



# Upper M-Line Traction Power Upgrades



BART Board  
January 25, 2018

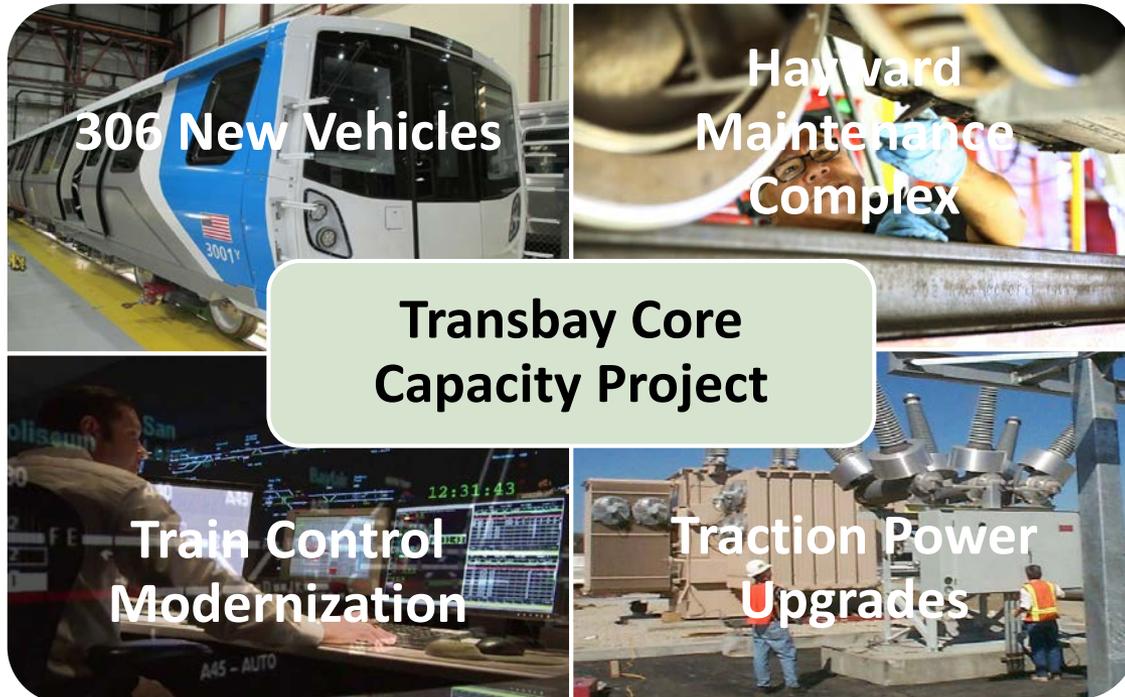


# BART Core Capacity Initiative

**GOAL:** Enable higher-capacity service to meet expected growth in travel demand  
*(anticipated 2M additional residents in nine-county Bay Area by 2040)*

**OBJECTIVES – 33% Capacity Increase**

- Increase Transbay capacity from 23 to 30 trains per hour (TPH)
- Change from 15-minute to 12-minute base headways
- All 10 car trains (300 cars)



