



samTrans

Innovative Clean Transit (ICT) Rollout Plan

December 2, 2020

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Document Control

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This ICT Rollout Plan will guide the transition to zero-emission buses for the San Mateo County Transit District (SamTrans)
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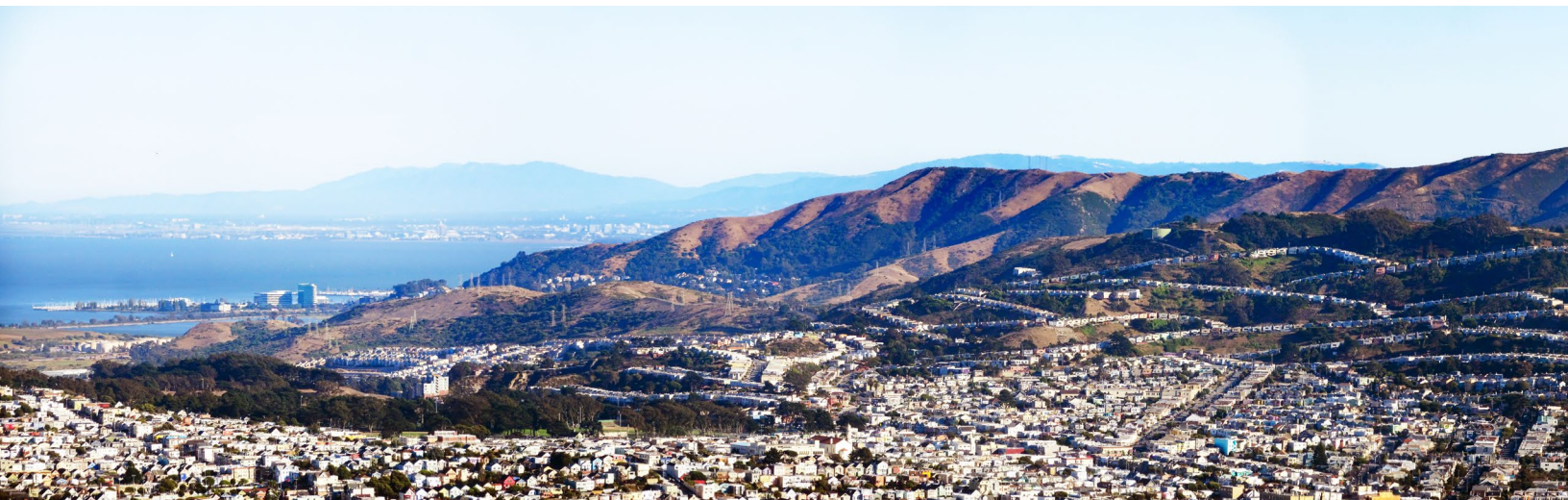
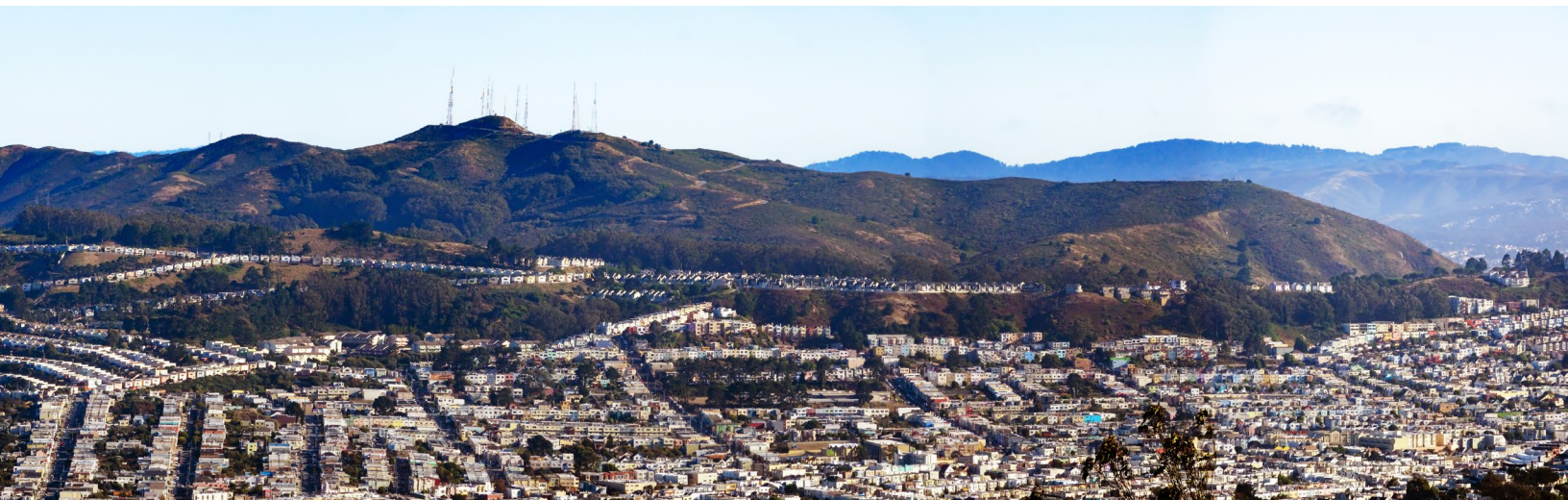
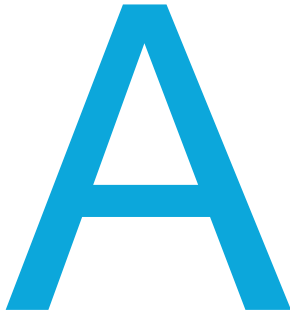


Table of Contents

A Transit Agency Information3
B Rollout Plan General Information7
C Technology Portfolio9
D Current Bus Fleet Composition and Future Bus Purchases11
E Facilities and Infrastructure Modifications15
F Providing Service in Disadvantaged Communities17
G Workforce Training21
H Potential Funding Sources25
I Start-up and Scale-up Challenges27





Transit Agency Information

Introduction

The San Mateo County Transit District (District) was created by the voters in November 1974. The Board of Directors convened its first meeting in early 1975. Later that year, the District's first General Manager was hired. The highest priority at the time was to consolidate the 11 city bus systems that were in existence prior to the formation of SamTrans. SamTrans began service on July 1, 1976.

Today, the San Mateo County Transit District is the administrative body for the principal public transit and transportation programs in San Mateo County: SamTrans bus service, including Redi-Wheels paratransit service, Caltrain commuter rail through its role as both a member agency of the Peninsula Corridor Joint Powers Board (Caltrain) and the administering entity for the service, and San Mateo County Transportation Authority (TA). Caltrain and the TA have contracted with the District to serve as their managing agency, under the direction of their appointed boards.

