APPENDIX B

National Historic Preservation Act – Section 106 Continuing Consultation

APPENDIX B.1

Finding of Effect

National Historic Preservation Act – Section 106
Supplemental Consultation:
Final Finding of Effect

Transbay Transit Center

Prepared for:

Transbay Joint Powers Authority

and

Federal Transit Administration

Region 9

AECOM

November 2016

If there are variances from this report and statements in the FTA letter requesting concurrence from SHPO (see Appendix B.2), the information and analysis in Appendix B.2 are to be considered correct.

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CHAPTER 1 INTRODUCTION

The Transbay Joint Powers Authority (TJPA), in cooperation with the Federal Transit Administration (FTA) and the Federal Railroad Administration (FRA), proposes changes to the approved 2004 Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project (Transbay Program). Further engineering for the Caltrain Downtown Extension (DTX) has occurred since its approval in 2004 and includes track curvature entering the train box, extension of below-grade rail levels of the Transbay Transit Center (TTC) to accommodate high-speed rail (HSR) requirements, and other refinements necessary for implementing the Transbay Program.

The proposed project is seeking federal funding assistance from the FTA and is subject to federal regulatory requirements for projects that may affect cultural resources in accordance with Section 106 of the National Historic Preservation Act of 1966 (54 USC 300101), as amended; the implementing regulations of the Advisory Council on Historic Preservation (36 CFR Part 800); and FTA's regulatory requirements regarding cultural resources. As such, FTA has determined that this undertaking is subject to Section 106. The project was previously reviewed under Section 106, resulting in State Historic Preservation Officer (SHPO) concurrence on the finding of effect (Peninsula Corridor Joint Powers Board et al., 2003) and resolution of adverse effects through execution of a 2004 Memorandum of Agreement (MOA) (USDOT et al., 2004). The MOA has been amended twice in August 2010 and June 2016 since its execution in 2004, and the stipulations contained in the amended MOA will apply to this undertaking. The proposed changes to the approved 2004 Transbay Program constitute the proposed undertaking that is the subject of this supplemental Section 106 finding of effect.

FTA has determined that the proposed undertaking would result in "no effect" to archaeological resources and "no adverse effect" for historic resources. Pursuant to 36 CFR 800.3 through 36 CFR 800.5, FTA has previously requested SHPO concurrence with the definition of the undertaking and APE and identification of historic properties in a letter dated September 11, 2015, and is requesting concurrence with the finding that the proposed undertaking would have no new adverse effects on historic properties, as described in the remainder of this report. This Supplemental Finding of Effect (FOE) will also be used by FTA in implementing Section 4(f) of the Department of Transportation Act of 1966 (49 USC 303) and its implementing regulations, codified by FTA in March 2008 as a Final Rule at 23 CFR Part 744.

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CHAPTER 2 DESCRIPTION OF THE UNDERTAKING

Subsequent to the Transbay Program approved in 2004 and addenda (through 2011), additional changes have been proposed: refinements to Phase 2 of the Transbay Program and other transportation improvements to further enhance connectivity and use of alternative modes of transportation. These components are illustrated in Figure 1 and summarized in Table 1. Some of the components were previously analyzed in the 2003 FOE; however, specific locations and features of the vent structures and the alignment of the underground Fourth and Townsend Station, for example, have been refined since that time and are evaluated in this Supplemental FOE. Changes to the throat structure and the train box are required to accommodate future high-speed rail service proposed by the California High-Speed Rail Authority, and these changes are likewise evaluated in this report.

It should be noted that the land development that could be accommodated on sites not fully used for transportation facilities is described in the FTA/TJPA Supplemental Environmental Impact Statement/ Environmental Impact Report (SEIS/EIR), but this development is not considered a part of this undertaking since the FTA would not have a role in approving or funding this activity. This adjacent land development that is included in the SEIS/EIR is considered part of the proposed project for the purposes of the California Environmental Quality Act (CEQA) review. The SEIS/EIR for changes to the approved Transbay Program specifically characterizes this land development as an indirect effect of the federal action. Because the land development is not part of the undertaking, it is not included in this Section 106 report.

2.1 PHASE 2 DTX REFINEMENTS

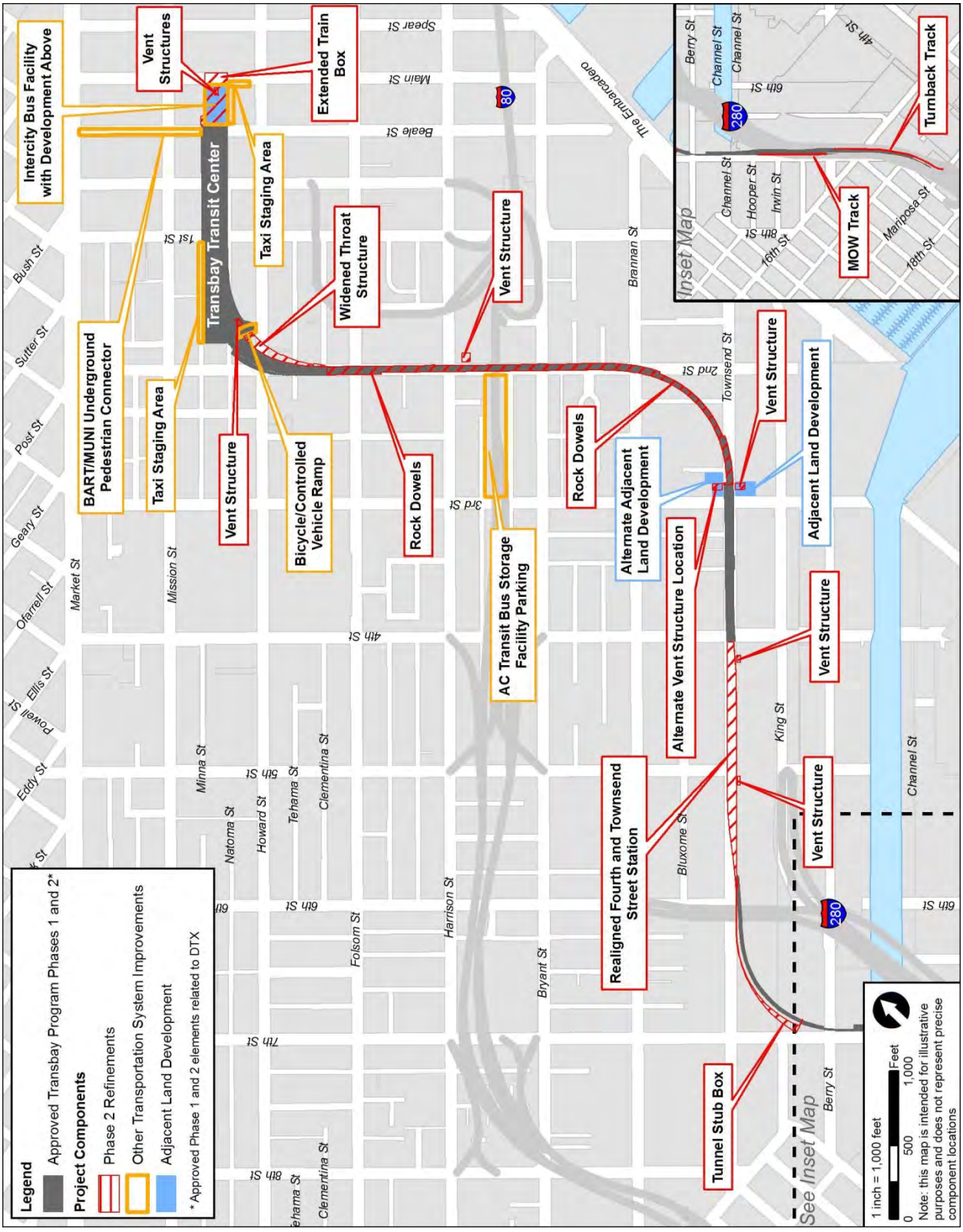
There are seven proposed refinements to the DTX as part of the proposed project. They involve modification of the throat structure, extension of the underground levels of the Transit Center train box from Beale Street eastward to Main Street, realignment of the underground Fourth and Townsend Street Station, construction of vent structures at specific locations, modifications at the Fourth and King Streets railyard at the western end of the proposed project limits, installation of rock dowels in conjunction with construction of the mined tunnel segment, and additional trackwork south of the Caltrain railyard. These changes would not alter the operating plans for the DTX or HSR trains.

2.1.1 Widened Throat Structure

The proposed project would widen the throat structure on the northeast side of the DTX alignment entering the west side of the Transit Center. The proposed project would widen the throat structure eastward and increase the footprint of the throat structure by 14,059 square feet, for a total area of 78,669 square feet. This increased area is proposed to accommodate updated design specifications that were released by the CHSRA in 2010 regarding track curvature and platform design. The proposed project would enable a minimum 650-foot curve radius, an increase from the previously approved DTX track curve radii of 498 to 545 feet.

2.1.2 Extended Train Box

The proposed project would extend the underground levels of the Transit Center (train box) eastward into Main Street to enable fully tangent tracks of 1,355 feet, at minimum, for HSR trains. Caltrain, by contrast, requires a minimum 800-foot platform length. The previously approved DTX train box terminates at Beale Street. The proposed project would extend the Lower Concourse and Train Platform levels by one block from Beale Street to Main Street. To construct the Transit Center train box extension, the above-grade podium structure at 201 Mission Street would be removed. Siting the shorter Caltrain tangent tracks and loading platform on the north side of the train box would avoid conflicts with the foundations of the



Sources: City and County of San Francisco 2013; Compiled by AECOM 2013

Figure 1: Proposed Project Components – Refinements to the Approved Transbay Program

Table 1
Proposed Undertaking Components

DTX Refinements
• Modification of widened throat structure entering the west side of the below-grade levels of the Transit Center and related property acquisitions to accommodate HSR trains and to reduce track and wheel maintenance and noise from wheel squeal.
• Extension of the underground levels of the Transit Center (the train box) eastward to Main Street to accommodate 400-meter, fully tangent platforms for HSR service. Level boarding is planned for the Transit Center; details regarding platform height are under discussion among TJPA, Caltrain, and HSR and would be determined outside the environmental process. Implementation of the extended train box would require demolition of the back (south portion) of the 201 Mission Street office tower and the relocation of existing above- and below-grade facilities of that building.
• Realignment and lowering the profile of the underground Fourth and Townsend Street Station, adding a mezzanine at the station, and lengthening the tunnel.
• Construction of vent structures (emergency ventilation/smoke evacuation structures co-located with emergency tunnel exits) at both ends of the underground Caltrain Fourth and Townsend Street Station, at Third and Townsend Streets, at the southeastern corner of Second and Harrison Streets, and at both ends of the train box in the Transit Center. Also, construction of two exhaust fans at the west end of the Transit Center adjacent to the proposed vent structure and extending from below up to the street level. This refinement includes both new facilities not previously evaluated as well as facilities that have been relocated from the sites previously evaluated.
• Minor relocation of lead tracks to the railyard to maintain access to the current Fourth and King Street Station and enable construction of a below-grade tunnel stub box under the already approved U-wall to expedite future arrival of below-grade Caltrain and HSR.
• Preservation of six at-grade platforms (12 tracks) at the Caltrain railyard as currently configured, rather than three at-grade platforms (six tracks) in the southern portion of the railyard.
• Installation of rock "dowels" primarily along Second Street during construction of the mined tunnel to reduce ground movements around the tunnel and protect adjacent properties. This component may require underground easements.
• Additional trackwork south of the railyard (a turnback track and maintenance of way (MOW) storage track) within the existing Caltrain right-of-way between Hooper Street and Mariposa Street, immediately east of Seventh Street.
Other Transportation System Improvements
• An intercity bus facility to provide regional and airport bus and shuttle services above the train box extension between Beale and Main Streets. The intercity bus facility would serve Amtrak and private bus operators such as Greyhound.
• Taxi staging area at curbside along portions of Minna, Natoma, and Main Streets.
• A bicycle/controlled vehicle ramp from Howard Street north to the Transit Center and below-grade bicycle facilities.
• Use of the AC Transit bus storage facility on Third Street between Perry and Stillman Streets for special event and nighttime public parking.
• An alternative replacement alignment in Beale Street for an Embarcadero BART/Muni Metro underground pedestrian connector to the Embarcadero Station.
Adjacent Land Development*
• Above the intercity bus facility, two floors of office, totaling 45,000 square feet, or 128 residential units.
• At the vent structure site at 701 Third Street (at Townsend Street), 76,000 square feet of mixed uses, consisting of a 4,000-square-foot restaurant and either 72,000 square feet of office or 72 residential units. At the alternate site at the northeast corner of Third and Townsend Streets, 72,000 square feet of professional offices or other commercial space consistent with City zoning regulations.
Note:
* The adjacent land development is not under FTA's jurisdiction, and, thus, it is not considered to be part of the NEPA action and is also not subject to the NHPA. Under NEPA, future development of these sites to include additional land uses besides the transportation improvements is considered a secondary or indirect effect. The adjacent land development has been included in this table, because it is part of the CEQA project description.
Source: Compiled by TJPA and AECOM in 2013

201 Mission Street office tower. Development of an intercity bus facility above the extended train box is discussed separately under "Other Transportation Improvements."