306 New Vehicles

Hayward  
Maintenance  
Complex

Transbay Core  
Capacity Project

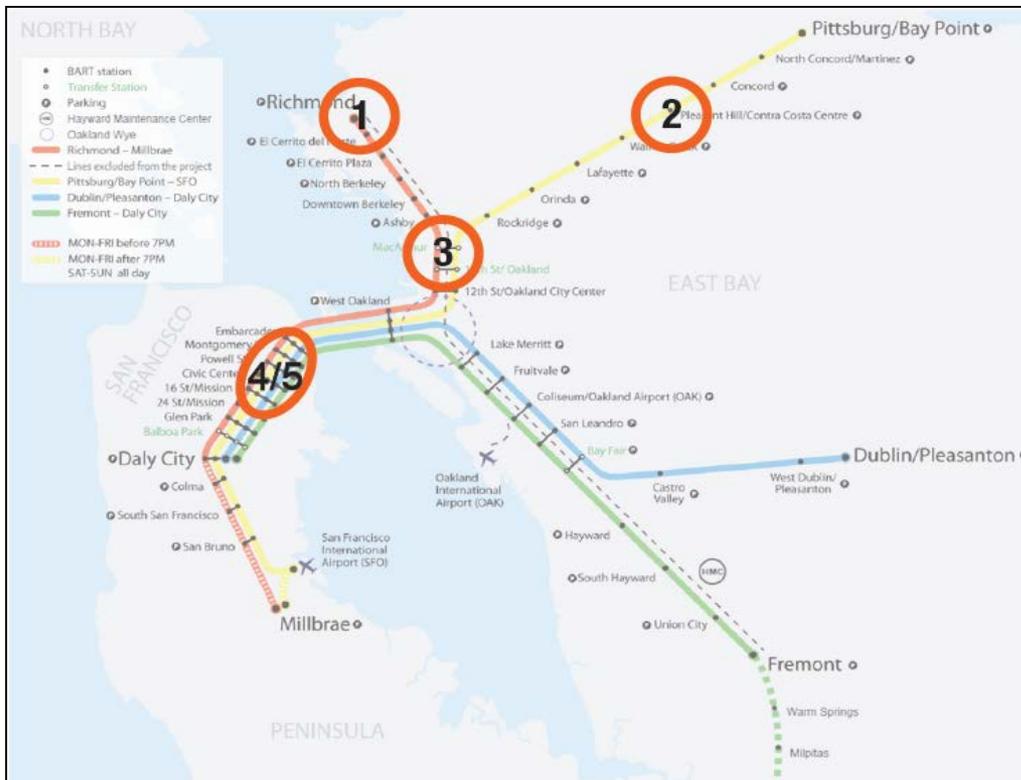
Train Control  
Modernization

Traction Power  
Upgrades



# Low Voltage Areas Needing New TPSS

**30 TPH service requires 5 new TPSS**



*Why are more substations needed?*

- Increased power draw from:
  - 23 TPH → 30 TPH
  - 8/9/10 car trains → all 10 car trains
  - Higher performance new cars
- Address low voltage segments of the system
- Allow older substations to be taken off-line to rebuild while maintaining service



# Traction Power System

- BART's traction power system provides the **functional foundation** necessary for existing service as well as for higher-capacity train service
  - BART trains run on 100% electric power
  - 68 Traction Power Substations (TPSS)
  - Over 700 high voltage circuit breakers and switchgears
  - Over 1.5M linear feet of cabling
- **System Renewal** (highest priority for renewal at BART)
  - Urgent need to upgrade the system
  - Many TPSS that power the trains are original to the system and at growing risk of failure
- **System Enhancement**
  - Additional TPSS needed to increase Transbay capacity and redundancy
  - Power draw greatest with closely spaced stations and multiple trains accelerating<sub>4</sub>





# Traction Power Study

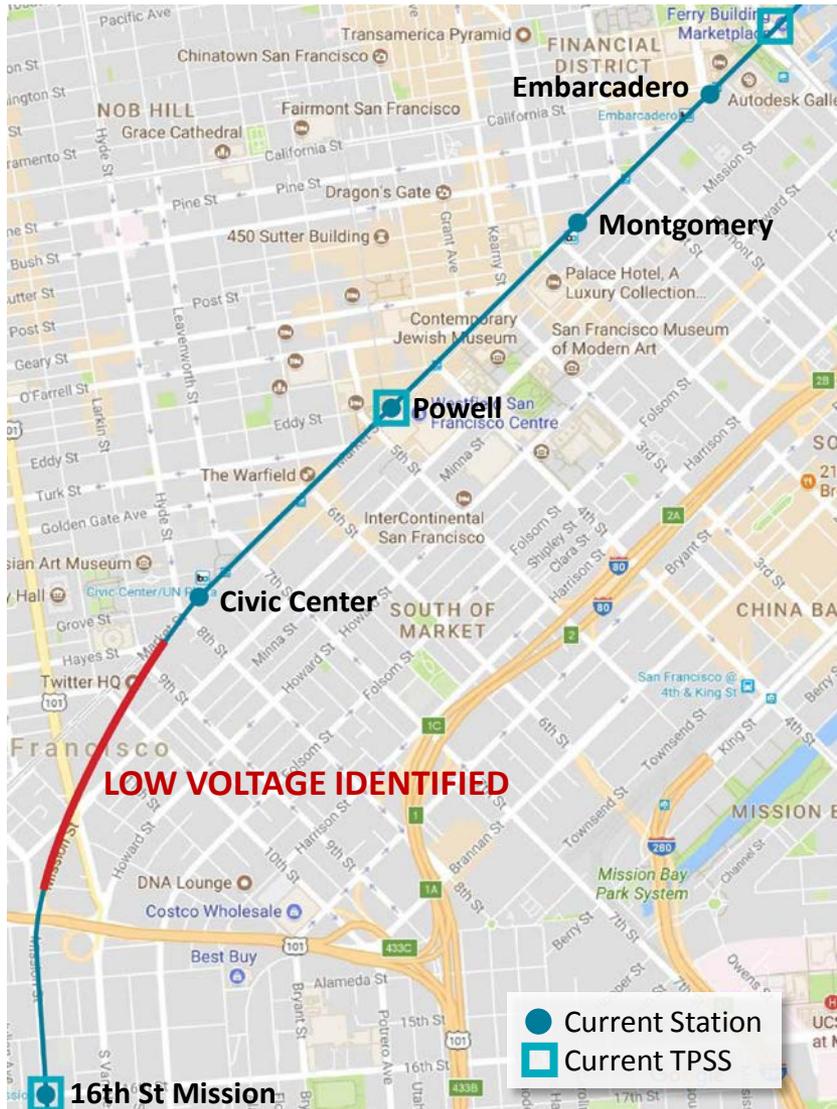
*From 2015-2016, PGH Wong conducted an analysis of BART's traction power system*

