

# Innovative Clean Transit (ICT) Plan Update

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SamTrans Board of Directors  
November 1, 2023

**Revised 11-01-2023**



# AGENDA

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

December 2, 2020

# Background

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- ✓ **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





SAN MATEO COUNTY TRANSIT DISTRICT

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

NOVEMBER 2023  
DRAFT



# 2023 ICT Plan Update

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## **Mar-2023: Board Workshop**

- ZE Technology Review: BEBS vs. Hydrogen Fuel Cell Electric Buses (FCEBs)
- Life Cycle Cost Analysis: BEBs vs. FCEBs



## **Nov-2023: Update aligns with Mar-2023 Board Workshop**

- FCEBs in addition to BEBs
- Eliminates diesel bus purchases
- Enhanced analysis on equity & workforce
- Complete ZE transition in 2034



# Existing Conditions – North Base

Photo Credit: [Craig Howell](#)



## Location

- 301 N Access Rd South San Francisco



## Size

- 27 acres



## Vehicles

- Accommodates 175 buses



## Zero-Emission Infrastructure Status

- 10 Interim Chargers commissioned
- 1 Hydrogen Mobile Refueler (early 2024)
- 4 indoor FCEB maintenance bays (early 2024)

# Existing Conditions – South Base



## Location

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- 501 Pico Boulevard  
San Carlos



