

# Update of Innovative Clean Transit (ICT) Plan

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SamTrans Board of Directors  
December 6, 2023



# TOPICS

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**samTrans**  
Innovative Clean Transit (ICT) Rollout Plan

December 2, 2020

# Background

- ✓ **2018: California Air Resources Board (CARB) adopted ICT Regulation**
  - Requires transit providers to transition fleet to 100% Zero Emission (ZE) by 2040
  - Requires 100% of fleet purchases to be ZE by 2029
- ✓ **2020: SamTrans ICT Plan approved by Board**
  - Battery electric buses (BEBs) only
  - Includes diesel bus purchases
  - Complete ZE transition in 2038



# Program Scope



Vehicle  
Replacement



Infrastructure



Workforce  
Training

# Program Scope Fixed Route Service

446 square miles  
service area

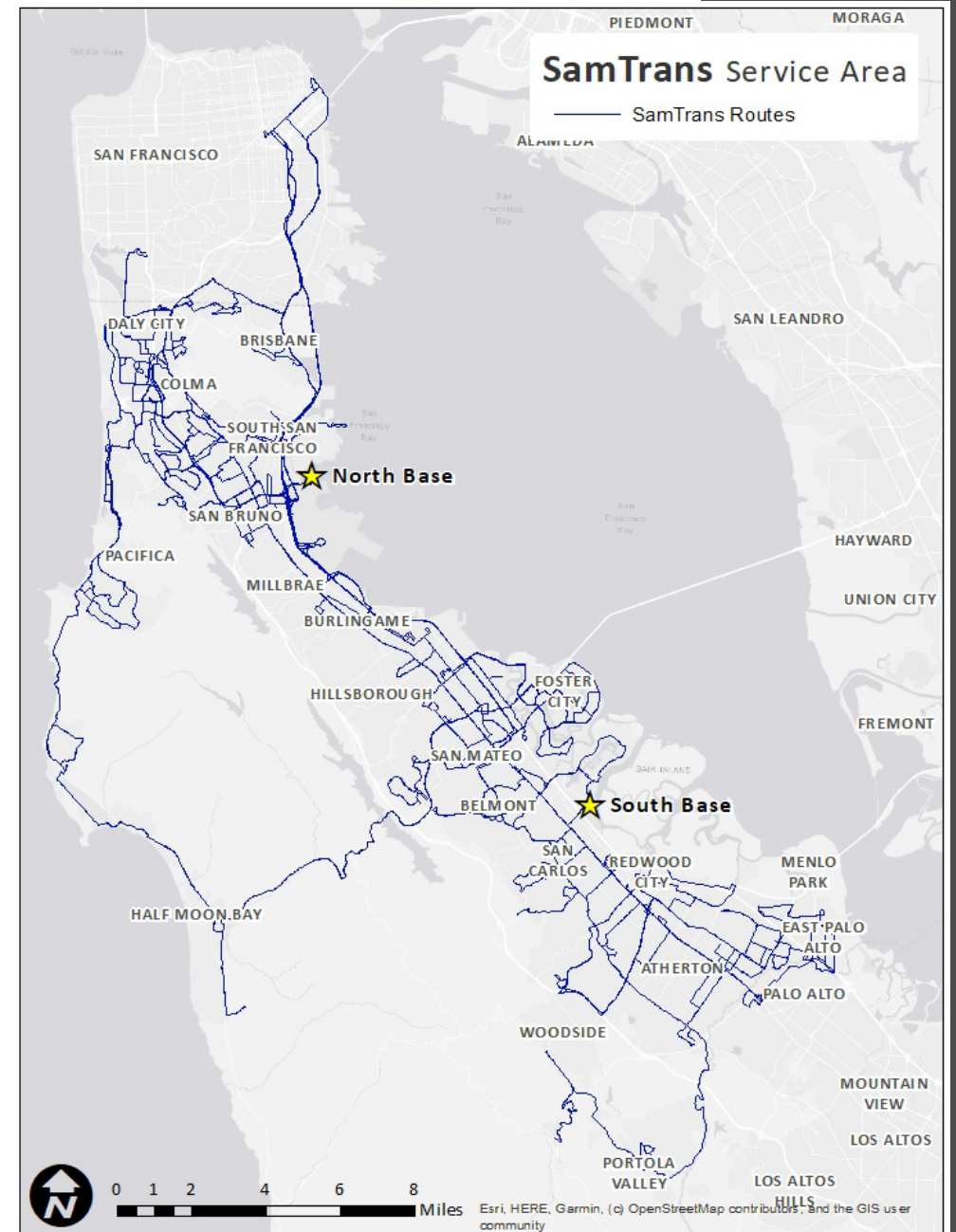


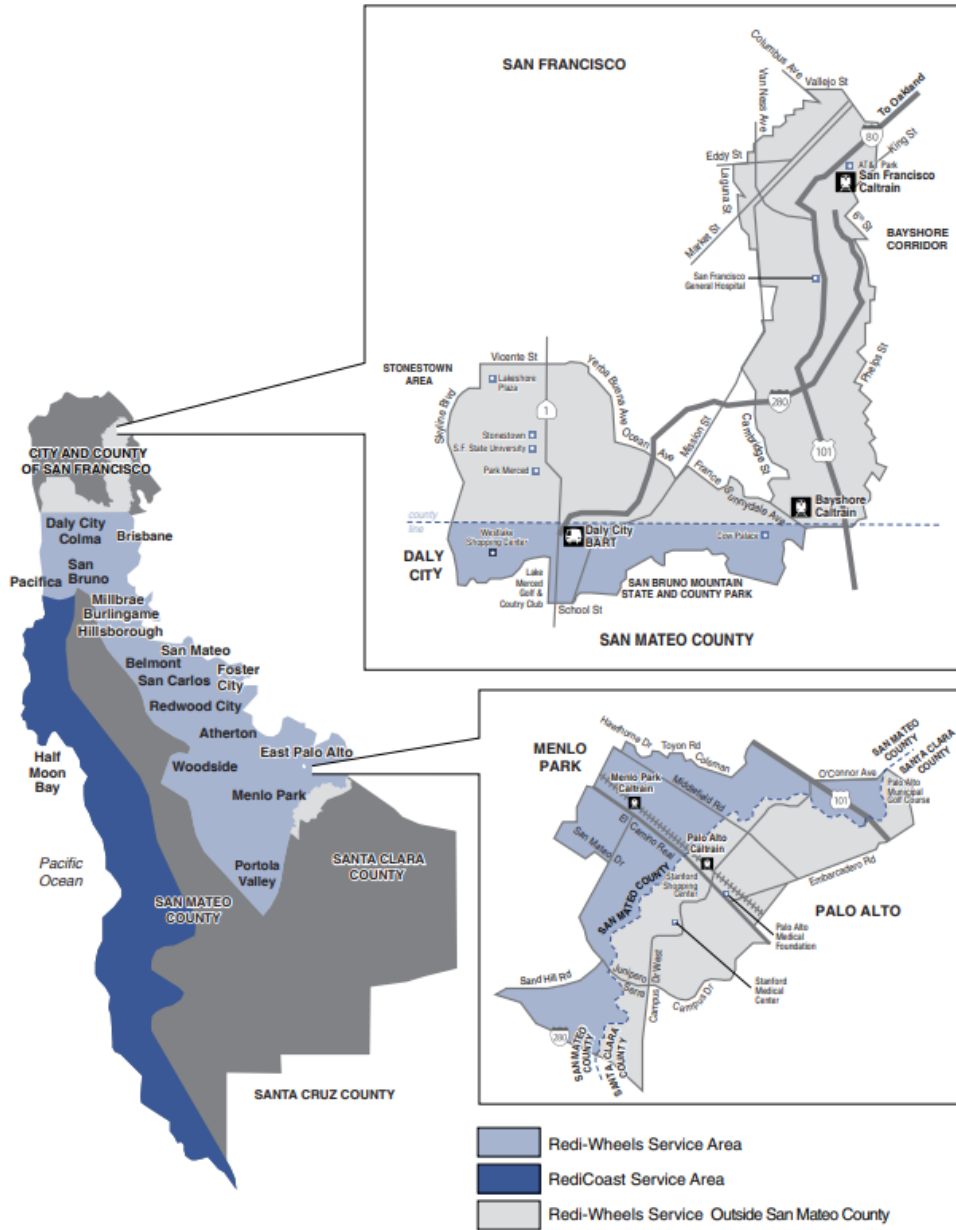
Over 10 million  
trips (pre-COVID)