## **METHODOLOGY:**

1. Identified probable low voltage areas on the system in various operating conditions
2. Reviewed possible alternative TPSS sites for the low voltage locations identified
3. Narrowed down TPSS site options based on location, space, environment, and customer impact criteria
4. Confirmed that the remaining TPSS site options would be able to handle future load
  - Simulations of entire system with higher frequency schedule, new cars, etc. under various loads and conditions



# Downtown SF Traction Power System



## 2 new TPSS needed in Downtown SF:

- To address low voltage area (Most critical area: between 16th St and Civic Center stations)
- To allow for the needed closure and rehabilitation of the existing Bay Tube West (Embarcadero) and Powell TPSS



# Screening Criteria for TPSS Locations

## LOCATION REQUIREMENTS

1. Near **low voltage** areas identified
2. Near stations where train starting power **needs are greatest**
3. At an appropriate location given **existing TPSS power distribution**
4. Near the **alignment**
  - To minimize power & voltage losses
  - To reduce high distribution system installation costs
5. On **property owned by BART**, due to prohibitively high SF real estate costs, lengthy EIR requirements, and community opposition to surface facilities



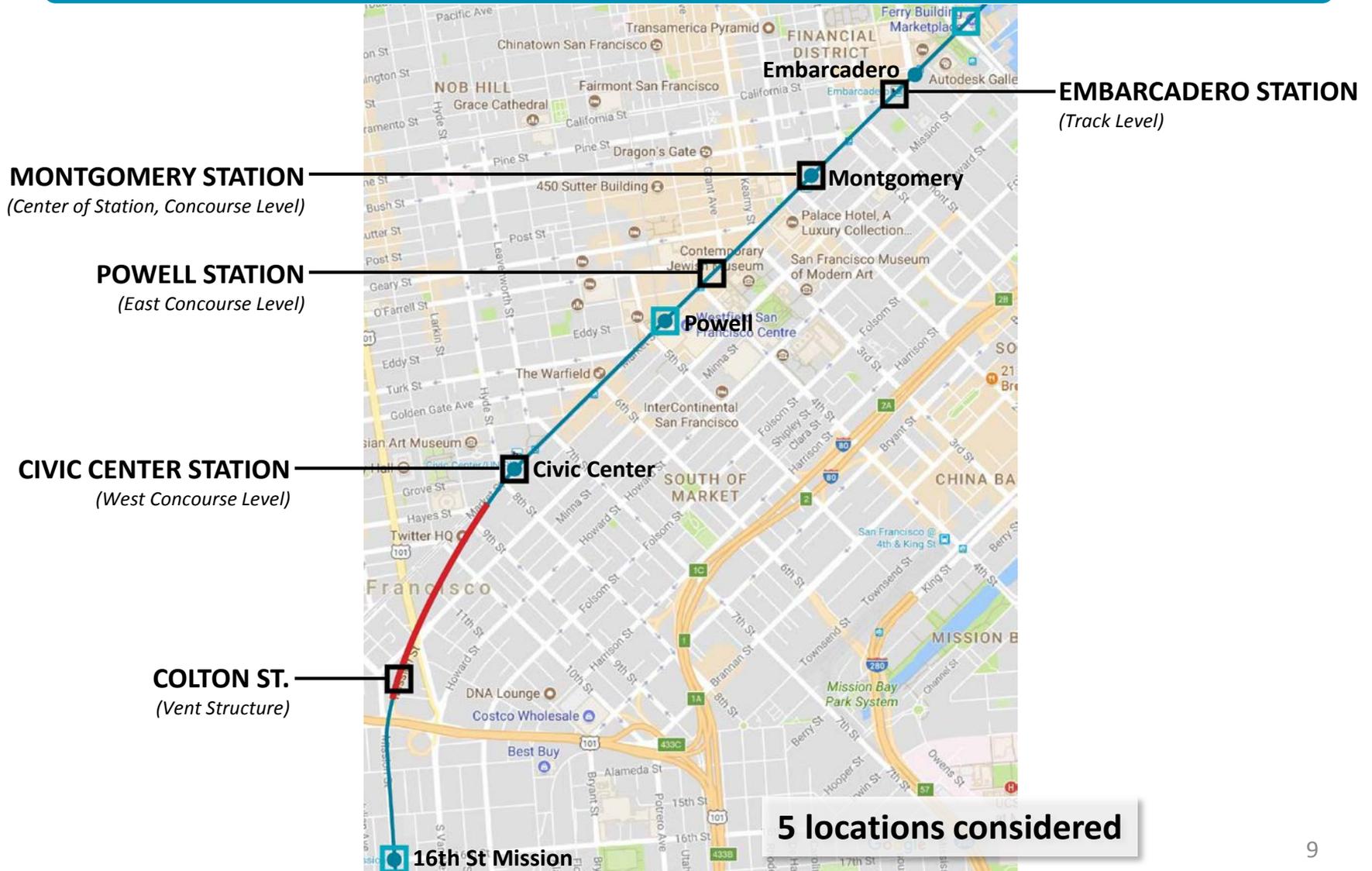
# Screening Criteria for TPSS Locations

## SPACE/ENVIRONMENT/CUSTOMER IMPACT REQUIREMENTS

1. Low **customer and environmental impact**
  - Noise, aesthetics, etc. → avoid surface level
2. Overall footprint roughly **100x70ft** or **130x50ft** to accommodate:
  - Alternating Current (AC) House
  - Direct Current (DC) House
  - 1-2 Transformers
3. Practicable for **installation, replacement, accessibility & ventilation** of large, heavy equipment
4. Ability to **provide auxiliary services** within substation