SamTrans provides bus service primarily within San Mateo County (population 766,573, 2019 ACS), with additional connecting service provided into adjacent San Francisco County (population 881,549, 2019 ACS) to the north. SamTrans is not part of a Joint Group (13 CCR § 2023.1(d)(3)).



Sustainability Policy

SamTrans is committed to supporting the State of California and the California Air Resources Board to lead the state by example and work to reduce the impacts of transportation on air quality and climate on the region, state, and world. As part of SamTrans' sustainability policy, the District commits to:

- Streamline business practices to reduce waste and improve operational effectiveness
- Evaluate and improve the long-term resource efficiency of our facilities and equipment, including the life-cycle return on investment
- Educate and incentivize our employees to integrate sustainability practices into their work and their personal lives
- Encourage business partners to incorporate sustainability practices into their own operations
- Measure the environmental impacts of our activities on an ongoing basis, and set and meet targets to reduce our impacts
- Deploy sustainability-themed programs that encourage the use of public transit and that support our local communities

Community Role

SamTrans has played a central role in San Mateo County communities, ensuring equitable access to transportation, reducing reliance on privately-owned vehicles, and offering residents a more sustainable way to move around the county. SamTrans provides essential services, but is also an active member of communities throughout the County, from moving Olympic athletes to and from the games, engaging the youth community, and hosting the annual “Stuff a Bus” toy drive.

The transition to zero-emission buses represents a promise to the communities that SamTrans serves to protect the health and safety of community members within the Bay Area. This commitment is supported by the District’s vision to be a ***“Mobility leader, providing transportation choices and a sustainable future that meets the needs of our diverse communities.”***

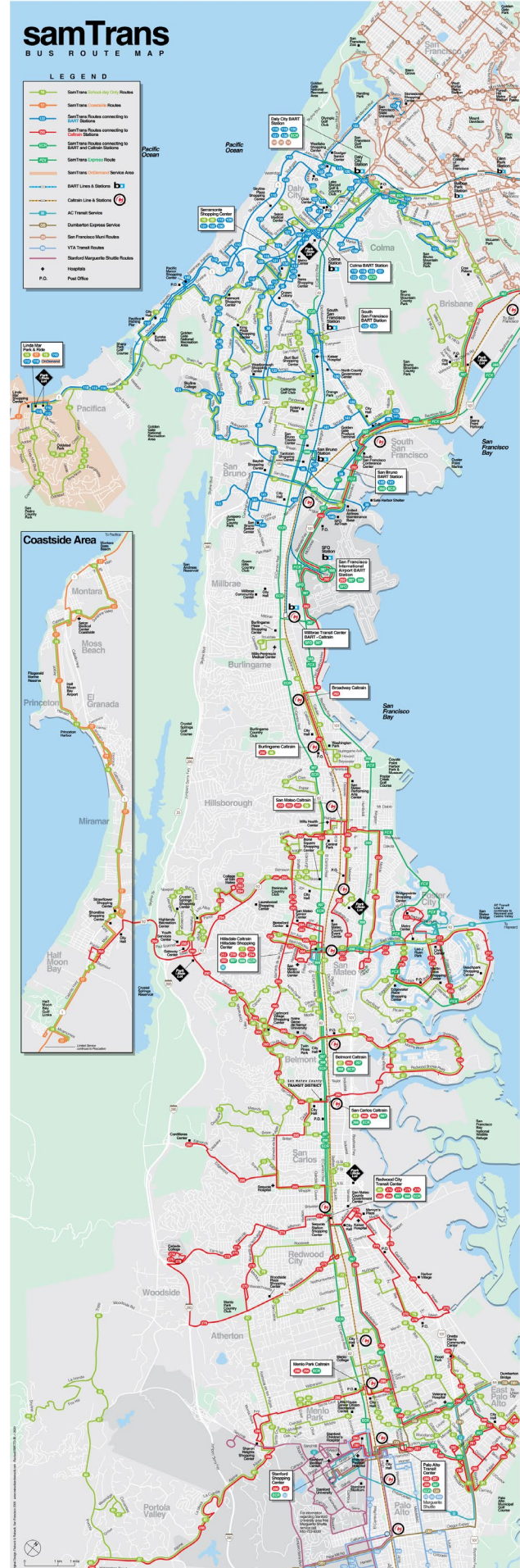


Service

SamTrans operates over 70 fixed routes in the San Mateo County. Prior to COVID -19, the agency provided more than 35,000 passenger boardings each weekday, providing nearly seven million miles of passenger bus service per year to access jobs and economic activity throughout the county. The fixed route service is supported by a fleet of 312 buses. Paratransit services are supported by 70 Paratransit vehicles (see Table 1).

Table 1: SamTrans Fleet

Vehicle Type	Quantity
Articulated coaches (60-foot)	55
Standard coaches (40-foot)	197
Standard coaches (35-foot)	40
Mini coaches (29-foot)	20
Total fixed-route revenue vehicles	312
Cutaways	46
Minivans	24
Total Paratransit vehicles	70



B

Rollout Plan General Information

ICT Background

The California Air Resources Board (CARB) is the lead agency for climate change programs and is charged with protecting the public from harmful effects of air pollution and developing programs and actions to fight climate change. In December 2018, CARB adopted the Innovative Clean Transit (ICT) Regulation that requires all public transit agencies in the state to gradually transition to 100-percent zero-emission bus fleets by 2040.

Through the deployment of zero-emission technologies, the ICT regulation will provide significant benefits across the state, including:

- Reduce NOx and GHG emissions for all Californians, especially transit-dependent and disadvantaged communities. The majority of these benefits will be in the State's most populated and impacted areas where transit buses are most prevalent
- Increase penetration of the first wave of zero-emission heavy-duty technologies into applications that are well suited to their use to further achieve emission reduction benefits
- Save energy and reduce dependency on petroleum and other fossil fuels
- Expand zero-emission vehicle industry to bring high quality green jobs to local communities and trained workforce to California
- Provide other societal benefits by encouraging improved mobility and connectivity with zero-emission transportation modes and reduced growth in light-duty vehicle miles traveled

SamTrans ICT Rollout

This document outlines a plan to guide SamTrans' transition from diesel and gasoline-powered vehicles to zero emission by 2038, without early retirement of diesel vehicles. The ICT Rollout Plan is a coordinating document to assist the planning, design, construction, acquisition, and implementation of zero emission technology. SamTrans adoption of zero emission technology will ultimately meet and exceed the ICT regulation requirements. The ICT Rollout Plan is approved by the SamTrans Board on December 2, 2020; a copy of the approved resolution is located in the attachments (13 CCR§ 2023.1(d) (2)).