67 Routes/322 Buses

Local | Community |  
Express/Limited |  
School-oriented | Owl |  
& Special Routes





# Program Scope

## Paratransit Service



**70 Vehicles**

To be replaced by ZEVs starting 2026



**Shared Ride, Curb-to-Curb Service**

Optional door-to-door



Over **344K** trips (pre-COVID)

# Program Scope

# North Base

# Infrastructure

Photo Credit: [Craig Howell](#)



## Location

- 301 N Access Rd South San Francisco



## Size

- 27 acres



## Vehicles

- 175 buses



## Zero-Emission Infrastructure Status

- 10 Interim Chargers commissioned

\* Zero emission infrastructure constructed on SamTrans-owned property with no disruption to bus service

# Program Scope

# South Base

# Infrastructure



## Location

- 501 Pico Boulevard  
San Carlos



## Size

- 13 acres



## Vehicles

- 147 buses



## Zero-Emission Infrastructure Status

- 10 Interim Chargers under construction (late 2024)
- 37 Permanent BEB Chargers (late 2026)

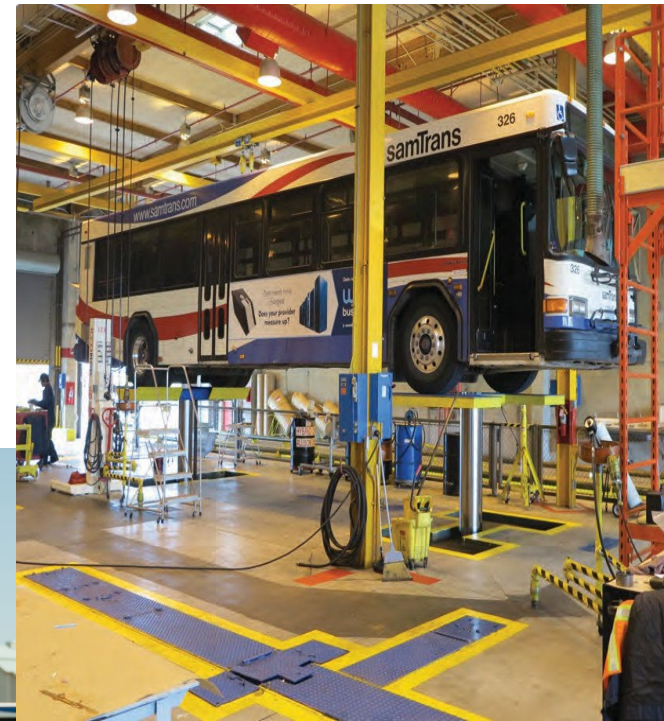
\* Zero emission infrastructure constructed on SamTrans-owned property with no disruption to bus service



# Program Scope Workforce Training

Similar job duties/descriptions.  
New skills!

- ✓ Training
- ✓ Skills gap assessment
- ✓ Re-skilling modules



SamTrans is committed to  
training staff

# Zero Emission (ZE) Technology Evaluation



**BEBs**

## **Battery Electric Buses (BEBs)**

Range: 150 – 200 miles

Charging Time: 4 - 6 hours

**FCEBs**

## **Hydrogen Fuel Cell Electric Buses (FCEBs)**

Range: approx. 300 miles

Fueling Time: 10 - 15 minutes

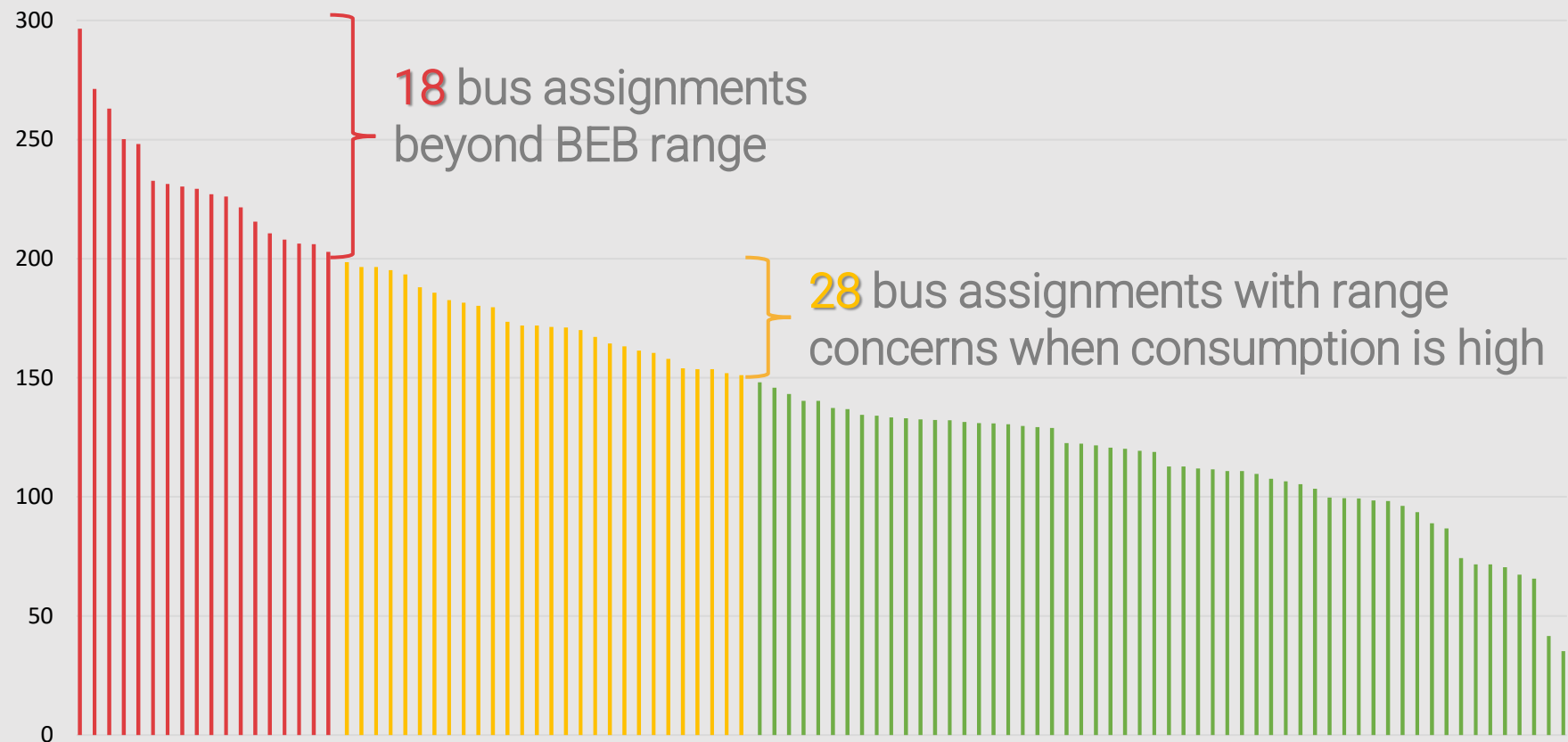
# ZE Technology Evaluation Fixed Route Service (North Base)