## Size

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- 13 acres



## Vehicles

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- Accommodates  
147 buses

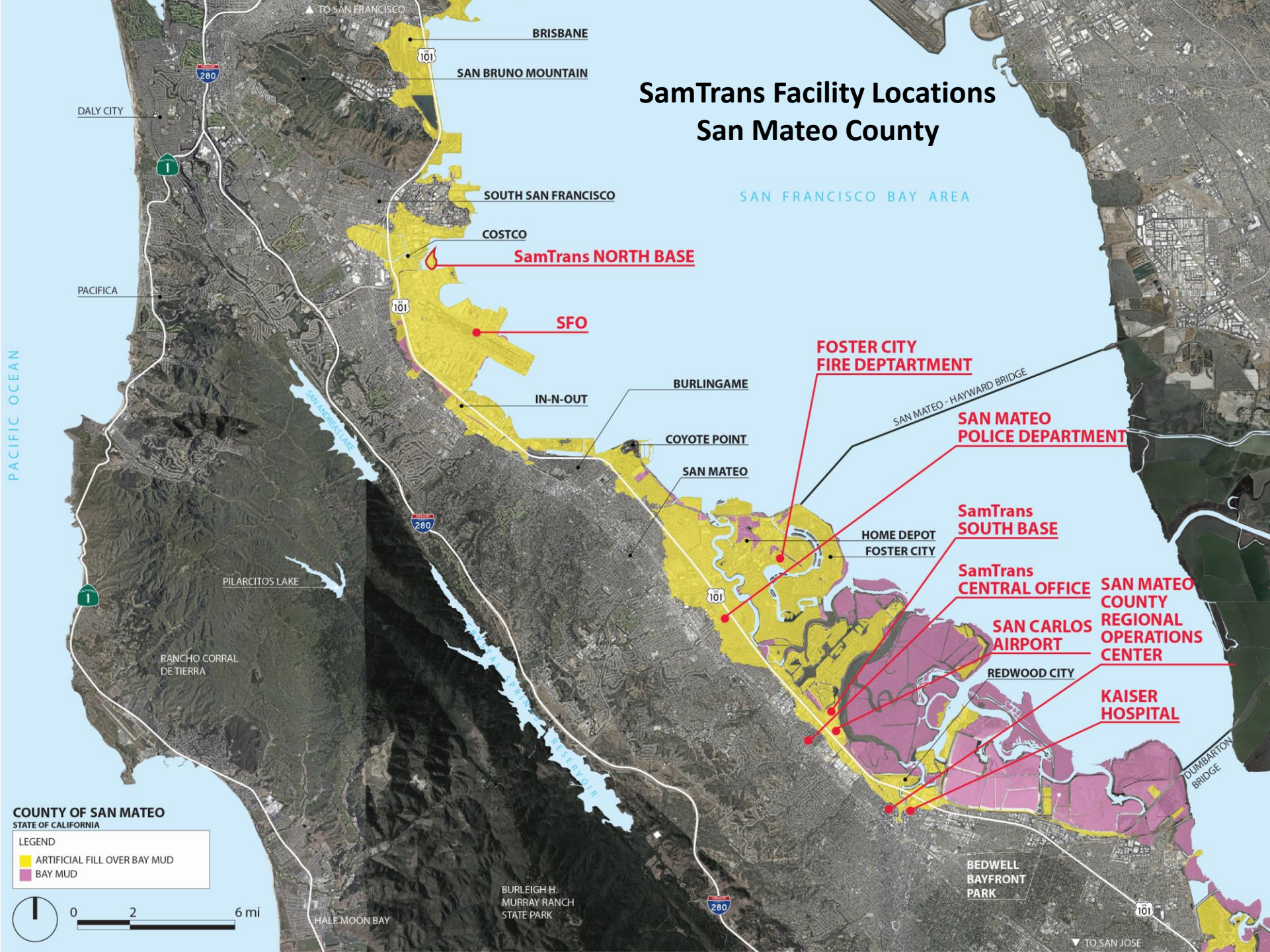


## Zero-Emission Infrastructure Status

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

# SamTrans Facility Locations San Mateo County



# Existing Conditions Fixed Route Service

446 square miles  
service area

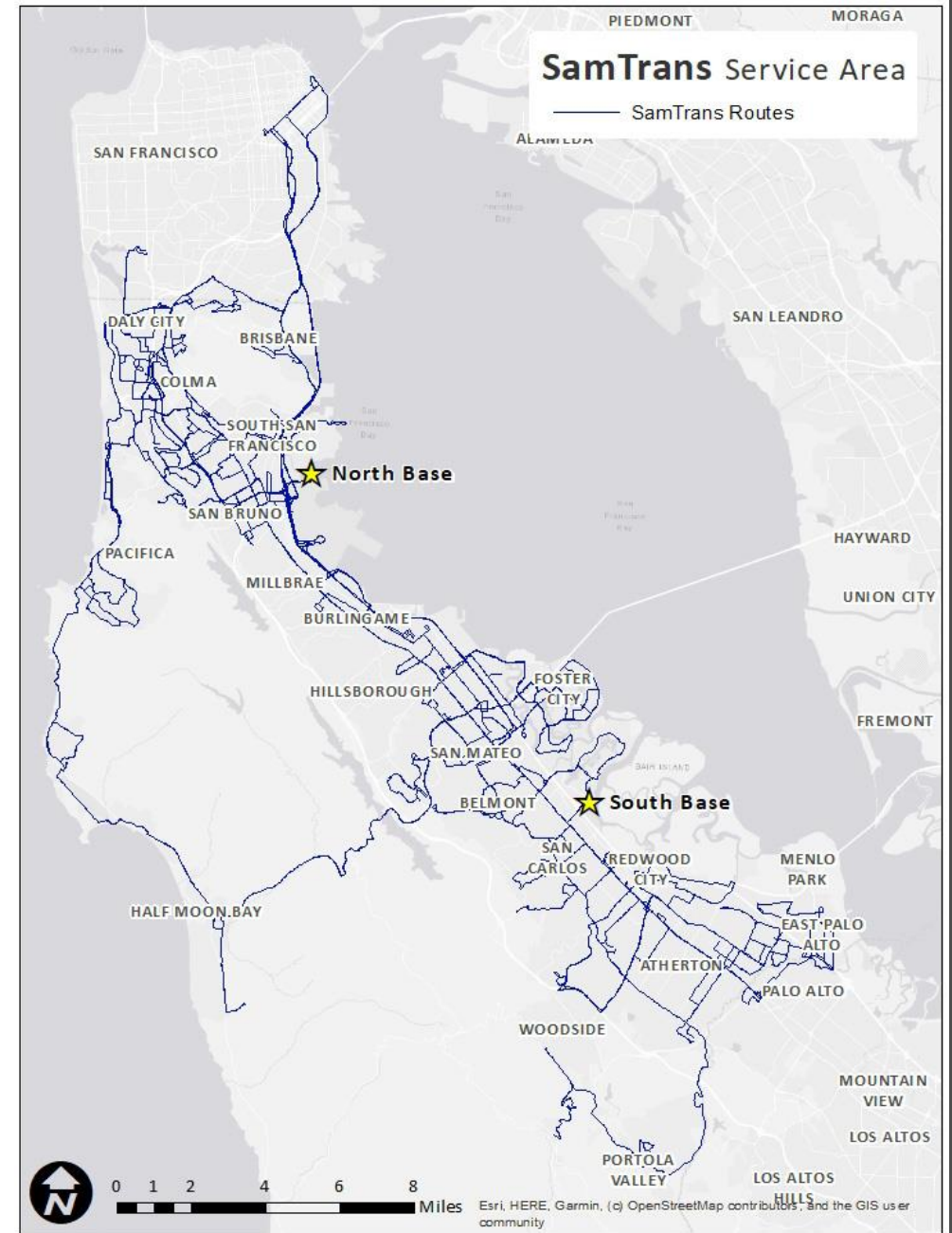


Over 10 million  
trips (pre-COVID)



67 Routes

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





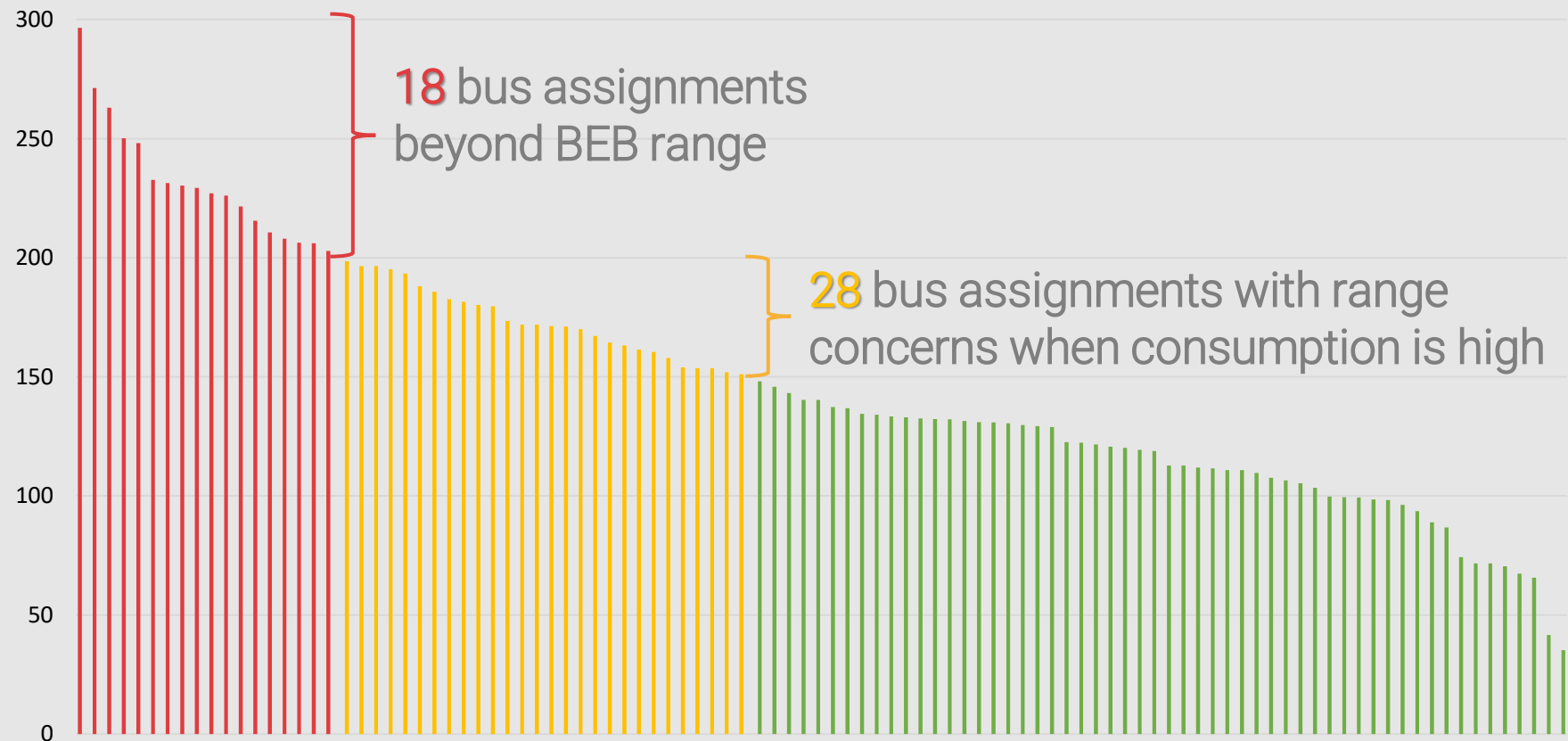
# Existing Conditions Fixed Route Service (North Base)