The ICT Rollout Plan is divided into the following sections per the ICT requirements:

- A Transit Agency Information
- B Rollout Plan General Information
- C Technology Portfolio
- D Current Bus Fleet Composition and Future Bus Purchases
- E Facilities and Infrastructure Modifications
- F Providing Service in Disadvantaged Communities
- G Workforce Training
- H Potential Funding Sources
- I Start-up and Scale-up Challenges

The ICT Rollout Plan was created by SamTrans with assistance from HDR, Inc., a planning/engineering consultant.



C

Technology Portfolio

Technology Options

Although there are currently two commercially-viable zero emission bus technologies to transit agencies; battery-electric buses (BEB) and hydrogen fuel cell electric buses (FCEB), BEBs are the preferred technology to initial the fleet conversion. For SamTrans, consistency in vehicles, operation, infrastructure, training, and performance are all important and factored into the decision for the preferred technology. The key considerations used to identify a preferred option were adaptability and ease of implementation. FCEB technology remains a viable alternative for long-range routes and for routes of extended duration. FCEB technology is also considered for its operational flexibility during power outages or rolling black outs.





Primary Technology

Battery electric buses are identified as the preferred technology for SamTrans' ZEV transition. To further understand how this technology will affect current operations, a route power analysis was completed to determine the power usage of the fleet that accounts for weather (temperature), elevation change, and other power consumption elements. This analysis used existing schedules and routes to develop a realistic understanding of the power needs and potential range for each schedule block, and which blocks may be too long for the current battery capacity.

Some existing routes are lengthier than the service range current battery-electric buses can deliver; therefore, SamTrans is analyzing the need for remote opportunity charging or en-route charging, in addition of considering the benefits of FCEBs on these routes. This analysis will evaluate additional infrastructure costs to support the most effective technology, en-route chargers or FCEBs.

A cost-benefit analysis of the two technologies inclusive of infrastructure and fuel costs will influence future bus procurements toward the end of the ICT Rollout schedule. Emerging technologies in battery chemistry that can provide increased range through higher capacity, weight saving, and faster charging rate are anticipated and considered game changers.

D

Current Fleet and Future Purchases

Bus Fleet

SamTrans conducted a route power analysis that models the energy usage on a block-by-block basis of each route. The ability for the BEB vehicles to serve each route is determined on a number of different variables, including ambient temperature, route grade changes, passenger load, traffic, and driver aggressiveness.

Table 2 shows the existing SamTrans bus fleet and Table 3 shows the fleet transition schedule. The projected costs by year of the fleet transition are shown in Figure 1. All of the SamTrans ZEB fleet requirements will be met through the purchase of new vehicles.

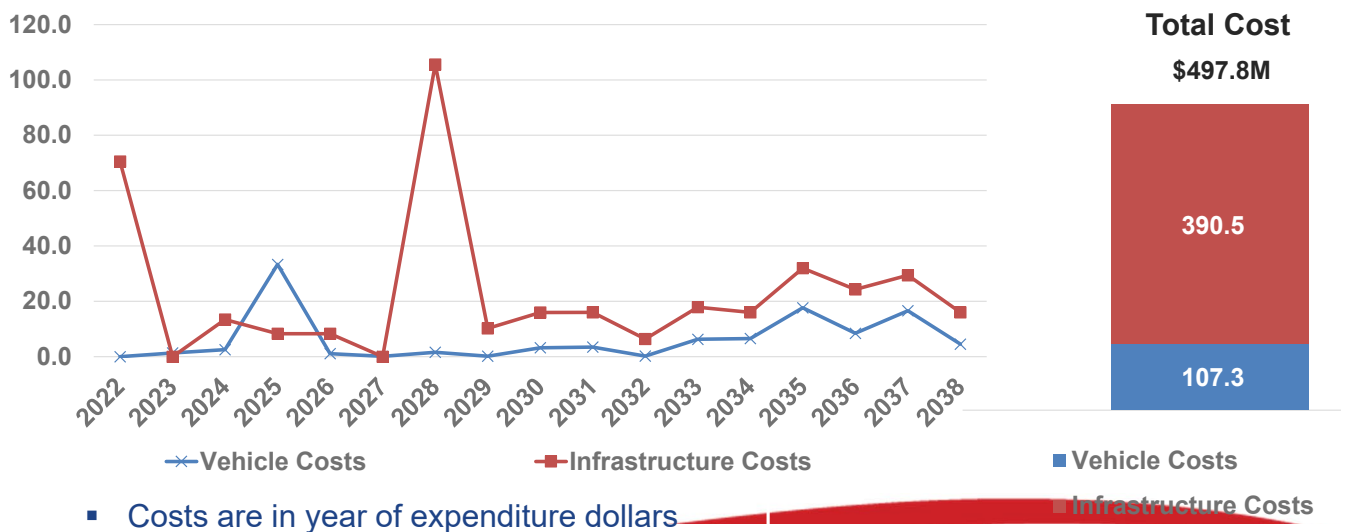
Table 2: Existing bus fleet

Model Year	Fuel Type	Bus Length	Bus Qty.
2009	Diesel	29'	4
2009	Diesel	35'	40
2009-2010	Diesel	40'	91
2013	Diesel	29'	4
2013	Diesel Hybrid	40'	25
2014	Diesel	29'	12
2014	Diesel	40'	21
2017	Diesel	40'	50
2018	Battery Electric	40'	2
2020	Diesel	Articulated 60'	55
2020	Battery Electric	40'	8
Total Fixed Route Fleet			312

Table 3: Fleet transition schedule

ICT Requirement	Year	ZEB				Conventional				Total Purchased
		Qty.	% of Total	Bus Length	Technology	Qty	% of Total	Bus Length	Fuel	
25%	2023	15	60%	40'	Battery - Depot	15	40%	40'	Diesel	37
		7		45'	Battery - Depot					
	2024	20	50%	35'	Battery - Depot	20	50%	35'	Diesel	40
		40	74%	40'	Battery - Depot	25	26%	40'	Diesel	95
30	45'	Battery - Depot								
50%	2026	13	52%	40'	Battery - Depot	12	48%	40'	Diesel	25
	2027									
	2028	21	100%	40'	Battery - Depot					21
100%	2029	16	100%	29'	Battery - Depot					16
	2030	25	100%	40'	Battery - Depot					25
	2031	25	100%	40'	Battery - Depot					25
	2032	10	100%	40'	Battery - Depot					10
	2033	28	100%	Articulated 60'	Battery - Depot					28
	2034	27	100%	Articulated 60'	Battery - Depot					27
	2035	50	100%	40'	Battery - Depot					50
	2036	38	100%	40'	Battery - Depot					38
	2037	47	100%	40'	Battery - Depot					47
	2038	25	100%	40'	Battery - Depot					25