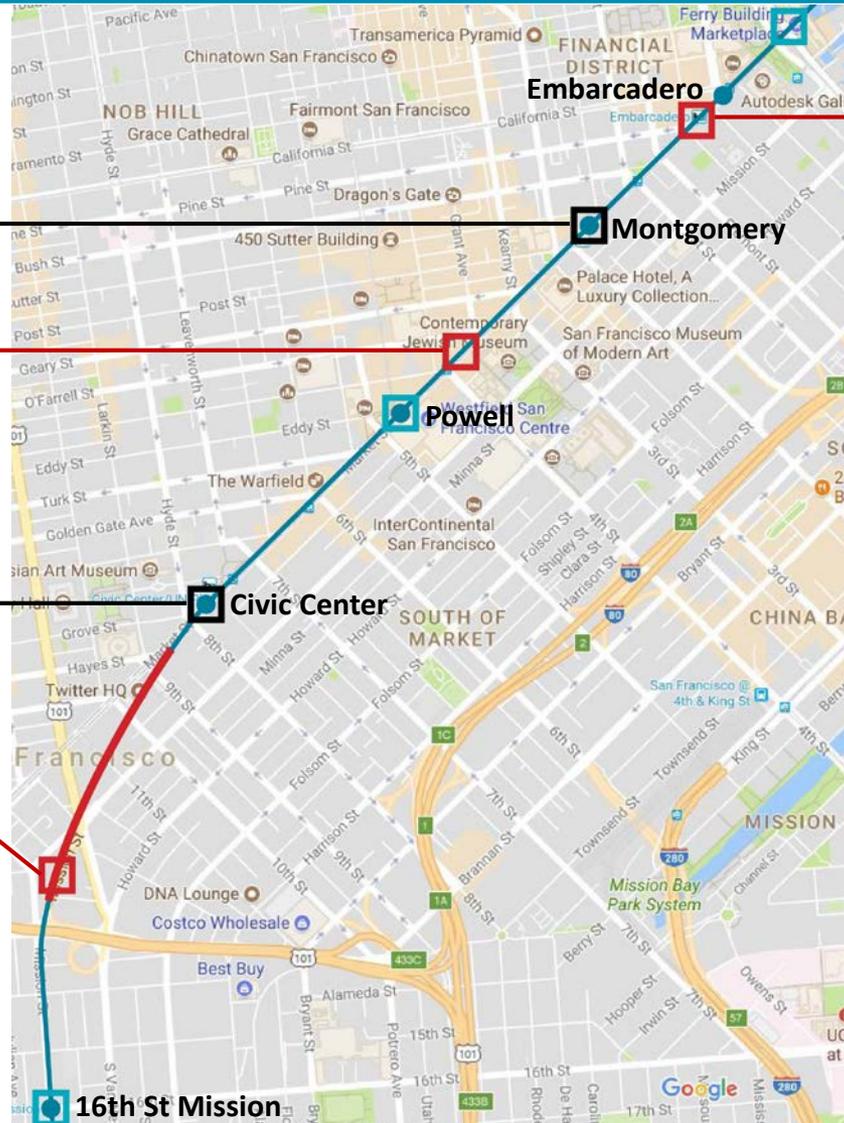


# Downtown SF TPSS Options





# Downtown SF TPSS Options



**MONTGOMERY STATION**  
(Center of Station, Concourse Level)

**POWELL STATION**  
(considered but not viable)

- Existing Powell Substation
- Space constraints

**CIVIC CENTER STATION**  
(West Concourse Level)

**COLTON ST.**  
(considered but not viable)

- Doesn't address need to support acceleration at Civic Center Station
- Space constraints – real estate acquisition needed
- Adjacent to new Strada housing development

