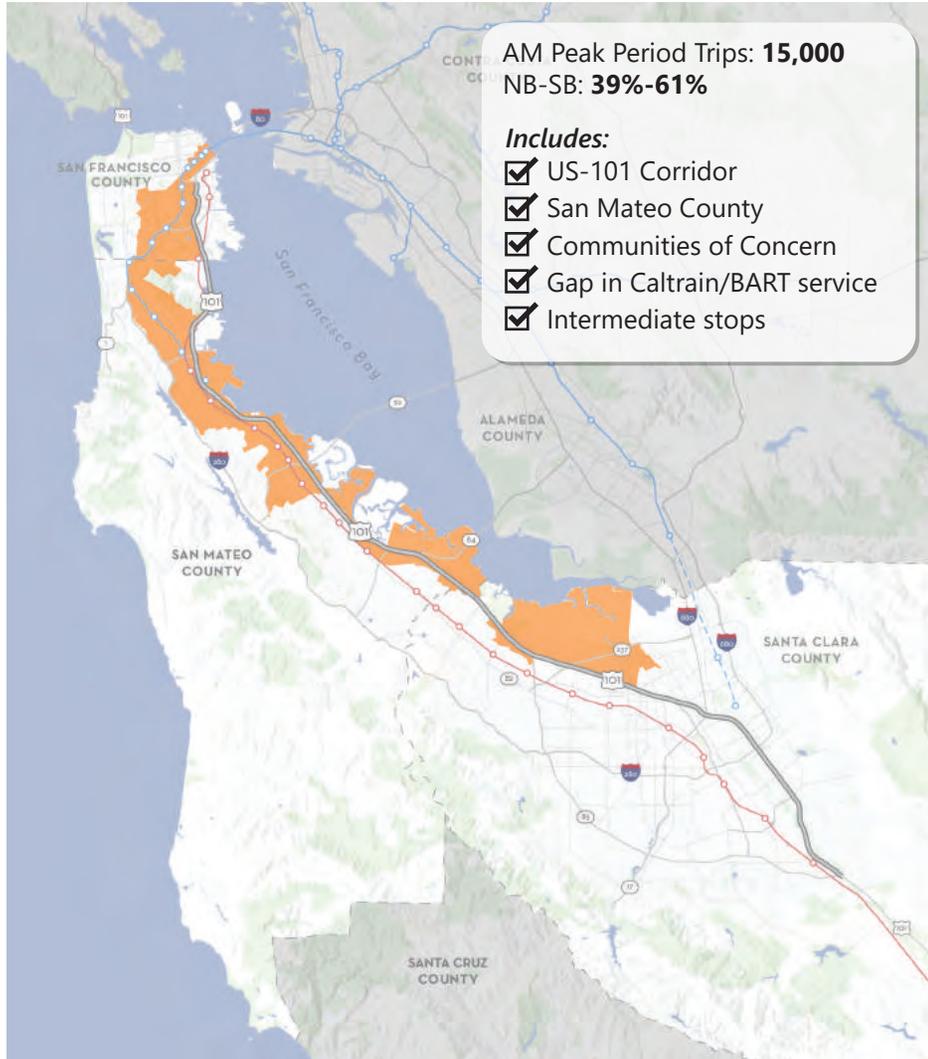
### Market 2A (San Francisco to Mountain View/Sunnyvale Limited via US-101 Corridor) or Market 2B (BART to Mountain View/Sunnyvale Limited via US-101 Corridor)

A variation on markets 1A and 1B, limited stop service between San Francisco (Market 2A) or San Bruno/Millbrae BART (Market 2B) and Mountain View (North Bayshore area) and Sunnyvale (Moffett Field area/VTA Light Rail Mountain View-Winchester Line) would serve a comparable bidirectional mix of short-, intermediate-, and long-distance trips, totaling 15,000-17,000 VPT during the AM peak period. The capture rate may be similarly low; moreover, employers in the North Bayshore and Moffett Field areas have fewer parking constraints than Palo Alto and Stanford and some (e.g. Google, LinkedIn, and Yahoo) operate their own private express bus services. Market 2B also requires a transfer to BART at either Millbrae or San Bruno Stations. Markets 2A and 2B are shown in **Figure 12**.



## Market 2A

San Francisco to Mountain View/Sunnyvale Limited via US-101 Corridor



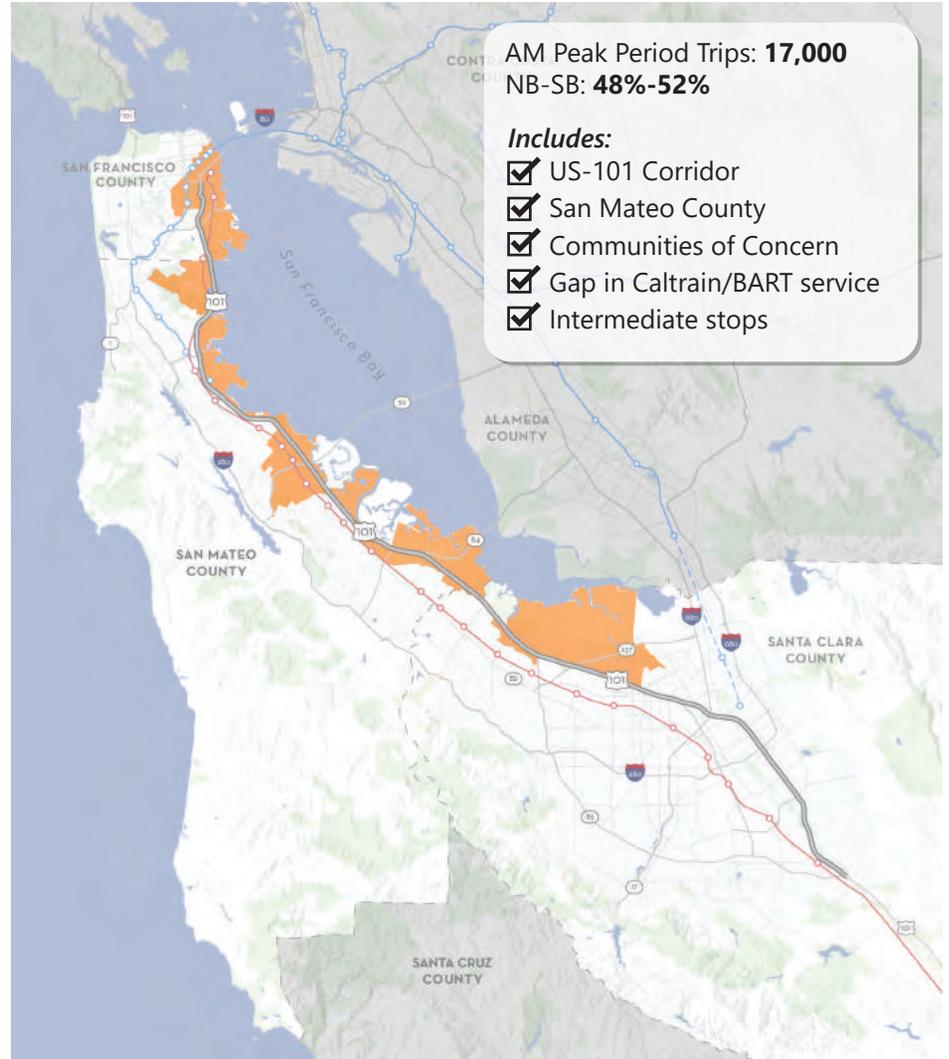
AM Peak Period Trips: **15,000**  
NB-SB: **39%-61%**

**Includes:**

- US-101 Corridor
- San Mateo County
- Communities of Concern
- Gap in Caltrain/BART service
- Intermediate stops

## Market 2B

BART to Mountain View/Sunnyvale Limited via US-101 Corridor



AM Peak Period Trips: **17,000**  
NB-SB: **48%-52%**

**Includes:**

- US-101 Corridor
- San Mateo County
- Communities of Concern
- Gap in Caltrain/BART service
- Intermediate stops

-  Opportunity Travel Market
-  US-101 Corridor
-  Caltrain
-  BART
-  County Line



Figure 12  
Opportunity Travel Markets

## 6.8 Opportunity Travel Markets: Bidirectional Express Service

Bidirectional express bus travel markets occur between the Mid-Peninsula (Foster City, Redwood Shores, and eastern San Mateo) and population and employment centers along the edges of San Mateo County in San Francisco and Palo Alto/Stanford. Some of these markets overlap with other opportunity markets identified. Generally speaking, it is assumed that bidirectional markets require at least 30 percent of ridership in the “reverse commute” direction and strong employment anchors on both ends.

### Market 3A (Foster City – San Francisco) and Market 4A (Redwood Shores – San Francisco)

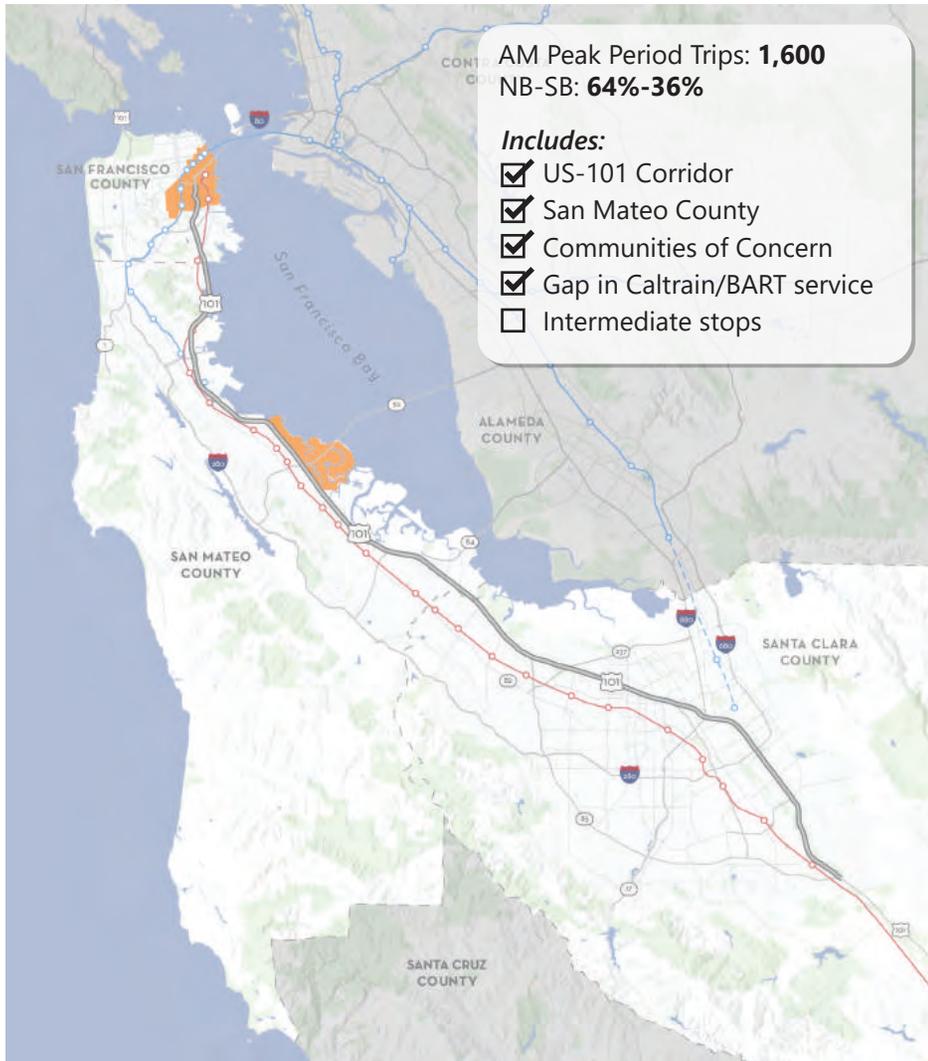
Travel markets between Foster City and Downtown San Francisco and Redwood Shores and Downtown San Francisco via eastern San Mateo demonstrate potential for bidirectional express bus service. Neither market is directly served by Caltrain service; previously, the FX in Foster City was the most productive of SamTrans’ express bus routes, carrying approximately 230 northbound passengers during the AM peak period, while the NX had limited service in Redwood Shores. The Foster City-San Francisco market includes approximately 1,600 VPT during the AM peak period (64 percent northbound and 36 percent southbound). The Redwood Shores-San Francisco market via the US-101/3<sup>rd</sup> Street bus pad includes approximately 1,300 VPT during the AM peak period split evenly between northbound and southbound trips. Express bus service to either market may be implemented through serving neighborhoods directly with limited park-and-ride use. Potential time savings for the route relative to Caltrain may shift some Caltrain passengers and attract some passengers with origins or destinations beyond Downtown San Francisco and the Mission District/Potrero Hill area; however, service to Redwood Shores may also compete against express bus service by Electronic Arts and availability of free parking. Despite the proximity of Foster City and Redwood Shores, routes serving both areas may prove challenging due to geographic barriers between the two. Both routes could include stops in eastern San Mateo, a Community of Concern. Markets 3A and 4A are shown in **Figure 13**.

### Market 3B (Foster City – BART) and Market 4B (Redwood Shores – BART)

A variation on markets 3A and 4A, express bus service between BART and Foster City or Redwood Shores via eastern San Mateo could similarly fill a gap in regional transit service. The Foster City-BART market includes approximately 5,200 VPT during the AM peak period (66 percent northbound) while the Redwood Shores-BART corridor includes approximately 3,600 VPT evenly split between northbound and southbound trips. However, while these totals are higher than markets 3A and 4A, the capture rate is likely to be lower given barriers to accessing BART and transferring between services. In 2010, the replacement of the FX with the 359 route to BART and 16 percent reduction in service resulted in a 75 percent year-over-year decline in ridership, suggesting a high level of market sensitivity to travel times and transfers. Markets 3A and 4A are shown in **Figure 14**.

## Market 3A

Foster City – San Francisco



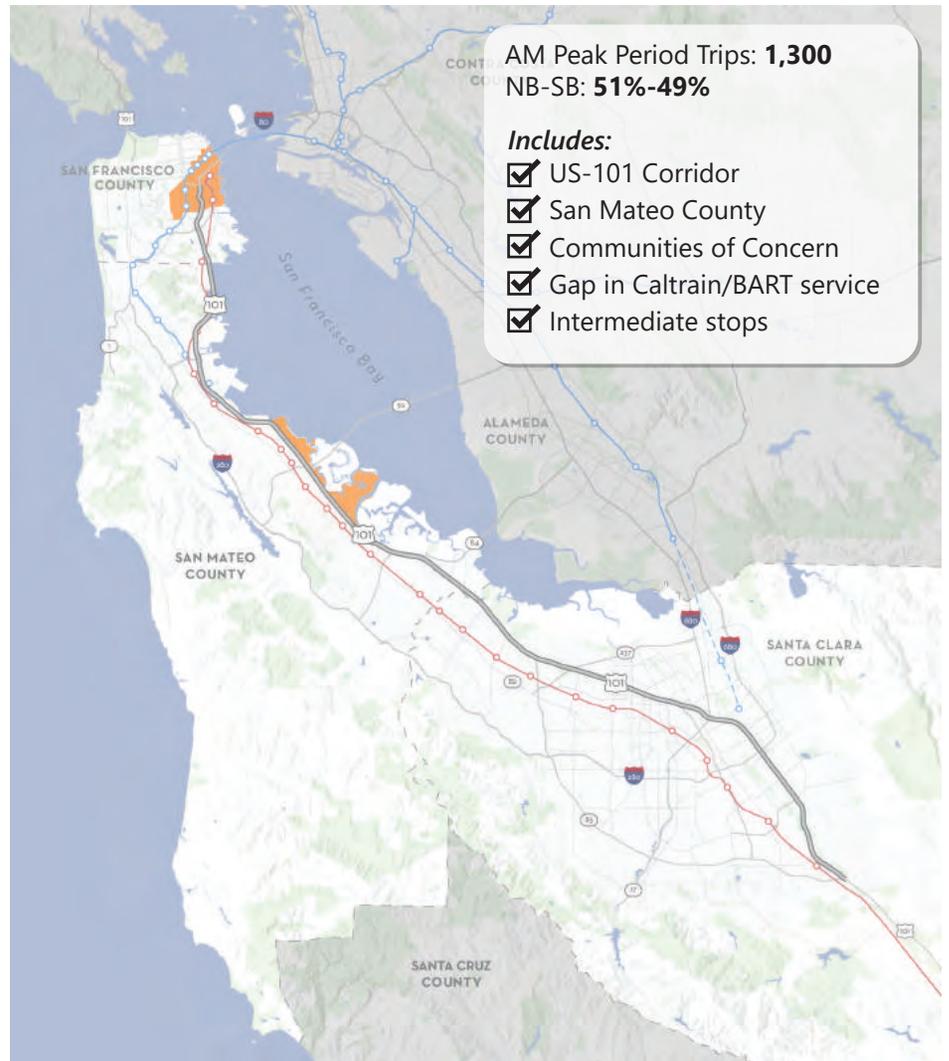
AM Peak Period Trips: **1,600**  
NB-SB: **64%-36%**