2.1.3 Realigned Fourth and Townsend Street Station

For the proposed project, the underground station at Fourth and Townsend Streets would be lowered and realigned along and underneath Townsend Street, a mezzanine added, and the tunnel lengthened. The realignment would shift the station slightly north from the previously approved DTX station plan and profile, which is partially under the Caltrain railyard and partially under Townsend Street. The realignment of the Fourth and Townsend Street Station as part of the proposed project would not affect the use of the existing at-grade tracks and station area at Fourth and King Streets for an interim HSR terminal station, if needed. The lowered profile would provide space for a mezzanine and would reduce relocation impacts on the City's combined sewer system.

This new alignment would incorporate the City's desire to accommodate possible future development at the existing railyard, improve Caltrain operations to the Transit Center, and enhance passenger orientation and wayfinding. The City is exploring the potential for either reconfiguring or replacing the existing Fourth and King Station to allow potential redevelopment of the site for development of housing and employment in the area. The City's study, entitled the Railyard Alternatives and I-280 Boulevard Feasibility Study, would evaluate removing the end of the I-280 freeway, extending Caltrain and HSR tracks underground, creating a surface boulevard and allowing the reconnection of adjacent neighborhoods at the Fourth and King Station, and potentially redeveloping the Fourth and King Station. However, such future development remains at the conceptual planning phase, is not included in any adopted plan, and would be the subject of separate environmental review by Caltrain or the City and County of San Francisco, as appropriate.

Construction of the DTX would require installation of emergency ventilation/smoke evacuation structures co-located with emergency tunnel exits when possible (collectively referred to as vent structures). Under the proposed project, specific locations and detailed engineering of these emergency structures have been identified as follows:

- Realigned underground Fourth and Townsend Street Station – one at the west end of the station at Fifth Street on the south side of Townsend Street and one at the east end of the station at Fourth Street on the south side of the Townsend Street. Each of these vent shafts would extend approximately 35 feet above street level.

- Third and Townsend Streets – this vent structure would be sited in the northeast quadrant of a 13,750-square-foot parcel at 701 Third Street or across Townsend Street at 699 Third Street and 180 Townsend Street. An approximately two-story structure (about 18 feet tall), occupying a footprint of approximately 3,600 square feet, would front onto Townsend Street under the 701 Third Street site option, or would be set back away from Townsend Street in the northeast portion of the 699 Third Street/180 Townsend Street site option. An exhaust air shaft, an intake air shaft, and the vent shaft would extend upward from the roof of the two-story structure. The vent shaft would be approximately 105 feet above the street level for the 701 Third Street site option and approximately 95 feet above the street level for the 699 Third Street/180 Townsend Street site option.

- Second and Harrison Streets – this vent structure would be sited in the southeastern portion of this 13,750-square-foot parcel at the corner of Second and Harrison Streets. An approximately two-story structure (approximately 18 feet tall), occupying a footprint of approximately 3,600 square

feet, would front onto Second Street. The vent shaft would extend upward from the roof of this structure to approximately 101 feet above the street level.

- Transit Center – at the west end of the train box, a ventilation shaft/cooling tower will be constructed as part of Phase 1. This shaft, approximately 14 feet in diameter, will be approximately 12 feet tall. Two additional vents for exhaust fans, immediately east of the cooling tower under construction, would be needed for the DTX operations under Phase 2. These exhaust fans would be constructed to street level and covered until needed. When DTX service commences, these exhaust fans would be uncovered and become operational. They would not protrude above the street level. All three of these new vent structures would be located within the footprint of the train box that was approved and previously evaluated in the 2004 FEIS/EIR.

  A fourth vent structure would be constructed at the east end of the Transit Center in the vicinity of Natoma and Main Streets. This facility, including the emergency exits, would be integrated into the design of the proposed intercity bus facility (see below under "Other Transportation Improvements" for additional information). The vent shaft and emergency exits would be within the building envelope of the bus facility that would be 40 feet above street level and located along the wing of the building along Main Street.

Each of the vent structures would contain a shaft, electrical room, fan room, emergency generator, and stairway, which would tie into the DTX tunnel.

2.1.4 Tunnel Stub Box

The proposed project would involve modifications at the west end of the railyard located south of Townsend Street between Sixth and Seventh Streets. A retained cut/U-wall is already approved as part of the Transbay Program to transition trains travelling at-grade to the lower elevation of the below-grade station at Fourth and Townsend Streets. A possible future connection from a tunnel from the south to the underground Fourth and Townsend Street Station is being considered by the TJPA and its regional partners. This would require constructing a new train box segment (36 to 48 feet wide) under the U-wall to expedite future DTX and HSR service. The additional underground construction beyond the horizontal limits of the retained cut/U-wall already proposed. When grade-separated intersections farther south on the Caltrain alignment (a separate project not part of the proposed project) are constructed, the upper deck of the U-wall portion could be demolished and the lower train-box level could be outfitted with tracks, signaling, and other required elements. The tunnel stub box would not preclude service to existing Caltrain stations.

2.1.5 Rock Dowels

Construction of the mined tunnel from the Townsend Street curvature and along Second Street would require installation of rock dowels to temporarily support the tunnel. Rock dowels are high-strength steel reinforcing bars installed into holes drilled around tunnel perimeters and grouted into place with non-shrink grout (i.e., cement, water, and additives). After the grout sets up or hardens, the dowels can be tensioned to support the rock mass around the tunnel. In addition, the dowels are able to stabilize blocks of rock around the tunnel that might fall out into the tunnel if no support is provided. Providing such support elements would reduce ground movements around the tunnel and protect adjacent properties affected by creation of the tunnel opening. The rock dowels could extend beyond the public right-of-way and, thus, could require easements from property owners on either side of the tunnel. Because of the depth of the DTX tunnel (60 to 100 feet below the surface), no conflicts are anticipated to occur between the rock dowels and the foundations or basements of adjacent buildings.

2.1.6 Additional Trackwork South of the Railyard

The proposed project would include additional trackwork in the existing Caltrain right-of-way, south of Caltrain railyard and along Seventh Street. The first improvement would be a turnback track, which would be required for Caltrain to move trains between the Caltrain railyard and the Transbay Transit Center when not in use or when maintenance is required. Trains would be moved to the Caltrain railyard, and the turnback track would be needed for this movement. The turnback track would be constructed on the east side of the existing mainline tracks from Hubbell Street on the north and extend southward for approximately 1,400 feet under the elevated Interstate 280 freeway across 16th Street and terminating at Mariposa Street. Trains from the Caltrain railyard would travel south along the track lead, onto the mainline track, and onto the turnback track (at Hubbell Street).Trains would continue along the turnback track, crossing 16th Street at-grade, until Mariposa Street. Trains would then proceed north back along the turnback track and transition onto the mainline heading towards the Transit Center. The same movements would be followed to move trains from the Transit Center to the Caltrain railyard.

The second track improvement is an maintenance of way (MOW) storage track. This track would be constructed on the west side of the main tracks from Hooper Street on the north and extend southward to Daggett Street for approximately 850 feet. The MOW storage track would be used for equipment storage needed for railway maintenance.

Operating plans for Caltrain service to the Transit Center still are being defined, and will vary based on service levels and overnight train storage assumptions at the Transit Center. Based on the most current information received from Caltrain, there would be 24 crossings per day along the turnback track over 16th Street, and Caltrain has committed to not use the turnback track during the AM and PM peak periods (7 a.m. to 9 a.m. and 4 p.m. to 6 p.m.). The total time to move trains between the Caltrain railyard and the below-grade station at Fourth and Townsend is estimated to be approximately 10 minutes. Trains would cross 16th Street at-grade as they do currently for routine revenue service. During each crossing, the crossing gate at 16th Street would be lowered for 70 seconds (60 seconds for the train to cross and 10 seconds to raise and lower the crossing gate) to move the train to the end of the turnback track, and another 70 seconds to move the train north, back toward the mainline).

As part of this proposed project component, related modifications to the roadway configuration and signals along 16th Street in the vicinity of Seventh Street and the Caltrain right-of-way, may be necessary based on coordination and approval from the City and the California Public Utilities Commission (CPUC) pursuant to General Order 164. The San Francisco Municipal Transportation Agency (SFMTA) is proposing to re-route the 22 Fillmore electric trolley buses (ETB) from their current route, which crosses over the Caltrain right-of-way at 18th Street, to an at-grade crossing at 16th Street. TJPA, in cooperation with the Caltrain Peninsula Corridor Joint Powers Board and SFMTA and subject to CPUC approval, would modify, as necessary, the technical solution implemented by Caltrain for the PCEP to allow operation of both the ETB at the 16th Street crossing and Caltrain along the turnback track.

2.2 OTHER TRANSPORTATION SYSTEM IMPROVEMENTS

Other transportation system improvements included as part of the proposed project under Phase 2 of the Transbay Program involve modifications to pedestrian, bicycle, and bus facilities, described below, to enhance connectivity to the transit systems and facilities in the project area and to provide an alternative to automobile travel.

2.2.1 Intercity Bus Facility

After the extended underground train box for the Transit Center is complete, an intercity bus facility would be constructed at street level, above the train box, to accommodate regional and long-haul bus operators, such as Greyhound and Amtrak. Located behind the 201 Mission Street building (south side), the intercity bus facility would be two levels above-grade (nearly 40 feet tall), with the ground floor serving passengers loading and unloading from the buses and administrative offices, and an above-ground level accommodating mechanical equipment and additional administrative offices for intercity bus facility service providers.

The intercity bus facility would accommodate shuttle services and bus operations, and would expand and enhance the Transit Center's inter- and intra-regional transit linkages by connecting into the two below-ground levels of the Transit Center.

2.2.2 Taxi Staging Area

Taxi pick-up/staging would occur at Ground level at the following locations:

- Along the south side of Minna Street between First and Second Streets, providing taxi service to passengers as they exit from elevators and escalators near the Shaw Alley entrance, the elevators located near First Street, and from the Grand Hall.

- Along the north side of New Natoma Street between Beale and Main Streets and along the west side of Main Street between Natoma and Howard Streets, with a pick-up area on the south side of the intercity bus facility. This location would provide taxi services to passengers at the intercity bus facility and persons exiting the Transit Center at Beale Street.