● BEB Travel Range:  
~150 miles – 200 miles

● FCEB Travel Range:  
~300 miles

*Assumed 40' bus with 440 kWh, energy consumption at 2.02 kWh/mile – 3 kWh/mile.*

North Base Bus Assignments Distance (Weekday)



● 18% - 45% of bus assignments may have range concerns if only using BEBs

● All bus assignments can be completed by FCEBs

# ZE Technology Evaluation Fixed Route Service (South Base)

● BEB Travel Range:  
~150 miles – 200 miles

● FCEB Travel Range:  
~300 miles

*Assumed 40' bus with 440 kWh, energy consumption at 2.02 kWh/mile – 3 kWh/mile.*

South Base Bus Assignments Distance (Weekday)



● Fewer bus assignments than North Base

● Most bus assignments are shorter than 150 miles

● 1% - 8% of bus assignments may have range concerns if only using BEBs

# FCEB Demonstration

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Mobile Hydrogen Refueler

- ✓ June 2022: Board approved purchase of 10 FCEBs for North Base as part of a Demonstration Program
- ✓ May 2023: Board approved purchase of a mobile hydrogen refueler & award of a 2-year hydrogen supply contract for the 10 FCEBs
- ✓ May 2023: Board approved contract to modify 4 maintenance bays at North Base to enable indoor maintenance of FCEBs

# Life-cycle Cost Analysis\*

- Performed for **North Base** Fixed Revenue Fleet
- FCEBs** have lower infrastructure costs; **BEBs** have lower energy costs
- 12-year lifecycle cost savings of FCEB fleet estimated at **\$94 M**

CAPITAL & OPERATING COSTS (12-year Lifecycle)		
Item	BEB Option	FCEB Option
Number of Buses	185	162
<b>Buses</b>	\$252,393,157	\$247,008,174
<b>Infrastructure</b>	\$144,950,000	\$36,150,000
<b>Maintenance</b>	\$40,492,886	\$50,686,882
<b>Energy (Electricity &amp; Hydrogen)</b>	\$41,096,703	\$51,129,786
<b>Lifecycle Cost Total (NB)</b>	\$478,932,746	<b>\$384,974,842</b>

# BEB Infrastructure\*



DIGITAL RENDERING

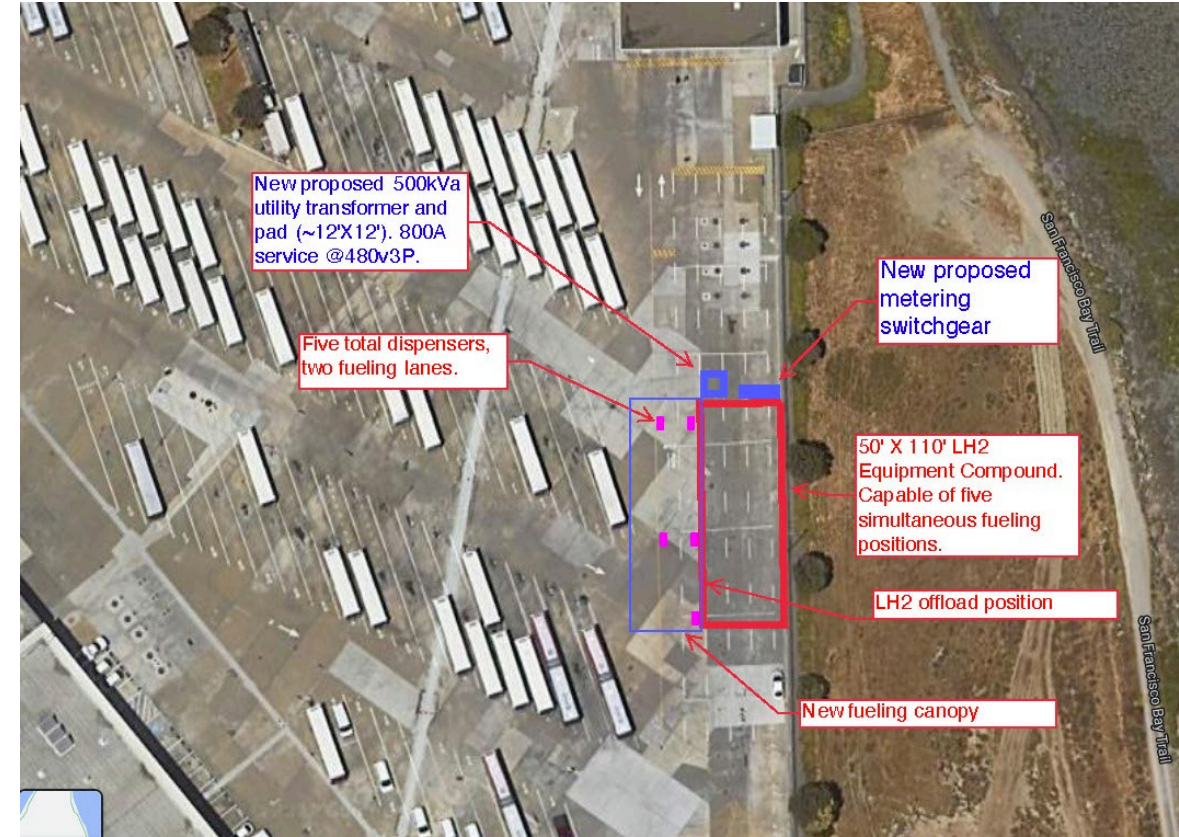


\* Provided at Mar-23 Board Workshop



SCALE: 1" = 20'	24' BUS, Rack/Shop	<b>NORTH BASE</b> SAMTRANS ALTERNATIVE 2 - OPTIMIZE DRIVE AISLE WIDTH	
DATE: FEB 2019	40' BUS, Fixed Route		
FILE:	60' BUS, Fixed Route		
<b>VEHICLE COUNT</b>			
24' BUS		57	
40' BUS		187	
60' BUS		28	
<b>TOTAL</b>		<b>272</b>	

