

VTA's BART SILICON VALLEY PHASE II

Travel Forecast Results Report

Request for Inclusion in the FY 2024 Capital Investment Grant
Budget Request to Congress

DRAFT

November 2, 2022

**BART Silicon Valley Phase II
Extension Project**





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1 INTRODUCTION

This document provides the Travel Forecast Results Report (TFRR) for the BART Silicon Valley Phase II Extension (BSVII) Project's Federal Transit Administration's (FTA's) Capital Investment Grant (CIG) New Starts submission. This report includes:

- Description of the project
- Primary mobility benefits of the project
- Forecasting approach using Simplified Trips-on-Project Software (STOPS) version 2.5 including model implementation and calibration comparisons with observed ridership
- Project forecasts for Current (2019) and Horizon (2040) year conditions.



2 PROJECT DESCRIPTION

The BART Silicon Valley Phase II Extension (BSVII) is a Santa Clara Valley Transportation Authority (VTA)-sponsored fixed guideway capital project extending Bay Area Rapid Transit (BART) District service from the BSV Phase I Berryessa/North San José Station through downtown San José to the Santa Clara Station in the City of Santa Clara. The project is approximately six miles in length with four stations, five miles of subway tunnel, 48 heavy rail vehicles, and a railroad yard and maintenance facility. BSVII is being implemented by VTA, who will design, construct, and own the completed facilities, in partnership with BART, who will operate and maintain the service.

According to its 2018 Final Supplemental Environmental Impact Statement (SEIS) / Supplemental Environmental Impact Report (SEIR), the purpose of the project is to provide increased transit capacity and faster, convenient access to major Santa Clara County employment centers and throughout the Bay Area; enhance connectivity of regional transit services; provide a viable option to travel by automobile to promote economic development in the Silicon Valley; improve mobility for transportation-disadvantaged populations; and to support local and regional land use plans¹.

Figure 2-1 on the following page presents a map of the BSVII alignment, and its relationship to the existing BART system. A unique feature of the project is the single, large-diameter tunnel that VTA is constructing through the downtown core of San José. This unique single-bore method – made possible by recent innovations in tunneling equipment and control technologies – minimizes disruption to vehicles, pedestrians, underground utilities, and businesses during construction, as compared to “cut-and-cover” methods. Although increasingly common around the world for both roadway (Madrid, Miami, Seattle) and transit (Barcelona, Groene Hart in the Netherlands) projects, this tunnel configuration will be the first application in the U.S. for a high-volume, heavy-rail transit subway.

The Federal Transit Administration (FTA) accepted BSVII into New Starts Project Development in March 2016 and issued a Record of Decision on the project in June 2018. FTA subsequently accepted BSVII into the Expedited Project Delivery (EPD) Pilot Program in June 2019. VTA intends to return to the Capital Investment Grant (CIG) Program as a New Starts project in late 2022.

¹https://www.vta.org/sites/default/files/documents/Volumel_Chapter%25201%2520Purpose%2520and%2520Need_feb20_2018.pdf

Figure 2-1 BART Silicon Valley Extension Phase II



The following summarizes the primary mobility benefits which are expected to be achieved with the implementation of the BART Silicon Valley Phase II Extension.

3 SUMMARY OF PRIMARY MOBILITY BENEFITS

The BSVII project provides improved accessibility between San Jose and the San Francisco Bay area via Alameda County. Table 3-1 shows the trips of the project between the locations for the current and horizon years. Majority of the trips on the project are between the San Jose area, San Francisco Bay area, and West Alameda. Approximately 53% of the trips on the project are home-based work trips with the remaining 47% being non work. Approximately 20% of the trips on the project are from 0-car households with the remaining 80% from 1+ car households. New-to-transit riders in the current year (5,200) and horizon year (10,700) save 61,700 and 151,700 vehicle miles traveled respectively. Table 3-1 shows the distribution of the trips on the project.

Table 3-1 Trips on the Project Summary

Trips that are	Current Year		Horizon year	
	Trips on the Project	% of Trips	Trips on the Project	% of Trips
Within area of the 4 project stations	991	7%	1,700	5%
To or from Phase 1 (Berryessa and Milpitas) station areas	1,946	14%	3,581	11%
To or from North Santa Clara	484	3%	599	2%
To or from east and south San Jose	5,477	38%	8,935	27%
To or from Alameda County and Tri Valley	1,820	13%	3,419	10%
To or from San Francisco	3,282	23%	13,888	42%
To or from rest of region	234	2%	795	2%
Total	14,234	100%	32,917	100%

The population and employment in the model area are expected to grow by about 29% and 26% respectively between 2019 and 2040. The San Francisco Bay area is expected to grow its population by about 37% and employment by about 45%. The project area is expected to grow its population by about 71% and the employment by about 45%. This growth in population and employment drives the increase in project trips between the current and horizon years and is the primary uncertainty inherent in the forecasts.

The sections in this report that follow (Forecasting Approach and Project Forecasts) describe in detail the STOPS-based model that was used to generate these mobility benefit forecasts and the calibration of the model, as well as details of the forecasts used to assess the benefits of the project summarized above.

4 FORECASTING APPROACH

This section discusses the forecasting approach for the BSVII project. It includes the data sources used as model inputs and model implementation to calibrate the model.

4.1 DATA SOURCES

The following section lists the data used to setup the STOPS model from the Federal Transit Administration, Santa Clara Valley Transit Authority (VTA).

From FTA

The following data was provided by the Federal Transit Administration:

- STOPS model version 2.50
- American Community Survey (ACS) 2006-2010 CTPP data for California including zone shapefiles, census block shapefiles, and Journey to Work data

From VTA

The following data was provided by the Santa Clara Valley Transit Authority (VTA).

- Traffic Analysis Zone (TAZ) shapefile
- Association of Bay Area Governments (ABAG) MPO approved population and employment forecasts for the base and forecast years
- Zone to Zone highway travel time and distances for base and forecast years from VTA regional model (BART version (highway skims))

Incremental trip tables were developed by using the survey data from VTA and the Metropolitan Transportation Commission (MTC) transit passenger surveys. The MTC survey is from 2015 and has survey records for the BART, Caltrain, SamTrans, and ACE. The VTA On-Board Survey is from 2017. The MTC survey was processed for the linked trips data by trip purpose and vehicle ownership at the Production and Attraction level. The MTC data was provided at MTC zone level, so MTC zone to ACS zone equivalency was used to convert the survey data to ACS zone format.

The 2017 VTA On-Board Survey data was processed for the linked trips data by trip purpose and vehicle ownership at the Production and Attraction level. Since the MTC and VTA datasets could have common records, it was ensured that the linked trips records between the datasets are not duplicated, by checking the production and destination information, and transfer information. VTA zone to ACS zone equivalencies were developed and the linked trip data was converted to the ACS zone level. The MTC and VTA linked trip data was combined to generate a final incremental trip table to be used in the model.

Station-level and route-level targets for input into the STOPS model were developed based on the following data sets:

- VTA – Nov 2019
- BART – Oct 2019
- Caltrain – 2019
- SamTrans – Nov 2019

GTFS data was provided by VTA for Nov 2019. GTFS for BART, Caltrain, SamTrans, ACE, Capitol Corridor and VTA were obtained from the publicly available database from TransitFeeds website and included in the model.

4.2 MODEL IMPLEMENTATION

This section discusses the assumptions and techniques used in the final model implementation to calibrate the STOPS model and generate forecasts. Descriptions of the parameter file used, district system, stop groups, zone splits, walk penalties, and transfer penalties are provided in this section.

Figure 4-1 shows the STOPS parameter settings used. Most settings are left as default, with the model set up as Mode 3 (incremental) with an on-board survey-based trip table and Type 12 Group calibration approach using stop group and route group counts. All other parameters were kept as default values.