● 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

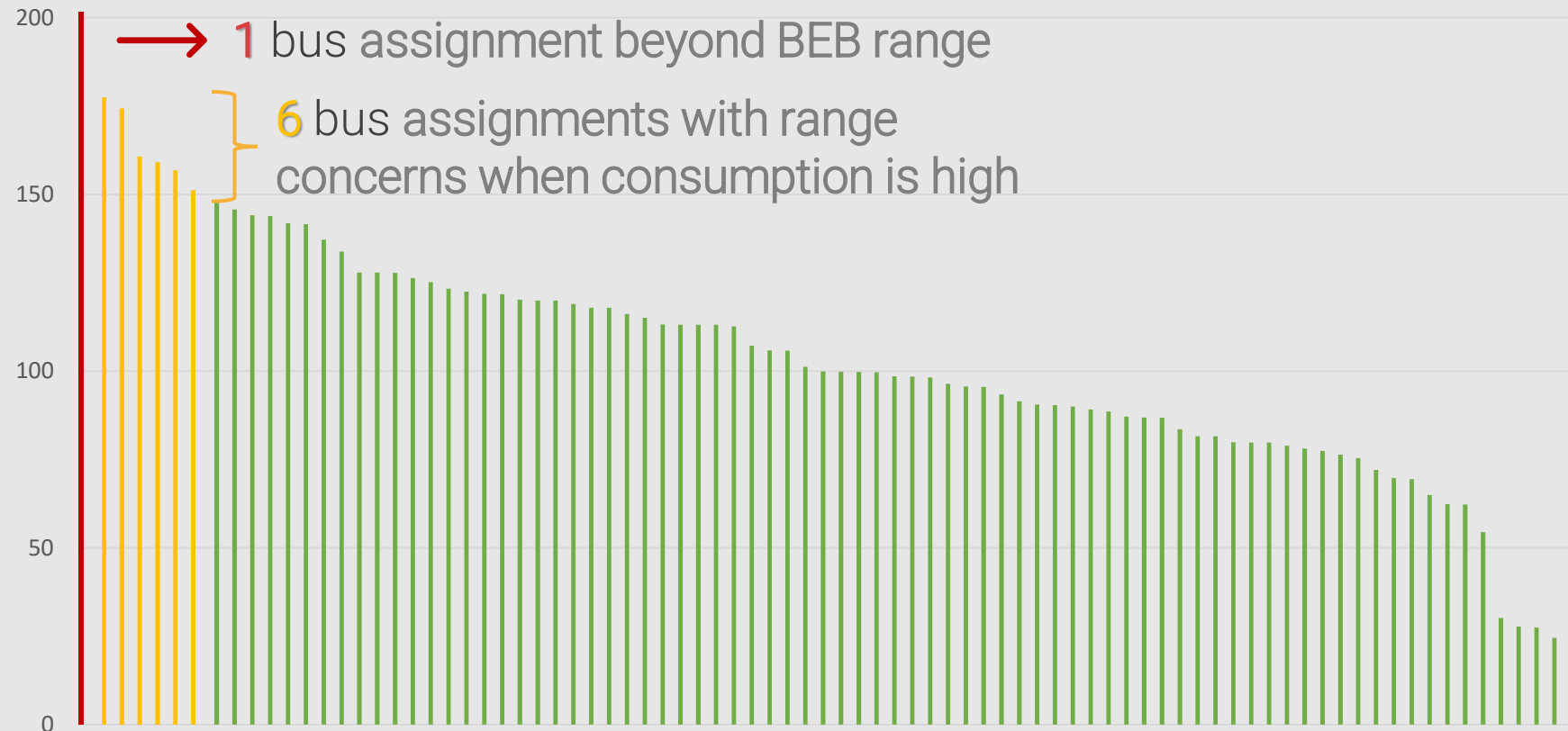
# Existing Conditions Fixed Route Service (South Base)

