September 2015

# Powell St. BART Station Modernization Program

## FINAL REPORT


ARUP

BART

# Acknowledgements

**The Plan involved a larger number of BART internal stakeholders, San Francisco city agencies, and community stakeholders, including:**

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# Table of Contents

# 1. INTRODUCTION

Powell St. Station is the third busiest station in the San Francisco Bay Area Rapid Transit (BART) system. Serving as a gateway to San Francisco and the Bay Area, it is located in the heart of the City's shopping, hotel and convention center districts. Adjacent to the neightborhoods of Union Square, Tenderloin, Mid-Market and SoMa, Powell St. Station is often the first destination of visitors from San Francisco International and Oakland International airports. Powell St. Station also provides important transit connections between BART and Muni. In addition, the station will soon connect with the Central Subway, further enhancing the station as a major connection point for Muni-Muni and Muni-BART transfers. Figure 1 show the station's location adjacent to many activity destinations.

The Powell St. Station Modernization Plan ("Plan") is a comprehensive effort to update the 43-year old Powell St. Station for the 21st century. Part of BART's larger Station Modernization Program, the Plan creates a framework for investing resources to address BART's increasing ridership and enhance and extend the functional life of the station. Through Proposition 1B, a California state bond passed by voters in 2006, funding is available to implement short/long-term improvements at the station. The Plan identifies projects to improve the look, feel, usability, safety and security of the station for riders as well as enhance the work environment for BART employees. These projects will address all components of the station, both public-facing and BART-facing, including stairwells, escalators and elevators, circulation and signage, plazas and waiting areas, ceiling and lighting, ventilation and mechanical systems, and other station improvements.

## 1.1 Project Goals

The Plan includes goals to guide the development and prioritization of improvement projects.

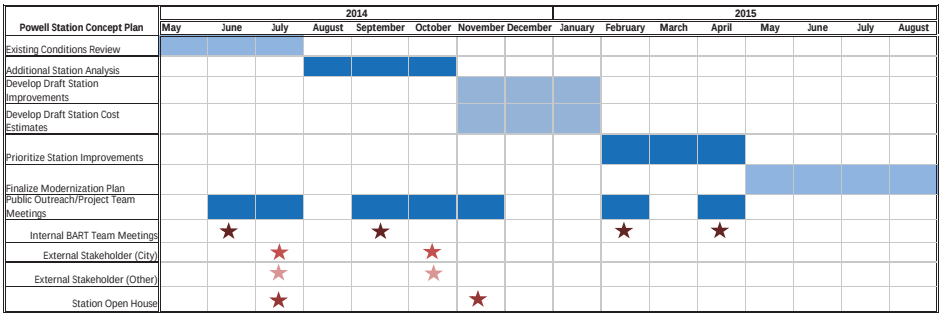
*Figure 1: Station Location and surrounding destinations and activities*


These goals have been vetted with many internal BART stakeholders, project partners and external stakeholders. They include:

- Enhance Powell St Station as a world class station that is the gateway to San Francisco.
- Modernize and refresh the station for the 21st century.
- Ensure that the station reflects BART's sustainability goals.
- Improve the station's function, safety, capacity and appearance.
- Implement improved wayfinding and signage features to make the station easier to use and navigate.
- Incorporate art within the station.

## 1.2 Project Process and Schedule

The Plan describes the station analysis, public and stakeholder outreach, and the project prioritization process. Much of the station analysis was conducted as part of the Powell St Station Design Guidelines. BART will inititate preliminary engineering for prioritized projects. It is expected that following preliminary engineering, the projects will be completed in 2017-2018.



# 2. RELATED STAKEHOLDERS PLAN AND PROJECTS

This section describes related plans and projects external to Powell St. Station. These external plans provide the land use vision for the neighborhoods that include Powell St. Station and the role the station has as a central mobility and access point.

## 2.1 Central SoMa Plan

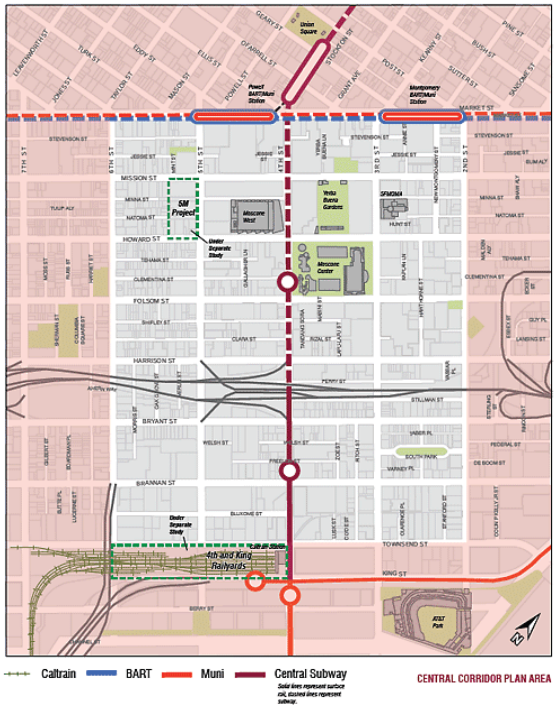
Begun in 2011, the Central SoMa Plan is an effort led by the San Francisco Planning Department to develop an integrated community vision for the southern portion of the Central Subway rail corridor. The Plan area is bounded by 4th, 6th, Townsend, and Market Streets.

The Central SoMa plan will develop concepts for the study area that address zoning, building heights, open space, and the street network. The Plan is guided by five project goals, which are:

- Support transit oriented growth
- Shape the area's urban form
- Maintain the area's economic and physical diversity
- Support the elements of complete communities
- Create a model of sustainable growth

The project included an extensive two-year outreach process, which gathered a wide range of public feedback and input. The project is currently undergoing an environmental review process and refinement of the Draft Plan. A Draft Environment Impact Report and revised Draft Plan are expected in late 2015. Public presentations on the Draft Plan is expected to commence in early 2016. Figure 2 shows the plan's extent.

*Figure 2: Central SoMA Plan Area*




## 2.2 Better Market Street Plan

The Better Market Street plan is an interagency effort to reconstruct the City's premier cultural, civic and commercial corridor and the region's most important transit street from Octavia Boulevard to The Embarcadero.

Led by the San Francisco Public Works (Public Works), the design team includes the San Francisco Planning Department, San Francisco Municipal Transportation Agency, the Public Utilities Commission, the San Francisco Office of Economic and Workforce Development, and the San Francisco County Transportation Authority.

The Better Market Street Plan focuses on remaking the street for pedestrians, bicyclists and transit and making it easier and safer for people to get around and creating a vibrant and inclusive destination where people want to live, work and visit.

The project is currently undergoing environmental review and preliminary engineering, followed by final design and construction. Conceptual renderings of Hallidie Plaza were developed to initiate discussion. This vision is one of many ideas that have been discussed in the past. Figure 3 shows a rendering of Hallidie Plaza.

*Figure 3: Conceptual Rendering of Raised Hallidie Plaza*

## 2.3 Central Subway

The Central Subway Project is SFMTA's new 1.7 mile extension of Muni's Light Rail T Third Line. Slated to open in 2019, the project follows 4th Street to Market Street, then continues along Stockton Street to Chinatown, passing underneath the current BART / Muni Lines running along Market Street. A new Union Square / Market Street Station will be located near Stockton and Market streets. The Central Subway will create a new direct connection to Muni and BART riders at the current Powell St station.

*Figure 4: Powell Street Station map*


The Central Subway project will bring changes within Powell St.Station:

- A secure access gate between the two stations will be installed to allow for the two stations to be secured outside of operational hours (connection to BART would still be provided from the Stockton / Ellis station entrance).
- Muni, with BART, will reconfigure the eastern (secondary) BART paid area. The reconfigured paid area will include new barriers to incorporate the existing platform elevator into the paid area.
- Six new faregates (one accessible faregate) will be added to the paid area. All new BART faregates will be bi-directional to be flexible with passenger flows.
- A new Muni level elevator is planned for the western end of the station that will provide connections between the Muni paid area and the Muni platforms.

## 2.4 Golden State Warriors Venue

The Golden State Warriors announced plans in Spring 2014 for a new basketball arena to be located in the San Francisco Mission Bay neighborhood. Expected to be open in 2018, the new arena will be an 18,000 seat venue. Access to the site will draw on the Muni Central Subway line, the 22 Fillmore Bus line extension, Caltrain and BART. It is anticipated that BART riders would transfer to the Muni Central Subway line at Powell St. Station for direct service to the venue.

## 2.5 Westfield Entrances Remodel

Westfield, the operator of the San Francisco Shopping Centre, has two entrances that directly connect from the shopping mall to the concourse level within Powell St. Station. Westfield is currently undergoing a design effort to remodel the entrances between the station and the mall.

## 2.6 Moscone Center Expansion Project

The City of San Francisco and the San Francisco Tourism Improvement District are leading an effort to expand the existing convention space at Moscone Center. The project is expected to add over 305,000 square feet of exhibition space, meeting rooms, performance space, ballroom space, and support areas. The project is currently undergoing final design and public outreach, and construction is expected to be complete in 2018.

*Figure 5: Southeast Entrance Tile Wall Installation*

# 3 STATION CONDITIONS

This section documents the current conditions within the station. This includes analysis of the station's physical conditions and factors that contribute to the station's daily function.

Elements affecting the station's function:
- Aesthetics and Placemaking
- Access and Circulation
- Safety and Security

Elements addressing the station's physical condition:
- Station Lighting
- Station Ceiling
- Station Communications
- Station Ventilation
- Station Acoustics
- Fire Sprinklers
- Geotechnical Issues
- Station Capacity

Much of the analysis of the station's physical conditions was developed as part of the Powell St. Station Improvement Guidelines. This was a comprehensive and holistic effort to understand the station's functionality, including both public and private station spaces.

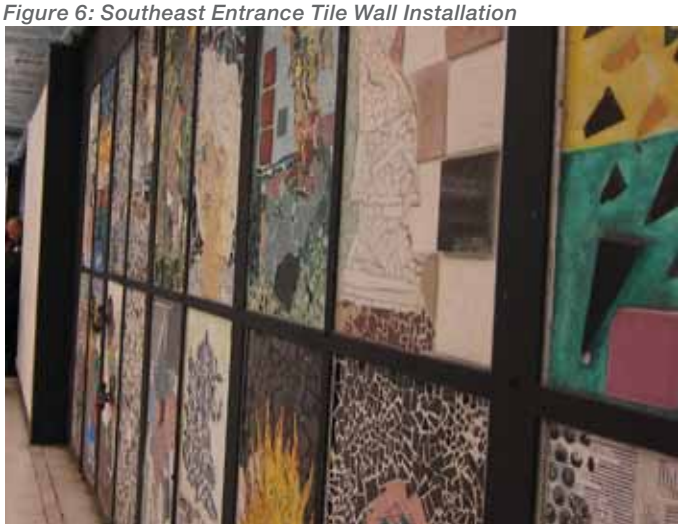
## 3.1 Aesthetics and Placemaking

Powell St. Station is a long, rectangular shaped station that is centered around two main "lobby" areas connected by circulation spaces. One lobby area is immediately adjacent to Hallidie Plaza and serves as the main entry and exit point for all users to the station. The second lobby is located north of the main lobby, and has lower passenger volumes than the lobby adjacent Hallidie Plaza. Both lobbies are bordered by entry and exit points to the Muni and BART platforms.

Aesthetics and placemaking incorporate elements of art, retail, advertising and wayfinding. Each of these elements serve a different function within the station. Currently the only public art at Powell St. Station is the youth tile wall installation at the southeast entrance.

Retail has a very limited in-station presence, with no vending machines or retail stores located within the station[1]. Advertising is currently located throughout

*Figure 6: Southeast Entrance Tile Wall Installation*



the station, on wall spaces, wrapped around columns, and for specific advertising campaigns, wrapped around the ceiling. Wayfinding consists of station signage to help passengers navigate the station. Details on the art, retail, advertising and wayfinding programs at the station are provided in Section 6.

## 3.2 Safety and Security

Safety and security are key concerns at Powell St. Station, which experiences many similar issues as other downtown BART stations, such as fare evasion and loitering.

BART Police Department (BPD) is responsible for security within the station and maintains a sub-station on-site. BART does not provide 24 hour police presence; however, at least one team of officers is usually located on the line between BART 16th St. and Embarcadero Stations. The San Francisco Police Department (SFPD) has jurisdiction within the MUNI transit system and the BPD and SFPD cross-train together on a regular basis.

### 3.9.2 Platform Acoustics

The majority of platform noise is generated by the BART train wheels operating along the rail track. Sound level measurements were taken at various times on the platform level. The following data points reflect the average sound levels in current conditions:

Criterion for platform noise levels during train pass-by widely varies for urban transit networks, but generally falls into the range of 75 dBA and 85 dBA. Many rail networks fail to achieve these noise levels due to inherent noise generation of rolling stock. For comparison purposes, a typical Muni train pass by (as measured on the Muni platform at Powell St.

1 The two retail outlets located adjacent to the Westfield entrance opposite Hallidie Plaza are within Westfield property.

BART police statistics from April 2013 reported categories of crimes committed at the station include aggravated assault, arrest by felony, arrest by misdemeanor and arrest by citation. Powell St. Station has the highest instance of these crime categories when compared to the BART system average.

The recent enforcement of a ban on sleeping, lying, or sitting with legs extended at the station has visibly reduced the number of people sitting or loitering within the station's corridors. The enforcement action responds to the emergency egress fire code that requires the concourse be evacuated in four minutes and the entire station in six minutes in the event of an emergency.

To address these safety and security issues, additional BART Police officers will be hired in Fiscal Year 2016 and stationed in Downtown San Francisco. BART staff will further explore potential strategies with the City.

## 3.3 Access and Circulation

Powell St. Station meets basic ADA requirements, but does not provide universal access to all patrons. Powell St. Station sees a high volume of visitors navigating the station for the first time. The station does not provide intuitive wayfinding nor easily-identifiable accessible routes. Primary areas for improvement include ease-of-access between paid and free areas, continuity of access and reduced distance between access points, barrier-free spaces and ease of wayfinding. More detail is provided in Section 6.6.

## 3.4 Station Brightening

Powell St. Station's everyday functionality relies on keeping the station in a state of good repair. The BART modernization effort identifies station elements that are good candidates for quick repairs or maintenance that would have a large impact on the daily experience of station users.

- Station Painting
- Deep Cleaning
- Repair Light Fixtures
- Entrance improvements

## 3.5 Station Ceiling

The station ceiling has been removed due to water intrusion from the underground water flows. The water intrusion caused damage to the original ceiling, forcing ceiling removal and re-coating with new waterproofing materials and flame retardant. The Ceiling and Lighting Replacement project is currently undergoing preliminary engineering, described further in Section 4.1.

## 3.6 Station Lighting

Station lighting affects passenger safety, security, and wayfinding and influences overall passenger comfort and satisfaction. Powell St. Station lighting is generally characterized by a combination of over-lighting at the concourse and a lack of lighting consistency at the platform level. Holistically, the station lighting is functionally inefficient and near term improvements could reduce current energy use.

### 3.6.1 Concourse Lighting

Visual evaluation notes that existing concourse lighting uses about two watts per square foot (W/ft2), where the California Title 24 Energy Code allows 1.2 W/ft2 for transportation facilities.

The visual inspection also noted the condition of the physical lighting elements, finding that:

- Many fixtures are missing lenses and are corroded.
- Concourse level is over-lit at about 80 footcandles (fc), 16 times more light than is technically recommended by the Illuminating Engineering Society of North America (IESNA) of 5 fc[2].
- Concourse lighting is extremely uniform making it hard for patrons to orient themselves within the station and to identify wayfinding-specific signage.
- Recessed lighting near Ticket Vending Machines (TVM) are in a poor state and these locations appear darker than their surroundings.

*Figure 8: Typical Lighting on the Platform Level*

2 The IESNA recommendations should be taken in context with the definition for transportation facilities which refers to aviation facilities without specific transit recommendations

*Figure 7: Typical Lighting on the Concourse Level*

- The lighting condition in the emergency stairs requires improvement. The light quality is poor and dim compared to the platform and concourse levels.
- Fixtures are a potential source of vandalism. The risk of vandalism is increased by the lack of strong lenses on the fixtures – or in many cases the lack of any lens or lamp shielding media. Many general lighting fixtures have exposed fluorescent lamps, which are particularly vulnerable to vandalism and can expose patrons to broken glass on the floor and minute amounts of mercury if the lamps are broken.

The review of the existing lighting conditions on the concourse can be improved, through the following measures:

- Setting a target average horizontal illuminance of 10 - 30 fc for the concourse.
- Addressing the over-lit condition by reaching BART's standard light levels during daylight hours and near entry and exit points and reducing the general light level uniformly during off-peak times.
- Repairing or replacing the lamps and ballasts in the fixtures near the TVM's as soon as possible to help with wayfinding and to improve security in those areas.
- Considering a system with better controls that can provide on-the-fly programming for weekday and weekend or special events. The lighting levels may also be directly tied to occupancy sensors to reduce lighting when areas are not in use.
- Implementing occupancy based controls in the emergency stairwell. Because these stairwells are seldom used, significant energy savings are achievable with bi-level occupancy sensor controlled lighting – now required by Title 24.
- Improving the emergency egress lighting by keeping a portion of the general lighting lit as emergency egress fixtures in the event of an emergency.

### 3.6.2 Platform Lighting

The lighting on the platform is characterized by poor color quality, poor uniformity, and relatively low light levels. Many of the light fixtures have poor optical control – resulting in glare conditions for passengers. This creates discomfort for passengers and reduces visibility, potentially making it harder for some passengers to navigate the station. Some fixtures appear to have been vandalized and some are not properly affixed to the ceiling.

The majority of the lights on the platform are metal halide, which are in various states of depreciation. The lamps display significant color shift and lumen depreciation.[3] This creates a condition where the intensity and color of light varies across the ceiling and the platform. Half of the lamps over the trackway are currently not working; combined with dirty walls the lights make the whole station feel dirtier than it really is. Lighting is not consistent along the length of the platform.

*Figure 9: Typical Back-of House lighting)*

3 This refers to the expected "life" of the lighting fixture

Suggested improvements include:

- Replacing the fixtures with fluorescent or Light Emitting Diode (LED) lights to achieve more uniform lighting and better color properties.
- Re-lamping each fixture to improve uniformity and color quality.
- Upgrading to LED lighting at the trackway in the future, and re-lamping all linear fluorescent lamps along the trackway in the near term.