Figure 4-1 STOPS Parameter Settings

STOPS Control File Editor - F:\VTA_STOPS\Runs\V4_DistRevV3_40_SENTasV5_FINAL\VTA_Stops.ctf

Run Name:

System Name:

STOPS Mode:

Import File Name (in Inputs\):

Geography Type:

State 1:

Optional State 2 (blank if no state 2):

Optional State 3 (blank if no state 3):

MPO Code:

GTF5 Connectors:

Project Trip Definition: Station Boarding/Alighting Only

GTF File Set 1

Existing Directory:

No-Bld Directory:

Build Directory:

Optional Suffix:

Schedule Day:

Route ID Position*: to

Trip ID Position*: to

Stop ID Position*: to

Optional GTF File Set 2

Existing Dir.:

No-Bld Dir.:

Build Dir.:

Optional Suffix:

Schedule Day:

Route ID Position*: to

Trip ID Position*: to

Stop ID Position*: to

Optional GTF File Set 3

Existing Dir.:

No-Bld Dir.:

Build Dir.:

Optional Suffix:

Schedule Day:

Route ID Position*: to

Trip ID Position*: to

Stop ID Position*: to

Optional GTF File Set 4

Existing Dir.:

No-Bld Dir.:

Build Dir.:

Optional Suffix:

Schedule Day:

Route ID Position*: to

Trip ID Position*: to

Stop ID Position*: to

[Previous page of GTF5 datasets](#)

[Next page of GTF5 datasets](#)

STOPS Parameters

	HBW Trips/JTW	HBW Linked Transit	HBO Trips/JTW	HBO Linked Transit Goal	NHB Trips/JTW	NHB Linked Transit Goal
0-Car HH	<input type="text" value="1.5000"/>	<input type="text" value="42458.0000"/>	<input type="text" value="1.6000"/>	<input type="text" value="33025.0000"/>	<input type="text" value="3.2100"/>	<input type="text" value="14418.0000"/>
1-Car HH	<input type="text" value="1.5000"/>	<input type="text" value="106931.0000"/>	<input type="text" value="1.6000"/>	<input type="text" value="44723.0000"/>	<input type="text" value="3.2100"/>	<input type="text" value="18630.0000"/>
2-Car HH	<input type="text" value="1.5000"/>	<input type="text" value="174070.0000"/>	<input type="text" value="1.6000"/>	<input type="text" value="74114.0000"/>	<input type="text" value="3.2100"/>	<input type="text" value="29073.0000"/>
All-Car HH		<input type="text" value="323460.0000"/>		<input type="text" value="151862.0000"/>		<input type="text" value="62121.0000"/>

Fraction of Transfer Penalty to Apply (0 to 2, Default 1.0):

Minutes of PNR penalty to add (0 to 20, Default 0.0):

Full (Type not 0) Fixed Guideway Settings (1.0=Full to 0.0=None):

Partial (Type=0) Fixed Guideway Settings (1.0=Full to 0.0=None):

Ratio of Unlinked to Linked Transit Trips (1 to 2, Default 1.4):
(For computing trip targets when linked trips are not provided.)

CTPP Calibration Approach:

Group Calibration Approach:

Calibration Settings (Default to 1.0):

Walk Weight	KNR Transit	PNR Transit	PNR Bus	Auto Time Factor
<input type="text" value="1.0000"/>	<input type="text" value="1.0000"/>	<input type="text" value="1.0000"/>	<input type="text" value="1.0000"/>	<input type="text" value="1.0000"/>

Notes: * Optional character position designators for GTF ID Fields. Messages:

The district definition for the STOPS model was taken from the VTA model. Figure 4-2 shows the district system including the BART and the project stations. Figure 4-3 shows the district system for the project area.