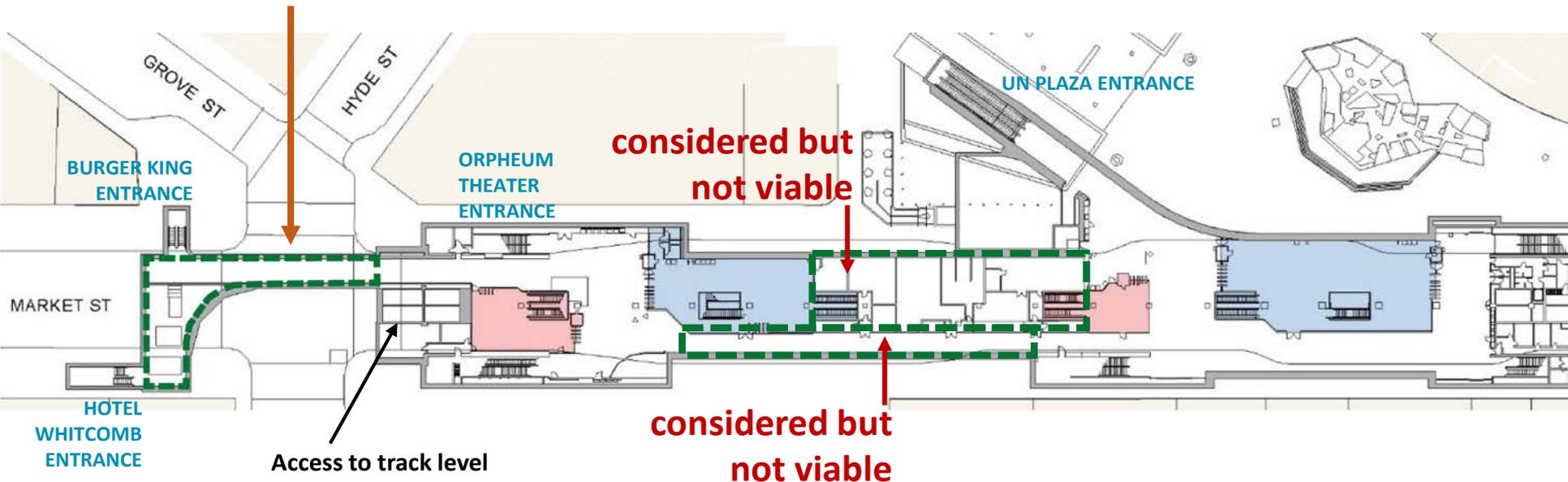
**EMBARCADERO STATION**  
(considered but not viable)

- Existing substation near Embarcadero Station
- Lowest location priority; farthest from low voltage area
- Space constraints
- Ventilation very difficult