**Includes:**

- US-101 Corridor
- San Mateo County
- Communities of Concern
- Gap in Caltrain/BART service
- Intermediate stops

## Market 4A

Redwood Shores – San Francisco



AM Peak Period Trips: **1,300**  
NB-SB: **51%-49%**

**Includes:**

- US-101 Corridor
- San Mateo County
- Communities of Concern
- Gap in Caltrain/BART service
- Intermediate stops

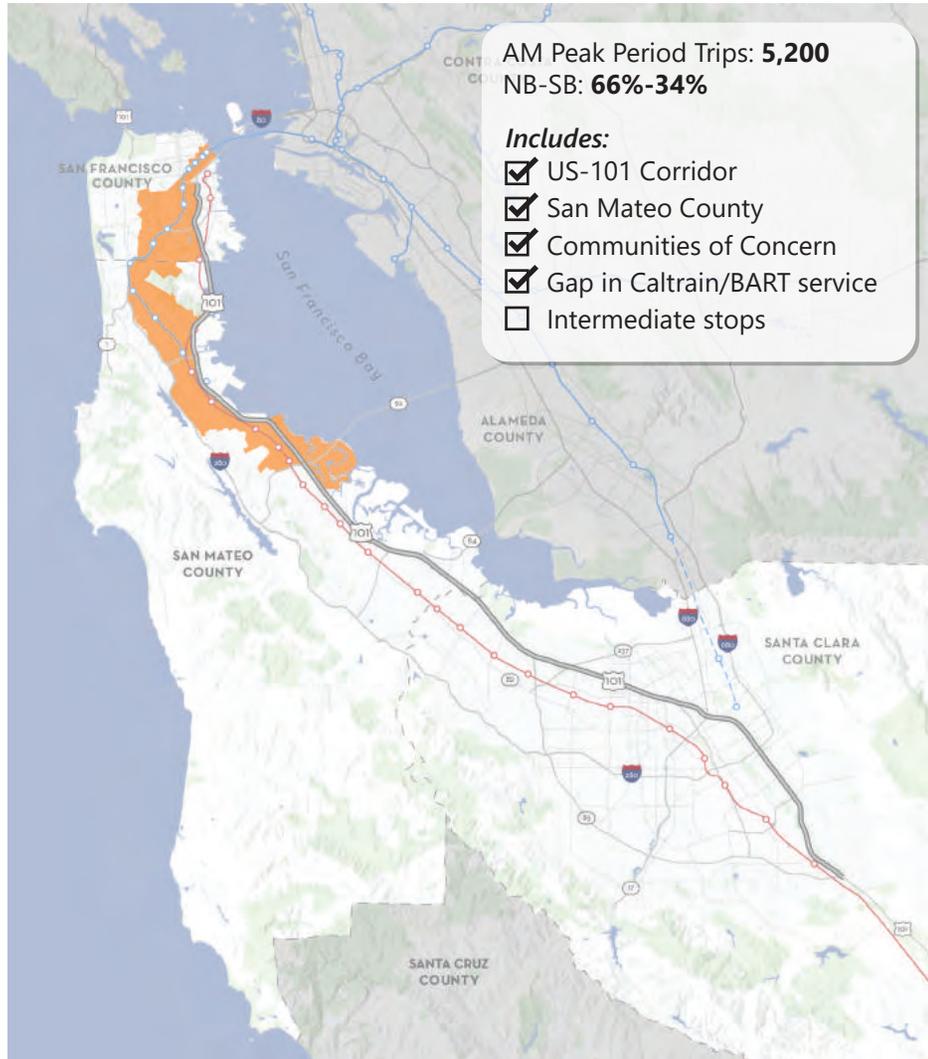
- Opportunity Travel Market
- US-101 Corridor
- Caltrain
- BART
- County Line



Figure 13  
Opportunity Travel Markets

## Market 3B

Foster City – BART



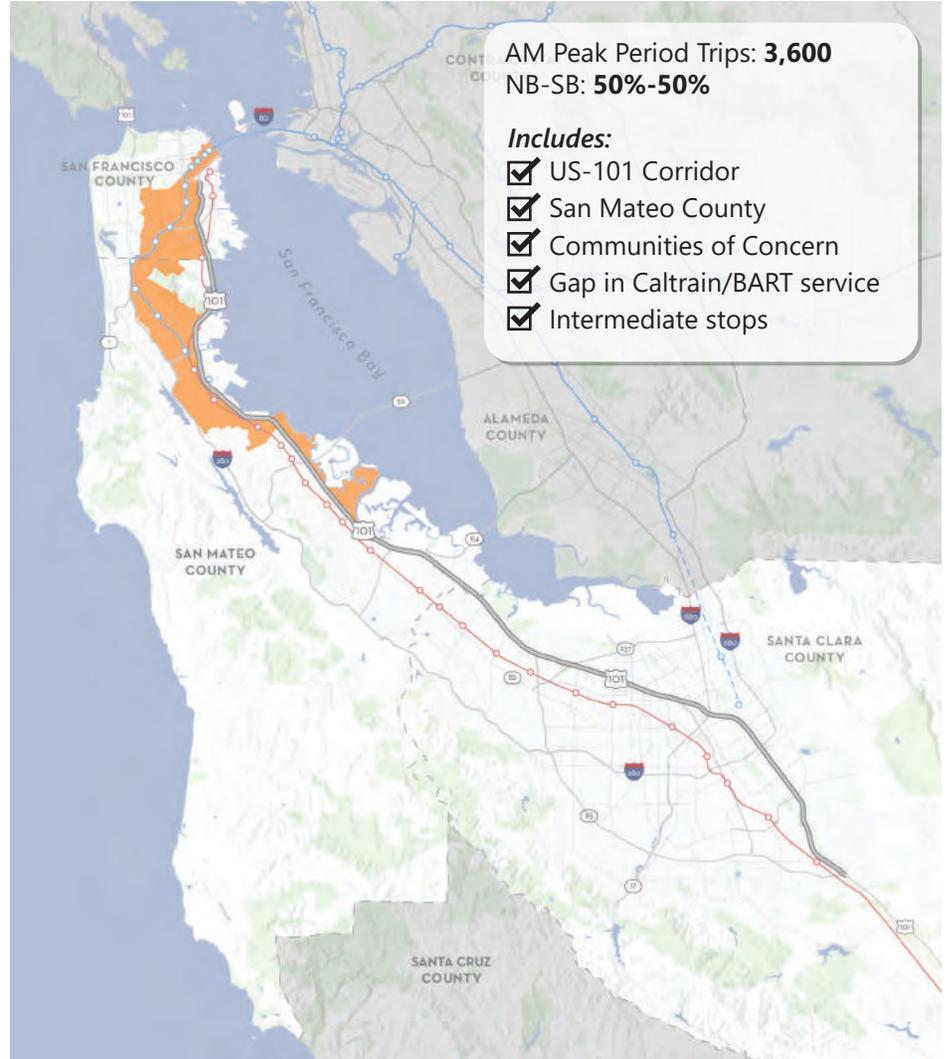
AM Peak Period Trips: **5,200**  
NB-SB: **66%-34%**

**Includes:**

- US-101 Corridor
- San Mateo County
- Communities of Concern
- Gap in Caltrain/BART service
- Intermediate stops

## Market 4B

Redwood Shores – BART



AM Peak Period Trips: **3,600**  
NB-SB: **50%-50%**

**Includes:**

- US-101 Corridor
- San Mateo County
- Communities of Concern
- Gap in Caltrain/BART service
- Intermediate stops

- Opportunity Travel Market
- US-101 Corridor
- Caltrain
- BART
- County Line



Figure 14  
Opportunity Travel Markets

### Market 5 (Foster City/Redwood Shores – Palo Alto)

A balanced bidirectional market of approximately 1,800 VPT occurs between Foster City/Redwood Shores and Palo Alto/Stanford during the AM peak period. Individually, neither Foster City nor Redwood Shores achieves a sufficient threshold for bidirectional express bus service: Foster City-Palo Alto includes approximately 800 trips (60 percent southbound) while Redwood Shores-Palo Alto includes approximately 1,000 trips (57 percent northbound). A combined service for Foster City and Redwood Shores may be achieved through serving employment centers along US-101 with limited diversions to residential areas; access would therefore necessitate higher rates of bicycling, park-and-ride, and drop-offs. Alternatively, expanded first/last mile shuttle services between Foster City or Redwood Shores and Caltrain may achieve a similar mode shift for this market. Market 5 is shown in **Figure 15**.

### Market 6 (Daly City-Palo Alto, via I-280 Corridor)

A bidirectional market of approximately 3,300 VPT occurs between Palo Alto/Stanford and the BART corridor in San Francisco/Daly City along the I-280 corridor. In the southbound direction, approximately 1,300 VPT travel southbound between origins near BART to the Stanford Research Park, Stanford University, and Downtown Palo Alto. In the opposite direction, approximately 2,000 VPT travel between Palo Alto, Menlo Park, and Woodside toward destinations along the BART corridor in San Francisco and Daly City. This market is already served by BART and Caltrain, but express bus service may provide an opportunity to serve some locations less accessible to Caltrain (e.g. the Stanford Research Park and Woodside) and supplement Caltrain service if Caltrain ridership grows faster than expected and capacity becomes constrained. Market 6 is shown in **Figure 15**.

### Market 7 (Redwood City/Menlo Park/East Palo Alto Area-Mountain View/Sunnyvale)

A limited stop overlay along portions of SamTrans' 278 and 297 local service with express service to the North Bayshore area in Mountain View and Moffett Field area in Sunnyvale would serve approximately 2,100 VPT during the AM peak period (excluding local trips). While a bus route serving this market could include a majority of its operations on local streets, the market represents a gap in SamTrans service for Communities of Concern in Redwood City, North Fair Oaks, Menlo Park, and East Palo Alto. A northbound market of approximately 1,200 VPT also occurs. Market 7 is shown in **Figure 16**.

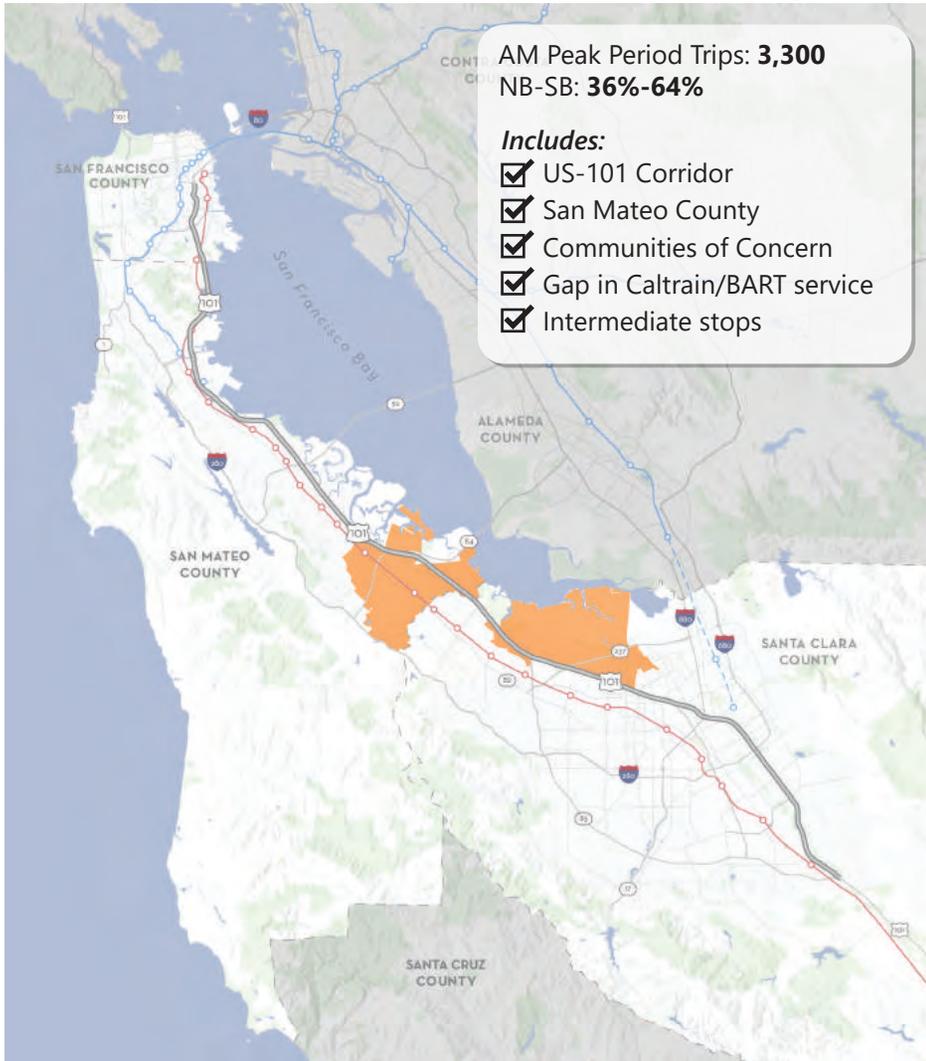
### Market 8 (Western San Francisco-SFO/San Mateo/Belmont/San Carlos/Redwood City)

A southbound market of 1,900 VPT occurs between Sunset and Richmond Districts in San Francisco and mid-Peninsula areas of San Mateo, Belmont, San Carlos, and Redwood City. While the corridor is well-served via transit service, these trips currently require multiple transfers via Muni, BART, and Caltrain. A smaller market of approximately 900 VPT occurs in the northbound direction, which may warrant express bus service



## Market 7

Redwood City/Menlo Park/East Palo Alto Area-Mountain View/Sunnyvale



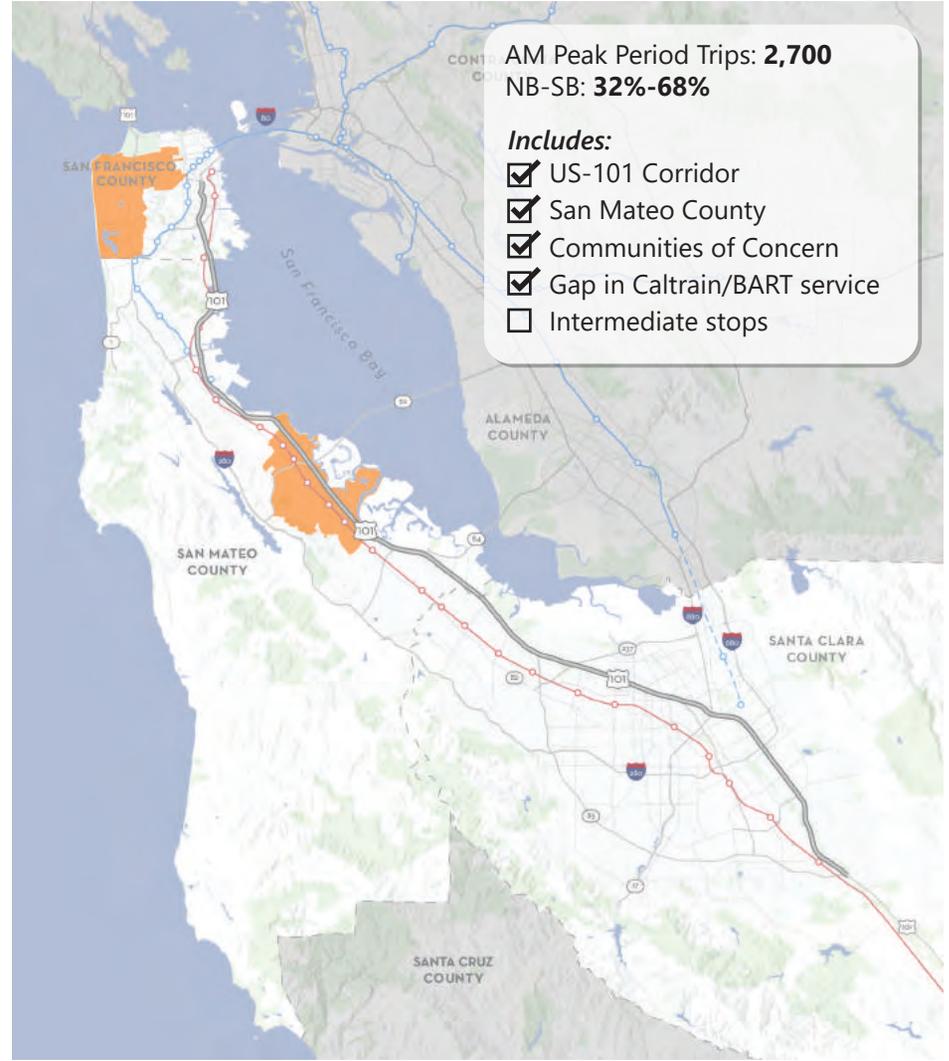
AM Peak Period Trips: **3,300**  
NB-SB: **36%-64%**

**Includes:**

- US-101 Corridor
- San Mateo County
- Communities of Concern
- Gap in Caltrain/BART service
- Intermediate stops

## Market 8

Western San Francisco-SFO/San Mateo/Belmont/San Carlos/Redwood City



AM Peak Period Trips: **2,700**  
NB-SB: **32%-68%**

**Includes:**

- US-101 Corridor
- San Mateo County
- Communities of Concern
- Gap in Caltrain/BART service
- Intermediate stops

- Opportunity Travel Market
- US-101 Corridor
- Caltrain
- BART
- County Line



Figure 16  
Opportunity Travel Markets

if a high capture rate is achieved via partnerships with major institutions such as San Francisco State University, University of California San Francisco, and University of San Francisco. Market 8 is shown in **Figure 16**.