Figure 4-2 Model District System

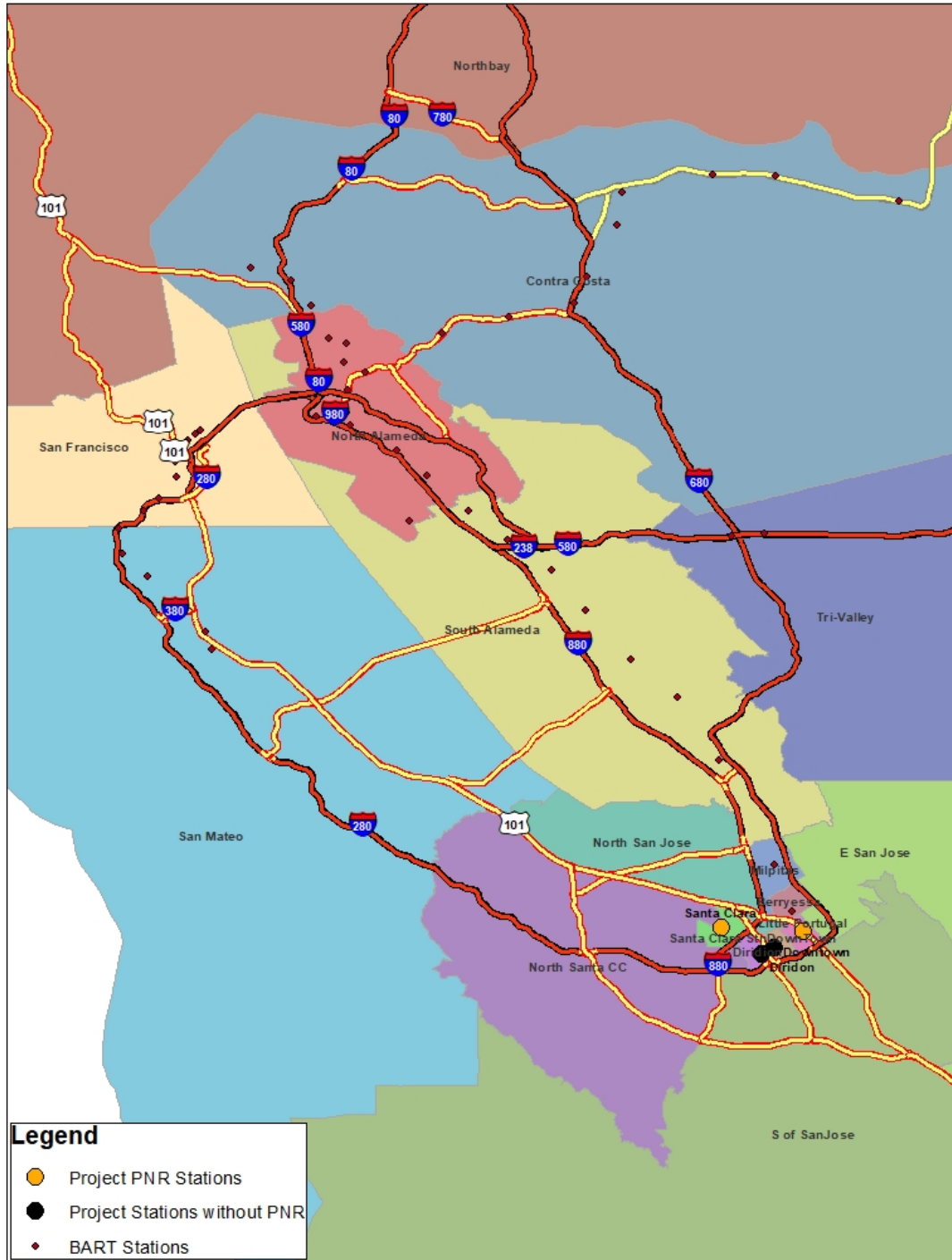
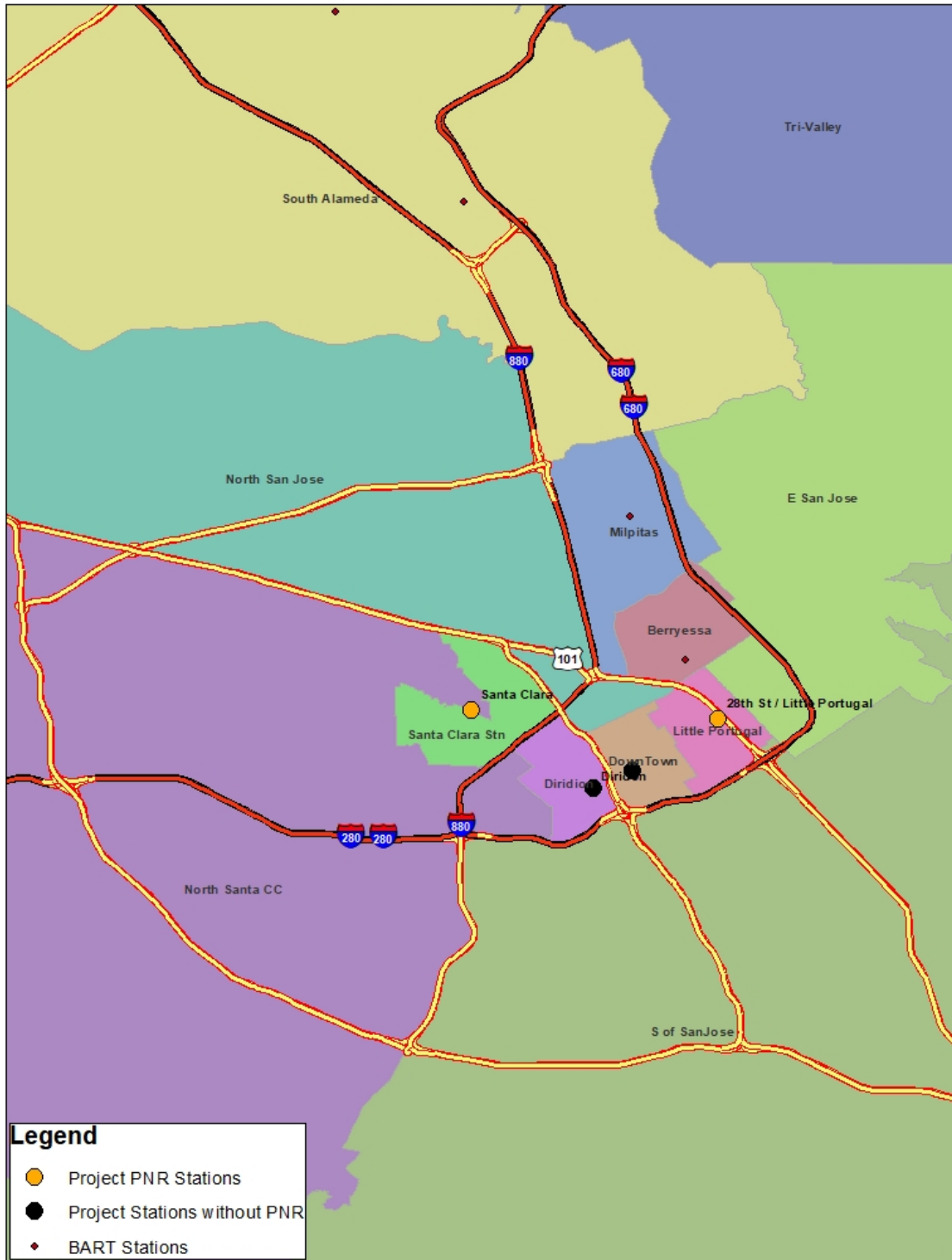
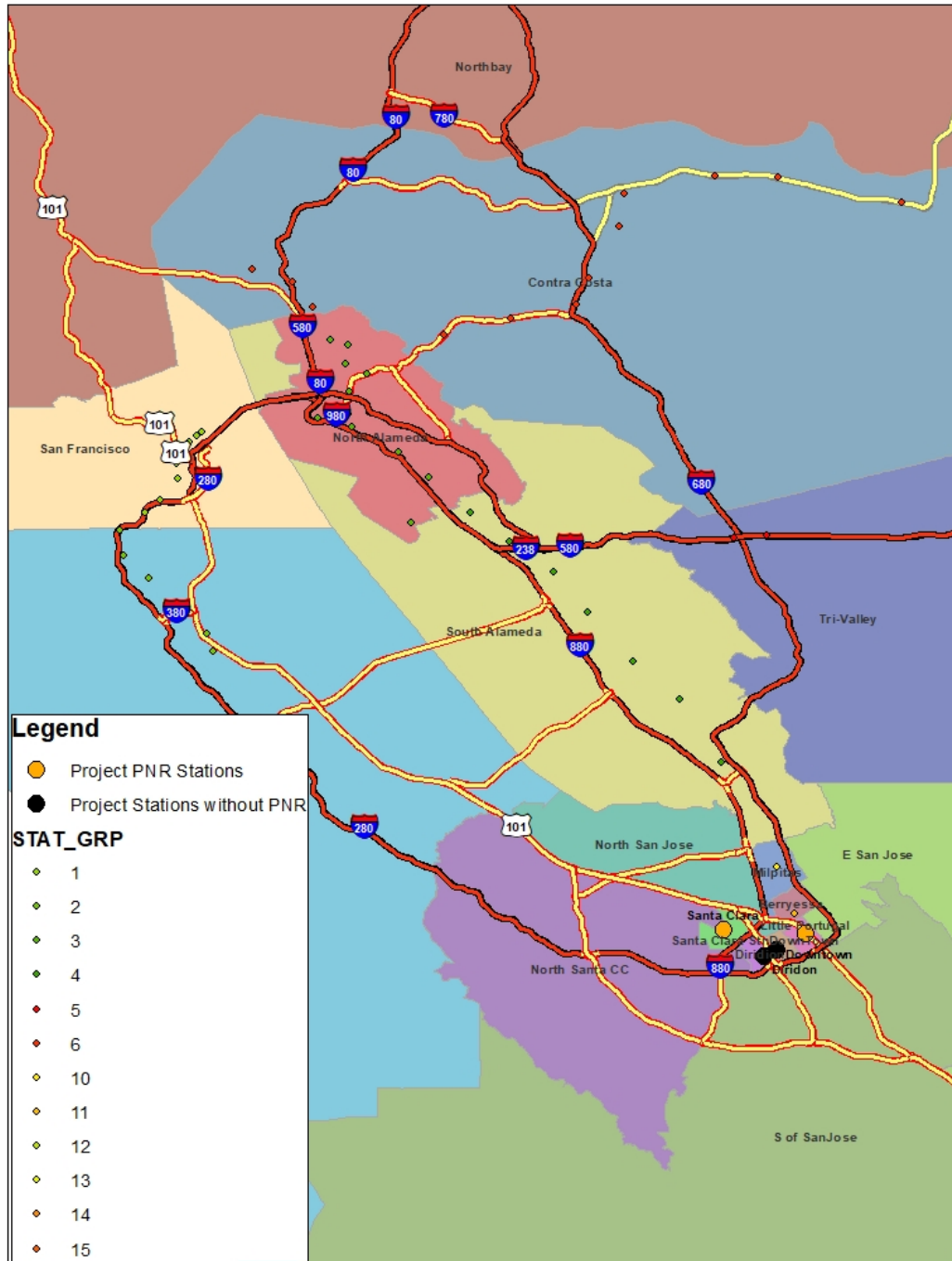


Figure 4-3 Model District System in Study Area



For the type 12 implementation, the model uses the stop groups and route-level groups for the calibration. The stations in the model were grouped based on the model districts. Figure 4-4 shows a plot of the BART station groupings. The routes in the model were grouped into separate groups to enable better route-level calibration.