# Proposed Civic Center TPSS: Sites Considered

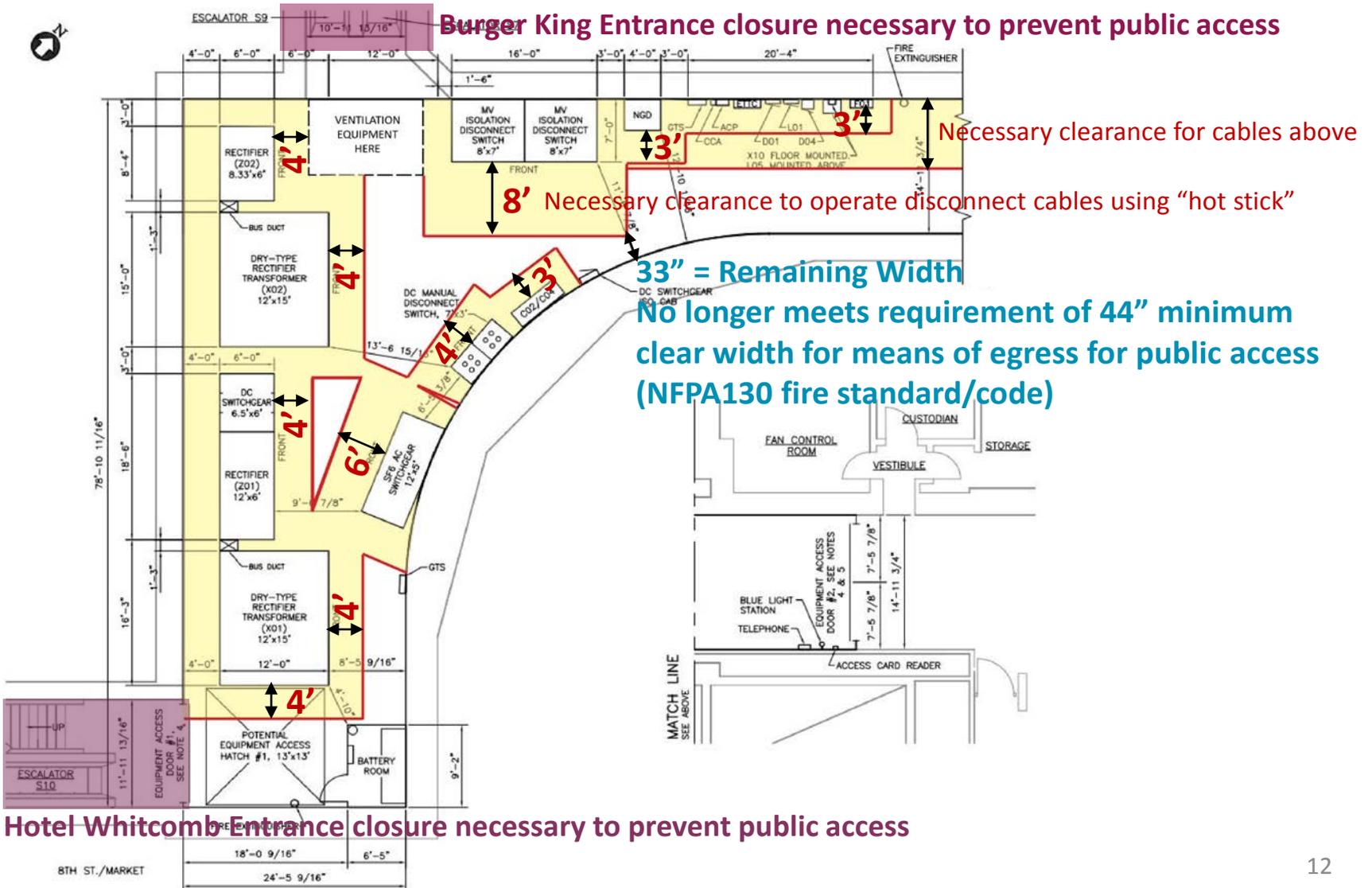
## Preferred Location



- Preferred location does not require any temporary or permanent structural support over Muni trackway
- Preferred location is adjacent to vertical access to track level
- Other locations split station in half or are occupied

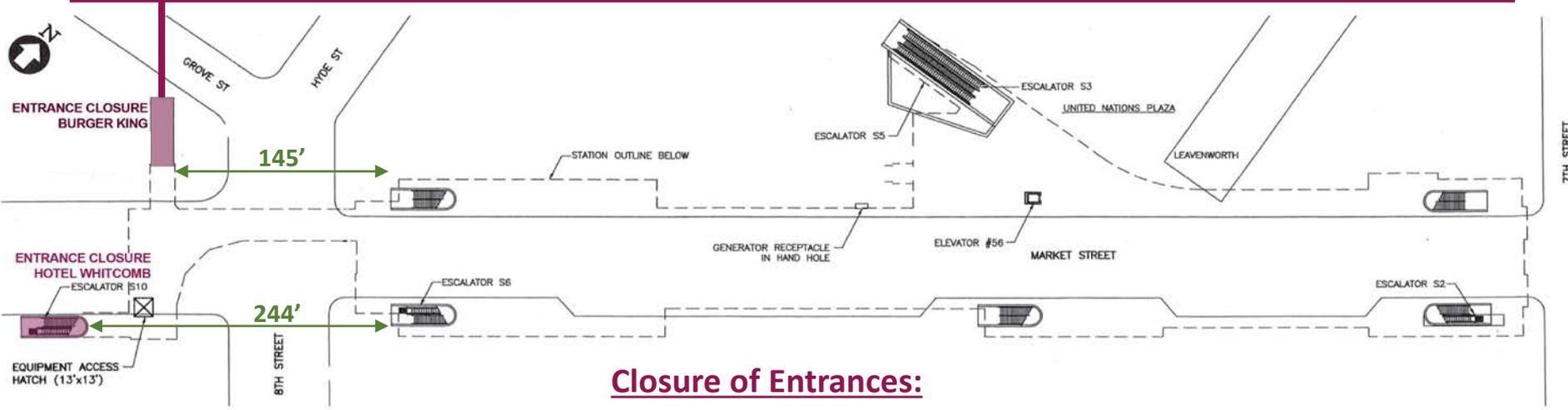


# Installation – Required Clearances





# Entrance Closures – Burger King & Hotel Whitcomb

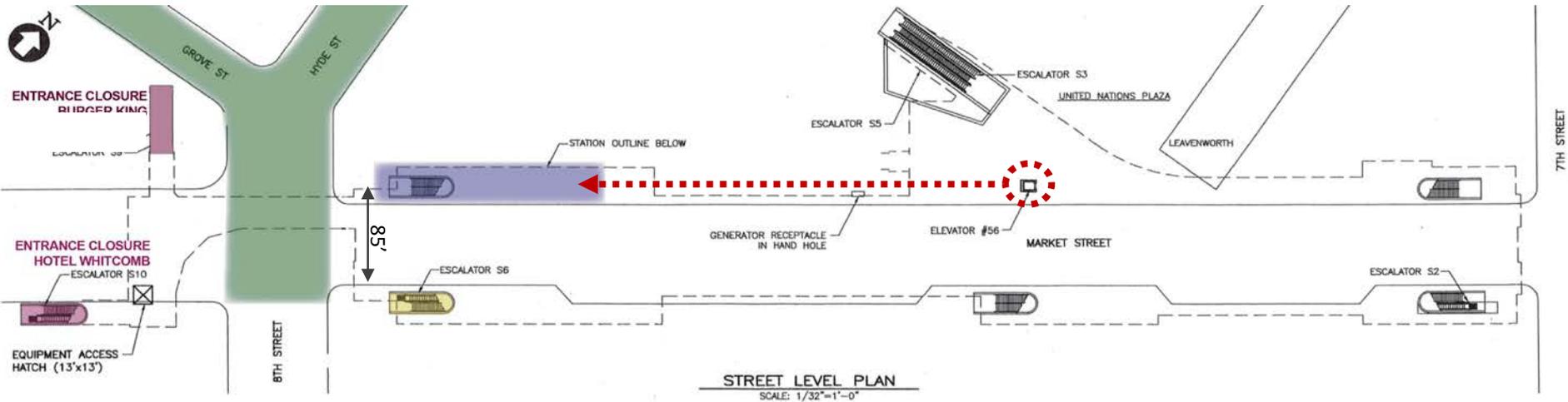


### Closure of Entrances:

- does not impact exiting capacity based on 6 & 8 minute calculations
- does not impact daily passenger entering/exiting ability