## 6.9 Opportunity Travel Markets: One-Directional Express Service

Several one-way travel markets exhibit potential for express bus service. Some of these markets overlap with other opportunity markets identified. These markets lack a reverse commute share of at least 30 percent and strong employment anchors on both ends.

### Market 9 (Western Santa Clara County – Foster City/Redwood Shores) and Market 10 (Western Santa Clara County-San Francisco)

Western Santa Clara County has two sizeable long-distance travel markets to Redwood Shores/Foster City and to the BART corridor in San Francisco/Daly City, as shown in **Figure 17**. Approximately 2,400 VPT occurs during the AM peak period between Mountain View, Sunnyvale, Santa Clara, Cupertino, and neighboring areas and employment centers in Redwood Shores and Foster City. Another 1,600 VPT occurs between western Santa Clara County and Downtown San Francisco. Trips between these markets may occur along US-101 or I-280. Given the large, relatively low density catchment area, express bus service would rely heavily on park-and-ride access to serve this market. Consequently, the capture rate may be low and highly dependent on the siting of a park-and-ride hub. Southbound flows for these markets are substantially smaller, suggesting such service would be infeasible.

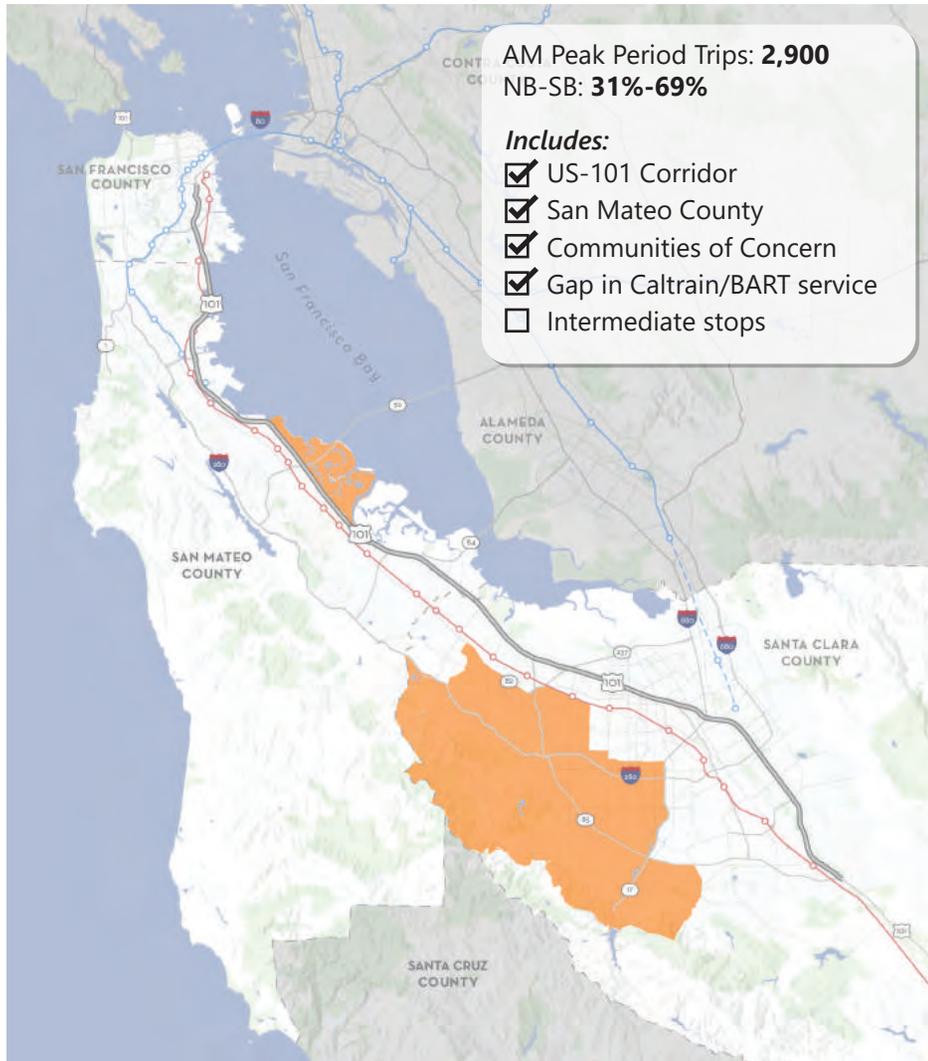
### Market 11 (San Carlos/Belmont/San Mateo-San Francisco), and Market 12 (Burlingame/San Mateo-San Francisco)

While Caltrain is expected to offer the fastest and most frequent transit option along much of the rail corridor, express bus service may supplement Caltrain at select stations where lower service levels may not fully capture potential demand. Additionally, while Caltrain is expected to maintain available capacity through 2030-2035, express bus service may be warranted to supplement mid-Peninsula bottlenecks if ridership grows faster than expected. Although future Caltrain schedules have not yet been determined, one-way express bus service to San Francisco may be merited at lower frequency stations such as Burlingame, Broadway, Belmont, and San Carlos. These stations also include a typically underutilized parking supply totaling 770 spaces, while the nearby US-101/CA-92 park-and-ride lot has an additional 174 spaces.

Current conditions suggest that service between Burlingame/San Mateo and San Francisco (2,900 northbound VPT, including Millbrae and Hillsborough) and San Carlos/Belmont/San Mateo-San Francisco (1,400 northbound VPT) present the strongest opportunities for supplementary express bus service along the Caltrain corridor, as shown in **Figure 18**. However, the previous KX, MX, and PX routes achieved a low

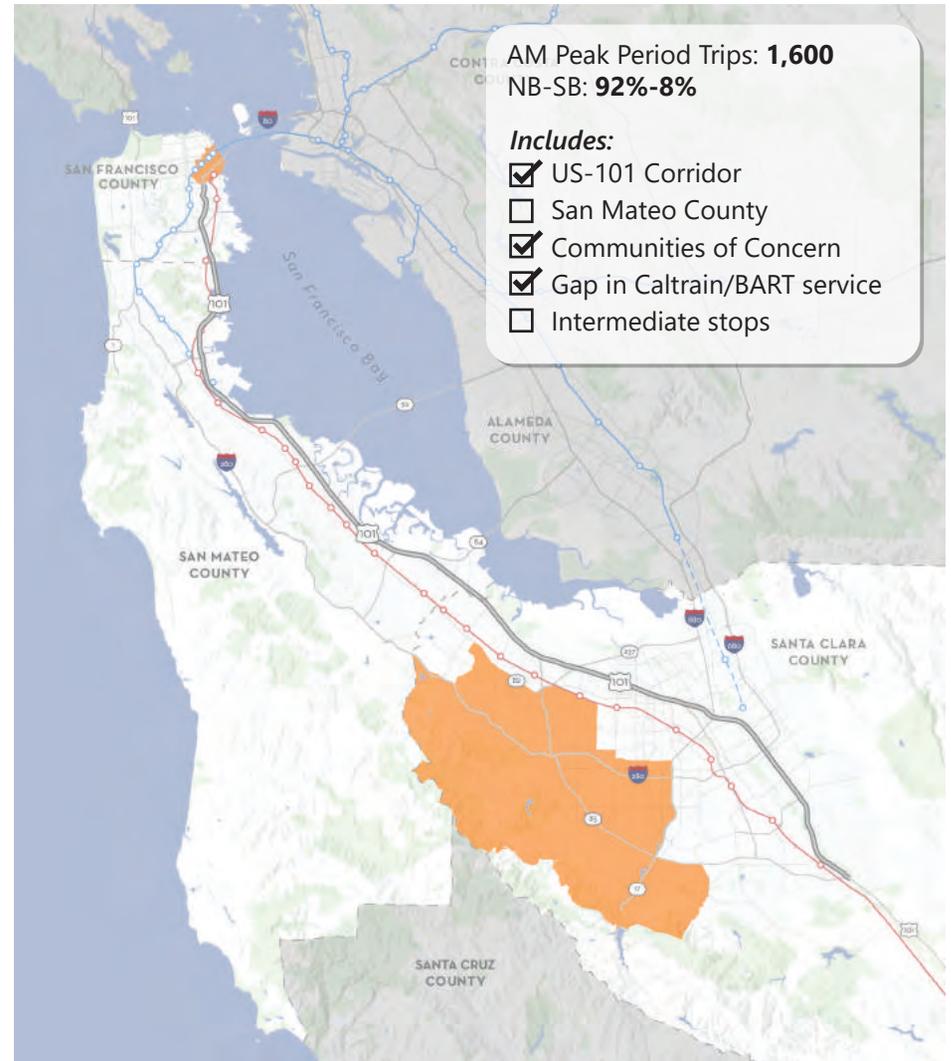
## Market 9

Western Santa Clara County – Foster City/Redwood Shores



## Market 10

Western Santa Clara County-San Francisco



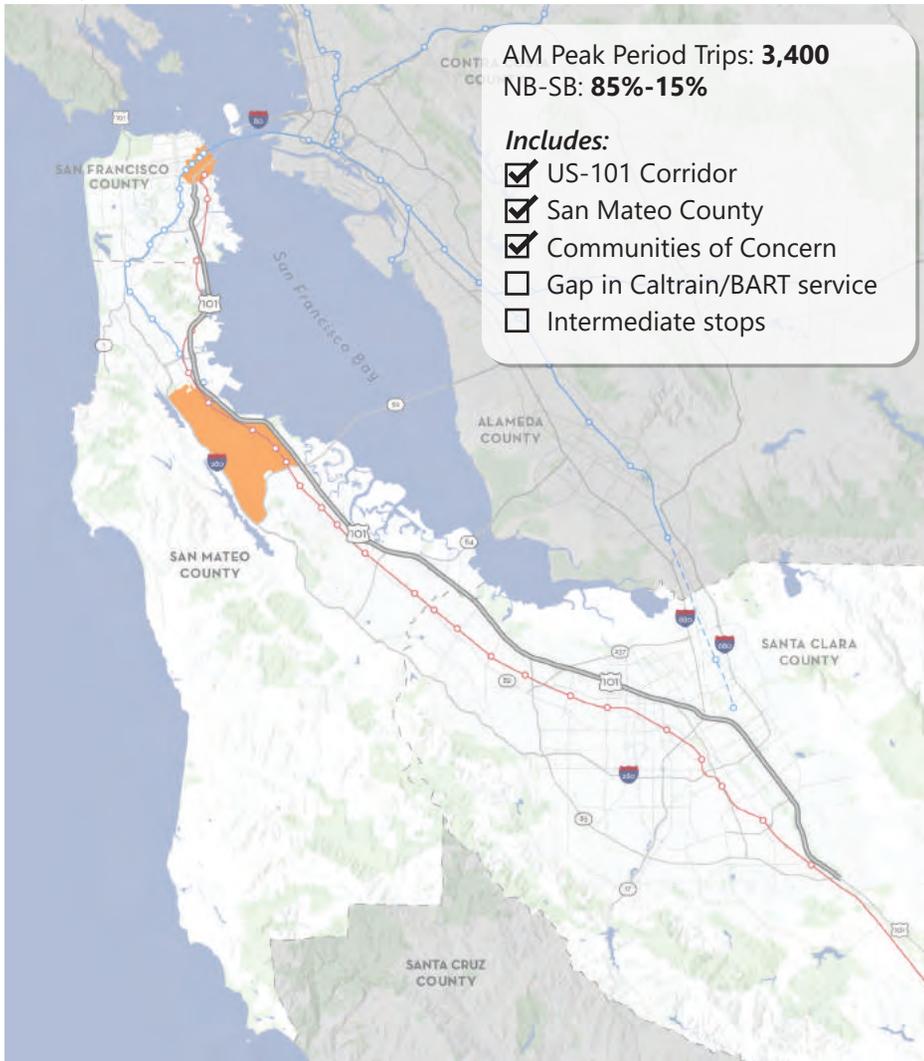
- Opportunity Travel Market
- US-101 Corridor
- Caltrain
- BART
- County Line



Figure 17  
Opportunity Travel Markets

# Market 11

Burlingame/San Mateo-San Francisco



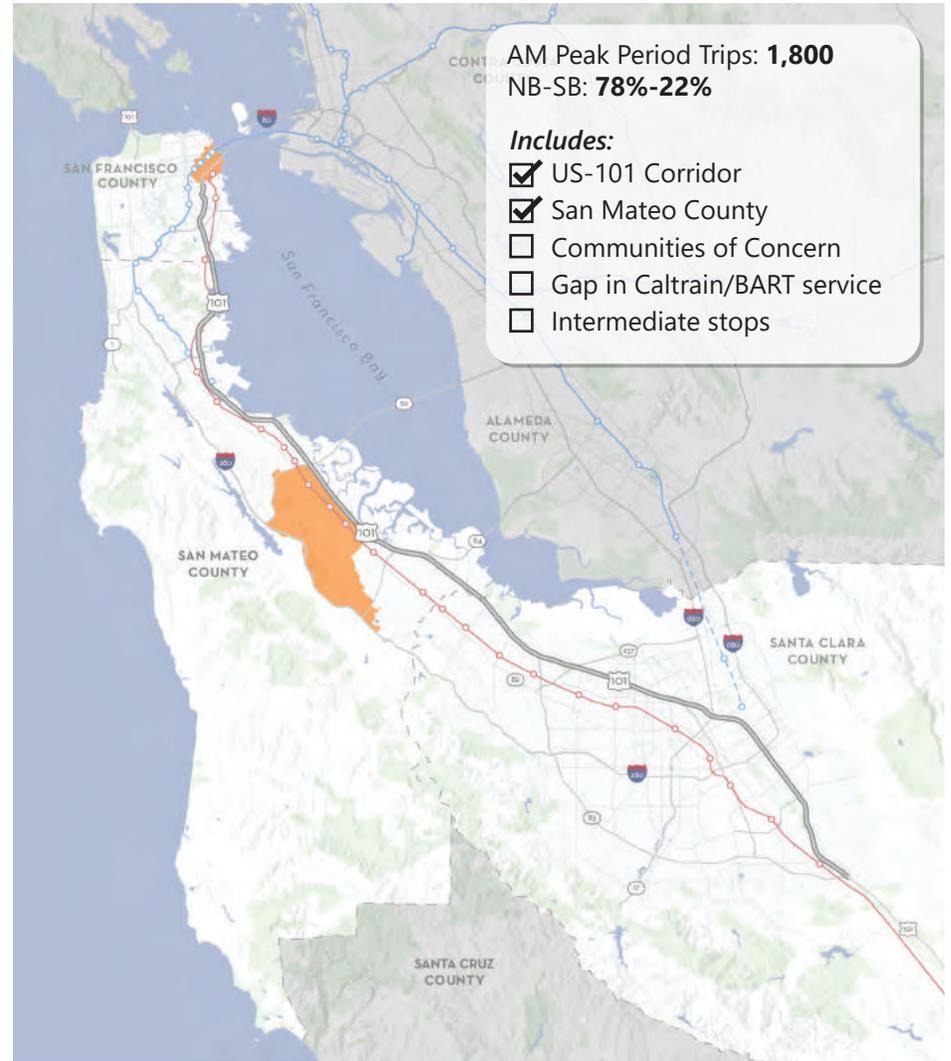
AM Peak Period Trips: **3,400**  
NB-SB: **85%-15%**

**Includes:**

- US-101 Corridor
- San Mateo County
- Communities of Concern
- Gap in Caltrain/BART service
- Intermediate stops

# Market 12

San Carlos/Belmont-San Francisco



AM Peak Period Trips: **1,800**  
NB-SB: **78%-22%**

**Includes:**

- US-101 Corridor
- San Mateo County
- Communities of Concern
- Gap in Caltrain/BART service
- Intermediate stops

- Opportunity Travel Market
- US-101 Corridor
- Caltrain
- BART
- County Line



Figure 18  
Opportunity Travel Markets

capture rate in these areas due to competition from Caltrain, with 17 peak period trips serving approximately 150-200 AM riders along El Camino Real in San Carlos, Belmont, and San Mateo.