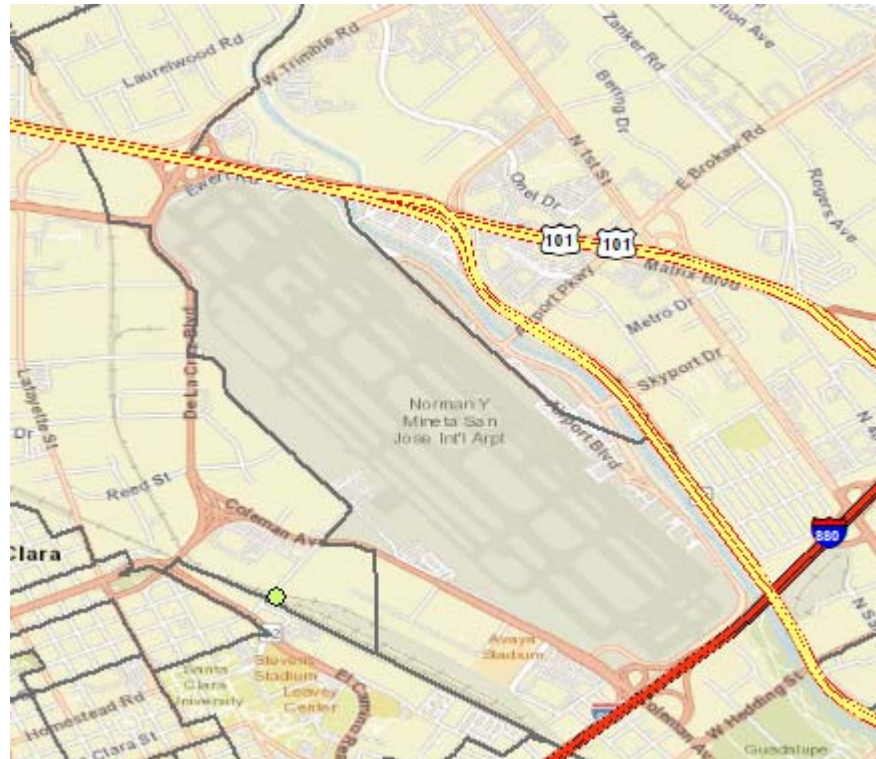
Figure 4-4 BART Station Grouping



The initial estimates of the park and ride (PNR) boardings showed the total PNR boardings were much higher than the total available spaces, so the PNR costs for the stations were adjusted.

During model development it was discovered that the San Jose Airport (SJC) zone from the ACS zone was generating walk links across the runway areas. To address this unrealistic situation, the ACS zone was split to separate the runway area from the terminal area. Figure 4-5 shows the zone split for the SJC zone.

Figure 4-5 Zone Split for the SJC Zone



4.3 CALIBRATION COMPARISONS

The STOPS model was implemented using incremental type 12 calibration (station-level and route-level calibration). As part of the calibration adjustments, a 5-minute walk penalty was added for BART stations, and a 5-minute transfer penalty (through Different GTFS penalty attribute in the station level database) was added to Caltrain stations. Table 4-1 shows the calibration statistics, with the regional calibration factor at 1.01. Table 4-2 shows the route-level boardings comparison for the BART, Caltrain and VTA routes against the observed counts. Table 4-3 is a similar summary by mode of access.

Table 4-1 Calibration Statistics (STOPS Report Table 2.04)

Calibration Statistics (Table 2.04)	2019 Existing STOPS Model
Linked Model	527,226
Unlinked Model Raw	646,177
Model Xfer Ratio	1.23
Target Unlinked Trips	659,757
Calibration Factor	1.01

Table 4-2 Route-Level Comparison

Route	Count	Model Type 0	Model Type 12
BART			
Yellow-Antioch - SFO/Millbrae	149,364	119,032	143,853
Blue-Wkd/Sat-Dublin/Pleasanton	74,689	50,779	69,911
Orange-Warm Springs/South Fremont	58,458	41,526	58,106
Green-Warm Springs/South Fremont	61,069	62,354	56,133
Red-Richmond - Daly City/Millbrae	87,881	97,611	82,708
Purple-Millbrae - SFO	0	633	159
Beige-OAK - Coliseum	0	2,755	692
Sub Total	431,461	374,690	411,562
Caltrain			
Bullet-Baby Bullet	21,181	15,293	20,368
Limited-Limited	36,453	28,713	35,376
Local-Local	11,468	15,974	11,167
Subtotal	69,102	59,980	66,911
VTA			
900-OHLONE/CHYNOWETH - ALMAD	765	840	764
901-ALUM ROCK-SANTA TERESA V	14,561	19,137	14,561
902-MOUNTAIN VIEW - WINCHEST	11,548	14,879	11,542
LRT Subtotal	26,874	34,856	26,867
Rest of VTA	94,168	118,189	94,301
Total VTA	121,042	153,045	121,168

Table 4-3 Mode of Access Comparison

Route	Count	2019 (Type 12)			
		WLK	KNR	PNR	ALL
BART					
Yellow-Antioch - SFO/Millbrae	149,364	77,344	16,317	50,192	143,853
Blue-Wkd/Sat-Dublin/Pleasanton	74,689	41,168	10,667	18,076	69,911
Orange-Warm Springs/South Fremont	58,458	33,764	10,753	13,589	58,106
Green-Warm Springs/South Fremont	61,069	37,171	5,129	13,832	56,133
Red-Richmond - Daly City/Millbrae	87,881	62,629	7,972	12,108	82,708
Purple-Millbrae - SFO	0	100	19	40	159
Beige-OAK - Coliseum	0	452	150	90	692
Sub Total	431,461	252,628	51,007	107,927	411,562
Caltrain					
Bullet-Baby Bullet	21,181	11,426	2,177	6,766	20,368
Limited-Limited	36,453	20,007	3,230	12,139	35,376
Local-Local	11,468	8,325	1,780	1,062	11,167
Subtotal	69,102	39,758	7,187	19,967	66,911
VTA					
900-OHLONE/CHYNOWETH - ALMAD	765	689	45	31	764
901-ALUM ROCK-SANTA TERESA V	14,561	12,412	1,429	720	14,561
902-MOUNTAIN VIEW - WINCHEST	11,548	9,338	1,191	1,013	11,542
LRT Subtotal	26,874	22,439	2,665	1,764	26,867
Rest of VTA	94,168	85,917	6,139	2,243	94,301
Total VTA	121,042	108,356	8,804	4,007	121,168

5 PROJECT FORECASTS

This section discusses the modifications to the 2019 GTFS files to represent the service planning assumptions for the No Build and Build scenarios, project-level metrics, and systemwide metrics for current and horizon forecasts.

5.1 SERVICE PLANNING ASSUMPTIONS

This section discusses the service planning assumptions used for the No build and the Build scenarios.

5.1.1 No Build Alternative

The major updates to the No Build scenario include the extension of the VTA LRT lines, BART extension to Berryessa with headway updated to 12 minutes, and electrification of Caltrain routes.

VTA assumptions are listed below:

- Vasona LRT extension (1 new station at Vasona Junction in Los Gatos), 15-minute headways, throughout the day
- Eastridge LRT extension (2 new stations: Story and Eastridge), 15-minute headways, throughout the day
- VTA Buses: represent the January 2020 service plan

The BART assumptions are summarized below:

- BART to Berryessa, served by two lines with a combined headways of 6 minutes
- Headways per line goes from 15 minutes in 2019 to 12 minutes, except for services between S. Hayward (BART 5 IB) and BART 3, which have 60-min headway during peak. Table 5-1 shows the frequencies for the services.