### 3.6.3 Back of House and Transition Areas

In transition areas, the entry to the stairway from the platform is lit to 3 to 5 fc and has inconsistent uniformity. Passengers moving from the platform to concourse transition from a 5 fc environment to an 80 fc environment, which can be disorienting. The difference in light levels is exacerbated at night when passengers exit the concourse to streets lighted to about 2 fc. This increases the potential for further disorientation, increasing risk of security and safety issues.

The back of house areas have very poor lighting without any automatic off controls and are often blocked by exposed utilities and other equipment. Since many of these areas are accessed only a few times a day, they could benefit from having occupancy sensors or timer switches that reduce or extinguish the lighting when not in use.

The lighting in the station agent booths were off during the site visit. Booth lighting was noted to be generally off, which may be due to the overlit concourse and excessively bright booth lighting. This condition reduces the visibility of the booth and communicates to patrons that the booth may not be staffed.

## 3.7 Station Communications

Information Technology and Communications (ITC) at Powell St. Station and the BART system at large is constantly evolving. The ITC systems grew organically over time, with improvements implemented on a system-by-system (systems at individual stations) and as-needed basis as funding became available. Currently, the ITC systems are not designed or installed strategically or holistically to address station-specific challenges.

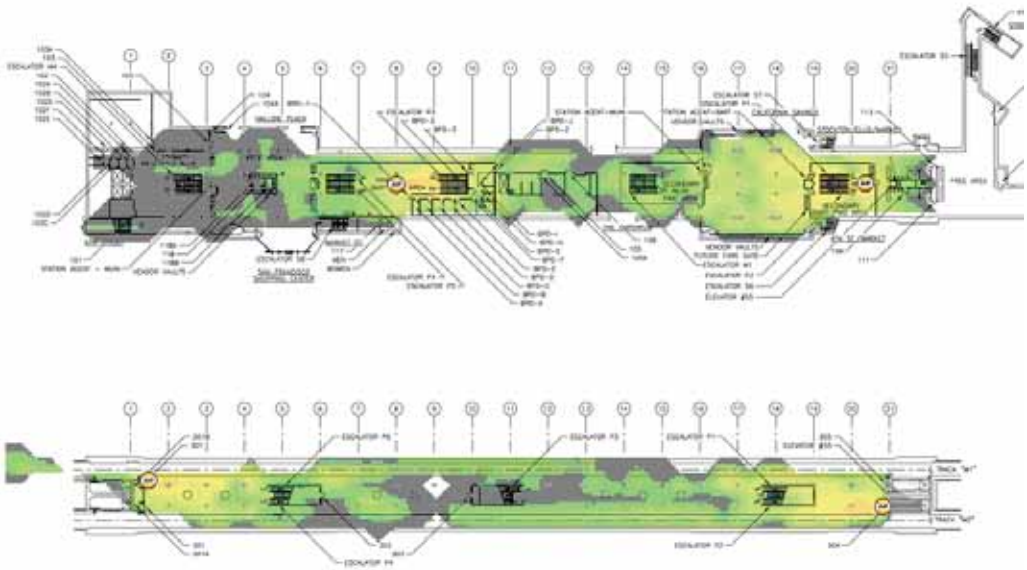
The challenges that arise from this ad-hoc system include:

- Multiple generations of equipment are forced to co-exist, creating challenges for maintenance and repair.
- The station does not have the benefits of an integrated system.

Powell St. Station has a number of ITC systems, generally functioning only at the station and not connected to BART's Operations Control Center:

1. **Closed Circuit Television:** Closed circuit television (CCTV) is the most recent upgrade at the Powell St Station. Visual coverage is 100% of the concourse and platform areas, commonly referred to as "flood coverage". In addition the digital internet protocol based system, some legacy analog cameras remain, of which some are monitored locally (e.g. in the station agent booth) and others abandoned

*Figure 10: Model of existing Wi-Fi Coverage within Powell Street Station (Source: Arup)*



completely

2. **Access Control:** Access to the train control room and other secure areas in Powell St. Station is via keyed entry
3. **Telephones:** Public pay phones are located throughout the station on both the concourse and platform level. Various phones within phone banks are missing, leaving empty spaces. BART customers can use the pay phones for emergency calls while on the platform level. Phones connecting to the station agent booth are located at either end of the platform, at elevators and in other locations (usually at old payphone locations)
4. **Wired Networking:** In recent years, BART has implemented a converged network strategy whereby a single multi-purpose network is implemented and can be used by multiple systems. There appears to be equipment in the train control room which indicates that a station-serving node is active in Powell St. Station, likely primarily serving the CCTV system, but, capacity permitting, may be used for other services, such as IP phones, and digital signage
5. **Wireless Networking:** Wireless networking at the station is made up of three systems:

   A. **Public Wi-Fi:** There are four total Wi-Fi access points: two located on the concourse just inside the BART paid areas and two located at the ends of the platform. Preliminary analysis (i.e. testing using a smartphone client at various locations) showed areas with no coverage or slow throughput

   **B. Radios:** Radiating co-axial cable on the concourse level is used by BART police and operations staff for their mobile radios. Antennas are placed in strategic areas to provide additional coverage throughout the concourse. It is not clear where the radio head-end is located but a desk-console is contained within the BART Police sub-station.

   **C. Commercial Wireless:** Radiating co-axial cable on the platform level provides service for cell phone users. A commercial wireless provider installed the service, although BART retains control of the network. A bi-directional amplifier for the commercial radio is reported to be within the station footprint but was not visually identified during the walk-through

Redundancy does not appear to be built into individual wireless systems, although a common practice is to use one system to provide support to another system (e.g. to use cellular radio if mobile radio system is not available). Figure 10 shows the current wireless coverage at the station. Areas in green represent good coverage, with gray areas representing no wireless coverage. Yellow represents the transition coverage between green and gray.

## 3.8 Station Ventilation

Powell St. Station contains two ventilation systems: an emergency ventilation system positioned at either end of the platform level and a centralized ventilation system primarily for climate control at the concourse level.

The entire centralized mechanical ventilation system for the concourse was turned off in the 1980s due to concerns of:

- Asbestos at both the concourse and platform levels.
- Lack of centralized control from Operations Control Center and manual responsibility placed with the station agents.

## 3.9 Station Acoustics

The Powell St. Station acoustic environment affects passenger comfort, speech communication, and general quality of the passenger experience.

### 3.9.1. Concourse Acoustics

At the concourse level, the goal of moderate ambient noise levels allows communication between passengers and/or BART staff without a raised effort. In large transient spaces, the overall noise level ambient target is at or below 70 decibels (dBA).

The ambient environment at Powell St. Station has the following key features:

- No significant mechanical systems noise in patron areas.
- Outdoor noise heard on the platform.
- High ambient levels during rush hour periods.
- Confusing for blind and low-vision passengers, lack of acoustic or audible cues to aid in identification of destination or orientation.

station) is 88 dBA. Current BART train noise levels of 100 dBA have been measured by previous studies and this study. It appears that noise levels have not significantly changed in recent years.

There are a number of improvements for consideration to reduce the level of platform noise. These include:

- Sound absorbing finishes in the station
- Platform screen doors

*Table 1: Average Sound Levels at Powell Street Station*

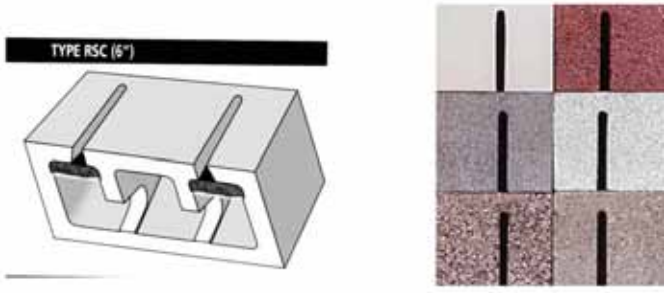
| Location | |
|---|---|
| BART Platform (empty) | 40 A-weighted decibles (dBA) |
| BART Platform (typical occupied) | 60 dBA |
| MUNI Pass-by as heard on BART Platform) | 73 dBA |
| BART train pass-by on BART Platform | 100 dBA |

Installation of sound absorbing finishes in the station can only provide incremental benefit, typically 2-5 dB of ambient noise reduction. Ceiling sound absorbing finishes are generally undesirable from operation and maintenance perspectives. Additionally, the ceiling is far from the wheel/rail interface. There are under-platform sound absorbers which have been proposed in transit facilities.

For Powell St. Station, an acoustic concrete masonry unit (CMU) block approximately four to six feet deep is recommended for below the platform. This is a robust and relatively low-cost solution which places slots in standard CMU blocks and add insulation to the block cavities. These can be tuned to maximize efficiency at the frequencies specific to the trains.

An alternate means of introducing sound absorbing finishes would be through a large-scale art project designed to be to include sound absorbing materials. An example is shown in Figure 12.

*Figure 11: Example of Acoustic CMU Block - Proudfoot RSC*




Platform edge doors could provide added absorption of up to 10 dBa or more. If coupled with improvements to the wheel, rail, or rolling stock, platform noise levels would be significantly reduced, and may achieve the generalized 75 to 85 dBA criteria.

### 3.9.3 Public Address System

In the current condition, the intelligibility of announcements on the platform level can be subjectively characterized:

- Digital synthesized voice messages were intelligible.
- 'Live' messages were marginally intelligible.
- Limited intelligibility of announcements during Muni pass-by.
- Unintelligible during BART pass-by.

### 3.9.4 Acoustic Challenges for Blind and Low-Vision Passengers

Typical challenges of a blind patron's experience at Powell St. Station can be described as:[4]

- One cannot easily to find the turnstiles using non-visual (multisensory) cues. This is particularly true when the station is lightly traversed.
- The stairs and escalators are difficult to find when on the platform in light traffic and when trains are going by.
- When encountering the side wall of one of the service core blocks on the platform, it is not clear which end opens to the stairs / escalator.
- The bumpy tactile warning strips are placed on top of and immediately adjacent to the bumpy brick pavers at the platform. It can be difficult to tell the two apart especially when trains are moving in the station due to all the noise.

The blind and low vision users of the station will greatly

*Figure 12: Example of Dual Use Art/Acoustics Tiles*

benefit from more multi-sensory cues which address these and other challenges. A goal would be to create enough non-visual cues to generate a multi-sensory map which future users of the station can reference.

## 3.10 Fire Sprinklers

Automatic sprinklers are provided throughout the entire concourse area and in a portion of the back of house area. The train control room, fan rooms, and electrical rooms are not protected by an automatic sprinkler system.

Located within the ceiling are two to four ft. deep steel beams. The beams are spaced approximately every 4.5 ft., creating regular beam pockets in the ceiling. Pendant type sprinklers are installed in each beam pocket. Most sprinklers are installed within one foot from the ceiling deck and the adjacent beams. The 2010 National Fire Protection Association 13 allows a maximum distance of 22 inches below the ceiling deck where the distance between beams are 7.5 ft. or less. The current sprinkler installation meets the code requirement.

A visual inspection of the fire sprinkler system at Powell St. Station found non-code compliant issues with fire sprinklers at various locations. These issues include:

- Distance between sprinkler and ceiling
- Tilted sprinkler branches
- Foreign materials on sprinklers

### 3.10.1 Ceiling Considerations

With BART's ongoing ceiling replacement project, the ceiling design is moving forward with an open-grid ceiling. NFPA 13 requires specific design elements in order to avoid additional sprinkler protection below open-grid ceiling.

## 3.11 Geotechnical and Groundwater Issues

The main geotechnical issue identified at Powell St. Station is groundwater interaction with and infiltration into the station box. Waterproofing improvements are currently being finished at the station. The improvements consist of ceiling waterproofing treatment using chemical (urethane) grouting, upgrades to ceiling architectural treatments and passenger flow utilities.

The station has historical and ongoing issues of groundwater ingress in both the tunnel and station box structures. The overall groundwater regime in the area is anticipated to be from the higher areas to the north and northwest of the site, flowing in a south and south easterly direction towards San Francisco Bay and China Basin. The map, including the location of Powell StreetSt Station and anticipated groundwater flow, has been included as Figure 13.

4 Working with Chris Downey, president of Architecture for the Blind

*Figure 13: Creek and Watershed Map of San Francisco: Anticipated Groundwater Flow in Vicinity of Powell Street Station**


## 3.12 Station Capacity

### 3.12.1 Ridership and Station Capacity

Powell St. Station is a four level station. The BART platform is on the lowest level (3 levels below street) and consists of a center platform and two tracks. Track 1 operates services from the east of San Francisco to the San Francisco International Airport (SFO) and Millbrae Stations. Track 2 operates services from SFO and Millbrae Stations to destinations east of San Francisco.

SFMTA operates Muni on the second level below street, also consisting of a center platform and two tracks. The station concourse is located one level below street and is divided into three main areas: Unpaid Area, BART Paid Area, and Muni Paid Area. Access to Powell St. Station is provided from entrances located along Market Street, Stockton Street, and via Hallidie Plaza. The street connection via Stockton Street is closed as part of the construction work for Central Subway and will become the future connection with the Central Subway Union Square / Market Street Station.

The station has five escalators, three stairways, and one elevator between the BART platform and station concourse areas. The Muni platform has two escalators, two stairways, and one elevator between the platform and concourse areas. Figure 14 shows the layout of the Muni and BART Powell St. Station platform levels.

### 3.12.2 Station Passenger Activity – Weekday and Weekend

Powell St. Station is the third busiest BART station with 32,150 station entries and 28,100 station exits on an average weekday in April 2013. On Saturdays and Sundays, the station is the busiest station within the system with nearly double the volume of riders using the station than the second busiest, Embarcadero Station. Tables 2 to 4 summarize the top five stations ranked by total entries and exits for average weekday, Saturday and Sunday for April 2013.

Among the four Downtown San Francisco BART stations (Embarcadero to Civic Center), Powell St. Station has a unique station activity profile, with relatively high midday usage when compared to the AM and PM peaks. The main driver for the strong midday / evening / weekend usage is the surrounding retail land uses, hotels, and major local and tourist destinations.

*Figure 14: Comparison of Combined Entry and Exits by Time of Day – Typical Weekday (April 2013)*

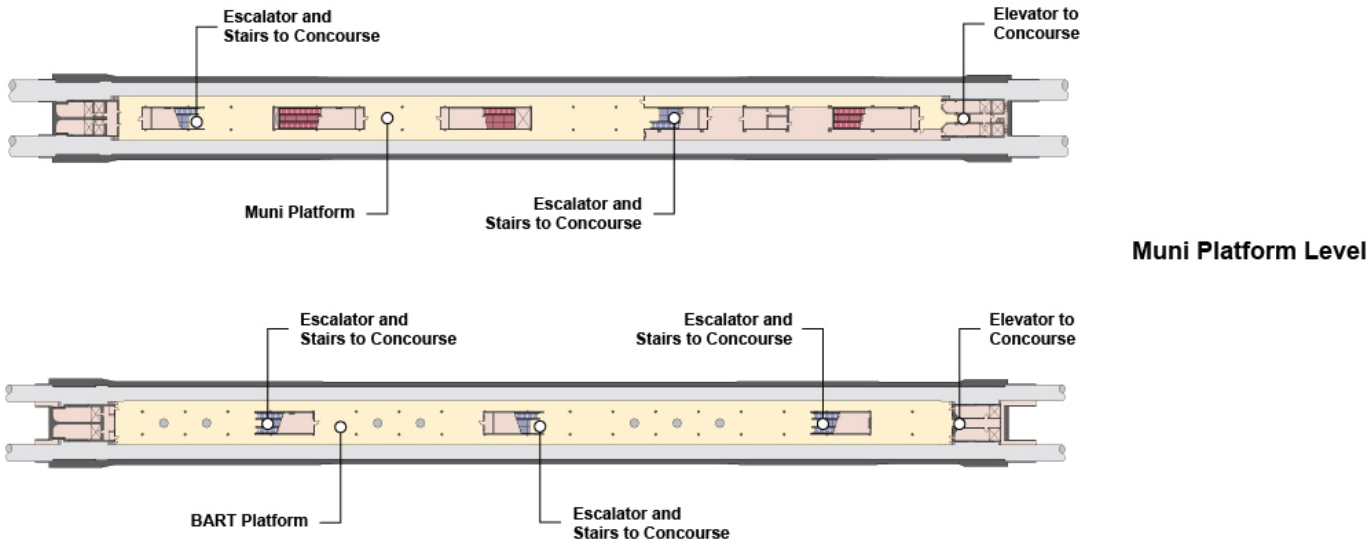





*Table 2: April 2013 Average Weekday Use Top Five Stations*

| Rank | Station | Entries | Exits | Total |
|---|---|---|---|---|
| 1 | Embarcadero | 37,325 | 42,254 | 79,579 |
| 2 | Montgomery | 37,921 | 40,310 | 78,231 |
| **3** | **Powell** | **32,143** | **28,119** | **60,262** |
| 4 | Civic Center | 22,733 | 20,537 | 43,269 |
| 5 | Berkeley | 12,942 | 13,662 | 26,604 |

*Table 3: April 2013 Average Saturday Use Top Five Stations*

| Rank | Station | Entries | Exits | Total |
|---|---|---|---|---|
| **1** | **Powell** | **28,375** | **26,421** | **54,795** |
| 2 | Embarcadero | 12,847 | 15,632 | 28,479 |
| 3 | Civic Center | 13,037 | 12,269 | 25,305 |
| 4 | Montgomery | 9,268 | 12,021 | 21,288 |
| 5 | 16th Street Mission | 9,024 | 9,739 | 18,763 |

*Table 4: April 2013 Average Sunday Use Top Five Stations*

| Rank | Station | Entries | Exits | Total |
|---|---|---|---|---|
| **1** | **Powell** | **19,961** | **16,731** | **36,692** |
| 2 | Embarcadero | 9,165 | 10,157 | 19,322 |
| 3 | Civic Center | 8,894 | 8,287 | 17,181 |
| 4 | Montgomery | 6,917 | 8,314 | 15,231 |
| 5 | Coliseum | 6,657 | 6,561 | 13,218 |

*Table 5: April 2013 Typical Weekend Entry and Exits Comparison*

| | Powell | | | Montgomery | | | Embarcadero | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Entries** | **Exits** | **Total** | **Entries** | **Exits** | **Total** | **Entries** | **Exits** | **Total** |
| **AM Peak Hour (08:15 to 09:15)** | 748 | 3,734 | 4,482 | 596 | 11,332 | 11,928 | 742 | 11,004 | 11,746 |
| **PM Peak Hour (5:30 to 6:30)** | 4,591 | 2,060 | 6,651 | 9,468 | 1,181 | 10,649 | 9,218 | 1,380 | 10,598 |
| **Daily** | 32,857 | 29,337 | 62,194 | 38,741 | 41,232 | 79,973 | 37,057 | 42,085 | 79,142 |



Powell St. Station is also a major destination for passengers boarding at San Francisco International Airport Station, with nearly 23% of those trips exiting at Powell Street.