## 6.10 Other Markets

### SamTrans KX, 292, and 398 Routes

The KX, 292, and 398 routes along the US-101 corridor exhibit limited potential for ridership growth for intermediate- and long-distance trips relative to Caltrain, BART and other potential express routes identified in **Section 6.7**. The 292 route serves approximately 1,500 riders per day between San Francisco and San Mateo Counties at 15 to 30 minute frequencies, while the KX and 398 routes serve a combined 200 express riders per day within San Mateo County at hourly frequencies; previously, the KX served approximately 1,000 express riders per day (**Section 3.4**). While these routes have substantially longer travel times than Caltrain or BART, they offer a lower-cost alternative to traveling within San Mateo County, to the San Francisco International Airport, or Downtown San Francisco (**Section 1.4**). Additionally, these routes may supplement local bus service and low-frequency Caltrain stations, serving Communities of Concern in Downtown and southeastern San Francisco, South San Francisco, and San Mateo. However, given their recent ridership declines and plans for increased Caltrain service at low-frequency stations, there is limited potential for ridership gains among these routes.

### Southern and Eastern San Jose

Southern and eastern San Jose lack a strong travel market to San Mateo or San Francisco Counties, which accounts for approximately two percent of trips without a major concentration of destinations. These areas displayed stronger travel markets to Downtown San Jose, north San Jose, Sunnyvale, Mountain View, and the Stevens Creek Boulevard corridor. VPT in these areas may be served by upcoming improvements such as BART to Silicon Valley Phase II, Caltrain Modernization, and enhancements to VTA light rail and local, rapid, and express bus service.

### North San Jose

North San Jose is a major regional employment hub that includes approximately 100,000 jobs, the Mineta San Jose International Airport, and a growing residential population. However, most trips to and from this area are local: over 80 percent of VPT with destinations in the area and over 90 percent of VPT originating in the area are from elsewhere in Santa Clara County, while most of the remaining trips are to and from the East Bay. Travel between San Mateo County and north San Jose accounts for less than four percent of total VPT, while travel between San Francisco County and north San Jose accounts for less than one percent of VPT. Consequently, the area lacks an intercounty express bus market to the Peninsula. VPT in north San Jose

may be served by upcoming improvements such as BART to Silicon Valley Phase II and enhancements to VTA light rail.

### **San Francisco – Santa Clara County**

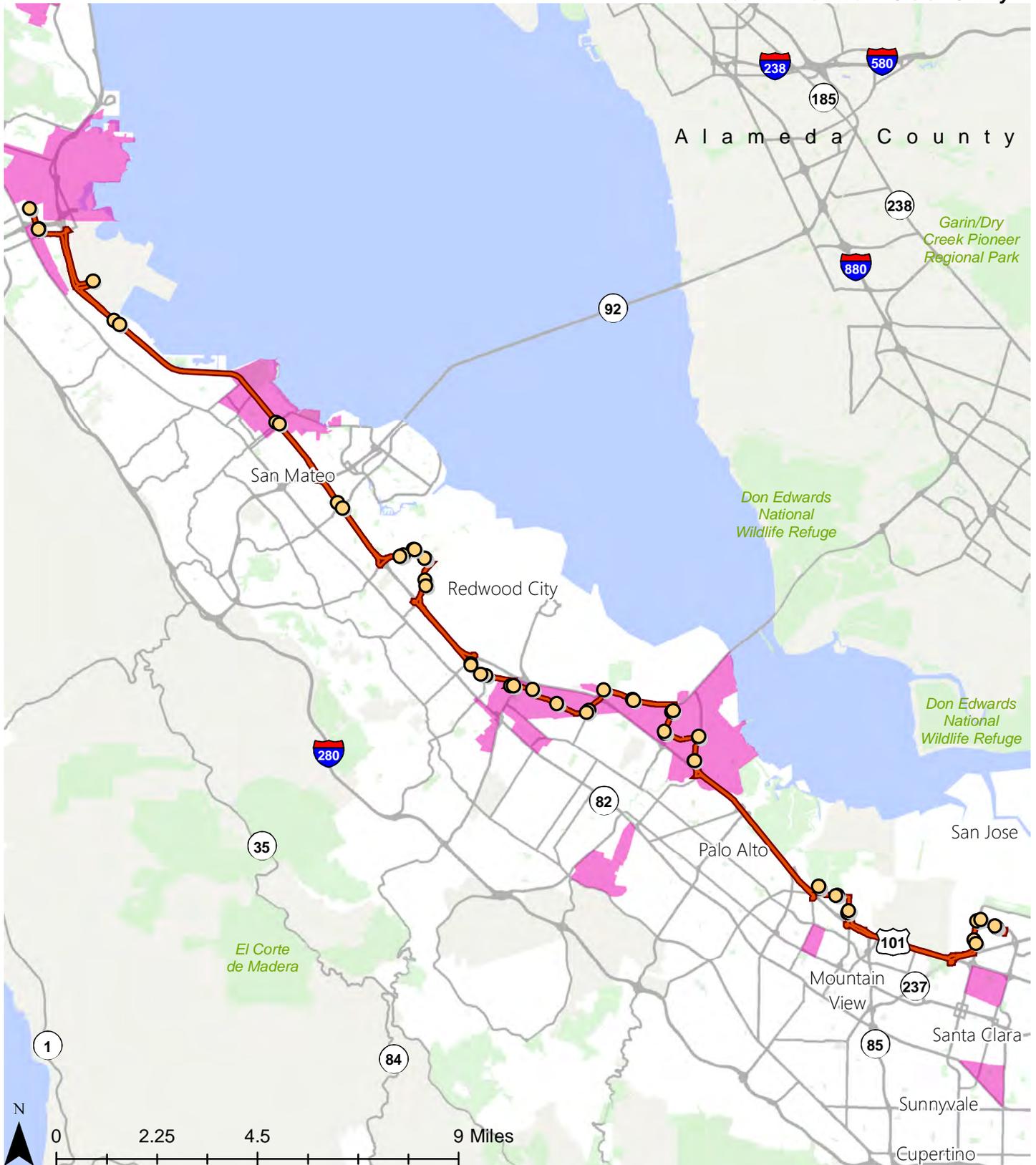
The San Francisco to Santa Clara County travel market is already well served by private express bus services and Caltrain; the Caltrain Modernization and BART to Silicon Valley Phase II projects will further improve transit serving this market. Beyond the opportunity markets discussed in **Sections 6.6** through **6.9**, Santa Clara County lacks sufficient density of origins or destinations traveling to or from San Francisco County.

### **6.11 Conclusion**

AM peak period service presents a foundation for measuring potential markets for express bus service. Twelve travel markets present opportunities for express or limited stop service along the US-101 and I-280 corridors during the AM peak period. Of these, eight demonstrate a bidirectional demand, while four present one-directional demand. Four markets present opportunities for service either to San Francisco or to BART depending on potential managed lanes improvements north of I-380. Further refinement routes will support identification of ridership potential during the AM and PM peak periods as well as midday and evening periods.