Table 5-1 BART Service Plan Under No Build Conditions

ROUTE ID	FROM	TO	Direction IB=Inbound OB=Outbound	2040 Weekday	
				PK	OP
BART1	Richmond	Millbrae - SFO	2	12 min	12 min
BART3	Pleasant Hill	SFO	2	12 min	12 min
	Pittsburg/ Bay Point	Glen Park	2	12 min	-
	Pittsburg/ Bay Point	Daly City	1 IB	60 min	-
BART5	Berryessa	Daly City	2	12 min	12 min
	S. Hayward	Daly City	1 IB	60 min	
BART7	Dublin/ Pleasanton	Daly City	2	12 min	12 min
BART9	Berryessa	Richmond	2	12 min	12 min
OAC	OAK	Coliseum	2	5 min	5 min
eBART	Baypoint	Byron	2	12 min	12 min

Caltrain Electrification will increase both speeds and frequency. Frequency information is shown in Table 5-2 and train/stopping patterns are listed below.

Table 5-2 Caltrain Headway and Number of Trains by Line in 2040

		Peak Headway	Off-peak Headway	No. of Trains During Peak NB&SB	No. of Trains During Off-peak NB&SB
Express1	NB&SB	30 min		32	
Express2	NB&SB	30 min		32	
Limited1	NB&SB	30 min		32	
Limited2	NB&SB	30 min		32	
Midday1	NB&SB		30 min		32
Midday2	NB&SB		30 min		32
Total				128	64

Express1 (CALNB1/CALSB1): SF Transbay Terminal to Gilroy, via Blossom Hill & San Martin.

Stop Stations: SF Transbay Terminal, SF 4th, Millbrae, San Mateo, Hillsdale, Redwood City, Palo Alto, Mountain View, Sunnyvale, Diridon, Tamien, Blossom Hill, San Martin, Gilroy

Express2 (CALNB2/CALSB2): SF Transbay Terminal to Gilroy, via Hillsdale.

Stop Stations: SF Transbay Terminal, SF 4th, Millbrae, San Mateo, Hillsdale, Redwood City, Palo Alto, Mountain View, Sunnyvale, Diridon, Tamien, Capitol, Morgan Hill, Gilroy

Limited1 (CALNB3/CALSB3): SF Downtown to Tamien.

Stop Stations: SF 4th, 22nd, Bayshore, San Bruno, Millbrae, Burlingame, Hayward Park, Hillsdale, Belmont, San Carlos, Redwood City, Menlo Park, Palo Altos, California Ave, Mountain View, Sunnyvale, Lawrence, Santa Clara, Diridon, Tamien

Limited2 (CALNB4/CALSB4): SF Downtown to Tamien.

Stop Stations: SF 4th, 22nd, Bayshore, South San Francisco, Millbrae, Burlingame, San Mateo, Hillsdale, Belmont, San Carlos, Redwood City, Menlo Park, Palo Altos, California Ave, San Antonio, Mountain View, Sunnyvale, Santa Clara, Diridon, Tamien

Midday1 (CALNMD1/CALSMD1): SF Transbay Terminal to Tamien.

Stop Stations: SF Transbay Terminal, SF 4th, 22nd, Bayshore, South San Francisco, Millbrae, Burlingame, San Mateo, Hillsdale, Belmont, San Carlos, Redwood City, Menlo Park, Palo Altos, California Ave, San Antonio, Mountain View, Sunnyvale, Santa Clara, Diridon, Tamien

Midday2 (CALNMD2/CALSMD2): SF Transbay Terminal to Tamien.

Stop Stations: SF Transbay Terminal, SF 4th, 22nd, Bayshore, San Bruno, Millbrae, Burlingame, Hayward Park, Hillsdale, Belmont, San Carlos, Redwood City, Menlo Park, Palo Altos, California Ave, Mountain View, Sunnyvale, Lawrence, Santa Clara, Diridon, Tamien

5.1.2 Build Alternative

This section discusses the Build alternative assumptions. Major changes include changes to VTA buses and the BART extension that includes 4 new stations.

VTA assumptions are listed below:

- VTA LRT is identical to No Build
- Table 5-3 lists the bus changes between the No Build and Build scenarios.

Table 5-3 VTA Bus Service Differences between No Build and Build

Route	No Build	Build
72	Senter & Monterey via McLaughlin to Downtown San Jose	Senter & Monterey via McLaughlin to Alum Rock Station
500	San Jose Diridon Station to Berryessa Transit Center	Remove
523	Lockheed Martin Transit Center - Berryessa Transit Center	Lockheed Martin Transit Center - Santa Clara/2nd (Downtown San Jose)

The BART assumptions are summarized below.

- Extension from Berryessa to Santa Clara with 4 new stations (Little Portugal/Alum Rock, Downtown, Diridon, Santa Clara)
- Extension will be served by two lines with a combined headway of 6 minutes
- No other extensions or change in frequency, compared to No Build. Table 5-4 lists the service plan for the build scenario

Table 5-4 BART Service Plan Under Build Alternative

ROUTE ID	FROM	TO	Direction IB=Inbound OB=Outbound	2040 Weekday	
				PK	OP
BART1	Richmond	Millbrae - SFO	2	12 min	12 min
BART3	Pleasant Hill	SFO	2	12 min	12 min
	Pittsburg/ Bay Point	Glen Park	2	12 min	-
	Pittsburg/ Bay Point	Daly City	1 IB	60 min	-
BART5	Santa Clara	Daly City	2	12 min	12 min
	S. Hayward	Daly City	1 IB	60 min	
BART7	Dublin/ Pleasanton	Daly City	2	12 min	12 min
BART9	Santa Clara	Richmond	2	12 min	12 min
OAC	OAK	Coliseum	2	5 min	5 min
eBART	Baypoint	Byron	2	12 min	12 min

The Caltrain service plan is unchanged from No Build.

5.2 PROJECT METRICS

The project-specific metrics developed from the STOPS model are the Trips on the project, which are total trips that use any of the four new project stations, regional new riders which are new transit riders that would not take transit in the No Build scenario, but would do so in the Build scenario, station boardings by mode of access to the BART Stations, and regional VMT change between the No Build and Build scenarios.

Table 5-5 shows the forecasted trips on the project segmented by type of trip (Work and Non-Work) and household auto ownership (0 and 1+ cars). The STOPS forecasts show 14,200 trips on the project for 2019 and 32,900 trips on the project in 2040.

Table 5-5 Current and Future Year Trips on the Project

Trips on the Project	2019	2040
	Build	Build
Work Trips - 0-Car Households	1,513	2,736
Work Trips - 1+Car Households	5,984	14,094
Work Trips - Total	7,497	16,830
Non-Work Trips - 0-Car Households	1,488	3,599
Non-Work Trips - 1+Car Households	5,249	12,489
Non-Work Trips - Total	6,737	16,088
Total Trips - 0-Car Households	3,001	6,335
Total Trips - 1+Car Households	11,233	26,583
Total Trips - Total	14,234	32,918

Table 5-6 summarizes the forecasted regional linked trips in the No Build and Build scenarios, with new riders being the calculated as the difference in linked trips between the scenarios. There are 5,200 and 10,700 new riders in 2019 and 2040, respectively.

Table 5-7 and

Table 5-8 show the station-level ridership forecasts for No Build and Build scenarios for current year and future year respectively for BART service. Table 5-9 and Table 5-10 show the station-level ridership forecasts for No Build and Build scenarios for current year and future year, respectively for Caltrain.