Figure 1: Projected Costs by Year (in \$ millions)



Paratransit Fleet

Table 4 shows the existing SamTrans paratransit fleet and Table 5 shows the paratransit fleet transition schedule. The 22-foot cutaway vehicles exceed 14,000 GVWR, and they are identified within the paratransit sub-fleet subject to ICT regulation. SamTrans has identified the following considerations related to transitioning the paratransit fleet to zero-emission vehicles:

- The initial ZEV purchases to convert the District's cutaways to zero emission vehicles (ZEV) is contingent on the success of the rollout for the fixed route buses. ICT has established a purchase requirement commencing in January 2026. SamTrans will continue to monitor the industry and evaluate ZEVs for its paratransit services in compliance with ICT.
- The paratransit sub-fleet conversion to zero emission vehicles (ZEV) is anticipated to take place after January 1, 2026, or sooner if operating performances, funding, and infrastructure are aligned to operate zero-emission technologies. Gasoline-powered vehicles will remain in the paratransit sub-fleet until the regulation takes effect and ZEVs are commercially available for the paratransit duty cycle.



Note:
 The San Mateo County Transit District's ICT Rollout Plan lists 24 gasoline powered min-vans as part of the paratransit sub-fleet. The mini-vans are not part of the formally known Transit Fleet Vehicles and therefore report their emissions through the Bureau of Automotive Repair (BAR). They are listed in the ICT Rollout Plan as part of the District's overall strategy to convert its fleet's of vehicles into zero emission vehicles.

Table 4: Existing paratransit fleet

Model Year	Fuel Type	Bus Length	Bus Qty.
2015	Gasoline	22' Cutaway, Redi-Wheels	1
2015	Gasoline	22' Cutaway Redi-Wheels	20
2017	Gasoline	22' Cutaway, Redi-Wheels	9
2017	Gasoline	Minivan, Redi-Wheels	10
2018	Gasoline	22' Cutaway, Redi-Wheels	3
2020	Gasoline	22' Cutaway, Redi-Wheels	13
2020	Gasoline	Minivan, Redi-Wheels	14
Total Paratransit Fleet			70

Table 5: Paratransit fleet transition schedule

ICT Requirement	Year	ZEB				Conventional				Total Purchased
		Qty.	% of Total	Bus Length	Technology	Qty	% of Total	Bus Length	Fuel	
0%	2023									0
	2024	0	0%	22' Cutaway	Battery - Depot	9	100%	22' Cutaway	Gasoline	9
	2025	0	0%	22' Cutaway	Battery - Depot	3	100%	22' Cutaway	Gasoline	3
50%	2026									
	2027	7	55%	22' Cutaway	Battery - Depot	6	45%	22' Cutaway	Gasoline	13
	2028									
100%	2029	21	100%	22' Cutaway	Battery - Depot	0	0%	22' Cutaway	Gasoline	21
	2030									
	2031	9	100%	22' Cutaway	Battery - Depot	0	0%	22' Cutaway	Gasoline	9
	2032	3	100%	22' Cutaway	Battery - Depot	0	0%	22' Cutaway	Gasoline	3
	2033									
	2034	13	100%	22' Cutaway	Battery - Depot	0	0%	22' Cutaway	Gasoline	13
	2035									
	2036	21	100%	22' Cutaway	Battery - Depot	0	0%	22"Cutaway	Gasoline	21
	2037									
2038										

E

Facilities and Infrastructure Modifications

SamTrans Bus Facilities

Infrastructure upgrades are planned in phases to incrementally expand ZEV infrastructure as new ZEV's are inserted in the fleet. Planned improvements include the repaving and restriping of bus parking areas, installation of managed bus charging infrastructure, and an electrical service upgrade for each garage. SamTrans has produced designs for restructured parking areas on both the North Base and South Base garages to support the addition of 37 express buses such as the over the road coaches.

The ICT Rollout Plan considers photovoltaic canopies to offset operational expenses while taking advantage of renewable solar energy.

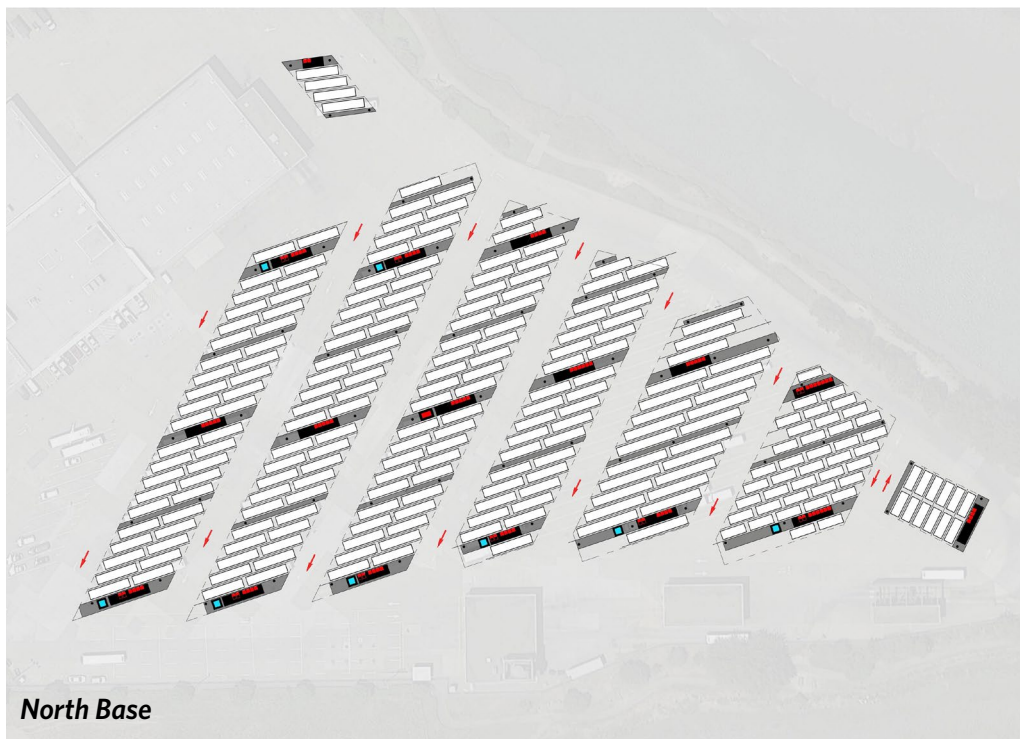
The North and South Base garages are both planned to receive an update to parking arrangements. This update is intended to accommodate the introduction of 55 articulated vehicles, along with an additional 37 standard buses for a planned service expansion. The reorganized parking areas will have enough parking capacity to accommodate any additional vehicles needed due to limited range of the ZEB vehicles on key routes.