2.2.3 Bicycle/Controlled Vehicle Ramp and Below-Grade Bicycle Facilities

The proposed project calls for installation of a bicycle ramp and below-grade bicycle facilities. The proposed bike ramp would reduce conflicts between bicycles, pedestrians, and vehicles. A separate controlled vehicle ramp would also run parallel to the bike ramp to access the Lower Concourse level. The vehicle ramp would be limited to a maximum speed of 15 miles per hour and would include speed control measures. The proposed plan would include a 500-bicycle storage facility, with room to potentially double this number to 1,000 bicycles. Bicycle storage is intended for all users of the Transit Center, and would have sufficient capacity to accommodate demand from future HSR passengers.

2.2.4 BART/Muni Underground Pedestrian Connector

The 2004 FEIS/EIR evaluated a design option for a pedestrian connection from the Lower Concourse level of the Transit Center and underneath Fremont Street to the Embarcadero BART/Muni Metro Station. Subsequently, the TJPA undertook a study to evaluate alternative alignments for an underground pedestrian connection between the Transit Center and either the Embarcadero BART/Muni Metro Station or the Montgomery BART/Muni Metro Station.

The proposed project would include an underground pedestrian tunnel following Beale Street to provide direct connection between the Embarcadero BART/Muni Metro Station and the Transit Center. Based on preliminary engineering studies, it is anticipated that the envelope of the underground pedestrian connector would be approximately 800 feet long, 30 feet wide, and 20 feet high. The depth of the connector would vary along Beale Street from 8 to 30 feet below the ground surface. The connector would be at its greatest depth of 30 feet below Mission Street to avoid major utility lines. TJPA would not

construct the underground pedestrian connector until station improvements are made at the Embarcadero BART/Muni Metro Station and can accommodate the incoming passengers.

2.2.5 AC Transit Bus Storage Facility Parking

The AC Transit bus storage facility is bounded by Perry, Stillman, Second, and Third Streets, with bus access from Perry Street. This facility can accommodate up to approximately 73 buses. Under the proposed project, the AC Transit bus storage is proposed to be used for off- hours/nighttime or event parking (e.g., nighttime sporting or special events) when not in use by AC Transit for regular operations. The AC Transit bus storage facility would have two potential modes of parking: 202 valet-parked spaces or 167 self-parked spaces. Construction and use of this site for an AC Transit bus storage facility already received environmental clearance and approval as part of the Transbay Program. No additional construction activities would be necessary to use this facility for vehicle parking during off-hours.

2.3 CONSTRUCTION SCENARIO AND ACTIVITIES

2.3.1 Overall Sequence and Timing

Construction of the proposed project is anticipated to require approximately five years. All of the construction is associated with Phase 2 of the Transbay Program. The anticipated sequence for the proposed project components is described below. The timeframe and the phases would be highly variable and would be defined at the discretion of the contractor. The information below is, therefore, only a conceptual overview to the construction schedule and methods, based on similar transportation projects.

- **During DTX Construction** – Proposed project components that are needed for the DTX or serve DTX operations, such as the widened throat structure, vent shafts, taxi staging area, and bicycle and controlled vehicle ramp to the Lower Concourse, would be constructed as part of Phase 2 of the Transbay Program. The vent structures were already anticipated as part of the construction analysis in the 2004 FEIS/EIR. The ancillary facilities at the Transit Center and at the Fourth and Townsend Street Station would be constructed as part of the stations, and the above-ground portions of the vent structures would be incorporated as part of the DTX facilities. The vent structures that are not part of the stations (i.e., those at Third and Townsend Streets and at Second and Harrison Streets) would be constructed near the beginning of the DTX construction project, since the tunneling contractor would likely use these shafts to move and remove personnel, equipment, and material.

  The train box is already under construction as part of Phase 1. However, its extension to comply with CHSRA standards would occur as part of Phase 2

- **Post-DTX Construction –** The intercity bus facility could be constructed once the extended train box is completed.

- **Independent of DTX Construction** – Nighttime and/or event parking at the AC Transit bus storage facility could begin at any time and is not dependent on DTX construction. As stated earlier, construction of the AC Transit bus storage facility has already been environmentally cleared. The addition of nighttime/event parking would not involve new construction activities.

- **Uncertain Timing, Pending Negotiations with Others** – The underground pedestrian connector to the Embarcadero BART/Muni Metro Station would require participation of other entities in addition to the TJPA, including coordination with BART and other agencies, property owners and

developers, and agreements between the TJPA and other entities. Therefore, the timing for construction of these proposed project components is uncertain.

2.3.2 Construction Staging

Construction staging areas for the proposed project would be located in the three areas listed below.

1. Vent structure site at Third and Townsend Streets
2. Vent structure site at Second and Harrison Streets
3. Throat structure area

Activities that would occur at these sites primarily include stockpiling of materials and storage of equipment. It is expected that the contractor would rent local office space to use as a construction office. Some equipment needed for cut-and-cover activities is heavy-duty, high-volume machinery that requires adequate space when standing still and additional space for turning and maneuvering.

2.3.3 Construction Activities

Each of the proposed project components would involve different structures and facilities, and, thus, the duration of construction, the quantities of construction materials, and the types of construction equipment would vary. However, the basic steps would generally be similar and are described below. The construction crew would average approximately 25 workers per day for each project component site. The TJPA does not provide parking for construction workers. Public transportation and public parking facilities are available within the area. Approximately 50 percent of the current Transit Center work force uses carpools and public transportation to go to and from work.

Demolition and Utility Relocation

The demolition requirements differ for each proposed project component, as some locations are currently parking lots or open space along train tracks and others have small- to medium-sized buildings that must be demolished prior to beginning the shoring and excavation phases of construction. As part of this step, the contractor would remove buildings and building foundations and surrounding hardscape (i.e., asphalt and concrete) and relocate utilities outside of the structure footprint. Construction equipment for this step would generally include excavators and trucks.

Shoring

For most of the proposed project components, a cement deep-soil-mixed (CDSM) shoring wall would be installed to prevent soils and rock from sloughing or collapsing into excavated areas. The underground pedestrian connector under Beale Street would need shallow shoring since the excavation depth is up to 30 feet. Construction equipment for this step would generally include cranes, excavators, and trucks.

Excavation and Bracing

This step would involve the removal of soil from the construction site. When excavations have the potential to affect occupants or the building structure of adjacent properties, bracing must be installed to support the soil. Bracing installation is advanced sequentially as the excavation proceeds, often with horizontal walers and cross-lot struts that extend across the excavation. After completing excavation and final bracing, the concrete work would proceed. The bracing would subsequently be removed as the

concrete structure advances up to the ground surface. Construction equipment for this step would generally include excavators, trucks, and cranes.

Concrete Structural Work

The structural concrete work would typically require a thickened mat slab (3 to 5 feet thick). The wall sections would generally be 3 feet thick. Construction equipment for this step would generally include trucks, a dozer, and a vibrating sheep's foot roller.

Backfill Excavation

Excavated areas would be backfilled with earth fill, and road reconstruction or paving would occur on top of this backfill. Construction equipment for this step would generally include trucks and a vibrating sheep's foot roller. Backfill would be primarily for the widened throat structure and the tunnel stub box. Little to none of the materials excavated for proposed project components would be acceptable for engineered backfill. It is not expected that stockpiling of excavated materials would occur at the various construction sites; rather, excavated materials would be removed by truck similar to the current practice for Phase 1 construction.

2.3.4 Widened Throat Structure

Construction for this proposed project component would be performed using cut-and-cover techniques. Shoring walls would be constructed on either side of the throat structure and the area would be excavated to the bottom of the structure. Once the throat structure box is completed, the site would be backfilled to the original grade.

The widened throat structure would be constructed underneath portions of two developed parcels and would impact the foundations of the overlying properties. CBS occupies a six-story structure with a one-story basement at 235 Second Street, and a mix of businesses occupies a five-story building at 589 Howard Street. Because a portion of the CBS building would be directly above the throat structure, the portion of the building above the structure would be demolished. A temporary support wall would be constructed along the portion of the building that would remain. Following construction and backfilling, the portion of the building that was demolished would be restored.

For 589 Howard Street, the basement space located beneath the sidewalk on the north side of the building would be demolished. Shoring walls would be constructed on either side of the throat structure box to retain the soil beyond the limits of the box, and the site would be excavated to the bottom of the box. Because a portion of the building at 589 Howard Street overlies the box, large-diameter piles would be installed and then an underpinning beam would be placed to support the building while the widened throat structure is constructed.

Under the proposed project, the widened throat structure would be shifted to the east from the previously approved alignment. Because the southwest wall of the DTX would pass beneath the tip of the southeast corner of 165-173 Second Street (current address 171 Second Street), acquisition and demolition of this building (identified in the 2004 FEIR/EIS) would no longer be required. The southeast corner of 171 Second Street would be underpinned if necessary to support the building on the property during construction, using the same construction methods for underpinning the building at 589 Howard Street described above (see additional details later in Section 5.2.2).

2.3.5 Extended Train Box

The east end of the train box, which is now under construction, is proposed to be extended to Main Street. The demolition step would remove portions of the building on the south side of 201 Mission Street, involving the first- to fourth-floor exterior stairs, planters, and open patio sitting areas. The core building footprint of 201 Mission Street would remain, but some office space, utility functions, and surface parking areas would be displaced. After demolition and removal of sub-grade obstructions, the contractor would install the CDSM shoring wall for the train box extension, beginning along the existing CDSM shoring wall on the east side of Beale Street. After the shoring wall is constructed, excavation and bracing would begin. When excavation has occurred to the correct depth, the structural concrete box would be constructed.

2.3.6 Vent Structures

Realigned Fourth and Townsend Street Station.

The vent structure sites are along the northern portion of the Caltrain railyard. The west vent structure area (at Fifth Street on the south side of Townsend Street) currently is used as a Caltrain employee parking lot. The east vent structure area (at Fourth Street on the south side of Townsend Street) currently is occupied by the Caltrain Fourth and King Street station building as the northeast access point and for bicycle parking. Construction of these vent structures would be constructed as part of the realigned Fourth and Townsend Station that is part of the proposed undertaking. The previously approved Fourth and Townsend Station was oriented differently and its depth below grade was not as deep as the current proposal.

Second and Harrison Vent Structure

This vent structure site is a triangle-shaped property that is currently used as a parking lot. It is located near Interstate 80 on-ramps and is surrounded by office, retail, and other surface parking uses. Only minor demolition and utility relocation would be required to construct a ventilation shaft on this site. Often, once a shaft is excavated into the ground such as the proposed ventilation shaft, that shaft is used as a portal for moving personnel, equipment, and material during tunnel excavation. Once the tunnel is completed, the vent structure would be completed above ground.

701 Third Street Vent Structure

A vent structure is proposed at the intersection of Third and Townsend Streets. Two sites have been identified by the TJPA: 701 Third Street which is occupied by a fast-food restaurant and is surrounded by office, residential, and retail uses, and 699 Third Street/180 Townsend Street which is occupied by retail uses and surrounded by retail and office uses. The first site may be redeveloped when the restaurant's lease expires in early 2017 and unavailable for the proposed project.

Construction at either the 701 Third Street site or the site across the street at 699 Third Street/180 Townsend Street would require demolition of the existing buildings and utility relocation, after which the contractor would remove underground obstructions in the pathway of the CDSM shoring wall. Like the Second and Harrison Street vent structure, the Third and Townsend Street facility could be used as a portal for moving personnel, equipment, and material into the tunnel. This structure is close to the proposed Sixth and Townsend Street portal, and, thus, may not be used as much as the Second and Harrison Street vent structure to assist in DTX tunneling.