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# APPENDIX C: SHORTLISTED ROUTE MAPS WITH COMMUNITIES OF CONCERN

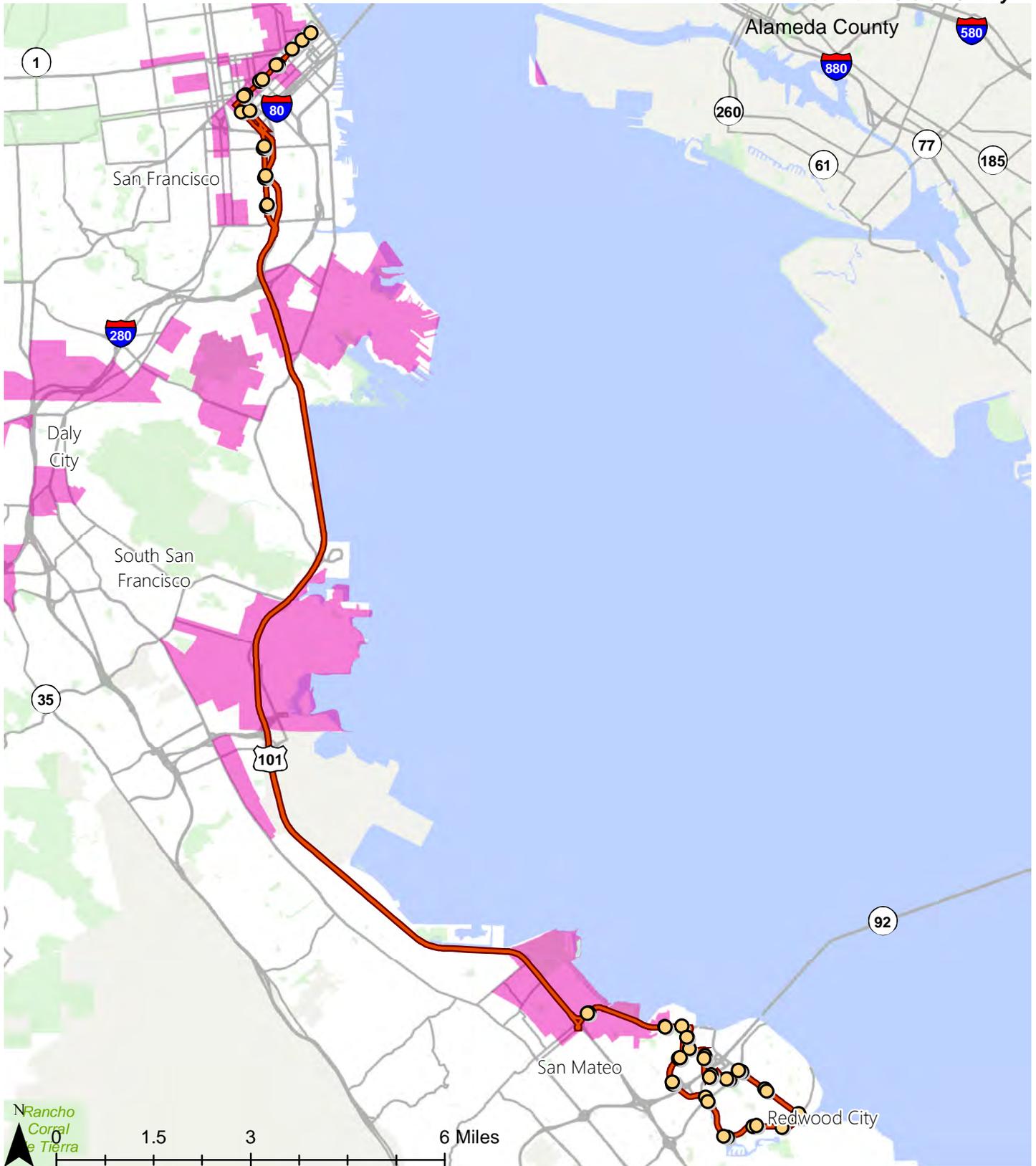


-  Planned Express Stop
-  Planned Express Route
-  MTC Community of Concern

**Route 2: BART-Sunnyvale Limited**  
Service in Communities of Concern



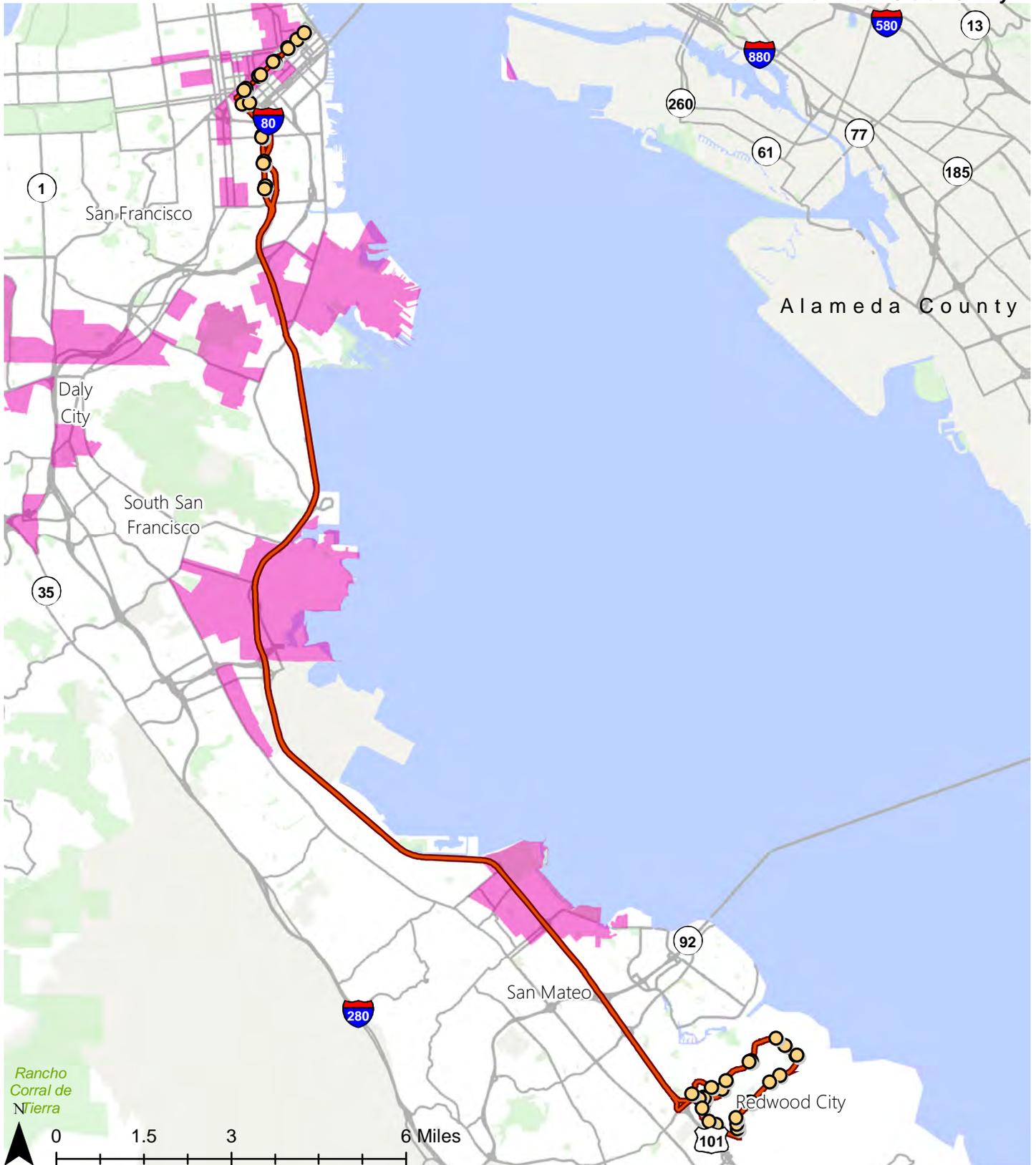
**\*\*For Internal Use Only\*\***



-  Planned Express Stop
-  Planned Express Route
-  MTC Community of Concern

**Route 3: SF-Foster City**  
Service in Communities of Concern

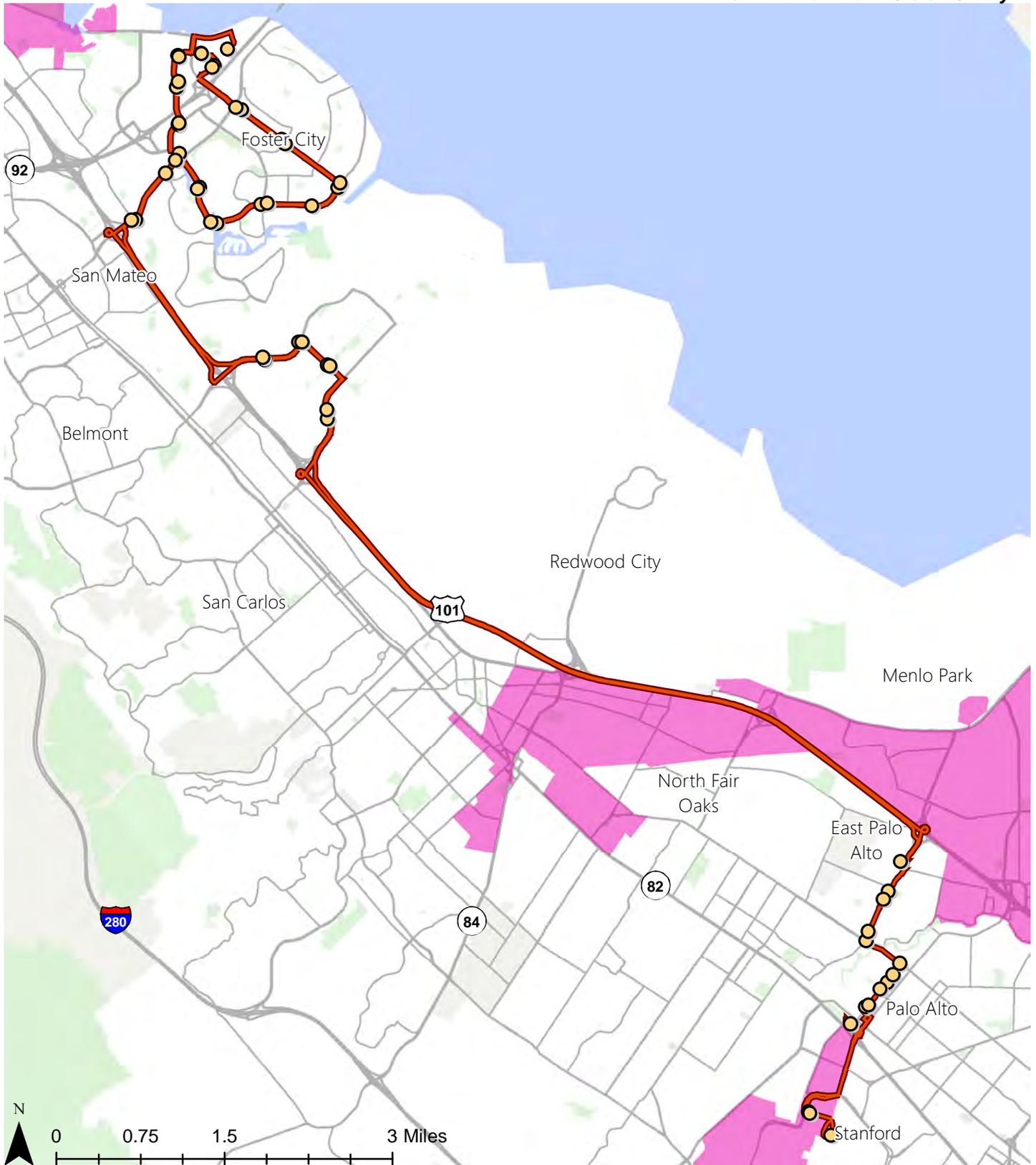




-  Planned Express Stop
-  Planned Express Route
-  MTC Community of Concern

**Route 4: SF-Redwood Shores**  
Service in Communities of Concern

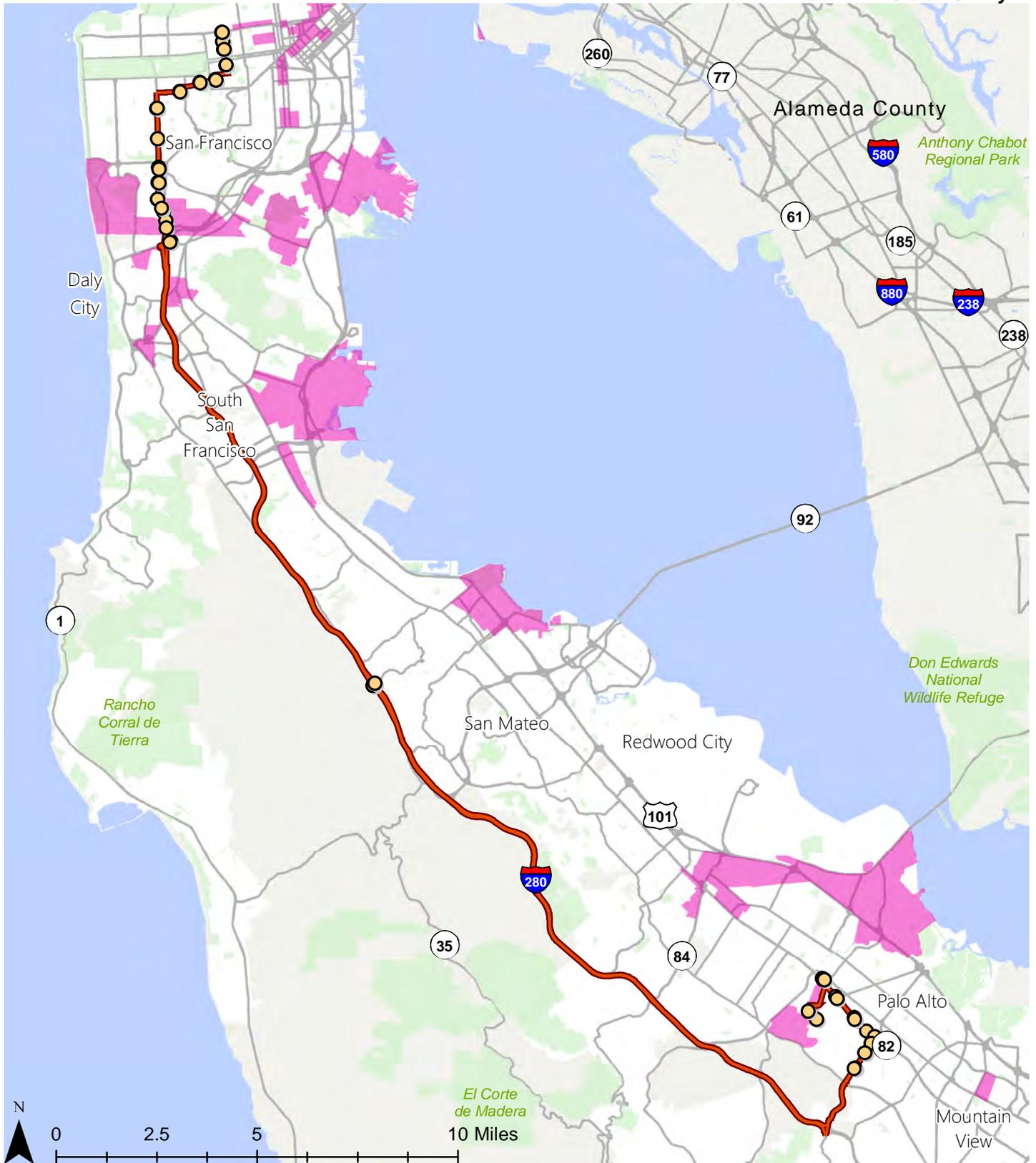




-  Planned Express Stop
-  Planned Express Route
-  MTC Community of Concern

**Route 5: Foster City-Palo Alto**  
Service in Communities of Concern

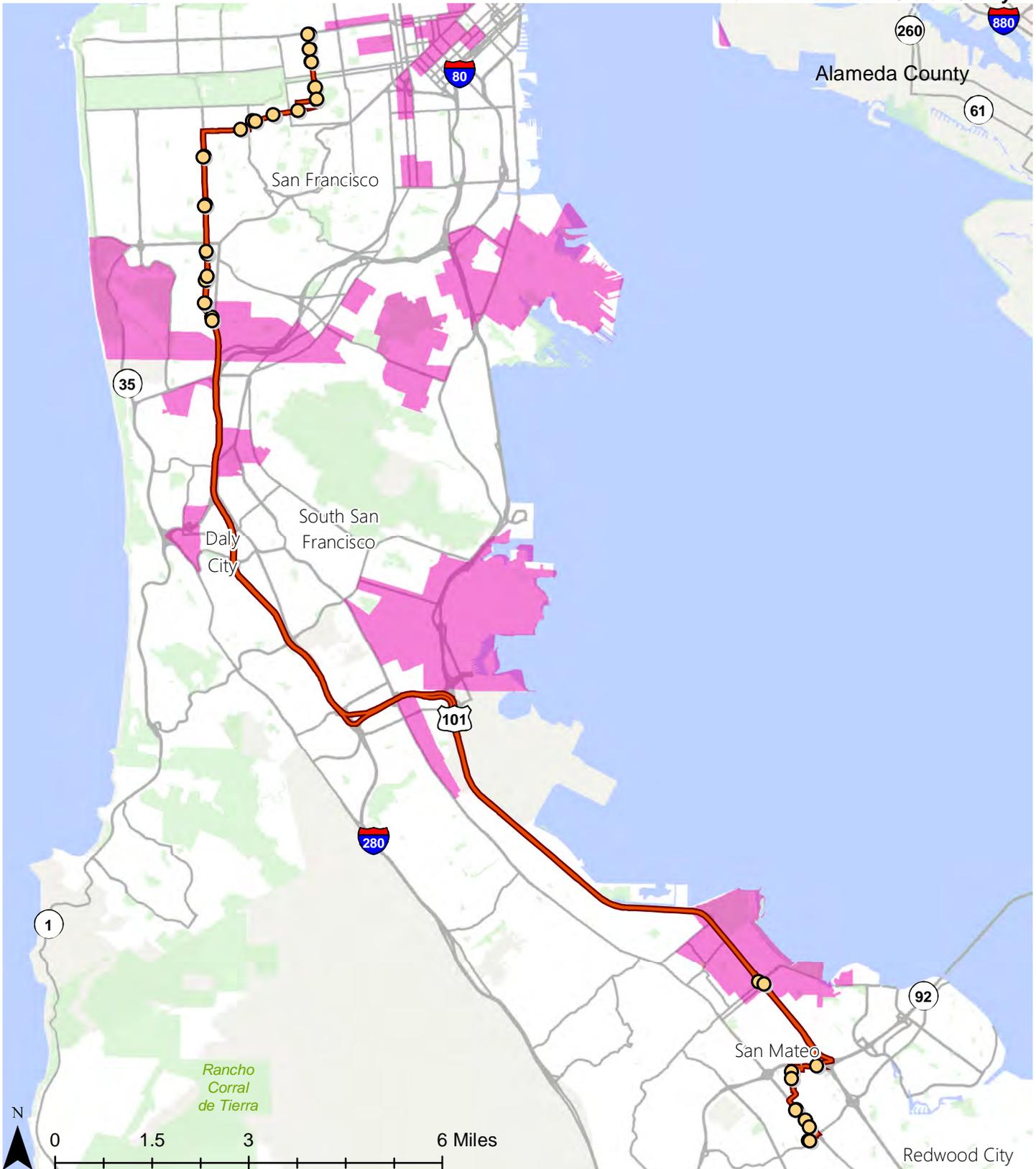




-  Planned Express Stop
-  Planned Express Route
-  MTC Community of Concern

**Route 6: Western SF-Palo Alto**  
Service in Communities of Concern



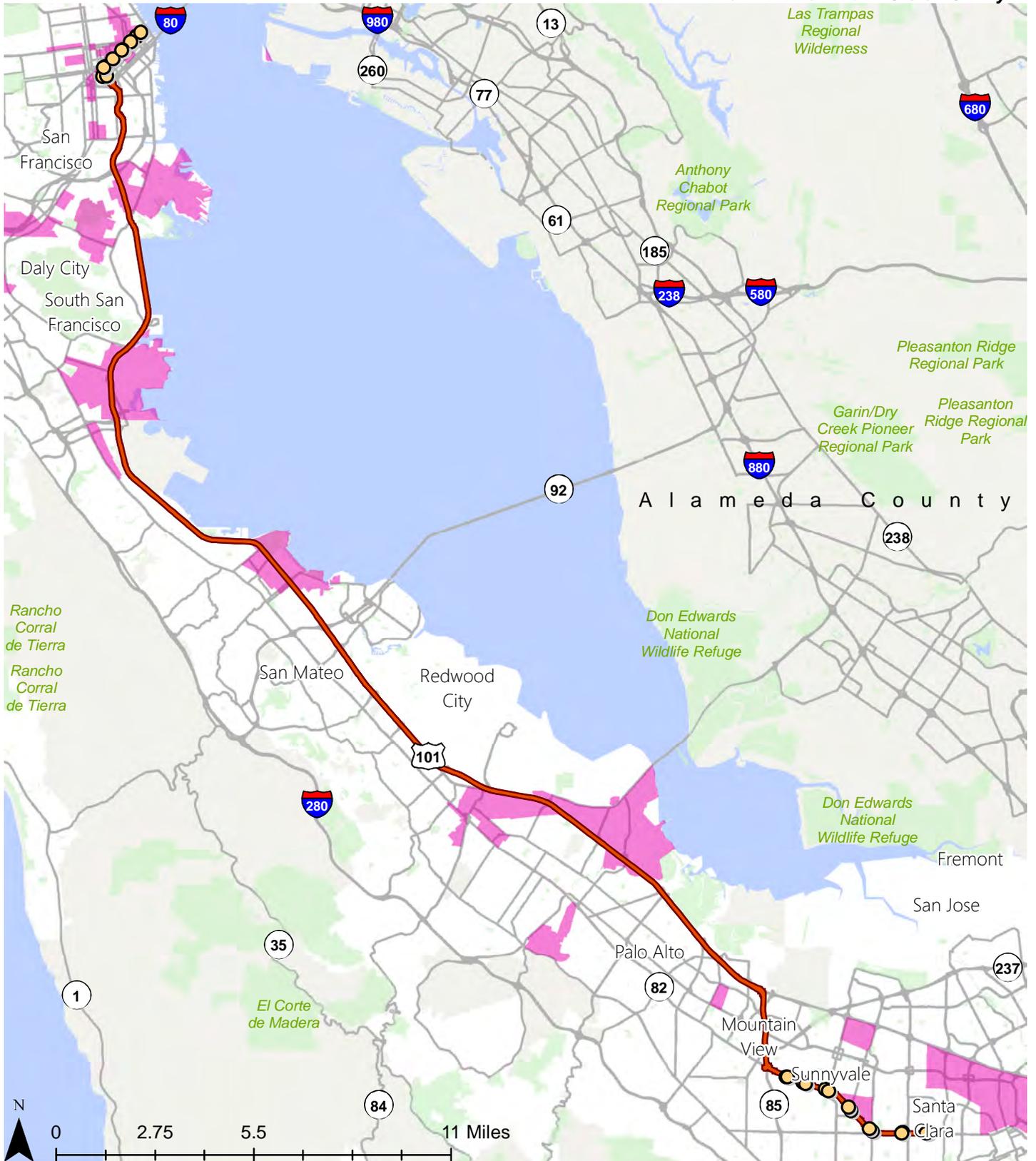


-  Planned Express Stop
-  Planned Express Route
-  MTC Community of Concern

**Route 8: Western SF-Hillsdale Caltrain**  
Service in Communities of Concern



**\*\*For Internal Use Only\*\***

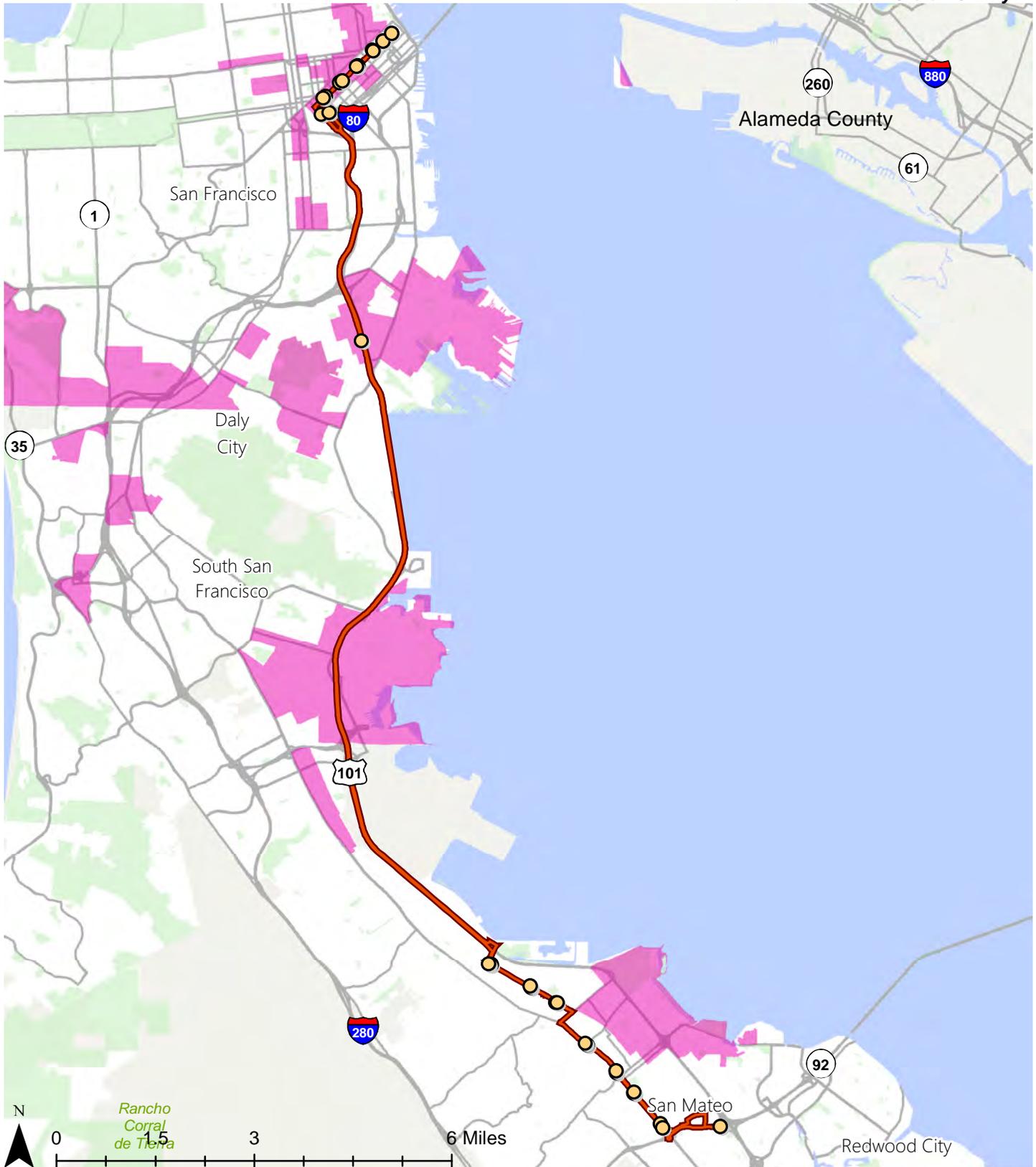


-  Planned Express Stop
-  Planned Express Route
-  MTC Community of Concern

### **Route 10: Sunnyvale-SF** Service in Communities of Concern



Source: SamTrans US 101 Express Bus Feasibility Study, 2018; Plan Bay Area 2040

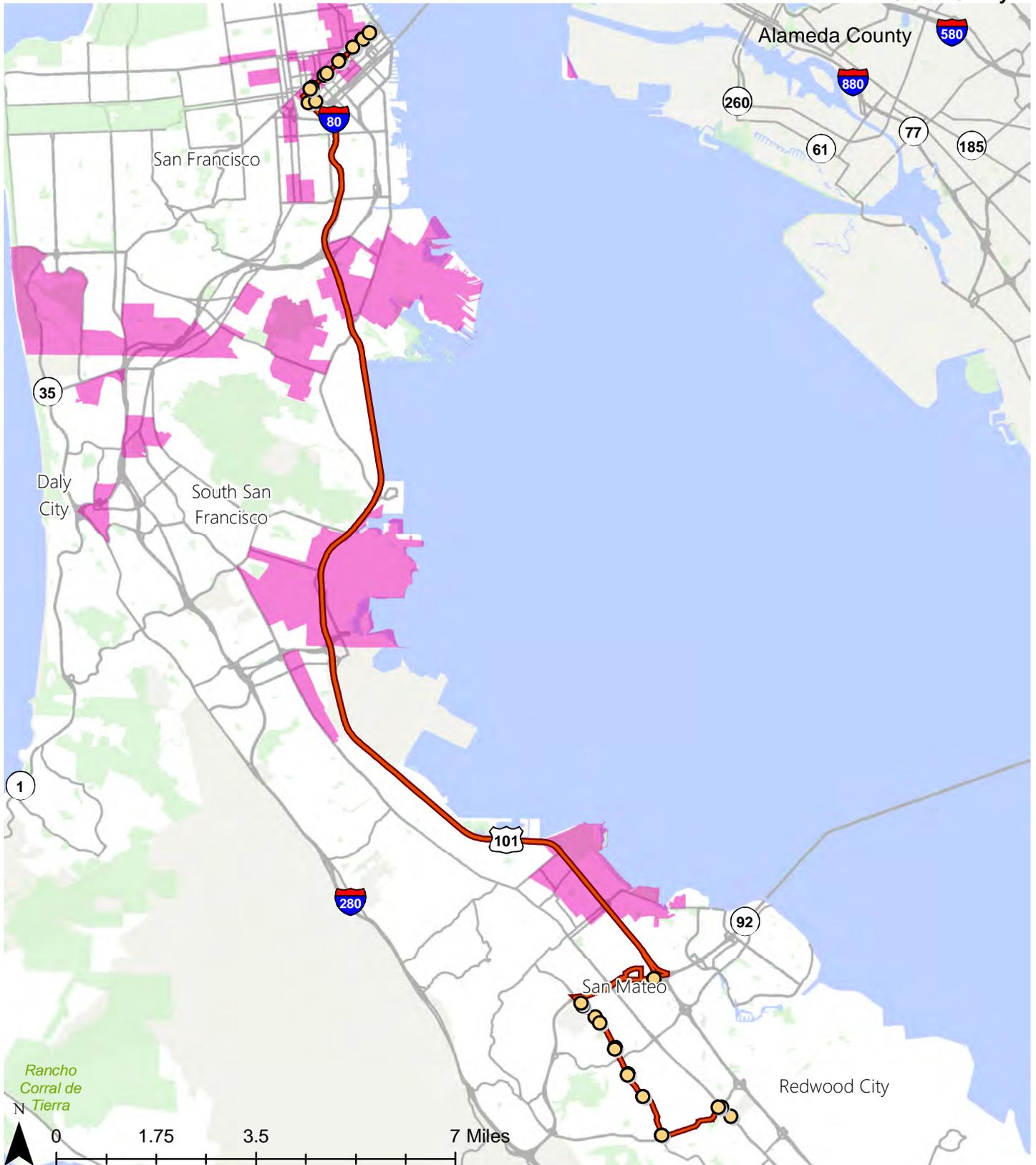


-  Planned Express Stop
-  Planned Express Route
-  MTC Community of Concern

**Route 11: Burlingame-SF**  
Service in Communities of Concern



**\*\*For Internal Use Only\*\***



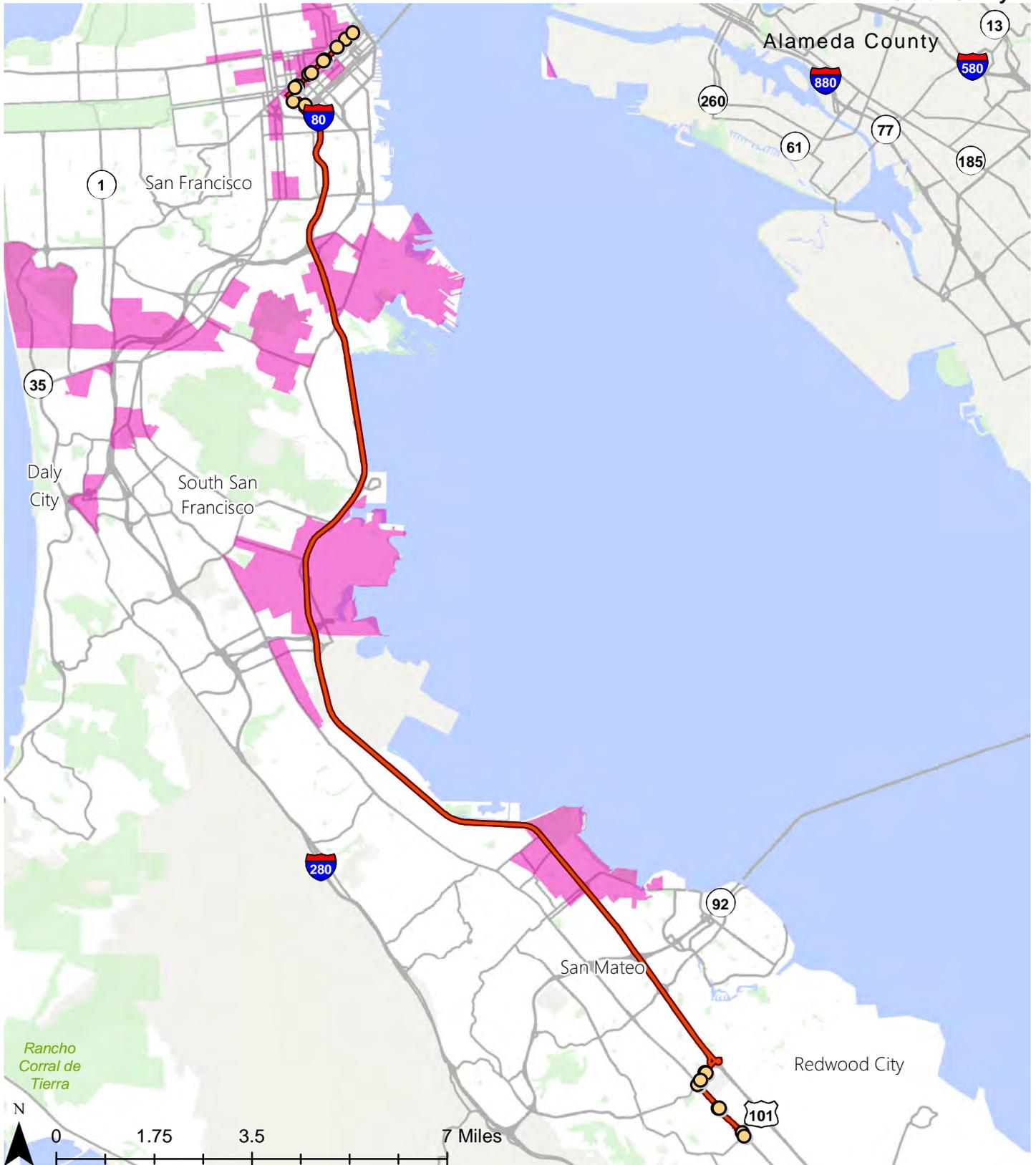
-  Planned Express Stop
-  Planned Express Route
-  MTC Community of Concern

**Route 12: San Mateo-SF**  
Service in Communities of Concern



Source: SamTrans US 101 Express Bus Feasibility Study, 2018; Plan Bay Area 2040

**\*\*For Internal Use Only\*\***



-  Planned Express Stop
-  Planned Express Route
-  MTC Community of Concern

**Route 13: San Carlos/Belmont-SF**  
Service in Communities of Concern





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# APPENDIX D: TRAVEL DEMAND MODEL VALIDATION MEMO



## MEMORANDUM

Date: December 29, 2017  
To: Millie Tolleson and Daniel Shockley, SamTrans  
From: Fehr & Peers  
Subject: **Express Bus Modeling Methodology**

*SF17-0916*

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The purpose of this memo is to summarize our proposed methodology for using the San Mateo Cities and County Association of Governments ("C/CAG") travel model ("C/CAG Model") to support SamTrans in the US-101 Express Bus Feasibility Study. The C/CAG Model is developed and maintained by the Santa Clara Valley Transportation Authority ("VTA").

This memo describes the base model to be used, the transportation and land use assumptions under future conditions, and the route scenarios to be modeled. This memo details three key assumptions:

1. The Express Bus Study Model will combine the Managed Lanes and Dumbarton Models to reflect the Managed Lanes Model's vehicular demand forecasts and the Dumbarton Model's transit forecasts.
2. The Express Bus Study Model will update the Managed Lanes Model's land use forecasts to be consistent with the 2017 update to Plan Bay Area.
3. The Express Bus Model will run six scenarios that analyze how express bus service may be affected by various combinations of regional transportation projects.