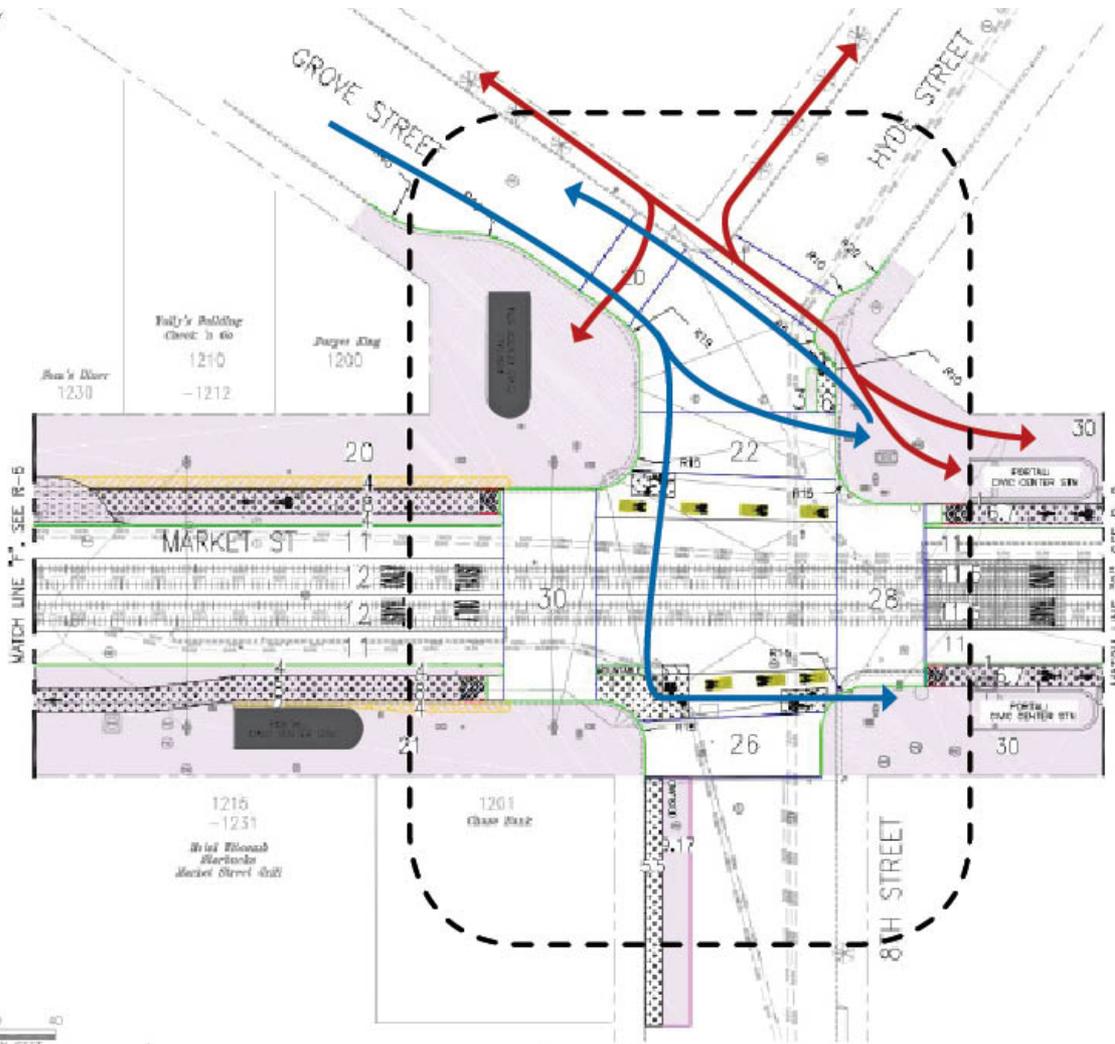
# Mitigation Plan



- No Orpheum escalator due to emergency exiting calculation. However, reverse Escalator S6 direction, starting at 9 pm daily (done).
- Relocate existing street elevator on north side closer to Orpheum Theater Entrance (*as part of Phase 1 Better Market St.*). *Potential future elevator proposed on the south side – exact location TBD.*
- SFMTA/Public Works/BART agree to improve bicycle and pedestrian access/safety ahead of Better Market St Project with at-grade treatments, including traffic signal upgrade. Construction anticipated in 2019.