Table 6: Existing bus fleet

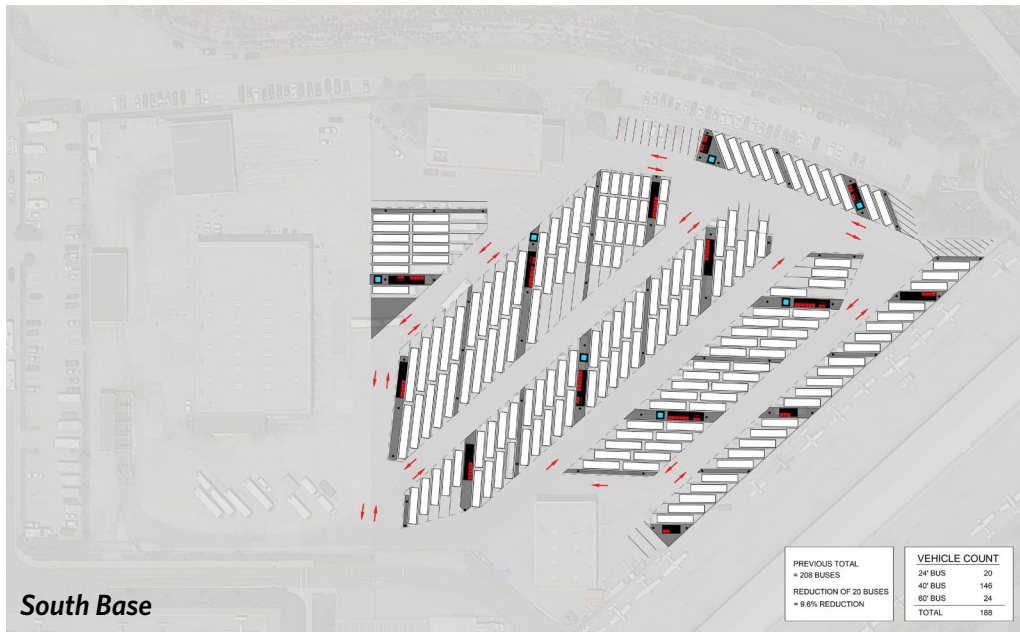
Facility	Address	Main function	Type(s) of infrastructure	Service capacity	Needs upgrade? (yes/no)	Estimated construction timeline
North Base	301 N Access Rd, South San Francisco, CA 94080	Bus maintenance and storage	Chargers Service Main Parking rehab	246 Vehicles	Yes	Completed by 2029
South Base	501 Pico Blvd San Carlos, CA 94070			188 Vehicles	Yes	Completed by 2032

**Battery Electric
Charging Footprint**

Revised parking layouts that accommodate fleet expansion and charging infrastructure.

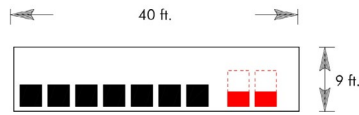
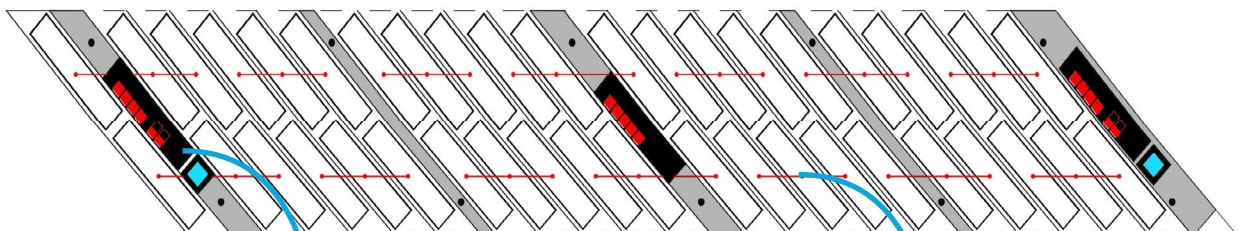


North Base



South Base

PREVIOUS TOTAL		VEHICLE COUNT	
+ 208 BUSES		24' BUS	20
REDUCTION OF 20 BUSES		40' BUS	146
+ 9.6% REDUCTION		62' BUS	24
		TOTAL	168



Charger grouping with transformer
3 Buses / 250Kw Charger

Group of 3 dispensers

F

Service in Disadvantaged Communities

Overview

Disadvantaged communities are identified by the California Environmental Protection Agency (CalEPA)* as the top 25% most impacted census tracts in CalEnviroScreen 3.0 - a screening tool used to help identify communities disproportionately burdened by multiple sources of pollution and with population characteristics that make them more sensitive to pollution.

There are six SB535 disadvantaged communities within San Mateo County that are served by SamTrans bus service. SamTrans operates routes within San Francisco County that serve five SB535 Disadvantaged Communities. The SB535 Disadvantaged Communities are identified by CalEnviroScreen (see Figure 2) are listed below by county:

San Mateo County SB535 Disadvantaged Communities:

- 6081602300
- 6081611900
- 6081610201
- 6081602100
- 6081612000
- 6081604200

SF County SB535 Disadvantaged Communities:

- 6075023300
- 6075017601
- 6075017801 (1000')
- 6075012502 (1000')
- 6075012301 (1000')



Seven battery-electric buses will be deployed as service expansion that utilize high occupancy managed lanes to provide express bus service throughout San Mateo County along the US-101 corridor. Other planned future services will travel west along I-380 thus serving five of the disadvantaged San Mateo County districts.

Following this initial purchase of the (7) battery-electric buses, service scheduling and bus replacements will prioritize routes that serve SB535 Disadvantaged Communities. The following routes intersect or are within 1,000' of a disadvantaged community: 28, 37, 38, 39, 49, 79, 83, 88, 122, 140, 141, 270, 276, 280, 281, 292, 296, 397, 398, and ECR.