### BASE MODEL

#### Model Versions

Fehr & Peers will use a combination of base models derived from the US-101 Managed Lanes Project (ML Model) and the Dumbarton Transportation Corridor Study ("DTCS Model") to model



express bus ridership on this study. These models differ from the stock C/CAG model ("Stock Model") identified by VTA as current and valid in April and July, 2016.

The 2013 base year outputs of the Stock Model and model variants were compared to observed data. The two metrics that were compared were:

- Select transit ridership by bus and rail
- Origin/Destination ("O/D") market demand, represented by person trips in vehicles, focused on San Mateo, San Francisco, and Santa Clara counties

The SamTrans US-101 Express Bus Feasibility Study focuses on mode shift and distribution of potential travel market, so highway assignment validation of the models compared to counts was not conducted since it was not included in our scope and not essential to estimating transit mode shares.

### **US-101 Managed Lanes Model**

The US-101 Managed Lanes Model was modified from the Stock Model by Kittelson & Associates, Inc, for use in the US-101 Managed Lanes Project, headed by Caltrans. The project studies the travel behavior implications for several alternatives of implementing a managed lane on US-101 between the Santa Clara County line to the south and I-380 to the north. The project could create new Express Lanes and/or convert existing High Occupancy Vehicle (HOV) lanes to Express Lanes.

The modeling effort involved incorporating limited tech employer shuttles into the model. No further calibration of the model was conducted; however, the model was validated on the highway level.

### **Dumbarton Transportation Corridor Study**

The Dumbarton Transportation Corridor Study model was modified from the Stock Model by Fehr & Peers for use in the Dumbarton Transportation Corridor Study, headed by SamTrans. The project studies several alternatives for introducing robust transit service across the Dumbarton Bridge, including rail and express bus service.

The model calibration effort involved several updates:

- Updating the 2013 employment to match the actual employee counts at the Facebook, Google and Stanford campuses.



- Incorporation of empirical mode shares in cases where mode shares are monitored and enforced, including trip caps applied to Stanford, Facebook, and the North Bayshore area of Mountain View.
- Corrections to the original coding of the Dumbarton Express (DBX) bus services across the Dumbarton Highway Bridge, and validation of directional bus ridership across the bridge.
- Adding the primary tech company shuttles which cross the Dumbarton Highway Bridge to allow forecasting of aggregate public and private transbay bus ridership.
- Factoring county-to-county movements in the highway pre-assignment origin-destination matrix based on empirical data in consultation with VTA model managers and experts.

### Transit Ridership Comparison

Observed ridership was collected as part of the DTCS Model validation effort for several key transit agencies and specific transit lines. Specifically, the following transit ridership metrics were used to assess transit performance in the DTCS Model:

- Caltrain systemwide boardings
- BART systemwide boardings
- SamTrans systemwide boardings

The Stock, ML, and DTCS model results for BART, Caltrain, and SamTrans system-wide boardings were compared with observed ridership for the 2013 model year.

As shown in **Table 1**, the DTCS Model closely forecast observed 2013 ridership on BART and Caltrain, falling within 0.5 percent of BART's actual ridership and three percent of Caltrain's ridership. The Stock and ML models underestimated these agencies' actual ridership by ten to 13 percent.