Table 5-6 Current and Future Year New Riders

Project Metrics Alternative	2019		2040	
	No Build	Build	No Build	Build
Regional Boardings	683,060	690,640	1,042,661	1,049,974
Regional Linked Trips	605,591	610,773	902,153	912,837



VTA's BART SILICON VALLEY PHASE II EXTENSION PROJECT
Travel Forecast Results Report

New Riders	-	5,182	-	10,684
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Table 5-7 STOPS Model Current Year BART No Build and Build Station Level Ridership

BART Stations	Y2019 EXISTING					Y2019 NO BUILD					Y2019 BUILD				
	WLK	KNR	PNR	XFR	ALL	WLK	KNR	PNR	XFR	ALL	WLK	KNR	PNR	XFR	ALL
12th St. Oakland Cit	12,974	310	0	330	13,614	12,196	171	0	603	12,970	12,204	171	0	625	13,000
16th St. Mission	13,611	924	0	27	14,562	14,275	1,013	0	31	15,318	14,328	1,028	0	31	15,387
19th St. Oakland	14,265	321	0	1,596	16,182	15,782	180	0	471	16,433	15,787	180	0	528	16,494
24th St. Mission	15,111	561	0	83	15,754	16,200	581	0	11	16,793	16,223	594	0	13	16,830
Antioch	255	361	1,423	0	2,039	269	398	1,374	0	2,041	269	401	1,378	0	2,048
Ashby	3,926	133	954	0	5,013	4,280	253	317	0	4,849	4,281	253	317	0	4,851
Balboa Park	14,510	669	0	155	15,334	16,161	287	0	531	16,979	16,167	288	0	563	17,018
Bay Fair	5,074	866	1,675	363	7,978	5,233	826	1,450	257	7,765	5,241	831	1,460	259	7,790
Castro Valley	1,679	299	854	0	2,831	1,869	311	869	0	3,050	1,870	311	869	0	3,050
Civic Center/UN Plaza	19,187	719	0	146	20,053	20,313	963	0	108	21,384	20,421	1,000	0	107	21,528
Coliseum	3,209	811	704	1,796	6,520	3,414	767	933	3,087	8,202	3,416	769	937	3,112	8,235
Colma	1,600	120	1,378	1,441	4,540	1,599	228	4,379	1,507	7,713	1,601	221	4,321	1,501	7,643
Concord	2,875	755	1,840	0	5,470	2,714	664	2,353	0	5,731	2,714	665	2,353	0	5,732
Daly City	3,872	570	2,906	2,459	9,807	4,121	348	1,025	2,247	7,740	4,127	362	1,127	2,261	7,876
Downtown Berkeley	12,721	188	0	0	12,909	13,753	270	0	0	14,023	13,763	272	0	0	14,034
Dublin/Pleasanton	2,249	2,117	3,183	0	7,549	2,503	2,388	1,921	0	6,812	2,504	2,393	1,921	0	6,818
El Cerrito del Norte	2,462	422	1,579	0	4,464	2,567	436	2,143	0	5,146	2,568	437	2,146	0	5,151
El Cerrito Plaza	2,601	197	915	0	3,713	2,713	186	1,340	0	4,239	2,714	186	1,342	0	4,243
Embarcadero	38,213	628	0	393	39,234	41,604	539	0	601	42,744	41,762	545	0	603	42,909
Fremont	4,209	684	2,449	76	7,417	4,520	721	2,087	0	7,328	4,563	744	2,147	0	7,454
Fruitvale	4,060	663	1,531	16	6,270	4,378	637	1,235	0	6,251	4,380	639	1,247	0	6,266
Glen Park	21,153	665	0	306	22,123	21,295	720	0	62	22,077	21,318	726	0	67	22,112
Hayward	3,475	652	1,283	0	5,411	3,718	711	1,234	0	5,663	3,726	719	1,243	0	5,688
Lafayette	414	182	718	0	1,314	447	180	768	1	1,396	447	180	768	1	1,396
Lake Merritt	6,671	358	1,046	830	8,905	7,626	401	1,861	6	9,894	7,636	404	1,940	6	9,986
MacArthur	6,500	351	1,326	2,769	10,947	6,837	292	867	861	8,857	6,844	292	869	860	8,865
Millbrae	1,103	146	357	5,152	6,758	954	125	528	2,745	4,352	953	125	528	2,575	4,181
Montgomery St.	41,215	1,109	0	58	42,382	38,958	493	0	6,514	45,965	39,083	499	0	6,311	45,893
North Berkeley	2,474	153	600	0	3,226	2,805	180	706	0	3,692	2,806	180	709	0	3,696
North Concord/Martin	827	197	1,081	0	2,105	791	318	1,165	0	2,274	791	319	1,166	0	2,275
Oakland International	346	0	0	0	346	373	0	0	0	374	376	0	0	0	376
Orinda	224	131	763	0	1,117	234	121	802	2	1,159	234	121	802	2	1,159
Pittsburg/Bay Point	1,066	212	1,568	0	2,845	850	231	1,560	0	2,641	850	231	1,561	0	2,641
Pittsburg Center	978	253	823	0	2,054	952	262	576	0	1,790	952	262	576	0	1,790
Pleasant Hill/Contra	3,274	1,663	8,792	0	13,729	3,379	1,862	8,817	54	14,113	3,381	1,862	8,819	54	14,116
Powell St.	16,013	398	0	68	16,478	16,723	440	0	84	17,247	16,836	447	0	90	17,373
Richmond	1,868	663	916	669	4,115	2,071	506	425	877	3,878	2,073	507	427	860	3,867
Rockridge	3,112	328	1,187	1	4,628	3,301	136	2,068	5	5,511	3,302	136	2,068	5	5,511
San Bruno	1,406	168	324	507	2,403	1,392	128	509	431	2,460	1,407	128	509	431	2,475
San Francisco Intern	1,371	87	0	349	1,806	1,381	40	0	577	1,997	1,382	40	0	576	1,998
San Leandro	4,760	687	1,297	210	6,954	5,172	639	1,213	272	7,296	5,180	643	1,218	295	7,336
South Hayward	1,752	693	1,081	0	3,526	1,899	808	911	0	3,618	1,896	809	928	0	3,634
South San Francisco	1,356	174	527	759	2,815	1,375	152	809	598	2,935	1,377	153	803	600	2,932
Union City	1,751	483	1,122	0	3,356	1,809	497	1,629	0	3,934	1,815	508	1,654	0	3,977
Walnut Creek	4,364	817	3,278	0	8,459	4,634	824	3,537	44	9,039	4,635	824	3,538	44	9,041
Warm Springs/South F	40	163	350	787	1,339	43	167	470	96	776	43	169	531	79	822
West Dublin/Pleasant	2,010	928	1,644	0	4,582	2,146	1,098	2,894	0	6,138	2,147	1,099	2,894	0	6,139
West Oakland	4,701	287	1,509	85	6,582	4,929	212	1,071	2,433	8,645	4,930	213	1,071	2,451	8,665
Milpitas	0	0	0	0	0	279	45	110	1,803	2,237	1,009	65	173	3,114	4,362
Berryessa	0	0	0	0	0	213	136	607	724	1,680	339	45	634	467	1,485
28th St/ Little Portugal	0	0	0	0	0	0	0	0	0	0	1,033	127	355	58	1,572
Diridon	0	0	0	0	0	0	0	0	0	0	943	82	0	462	1,487

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	WLK	KNR	PNR	XFR	ALL	WLK	KNR	PNR	XFR	ALL	WLK	KNR	PNR	XFR	ALL
Downtown	0	0	0	0	0	0	0	0	0	0	2,986	72	0	1,141	4,199
Santa Clara	0	0	0	0	0	0	0	0	0	0	375	81	133	499	1,088
Total	312,887	24,266	52,983	21,431	411,558	327,050	23,891	56,563	27,643	435,149	334,008	24,358	57,482	30,651	446,494