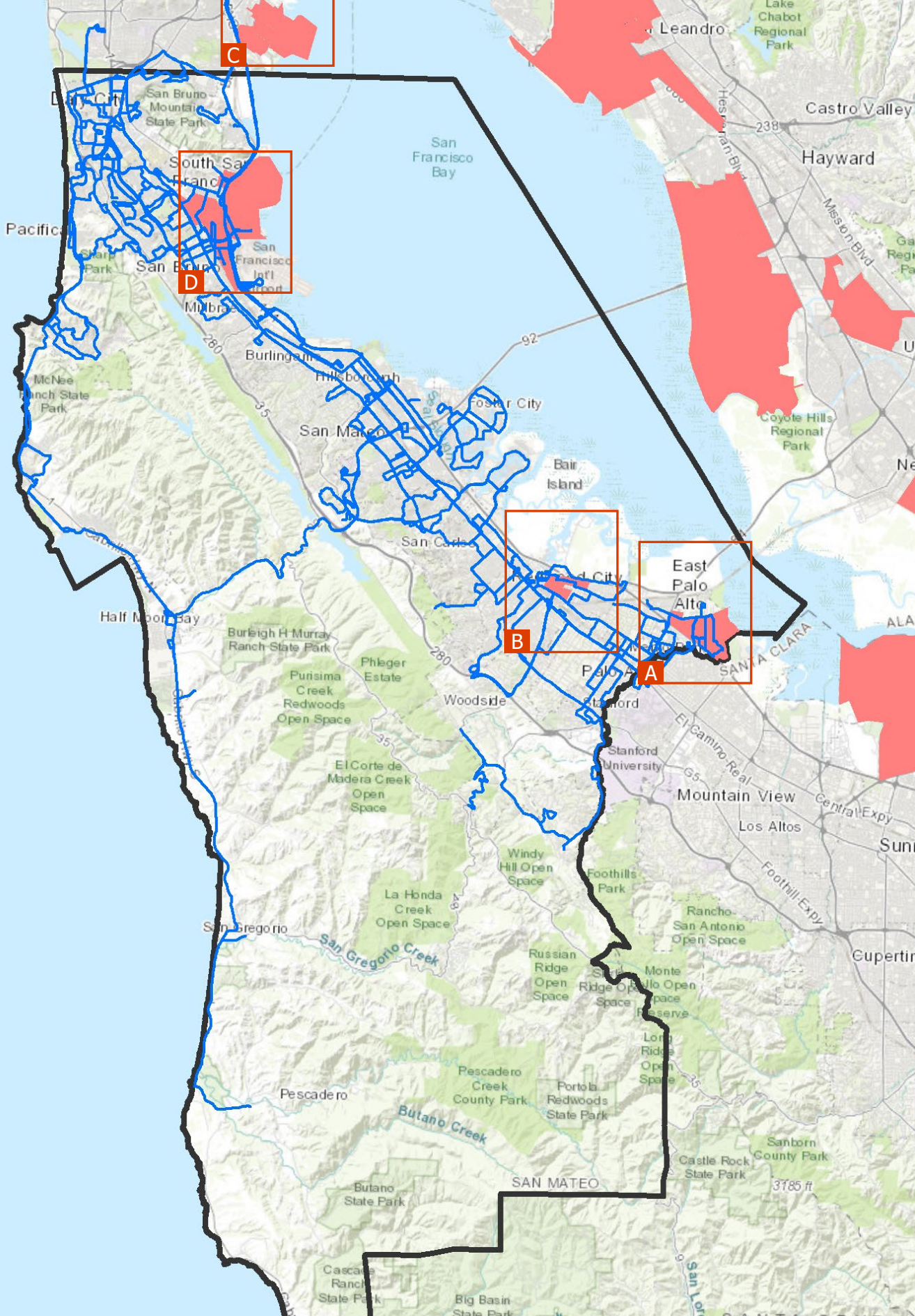
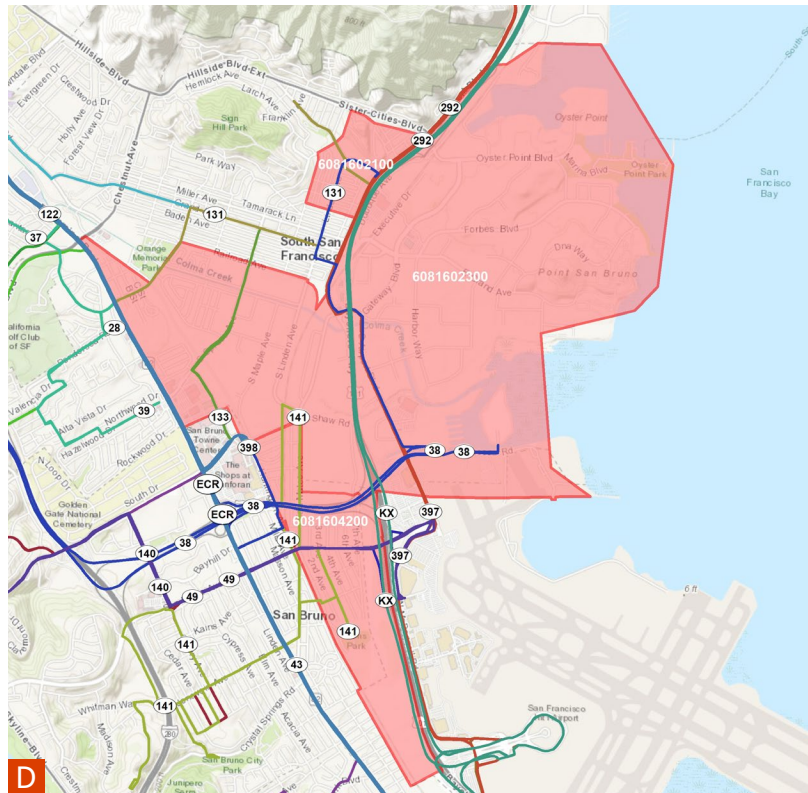
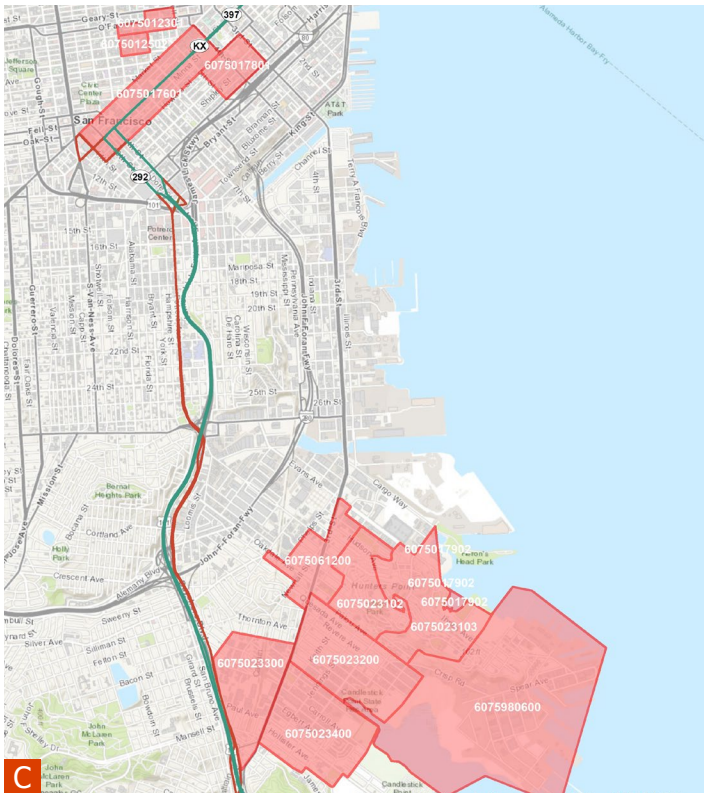