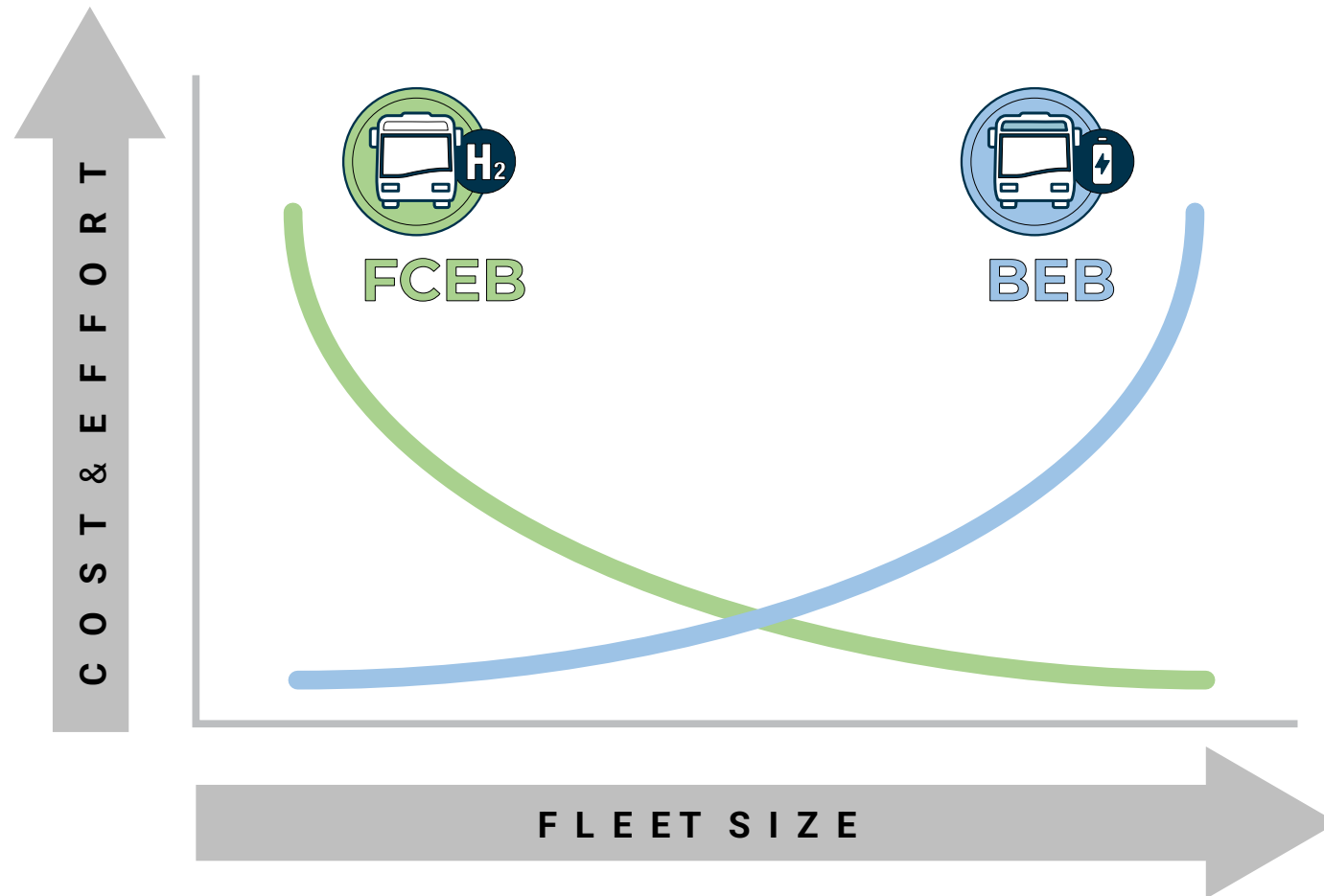
# FCEB Infrastructure\*





## FCEBs vs. BEBs

# Cost per Bus vs. Fleet Size\*



\* Provided at  
Mar-23 Board  
Workshop

## FCEBs vs. BEBs

# ZE Technology Comparison\*

		Fuel Cell Electric Bus (FCEB)	Battery Electric Bus (BEB)
Market	Number of Manufacturers		✓
Operations	Advertised Range	✓	
	Fueling Time	✓	
	Resilience	✓	
Costs	Maintenance		✓
	Energy/Fuel		✓
Facility	Infrastructure	✓	
Climate	GHG Reduction		✓

\* Provided at Mar-23 Board Workshop





SAN MATEO COUNTY TRANSIT DISTRICT

### **SAMTRANS INNOVATIVE CLEAN TRANSIT ROLLOUT PLAN**

NOVEMBER 2023  
DRAFT



\* Aligns with  
Recommendations  
at Mar-23 Board  
Workshop

# 2023 ICT Plan Update\*

- ✓ Replaces all fixed route vehicles at North Base with FCEBs
- ✓ Eliminates diesel bus purchases
- ✓ Defers decision for remaining South Base fleet until 2024
- ✓ Increases focus on equity and workforce development
- ✓ Completes zero emission transition in 2034