Table 5-8 STOPS Model Future Year BART No Build and Build Ridership

BART Stations	Y2040 NO BUILD					Y2040 BUILD				
	WLK	KNR	PNR	XFR	ALL	WLK	KNR	PNR	XFR	ALL
12th St. Oakland Cit	17,705	197	0	2,162	20,063	17,752	196	0	2,281	20,230
16th St. Mission	23,590	1,389	0	82	25,061	24,023	1,404	0	82	25,509
19th St. Oakland	28,256	193	0	1,080	29,528	28,279	193	0	948	29,420
24th St. Mission	20,743	922	0	20	21,685	20,773	943	0	27	21,742
Antioch	552	931	2,493	0	3,976	553	932	2,495	0	3,979
Ashby	4,691	299	891	0	5,880	4,700	300	905	0	5,905
Balboa Park	15,932	414	0	838	17,184	15,943	418	0	894	17,255
Bay Fair	6,819	1,077	1,983	316	10,195	6,839	1,088	2,001	320	10,248
Castro Valley	2,418	318	904	0	3,639	2,419	317	905	0	3,641
Civic Center/UN Plaza	30,262	1,129	0	244	31,635	30,391	1,190	0	238	31,819
Coliseum	4,531	1,485	1,138	6,671	13,825	4,534	1,486	1,141	6,778	13,940
Colma	2,301	247	4,499	2,763	9,809	2,302	238	4,401	2,748	9,689
Concord	2,793	695	3,495	0	6,982	2,794	695	3,495	0	6,984
Daly City	6,302	761	863	2,810	10,737	6,333	788	972	2,849	10,942
Downtown Berkeley	28,402	531	0	0	28,933	28,434	539	0	0	28,973
Dublin/Pleasanton	4,606	3,357	69	0	8,032	4,608	3,362	68	0	8,038
El Cerrito del Norte	3,740	638	3,240	0	7,617	3,740	639	3,245	0	7,625
El Cerrito Plaza	3,125	186	662	0	3,973	3,134	189	663	0	3,987
Embarcadero	59,307	787	0	931	61,024	59,860	801	0	936	61,598
Fremont	6,882	1,281	1,821	0	9,984	7,005	1,317	1,848	0	10,169
Fruitvale	6,888	966	1,372	0	9,226	6,892	969	1,376	0	9,238
Glen Park	19,450	929	0	139	20,518	19,471	936	0	159	20,566
Hayward	4,826	970	764	0	6,559	4,835	981	766	0	6,582
Lafayette	601	321	1,738	1	2,661	601	321	1,738	1	2,661
Lake Merritt	12,779	508	879	16	14,181	12,811	512	889	16	14,227
MacArthur	11,288	344	288	2,549	14,469	11,301	345	289	2,549	14,483
Millbrae	1,164	245	2,137	4,244	7,790	1,163	244	2,118	3,902	7,427
Montgomery St.	50,057	689	0	12,966	63,713	50,365	698	0	12,469	63,532
North Berkeley	3,821	217	411	0	4,449	3,826	218	418	0	4,462
North Concord/Martin	1,165	1,029	1,166	0	3,360	1,167	1,030	1,167	0	3,364
Oakland International	760	0	0	0	760	764	0	0	0	764
Orinda	301	177	1,335	8	1,821	301	177	1,335	8	1,821



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BART Stations	Y2040 NO BUILD					Y2040 BUILD				
	WLK	KNR	PNR	XFR	ALL	WLK	KNR	PNR	XFR	ALL
Pittsburg/Bay Point	1,210	347	1,963	0	3,519	1,210	347	1,963	0	3,520
Pittsburg Center	1,559	428	156	0	2,142	1,559	428	156	0	2,142
Pleasant Hill/Contra	3,751	3,351	20,125	105	27,333	3,753	3,351	20,129	105	27,339
Powell St.	20,418	732	0	164	21,314	21,209	762	0	170	22,141
Richmond	3,407	836	39	1,659	5,941	3,413	838	39	1,629	5,919
Rockridge	5,228	145	700	13	6,087	5,229	145	700	13	6,087
San Bruno	1,556	173	634	774	3,138	1,580	173	634	775	3,161
San Francisco Intern	2,178	45	0	912	3,134	2,189	45	0	912	3,146
San Leandro	6,540	848	1,768	1,062	10,219	6,553	853	1,777	1,126	10,309
South Hayward	2,668	1,228	2,241	0	6,137	2,664	1,228	2,257	0	6,149
South San Francisco	1,868	221	1,089	793	3,970	1,873	221	1,072	794	3,960
Union City	2,808	657	880	0	4,346	2,851	672	902	0	4,425
Walnut Creek	6,865	928	2,397	52	10,241	6,909	933	2,404	52	10,298
Warm Springs	75	248	831	319	1,473	76	251	898	112	1,337
West Dublin/Pleasant	2,622	1,714	2,757	0	7,093	2,623	1,729	2,756	0	7,108
West Oakland	6,776	430	17,947	4,151	29,305	6,778	432	18,305	4,214	29,729
Milpitas	537	495	1,721	7,248	10,002	1,714	494	1,513	8,148	11,869
Berryessa	675	345	1,648	1,888	4,555	1,321	76	892	1,018	5,674
28th St/ Little Portugal	0	0	0	0	0	1,658	195	1,016	87	2,957
Diridon	0	0	0	0	0	2,155	167	0	785	3,107
Downtown	0	0	0	0	0	6,638	178	0	2,253	9,069
Santa Clara	0	0	0	0	0	583	190	1,446	875	3,094
Total	456,798	36,403	89,044	56,980	639,218	472,451	37,174	91,094	60,273	663,360

Table 5-9 STOPS Model Current Year Caltrain No Build and Build Station Ridership

Caltrain Stations	Y2019 EXISTING					Y2019 NO BUILD					Y2019 BUILD				
	WLK	KNR	PNR	XFR	ALL	WLK	KNR	PNR	XFR	ALL	WLK	KNR	PNR	XFR	ALL
San Francisco	7,068	482	0	410	7,960	8,127	713	0	1,076	9,916	8,049	646	0	1,072	9,766
22nd Street	1,154	192	0	0	1,345	2,061	125	0	0	2,186	2,049	118	0	0	2,167
Bayshore	106	60	12	15	193	244	156	218	77	695	244	151	205	77	677
South San Francisco	304	28	33	27	392	453	38	20	8	519	456	37	16	8	517
San Bruno	586	52	372	91	1,101	835	46	385	80	1,346	831	46	395	79	1,351
Millbrae	1,089	98	219	4,950	6,357	1,627	185	541	4,103	6,456	1,629	183	500	3,882	6,194
Burlingame	1,009	22	60	22	1,114	1,522	52	71	34	1,678	1,528	52	70	34	1,684
San Mateo	2,178	98	74	328	2,678	2,831	123	6	444	3,404	2,835	123	6	434	3,397
Hayward Park	604	16	209	0	829	849	28	198	1	1,076	863	28	198	1	1,090
Hillsdale	2,043	150	446	232	2,872	2,716	206	563	1,000	4,485	2,723	206	566	994	4,490
Belmont	651	21	105	92	867	998	39	379	314	1,731	999	39	379	314	1,732
San Carlos	1,224	50	324	139	1,737	1,550	38	349	48	1,985	1,558	38	345	48	1,990
Redwood City	3,041	122	417	727	4,307	4,052	174	515	589	5,330	4,061	174	517	590	5,342
Menlo Park	1,901	62	254	385	2,602	2,464	61	118	449	3,092	2,475	61	118	449	3,104
Palo Alto	5,866	158	353	942	7,318	7,756	233	396	1,811	10,196	7,797	233	396	1,797	10,223
California Ave	1,455	71	172	52	1,750	2,064	127	167	205	2,564	2,087	121	166	229	2,603
San Antonio	1,117	51	157	75	1,399	1,709	54	135	45	1,944	1,741	60	134	49	1,984