2.3.7 Tunnel Stub Box

This DTX refinement would involve extensive underground shoring and construction of a cut-and-cover tunnel box. The shoring wall would be installed, allowing excavation to proceed. Once the final excavation depth is reached, the tunnel box would be constructed and backfilled. More than 300,000 cubic yards would be excavated, and approximately 200,000 cubic yards would be needed for backfill.

2.3.8 Underground Pedestrian Connector

The proposed Embarcadero BART/Muni Metro Station underground pedestrian connector tunnel would be constructed with cut-and-cover techniques. Because the alignment of the connector would be in the Beale Street right-of-way, no demolition of above-ground structures would be needed, and utilities would be protected in place. Shoring walls would be installed and then excavation would occur. The pedestrian box would be constructed and then the construction site would be backfilled.

2.3.9 Tunnel Construction Method

Stacked drift methods, as described and evaluated in the 2004 FEIS/EIR, are rarely employed in tunneling work at the present time because of high cost and the extended construction time. It is now proposed that the DTX tunnel segment be constructed using the Sequential Excavation Method (SEM), a modification of the New Austrian Tunneling Method (NATM). The NATM/SEM has been used in the U.S. since the early 1980s on a variety of transit projects, including projects in the Bay Area.

The basic principle of NATM/SEM design is to allow controlled ground movements to mobilize the strength of the ground. These movements significantly reduce the loads on the final lining. Rock bolts, lattice girders, shotcrete, and wire mesh are employed instead of heavy timber or steel supports to develop the strength of the ground without compromising excavation stability. Advantages include a very rigid support system that minimizes ground movements and minimizes the risk of a tunnel collapse. Close monitoring would be required so that risk of damage to overlying buildings along the tunnel alignment is controlled.

CHAPTER 3 PUBLIC PARTICIPATION

In June 2015, letters were sent of inquiry describing the proposed project and requesting any information about potential cultural resources in the APE. These letters were sent to:

- California Heritage Council
- California Historical Society
- California Preservation Foundation
- GLBT Historical Society
- National Trust for Historic Preservation
- Native Daughters of the Golden West
- Native Sons of the Golden West
- San Francisco African American Historical and Cultural Society
- San Francisco Architectural Heritage
- San Francisco History Association
- San Francisco Museum and Historical Society
- Society of California Pioneer.

As of the date of this report, no comments have been received.

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CHAPTER 4 DESCRIPTION OF HISTORIC PROPERTIES

The historic properties in the APE are discussed below.

4.1 SECOND AND HOWARD STREETS NRHP HISTORIC DISTRICT

A portion of the NRHP-listed Second and Howard Streets Historic District is located in the APE. The district consists of three non-contributors and 19 contributing properties, including 589 Howard Street, 163 Second Street, and 165-173 Howard Street. The buildings within the district are all located on Second, Howard, Natoma, and New Montgomery Streets. The district was listed in the NRHP in July 1999, at the local level of significance for its architectural significance (NRHP Criterion C) within the context of San Francisco's rebuilding after the 1906 earthquake and fire. All of the contributing properties were constructed between 1906 and 1912, the district's period of significance. The contributing properties are commercial-style buildings with Renaissance-Baroque ornamentation (Bloomfield 1998). The district appears to remain eligible for the NRHP.

4.2 RINCON POINT/SOUTH BEACH HISTORIC WAREHOUSE-INDUSTRIAL DISTRICT

A portion of the Rincon Point/South Beach Historic Warehouse-Industrial District is located in the APE. This was an area of San Francisco developed beginning in the 1850s and 1860s after landfill and warehouse construction changed the physical appearance of the waterfront. The district was identified by Caltrans historians as appearing eligible for the NRHP under all four criteria. Approximately 60 buildings within the district were identified as contributing to the district's significance.

4.3 SOUTH END HISTORIC DISTRICT

In October 2008, this district was certified by the Secretary of the Interior for the purposes of the Tax Reform Act of 1986, as eligible for the NRHP (Lapsley 2208:1). When it was determined eligible, the district included 55 contributing buildings, primarily light industrial buildings and warehouses, and 23 non-contributing buildings. The boundaries were originally defined by Bryant, 1st, King and 3rd Streets. In 2010, the boundaries were expanded to incorporate an additional 12 contributing properties. The boundaries of the South End Historic District are nearly identical to the Rincon Point/South Beach Historic Warehouse-Industrial District. The district, with its additional 12 properties, appears to remain eligible for the NRHP.

4.4 BLUXOME AND TOWNSEND WAREHOUSE DISTRICT

A portion of the Bluxome and Townsend Warehouse District is located within the APE. This district appears eligible for the NRHP under Criterion A and C and has nine contributing buildings within its boundaries. The period of significance for the district is 1912 to 1936. The district is industrial in character and ornamentation reflects the Classical Revival, Spanish Revival, and Art Deco architectural styles. The district appears significant for its association with an important trend in development patterns in San Francisco, and as a representation of a group of properties that embody the distinctive characteristics of a type, period, or method of construction (Page & Turnbull 2009:2, 6). The district appears to remain eligible for the NRHP.

4.5 SAN FRANCISCO FIRE DEPARTMENT AUXILIARY WATER SUPPLY SYSTEM

This is a discontiguous district that includes one reservoir, two storage tanks, two pump stations, 172 cisterns, and approximately 135 miles of pipes. The district appears eligible for the NRHP under Criterion A for its association with the 1906 earthquake and rebuilding and reconstruction of San Francisco after

the fires, and Criterion C for its innovative design as a water supply system during the period of rebuilding and reconstruction in San Francisco (Mates 2009:1, 34). It should be noted that given the discontiguous nature of the largely underground infrastructure district that spans the city as well as the large number of the contributing resources, the AWSS historic district is understood to exist within the area generally surrounding the proposed project. Two contributing resources to the AWSS historic district, an 18-inch-diameter pipe running underneath Second Street and a 12-inch-diameter pipe underneath Howard Street, are located in the APE. The district appears to remain eligible for the NRHP.

CHAPTER 5 APPLICATION OF CRITERIA OF ADVERSE EFFECT

Under federal law, the Criteria of Adverse Effect are set forth by the Advisory Council on Historic Preservation (ACHP) in its implementing regulations, 36 CFR Part 800 (revised August 5, 2004). As codified in 36 CFR Part 800.4(d)(2),[1] if historic properties may be affected by a federal undertaking, the agency official shall assess adverse effects, if any, in accordance with the Criteria of Adverse Effect.

The Criteria of Adverse Effect (36 CFR 800.5[a][1][2]) reads:

> An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the [NRHP] in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the [NRHP]. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

36 CFR 800.5(a)(2) reads:

> Adverse effects on historic properties include, but are not limited to:
>
> (i) Physical destruction of or damage to all or part of the property;
>
> (ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the [secretary of the interior's] Standards for the Treatment of Historic Properties (the Standards) (36 CFR part 68) and applicable guidelines;
>
> (iii) Removal of the property from its historic location;
>
> (iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
>
> (v) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;
>
> (vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
>
> (vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

[1] Current language specified in this report under 36 CFR 800.4 was comparably cited under 36 CFR 800.5 in 1986.
[2] Current language specified in this report under 36 CFR 800.5 was comparably cited under 36 CFR 800.9 in 1986.

5.1 EFFECTS ON ARCHAEOLOGICAL HISTORIC PROPERTIES

The criteria of effect are applied for each of the relevant components of the proposed undertaking in the following evaluation of effects on archaeological resources. Table 2 identifies which components of the undertaking have the potential to affect pre-historic and historic archaeological resources identified. The effects are summarized in this table and the substantiation for these findings is provided on the following pages. It should be noted that Table 2 reports the highest potential to encounter undiscovered archaeological resources; whereas, the findings present the likelihood of encountering prehistoric and historic archaeological resources separately.

Table 2
Archaeological Resource Effects by Proposed Undertaking Component

Historic Resource	Widened Throat Structure	Extended Train Box	Fourth and Townsend Station and Vent Structures	Vent Structure - Third and Townsend	Vent Structure - Second and Harrison	Tunnel Stub Box	Bike/ Controlled Vehicle Ramp	Under-ground Pedestrian Connector
Documented Archaeological Resource	No identified resources within the APE, so no effect							
As-yet Undiscovered Archaeological Resource	High Potential	Low Potential	Moderate Potential	Moderate Potential	Moderate Potential	Moderate Potential	N/A – covered by Phase 1	Very Low Potential

N/A – Not applicable because the APE for the component does not include the resource or the component lies within the APE for the previously approved Transbay Program. As a result, these components would have No Effect on the historic resource.
Source: Compiled by AECOM 2015

5.1.1 Effects on Documented Archaeological Historic Properties

There are no documented archaeological historic properties within the project APE and thus no potential to affect such properties.

5.1.2 Effects on As Yet Undiscovered Archaeological Historic Properties

The project has the potential to cause a direct adverse effect on as yet undiscovered archaeological historic properties. Construction of the widened throat structure, extended train box, realigned Fourth and Townsend Street Station, vent structures at Third Street and Second and Harrison Streets, the tunnel stub box, and the underground pedestrian connector would disturb sediments to considerable depths below the modern surface. As described in detail below, each of these proposed project components has the potential for post-review discovery of archaeological resources during construction, and in some cases, the potential for post-review discovery of Native American human remains. Expected archaeological resources could have important research value and could be eligible for the NRHP as historic properties. In this way, the proposed construction could have a direct adverse effect on one or more as-yet-unknown historic properties. The other proposed project components would not have this same potential for inadvertent discoveries and are not discussed further.

The substantial adverse changes in the significance of as-yet-unknown archaeological resources have been and would continue to be reduced to no adverse effect through implementation of previously

adopted Mitigation Measures CH 15 through CH 20, identified in the 2004 FEIS/EIR and memorialized in the MOA (U.S. Department of Transportation et al. 2004), as amended in 2010 and 2016. Specifically, these measures include the development and implementation of ARDTPs, guidelines for the treatment of Native American burials, and the preparation and distribution of technical reports describing the findings of the implementation of each ARDTP. The adopted mitigation measures require the TJPA to initiate the process of determining how archaeological properties that may be affected would be identified, how NRHP eligibility would be addressed, and how effects might be taken into account (CH 15); prepare and implement archaeological resource treatment plans, including documentation of results of implementation the plans (CH 16 and CH 17); follow certain procedures for properties discovered during construction for which a treatment plan had not been prepared (CH 18); comply with Section 304 of the NHPA and with Section 6254.10 of the California Government Code (CH 19); and comply with state regulations regarding the discovery of Native American burials and related items discovered during project construction (CH 20). The second MOA amendment, executed in 2016, also amends Stipulation IV.D to require the TJPA to provide immediate notification to FTA, SHPO, and any Native American Tribe that might attach religious or cultural significance to the affected property, of cultural deposits that are discovered within the APE during ground-disturbing activities. The amended stipulation also contains procedures to be implemented in the event of a discovery.

The seven project components discussed below have the potential for post-review discoveries of archaeological historic properties and/or Native American human remains.

Widened Throat Structure

Because the Archaeological and Vertical APEs for the widened throat structure are similar to and overlap those associated with the west side of the train box, the degree of direct adverse effects would also be the same as those reported in the 2003 FOE. The train box is currently under construction as Phase 1 of the Transbay Program. The design of the transition from the below-grade DTX tracks in Second Street into the west end of the train box between Minna and Tehama Streets has been modified to conform to design specifications of the California High-Speed Rail Authority, effectively widening the APE on the inside eastern edge of the curve into the train box. A shaft and shoring wall would be extended around the perimeter of the widened throat structure footprint and then soil and fill would be removed from within the wall enclosure by mass excavation. The maximum depth of the excavation would be 65 feet below grade, in line with the train box and throat structure currently under Phase 1 construction. A series of piles would be installed beneath this base level of excavation. The final depth of these piles is not yet known. The modification to the throat structure would extend the area of disturbance east into the northwest corner of the block defined by Howard, Folsom, First, and Second Streets, and the southwest corner of the block defined by Howard, Minna, First, and Second Streets.