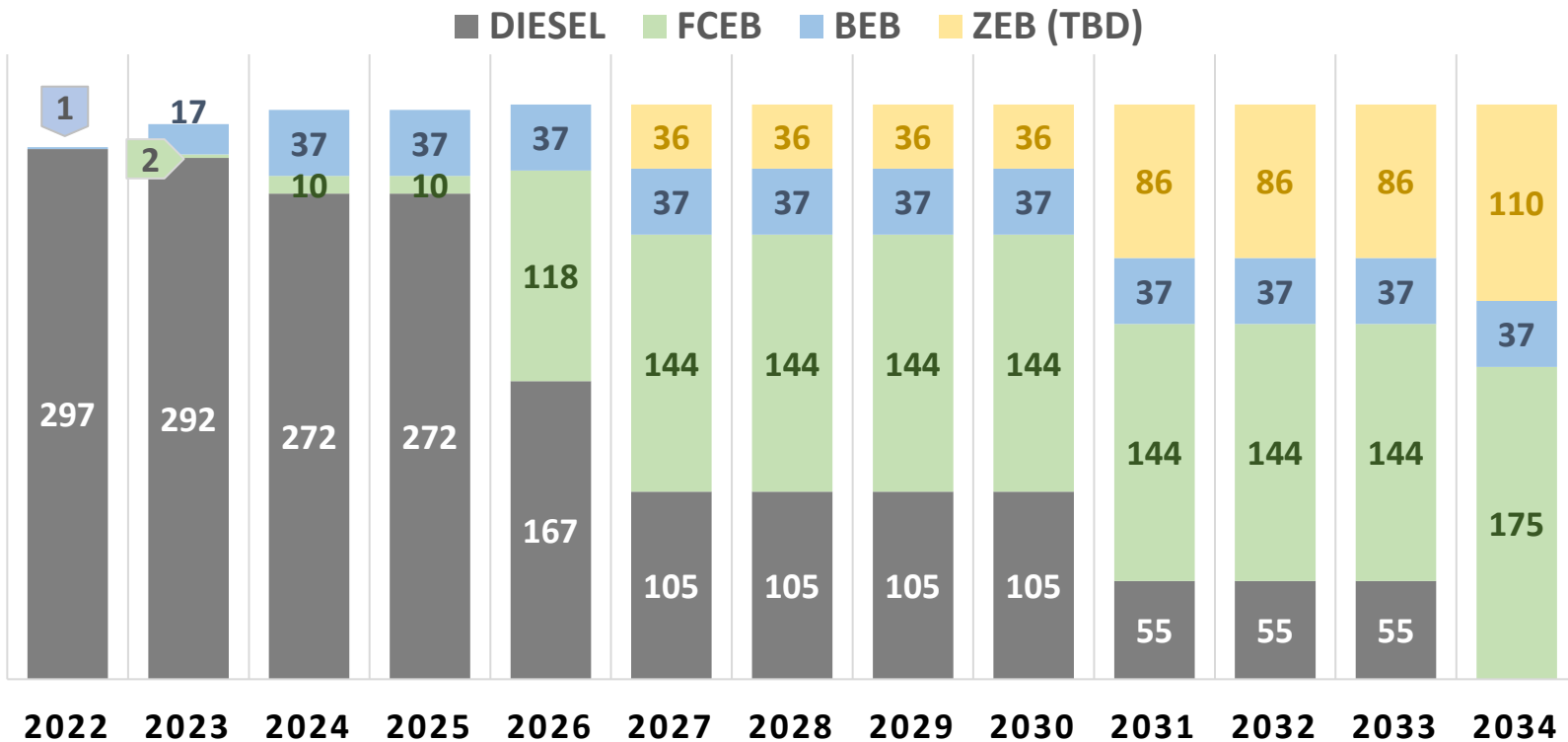
# 2023 ICT Plan

# Fleet Procurement Plan

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Procurement Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
<b>FCEBs (No. Base)</b>	<b>0</b>	<b>10</b>	<b>20</b>	<b>88</b>	<b>26</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>31</b>
<b>BEBs (So. Base)</b>	<b>7</b>	<b>30</b>	<b>0</b>									
<b>ZEBs (So. Base)</b>				<b>0</b>	<b>36</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>50</b>	<b>0</b>	<b>0</b>	<b>24</b>
	<b>7</b>	<b>40</b>	<b>20</b>	<b>88</b>	<b>62</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>50</b>	<b>0</b>	<b>0</b>	<b>55</b>

# 2023 ICT Plan Fleet Replacement Plan



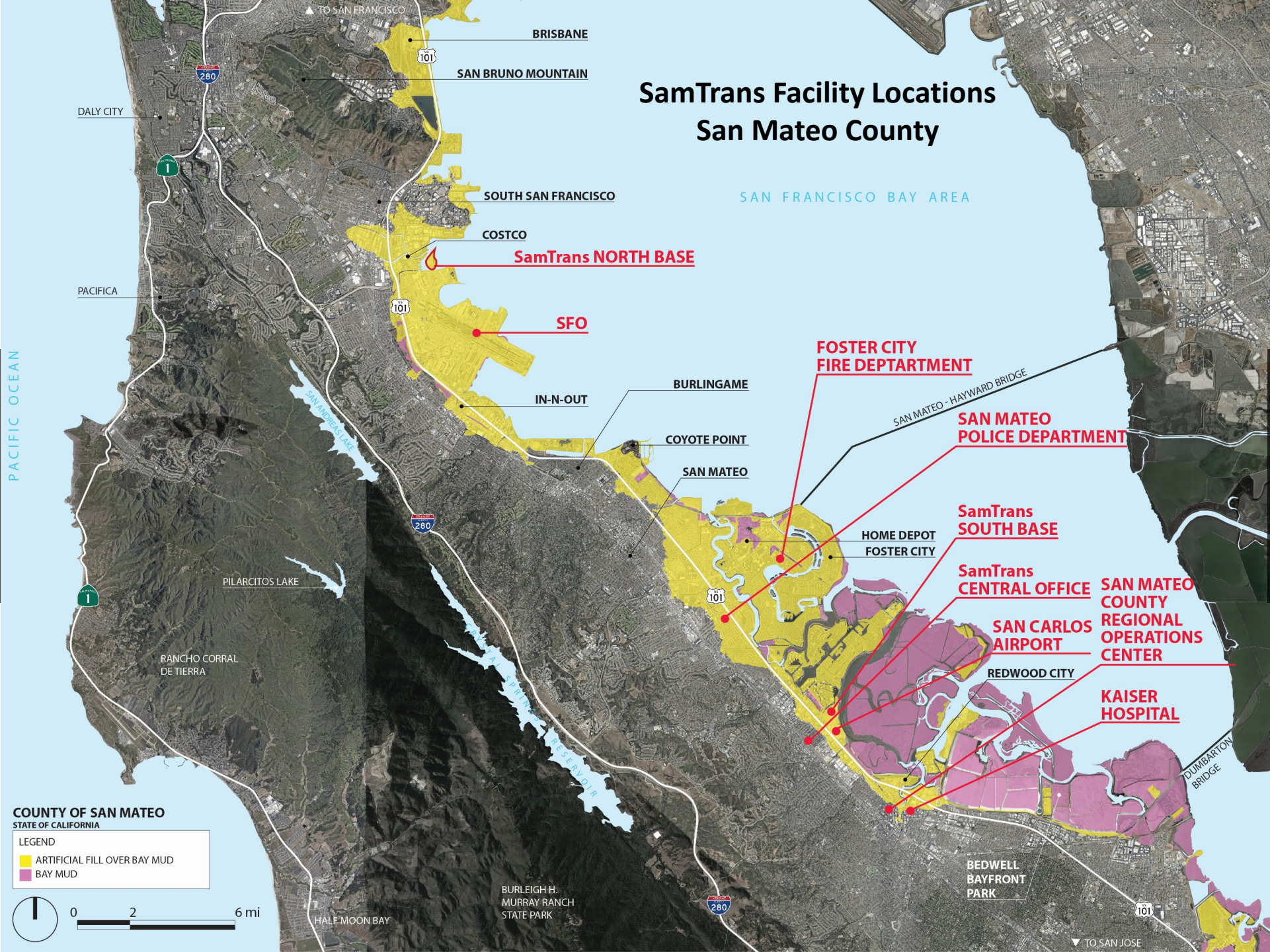
- 2023 6% ZEB
- 2026 48% ZEB
- 2034 100% ZEB

# 2023 ICT Plan Infrastructure



- ✓ Hydrogen Storage & Fueling Station at North Base
- ✓ Additional Modifications to North Base Maintenance Building
- ✓ Additional Permanent BEB Chargers and/or Hydrogen Fueling Station at South Base, depending on decision for remaining fleet