Caltrain Stations	Y2019 EXISTING					Y2019 NO BUILD					Y2019 BUILD				
	WLK	KNR	PNR	XFR	ALL	WLK	KNR	PNR	XFR	ALL	WLK	KNR	PNR	XFR	ALL
Mountain View	2,654	263	307	1,238	4,463	3,597	289	591	1,685	6,163	3,669	289	589	1,549	6,097
Sunnyvale	1,335	231	3,162	459	5,187	2,094	370	5,639	1,495	9,597	2,121	359	4,646	1,442	8,569
Lawrence	517	73	108	136	833	611	75	128	0	814	610	68	19	0	697
Santa Clara	501	78	133	598	1,310	857	109	22	846	1,835	727	135	1,457	1,013	3,332
College Park	478	4	0	8	490	0	0	0	0	0	0	0	0	0	0
San Jose Diridon	2,053	459	385	3,383	6,280	3,032	414	78	4,211	7,735	2,729	395	27	3,866	7,017
Tamien	327	46	192	938	1,503	951	257	171	1,801	3,179	943	233	219	1,645	3,040
Capitol	200	72	529	55	856	408	92	508	246	1,253	407	90	430	226	1,152
Blossom Hill	152	47	210	28	437	291	115	1,207	0	1,614	294	113	1,086	0	1,494
Morgan Hill	87	22	151	10	270	310	49	357	91	807	310	50	358	90	808
San Martin	18	13	86	10	128	0	0	0	0	0	0	0	0	0	0
Gilroy	129	29	169	8	334	463	67	457	47	1,034	463	67	460	47	1,036
Total	39,847	3,070	8,639	15,358	66,912	54,472	4,235	13,219	20,706	92,634	54,198	4,115	13,302	19,935	91,553

Table 5-10 STOPS Model Future Year Caltrain No Build and Build Station Ridership

Caltrain Stations	Y2040 NO BUILD					Y2040 BUILD				
	WLK	KNR	PNR	XFR	ALL	WLK	KNR	PNR	XFR	ALL
San Francisco	18,161	1,052	0	3,331	22,544	18,188	944	0	3,284	22,416
22nd Street	7,627	156	0	0	7,783	7,324	148	0	0	7,473
Bayshore	1,021	499	76	264	1,860	1,019	489	70	267	1,845
South San Francisco	846	51	175	17	1,089	855	49	163	14	1,081
San Bruno	1,580	51	328	78	2,037	1,574	50	273	78	1,976
Millbrae	2,221	332	540	6,811	9,903	2,236	330	529	6,359	9,453
Burlingame	4,793	175	119	68	5,155	4,891	175	119	68	5,252
San Mateo	4,046	203	47	824	5,120	4,080	203	47	791	5,122
Hayward Park	1,142	69	325	0	1,535	1,154	69	325	0	1,548
Hillsdale	4,793	380	408	2,957	8,538	4,814	380	408	2,839	8,442
Belmont	1,271	146	594	580	2,591	1,286	145	593	581	2,605
San Carlos	1,841	29	162	75	2,106	1,861	29	153	75	2,117
Redwood City	5,701	345	638	927	7,611	5,771	344	613	931	7,658
Menlo Park	2,981	68	96	631	3,776	3,022	73	201	638	3,934
Palo Alto	9,789	424	538	2,497	13,247	9,995	422	417	2,469	13,302
California Ave	2,875	380	205	259	3,719	2,920	368	280	263	3,831
San Antonio	2,815	136	284	70	3,304	2,837	139	221	68	3,265
Mountain View	4,946	659	361	4,555	10,521	4,956	654	181	3,306	9,097
Sunnyvale	3,020	962	1,959	3,380	9,321	2,961	960	5,122	3,118	12,161
Lawrence	1,608	257	138	0	2,003	1,537	243	88	0	1,869
Santa Clara	1,617	337	600	1,623	4,177	1,371	348	1,403	1,894	5,016
College Park	0	0	0	0	0	0	0	0	0	0
San Jose Diridon	7,029	1,299	1,193	9,083	18,603	5,978	1,238	726	7,580	15,522
Tamien	1,483	455	654	3,240	5,831	1,465	429	383	2,856	5,133
Capitol	587	151	786	343	1,867	585	146	717	315	1,763
Blossom Hill	449	177	2,557	0	3,183	454	177	2,426	0	3,057
Morgan Hill	579	115	576	158	1,428	578	116	576	156	1,426
San Martin	0	0	0	0	0	0	0	0	0	0
Gilroy	592	163	607	103	1,465	592	163	607	103	1,466
Total	95,413	9,071	13,966	41,874	160,317	94,304	8,831	16,641	38,053	157,830

Table 5-11 shows the VMT savings for the current and future year scenarios. An average auto occupancy of 1.36 derived from the MTC survey data was used to convert the Passenger Miles Traveled (PMT) estimated from the model to VMT savings. The model forecasts about 61,700 vehicle miles in savings for 2019 and about 151,700 for 2040 scenario.

Table 5-11 VMT Savings

	2019 Build	2040 Build
Change in PMT	-83,863	-206,364
Average Vehicle Occupancy	1.36	1.36
VMT Savings	-61,664	-151,738

5.3 SYSTEM LEVEL METRICS

Table 5-12 shows the route-level ridership comparison between the 2019 counts, the model estimated existing, 2019 No Build and Build scenarios, as well as the 2040 No Build and Build forecasts.

Table 5-12 Route-Level Ridership

Route	Count	2019			2040	
		Existing	No Build	Build	No Build	Build
BART						
Yellow-Antioch - SFO/Millbrae	149,364	143,853	147,340	147,398	215,376	215,363
Blue-Wkd/Sat-Dublin/Pleasanton	74,689	69,911	66,762	66,656	89,786	89,410
Orange-Warm Springs/South Fremont	58,458	58,106	50,018	54,483	78,852	85,836
Green-Warm Springs/South Fremont	61,069	56,133	71,115	78,485	110,084	126,162
Red-Richmond - Daly City/Millbrae	87,881	82,708	98,762	98,316	142,729	141,829
Purple-Millbrae - SFO	0	159	407	401	874	865
Beige-OAK - Coliseum	0	692	747	751	1,519	1,527
Sub Total	431,461	411,562	435,151	446,490	639,220	660,992
Caltrain						
Bullet-Baby Bullet	21,181	20,368	51,809	49,937	89,837	86,928
Limited-Limited	36,453	35,376	32,123	32,726	50,900	51,261
Local-Local	11,468	11,167	22,724	22,369	51,936	50,341
Subtotal	69,102	66,911	106,656	105,032	192,673	188,530
VTA						
900-OHLONE/CHYNOWETH - ALMAD	765	764	10,455	10,692	22,024	21,051
901-ALUM ROCK-SANTA TERESA V	14,561	14,561	12,306	12,045	22,524	21,139
902-MOUNTAIN VIEW - WINCHEST	11,548	11,542	11,124	12,418	25,964	24,308
LRT Subtotal	26,874	26,867	33,885	35,155	70,512	66,498
Rest of VTA	94,168	94,301	97,266	93,514	140,373	130,699



Total VTA	121,042	121,168	131,151	128,669	210,885	197,197
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