The widened throat structure is immediately adjacent to the Archaeological APE for the Phase 1 train box and the conclusions of the Existing Transbay Transit Terminal and Ramp Demolition, Utility Relocation, New Transit Center Foundation Excavation (DURF) ARDTP (William Self Associates, Inc. 2010) are relevant for evaluating the archaeological sensitivity of this proposed project component footprint. The depositional history of the APE indicates an approximately 13-foot-thick layer of fill, a 12-foot-thick layer of intact dune sand, nearly 4 feet of marsh deposits laid down at the former margin of the cove waters, and a very thick layer of Colma sand that extends well below the proposed depth of disturbance. The dune sand, marsh deposits, and top layer of Colma sand are all sensitive for prehistoric Native American archaeological deposits and human remains. The entire city block of First, Second, Howard, and Folsom Streets has been recorded as archaeological site CA-SFR-151/H. The APE of the widened throat structure passes through the western edge of this city block and archaeological site. Limited archaeological testing of the central portion of the block, outside of the widened throat structure APE, has revealed both a prehistoric Native American shell midden and historic-era features such as privies and

trash dumps dating to the 1860s through 1906. The prehistoric interment discovered recently within the Phase 1 train box footprint lies outside of the widened throat structure APE, but less than two city blocks away.

There is a high potential for the inadvertent discovery of prehistoric Native American archaeological resources and human remains, and historic archaeological resources such as later 19th century ground surfaces, building foundations, and hollow-filled features. Construction of the widened throat structure has the potential for adverse changes in the significance of as-yet-unknown archaeological resources. The adverse changes in the significance of as-yet-unknown archaeological resources and Native American human remains have been and would continue to be reduced to no adverse effect through implementation of previously adopted Mitigation Measures CH 15 through CH 20, identified in the 2004 FEIS/EIR and memorialized in the MOA (U.S. Department of Transportation et al. 2004), as amended.

Extended Train Box

The prehistoric interment discovered recently within the Phase 1 train box footprint lies outside of the extended train box APE, but less than two city blocks away. Because the Archaeological and Vertical APEs for the extended train box to Main Street are similar to and overlap those associated with the east end of the train box, the same type and scale of potential adverse effects as described in the 2003 FOE for the train box may be anticipated. The train box would be extended below-grade lengthwise to the eastern edge of Main Street. The disturbance due to construction would be similar to that caused by construction of the existing train box, measuring approximately 182 feet wide and extending approximately 55 feet below grade at Beale Street, narrowing slightly to approximately 156 feet wide and 53 feet below grade as it approaches Main Street. A shaft and shoring wall would be extended around the perimeter of the extended train box footprint and then soil and fill would be removed from within the wall enclosure by mass excavation. A series of piles would be extended below the base of excavation; the final depth of these piles is not yet known.

From approximately 6,000 years ago until the filling of this portion of the bay in the 1860s, the extended train box APE would have been situated in the waters of Yerba Buena Cove. Geotechnical reports indicate a layer of fill at least 17 feet thick overlying a similarly thick layer of Bay Mud and an even thicker layer of marine sands. The recently discovered prehistoric burial at 55 feet below ground surface near Fremont Street was situated at the interface between Marine Sands and Lower Bay Mud. This interface is below the limits of the extended train box APE. Therefore, there is low potential for encountering buried prehistoric Native American deposits or human remains in primary context or as secondary deposits in fill. The City considers both primary and secondary deposits as having potential eligibility for listing in the CRHR and NRHP. The area within the APE primarily housed iron works, wood mills, storage yards, and warehouses after the land was filled, but construction of the 201 Mission building, which covers a majority of the APE, resulted in removal or destruction of a large part of the soils and fill within the horizontal and vertical APE. Construction of the extended train box has the potential for adverse changes in the significance of as-yet-unknown historic era archaeological resources from the post-fill 19th century industries and warehouses that were once situated on the property. The adverse changes in the significance of as-yet-unknown archaeological resources have been and would continue to be reduced to no adverse effect through implementation of previously adopted Mitigation Measures CH 15 through CH 20, identified in the 2004 FEIS/EIR and memorialized in the MOA (U.S. Department of Transportation et al. 2004), as amended.

Realigned Fourth and Townsend Station

There is very low potential for historic-era archaeological resources within the footprint of Townsend Street, which was established early in the history of the development of the City and is unlikely to contain

historic-era deposits, features, or structural remains within the fill beneath the street surface. The APE lies in what was formerly the edge of Mission Bay and adjacent marshlands from between approximately 6,000 years ago until the 1860s, when the land was reclaimed by filling. Prior to approximately 6,000 years ago, before the waters of the bay reached their maximum extent, the APE would have been an attractive estuarine and marshy area accessible to prehistoric-era Native Americans to use and occupy. Construction of the realigned Fourth and Townsend Station has a moderate potential for adverse changes in the significance of as-yet-unknown prehistoric era archaeological resources and Native American human remains. The adverse changes in the significance of as-yet-unknown archaeological resources and Native American human remains have been and would continue to be reduced to no adverse effect through implementation of previously adopted Mitigation Measures CH 15 through CH 20, identified in the 2004 FEIS/EIR and memorialized in the MOA (U.S. Department of Transportation et al. 2004), as amended.

Vent Structure at Third and Townsend Streets

The Archaeological and Vertical APEs for the vent structure at Third and Townsend Streets are similar to that of the DTX alignment at this location. Therefore, the type and scale of the effects would also be similar to those reported in the 2003 FOE for this segment of the DTX. This vent structure sits adjacent to the DTX alignment. The site of the proposed vent structure is at the base of a hill immediately adjacent to the former edge of Mission Bay. The underlying stratigraphy is simple, with a relatively thin layer of fill (10–15 feet) overlying residual soil of varying thickness on top of bedrock. None of the layers sensitive for prehistoric Native American archaeological resources or human remains are present within the APE; therefore, there is no potential for encountering buried prehistoric Native American deposits or human remains in primary context, and there is only a very low potential for encountering such remains that may have been redeposited as fill. They could only exist as secondary deposits accidentally included in the fill in the 19th century. Nonetheless, the City considers such secondary deposits as having potential eligibility for listing in the CRHR and NRHP. The APE housed San Francisco Lumber Company by 1887, and there is a moderate potential for adverse changes in the significance of as-yet-unknown archaeological deposits associated with this commercial enterprise during construction for the vent structure. The adverse changes in the significance of as-yet-unknown archaeological resources have been and would continue to be reduced to no adverse effect through implementation of previously adopted Mitigation Measures CH 15 through CH 20, identified in the 2004 FEIS/EIR and memorialized in the MOA (U.S. Department of Transportation et al. 2004), as amended.

Vent Structure at Second and Harrison Streets

Because the Archaeological and Vertical APEs are similar to the DTX alignment at this location, the vent structure at Second and Harrison Streets would have the same type and scale of effects as those that reported in the 2004 for the tunneling for the DTX in this section of the alignment. The vent structure is located adjacent to the tunnel at Second and Harrison Streets. The stratum underlying the APE consists of a 5-foot-thick layer of fill overlying bedrock. There are no native soils present within the APE; therefore, there is no potential for encountering buried prehistoric Native American deposits or human remains in primary context. There is also a very low potential for encountering such remains that may have been redeposited as fill; they could only exist as secondary deposits accidentally included in the fill in the 19th century. Nonetheless, the City considers such secondary deposits as having potential eligibility for listing in the CRHR and NRHP. The APE lies in the northwest corner of archaeological site CA-SFR-152H, and later 19th century historic-era features have been recovered during prior archaeological investigations outside of the APE. The APE is located at the edge of Rincon Hill, which housed large residences and stables in the days following the Gold Rush. However, with the Second Street Cut in 1868, which changed the feel of this once exclusive hillside neighborhood, the residences were razed, and only in the 20th century was the corner redeveloped for commercial uses. The vent structure at Second and Harrison

Streets has a moderate potential for adverse changes in the significance of as-yet-unknown remains from the pre-1868 residential occupation of the APE and the post-1913 commercial use of the APE. The adverse changes in the significance of as-yet-unknown archaeological resources have been and would continue to be reduced to no adverse effect through implementation of previously adopted Mitigation Measures CH 15 through CH 20, identified in the 2004 FEIS/EIR and memorialized in the MOA (U.S. Department of Transportation et al. 2004), as amended.

Tunnel Stub Box

Construction of the tunnel stub box would involve construction underneath the proposed U-wall track structure. The tunnel stub box would require the removal, by cut-and-cover excavation, of additional soil and fill within the Caltrain railyard, extending to a greater depth than previously assessed for the U-wall.

The tunnel stub box is located within the formerly submerged margin of Mission Bay near the mouth of Mission Creek. The greater Mission Creek and Mission Bay areas were attractive places that were likely fished and hunted by Native Americans for thousands of years, and the geotechnical studies of the APE suggest that there is moderate potential for encountering prehistoric Native American archaeological deposits or human remains beneath the 10- to 20-foot-thick layer of fill. Archaeological deposits and human remains could either be in primary context in the Bay Mud, marine sands, and old bay clay beneath the fill or in secondary context as part of the fill. The City considers both primary and secondary prehistoric era deposits as having potential eligibility for listing in the CRHR and NRHP. Given the depth of the Colma sand layer, it is possible that piles used to support the western end of the new tunnel stub box may extend into Colma sand. The top layer of this sand is considered sensitive for archaeological deposits. Historically, the APE was part of a larger purchase by the Southern Pacific Railroad in 1868 and 1869 of former marsh and tidelands that the company gradually filled. Previous development within the footprint of the tunnel stub box is limited to the Southern Pacific railroad tracks, and the APE includes tracks that are currently in use. There is a very low potential for encountering as-yet-undiscovered archaeological resources from the historic period, and these would likely be related to the railroad. There is a moderate potential for adverse changes in the significance of as-yet-unknown prehistoric archaeological resources or Native American human remains. The adverse changes in the significance of as-yet-unknown archaeological resources and Native American human remains have been and would continue to be reduced to no adverse effect through implementation of previously adopted Mitigation Measures CH 15 through CH 20, identified in the 2004 FEIS/EIR and memorialized in the MOA (U.S. Department of Transportation et al. 2004), as amended.

BART/Muni Underground Pedestrian Connector

The Archaeological and Vertical APEs for this pedestrian connector depict a cut-and-cover excavation within Beale Street between the extended train box and Market Street, with a maximum depth of 30 feet at Mission Street, approximately 30 feet wide, and a total length of 800 feet. Construction-related excavation would remove all sediments within the footprint to a depth of 30 feet at its maximum depth at the southern end of this proposed project component. The connector would be installed in a location where the waters of Yerba Buena Cove occurred between approximately 6,000 years ago and the 1860s. Geotechnical reports indicate a layer of fill at least 23 feet thick overlying a similarly thick layer of Bay Mud. With the exception of the fill, the depositional history of this APE is marine; therefore, there is very low potential for encountering buried prehistoric Native American deposits or human remains in primary context, and there is a low potential for encountering such remains that may have been redeposited as fill. Nonetheless, the City considers such secondary deposits as having potential eligibility for listing in the CRHR and NRHP. There is very low potential for encountering other historic-era archaeological resources within the confines of Beale Street, with the exception of the remains of a Gold-Rush-era ship, the *Callao*, that was reportedly broken and left in the intersection of Beale and Mission Streets during the

filling of the cove margin following the Gold Rush. The BART/Muni underground pedestrian connector has the potential for adverse changes in as-yet-undiscovered archaeological resources. The adverse changes in the significance of as-yet-unknown archaeological resources have been and would continue to be reduced to no adverse effect through implementation of previously adopted Mitigation Measures CH 15 through CH 20, identified in the 2004 FEIS/EIR and memorialized in the MOA (U.S. Department of Transportation et al. 2004), as amended.