● 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

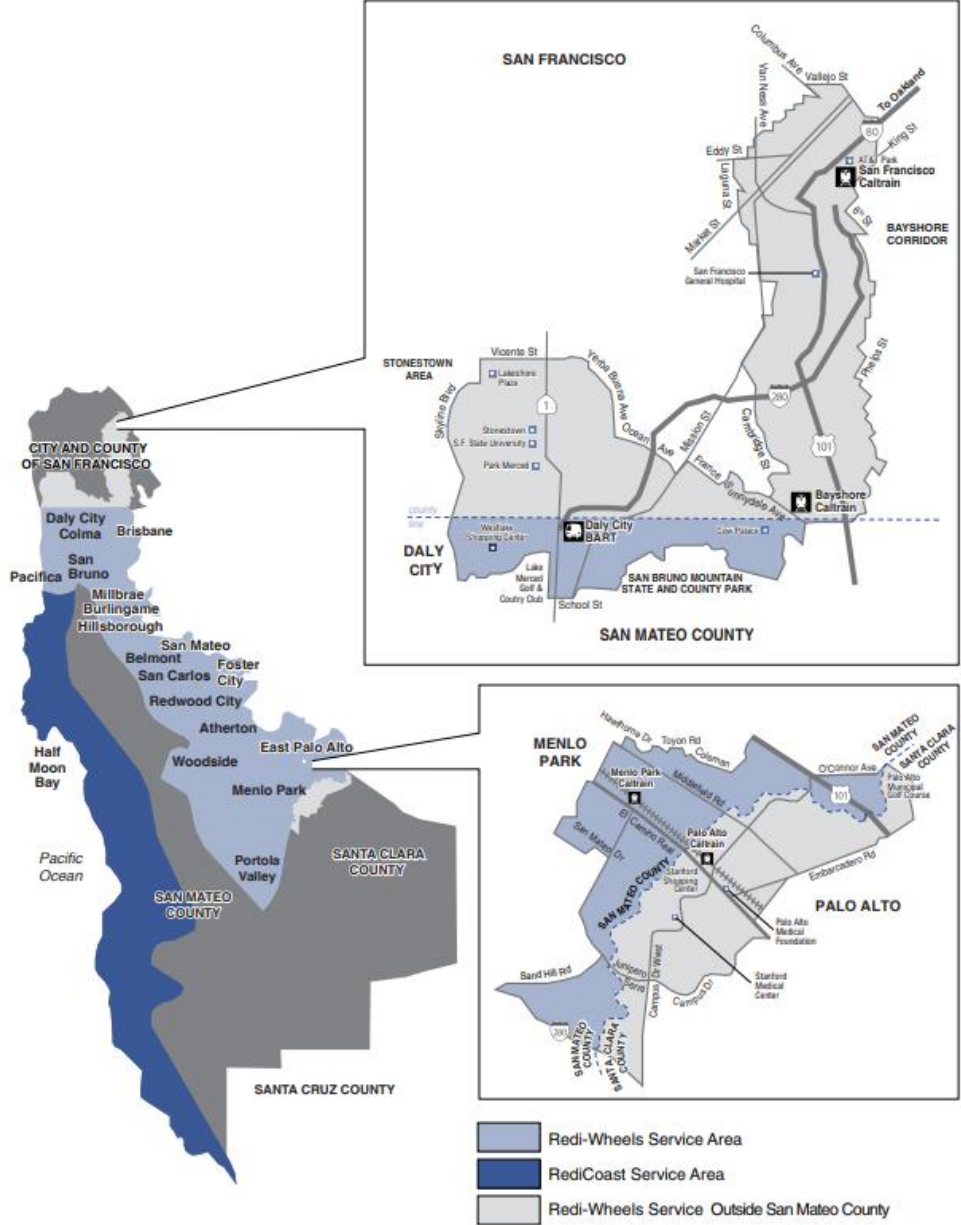
● Most bus assignments are shorter than 150 miles

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



# Existing Conditions

## 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)





# 2023 ICT Plan Update

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# 2023 ICT Plan Highlights



Updated transition timeline achieving **full ZE fleet in 2034** – 4 years ahead of the 2020 Rollout Plan timeline



Updated **technology** evaluations and review of the zero-emission **market**



Closer review of the **equity** impact and **workforce** development implications

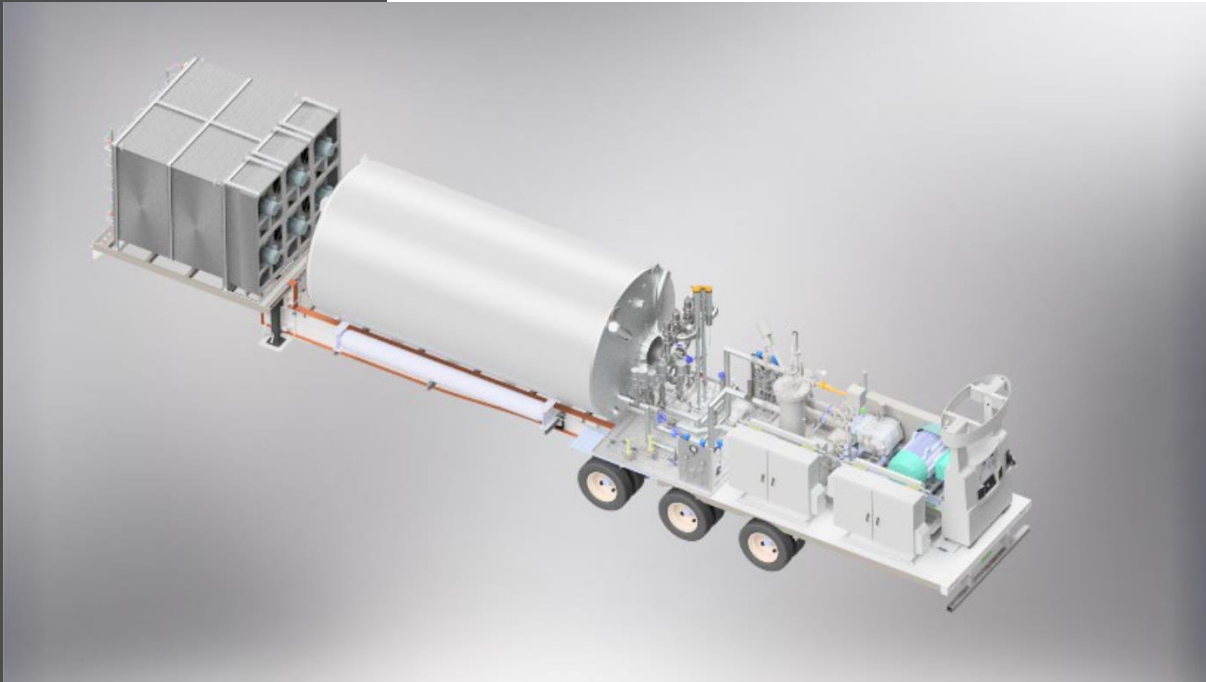
## FCEBs vs. BEBs

# 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           |                               | ☑                          |