Figures 15 present the station entry and exit activity at BART Powell St. Station during the day based upon a typical weekday, typical Saturday, and typical Sunday in April 2013. During the weekday, the AM Peak Period for entries and exits occurs between 7:30AM and 10:30AM, and the PM Peak Period occurs between 4:15PM and 7:15PM. On Saturday and Sunday, the peak entry and exit activity occurs between 5:00PM to 6:00PM.

During the AM Peak Hour, approximately 4,500 BART passengers use Powell St. Station, with 83% of passengers exiting the station and 17% of passenger entering the station during the AM Peak Hour. During the PM Peak Hour, the entry and exit activity is somewhat more balanced between the two movements, with approximately 6,600 passengers using thestation, of which 31% were exiting and 69% were entering. Table 5 provides a summary of the peak hour and daily passenger movements at Powell St. Station, together with a comparison of the passenger activity at Montgomery and Embarcadero stations.

### 3.12.3 Seasonal Variation

Based upon exits between April 2012 and March 2013, Powell St. Station has a fairly consistent demand profile over the year period. The average monthly station exits for weekdays (excluding holidays) is approximately 27,900. The lowest month is April, with an average of 26,100 exits per weekday, and the highest is December, with an average of 31,500 exits per weekday over the month. Figure 16 shows the seasonal variation of ridership at the BART Powell St. Station for the year.

On the weekends, Saturdays follow a similar seasonal variation as the weekdays; however, Sundays follow a more consistent ridership throughout the year although peaks occur in June and December. Figure 17 presents the seasonal variation of ridership at the weekends at the station for the year.

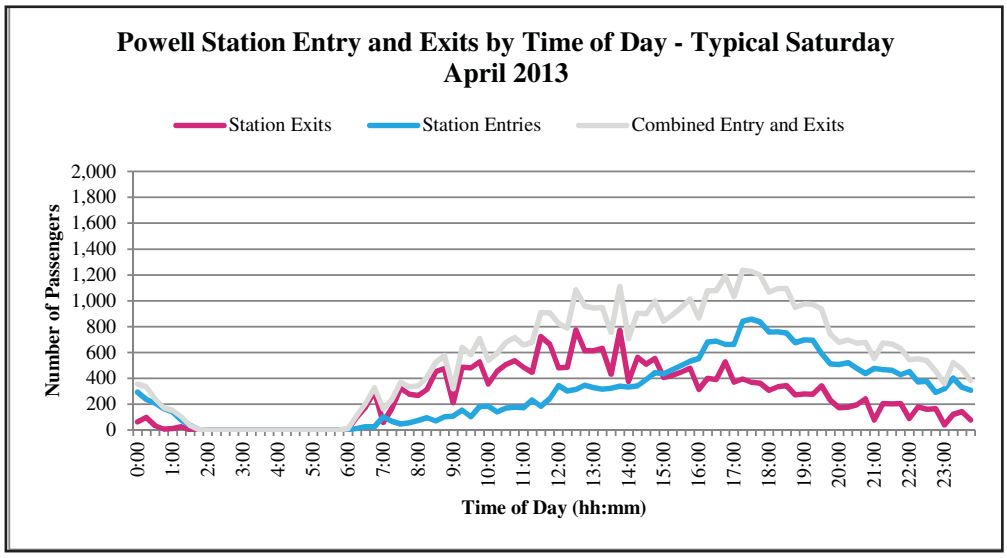
### 3.12.4 Special Events and Public Holidays Station Activity

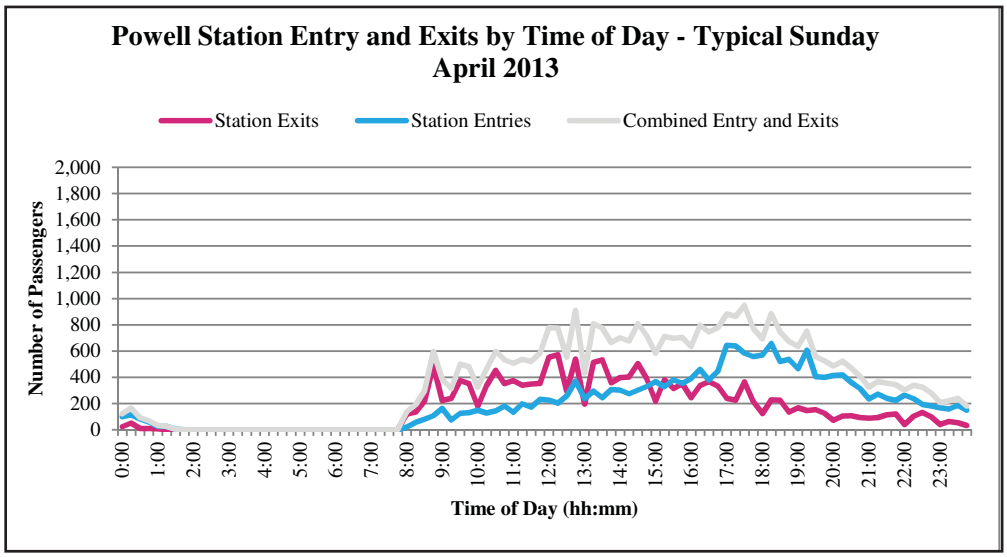
Powell St. Station is a key transit destination for special events in San Francisco and can experience higher than average passenger demands. These events include New Year's Eve, Chinese New Year, Gay Pride, Bay to Breakers, and sports celebration parades.

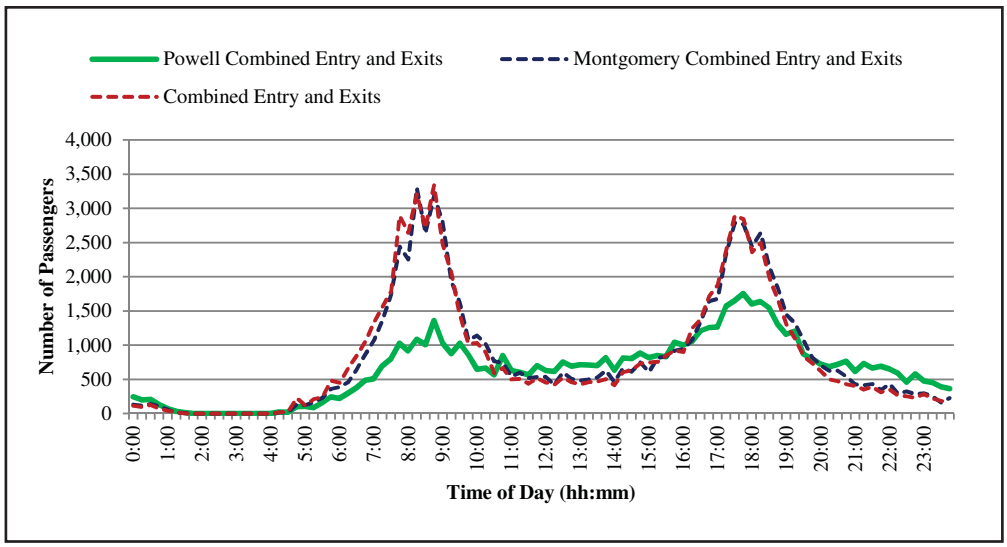
Powell St. Station also experiences major peaks in ridership on Black Friday, the day after Thanksgiving Passengers with shopping bags and luggage should be considered part of circulation and capacity studies, as the station experiences higher than average proportions of these types of passengers. A study of holiday ridership at the station was completed for public holidays between April 2012 and March 2013. Figure 18 presents the average passenger exits at Powell St. Station on public holidays, compared to the yearly average weekday exits.

Black Friday has the highest daily exits at Powell St. Station throughout the year, with an increase of 64.9% over the typical average weekday.

*Figure 15: Comparison of Combined Entry and Exits by Time of Day - Typical Weekday (April 2013)*




SECTION 4

*Figure 16: Average Weekday Exits at Powell Street Station by Month (BART only)*

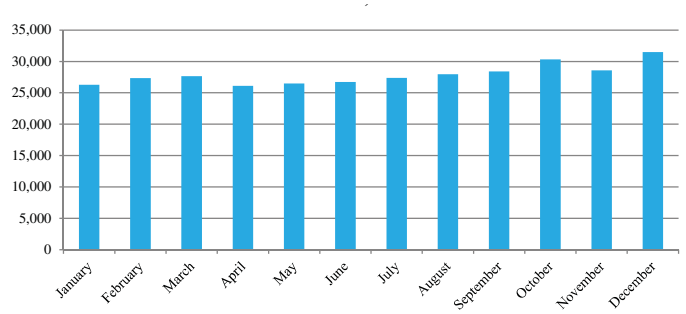



*Figure 17: Average Weekend Exits at Powell Street Station by Month*

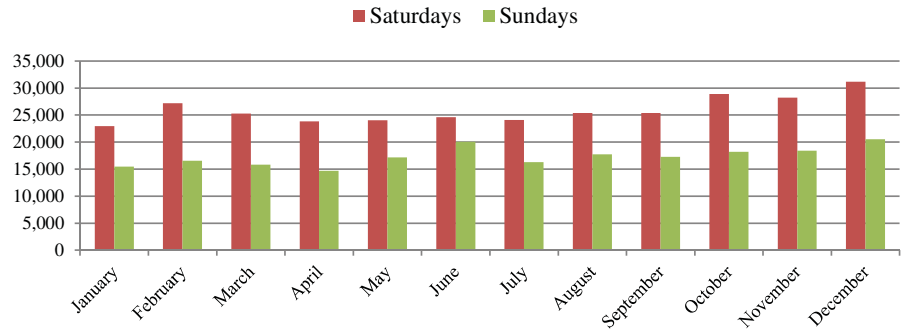
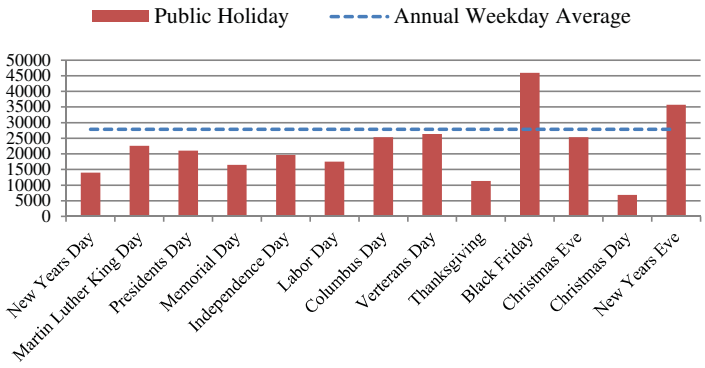



*Figure 18: Exits at BART Powell Street Station during Special Events (April 2012-March 2013)*




### 3.12.5 Platform Capacity

The BART Facilities Standards (BFS) specify the quantitative measure for platform capacity. The BFS identifies the platform range of 5 sq. ft. to 7 sq. ft. per passenger on average, reflecting the industry standard of Levels of Service (LOS) C and D. Seven (7) sq. ft. per passenger (LOS C) is the minimum space per passenger under normal operating conditions, and is the target for the peak hours. The following statements are typical industry descriptions of typical LOS C conditions the BART passenger may experience on the platform:

- Standing and restricted circulation through the queuing area.
- Within the range of personal comfort.

The BFS indicates that LOS D conditions on the platform should only be associated with a delay in service and be experienced for short periods of time.

The following statements provide a description of typical LOS D conditions the BART passenger may experience on the platform:

- Circulation is severely restricted within the queue and forward movement is only possible as group.
- Long-term waiting in these conditions is discomforting.

The BART platform at Powell St. Station measures a total length of 685 ft. and is 36 ft. wide, providing a gross platform area of 24,660 sq. ft. Taking into account the areas on the platform that passengers use for standing, the net platform area available for passenger waiting is 12,722 sq. ft. Table 6 provides

*Table 6: Breakdown of Net Platform Area Calculation*

| Component | |
|---|---|
| Platform Length | 685 ft. |
| Platform Width | 36 ft. |
| Gross Platform Area | 24,660 sq. ft. |
| Vertical Circulation Footprint | 2,747 sq. ft. |
| Run-off space at base of vertical circulation footprint (15ft. length) | 833 sq. ft. |
| Platform furniture and column footprints | 358 sq. ft. |
| Protective zone at edge of the platform (2ft. wide) | 2,740 sq. ft. |
| Free passenger circulation space for platform length (1 per side, 2ft. wide) | 2,740 sq. ft. |
| Unused space at extreme ends of platform (half traincar length per end) | 2,520 sq. ft. |
| Net Platform Area | **12,722 sq. ft.** |

a breakdown explaining how the net platform area was calculated.

Based upon the net platform area and the platform capacity measures identified in the BFS, the BART platform at Powell St. Station has capacity for 1,817 passengers. When a delay occurs at the station, the platform could accommodate up to 2,544 passengers for a short duration of time. It is not recommended that the platform operate at this level of service for more than a total of five minutes throughout the peak hour.

The platform analysis indicates that the station has sufficient capacity to accommodate anticipated future peak passenger loads. Platform screen doors have been contemplated at downtown San Francisco BART stations to help address platform capacity issues. While the installation of platform screen doors on the BART platform level would provide additional safety and security for waiting passengers, the doors are not required as a direct result of insufficient capacity on the platform level.

### 3.12.6 Vertical Circulation Capacity

Between the BART platform and concourse level, three escalators operate in the up direction (platform to concourse) and two escalators operate in the down direction (concourse to platform). Each escalator has a nominal capacity of 67.5 passengers per minute. In addition to the escalators, there are three stairways between the BART platform and concourse level. Two stairways are 4.6 ft. wide, with the third stairway width of 10.5 ft. The BFS specifies that two-way stairways have a capacity of 8.5 passengers per minute per foot of width. Based upon the available escalator and stairway widths, the vertical circulation can accommodate up to 370 passengers per minute leaving the platform to the concourse. Currently there is adequate vertical circulation capacity for both existing and future ridership at the station.

### 3.12.7 Future Weekday Ridership Demand

The 2025 daily exit projections at Powell St. Station are slightly lower than the 2012 Black Friday total exits. By analyzing the profile of activity during the day, it would be possible to identify if the peak activity on Black Friday would cause potential capacity failure within the station. BART ridership projections for 2025[5] indicate that in 2025, approximately 44,200 exits and 41,350 entries would occur on a typical weekday. Considering only peak hour travel, the station would have 5,800 exits and 1,250 entries during the AM Peak Hour and 3,000 exits with 6,450 entries during the PM Peak Hour in 2025.

BART future ridership demands indicates Powell St. Station will be the third-busiest station in the BART system in 2040. Figure 19 provides a comparison of the 2013 and 2040 peak hour ridership at Powell St. Station.

BART ridership projections for 2040[6] estimate approximately 47,896 exits and 47,836 entries on a typical weekday at Powell St. Station. The model projects 5,477 exits and 1,155 entries during the AM Peak and 3,141 exits and 6,240 entries during the PM Peak, shown in Figure 20.

*Figure 19: Comparison of Existing and Future Demand at Powell Street Station.*

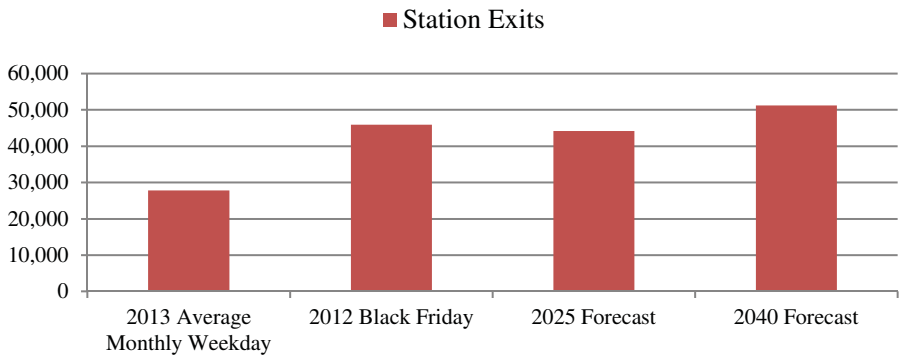
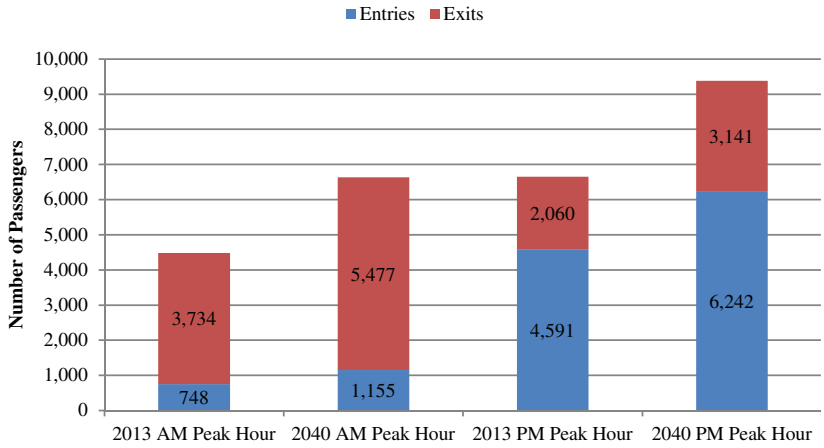



*Figure 20: Comparison of Existing and Future Peak Hour Ridership*




### 3.12.8 Current and Future Muni Demand

During the AM peak hour, Muni demand recorded an average of 1,047 exits at Powell St. Station between August 2014 - August 2015. The total daily average exits at Powell St Station over the same time period is 12,866.

The Central Subway report completed in 2008 identified the projected 2030 Muni demand during the AM Peak Hour was 4,070 exits and 2,330 entries. The PM Peak Hour forecasts indicated 2,248 exits and 2,813 entries. The daily weekday demands for Muni in 2030 were stated as 25,589 exits and 23,719 entries.

## 3.13 Platform Screen Doors

BART stations in downtown San Francisco experience capacity constraints during peak hour periods. One potential solution is the installation of platform screen doors on some of the busiest BART platforms. BART has been analyzing the peak hour capacity constraints issue for several years; however, no plan to implement platform screen doors has been selected.

The benefits of platform screen doors would be:

- Increase and maximize platform capacity by capturing the space along the platform edge to make room for waiting passengers.
- Increase safety by restricting access to the trackway, which would prevent falling, suicides and trespassing.
- Climate control for passengers waiting on the platform as trains push air through the station.