5.2 EFFECTS ON ARCHITECTURAL HISTORIC PROPERTIES

The criteria of effect are applied for each of the relevant components of the proposed undertaking in the following evaluation of effects to the built environment. Table 3 identifies which components of the undertaking have the potential to affect architectural historic resources. The effects are summarized in this table and the substantiation for these findings is provided on the following pages. Components of the undertaking as described in Chapter 2 (e.g., the vent structure as Second and Harrison Streets, rock dowels, the additional trackwork south of the railyard (turnback track and maintenance of way track), taxi staging areas, intercity bus facility, and AC Transit bus storage facility parking) that are not discussed in the evaluation below would have no effect on architectural resources in the project limits.

Table 3
Architectural Historic Property Effects by Proposed Undertaking Component

Historic Resource	Widened Throat Structure	Extended Train Box	Fourth and Townsend Station and Vent Structures	Vent Structure - Third and Townsend	Tunnel Stub Box	Bike/ Controlled Vehicle Ramp	Under-ground Pedestrian Connector
589 Howard, Contributor to Second and Howard Street NRHP District	No Adverse Effect	N/A	N/A	N/A	N/A	N/A	N/A
165-173 Second Street, Contributor to the Second and Howard Streets Historic District	No Adverse Effect	N/A	N/A	N/A	N/A	N/A	N/A
Auxiliary Water Supply System Historic District	No Adverse Effect	No Adverse Effect	N/A	N/A	N/A	N/A	No Adverse Effect
Bluxome and Townsend Warehouse District	N/A	N/A	No Adverse Effect	N/A	N/A	N/A	N/A
Rincon Point/South Beach Historic Warehouse-Industrial District and South End Historic District	N/A	N/A	No Effect	No Adverse Effect	N/A	N/A	N/A
Second and Howard Streets NRHP Historic District	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A – Not applicable because the APE for the component does not include the resource. As a result, these components would have No Effect on the historic resource.
Source: Compiled by AECOM 2015.

5.2.1 589 Howard Street, Contributor to Second and Howard Street NRHP District

The shift and expansion of the throat structure at the west end of the train box has the potential to directly affect historic architectural resources where the cut-and-cover construction activities extend farther east than the construction activities analyzed in the 2003 FOE. However, mitigation measure CH11 (repair any

damage to contributing elements to the historic districts) identified in the 2004 EIS/EIR and the 2004 MOA Stipulation III.A (protective measures) and Stipulation III.B (repair of inadvertent damage) already apply to this property and would continue to apply under the current undertaking. The shift and expansion has the potential to cause vibration impacts to buildings that were previously further removed from those activities. The widened throat structure would pass beneath portions of 589 Howard Street, a contributor to the Second and Howard Streets Historic District. To accommodate the expansion of the throat structure the basement space below the sidewalk on the north side of the 589 Howard Street would be demolished and two large-diameter cast-in-drilled-hole piles on the north and west side of the building would be installed. A large beam would be inserted to span the piles and the underpinning beam would support the building during construction. This method reduces the chances for structural damage to 589 Howard Street.

Photo of 589 Howard Street (taller brick building on the right)

Prior to any construction activities, Stipulation III.A (Mitigation of Effects on Second and Howard Streets Historic District and Protective Measures for Rincon Point/South Beach Historic Warehouse Industrial District) of the MOA would be implemented. That stipulation requires that TJPA, in consultation with owners of historic properties immediately adjoining the construction sites to develop and implement measures to protect historic properties; consultation with SHPO to document the historic properties prior to taking any action that could adversely affect these properties; and any damage to a historic property as a result of the undertaking will be repaired in accordance with the Secretary of the Interior's Standards for Rehabilitation. As required under Stipulation III.C (Repair of Inadvertent Damage) of the MOA, prior to construction, photographic documentation of the building will be taken to provide a baseline condition for assessing any potential damage. By following the above stipulations from the MOA, which already apply to this property, there would be ***no adverse effect*** to 589 Howard Street or to the historic district to which it contributes.

5.2.2 165-173 Second Street, Contributor to the Second and Howard Streets Historic District

The 2003 FOE determined that the Transbay Program would have an adverse effect on 165-173 Second Street (also known as 171 Second Street), a contributor to the Second and Howard Streets Historic District, because the building was slated for demolition. The proposed widened throat structure would shift this feature to the east of this building, and it would no longer be necessary to demolish the building. Similar to 589 Howard Street, an underpinning beam would support the building during construction and

reduce the chances for structural damage to 165-173 Second Street. More specifically, the following steps would be taken to protect the building at 171 Second Street:

- install shoring walls around the building and excavate as necessary to construct the widened throat structure;
- construct the widened throat structure and perform ground improvement under the building
- vacate the building as necessary and remove the shoring walls where underpinning walls would be constructed in the building basement
- construct concrete underpinning walls
- install underpinning beam supports and transfer the building load onto the beam supports
- excavate and shore the portion below the building
- construct the remaining portions of the widened throat structure
- backfill within and around the building, reconstruct the basement slab, and restore the building as required.

Prior to any construction activities, Stipulation III.A (Mitigation of Effects on Second and Howard Streets Historic District and Protective Measures for Rincon Point/South Beach Historic Warehouse Industrial District) and Stipulation III.C (Repair of Inadvertent Damage) of the MOA, as summarized above, would be implemented. By following the above stipulations from the MOA, there would be ***no adverse effect*** to 165-173 Second Street or the district to which it contributes.

Photo of 171 Second Street (taller brick building on the right)

5.2.3 AWSS Historic District

Widened Throat Structure

The widened throat structure would also require that an 18-inch-diamater pipe underneath Second Street be taken out of service and replaced with a new pipe of the same diameter after the completion of the DTX project. A 12-inch-diameter pipe under Howard Street would temporarily be out of service. These pipes are part of the 135 miles of pipes that contribute to the AWSS historic district. The removal of these two pipes (together totaling less than one mile) is a small percentage of the district's contributing features

and the district is large enough that this action would not significantly change the character of the system's use. As a result, their removal would have ***no adverse effect*** to the district, because there are enough of the pipes extant that can continue to express the significance of this discontiguous district.

Extended Train Box

Facilities of the San Francisco Fire Department AWSS, a NHPA discontiguous historic district, are located in the area of this proposed project component and could be removed or relocated during project activities. However, similar to the impact discussion for the widened throat structure, protection or relocation of AWSS components in a relatively small area of a system that spans the entire City would not constitute an adverse effect to the historic property. The additional area affected by the extension of the train box, where the AWSS would be found, is limited to the Beale Street right-of-way, or approximately 50 feet, compared to the 135 miles comprising the system. The area surrounding the proposed project component consists of mainly newer buildings (less than 45 years old), so that no additional historic architectural resources would be directly or indirectly impacted. Prior to disturbance of the AWSS, coordination with the SFPUC and TJPA would occur. The SFPUC provides guidance for maintaining the resource through design guidelines and/or "leave and protect in-place" methods. Written and documented consultation with the SFPUC is required prior to the disturbance of AWSS facilities. In conclusion, this proposed project component would have ***no adverse effect*** on the AWSS historic district.

BART/Muni Underground Pedestrian Connector

It is possible that components of the San Francisco Fire Department AWSS, a historic property, located in the area of this proposed project component, could be removed or damaged during project construction-related activities. Similar to the adverse effects discussions for the widened throat structure and the train box extension, removal or damage of AWSS components in a relatively small area (approximately 800 feet along Beale Street) of a 135-mile system that spans the entire City would not constitute an adverse effect to the historic property. Prior to disturbance of the AWSS, coordination with the SFPUC and TJPA would occur. The SFPUC provides guidance for maintaining the resource through design guidelines and/or "leave and protect in-place" methods. Written and documented consultation with the SFPUC is required prior to the disturbance of AWSS facilities. Since the proposed project component would be constructed underneath the Beale Street right-of-way, there is no potential for construction to cause an indirect adverse effect to historic architectural properties on Beale Street. In conclusion, this proposed project component would have ***no adverse effect*** on the AWSS historic district.

5.2.4 Bluxome and Townsend Warehouse Historic District

Realigned Fourth and Townsend Street Station

The realignment of the underground station within the Townsend Street right-of-way would not cause an adverse effect on the Bluxome and Townsend Warehouse Historic District. The Fourth and Townsend Street Station would be along the southern limits of the Bluxome and Townsend Warehouse Historic District. The realigned station would be underground beneath Townsend Street and would not introduce a new visual element other than station entries at the street level that would not result in any direct effects to the buildings along Townsend Street; vent structures associated with this station are discussed separately below. Projected construction and operation vibration levels would have no adverse effect on these districts, but new construction activities would be monitored in accordance with Stipulation III of the 2004 MOA to ensure that these activities would have no adverse effects to contributors to the Bluxome and Townsend Warehouse Historic District, which is the district located nearest the realignment. As a result, there would be no change to the setting, feeling and association of this historic district, and ***no adverse effect*** to the Bluxome and Townsend Warehouse Historic District.

Vent Structures on Townsend near Fourth and Fifth Streets

The two vent structures at Fourth and Townsend and Fifth and Townsend associated with the underground station would not cause an adverse effect to a historic property. The Bluxome and Townsend Warehouse Historic District is north and northwest of the proposed vent structure sites, which would be sited on the south side of Townsend Street at the Caltrain railyard, across the street from the district. Construction of the proposed vent structures would not substantially alter the relationship between the buildings of the district and the rail tracks—a relationship that, in part, helps to define the historic district's significance. Because the new structures would be constructed at a sufficient distance to avoid impeding sight lines from most of the historic district to the railyard, which is several blocks long with an approximately 800-foot frontage along Townsend Street. More specifically, the nearest vent structure to the district would be the one at the west end of the station, about 100 feet away and be of relatively small scale approximately 35 feet by 35 feet, based on the vent structure plans at Third and Townsend Streets that are expected to be similar to those for the vent structure at the Fourth and Townsend Street Station. The vent structure would, thus, affect some views but would not compromise the feeling, setting, or association with the railyard. Therefore, construction of the proposed vent structures would result in ***no adverse effect*** to the district.

5.2.5 Rincon Point/South Beach Historic Warehouse-Industrial District and South End Historic District

Realigned Fourth and Townsend Street Station

The realignment of the underground station within the Townsend Street right-of-way would not cause an effect on the Rincon Point/South Beach Historic Warehouse-Industrial District and South End Historic District. The Rincon Point/South Beach Historic Warehouse-Industrial District and South End Historic District is more than 500 feet from the station and separated by intervening buildings. The realigned station would be underground beneath Townsend Street and would not introduce a new visual element other than station entries at the street level that would not result in any direct effects to the buildings along Townsend Street; vent structures associated with this station are discussed separately below. Projected construction and operation vibration levels would have ***no effect*** on these districts because of their distance from the district, but new construction activities would nevertheless be monitored in accordance with Stipulation III of the 2004 MOA to ensure that these activities would have no indirect effects As a result, there would be no change to the setting, feeling and association of the two historic districts.

Vent Structures on Townsend near Fourth and Fifth Streets

The Rincon Point/South Beach Historic Industrial-Warehouse District and South End Historic District is one block (more than 800 feet) east of the nearest vent structure for the realigned Fourth and Townsend Street Station, making this proposed project component far enough away that the setting of those districts would not be indirectly affected by the proposed project. The vent would not cause an indirect effect because the setting, feeling and association of the district would remain intact. Because of the distance between the vent structures and the historic districts, there would be ***no effect*** these districts.