# SamTrans Facility Locations San Mateo County



**COUNTY OF SAN MATEO**  
STATE OF CALIFORNIA

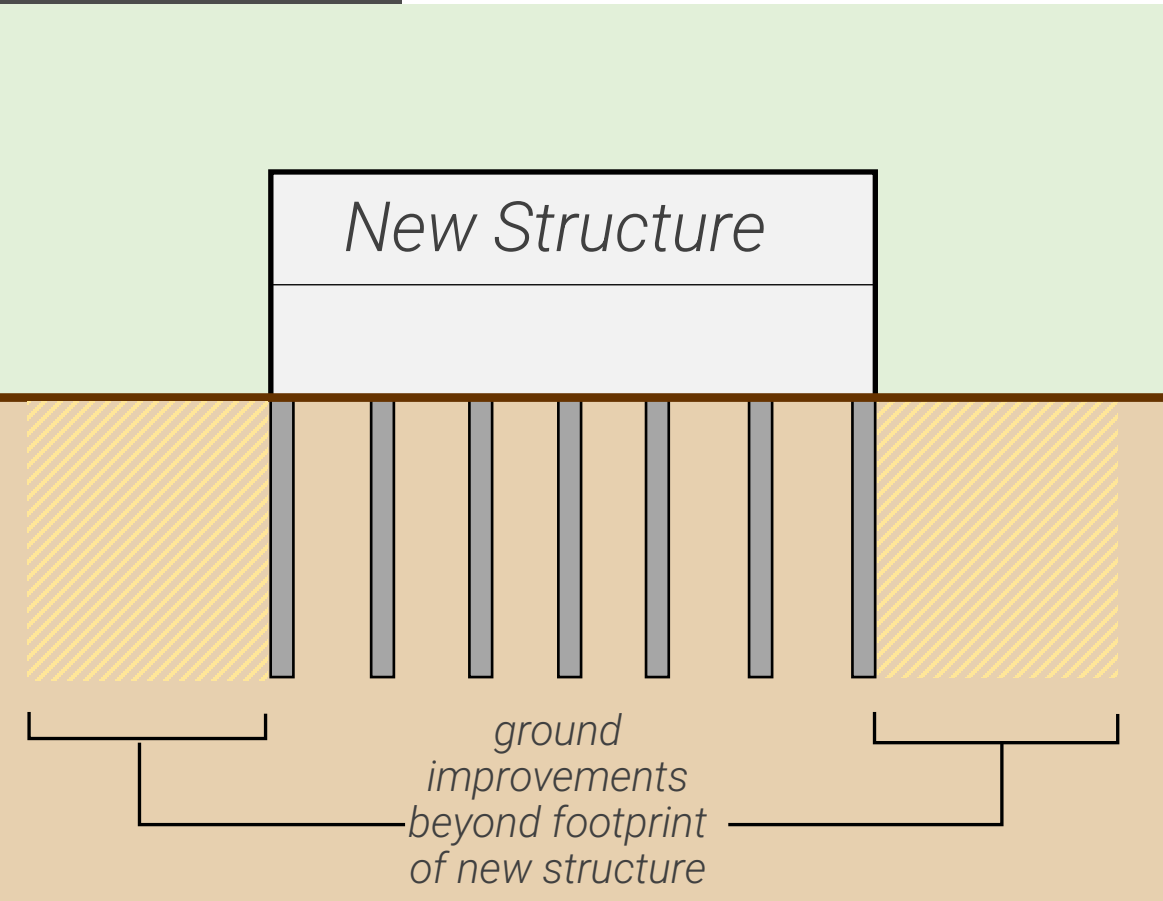
LEGEND

- ARTIFICIAL FILL OVER BAY MUD
- BAY MUD

0 2 6 mi

# 2023 ICT Plan

## Soils & Foundations



- ✓ Add materials to strengthen soil
- ✓ Install deep foundations to reduce settlement potential
- ✓ Place ground improvements beyond the building's footprint to confine soil
- ✓ Engage an independent third-party geotechnical engineer to review foundation design