## 3.14 Emergency Egress and Evacuation

The circulation and capacity review earlier in this section included an emergency egress study to determine if capacity improvements would be required to provide adequate station evacuation in the event of an emergency. The study assumed that improvements within the BART system by 2040 would enable the system to operate up to 30 trains per hour through the Transbay Tube in the peak direction during the peak hour.

5 2025 BART Ridership Model Forecasts with a system wide total daily ridership of 560,000

6 2040 BART Ridership Model Forecasts with a system wide total daily ridership of 684,200

The study relied on two guiding documents:

- California Public Utilities Commission (CPUC) BART Agreement 1989
- Current California Building Code

The study used the PM Peak Hour travel period for the basis of the analysis because it is the most critical time period for evacuation of passengers. During the PM Peak Hour, there are significantly more passengers waiting on the platform and the trains entering the station from both the Civic Center and Montgomery directions have heavier demand volumes than during the AM Peak Hour.

## 3.15 California Public Utilities Commission Agreement Analysis

The CPUC BART Agreement 1989 dictates the design of BART facilities to account for potential emergency evacuation events. The agreement states that station capacity must allow evacuation of the BART platform in 6 minutes or less and the entire station in 8 minutes or less. To support these requirements, the station design must also ensure that the maximum distance from the most remote point on the platform to the nearest exit does not exceed 300 ft.

With the projected 2040 ridership demand and using the CPUC methodology, it is estimated that the platform could be cleared in five minutes, fourteen seconds (5m:14s), and the total station evacuation time at 6m:55s. Both times meet the performance measure of clearing the station in under eight minutes. Based on this analysis, no capacity improvement is required for the station to meet the CPUC Agreement methodology.

### 3.15.1 California Building Code Analysis

The current California Building Code (CBC) Emergency Egress analysis differs from the CPUC requirement and stipulates a platform evacuation under emergency conditions in four minutes or less and the entire station in six minutes or less. To support these requirements, the station design must also ensure that the maximum distance from the most remote point on the platform to the nearest exit does not exceed 300 ft.

With the projected 2040 ridership demand and the CBC methodology, it is estimated that the platforms could be cleared in 4m:54s, and the entire station at 6m:34s. Neither of these times meet the CBC performance target. To meet the performance target, an additional 110 inches of vertical circulation width would be required between the platform and mezzanine level.

BART currently does not have a formal agreement with CBC on its station facilities, and is not required to meet this standard. Should additional vertical circulation be considered, it would categorized as an aspirational improvement.

A number of projects in and around Powell St. Station are currently in the planning stages or will be implemented in the near future. These projects are BART-led projects and are being done separately from the Powell Modernization Plan, but are related to the effort to modernize the station.

# 4 RELATED BART MODERNIZATION PROJECTS AND STUDIES

## 4.1 Ceiling Replacement and Lighting Upgrade Project

The ceiling replacement and lighting upgrade project is the result of water intrusion into the station. The water intrusion caused damage to the original ceiling, forcing BART to remove the ceiling and re-coat with new waterproofing materials and flame retardant. Designs for a new ceiling installation have been underway concurrent to this Plan.

The public outreach effort, described in Section 5 of this Plan, presented four draft ceiling concepts and asked survey respondents to rank choice vote their preferred option. Beyond a visual representation of the ceiling concept, the public was not provided additional information on issues such as cost, ease of maintenance, and materials.

Of the four options presented to the public, one emerged as the public favorite. Figure 21 shows the option with the most survey votes.

BART staff used these results as a basis for further discussion to select a preferred option. The preferred option that emerged was a blend of two options. The preferred option is based on a variety of factors, such as cost, ease of maintenance, ease of constructability and availability of materials.

## 4.2 Easy Wins

The station elements identified as "Early Wins" include:

- Station Painting
- Deep Cleaning
- Repair Light Fixtures
- Entrance improvements

## 4.3 Station Escalator and Canopies Investments

BART is currently progressing in the design phase with a pilot program to test a canopy enclosure over two locations at Powell St. Station (in front of the Men's Wearhouse and Diesel stores) and one location at Civic Center Station (in front of the CVS Pharmacy). The canopy is intended to provide weather protection for the escalator and increase passenger and employee safety. The canopy will provide lighting at the entrance, wayfinding, real time transit information and offer a way for the escalator stairwell to be locked at the top when the station is closed. Final design is expected to be completed by fall 2015, with completion of the three entrances in late 2017.

BART and the City of San Francisco are currently planning the next phase of the station project to complete the escalator and canopy investments at Powell St. Station.

## 4.4 Faregate Expansion Program

A number of improvements to the current arrangement of the BART faregates are planned for the near term. These improvements will address fare evasion and accommodating the expected growth in station customers once the Muni Central Subway opens for service.

*Figure 21: Rendered Images of Ceiling Design*

*Figure 22: Rendered Image of Station Canopy*


To prevent fare evasion, the concourse – platform elevator located near the secondary hall within the BART paid area will be enclosed. Currently the elevator is located outside the BART paid area and the Clipper tag machine function does not register tags to the BART platform.

The re-arrangement will also accommodate the increased number of passengers who will be transferring between BART and the Muni Central Subway at the concourse level. The new arrangement is intended to allow for ease of transfers between the two systems.

BART will assess future faregate technology to allow station agents to override and manually open the faregates during emergencies. This will eliminate the need for swing gates, which currently facilitates easy fare evasion.

## 4.5 Advertising Relocation

In an effort to provide clear sight lines and improve wayfinding in the station, a number of pieces of advertising furniture will be removed or relocated within the station. Currently, two large advertising light boxes sit between aluminum clad poles by the entryway from Hallidie Plaza into the concourse. These lightboxes are slated for removal.

## 4.6 Further Station Ventilation Analysis

The ventilation analysis described in Section 3.8 raised questions regarding the viability of restoring the existing ventilation system. As described previously, Powell St. Station was constructed with two ventilation systems: one to evacuate smoke in the event of a fire on either of the platform levels, and a second to provide outside air for comfort cooling and ventilation for both platforms, and at the concourse level. Since the 1980's the platform ventilation system has been closed due to the presence of asbestos and the lack of direct control from the BART Operations Control Center.

A second analysis was conducted to assess the viability of restoring the existing ventilation system.

The analysis considered the following key factors:

- The thermal comfort of the passengers on the platform
- The feasibility of the repair and restoration of the existing equipment
- Changes in codes and regulations since the original design

Following the assessment of the existing system, it was determined a new system may be more effective and cost efficient than repairing the existing system. The assessment also found that the existing ventilation system is sufficient to serve the increase in ridership projected for 2040. The analysis included recommendations for how a new system might be sized, specified and installed. More detail on the analysis and the finding can be found in Appendix B.

# 5 PUBLIC OUTREACH

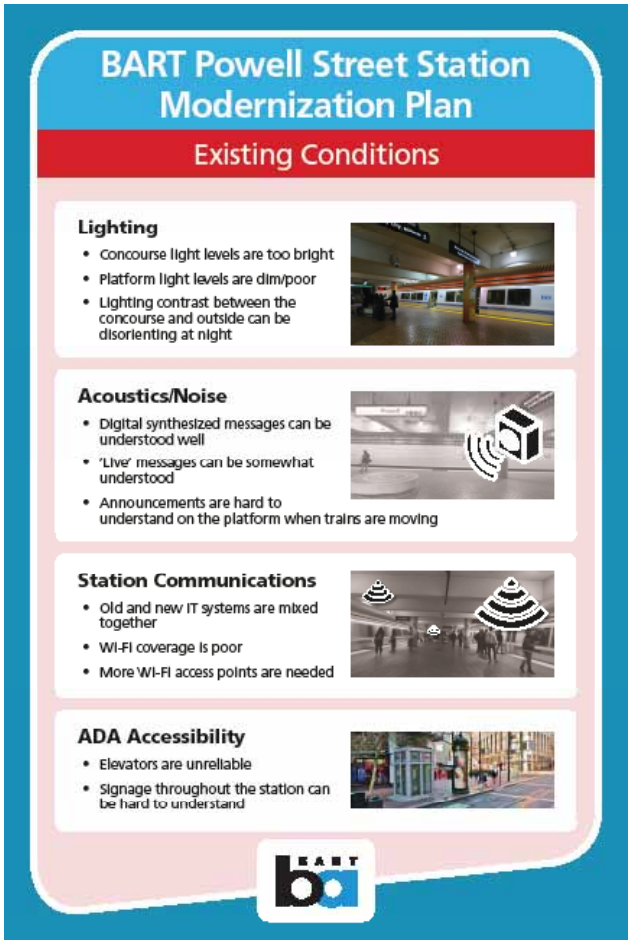
Powell St. Station's central location in San Francisco along Market Street yields numerous community and municipal stakeholders. The public outreach process cast a wide net to inform and gather input for this project. The Acknowledgements page lists the project partners that participated in the Modernization Plan process.

## 5.1 Stakeholder Outreach

The outreach plan called for a series of meetings with the project partners. The project partners were divided into two categories: City of San Francisco agencies and External Project Stakeholders.

Feedback from the meetings was combined with the input gathered from the public station open houses to assist with finalizing the prioritized project list as well as the design of the ceiling replacement.

*Figure 23: June 2014 Station Open House poster boards*


## 5.2 General Public

BART held the first of two station open houses for the Powell St. Modernization Plan. The first station open house was held over two days, with one shift during the morning peak hours (7am – 10am) and the second shift during the afternoon peak hours (4pm – 7pm).

Prior to the open house, BART advertised the event through the following:

- Radio advertising
- Social media
- Press release
- Email blasts
- In-station noticing

Both open house events utilized a mix of materials presented in-station with flyers directing customers to information posted on the BART website.

### 5.2.1. Station Open House: June 2014

The first station open house introduced the project to the public, presenting project goals, providing the planning context for the effort, existing conditions, potential project ideas, and initial concepts for the

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ceiling replacement.

All materials described above were printed on poster boards displayed at the station. BART staff and translators were on hand to guide the public through the material and answer any questions. A customer survey was distributed asking the public to rank potential station improvements from a pre-determined list and also submit their ranked choice vote on the ceiling concepts. The survey also asked a number of demographic questions. The results of the ranked choice voting for the ceiling options and the results of the demographic questions are provided in Appendix A.

Over 1,700 survey responses were collected, from both internet and in-person submissions. Overwhelmingly, survey respondents voted for improving cleanliness, safety, and maintaining escalators as the highest priority station improvements. A number of other issues were identified as important, but not with the same responses as the top three.

The survey also collected demographic data from the respondents. Figures 24-28 show information on respondents age, race, gender, household income, and household size.

*Figure 24: BART Powell Street Station Customer by Gender*

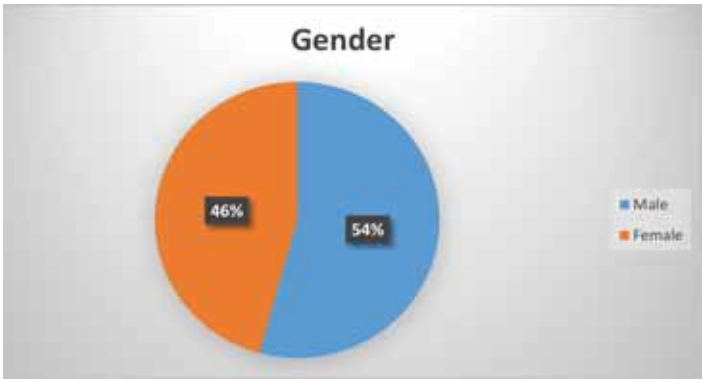



*Figure 25: BART Powell Street Station Customer by Race/Ethnicity*

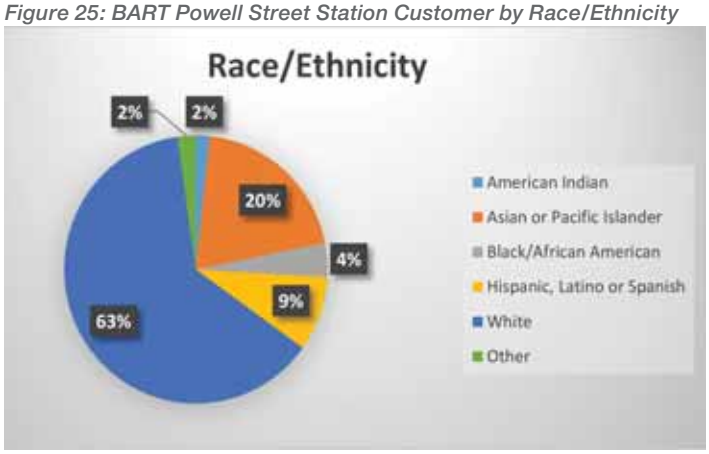



*Figure 26: BART Powell Street Station Customer by Age*

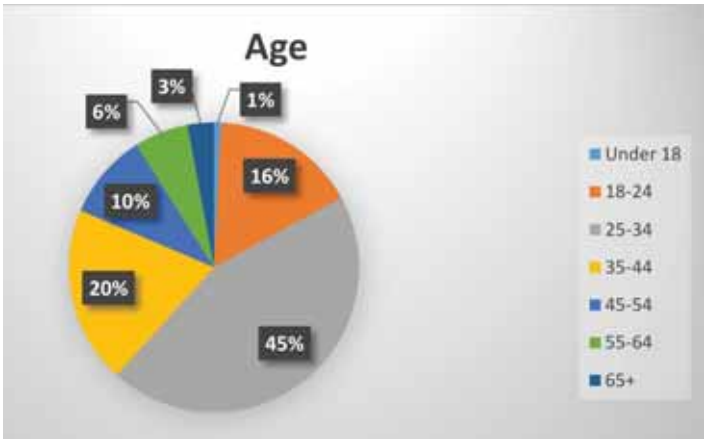



*Figure 27: BART Powell Street Station Customer by Total Household Income*

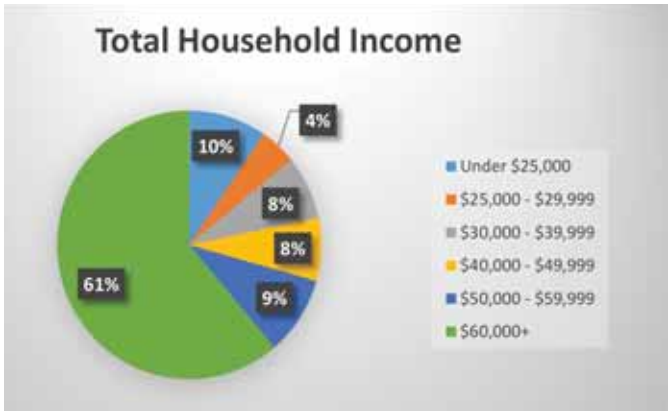
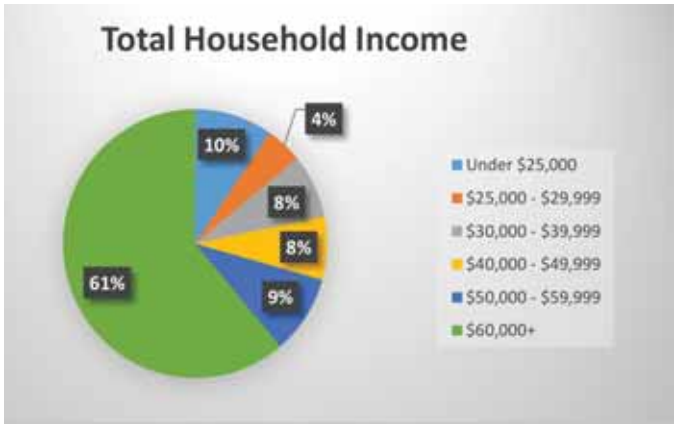



*Figure 28: BART Powell Street Station Customer by Household Size*



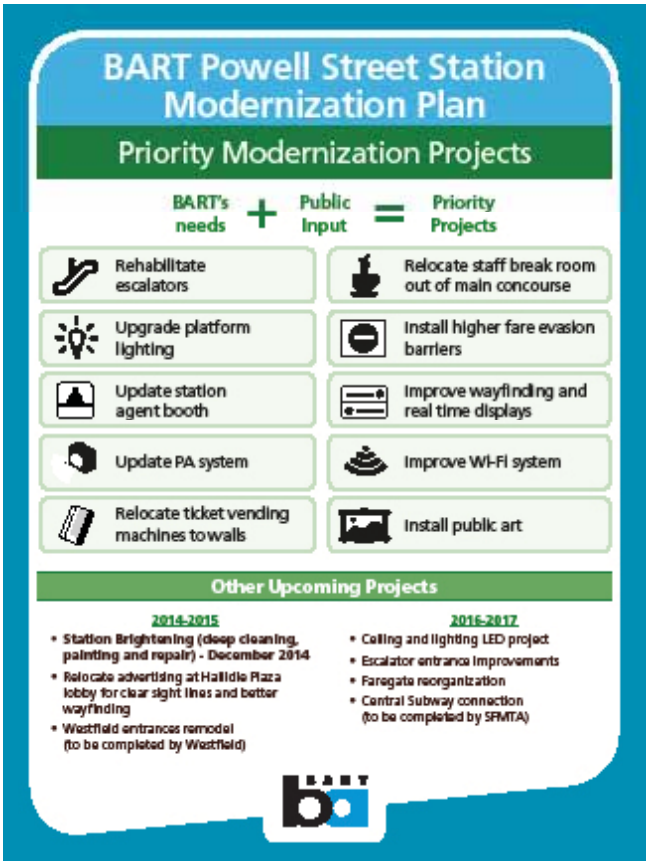

SECTION 5

### 5.2.2 Station Open House: November 2014

The second station open house reported the results of the customer survey distributed at the first open house, identified the prioritized projects, the proposed ceiling replacement concept and presented the proposed space plan for the concourse.

All materials described above were printed on poster boards displayed at the station. BART staff and translators were on hand to guide the public through the material and answer any questions. Postcards with the project website were distributed and comments were collected in person.

*Figure 29: Station Open House poster boards*

# 6 SPACE PLANNING

The space plan for Powell St. Station reviews existing station floor plans for both the platform and concourse levels and proposes improvement projects and future configuration layouts.

## 6.1 Space Plan Approach

The space plan documents the proposed station floor plans. The space plan documents existing station elements located within the public realm and in the back of house areas. These elements include:

- Fare gates, ticket vending machines and station agent booths
- Escalators, elevators and stairwells
- Mechanical, electrical, and storage rooms

The proposed station floor plans incorporate ongoing and planned improvement efforts, such as the Ceiling Replacement and Lighting Upgrade Project, Fare Barrier Improvement Project, BART Wayfinding Program and Art Program.