# 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

# 2023 ICT Plan Lifecycle Costs – North Base

- **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>              | <b>\$478,932,746</b> | <b>\$384,974,842</b> |



# 2023 ICT Plan

# Fleet Procurement Plan

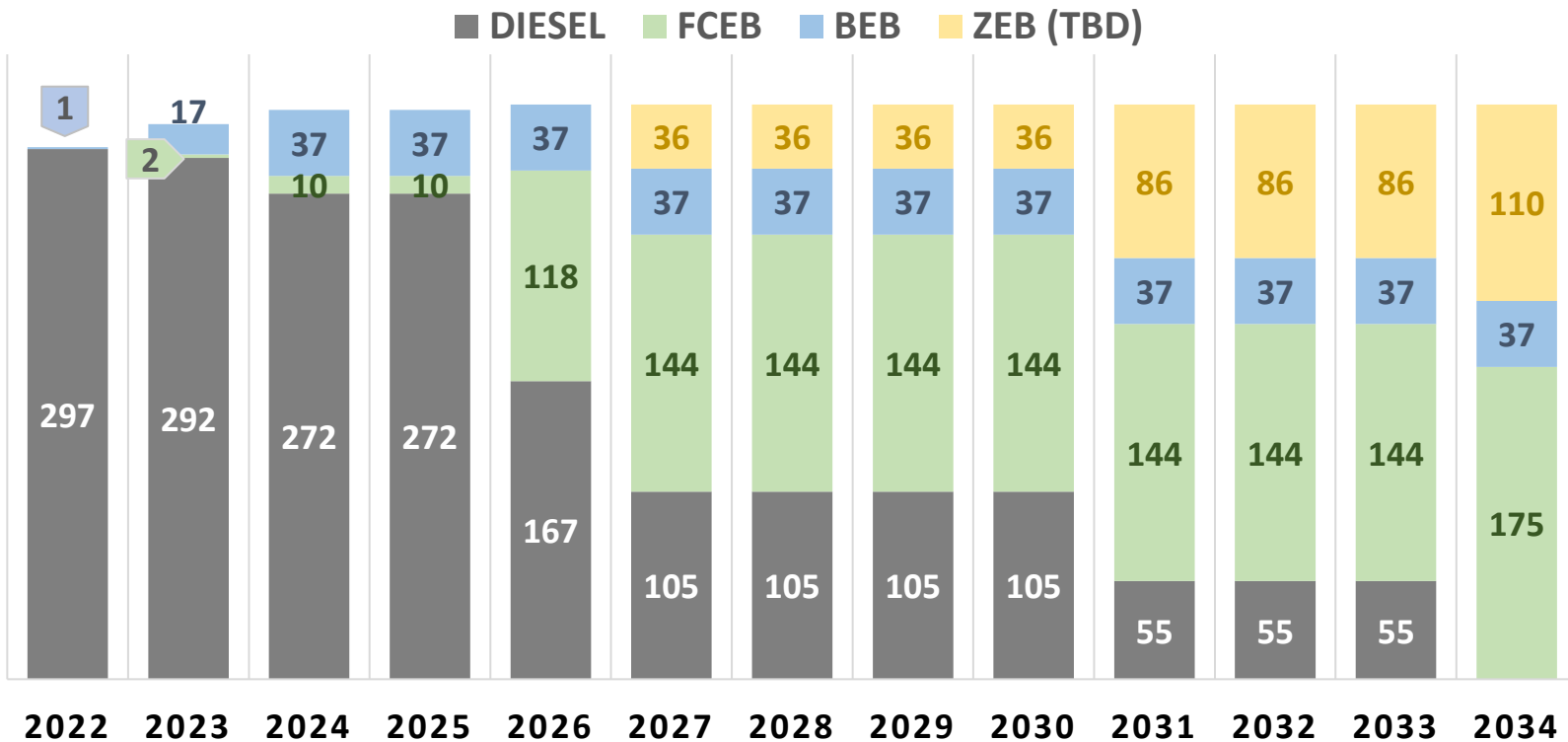
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| Procurement Year        | 2021     | 2022      | 2023      | 2024      | 2025      | 2026     | 2027     | 2028     | 2029      | 2030     | 2031     | 2032      |
|-------------------------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------|----------|----------|-----------|
| <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> |