All three models substantially overestimated SamTrans' 2013 daily average boardings. The Stock Model came closest with an overestimate of 14 percent; the ML Model overestimated SamTrans ridership by 15 percent and the DTCS Model overestimated SamTrans ridership by 22 percent.

**TABLE 1: MODELED AND OBSERVED TRANSIT RIDERSHIP**

<b>Model</b>	<b>BART Daily Average Boardings</b>	<b>Caltrain Daily Average Boardings</b>	<b>SamTrans Daily Average Boardings</b>
Stock Model	361,959	41,141	49,459
DTCS Model - 2013 Scenario "Base Final"	400,925	48,476	53,165
ML Model - 2013 Scenario "Base 101 Shuttles Rev"	361,141	40,741	49,972
<i>Observed/Counts</i>	<i>399,800</i>	<i>47,066</i>	<i>43,463</i>

Source: Fehr & Peers, 2017; National Transit Database, 2013.

### O/D Market Demand

As described in the *Draft Baseline Conditions Report* for the SamTrans US-101 Express Bus Feasibility Study, market demand between 71 origin/destination zones were developed using GPS data purchased by StreetLight Data and refined using a combination of outputs from the C/CAG travel model, MTC travel model, and 2012 California Household Travel Survey ("CHTS"). This O/D matrix was used as the basis of comparison for the Stock, ML, and DTCS models

The master O/D matrix ("Master Matrix") developed for the market analysis is based primarily on StreetLight GPS data calibrated to 2015 Caltrans ADT counts; consequently, it is the most accurate representation of vehicle person trip generation available on the study corridor. The Master Matrix included 1,678,805 trips among the 71 zones defined for the study. This total excludes trips occurring solely within or among the North Bay or East Bay; for comparison, the following total trip numbers also exclude these out-of-study-area trips. The total trips within the Master Matrix study area for the Stock, ML, and DTCS Models are presented in **Table 2**.

As shown in **Table 2**, the Stock and ML models estimate substantially more vehicle person trips within the study corridor compared to the Master Matrix, while the DTCS model is closer to Master Matrix totals. The Stock and ML models estimate nearly 2.1 million trips among the 71 study zones, which exceeds the Master Matrix total by 24 percent. The greatest overestimate occurs in San Mateo County, where origin trips are 34 percent higher and destination trips are 32 percent higher than observed in the

**TABLE 2: TOTAL VEHICLE PERSON TRIPS WITHIN O/D MASTER MATRIX STUDY AREA**

Model	Total Trips	Difference in Trips, Master Matrix vs. Models	Difference in Origin (& Destination) Trips, Models vs. Master Matrix		
			Santa Clara County	San Mateo County	San Francisco County
Stock Model	2,082,172	24%	21% (24%)	34% (32%)	13% (3%)
ML Model - 2013 Scenario "Base 101 Shuttles Rev"	2,077,774	24%	21% (23%)	34% (32%)	13% (3%)
DTCS Model - 2013 Scenario "Base Final"	1,739,746	4%	1% (2%)	9% (12%)	-2% (-8%)
<i>Master Matrix</i>	<i>1,678,805</i>				

## Notes:

Master Matrix based on Streetlight data calibrated to 2015 Caltrans ADT Counts

Difference in origin and destination data presented as Model origin (destination) / Master Matrix origin (destination)

Master Matrix. The DTCS model estimates approximately 1.7 million trips within the study corridor, which exceeds the Master Matrix total by four percent. Again, the greatest overestimate occurs in San Mateo County, where origin trips are nine percent higher and destination trips are 12 percent higher than observed in the Master Matrix. The lower number of person trips in vehicles exhibited by the DTCS Model compared to the others is primarily due to the county-to-county factoring process. These factors were developed in collaboration with VTA modeling staff specifically for calibration on cross-bay auto travel on the San Mateo and Dumbarton Bridges, which feed the US-101 corridor."

### Model Integration

The model metric comparisons above are in line with the respective calibration efforts and goals for each of the adjusted model variants. The ML Model, designed to inform highway mainline analyses, was validated on highway segments and was not calibrated for transit ridership or regional travel patterns. As a result, the ML Model estimates substantially lower transit ridership compared to observed counts and higher person trips in vehicles than indicated in the Master Matrix.

The DTCS Model, designed to inform transit ridership potential at a regional level, had calibration efforts targeted toward express bus and other transit ridership, as well as mode specific updates to



high growth areas and employer provided bus services, including Facebook, Google, and Stanford campus zones. Because of this, BART and Caltrain ridership and regional trip generation are much closer to actual counts, compared to the ML and Stock Models.

The 101 Express Bus model combines the strengths of the ML and DTCS models, using the ML mode steps for trip generation, distribution and traffic assignment for consistency with the vehicular demand forecasts of the Managed Lanes Project study, and using the transit network coding, mode choice, tech company express shuttle estimating methods and transit assignments from the DTCS modeling process. It benefits from the validation of the ML model with respect to forecasting highway volumes individually for SOV, HOV and solo users of the HOT lanes, and it takes advantage of the DTCS model's accuracy in estimating express bus use and other regional transit modes.

The trip generation and distribution steps are calibrated to reflect the 2017 comparison between the ML model's base year estimates of origin-to-destination movements with the actual OD movements measured in the big data analysis of corridor market segments. This will be accomplished through a "Fratat" matrix adjustment process<sup>1</sup>. Express bus routing will take advantage of the DTCS methods of estimating express bus speeds under congested and uncongested conditions, park-and-ride access, fares and transfer charges and the mode choice requirements placed on major employers including Stanford, Facebook and Google where those requirements are monitored and enforced.

The modeling will be based on guidance received from SamTrans on proposed span of service, service frequencies, and fares and charges for transfers between local and express buses. Express bus operating speeds under mixed-flow conditions will be subject to congestion and the resulting speeds offered to general traffic and to inefficiencies characteristic of large vehicles, as well as stop and dwell times at passenger pickup points. Access and use to park-and-ride lots will be calibrated to the same service-area parameters as validated in the Dumbarton study, Express buses operating within the managed lanes will be assumed to operate according to scheduled stop-to-stop times and consistent with Caltrans policy on operating speeds, including the design principle that HOV and SOV use of HOT lanes be limited to an amount that allows the lanes to operate at a minimum 45 miles per hour.

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<sup>1</sup> Fratar adjustments involve factoring trip production and trip attraction amounts to match respective production and attraction targets (actual OD movements) and iteratively rebalancing the trip matrix individual ODs so that both the production targets and attraction targets are met.



The modeling process will include reasonableness checks and sensitivity tests to ensure that the model is stable and produces reasonably expected results and that the general traffic volume forecasts are consistent with those found in the 101 Managed Lanes Project.

## MODEL ASSUMPTIONS

Transportation and land use assumptions in the C/CAG model are based on Plan Bay Area (2013). On July 27<sup>th</sup>, 2017, MTC certified the Environmental Impact Report (EIR) for a new Plan Bay Area. The C/CAG model has not yet been updated to reflect changes between the 2017 and 2013 plans. A summary of key assumptions for the C/CAG model and 2017 Plan Bay Area is provided in the Appendix. For instances where there are inconsistencies for new projects, we have noted a proposed resolution.

### Land Use Assumptions

The 2017 Plan Bay Area includes updates to land use and socio-economic data for the region. In light of this release and recent trends in employment and population, the land use data from the ML Model were compared with the Plan Bay Area assumptions and forecasts. The base year between the two data sources are different: the ML Model has a 2013 base year whereas the 2017 Plan Bay Area land use has a 2010 base year. In order to provide an apples-to-apples comparison, the Plan Bay Area base year data were updated to a 2013 base year through interpolation between 2010 and 2020 Plan Bay Area data by VTA modeling staff. Household and employment data from both are displayed in **Table 3** on the countywide level, respectively.

The household comparison reveals that 2017 Plan Bay Area forecasts, compared to the ML Model, show similar growth in San Mateo County, moderately higher growth in Santa Clara, and significantly higher growth in San Francisco County. For the employment comparison, Plan Bay Area overall forecasts higher employment growth than the ML Model, with a significant amount of growth occurring in San Francisco County.

We propose to update the Managed Lanes model to reflect new 2017 Plan Bay Area land use forecasts in order to reflect the latest regional forecasts. This approach would not be consistent with the Managed Lanes Study, which used the previous 2013 Plan Bay Area forecasts. Moreover, to our knowledge, Plan Bay Area land use forecasts are presently available at the city level but not at the TAZ level. Calibration of future land use conditions would therefore require a proportional



distribution of city growth at the TAZ level with consideration of TAZ growth rates and levels of population and employment.

**TABLE 3: HOUSEHOLD AND EMPLOYMENT GROWTH COMPARISON BY COUNTY**

Households Comparison by County						
County	ML Model			Plan Bay Area 2040		
	2013	2040	Growth	2013 (Interpolated)	2040	Growth
San Mateo	263,425	316,968	20%	263,643	317,940	21%
Santa Clara	624,317	819,607	31%	630,050	860,900	37%
San Francisco	355,588	447,248	26%	359,590	483,700	35%
<b>Total</b>	<b>1,243,330</b>	<b>1,583,823</b>	<b>27%</b>	<b>1,253,283</b>	<b>1,662,540</b>	<b>33%</b>

Employment Comparison by County						
County	ML Model			Plan Bay Area 2040		
	2013	2040	Growth	2013 (Interpolated)	2040	Growth
San Mateo	366,024	466,392	27%	356,000	472,100	33%
Santa Clara	978,631	1,263,834	29%	949,273	1,289,860	36%
San Francisco	598,048	760,230	27%	606,370	872,500	44%
<b>Total</b>	<b>1,942,703</b>	<b>2,490,456</b>	<b>28%</b>	<b>1,911,643</b>	<b>2,634,460</b>	<b>38%</b>

### Transportation Assumptions

The ML Model assumes most key projects within the study area that are included in the 2017 Bay Plan Area 2040 scenario, as shown in **Appendix A**. The 2040 model includes express lanes on US-101, I-280, and CA-85 in Santa Clara County, Caltrain Electrification, the Central Subway, the Caltrain Downtown Extension, and congestion pricing in Downtown San Francisco. The Caltrain Electrification and Central Subway projects are also included in the 2020 model. The model omits four relevant projects along the study corridor: managed lanes in San Francisco County, express lanes in Santa Clara County on US-101 south of I-880 and on I-280 north of Magdalena Avenue, and the California High Speed Rail (HSR) project. Fehr & Peers is not scoped to update the C/CAG model's background assumptions. In order to resolve the discrepancy of managed lanes in San Francisco, we will add freeway bus lanes as a proxy for managed lanes. We will not add HSR, which will affect travel patterns within the study corridor but will not directly compete against proposed routes. Changes to local and express bus services associated with HSR would be analyzed in a future



study. The discrepancy of Santa Clara County express lanes will have minimal effect on the propose routes given proposed routes overlap for less than two miles along these segments, so no action will be taken to incorporate these projects.

The C/CAG Model also does not incorporate changes associated with disruptive transportation changes, such as transportation network companies (TNCs), autonomous vehicles (AVs), one-way carpooling, and other services and technologies. Long-term ridership forecasts should therefore be reviewed with caution in relation to these ongoing changes.

## MODEL SCENARIOS

SamTrans has identified two no-project and three project scenarios for modeling, plus an additional project scenario will be identified at a later date. Model scenarios are presented in **Table 4**. All no project and project scenarios assume the completion of managed lanes to I-380 under 2020 and 2040 conditions. An additional project scenario assumes managed lanes to downtown San Francisco by 2040.

**TABLE 4: MODEL SCENARIOS**

Scenario	No Managed Lane	Managed Lane to I-380	Plan Bay Area (Managed Lane to SF)	Plan Bay Area + Enhancements
2020 Without express bus routes		✓		
2020 With express bus routes		✓		
2040 Without express bus routes	✓		✓	
2040 With express bus routes			✓	

### Model

2020 model runs are intended to provide a near-term estimate of express bus ridership to support the identification of viable express bus routes. Fehr & Peers will incorporate direct ridership modeling (DRM) methods to calibrate park-ride lot catchment areas for facilities where current use levels are known, and to model bus ridership and auto trip generation at major employers providing



their own express bus service and operating under vehicle trip generation caps imposed and enforced by their host jurisdictions, taking into account current commute mode shares and TDM programs.

2040 model runs are intended to provide a long-term perspective regarding the potential role of express bus service in the future transportation system. Given the uncertainty around future projects and travel behaviors, these outputs are not intended to inform service planning decisions. Modeling will take a similar approach to that described above for the 2020 analysis, but will be subject to the greater uncertainties inherent in long range land use forecasts, economic conditions and the role of emerging technologies such as TNCs and autonomous vehicles.

## APPENDIX: KEY TRANSPORTATION ASSUMPTIONS

Project	2017 Plan Bay Area (2040)	Managed Lanes Model (2040)	Express Bus Study (2040)
HOV/HOT Lanes on U.S. 101 and I-280 in San Francisco	Phase 1 (full implementation): Convert an existing mixed traffic lane and/or shoulder/excess ROW in each direction to HOV 3+ lanes on US 101 from SF/SM County line to I-280 interchange and on I-280 from US 101 interchange to 6th Street off ramp to enhance carpool and transit operations during peak periods. Phase 2 (planning and environmental review only): Convert Phase 1 HOV lanes to HOT/Express Lanes. Express transit to be funded with HOT lane revenues.	Extends to north to Candlestick Interchange; no HOV/HOT lanes north of here.	F&P will code in new bus-only lanes with Caltrans standard 45 mph speed to represent bus performance in managed lane
US 101 Express Lanes: Whipple Ave. in San Mateo County to Cochrane Road in Morgan Hill	Convert HOV Lanes to express lane and add a second express lane in some segments.	Does not extend southbound all the way to Morgan Hill. Ends at I-880 interchange.	No changes will be made – this segment does not affect any routes
SR 85 Express Lanes: US 101 (South San Jose) to Mountain View	SR 85 typically has 1 HOV lane and 2 general purpose lanes in both directions with auxiliary lane in some segments. Project will convert existing HOV lane to express lane and add a second express lane between SR 87 and I-280 in both directions.	Included in model; no changes necessary	



Project	2017 Plan Bay Area (2040)	Managed Lanes Model (2040)	Express Bus Study (2040)
I-280 New HOV Lane from San Mateo County line to Magdalena Avenue	New HOV lane added to I-280 from existing HOV lane at Magdalena Avenue to the San Mateo County Line. Requires constructing a new lane.	No, new HOV lanes between Magdalena Ave and Alpine Rd (SM County Line) are not reflected.	No changes will be made – this segment would only affect routes along one mile segment where congestion is low
I-280 Express Lanes: US-101 to Magdalena Avenue	Convert existing HOV lane to an express lane in both directions between US 101 and Magdalena Avenue	Included in model; no changes necessary	
Downtown Value Pricing/Incentives - Pilot, Transit Service, Supportive Infrastructure	A set of street improvements to support transit operations and cycling and pedestrian safety and comfort to support the anticipated mode shift due to the implementation of congestion pricing.	Included in model; no changes necessary	
California HSR in the Bay Area	This project implements the segment of California High Speed Rail that is in the Bay Area.	No	No changes will be made. Additional express routes may be considered in a future HSR access study. HSR would not compete with express bus routes that have been identified; therefore, implications for long-term decision making would be minimal.
Implement Transbay Transit Center/Caltrain Downtown Extension (Phase 1 - Transbay Transit Center)	The project has 3 components: (1) new Transbay Transit Center built on the site of the former Transbay Terminal in downtown San Francisco serving 11 transportation systems; (2) extension of Caltrain service from its current San Francisco terminus at 4th & King Streets to a new underground terminus; and (3) establishment of a Redevelopment Area Plan.	Included in model; no changes necessary	



Project	2017 Plan Bay Area (2040)	Managed Lanes Model (2040)	Express Bus Study (2040)
T-Third Phase II: Central Subway	Extends the Third Street Light Rail line north from King Street along Third Street, entering a new Central Subway near Bryant Street and running under Geary and Stockton Streets to Stockton & Clay Streets in Chinatown. New underground stations will be located at Moscone Center, Third & Market Streets, Union Square, and Clay Street.	Included in model; no changes necessary	

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# APPENDIX E: DETAILED EVALUATION RESULTS