Vent Structure on Third and Townsend Streets

Two buildings are located across Townsend Street to the north of the proposed vent structure site at 701 Third Street. The building at 689-699 Third Street is a non-contributor to the Rincon Point/South Beach Historic Industrial-Warehouse District and South End Historic District. The other building 180 Townsend is a contributor to the two districts. Construction of the vent structure at the 701 Third Street site would not cause an adverse effect to the historic districts. Although it does introduce a new visual element

adjacent to the districts, the overall integrity of the districts would remain intact because the vent structure would only be located in closest proximity to a non-contributing building of the historic districts. The construction of the vent would not result in the alteration or demolition of a contributing building of the historic district. The visual introduction would not alter the integrity of location, workmanship, and materials. The overall integrity of the districts' design, setting, feeling and association would remain and not be significantly affected by the visual introduction of the vent structure. Therefore, the introduction of a new visual element at this site would not diminish the districts' ability to convey their significance within the context of industrial development in San Francisco, and there would be ***no adverse effect*** to these historic districts.

The alternate location considered for a vent structure at Third Street and Townsend Street would require the demolition of the two above-mentioned buildings at 689-699 Third Street and at 180 Townsend, both within the Rincon Point/South Beach Historic Industrial-Warehouse District and South End Historic District. Of the two buildings that would be demolished, only the 1903–1905 California Wine Association Building at 180 Townsend is considered a contributor to the South End Historic District.

Photo of 180 Townsend Street

In the 2008 update to the historic district, the City of San Francisco certified that of the 78 buildings located within the historic district boundaries, 55 buildings contribute to the historic district and 23 buildings are non-contributors (see Figure 2). Subsequently, in June 2009, a DPR 523 Form was completed to adjust the boundary of the district. The San Francisco Historic Preservation Commission (Motion 0103) in December 1, 2010 adopted an augmentation survey that included the South End Historic District extension. The area encompassed within this boundary extension included 19 properties, 12 of which are contributing. Figure 2 shows the original district and the expanded district. The area added to the South End Historic District is adjacent to the western boundary of the original district and is visually and historically compatible with the warehouse architectural theme of the South End Historic District and the contributing resources are within the period of significance (1867-1935) established by

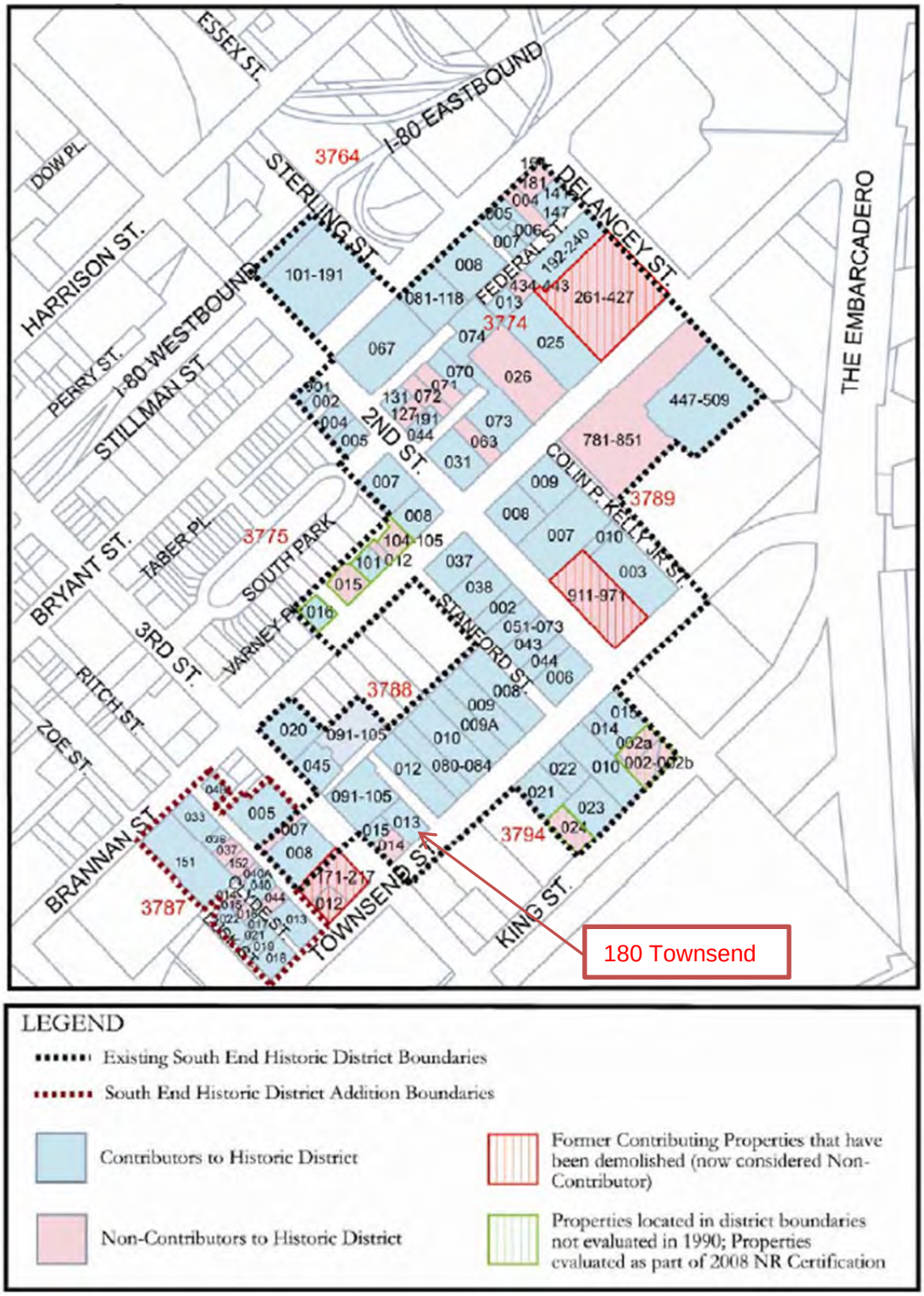


Figure 2: South End Historic District and Location of 180 Townsend

the original district. With this boundary adjustment, the number of properties in this district now totals 97 buildings, of which 67 are contributing buildings.

When considering a historic district, the integrity of the whole is considered paramount to the individual integrity of any one component, and in some cases, actions that would result in an impairment of the integrity of an individually eligible building or structure may not be considered actions that would impair the integrity of a historic district.

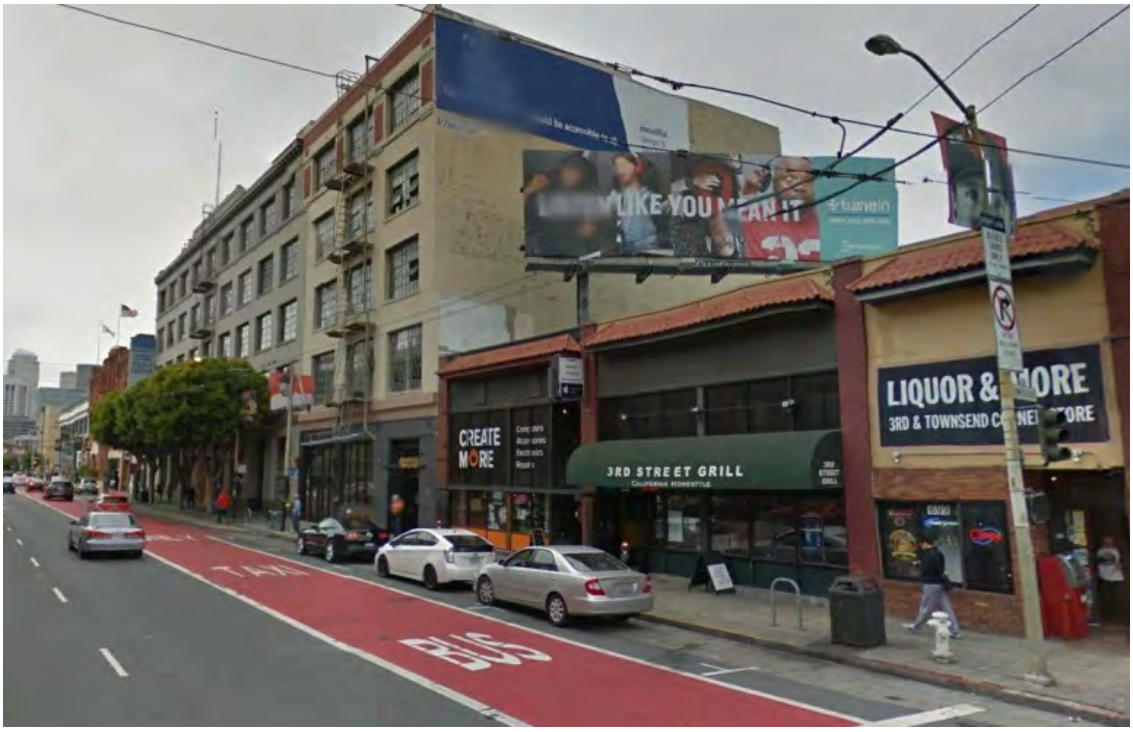
The demolition of this contributor building would not result in an adverse effect on the historic district, because the historical integrity of the district would remain strong as a whole, with 66 remaining contributors to the original district with the addition and because of the retention of a row of contributing buildings to the east along Townsend Street and to the north along Third Street (see Figure 3 for photos of contributor buildings that would remain and continue to strongly define the edges of the districts). The building at 180 Townsend is in the southwest corner of the original district (as shown in Figure 2). The demolition of 180 Townsend would create a gap between the contributing buildings to the west (west of Ritch Street that were included as part of the 2010 addition) from the contributing buildings to the east of180 Townsend Street (those east of Clarence Place). However, because of the remaining number of contributor buildings and the intact character of the districts' boundaries to the west, east and north, the proposed undertaking in this area would not constitute an adverse effect to the overall historical integrity of the district and would not diminish the characteristics that make the district eligible for the NRHP.

As shown in Figure 2, there are three former contributing properties that been demolished (although one property at the northwest corner of Third Street and Townsend Street is not within the district boundaries). The demolition of the building at 180 Townsend would contribute to the cumulative loss of buildings that help convey the integrity and value of the Rincon Point/South Beach Historic Warehouse-Industrial District and South End Historic District. Information regarding these properties is presented in Table 4 below to describe the changes that have occurred from past actions.

Future foreseeable actions that could affect the district would depend on market forces, private property owner proposals, and the City of San Francisco's planning and entitlement process. The cumulative project list and map (presented in Table 3.1-1 and Figure 3.1-1, respectively, in the SEIS/EIR for the project) do not identify any known foreseeable public or private projects within the boundaries of the historic district.

The City is undertaking a Central South of Market Area Plan, for which a revised draft plan was issued in August 2016. The plan anticipates the potential for up to 50,000 jobs and 7,500 housing units. While the plan envisions substantial changes in this area of the City, a core principle of the plan is to achieve neighborhood sustainability, in part by recognizing the diversity of buildings and architecture that characterize the area and respecting and enhancing the neighborhood's character. Plan adoption is anticipated sometime in late spring 2017. An EIR is being prepared and will identify mitigation measures to reduce potentially significant impacts, including those to historic resources. At this point, potential loss of historic resources within the Rincon Point/South Beach Historic Warehouse-Industrial District and South End Historic District is uncertain, until the City's plans and EIR are completed and future private development proposals are submitted to the City for approval. The cumulative effects are therefore speculative, although the proposed project's contribution to the cumulative effects would be minimal.