\* Defer decision on type of ZEB for remaining So. Base fleet until 2024

# 2023 ICT Plan Fleet Replacement Plan



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



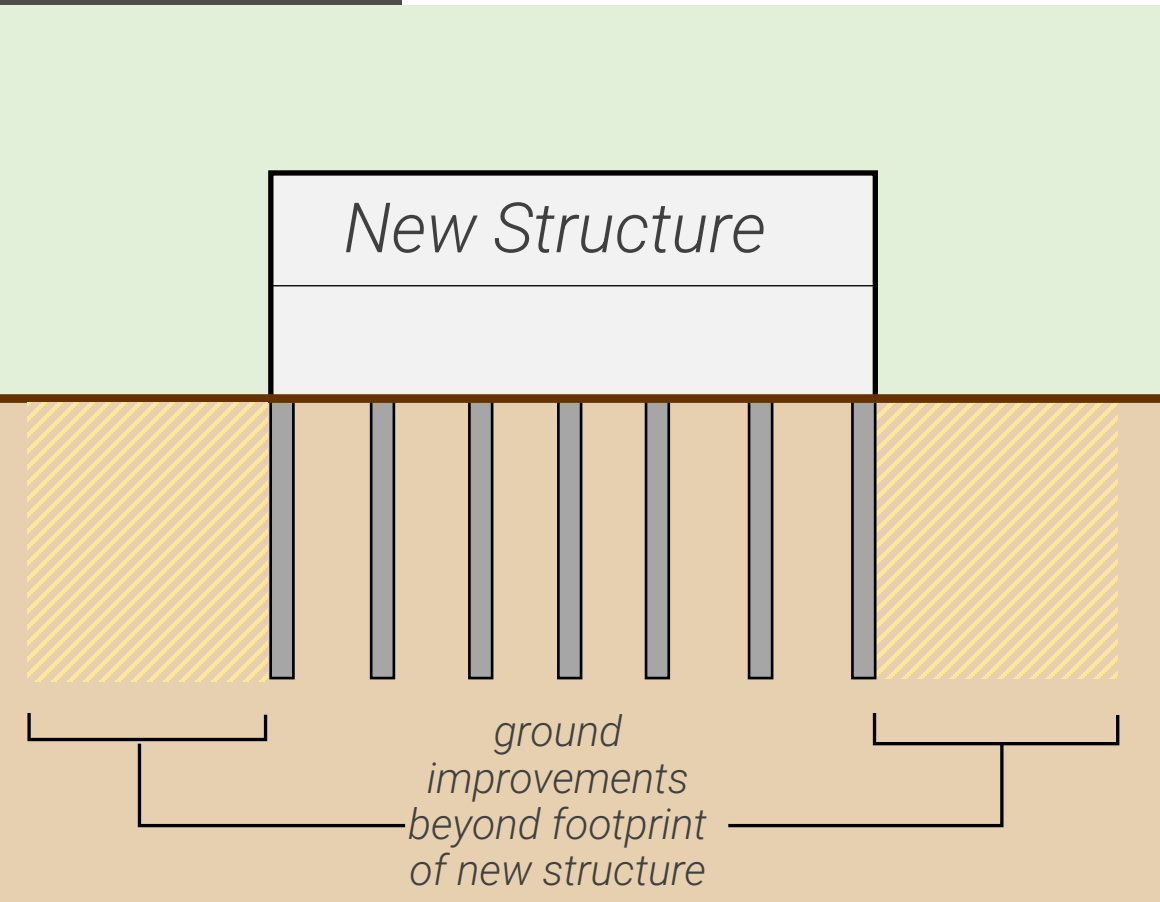
# Infrastructure



Hydrogen Storage & Fueling Station

- ✓ 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

# Soils & Foundations

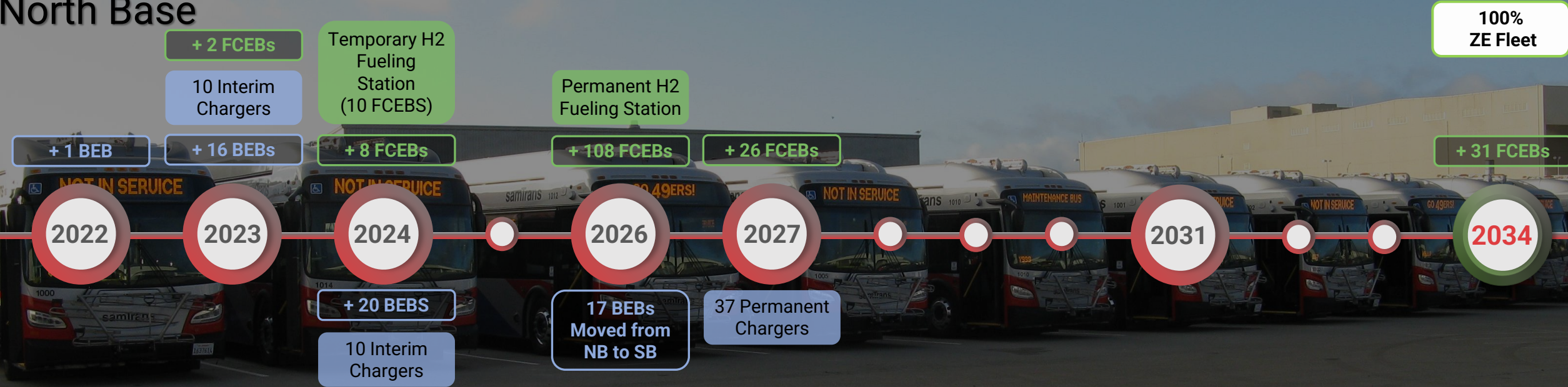


- ✓ Add materials to strengthen soil
- ✓ Install deep foundations to reduce settlement potential
- ✓ Place ground improvements beyond the building's footprint to confine soil
- ✓ Engage an independent third-party geotechnical engineer to review foundation design