The proposed space plan concepts re-envision the concourse level into two types of spaces: lobbies that house all primary passenger service functions such as ticket vending and wayfinding, and circulation spaces. The three primary lobbies within the station are designated as “decision making” zones where greatest emphasis is placed on wayfinding, patron services and art.

The station is divided into four geographic areas referred to as Sectors A, B, C and D. Proposed improvements for each sector is identified in the sector subsections.

The proposed space plan recommends general improvements for the overal station. These include:

**Proposed Improvements:**

- Replacing paid area barriers with 5’ glass barriers and reconfiguring barrier layout at specific locations where indicated.
- Recessing all TVMs in a false-wall assembly – either using existing or building new false-walls as needed for a flush-mounted appearance.
- Improving wayfinding signage.
- Replacing BART station agent booths with larger booths.
- Replacing BART fare gates with next-generation gates and reconfiguring arrays according to new standards addressing accessibility and fare evasion.

## 6.2 Proposed Major Projects

The station improvement recommendations focus on increasing vertical circulation capacity, ensuring continuity of universal access into and through the station, and streamlining overall station circulation. The specific recommendations include:

- **Elevator Capacity and Access:** Enlarge the existing BART platform-to-concourse elevator and add a new BART elevator at the center of the concourse, serving the BART platform and concourse, both accessed through a concourse-level paid area. The existing elevator would be able to accommodate a gurney, and the additional elevator in the center of the concourse would help reduce travel distances for passengers requiring elevator access. This elevator would normally serve BART customers and would only be available for Muni patrons in case of emergency
- **Operational / Egress Capacity at Bloomingdales Lobby:** Provide a new stairway between concourse and the BART platform near the eastern BART paid area. The proposed configuration incorporates a landing at the Muni platform level. This arrangement could accommodate BART-Muni transfers directly from platform to platform. Operational and fare collection concerns would need further study
- **Quantity and Location of ADA Fare Gates:** There is strong need to address dual concerns of insufficient ADA fare gate capacity and struggles from customers with luggage, strollers and bikes
- **Access through Hallidie Plaza:** Improve access to Hallidie Plaza between the Plaza level and station concourse. One near-term solution in the proposed scenario explores a new ramp between levels,. Long range plans reflect the City-driven master planning effort to bring the Hallidie Plaza up to street level
- **Paid Area Reconfiguration:** Various reconfigurations to BART and Muni paid areas and program locations are being proposed to improve sightlines and circulation access throughout the concourse.

*Figure 30: Illustrated Hallidie Plaza*

### 6.2.1 Sector A / Hallidie Plaza Lobby

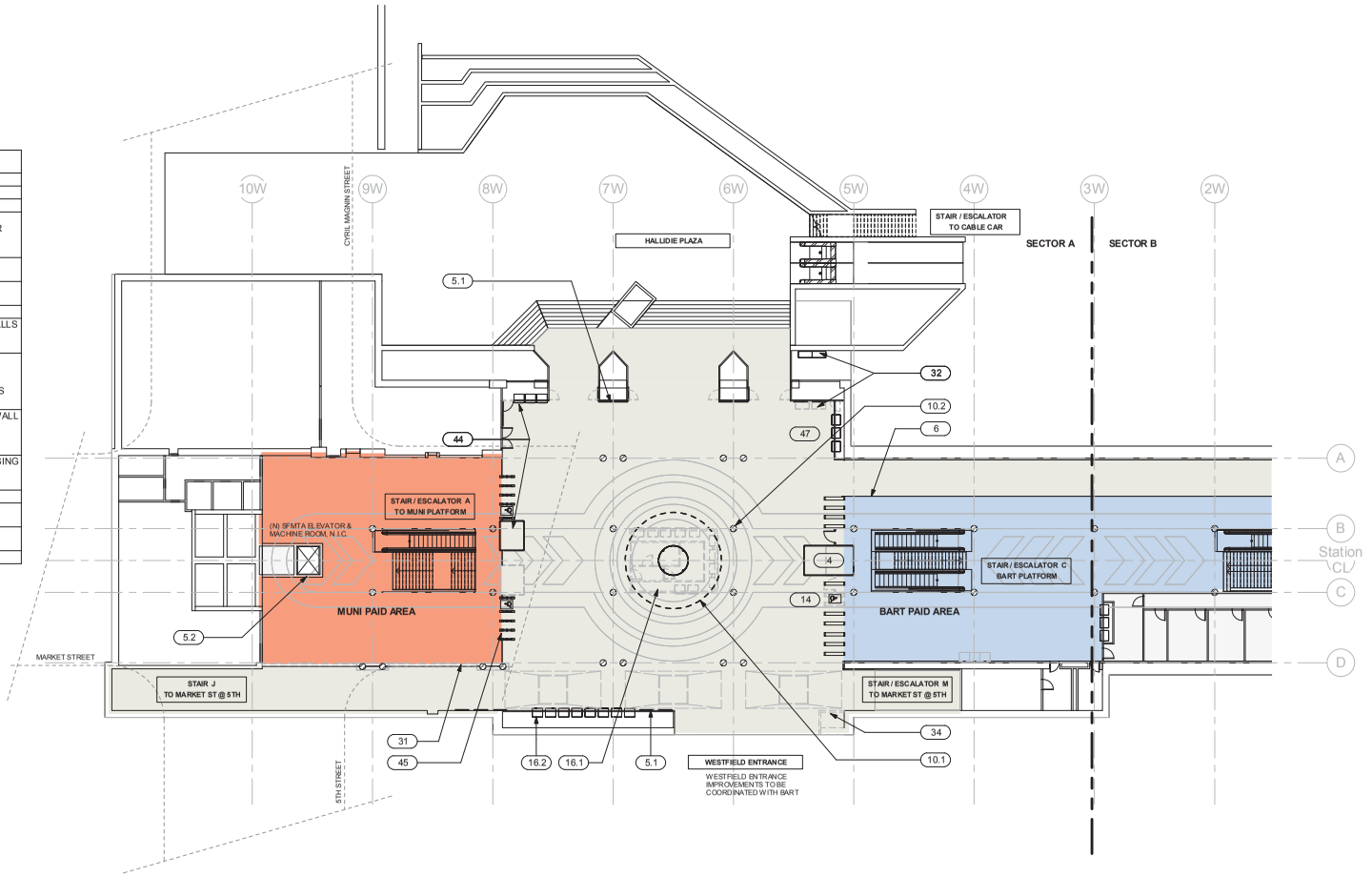
This lobby is the main circulation space for passengers entering the station from Hallidie Plaza, the San Francisco Centre (SFC) mall, or the Fifth/Market Street entrance. This is a primary passenger hub within the station and space planning improvements focus on making the lobby as spacious, barrier-free and visually transparent as possible.

Proposed Improvements:

- Update station agent booth
- Update wayfinding, maps & TIDS
- Demolish Paid/Free Barricade and replace with 5' glass paid/free barricade
- Art location on ceiling at the center of the lobby
- Additional ADA faregates
- Remove and relocate TVMs and break room
- Replace southwest entrance art wall. Demolish wall and column enclosures, replace with 5' glass paid/free barricade and stainless steel column covers
- Relocate escalator controller cabinets, recessing them into decommissoned pocket-door cabinet behind
- Relocate Muni/Clipper TVM from Muni station agent booth area
- Replace Muni paid area barriers with 5' Glass barrier
- Payphone removal

*Figure 31: Proposed Sector A Space Plan*

| KEYNOTE LEGEND | |
|---|---|
| 4 | UPDATE STATION AGENT BOOTH |
| 5.1 | WAYFINDING, MAPS & TIDS: (N) TIDS/MAPS |
| 5.2 | WAYFINDING, MAPS & TIDS: (N) ELEVATOR ID CUBE |
| 6 | DEMO (E) PAID/FREE BARRICADE AND REPLACE WITH 5' GLASS PAID/FREE BARRICADE, RECONFIGURING BARRIER CONFIGURATION WHERE INDICATED. TYP THROUGHOUT CONCOURSE. |
| 10.1 | ART OPPORTUNITY: (N) ART LOCATION ON CEILING AT CENTER OF LOBBY |
| 10.2 | ART OPPORTUNITY: (N) ART-WRAPPED COLUMNS WITHIN LOBBY |
| 14 | ADDITIONAL ADA FAREGATES |
| 16.1 | REMOVE AND RELOCATE TVMS AND BREAK ROOM. (E) WALLS TO BE DEMOLISHED, (E) EQUIPMENT AND BREAK ROOM RELOCATED TO LOCATIONS INDICATED IN PLAN |
| 16.2 | RELOCATED TVMS. RECESS (N) AND (E) RELOCATED MACHINES IN FALSE WALL ASSEMBLY, TYP AT ALL LOCATIONS. RECESS INTO (E) FALSE WALLS WHERE AVAILABLE. CONSTRUCT (N) FALSE WALL TO MATCH (E) AS NEEDED. |
| 31 | REPLACE SOUTHWEST ENTRANCE ART WALL. DEMO (E) WALL AND COLUMN ENCLOSURES, REPLACE WITH 5' GLASS PAID/FREE BARRICADE AND STAINLESS STEEL COLUMN COVERS |
| 32 | RELOCATE ESCALATOR CONTROLLER CABINETS, RECESSING THEM INTO DECOMMISSIONED POCKET-DOOR CABINET BEHIND |
| 34 | ABANDON CLOSET P15 |
| 44 | RELOCATED MUNI / CLIPPER TVMS FROM MUNI STATION AGENT BOOTH AREA |
| 45 | REPLACE MUNI PAID AREA BARRIERS WITH 5' GLASS BARRIER. |
| 47 | PAYPHONE REMOVAL |




1 A01 **POWELL STATION CONCOURSE - SECTOR A**

**Scale:** 1/16" = 1'-0"

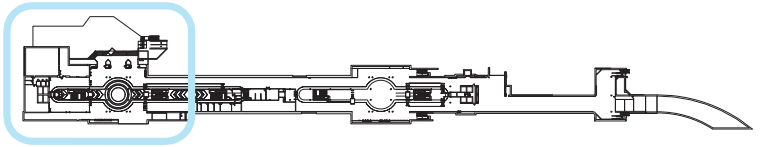
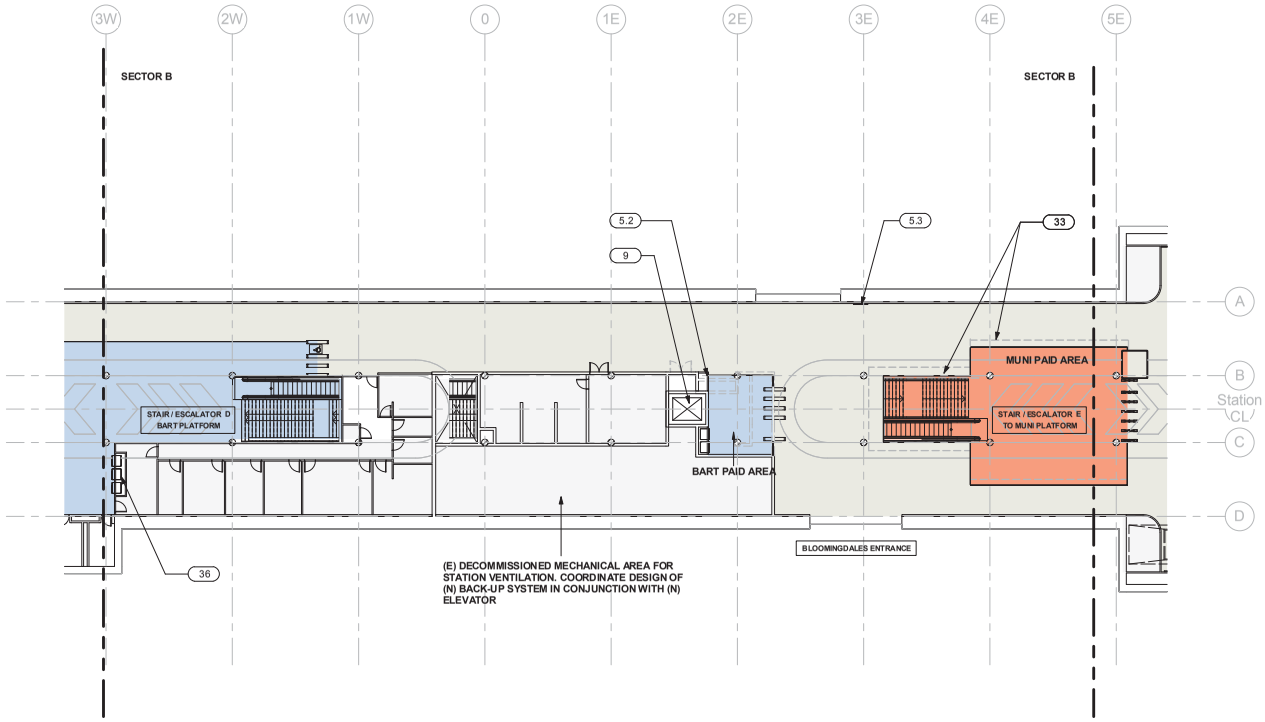


*Figure 32: Future Sector A Space Plan*

| KEYNOTE LEGEND | |
|---|---|
| 5.2 | WAYFINDING, MAPS & TIDS: (N) ELEVATOR ID CUBE |
| 5.3 | WAYFINDING, MAPS & TIDS: (N) DIRECTIONAL SIGN |
| 9 | NEW MID-STATION ELEVATOR WITH NEW VENTILATION SYSTEM. PROVIDE (N) PAID AREA WITH MINIMUM (2) FARE GATES, (1) ADDFARE MACHINE AND 5' GLASS PAID/FREE BARRIER. |
| 33 | MODIFY MUNI PAID AREA BARRIER. INSTALL NEW BARRIER TO MATCH BART 5' GLASS BARRIER. |
| 36 | RELOCATE ADDFARE MACHINES. (N) BART POLICE VESTIBULE WITH NICHE IN ENTRY WALL FOR ADDFARE MACHINES RELOCATED FROM SOUTH WALL. |




1 / A02 **POWELL STATION CONCOURSE - SECTOR B**

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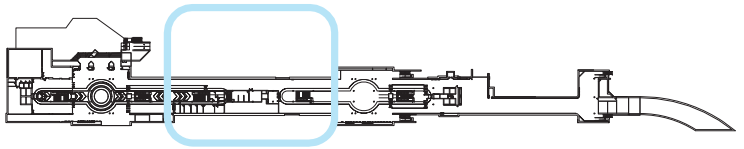


*Figure 33: Illustrated Bloomingdale's Lobby*

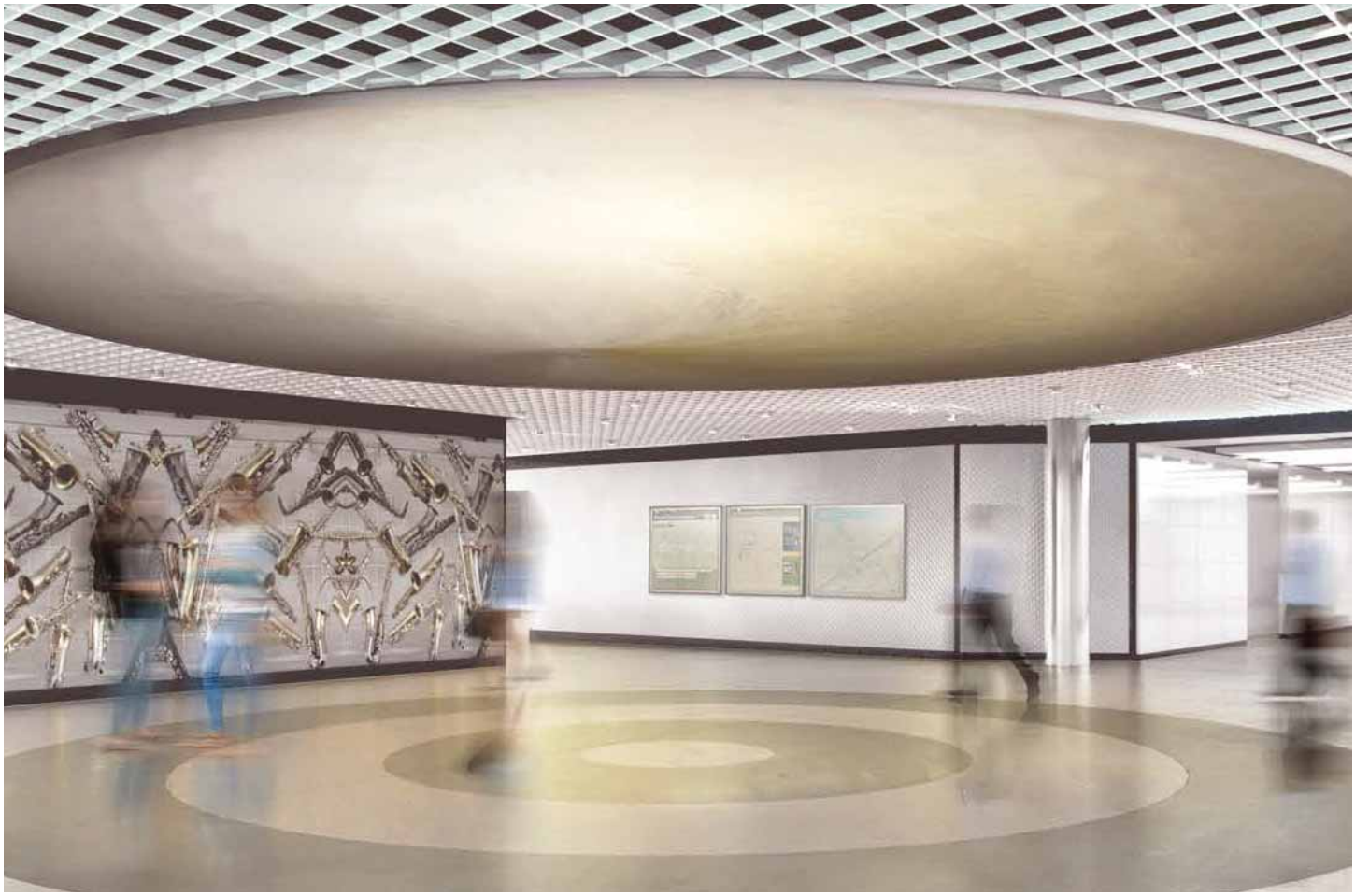
### 6.2.2 Sector B / Connector between Hallidie Plaza and Bloomingdales Lobbies

Sector B contains the circulation corridor between Hallidie Plaza Lobby and Bloomingdales Lobby, station operation spaces (BART Police, mechanical core) and portions of the BART and Muni paid areas. This functional corridor is the preferred location for advertising, retail and circulation experience that contrasts with the desired calm, open, ad-free Lobby spaces.