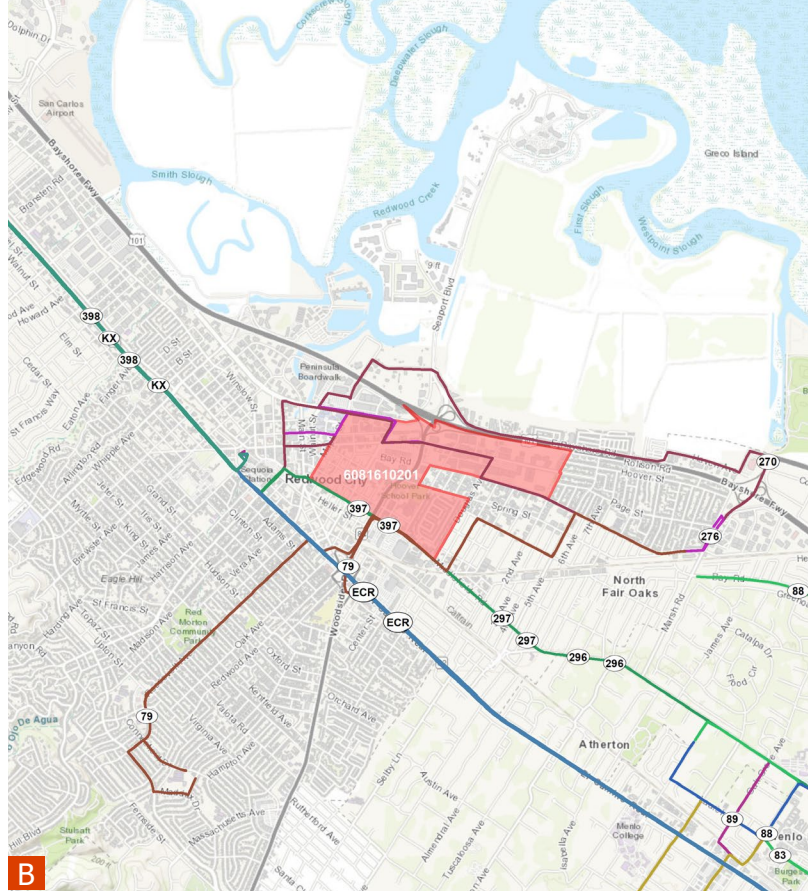
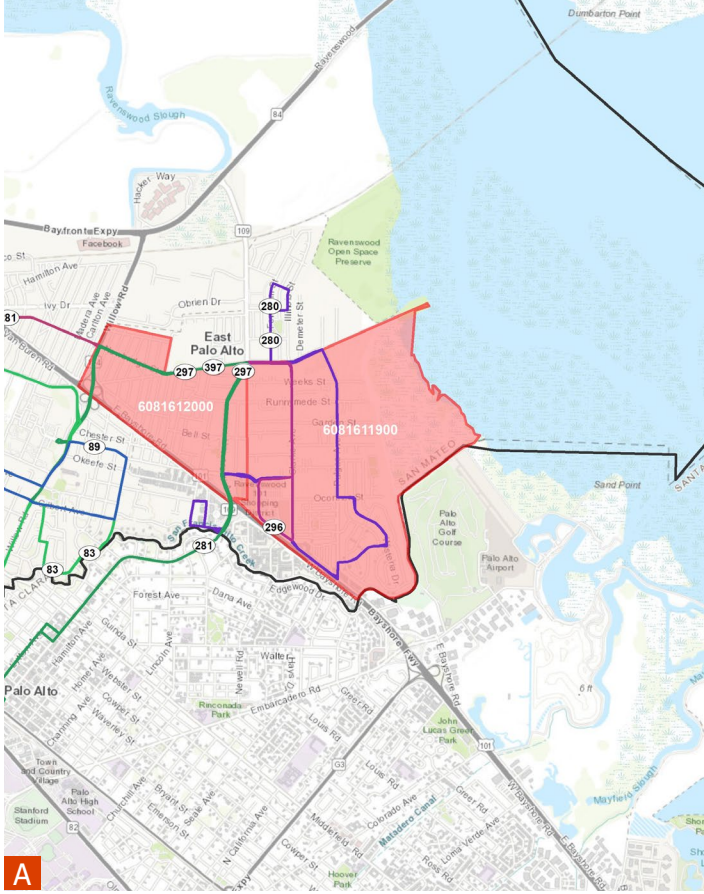