# 2023 ICT Plan

## 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

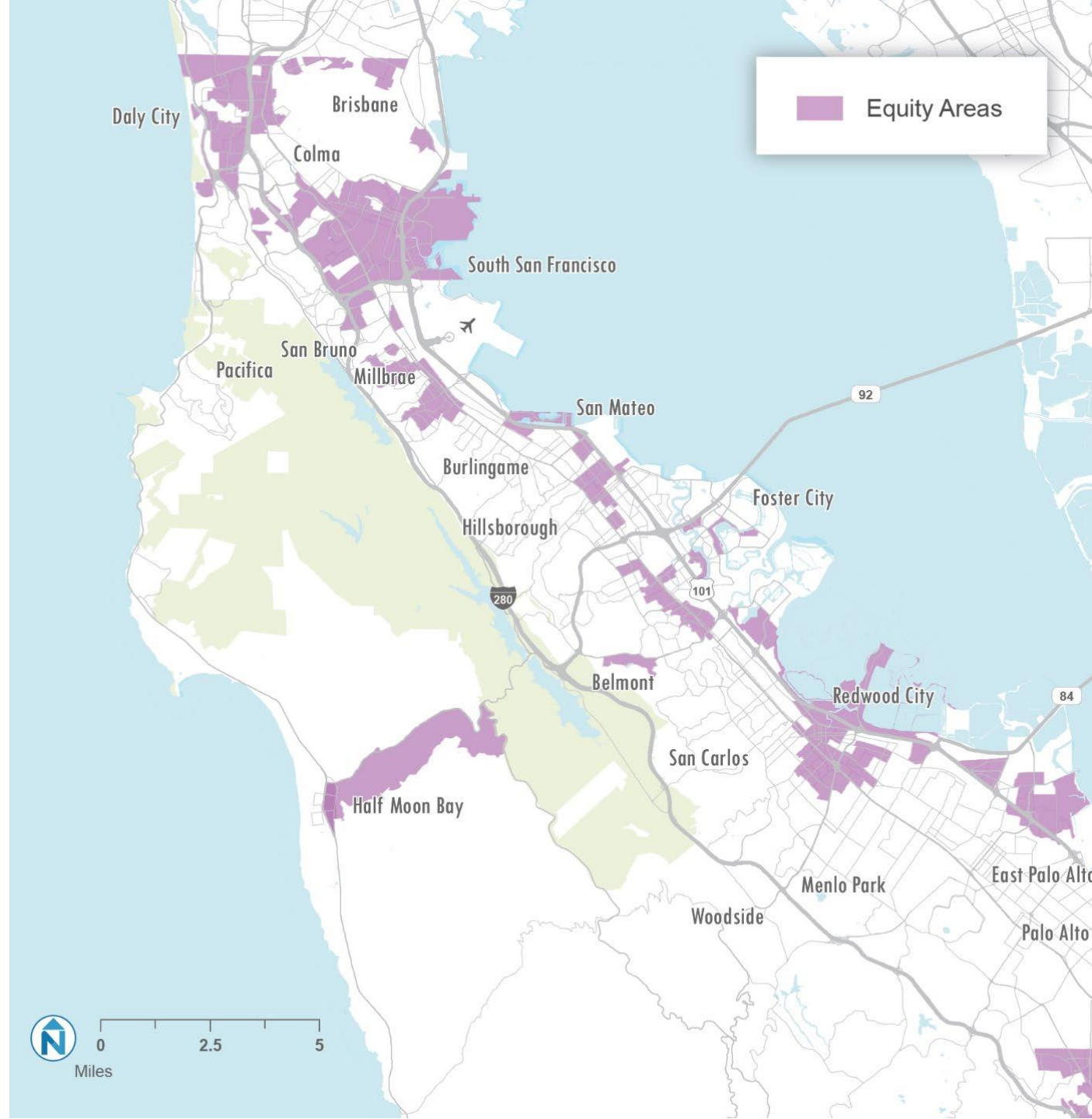
<sup>3</sup> ARCHES - Alliance for Renewable Clean Hydrogen Energy Systems (D.O.E. Hydrogen Hub Grant Recipient)

# 2023 ICT Plan 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



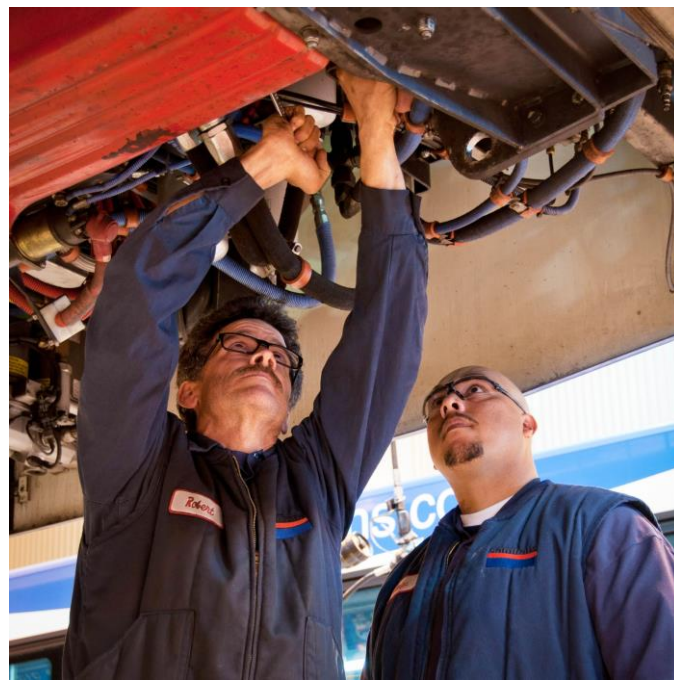
Reduce  
Pollution

# 2023 ICT Plan Workforce Training

Similar job duties/descriptions.  
New skills!

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

SamTrans commits to  
training staff!





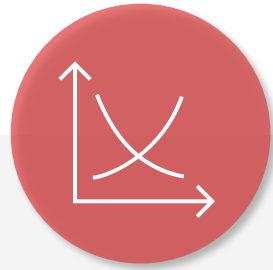
# 2023 ICT Plan

## Considerations & Challenges

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Significant Supply Chain & Production Delays