Proposed Improvements:

- Update wayfinding, Maps, & TIDS
- New Mid-station elevator with new ventilation system
- Provide paid area with minimum (2) fare gates, (1) addfare machine and 5' glass paid/free barrier
- Modify MUNI paid area barrier. Install new barrier to match BART 5' glass barrier
- Relocate addfare machines. BART Police vestibule with niche in entry wall for addfare machines relocated from south wall

*Figure 34: Illustrated Central Subway Lobby looking east*



### 6.2.3 Sector C / Bloomingdales Lobby and Central Subway Lobby

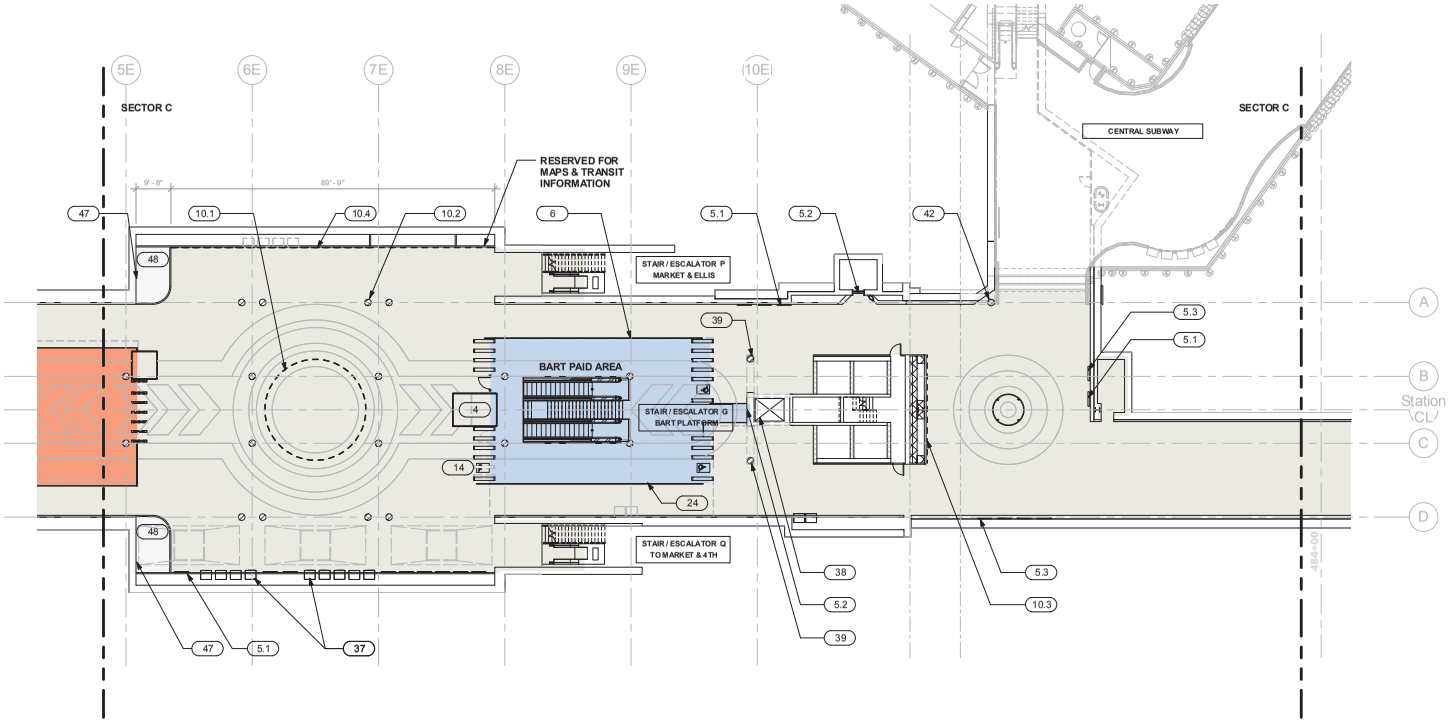
Sector C includes two of the three re-envisioned lobbies: the Bloomingdale's Lobby and the Central Subway Lobby – site of the future Central Subway connection. BART's east paid area and vertical circulation occupy the space between these two lobbies. Once Central Subway opens in 2019, this zone of the station will experience thousands of additional daily passengers exiting or transferring at Powell St. Station. A future grand stair to the platforms from the center of the Bloomingdales Lobby would bring additional activity and would dramatically change the use of this lobby.

Proposed Improvements:

- Update station agent booth
- Update wayfinding, maps & TIDs
- Demolish paid/free barricade and replace with 5' glass paid/free barricade, reconfiguring barrier configuration where indicated.
- Art opportunity on ceiling at center of lobby
- Art opportunity for art-wrapped columns within the lobby
- Art opportunity at central subway wall of lobby
- Additional ADA faregates
- Reconfigure east BART paid area
- Relocate TVMs from north wall to south wall
- Reconstruct elevator hoistway, replacing with glass enclosure and cab.
- Structural modifications to improve sightlines
- Payphone removal
- New transit store location and Transmart retail kiosk

*Figure 35: Proposed Sector C Space Plan*

| KEYNOTE LEGEND | |
|---|---|
| 4 | UPDATE STATION AGENT BOOTH |
| 5.1 | WAYFINDING, MAPS & TIDS: (N) TIDS/MAPS |
| 5.2 | WAYFINDING, MAPS & TIDS: (N) ELEVATOR ID CUBE |
| 5.3 | WAYFINDING, MAPS & TIDS: (N) DIRECTIONAL SIGN |
| 6 | DEMO (E) PAID/FREE BARRICADE AND REPLACE WITH 5' GLASS PAID/FREE BARRICADE, RECONFIGURING BARRIER CONFIGURATION WHERE INDICATED. TYP THROUGHOUT CONCOURSE. |
| 10.1 | ART OPPORTUNITY: (N) ART LOCATION ON CEILING AT CENTER OF LOBBY |
| 10.2 | ART OPPORTUNITY: (N) ART-WRAPPED COLUMNS WITHIN LOBBY |
| 10.3 | ART OPPORTUNITY: (N) ART LOCATION AT CENTRAL SUBWAY LOBBY |
| 10.4 | ART OPPORTUNITY: (N) ART LOCATION AT NORTH WALL OF LOBBY |
| 14 | ADDITIONAL ADA FAREGATES |
| 24 | RECONFIGURE EAST BART PAID AREA |
| 37 | RELOCATE TVMS FROM NORTH WALL TO SOUTH WALL |
| 38 | RECONSTRUCT ELEVATOR HOISTWAY, REPLACING WITH GLASS ENCLOSURE AND CAB. CONFIRM FEASIBILITY WITH STRUCTURAL. |
| 39 | MODIFY VENT STRUCTURE WALLS FOR INCREASED VISIBILITY. CUT BACK (E) WALL, REPLACE WITH STRUCTURAL COLUMN. CONFIRM FEASIBILITY WITH STRUCTURAL. |
| 42 | STRUCTURAL MODIFICATIONS TO IMPROVE SIGHTLINES |
| 47 | PAYPHONE REMOVAL |
| 48 | (N) TRANSIT STORE AND TRANSMART RETAIL KIOSK |




1 A03 **POWELL STATION CONCOURSE - SECTOR C**

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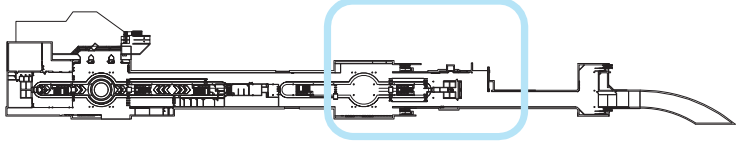
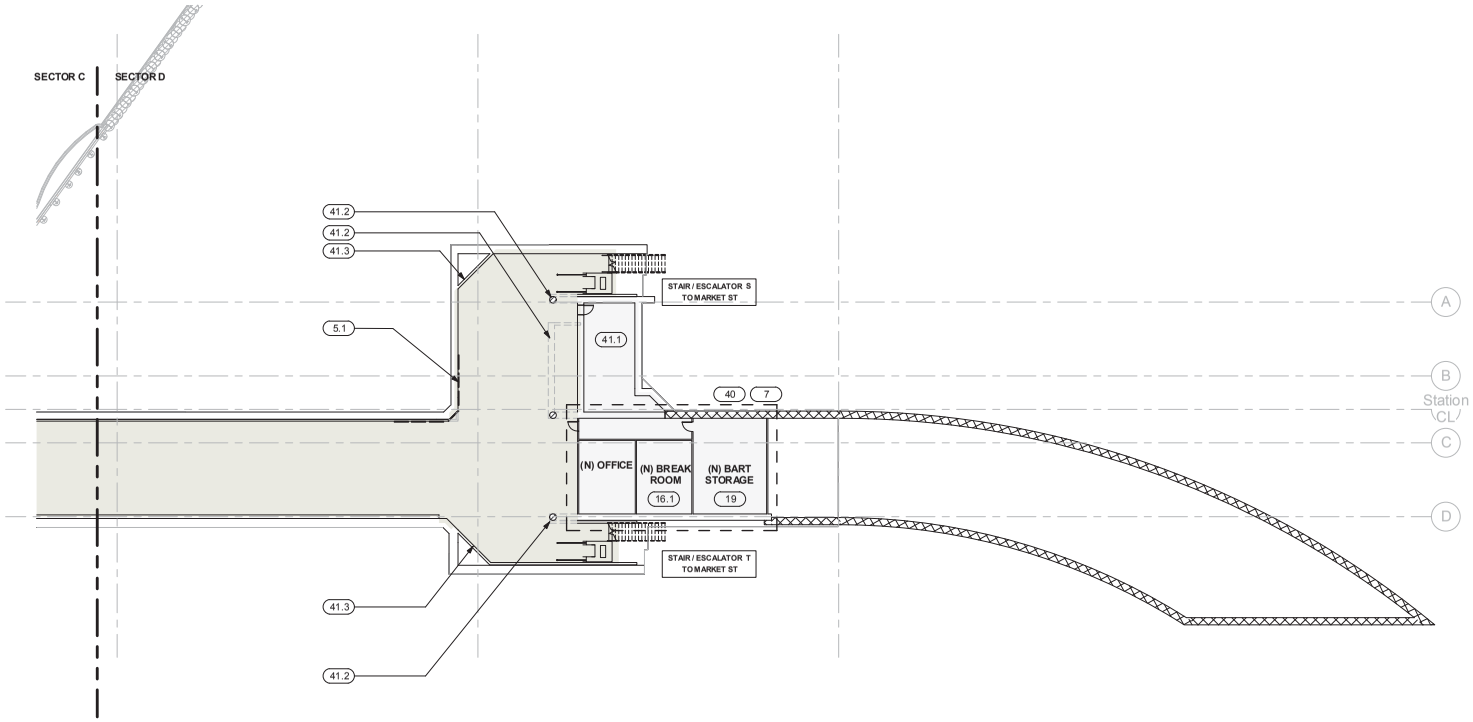


*Figure 36: Future Sector C Space Plan*

| KEYNOTE LEGEND | |
|---|---|
| 5.1 | WAYFINDING, MAPS & TIDS: (N) TIDS/MAPS |
| 7 | MORE BIKE PARKING, OPTION A. (N) SECURE PATRON-ACCESSIBLE BIKE STATION. |
| 16.1 | REMOVE AND RELOCATE TVMS AND BREAK ROOM. (E) WALLS TO BE DEMOLISHED, (E) EQUIPMENT AND BREAK ROOM RELOCATED TO LOCATIONS INDICATED IN PLAN |
| 19 | STORAGE FACILITY FOR DUMPSTERS, UTILITY CLOSET, JANITORIAL EQUIPMENT. |
| 40 | NEW PROGRAM SPACE AT YERBA BUENA CORRIDOR |
| 41.1 | STRUCTURAL MODIFICATIONS FOR IMPROVED CIRCULATION: EXPLORE REDUCING MECHANICAL ROOM FOOTPRINT BY RELOCATING WALL. COORDINATE WITH MECHANICAL TO DETERMINE FEASIBILITY OF POTENTIAL MODIFICATIONS TO CURRENT USE AND ASSOCIATED UTILITIES |
| 41.2 | STRUCTURAL MODIFICATIONS FOR IMPROVED CIRCULATION: IMPROVE VISIBILITY. CUT BACK (E) WALL, REPLACE WITH STRUCTURAL COLUMNS AT EACH CORNER. CONFIRM FEASIBILITY WITH STRUCTURAL. |
| 41.3 | STRUCTURAL MODIFICATIONS FOR IMPROVED CIRCULATION: (N) ANGLED WALL AT CORNERS |




1 A04 **POWELL STATION CONCOURSE - SECTOR D**

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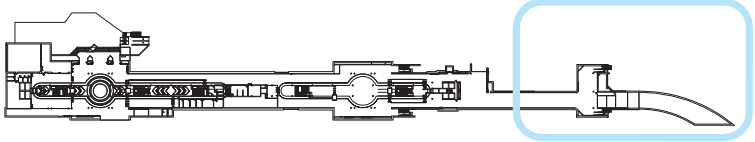


*Figure 37: Illustrated Central Subway Lobby Looking East*


### 6.2.4 Sector D / East Corridor and Station Entrance

Sector D is comprised of the east corridor leading to the Fourth/Market Street station entrance. Similar to Sector B, this functional corridor is a preferred site for ad placement (often used for domination advertising), retail, and station operation functions at new program areas between entrance stairs.

Proposed Improvements:

- Update wayfinding, maps, & TIDS
- Additional bike parking or a future option of secure patron-accessible bike station
- Remove and relocate TVMs and break room Equipment and break room relocated to locations indicated in plan
- Reconfigure storage facility for dumpsters, utility closet, janitorial equipment
- New program space at Yerba Buena corridor
- Structural modification for improved circulation: Explore reducing mechanical room footprint by relocating wall
- Structural modifications for improved circulation: Angeled wall at the corners

## 6.3 Wayfinding Program

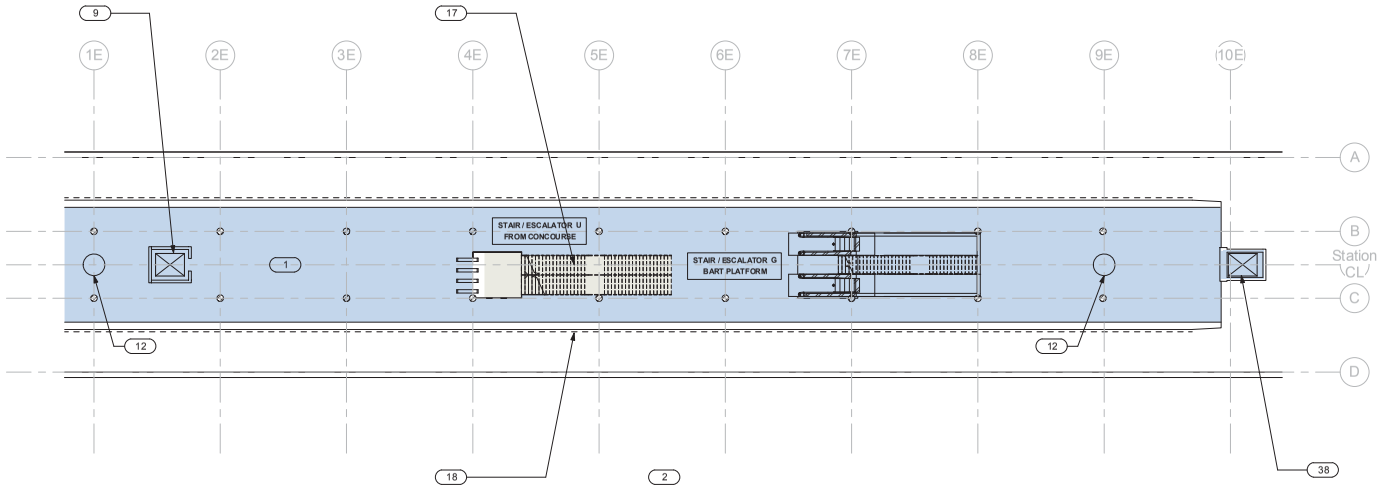
The primary improvement to wayfinding at Powell St Station includes fully implementing BART's Wayfinding Program and providing updated, more contemporary signage that is larger and easier to read. Improved wayfinding also relies on continuous coordination between BART and Muni to ensure that signage remains legible, is fixed or replaced when needed.

Survey feedback reveals a desire for real-time train information at the concourse level. Usability of the real-time information displays is very sensitive to display location in the station and readability of the content.

Additional wayfinding enhancements are encouraged. Enhancements include preserving unobstructed sightlines from passenger decision points to recognizable features such as elevators, station exists, escalators, etc. The color coding of glass paid area barriers by agency served (as shown in the station renderings) is another opportunity to embed wayfinding cues in the features of the station.