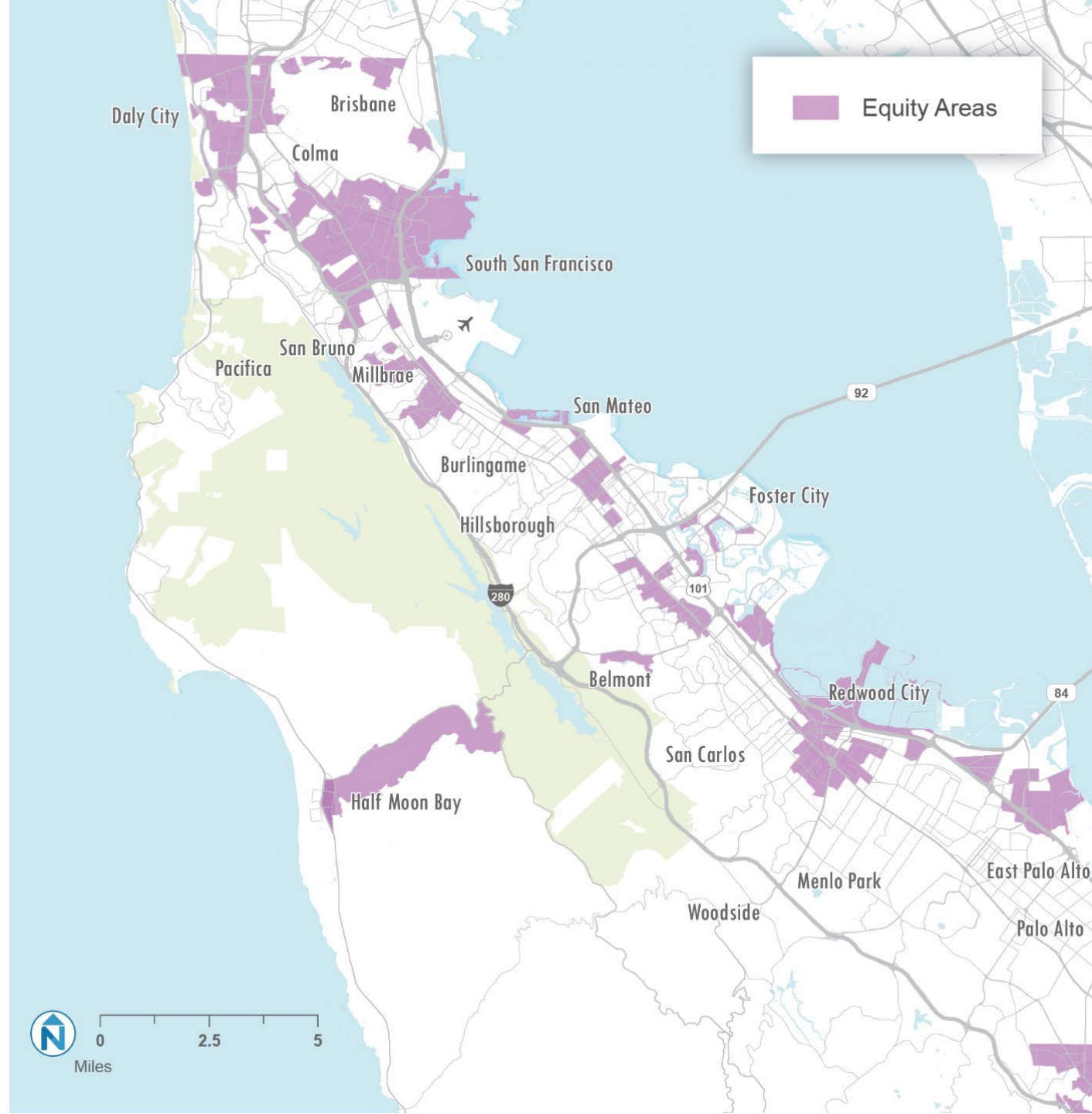


# 2023 ICT Plan Equity Analysis

## Equity Priority Areas

- Low-income households
- Racial and ethnic minorities
- Zero-car households

**Goal: Prioritize service in  
Equity Priority Areas**



Improve Air  
Quality



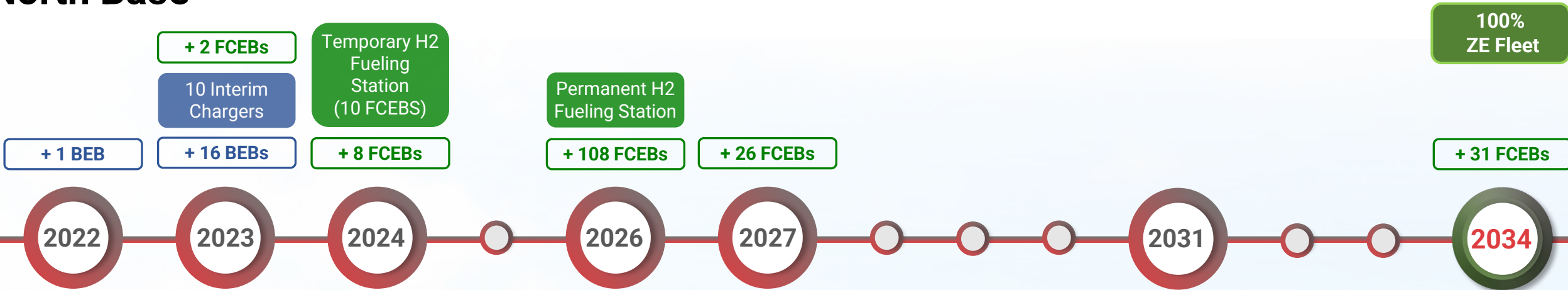
Reduce  
Ambient Noise



Reduce  
Pollution

# Path to Zero Emissions

## North Base



## South Base



# 2023 ICT Plan

## Cost Estimates & Funding

Item	Year of Expenditure	Estimate (in \$M)	Grants and Incentives
<b>Zero Emission Buses (ZEBs)</b>			
FCEBs	FY24	\$ 162.3	\$123.9M (FTA & State grants) + HVIP <sup>2</sup> + ARCHES <sup>3</sup>
FCEBs	FY25 - FY32	\$ 135.3	FTA (50% - 55% of Cost) + State Incentives
ZEBs (TBD) <sup>1</sup>	FY25 - FY32	\$ 198.4	FTA (50% - 55% of Cost) + State Incentives
Paratransit	FY25 - FY32	\$ 35.0	FTA (50% - 55% of Cost) + State Incentives
<b>Total - ZEBs</b>		<b>\$ 531.0</b>	
<b>ZEB Infrastructure</b>			
No. Base - FCEB	FY24 - FY26	\$ 36.2	ARCHES <sup>3</sup> Grant (amount pending)
So. Base - BEB	FY24 - FY27	\$ 37.5	\$28.12M in Federal & State grants
So. Base - ZEB (TBD) <sup>1</sup>	FY26 - FY31	\$ 93.6	Apply for Competitive Grants
<b>Total - ZEB Infrastructure</b>		<b>\$ 167.3</b>	

<sup>1</sup> Cost Estimates assume remaining ZEBs are BEBs

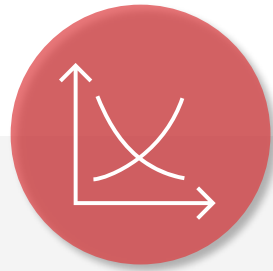
<sup>2</sup> HVIP - CA Hybrid & Zero Emission Truck & Bus Voucher Incentives

<sup>3</sup> ARCHES - Alliance for Renewable Clean Hydrogen Energy Systems (D.O.E. Hydrogen Hub Grant Recipient)

# 2023 ICT Plan Considerations & Challenges



Significant Supply  
Chain &  
Production Delays



BEB Market  
Fluctuations &  
Limited FCEB  
Options



New Protocols for  
Emergency, Safety,  
and Resiliency  
Management



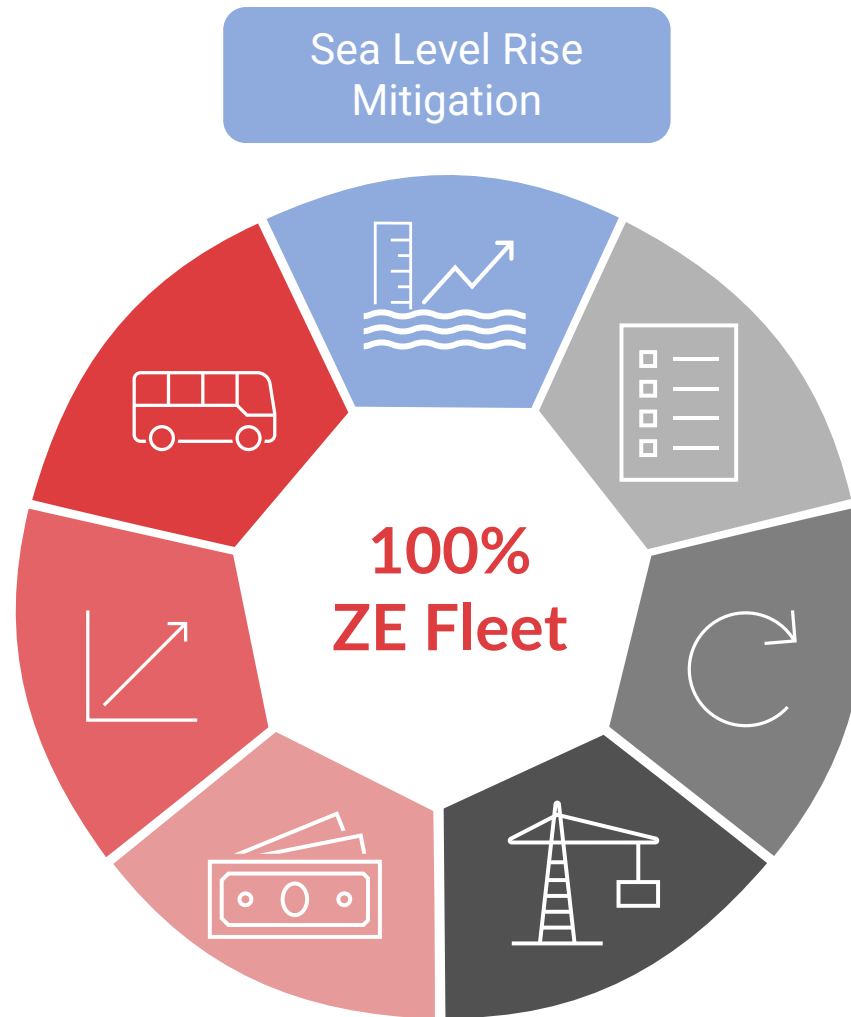
Material Sourcing  
& End-of-Life  
Sustainability