BEB Market Fluctuations & Limited FCEB Options

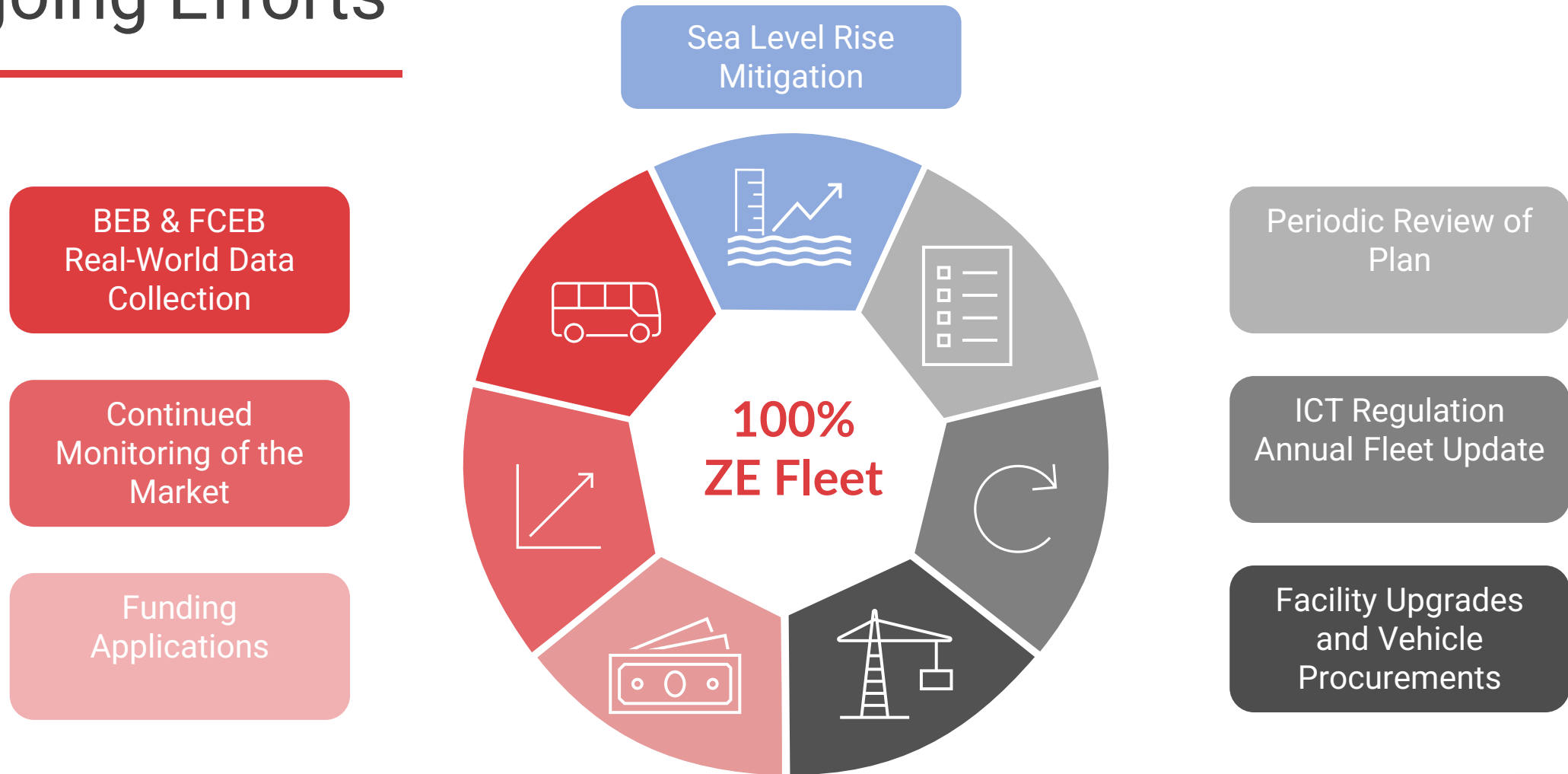


New Protocols for Emergency, Safety, and Resiliency Management



Material Sourcing & End-of-Life Sustainability

# Ongoing Efforts



emission ZERO

# Progress

H<sub>2</sub>

CA 58295



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

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# Progress

## 1 FCEB delivered to North Base

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# Progress North Base Facility Modifications for 10 FCEBS

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*General Work Activities*

*Lighting relocation*



*Electrical Work*



# Progress

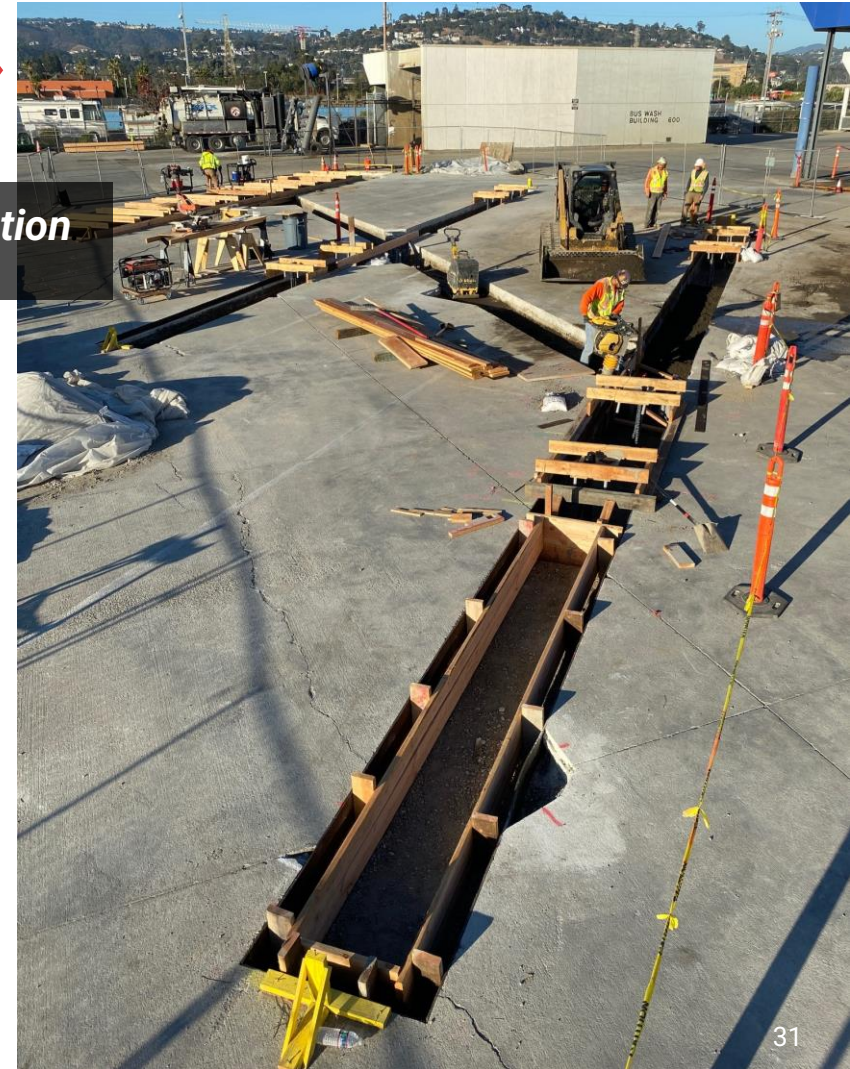
## South Base Installation of 10 Depot Chargers



*Construction of Charger Pads.*



*Conduit installation*



# NEXT STEPS

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- ✓ **Seek Board Approval of Updated ICT Rollout Plan at December 2023 BOD Meeting**
- ✓ **Submit Updated ICT Plan to California Air Resources Board**
- ✓ **Seek Board Approval for Purchase of up to 108 FCEBs at December 2023 BOD Meeting**





3000 **SamTrans**

# Q&A