*Figure 38: Proposed Sector D Space Plan*

| KEYNOTE LEGEND | |
|---|---|
| 1 | REPLACE PLATFORM FLOORING WITH TERRAZZO OR MARBLE TILES |
| 2 | UPGRADE PLATFORM LIGHTING |
| 9 | NEW MID-STATION ELEVATOR WITH NEW VENTILATION SYSTEM. PROVIDE (N) PAID AREA WITH MINIMUM (2) FARE GATES, (1) ADDFARE MACHINE AND 5' GLASS PAID/FREE BARRIER. |
| 12 | REPLACE WITH (N) PLATFORM LEVEL SEATING |
| 17 | NEW VERICAL CIRCULATION BETWEEN BART AND MUNI PLATFORMS AND CONCOURSE. FREE AREA STAIR WITH PAID/FREE BARRIERS AND FARE GATES AT EACH LEVEL |
| 18 | PLATFORM SCREEN DOORS FOR SAFETY AND FIRE PROTECTION |
| 38 | RECONSTRUCT ELEVATOR HOISTWAY, REPLACING WITH GLASS ENCLOSURE AND CAB. CONFIRM FEASIBILITY WITH STRUCTURAL. |




1 A05 **POWELL STATION - BART PLATFORM**

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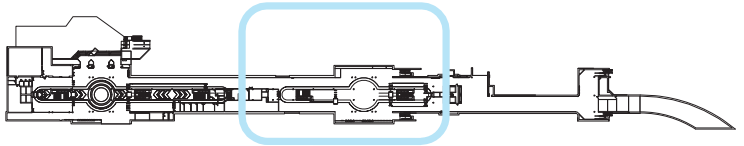
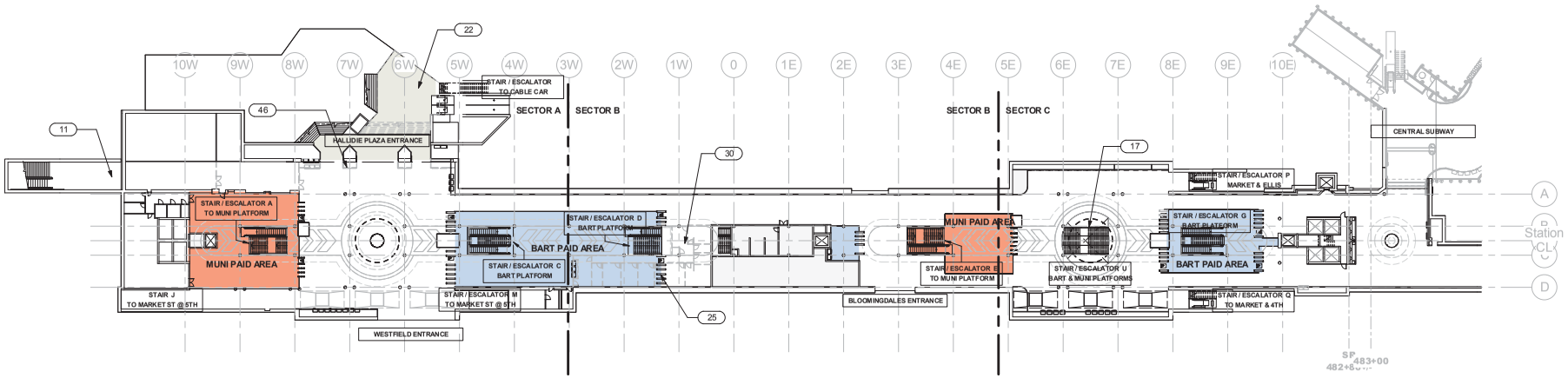


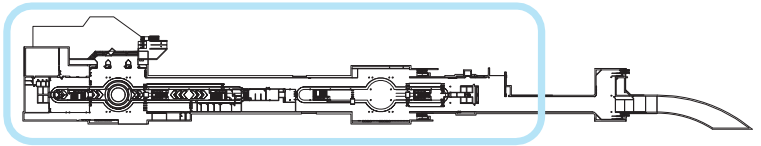
*Figure 39: Future Sector D Space Plan*

| KEYNOTE LEGEND | |
|---|---|
| 11 | NEW STAIR AND ESCALATOR TO STREET LEVEL |
| 17 | NEW VERICAL CIRCULATION BETWEEN BART AND MUNI PLATFORMS AND CONCOURSE. FREE AREA STAIR WITH PAID/FREE BARRIERS AND FARE GATES AT EACH LEVEL |
| 22 | DEMO HALLIDIE PLAZA IN THE AREA INDICATED, BUILD NEW CONCOURSE-LEVEL PLAZA, REPLACE ESCALATOR AND EXTEND STAIR TO CABLE CARS. |
| 25 | RECONFIGURE WEST BART PAID AREA |
| 30 | DEMO (E) BART POLICE AREA, REPLACE WITH (N) PAID/FREE BARRICADE AND FARE GATES, REPLACING FLOOR AND WALL FINISHES AS NEEDED. |
| 46 | DEMO (E) POCKET DOORS, PUSHING EQUIPMENT AND SIGNS BACK TO NEAREST WALL BEHIND, REFINISHED TO MATCH ADJACENT LOBBY WALLS. |




1 / A06 **POWELL STATION CONCOURSE - ALTERNATES**

**Scale:** 1/32" = 1'-0"



## 6.4 Art

The proposed locations for new art pieces are the ceiling, column covers and walls (where available) at each of the three new 'lobbies'.

The original incarnation of Powell St. Station had a ceiling dome over the circular floor graphic at the Bloomingdale's Lobby. This dome not only provides a sense of placemaking within the station, but in an integral part of the station's design. The Ceiling Improvement Project will reconstruct this dome and add an additional dome in the Hallidie Plaza Lobby and a similar circular disc at the Central Subway Lobby where the structure does not allow for a concave ceiling.

These locations are proposed as public art sites, along with the four surrounding column covers at the Hallidie Plaza and Bloomingdales Lobbies, the North Wall of the Bloomingdales Lobby and the West Wall of the Central Subway Lobby. The intent is to differentiate each lobby by creating site lines and nodes that can serve as meeting spaces and enhance wayfinding.

It is intended that all future art, wayfinding and other space planning improvements will be closely coordinated with retail and advertising to minimize conflicts.

## 6.5 Retail and Advertising

Retail and advertising throughout the BART system are managed through contracts with a master vendor or advertising provider. A number of individual retail vendor locations remain throughout the system as well.

This Plan proposes that locations identified for advertising placement be reviewed and revised in preparation for the next Advertising Franchise Agreement in 2018. The review cycle provides an opportunity to evaluate current advertising locations and identify where advertising locations can be changed to accommodate the Wayfinding or Art Program.

Over the long term, BART's Marketing & Research Department intends to explore possibilities to modernize the advertising infrastructure in ways that add light and complement the overall vision of this Plan. This would involve not only reviewing the placement of ads, but also looking at more modern formats, such as backlit and digital ads that fit with a more modern environment.

## 6.6 Access and Circulation

The review of the station's ADA compliance yielded recommendations for potential areas of improvement.

These include:

- Egress Capacity at Bloomingdales Lobby: Previous capacity studies indicated a need for a new egress stair from the BART and Muni platforms. The location identified is near the eastern BART paid area.
- General Wayfinding: Enhancing basic wayfinding in Powell St Station would ease circulation and reduce travel distances for all passengers.
- Barrier-Free Concourse: Many opportunities exist within Powell St Station to remove physical and visual obstructions and maximize clear circulation space for ease of access through the station.
- Accessibility at Westfield Mall Connection Points: The two station entrances from Westfield Mall require modifications for accessibility. Although these accessibility gaps occur on the Westfield Mall side, BART is interested in creating seamless passenger movement through the station as possible.

# 7 PRIORITY PROJECTS

## 7.1 Project List Development Process

Following public input on station improvements and needs (Section 5) and the Space Planning exercise (Section 6), a comprehensive list of projects was developed. Once the comprehensive project list was compiled, BART staff engaged in a refinement process, where the initial list of potential project improvements were screened using a set of evaluation criteria. The evaluation criteria is a pre-set list developed by BART to be used on a wide variety of projects to prioritize projects. The evaluation criteria is embedded in a decision support software tool called Decision Lens that is designed to guide stakeholders through an organized and transparent decision making process.

## 7.2 Decision Lens

The Decision Lens program is an interactive prioritization activity where users are engaged in actively ranking and valuing the importance of projects in real time against established parameters.

BART staff worked with the Decision Lens program to establish a pre-set list of criteria to prioritize multiple projects against one another. The baseline criteria is are weighted to the unique characteristics of each work effort that will utilize the Decision Lens program.

The pre-set criteria are organized around four main categories: Make Transit Work, Connect to Community, Create Place, and Implementation. Each category is made up of sub-criteria, shown in Table 8. Representatives from BART departments participated in a real time exercise to weight each criteria for Powell St Station projects, followed by using the weighted criteria to prioritize the projects.

*Table 8: Decision Lens Baseline Criteria*

| Criteria | Sub-Criteria | Description |
|---|---|---|
| **Make Transit Work** | | Ensure BART system is reliable and has the capacity to meet the customer and employee needs |
| | Maintain Reliability | Protect investment in existing system through systematic replacement of aging components and infrastructure; emphasis on positive customer experience |
| | Increase Station Capacity | Optimize the BART system's ability to meet projected ridership increases by increasing BART's capacity to carry passengers |
| | Advance Sustainability | Reduce BART District's environmental footprint through implementation of sustainable and cost-effective techniques such as conserving resources, lowering GHG emissions and reducing maintenance costs |
| | Improve Employee Empowerment | Ensure that the BART workforce has the tools and space that they need to support a healthy, safe, and productive workplace |
| **Connect to Community** | | Improve the connectivity to and within BART stations and connect to the community by responding to their priorities |
| | Connect to BART | Maximize connectivity and facilitate multi-modal access to stations and within station areas, including transit, walking and biking |
| | Expand Universal Design | Improve universal design of BART stations and access to stations to provide access for all |
| | Incorporate Community Input | Respond to the community and customer input regarding which improvements are perceived as most important |
| **Create Place** | | Encourage the BART station to integrate into the surrounding community and contribute the community's livability, safety and vitality |
| | Enhance Customer Experience | Contribute to beautification, comfort, and placemaking (e.g. art, architecture, ambience) to enhance livability and vitality at stations and to support regional goals |
| | Ensure Safety and Security | Enhance customer and system, real and perceived safety and security |
| | Leverage Partnerships | Protect the investment in rail transit through strategic partnership and leveraging outside funding to match BART investments |
| **Implementation** | | Ensure that the recommended improvements are feasible, cost effective and have the potential to leverage support from the community |
| | Project Readiness | A measure of the time it will take to construct the project, taking into consideration availability of existing standards, required additional analysis, outreach, or design, coordination and/or any foreseeable hurdles of implementation |
| | Project Efficiency | A measure of the long-term benefits and or savings gained by the project |

## 7.3 Project Scoring

Based on the BART staff weighting and project prioritization exercise through the Decision Lens program, an overall score was calculated for each project.

## 7.4 Project Cost Estimates

Following the Decision Lens exercise, estimated project costs were developed. These numbers are preliminary, for planning purposes only, are subject to change, and will be refined in later stages of design. Not every project was costed because some projects are already approved or linked to other improvement efforts.

Some projects were not costed due to reason including infeasibility, security, labor, and some projects are managed by the City of San Francisco.

The projects not costed include:

- Improve station cleanliness
- Improve safety and security
- Maintain escalator/elevators
- Cross platform connection
- Install phone chargers
- New Ventilation system
- Hallidie Plaza redesign
- Relocate Muni Station Agent booth (east paid area) from northeast corner of paid area to southeast corner
- Relocate Muni/Clipper TVM from west Muni paid area/station agent booth area

## 7.5 Final Prioritized List

The Decision Lens exercise, the project cost estimates, and BART priorities combined were all used to finalize the project list. The final prioritized list takes into account the available funding and how quickly the projects can be implemented. A number of projects identified on the project list score highly but are longer term projects that are also part of larger BART system improvement efforts. A few of the other projects have cost estimates that exceed available funding. The projects prioritized for implementation met the Plan's goals, can be completed within the available budget, and can make an immediate positive impact at the station.

The final priority list of projects combined are estimated to cost $93 Million. Specific project cost estimates for individual projects are show in Table 9.

BART is currently advancing the design for Phase 1 Project List in Table 10. However, the improvements that BART will ultimately implement in this phase will be decided by the amount of available funding and the construction bid cost information.

The Ceiling Replacement and Lighting Upgrade project is not included in the Phase I list as it is being funded separately.

Currently, there is no funding identified for subsequent improvements, including Phase 2 (Table 11). BART will work with key stakeholders to identify potential City, regional and federal funding sources.\

*Table 9: Project Cost Estimates*

| Project | Cost Estimate |
|---|---|
| Escalator (to street) Rehabilitation and replacement with Canopy | $25 million |
| Upgrade platform lighting | $1.7 million |
| Removal of TVMs and break room in the center of the concourse lobby | $925,000 |
| Improve Wi-Fi and incorporate BART mechanical and electrical system | $300,000 |
| PA System | $1.3 million |
| Wayfinding signage and real time displays | $865,000 |
| Expand and relocate Map and Transit Information Displays (TIDs) | $455,000 |
| Update station agent booth | $2.3 million |
| Fare evasion strategy | $690,000 |
| Structural modifications to improve sightlines and patron circulation - far east end of station. | $1.6 million |
| Reconfigure EAST BART paid area | $2.4 million |
| LED lighting for backrooms | $175,000 |
| Relocate TVM / Bill change machines from north wall of the secondary centroid (Bloomingdales Lobby) to south wall. | $575,000 |
| Reconstruct east (existing) concourse to platform elevator hoistway to install a larger elevator with maximized glass area in both the hoistway and cab construction for visibility. | $3.2 million |
| Move transit store and chronicle newsstands (integrate into retail stores) | $60,000 |
| Install art opportunities | $1.5 million |
| ADA - Handrail inside Westfield Mall between BART and Food Court | $460,000 |
| Relocate BART Police Facility out of station concourse footrpint. | $2.5 million |
| Construct new program space within the corridor at the far eastern end of the concourse | $740,000 |
| Modify MUNI paid area barrier configuration near east Westfield entrance to remove double barrier section and increase free corridor width. | $465,000 |
| Relocate Add Fare machines in the western BART paid area from the freestanding location on the south wall to a machine niche built on the west face of the police station. | $225,000 |
| Replace platform flooring | $3.4 million |
| Platform screen doors | $6 million |
| More bike parking | $1.7 million |
| Replace MUNI paid area barriers with 5' glass barrier at both paid area entrances | $65,000 |
| New mid-station elevator with new ventilation system | $6.1 million |
| Assisted Listening System (Hearing induction loops in station agent booth) | $300,000 |
| Storage facility for dumpsters, utility closet, janitorial equipment | $640,000 |
| New platform seating throughout station | $250,000 |
| ADA - Add street level directional audio cues throughout station | $300,000 |
| Reconfigure West BART Paid Area - | $1.2 million |
| Install sound absorbers at platform level | $575,000 |
| ADA - more reliable accessibility between BART and Nordstrom entrance (i.e.ramp, more reliable wheelchair lift) | $460,000 |
| Modify east vent structure walls for increased visibility and circulation space. | $935,000 |
| New in-station corridor to Cyril Magnin | $13.7 million |
| Payphone removal from platform | $12,000 |
| New vertical circulation (stairs from concourse to platform) | $5.6 million |
| Reopen public restrooms | $360,000 |
| Additional ADA faregates | $1 million |
| Replace south west entrance art wall with 5' tall glass barrier. | $300,000 |
| Demolish Hallidie Plaza entrance pocket door alcoves left over from previous horizontal sliding grilles. | $90,000 |
| Relocate Hallidie Plaza east escalator controller panels | $55,000 |
| Convert power outlets with adapters | $155,000 |
| Abandon closet P15 at the east end of the SF Centre entrance. | $25,000 |
| **Total** | **$93,857,000** |

*Table 10: Phase I Prioritized Projects*

| Project | Cost Estimate |
|---|---|
| Relocate TVMs / break room in the center of Hallidie lobby | $622,000 |
| Relocate TVMs from north wall to south wall of Bloomingdale's lobby | $493,000 |
| Upgrade platform lighting | $1,003,000 |
| Wayfinding, Transit Information Display Signs | $665,240 |
| Demo Hallidie entrance pocket door alcoves | $60,000 |
| Abandon close P15 at the east end of SF Centre entrance | $18,000 |
| Payphone removal | $11,000 |
| Replace southwest entrance art wall with fare evasion barrier | $256,000 |
| Storage facility for dumpsters, utility closets, janitorial supplies | $548,000 |
| Reconfigure East BART Paid Area | $2,083,000 |
| Fare evasion strategy in BART paid areas | $727,000 |
| Modify east vent structure walls | $801,000 |
| Replace platform flooring | $3,814,000 |
| ADA detectable pathway | TBD |
| New platform seating | $159,000 |
| **TOTAL** | **$11,260,240** |

*Table 11: Phase II Prioritized Projects*

| Project | Cost Estimate |
|---|---|
| Install sound absorbers at platform level | $493,000 |
| Reopen public restroom | $305,000 |
| More bike parking | $677,000 |
| Additional ADA fare gates | $939,000 |
| Hearing induction loop | $261,000 |
| ADA - add street level directional audio cues throughout station | $261,000 |
| Improve Wifi and incorporate BART mechanical engineering system | $261,000 |
| PA system | $1,144,000 |
| Relocate add fare machines on the western BART paid area | $780,000 |
| Construct new program space for within the corridor | $630,000 |
| Structural modifications to improve sightlines - far east end of station | $1,371,000 |
| Structural modifications to improve sightlines - Central Subway | $297,000 |
| Escalator rehab and replacement with canopy | TBD |
| Platform edge tactile strip | TBD |
| **TOTAL** | **$7,419,000** |

# 8 IMPLEMENTATION AND NEXT STEPS

The final prioritized improvements in the Phase 1 Project List has moved into preliminary engineering and design for eventual implementation and construction. This Phase is funded by Proposition 1B, which expires in mid-2018, so the improvements must be complete by then.

BART will continue to engage with the project stakeholders and the public and provide project updates when new information becomes available.

The Powell St. Station Modernization Plan sets the long term vision and identifies projects, priorities and provides the road map for implementing future improvement efforts at Powell St. Station. The Plan provides a framework for identifying what improvements are important for both BART and the public and how they should be prioritized. Funding available from Proposition 1B will be applied to the Phase I projects shown in Table 10. When additional funding becomes available, subsequent phases will be implemented.

# APPENDIX A: POWELL ST STATION VENTILATION STUDY

# APPENDIX B: PRIORITIZED PROJECT LIST

# Assessment of Powell Street Station Ventilation System and Development of Potential Replacements

## Introduction

The BART system serves San Francisco and much of the rest of the larger Bay area. It commenced operations in 1972 after a 20 year movement by a network of cities agreed to fund and engineer the network. The variety of station designs including those both above and below grade required a variety of engineering solutions to provide internal comfort to the passengers on the platforms. Many were naturally ventilated, while deeper stations in more densely populated areas required mechanical systems.

One of those stations was Powell St. Station in Downtown San Francisco. It serves the popular tourist destination of the Union Square area, as well as much of the shopping and financial districts surrounding it. It was designed with two large ventilation systems. One was designed to evacuate smoke in the event of a fire on either of the platform levels, while the second was designed to provide outside air for comfort cooling and ventilation for both platforms, and a concourse level. It is this second system which fell into disrepair some years after the station first opened, and which we were tasked with assessing it's restoration of replacement.

Key criteria for the assessment of the existing system were;

- The thermal comfort of the passengers on the platform
- The feasibility of the repair and restoration of the existing equipment
- Changes in codes and regulations since the original design

Following the assessment of the existing system, it was determined a new system might be more effective and cost efficient than repairing the old system. We therefore also studied how a new system might be sized, specified and installed including;

- Appropriate design criteria
- New technologies
- Controls integration

## Existing System Deactivation

The existing concourse / MUNI platform / BART platform mechanical ventilation system has not been in operation since at least the early 1980s. This was primarily for the following reasons:

1. The presence of Asbestos at both the Mezzanine level and lower levels (BART).
2. The system does not have the capability of being controlled directly from OCC. It is manually controlled at the station. Recent code (NFPA 130 and CBC 433), issued after the station was constructed requires any system that adversely affects the emergency ventilation to be shut off during an emergency event. To do this station agents would need to turn the system off manually which is perceived by BART to be a risk and an unnecessary additional task for the agents during a crisis.