Figure 2: SB535 Disadvantaged Communities served by SamTrans
 Route data compiled by Open San Mateo County (SMCGOV.org) Aug 27, 2016





Workforce Training

Workforce Development

SamTrans will add specialized training to the existing training program, which focuses on both behind-the-wheel training and bus maintenance practices. The battery electric technology is still evolving, and today's training programs are expected to be dynamic and flexible; they will be updated as needed to reflect innovations, industry best practices, and changes in technology. The maintenance training includes shop and system safety, system familiarization and operations, troubleshooting/diagnostics, and preventative maintenance.

SamTrans intends to develop high-skilled maintenance personnel who can address battery-electric technology diagnose, troubleshoot, repair, and maintenance zero emission vehicles. SamTrans has identified the following resources that will assist in the training process;

- Training purchased as part of new rolling stock procurement from bus manufacturers
 - » First responder safety and vehicle familiarization
 - » Operator and Maintenance safety and vehicle familiarization training
 - » High voltage systems safety and familiarization training, including: lock-out/tag-out and inspection, staging, and usage of PPE.
- Direct training from individual sub-system/system manufacturers, including components that make- up the high voltage system, battery and battery management system, propulsion/drivetrain systems, and accessory systems that have/will transition from mechanically to electrically controlled and/or operated



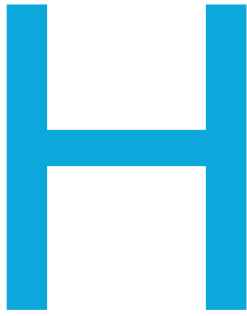
- Membership through Training Consortiums
 - » Southern California Regional Technical Training Consortium (SCR TTC)
- Peer agencies and transit associations
 - » Surrounding Bay Area agencies have continued to introduce zero emission bus (ZEB) technology into their fleets. Several agencies have established in-house training departments that will train their respective staff as they make the transition to emission technology.
- Transit associations
 - » Participation in committees such as Zero Emission Technology, Maintenance, and Workforce Development within transportation associations such as the American Public Transportation Association (APTA), California Transit Association (CTA), and the California Association for Coordinated Transportation (CalAct) provide insight to lessons learned and network resources.

The vehicle operator and maintenance training programs are detailed in Table 7, along with the updated training program that will include modifications for the battery electric vehicle technologies. SamTrans will also train bus operators on how to maximize vehicle regenerative energy and making best use of available power.

Table 7: Anticipated Maintenance and Operator Training

Training Module	Training Hours	Diesel	Battery-Electric
Shop Safety and Procedures	16	X	
High Voltage Safety (onboard systems and charging procedures)	16		X
Vehicle Familiarization, Systems and Sub-Systems Overview	8	X	X
Fundamentals of Troubleshooting	16	X	X
Basic Repair Skills	16	X	X
Basic Electrical	24	X	X
Air Brake Systems	24	X	X
Hydraulic Brake Systems	8	X	X
Steering and Suspension Systems	16	X	X
Sub-Systems (Cameras, Hubner, Windows, Doors, CLASS, Fire Suppression and Detection)	32	X	X
Multiplex systems	24	X	X
Diesel Engine Tune-up and Troubleshooting (Phased-out with 100% ZEB Fleet)	24	X	
Diesel Engine Electronic Control Systems (Phased- out with 100% ZEB Fleet)	16	X	
Automatic Transmissions (Phased-out with 100% ZEB Fleet)	24	X	
Heating, Ventilation, and Air Conditioning	16	X	X
Advance Communication System	16	X	X
BEB High Voltage Systems Troubleshooting and Repair	24		X
BEB Low Voltage Systems Troubleshooting and Repair	16		X
New Vehicle Bus Operator orientation (includes behind the wheel training)	2-4	X	X
BEB Propulsion systems (Drive Motor and Gearbox)	24		X





Potential Funding Sources

Funding

SamTrans is intending to use a variety of funding sources to acquire zero-emissions vehicles and required infrastructure, including regional, state, and federal sources. Examples of funding sources are as follows:

- Transit and Intercity Rail Capital Program (TIRCP)
- Low Carbon Transit Operation Program (LCTOP)
- FTA Funds
 - » 5307 Funds
 - » Section 5339 Bus and Bus Facilities Program
 - » Low-No Program
- SB1 Local Partnership Program (LPP)
- Affordable Housing and Sustainable Communities Program (AHSC)
- Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP)
- Caltrans State of Good Repair (STA SOGR)
- SamTrans Sales Tax

Other potential funding sources have been identified, but not included in the planned budget. These sources could be utilized at a future time to acquire either ZE vehicles or infrastructure.

- Bay Area Air Quality Management District (BAAQMD) Grant Program
- Volkswagen Environmental Mitigation Trust



Table 8: Anticipated Vehicle Funding Sources

Funding Source	Year					
	2023	2024	2025	2026	2027	2028
FTA	20,540,257	28,962,937	50,884,814	18,455,039	1,996,000	25,167,443
LCTOP	5,722,000	2,400,000	1,200,000	1,200,000		2,400,000
LPP	3,100,000	1,100,000	1,100,000	1,100,000		1,100,000
STA SOGR	1,200,000	1,200,000	1,200,000	1,200,000	377,000	1,200,000
TIRCP	-	-	15,000,000	-	-	-
AHSC	2,500,000	-	-	-	-	-
SamTrans	1,369,567	2,540,734	33,341,794	1,113,760	122,000	1,591,861
Vehicle Budget	34,431,825	36,203,671	102,726,608	23,068,799	2,495,000	31,459,303
Vehicle Type	Vehicles Purchased by Type					
Standard ZEB	15	20	25	12		
Standard Diesel	15	20	40	13		
Express Bus ZEB	7		30			
Paratransit ZEB					7	
Paratransit Gasoline		9	3		6	

Table 9: Anticipated Infrastructure Funding Sources

Infrastructure Type/Location	Year						
	2022	2023	2024	2025	2026	2027	2028
Basic Infrastructure							
North Base							\$45,498,357
South Base	\$33,418,630						
Photovoltaic System							
North Base							\$42,707,385
South Base	\$34,089,000						
Infrastructure Connection							
North Base							
South Base			\$12,852,000	\$7,956,000	\$7,956,000		\$12,852,000
Infrastructure Budget	\$70,545,473	\$0	\$13,430,340	\$8,314,020	\$8,314,020	\$0	\$105,605,340



Start-up and Scale-up Challenges

The Road Ahead

San Mateo County Transit District has learned there are still many unknowns and unexpected challenges to overcome:

- Deployment of ZEBs and infrastructure adds significant capital and operating costs
- Procurement of ZEBs now require careful timing to deliver ZEB infrastructure capital projects when ZEBs arrive on property
- ZEB operation is vulnerable to utility company priorities
- ZEB technology is evolving at a rapid pace, which complicates O&M with compatibility of components and charging infrastructure.
- IT Infrastructure cost/challenges
- Funding challenges due to the uncertainty of funding availability such as the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP), and the complexities of funding matches by type and percentages.
- Unexpected short-term and long-term impacts due to an emergency such as the COVID-19 pandemic or a natural disaster.

Without a doubt, ZEBs are readily available; however, in order to successfully transition the fleet, SamTrans will need policy makers, industry OEMs and energy providers to help address the existing challenges and risks.

It is important to note, the District's ZEB Rollout Plan is a living document meant to guide the implementation of zero-emission bus fleets and help the District work through many of the potential challenges to explore solutions. The Plan provides estimated timelines based on best available information for bus purchases, infrastructure upgrades, workforce training, or any other timelines in the Plan. SamTrans may update the Plan as needed with the most current information and industry best practices.