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SCENARIO A – SHORTLISTED ROUTES WITHOUT MANAGED LANES IN 2020

Scenario A			Route 2	Route 3	Route 4	Route 5	Route 6	Route 8	Route 10	Route 11	Route 12	Route 13
			San Bruno BART to Sunnyvale	San Francisco to Foster City	San Francisco to Redwood Shores	Foster City / Redwood Shores to Palo Alto	Western San Francisco to Palo Alto	Western San Francisco to San Mateo	Sunnyvale to San Francisco	Burlingame to San Francisco	San Mateo to San Francisco	San Carlos / Belmont to San Francisco
<b>Evaluation Criteria</b>												
<b>Results</b>	<b>Unit</b>	<b>Range</b>										
<b>Goal 1 - Provide Mobility Options and Improved Connections for Regional Trips</b>												
1.2 Average Weekday Boardings	Boardings	260 - 2,820	2,820	1,130	490	350	2,110	870	370	630	1,280	260
1.5 Reduction in Transit Travel Time	Percentage	0.0% - 0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1.6 Connectivity to Places	Rating	-	3	2	2	1	1	1	1	2	1	1
1.7 Number of Transit Lines Served	Count	15 - 1,005	21	957	1005	15	489	495	845	887	808	847
1.8 Number of Park and Ride Lots Served	Count	0 - 3	2	1	0	0	3	2	3	1	1	0
<b>Goal 2 - Increase Transit Market Share</b>												
2.4 Boardings per Revenue Hour	Boardings/hour	7 - 41	19	20	8	7	21	15	7	25	41	9
2.5 Passenger Trips per Revenue Mile	Passenger Trips/Mile	0.24 - 1.37	0.75	0.68	0.27	0.27	0.70	0.50	0.24	0.85	1.37	0.30
<b>Goal 3 - Develop a Cost-Effective Solution</b>												
3.1 Capital Cost Per Route Mile	\$/Mile	235,000 - 738,000	\$353,000	\$273,000	\$252,000	\$352,000	\$235,000	\$318,000	\$594,000	\$675,000	\$738,000	\$571,000
3.2 Capital Cost Per Passenger	\$/Passenger	8,070 - 38,190	\$8,880	\$11,830	\$27,280	\$38,190	\$9,820	\$18,620	\$36,120	\$11,790	\$8,070	\$28,560
3.3 Operating and Maintenance Cost Per Revenue Hour	\$/Hour	\$202 - \$264	\$206	\$223	\$220	\$231	\$202	\$229	\$259	\$255	\$264	\$256
3.4 Operating and Maintenance Cost Per Passenger	\$/Passenger	\$6 - \$35	\$11	\$11	\$27	\$34	\$10	\$15	\$35	\$10	\$6	\$28
<b>Goal 4 - Improve Transportation Equity</b>												
4.1 Ability to serve Communities of Concern (CoC)	Residents	-	45,200	53,000	52,000	3,500	13,200	11,400	46,900	46,800	31,500	41,300
4.2 Ability to Serve Communities Without Access to Frequent and Affordable Fixed Rail Service	Count	1 - 42	6	18	18	1	36	42	14	16	15	16
4.3 Percentage of Potential Riders Under 200% of Federal Poverty Level	Percentage	14.0% - 36.0%	31%	32%	33%	14%	19%	20%	29%	34%	33%	36%
<b>Goal 5 - Enhance Access to Population and Employment Centers</b>												
5.1 Number of Residents within Half-Mile of Stops	Residents	65,900 - 170,000	95,700	139,300	131,400	65,900	161,200	166,700	170,000	123,200	97,400	97,400
5.2 Number of Jobs within Half-Mile of Stops	Jobs	76,100 - 438,600	98,100	438,600	438,300	86,800	102,400	76,100	409,200	418,700	398,100	388,500
<b>Goal 6 - Support Sustainable Transportation and Land Use Policies</b>												
6.1 Ability to Serve Priority Development Areas (PDAs)	Sq. Mi.	-	6.65	6.19	7.01	0.11	3.51	5.83	7.80	9.18	6.08	6.43

SCENARIO B – SHORTLISTED ROUTES WITH SAN MATEO COUNTY MANAGED LANES TO I-380 IN 2020

Scenario B			Route 2	Route 3	Route 4	Route 5	Route 6	Route 8	Route 10	Route 11	Route 12	Route 13
			San Bruno BART to Sunnyvale	San Francisco to Foster City	San Francisco to Redwood Shores	Foster City / Redwood Shores to Palo Alto	Western San Francisco to Palo Alto	Western San Francisco to San Mateo	Sunnyvale to San Francisco	Burlingame to San Francisco	San Mateo to San Francisco	San Carlos / Belmont to San Francisco
<b>Evaluation Criteria</b>												
<b>Results</b>	<b>Unit</b>	<b>Range</b>										
<b>Goal 1 - Provide Mobility Options and Improved Connections for Regional Trips</b>												
1.2 Average Weekday Boardings	Boardings	310 - 2,870	2,870	1,190	580	420	2,060	970	480	640	1,310	310
1.5 Reduction in Transit Travel Time	Percentage	-6.4% - 0.0%	-2.5%	-3.8%	-5.7%	-3.6%	0.0%	-3.7%	-5.6%	0.0%	-5.6%	-6.4%
1.6 Connectivity to Places	Rating	-	3	2	2	1	1	1	1	2	1	1
1.7 Number of Transit Lines Served	Count	15 - 1,005	21	957	1005	15	489	495	845	887	808	847
1.8 Number of Park and Ride Lots Served	Count	0 - 3	2	1	0	0	3	2	3	1	1	0
<b>Goal 2 - Increase Transit Market Share</b>												
2.4 Boardings per Revenue Hour	Boardings/hour	8 - 42	19	21	10	8	21	17	10	26	42	11
2.5 Passenger Trips per Revenue Mile	Passenger Trips/Mile	0.32 - 1.41	0.76	0.72	0.32	0.32	0.69	0.56	0.32	0.86	1.41	0.36
<b>Goal 3 - Develop a Cost-Effective Solution</b>												
3.1 Capital Cost Per Route Mile	\$/Mile	235,000 - 738,000	\$353,000	\$273,000	\$252,000	\$352,000	\$235,000	\$318,000	\$594,000	\$675,000	\$738,000	\$571,000
3.2 Capital Cost Per Passenger	\$/Passenger	7,880 - 31,820	\$8,730	\$11,230	\$23,040	\$31,820	\$10,060	\$16,700	\$27,840	\$11,600	\$7,880	\$23,950
3.3 Operating and Maintenance Cost Per Revenue Hour	\$/Hour	\$202 - \$264	\$206	\$223	\$220	\$231	\$202	\$229	\$259	\$255	\$264	\$256
3.4 Operating and Maintenance Cost Per Passenger	\$/Passenger	\$6 - \$29	\$10.82	\$10.41	\$22.83	\$28.67	\$9.84	\$13.79	\$27.23	\$9.94	\$6.29	\$23.86
<b>Goal 4 - Improve Transportation Equity</b>												
4.1 Ability to serve Communities of Concern (CoC)	Rating	-	45,200	53,000	52,000	3,500	13,200	11,400	46,900	46,800	31,500	41,300
4.2 Ability to Serve Communities Without Access to Frequent and Affordable Fixed Rail Service	Residents	1 - 42	6	18	18	1	36	42	14	16	15	16
4.3 Percentage of Potential Riders Under 200% of Federal Poverty Level	Percentage	14.0% - 36.0%	31%	32%	33%	14%	19%	20%	29%	34%	33%	36%
<b>Goal 5 - Enhance Access to Population and Employment Centers</b>												
5.1 Number of Residents within Half-Mile of Stops	Residents	65,900 - 170,000	95,700	139,300	131,400	65,900	161,200	166,700	170,000	123,200	97,400	97,400
5.2 Number of Jobs within Half-Mile of Stops	Jobs	76,100 - 438,600	98,100	438,600	438,300	86,800	102,400	76,100	409,200	418,700	398,100	388,500
<b>Goal 6 - Support Sustainable Transportation and Land Use Policies</b>												
6.10 Ability to Serve Priority Development Areas (PDAs)	Sq. Miles	-	6.65	6.19	7.01	0.11	3.51	5.83	7.80	9.18	6.08	6.43

SCENARIO C – SHORTLISTED ROUTES WITH SAN MATEO AND SAN FRANCISCO MANAGED LANES IN 2020

Scenario C			Route 2	Route 3	Route 4	Route 5	Route 6	Route 8	Route 10	Route 11	Route 12	Route 13
			San Bruno BART to Sunnyvale	San Francisco to Foster City	San Francisco to Redwood Shores	Foster City / Redwood Shores to Palo Alto	Western San Francisco to Palo Alto	Western San Francisco to San Mateo	Sunnyvale to San Francisco	Burlingame to San Francisco	San Mateo to San Francisco	San Carlos / Belmont to San Francisco
<b>Evaluation Criteria</b>												
<b>Results</b>	<b>Unit</b>	<b>Range</b>										
<b>Goal 1 - Provide Mobility Options and Improved Connections for Regional Trips</b>												
1.2 Average Weekday Boardings	Boardings	410 - 2,820	2,820	1,310	720	440	2,030	920	540	740	1,410	410
1.5 Reduction in Transit Travel Time	Percentage	-10.6% - 0.0%	-2.5%	-8.6%	-10.4%	-3.6%	0.0%	-3.7%	-8.3%	-6.1%	-9.3%	-10.6%
1.6 Connectivity to Places	Rating	-	3	2	2	1	1	1	1	2	1	1
1.7 Number of Transit Lines Served	Count	15 - 1,005	21	957	1005	15	489	495	845	887	808	847
1.8 Number of Park and Ride Lots Served	Count	0 - 3	2	1	0	0	3	2	3	1	1	0
<b>Goal 2 - Increase Transit Market Share</b>												
2.4 Boardings per Revenue Hour	Boardings/hour	8 - 45	19	24	12	8	20	16	11	30	45	14
2.5 Passenger Trips per Revenue Mile	Passenger Trips/Mile	0.34 - 1.51	0.75	0.79	0.40	0.34	0.68	0.53	0.36	1.00	1.51	0.48
<b>Goal 3 - Develop a Cost-Effective Solution</b>												
3.1 Capital Cost Per Route Mile	\$/Mile	235,000 - 738,000	\$353,000	\$273,000	\$252,000	\$352,000	\$235,000	\$318,000	\$594,000	\$675,000	\$738,000	\$571,000
3.2 Capital Cost Per Passenger	\$/Passenger	7,320 - 30,380	\$8,880	\$10,200	\$18,560	\$30,380	\$10,210	\$17,610	\$24,750	\$10,030	\$7,320	\$18,110
3.3 Operating and Maintenance Cost Per Revenue Hour	\$/Hour	\$202 - \$264	\$206	\$223	\$220	\$231	\$202	\$229	\$259	\$255	\$264	\$256
3.4 Operating and Maintenance Cost Per Passenger	\$/Passenger	\$6 - \$27	\$11.02	\$9.45	\$18.39	\$27.36	\$9.99	\$14.53	\$24.21	\$8.60	\$5.84	\$18.04
<b>Goal 4 - Improve Transportation Equity</b>												
4.1 Ability to serve Communities of Concern (CoC)	Residents	-	45,200	53,000	52,000	3,500	13,200	11,400	46,900	46,800	31,500	41,300
4.2 Ability to Serve Communities Without Access to Frequent and Affordable Fixed Rail Service	Count	1 - 42	6	18	18	1	36	42	14	16	15	16
4.3 Percentage of Potential Riders Under 200% of Federal Poverty Level	Percentage	14.0% - 36.0%	31%	32%	33%	14%	19%	20%	29%	34%	33%	36%
<b>Goal 5 - Enhance Access to Population and Employment Centers</b>												
5.1 Number of Residents within Half-Mile of Stops	Residents	65,900 - 170,000	95,700	139,300	131,400	65,900	161,200	166,700	170,000	123,200	97,400	97,400
5.2 Number of Jobs within Half-Mile of Stops	Jobs	76,100 - 438,600	98,100	438,600	438,300	86,800	102,400	76,100	409,200	418,700	398,100	388,500
<b>Goal 6 - Support Sustainable Transportation and Land Use Policies</b>												
6.1 Ability to Serve Priority Development Areas (PDAs)	Sq. Mi.	-	6.65	6.19	7.01	0.11	3.51	5.83	7.80	9.18	6.08	6.43

SCENARIO D – SHORTLISTED ROUTES WITH SAN MATEO AND SAN FRANCISCO MANAGED LANES IN 2040

Scenario D			Route 2	Route 3	Route 4	Route 5	Route 6	Route 8	Route 10	Route 11	Route 12	Route 13
			San Bruno BART to Sunnyvale	San Francisco to Foster City	San Francisco to Redwood Shores	Foster City / Redwood Shores to Palo Alto	Western San Francisco to Palo Alto	Western San Francisco to San Mateo	Sunnyvale to San Francisco	Burlingame to San Francisco	San Mateo to San Francisco	San Carlos / Belmont to San Francisco
<b>Evaluation Criteria</b>												
<b>Results</b>	<b>Unit</b>	<b>Range</b>										
<b>Goal 1 - Provide Mobility Options and Improved Connections for Regional Trips</b>												
1.2 Average Weekday Boardings	Boardings	340 - 4,330	4,330	2,070	1,010	500	2,010	1,520	490	650	1,860	340
1.5 Reduction in Transit Travel Time	Percentage	-11.1% - 6.6%	6.3%	-7.6%	-8.5%	1.2%	6.6%	0.0%	-5.6%	0.0%	-11.1%	6.4%
1.6 Connectivity to Places	Rating	-	3	2	2	1	1	1	1	2	1	1
1.7 Number of Transit Lines Served	Count	15 - 1,005	21	957	1005	15	489	495	845	887	808	847
1.8 Number of Park and Ride Lots Served	Count	0 - 3	2	1	0	0	3	2	3	1	1	0
<b>Goal 2 - Increase Transit Market Share</b>												
2.4 Boardings per Revenue Hour	Boardings/hour	10 - 60	29	37	17	10	20	26	10	26	60	12
2.5 Passenger Trips per Revenue Mile	Passenger Trips/Mile	0.32 - 2.00	1.15	1.25	0.56	0.38	0.67	0.87	0.32	0.88	2.00	0.40
<b>Goal 3 - Develop a Cost-Effective Solution</b>												
3.1 Capital Cost Per Route Mile	\$/Mile	236,000 - 743,000	\$354,000	\$273,000	\$253,000	\$353,000	\$236,000	\$318,000	\$596,000	\$682,000	\$743,000	\$577,000
3.2 Capital Cost Per Passenger	\$/Passenger	5,590 - 27,350	\$5,800	\$6,470	\$13,270	\$26,800	\$10,350	\$10,660	\$27,350	\$11,540	\$5,590	\$22,060
3.3 Operating and Maintenance Cost Per Revenue Hour	\$/Hour	\$202 - \$264	\$206	\$223	\$220	\$231	\$202	\$229	\$259	\$255	\$264	\$256
3.4 Operating and Maintenance Cost Per Passenger	\$/Passenger	\$4 - \$27	\$7	\$6	\$13	\$24	\$10	\$9	\$27	\$10	\$4	\$22
<b>Goal 4 - Improve Transportation Equity</b>												
4.1 Ability to serve Communities of Concern (CoC)	Rating	-	45,200	53,000	52,000	3,500	13,200	11,400	46,900	46,800	31,500	41,300
4.2 Ability to Serve Communities Without Access to Frequent and Affordable Fixed Rail Service	Residents	1 - 42	6	18	18	1	36	42	14	16	15	16
4.3 Percentage of Potential Riders Under 200% of Federal Poverty Level	Percentage	14.0% - 36.0%	31%	32%	33%	14%	19%	20%	29%	34%	33%	36%
<b>Goal 5 - Enhance Access to Population and Employment Centers</b>												
5.1 Number of Residents within Half-Mile of Stops	Residents	64,000 - 257,500	84,900	197,200	198,700	64,000	182,000	187,300	257,500	169,000	143,600	159,200
5.2 Number of Jobs within Half-Mile of Stops	Jobs	68,700 - 464,400	87,300	464,400	457,200	68,700	160,300	92,300	461,000	455,400	431,900	427,400
<b>Goal 6 - Support Sustainable Transportation and Land Use Policies</b>												
6.10 Ability to Serve Priority Development Areas (PDAs)	Sq. Miles	-	6.65	6.19	7.01	0.11	3.51	5.83	7.80	9.18	6.08	6.43