**Thermal Comfort**

One of the key criteria for the restoration of the system was to ensure that thermal comfort for the passengers could be satisfied. Comfort criteria for the general platform and concourse areas were not stipulated in the BART design guidelines. ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning engineering) are widely regarded as the definitive source for guidance in HVAC related subjects and even in their literature, they stipulate the only criteria for maintaining a comfortable platform environment is that air flow should be limited to less than 1000fpm (5.1 m3/s). This apparent lack of guidance for platforms is replicated around the globe and seems to reflect the inherent transient nature of platform occupants. BART trains to any destination on the network arrive at Powell St no more than 15 mins apart at any time, so any small period of discomfort it relieved when the passenger steps on the trains, which are fully air conditioned.

However, there were a number of references from studies and other systems we could use to help define target criteria that can ensure relative comfort for passengers while maintaining energy efficient equipment operation.

Studies of tunnels around the world have shown that overheating was most common in, deeper buried systems like the Manhattan areas of the New York system and many London subways. This overheating appears to be due to insufficient ability for the system to discharge the heat accumulated from train breaking, carriage air conditioning unit heat rejection, and internal heat gains. Shallower systems, constructed using cut and cover tunnels similar to BART had not demonstrated these problems. Platforms in hotter climates without air conditioning were also more likely to overheat. In response, new expansion or retrofits in deeper subways or hotter climates have begun to stipulate target temperatures for their new stations.

**Figure 1** - Summary of design conditions for worldwide subway systems

| | Maximum Station Design Temperature | Station Environmental Control System | ASHRAE's Outdoor Design Temperature (2%) |
|---|---|---|---|
| Tren Urbano | 79ºF | Air-Conditioning | 89ºF |
| Athens Metro | 99ºF | Mechanical Ventilation (with provision for air-conditioning) | 89ºF |
| Delhi Metro | 84ºF | Air-Conditioning | 103ºF |
| Bangkok Metro | 84ºF | Air-Conditioning | 95ºF |
| Singapore Metro | No Control | Air-Conditioning | 90ºF |
| Hong Kong Metro | 82ºF | Air-Conditioning | 90ºF |
| London Underground | 95ºF | Natural Ventilation | 75ºF |
| Los Angeles Metro | 85ºF | Mechanical Ventilation | 78ºF |
| Washington RTS | 78ºF | Air-Conditioning | 89ºF |
| NYCT Existing Subway | No Control | Natural Ventilation | 89ºF |

As understanding of personal comfort becomes more developed, ASHRAE has aligned with the growing amount of research that suggests people are happier in a wider range of thermal conditions in spaces without mechanical ventilation than previously understood, especially in transient spaces or environments where they have direct control over their local surroundings. This is often defined as Adaptive-Comfort and ASHRAE is encouraging projects to define wider bands of comfortable criteria for all projects, to try to eliminate the use of mechanical heating and cooling and reduce energy use.

In response, recent projects have defined higher temperatures as acceptable, given the transient nature of the occupancy:

- 2nd Avenue subway project in New York chose 82°F (27.8°C) as an average temperature, which is allowed to rise during peak occupancies and train arrivals.
- The Transbay terminal defined an acceptable maximum air temperature of 90°F (32.2°C)

The existing Powell Street utilizes 100% outside air ventilation and cooling system drawings indicate that it was originally designed to ensure that the platform and concourse temperatures are limited to 70°F. Given San Francisco's mild climate, the outside air only would be able to achieve this around 89%.

For the re-commissioning of the old system, or design of the new it was recommended that BART follow a similar process and define target temperature limits for platforms as the local outside air temperature ±10°F.

Since the existing system was deactivated, the platforms had only been served by the introduction of air from the tunnels, and induction of air down shaft connecting to the surface, by the movement of the trains in the system. This 'piston effect' had conditioned the platforms

without complaints for over 20 years. This validated our reasoning that tighter temperature limits were not required, and no mechanical cooling would be required for Powell Street.

**Ventilation rate**
Although transient in nature, the supply of additional outside air to the platforms could off-set the accumulation of smells in public areas and feelings of confinement or stuffiness in the passenger population. A study of current building codes indicated a flow rate of around 15 cfm (7.2 l/s) per person would be appropriate if the ventilation system were reactivated or replaced.

A current analysis of platform occupancies indicate a predicted maximum of 2,500 people by 2030. This would require a maximum flow rate of around 40,000cfm. The current capacity is 220,000 cfm.
Alternately, provided the incoming air is clean enough, a limit of 400-800ppm of $CO_2$ measured on the platform could be established, with the ventilation system increasing in flow rate when this was exceeded for a specified period.

**Restore Existing Mechanical Ventilation System**

A number of initial issues were addressed when considering a new system.
**Asbestos**. BART staff advised that the asbestos had been removed where found from the critical elements of the ventilation system including the concourse level ceiling, supply plenum level and the BART platform. Asbestos remains around the beams and columns at BART platform level but not under the slab of the supply plenum.

We recommended that the presence (or absence) of asbestos should be confirmed before any work commences.

**Control of System from Operation Control Center**. We determined it was likely that the existing control system was obsolete and the majority of the components (dampers, actuators) would need replacing if the system we to be restarted. We recommended that the whole control system be replaced with a new DDC system which can then be tied into the emergency ventilation system and the remotely located OCC via BARTs preferred remote communications method.

Options should include a stand-alone building management system, which then reports to the OCC, or the system could be directly integrated into the OCCs other data systems.

**Equipment Condition.**
Our assessment of the existing equipment was as follows. In general the fans appear to be in an operating condition as they have been observed to pinwheel when there is a draft present. There is evidence that the fans were not operating correctly when they were first installed, with counterweights added across the blades, and it is believed that the fan blades had to be regularly replaced (almost monthly) due to damage during operation.

The current system appeared to offer only 2 stages of control, only dependent on outside air temperature, while a modern code compliant system could offer a much greater degree of control including occupancy sensors, relative humidity, CO/$CO_2$ concentration etc. if required. There

was no clear indication to the internal condition of the existing controls relays and wiring, so we can’t confirm if they would work even if the system were reactivated.

We recommended options to achieve this increased control could include adding a VFD (Variable frequency drive) to the existing fans or replacing with a fan wall style system. A fan wall system combines many small axial fans with the ability to ramp down to much lower proportions than larger fans, while operating quieter. This offers significant energy savings over the continuous operation of one large fan at low flow rates.

**Figure 3** - Extract from mechanical as built drawings showing how the system serves all three levels from one mechanical room on the concourse level. Air is distributed vertically through a series of shafts, and horizontally through plenums created between platform levels and above ceilings

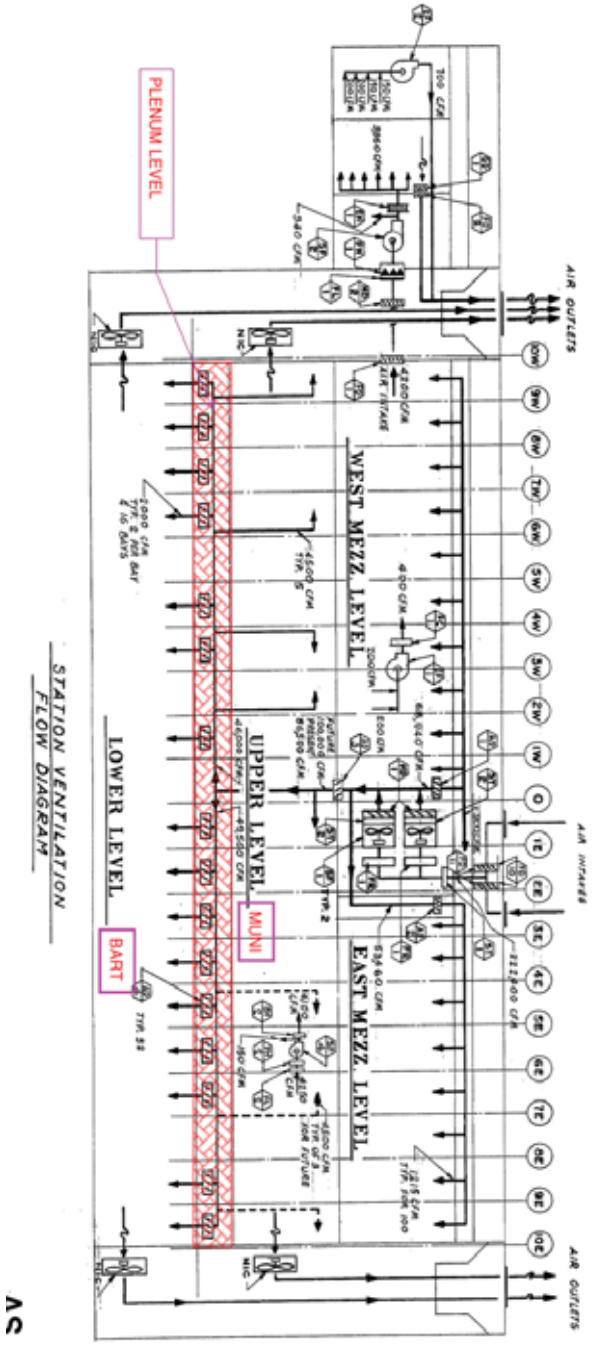
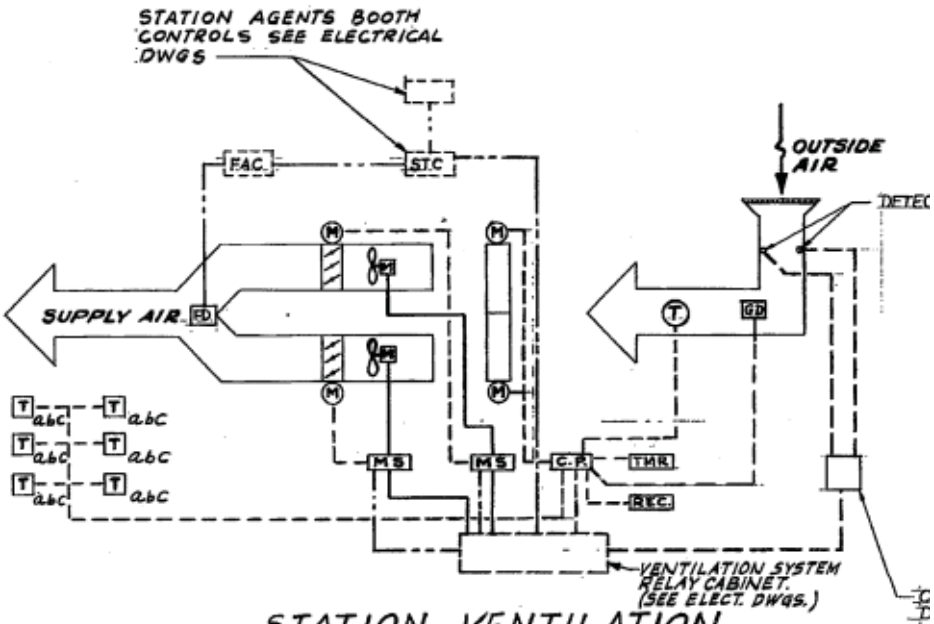


**Figure 4** - Extract from mechanical as built drawings showing platform temperature control scheme.




## STATION VENTILATION TEMPERATURE CONTROL DIAGRAM

### SEQUENCE OF OPERATION

1. ADJUSTABLE TIMER WITH ALTERNATOR STARTS AND STOPS FANS. ALTERNATE FANS ARE STARTED BY TIMER-ALTERNATOR.
2. ADJUSTABLE SPACE THERMOSTATS WITH DIFFERENTIAL ELEMENT, SENSOR ELEMENT, AND INDICATING ELEMENT CONTROL FANS WHEN SPACE TEMPERATURE BELOW SET POINT ONE FAN RUNS, WHEN TEMPERATURE ABOVE SET POINT BOTH FANS RUN. ANY ONE OF SPACE THERMOSTATS CAN START SECOND FAN. INITIAL SPACE THERMOSTAT SET POINT 70°F.
3. OUTSIDE THERMOSTAT SENSOR SUPPLIES OUTSIDE TEMPERATURE TO TEMPERATURE INTEGRATOR AT CONTROL PANEL. INTEGRATOR CAUSES ONLY ONE FAN TO OPERATE WHEN OUTSIDE TEMPERATURE MINUS ACTUAL INSIDE TEMPERATURE DIFFERENTIAL EXCEEDS 5°F (ADJUSTABLE 0° TO 10°)
4. HI. TEMP. LIGHT IN STATION AGENTS BOOTH LIGHTS WHEN BOTH FANS ARE RUNNING AND SPACE TEMPERATURE EXCEEDS SET POINT BY 5°F.
5. MULTIPEN STRIP CHART RECORDER SHALL RECORD ALL TEMPERATURES SENSED BY BOTH SPACE AND OUTDOOR THERMOSTATS.
6. WHEN EITHER FAN STARTS THE MOTORIZED DAMPER FOR THAT FAN OPENS. DAMPER CLOSES WHEN FAN STOPS.
7. WHEN EITHER FAN STARTS BOTH FILTER MOTORS START. FILTER MOTORS STOP WHEN BOTH FANS ARE OFF.
8. SPACE FIRE DETECTORS OR INTAKE GAS DETECTOR SHUT BOTH FANS OFF WHEN ACTIVATED. (SEE ELECTRICAL DWGS)
9. FANS WILL NOT START IN ANY DIRECTION WHEN SHUT OFF BY GAS DETECTOR UNTIL DETECTOR IS MANUALLY RESET.
10. STATION AGENT CAN OVERRIDE ALL CONTROLS EXCEPT GAS DETECTOR. SEE ELECTRICAL DRAWINGS FOR STATION AGENTS BOOTH CONTROLS.

**AIR INTAKE.**

We recommended that the current source of air (the roadway) would not be code compliant if the design were submitted today. Air intakes are usually required to be at least 10ft (3m) above grade and a similar distance from sources of pollutants such as cars etc. We therefore recommended that while site constarints make an alternate air source difficult to achieve, a repaired or new system draw air from an alternate source.

**Figure 5 -** Typical Air inlet / smoke exhaust grate on Market Street above Powell Street Station

Ideally, a new air intake would reach at least 10ft above roadway level. A large duct could connect the existing fan room to the Hallidie plaza, or a new street feature above grade near the station, although this would be difficult to conceal in an architecturally acceptable manner.

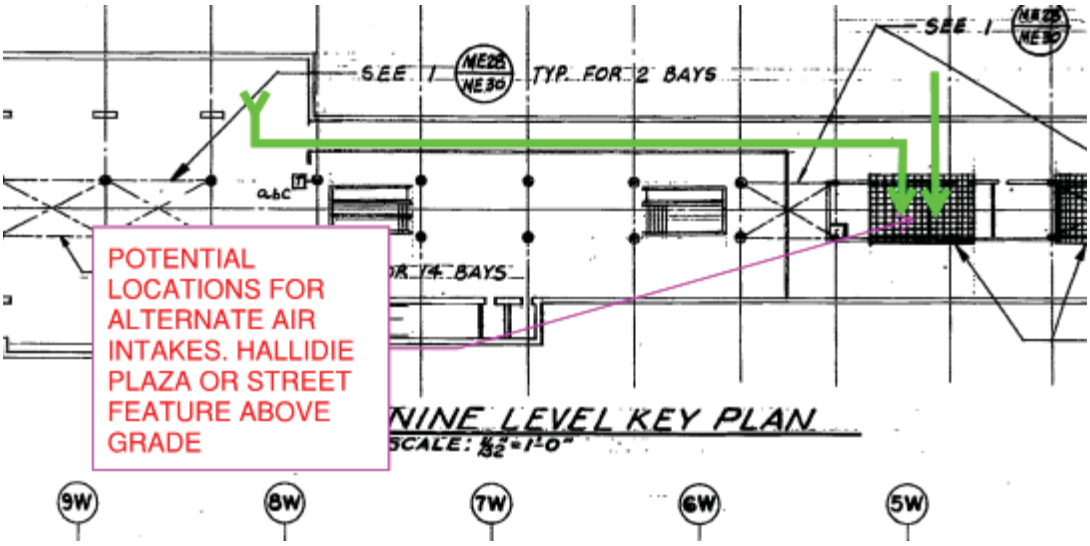



**Figure 6 Potential Alternate Air Intake Locations**

**Other Equipment.**
There were numerous other pieces of equipment in the fan room plenum space, some functional, some not. These seem to be dedicated to the adjacent police command center and include an AHU, and external condensing unit associated with the AHU, a hot water heater and a defunct ceiling mounted fan (non-operational).

**Heating And Cooling**
No heating or cooling equipment was provided in the existing ventilation system. As described in the section below, the platform and concourse levels seem to maintain comfortable conditions without any additional mechanical heating or cooling.

If a tighter band of control were required in the future, additional heating and cooling equipment could be added to the central ventilation system. Options could include;

- Hot and chilled water systems serving heating and cooling coils in the air system.
- Adiabatic spray cooling system in either the ductwork or the platforms itself.
- Refrigerant based heating and cooling coils.
- Refrigerant based heating and cooling in contained areas of the platform (rest rooms etc.).

Given the temperate nature of the platform environment, we did not believe the investment in additional systems would provide significantly higher comfort and would not recommend any upgrades at this time.

**Restarting Ventilation System**
A check list was provided to BART based on the information above, for them to use if they considered restarting or replacing the existing system:

1. Confirm all asbestos has been removed from the air stream of ventilation system, and any remaining asbestos near the system has been sealed and certified as not a threat upon restart of the system.
2. Determine the incoming air quality and the filtration requirements to make the incoming air an acceptable quality for use.
3. Determine the operational requirements of the ventilation system. We would recommend if the system is restarted, it should be operated to;
    a. Provide fresh air for the anticipated passenger load.
    b. Maintain the temperature on the platform/concourse to no greater than 10oF higher than ambient in summer.
4. Perform a life cycle cost analysis to study whether a new fan system would be more suitable to the proposed operation and could offer cost savings over the restarting the existing system. This would involve liaising with PGE to discuss any incentives that maybe offered for installing newer more efficient equipment and any demand charges they may require.
5. The new air intake should be constructed / current air intake cleaned and new filters be installed to ensure the quality of the incoming air to the system.

New controls should be installed on the new/existing equipment, tied into the OCC via BARTs preferred communication method, so the system can be activated /deactivated in conjunction with the emergency ventilation systems per NFPA 130. Components would include new dampers and actuators, VFD drives for the fans and filters / housings as required.