# Mitigation Plan – Access Improvements



- New traffic signals and crosswalks across Grove & Hyde streets (red)
- Wayfinding signage in BART and on local streets
- Bike improvements (blue)
- Started early coordination with SFMTA + Public Works
- City will design/construct, BART will fund
- Design in 2018, Construction in 2019



# Outreach

## **COMMUNITY OUTREACH**

- Station Modernization open house in 2016

## **BUSINESS COMMUNITY**

- Meetings/discussions with Hotel Whitcomb and Burger King management
- Market Street Association
- Contacted Central Market CBD and Civic Center CBD

## **PUBLIC AGENCIES AND OFFICIALS**

- Executive Directors of SFMTA, Planning and DPW
- Ongoing monthly coordination meetings with Better Market Street, DPW, SFMTA and Planning staff
- Briefed 3 new SF Supervisors
- SF Arts Commission



## Next Steps

- Ramp up design for Civic Center ped/bike improvements
- Explore partnerships with arts community
- Continue project coordination with City's Better Market St and Civic Center Public Realm Plan
- Continue stakeholder engagement

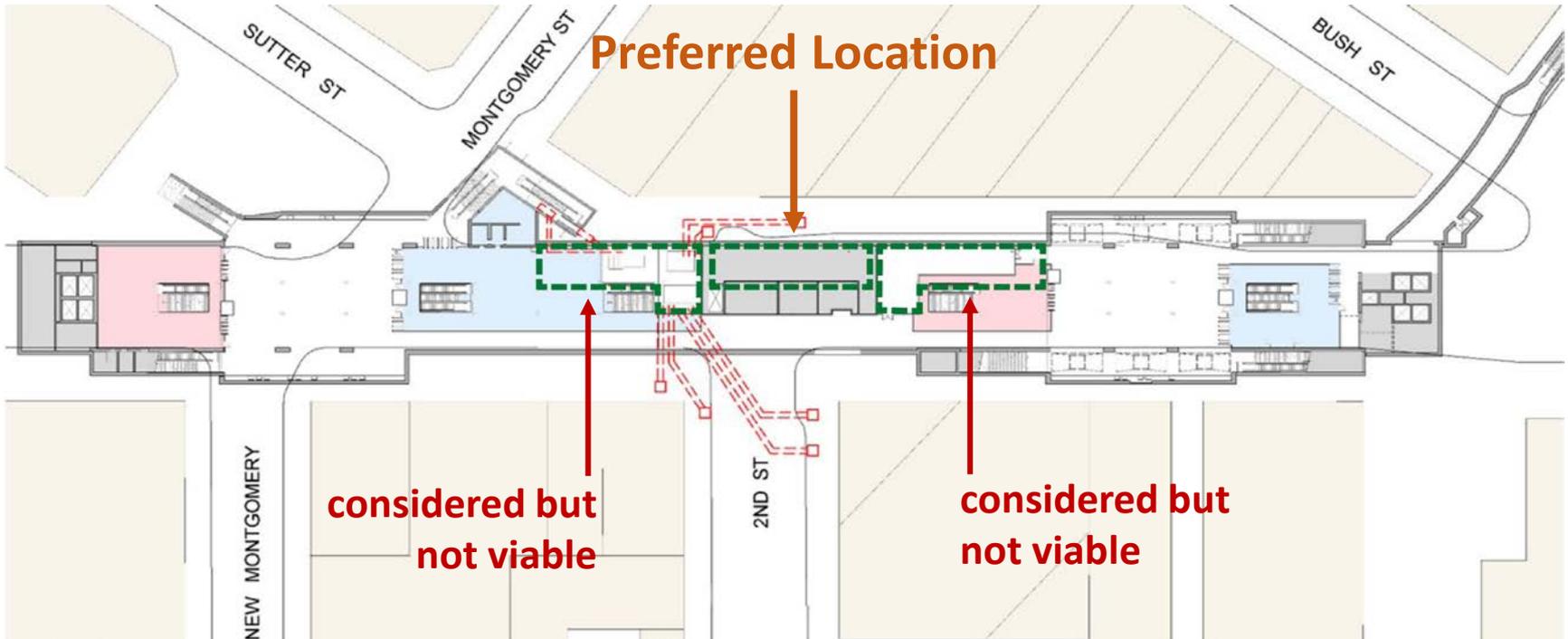


# Importance of Montgomery TPSS

- Provides supplemental **M-Line voltage support** to the west
- Provides **back-up power** critical to M-Line operations during:
  - Necessary closures and rehabilitations of Bay Tube West and Powell TPSS
  - Outage at Bay Tube West or Powell TPSS
- If Montgomery TPSS is not added, then during the Bay Tube West or Powell TPSS rehabilitations:
  - **A single point of failure at Bay Tube West or Powell TPSS could halt service on the M-Line for up to 10 months**



# Proposed Montgomery TPSS: Sites Considered



- Preferred location does not require permanent additional structural support over Muni trackway; alternate locations would
- Temporary structural support needed over Muni trackway to move TPSS equipment into place for all 3 locations
- Preferred location displaces currently unused equipment room





# Traction Power Upgrades Essential to Maintaining Service to San Francisco

- BART's traction power infrastructure today is in critically poor condition
- 30-year life assets are 45 years old
- San Francisco and Transbay Tube are most fragile pieces of the system – MTW and MPS have both failed previously
- BART does not have standby traction power capability
- SF portion of the system cannot be rebuilt and upgraded without first constructing some system redundancy
- **Urgent need to upgrade system**
  - For today's operation – BART “living on the ragged edge”
  - For future capacity needs – higher tempo service – more power draw