# 2023 ICT Plan Ongoing Efforts

BEB & FCEB  
Real-World Data  
Collection

Continued  
Monitoring of the  
Market

Funding  
Applications



Periodic Review of  
Plan

ICT Regulation  
Annual Fleet Update

Facility Upgrades  
and Vehicle  
Procurements

emission ZERO

# Progress

H<sub>2</sub>

CA 58295



Progress  
17 BEBs delivered to No. Base  
14 BEBs in revenue service



# Progress

## 1 FCEB delivered to North Base

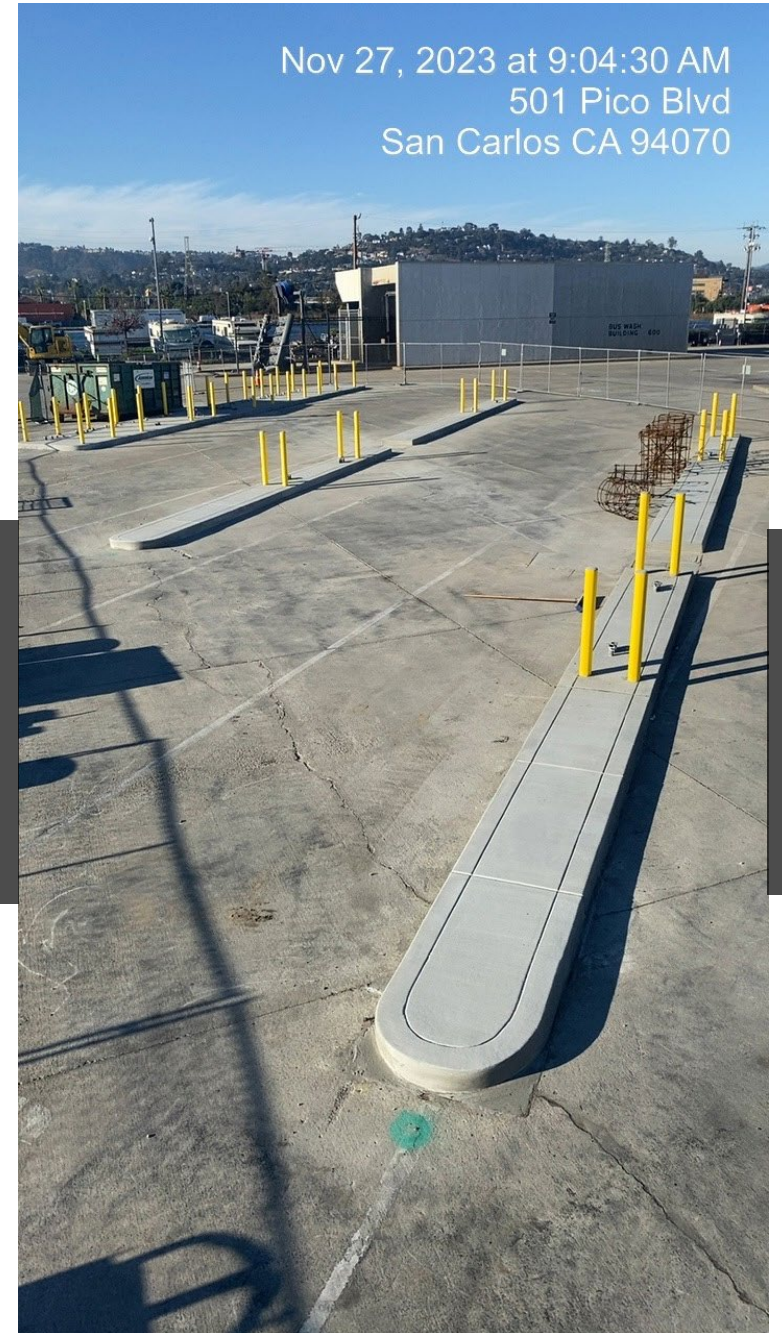




# Progress BEB Infrastructure



*10 Depot  
Chargers at  
North Base*



Nov 27, 2023 at 9:04:30 AM  
501 Pico Blvd  
San Carlos CA 94070



*Construction  
of 10 Depot  
Chargers at  
South Base*

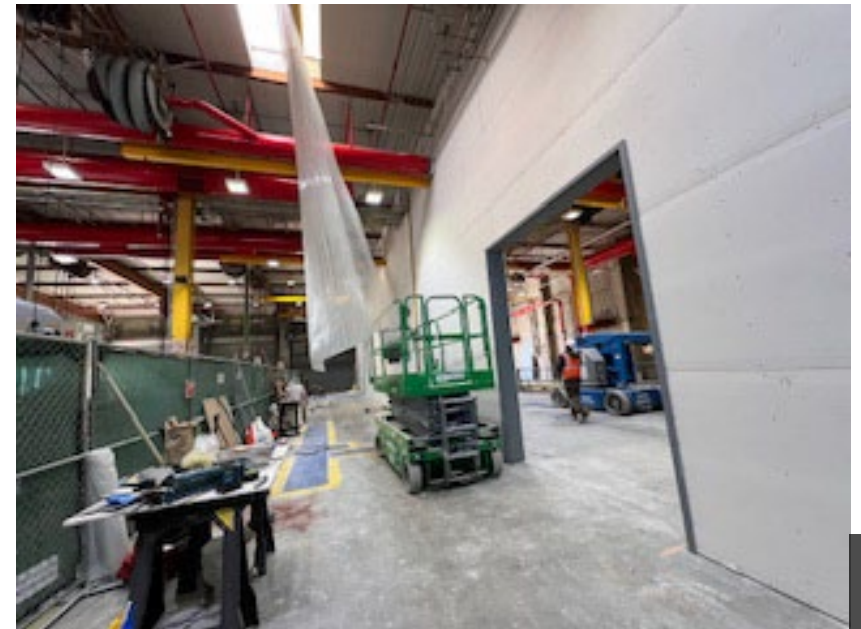
# Progress FCEB Infrastructure



*Mobile Hydrogen Refueler  
to be delivered to North Base*



*North Base  
Maintenance  
Building  
Modifications*





# NEXT STEPS

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- ✓ **Seek Board Approval for Purchase of up to 108 FCEBs**
- ✓ **Submit Updated ICT Plan to California Air Resources Board**

3000 SamTrans

# Q&A