Figure 3: Contributors to the South End Historic District in the Vicinity of 180 Townsend



Contributors to the north along Third Street (taller buildings behind the billboard)

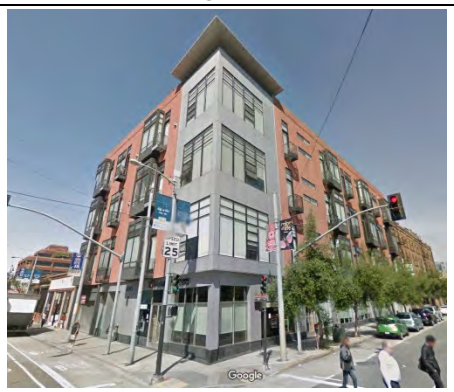
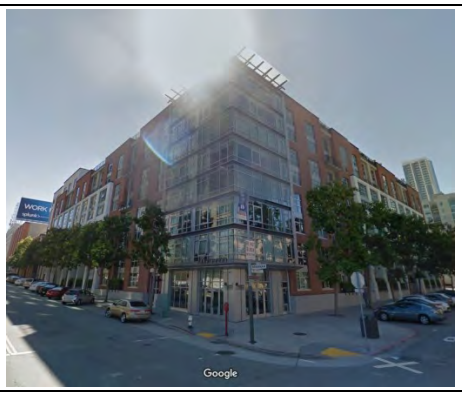
Alley separating 180 Townsend (on the left) with contributors to the east

Figure 3 (continued): Contributors to the South End Historic District in the Vicinity of 180 Townsend

Contributors immediately to the east of 180 Townsend, defining the district's southern boundary along Townsend Street

Contributors on the same block as photo above, defining the district's southern boundary further east along Townsend Street

Table 4
Former Contributing Properties in the South End Historic District

Property Name (Historic)	Built	Demolished	Existing Condition
Williamson Building 200 Townsend Street (identified in Figure 2 as a former contributing property but the address is outside the district boundaries)	1913	2001	
California Warehouse 88 Townsend Street	1882	2003	
Farnsworth & Ruggles #4 Warehouse 200 Brannan Street	1935	2001	

It is recognized that the FOE for the original Transbay Program did identify demolition of contributors as an adverse effect; however, that effect determination was attributable to the fact that the removal of those contributors resulted in the isolation and separation of other contributors and historic resources from the rest of the applicable districts. This condition would not occur with the proposed demolition of 180 Townsend, since its loss would not substantially isolate or separate other portions of the district.

Based on the above assessment, introduction of the vent structure at this location would result in a finding of ***no adverse effect***.

5.2.6 Other Effects Evaluation

Tunnel Stub Box

The proposed tunnel stub box has no potential to cause a direct or indirect adverse effect to historic architectural properties. This proposed project component involves below-grade construction under an already-approved U-wall at the west end of the Caltrain railyard. The Caltrain railyard was found ineligible for the NRHP (San Francisco Planning Department 2001), so that there is no potential for construction activities to directly or indirectly adversely affect a historic property located above the construction area. Furthermore, the 2003 FOE determined that new construction at the Caltrain site, specifically project components that are "similar in visual character to those existing at these sites, such as ... station structures" would not result in adverse visual (indirect) effects, so there is no potential for the tunnel stub box to indirectly impact surrounding historic architectural resources.

Bicycle/Controlled Vehicle Ramp

The proposed bicycle/controlled vehicle ramp and below-grade bicycle facilities have no potential to cause a direct adverse effect to historic architectural properties because no historic architectural properties are present at this location. The proposed bicycle/controlled vehicle ramp would descend from street level at Howard Street north to the Lower Concourse level of the Transit Center, with no above-grade elements. Its integration into the Transit Center, which was already found to be of similar scale and function as its surroundings, would not cause an indirect adverse effect to surrounding historic architectural properties, especially the buildings listed as contributors to the Second and Howard Streets Historic District and New Montgomery-Mission-Second Street Conservation District.

BART/Muni Underground Pedestrian Connector

Construction of an emergency exit on Beale Street between Market and Mission Streets for the proposed BART/Muni Underground Pedestrian Connector would not cause a direct or indirect adverse effect to the NRHP-listed Matson Building (25–45 Beale Street) on the east side of Beale Street. The exit is proposed to be constructed on the west side of Beale Street and is not proposed to project above the street level. This portion of Beale Street is not located in a historic district, and all of the buildings on the west side of Beale Street are less than 45 years old.

CHAPTER 6 CONCLUSION

In summary, this Supplemental FOE concludes that the proposed undertaking would have no new types of adverse effects on non-archaeological historic properties. Existing stipulations in the executed MOA, as amended, provide avoidance, minimization, and mitigation measures protective of archaeological and built environment historic properties.

One contributor to a historic district would be demolished, 180 Townsend, adding to the loss of historic properties in the SoMa area, and two other properties, 589 Howard Street and 165-173 Second Street, could be subject to construction-period vibration with the potential to result in damage to another historic property in the SoMA area. MOA Stipulation III.B, Documentation, will ensure proper recordation of potentially affected historic properties. This provision in the stipulation reads, in part: "Prior to taking any action that could adversely affect these properties, TJPA will consult SHPO and SHPO will determine the type and level of recordation that is necessary for these properties. Upon a written determination by SHPO that all documentation prescribed hereunder is complete and satisfactory…" The construction-period vibration would be mitigated by following Stipulation III and Appendix A (Protective Measures) of the MOA.

The 2003 FOE identified a direct adverse effect on 165-173 Second Street because it would be demolished. The building is proposed to be preserved as part of the proposed undertaking and would no longer have an adverse effect on this contributor to a historic district. To protect the building at 165-173 Second Street, the building would be underpinned during construction of the widened throat structure. Appendix A of the executed MOA contains protective measures to minimize effects related to ground movements, air emissions, and vibration.

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CHAPTER 7 REFERENCES

Peninsula Corridor Joint Powers Board and Planning Department of the City and County of San Francisco. 2003. *Finding of Effect: Locally Preferred Alternative Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project*. Prepared for Federal Transit Administration.

U.S. Department of Transportation, Federal Transit Administration, California State Historic Preservation Officer, TJPA, City and County of San Francisco, Peninsula Corridor Joint Powers Board, and California Department of Transportation. 2004. *Memorandum of Agreement among the Federal Transit Administration and California State Historic Preservation Officer for the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project in San Francisco, CA*.

William Self Associates, Inc. 2010. *Transbay Transit Center Program, Final Archaeological Research Design and Treatment Plan for the Existing Transbay Transit Terminal and Ramp Demolition, Utility Relocation, and New Transit Center Foundation Excavation (DURF)*. Prepared in collaboration with URS Corporation in association with Hatch Mott MacDonald and EPC Consultants, Inc., San Francisco, CA, for Transbay Joint Powers Authority, San Francisco, CA.

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CHAPTER 8 PREPARERS' QUALIFICATIONS

Patricia E. Ambacher, M.A. is an architectural historian with more than 12 years of experience conducting cultural resources studies. Ms. Ambacher completed her BA and MA in history from California State University, Sacramento. She has served as the lead historian responsible for cultural resources investigations in compliance with Section 106 of the NHPA for various agencies. Ms. Ambacher prepares a variety of technical reports including HPSR/HRERs, HABS/HAERS/HALS, FOEs, Historic Property Treatment Plans, Initial Studies, and environmental documents. She also conducts archival and historic research to establish appropriate historic contexts for the evaluations of a multitude of property types. Prior to working in the private sector Ms. Ambacher worked as a historian for the California Office of Historic Preservation and served as staff to the State Historical Resources Commission. She has given training sessions to California State Parks' cultural staff and presented at workshops and conferences concerning multiple property submissions and how to evaluate resources for the National Register and the California Register. She meets the Secretary of the Interior's standards for work in history and architectural history.

Heather A. Price, Ph.D., RPA has more than 25 years of experience in archaeology and serves as Senior Project Director of William Self Associates' (WSA) Pacific Region office. She began her professional career as an archaeologist for the USDA Forest Service on the Unaka National Forest in Tennessee, conducted archaeological research and fieldwork on early modern humans (Paleolithic) in southern France and Mongolia, and has taught archaeology at the University of California, Berkeley, at San Francisco State University, and at the College of Marin. She has been a cultural resources management specialist in northern California for 15 years. Dr. Price is experienced in all phases of regulatory compliance and permitting at local, state, and federal levels, including preparation of technical reports and sections for EIR/EIS, and EAs; cultural resource evaluations; agreement documents including PAs, MOAs, MOUs; Native American consultation; treatment plans; research designs; and plans for inadvertent discovery of cultural resources and human remains. She has been WSA's Project Director for two large transportation and water management projects subject to CEQA and NHPA Section 106 including the Los Vaqueros Reservoir Expansion (Contra Costa County), and the Transbay Transit Center Project (San Francisco).

APPENDIX B.2

FTA Letter to SHPO Regarding Finding of Effect

U.S. Department
of Transportation
**Federal Transit
Administration**

REGION IX
Arizona, California,
Hawaii, Nevada, Guam
American Samoa,
Northern Mariana Islands

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Suite 15-300
San Francisco, CA 94103-6701
415-734-9490
415-734-9489 (fax)

Ms. Julianne Polanco
State Historic Preservation Officer
Office of Historic Preservation
California Department of Parks and Recreation
1725 23rd Street, Suite 100
Sacramento, CA 95816
Attention: Kathleen Forrest, State Historian

FEB 17 2017

Re: Section 106 Consultation Transbay Terminal/Caltrain Downtown Extension Redevelopment Project, San Francisco, CA (Reference #: FTA011108A)

Dear Ms. Polanco:

The Federal Transit Administration (FTA), in cooperation with the Transbay Joint Powers Authority (TJPA), is continuing consultation with the California State Historic Preservation Officer (SHPO) pursuant to Section 106 of the National Historic Preservation Act (NHPA) for the Transbay Terminal/Caltrain Downtown Extension Redevelopment Project (also known as the Transbay Program) in the City and County of San Francisco, California. The Transbay Program is divided into two construction phases, Phase 1 and Phase 2. Subsequent to the 2003 Finding of Effect and the execution of the Memorandum of Agreement between the Federal Transit Administration, and the California State Historic Preservation Officer Regarding the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project (MOA) on June 23, 2004, the design for Phase 2 has been refined. FTA evaluated the changes and determined that the refinements to Phase 2 would not result in any new adverse effects to historic properties and the finding of effect for the undertaking remains the same. In accordance with 36 CFR 800.5, FTA requests your concurrence that the refinements would not result in any new adverse effects to historic properties.

In addition, one element of the Transbay Program, a vent shaft at the intersection of Third and Townsend Streets, was not previously identified in the Area of Potential Effects (APE) maps included in FTA's letter December 1, 2016. In accordance with 36 CFR 800.4, FTA is requesting your comments on the revised APE map, which includes this area (see Enclosure 1).

We respectfully request an expedited review in order to avoid project delays pursuant to 36 CFR 800.3(g). In accordance with 36 CFR 800.3(c)(4), if we have not heard from your office within thirty days, we will contact your office to address any comments you may have. Please let us know if we can assist in expediting the review.

Description of the Undertaking

The TJPA is the project sponsor of the Transbay Program. The Transbay Program will serve as a regional transit hub connecting 11 transportation systems, including public and private bus services, Caltrain, and future California High-Speed Rail services. Phase 1 of the

Transbay Program consists of the new Transit Center and the train box, which is the subterranean portion of the Transit Center that would house the Caltrain and high-speed rail station and all train-related systems and components of the Transit Center building. The Transit Center will encompass more than 1 million square feet within a complex extending from just south of Mission Street to between Second Street on the west and Beale Street on the east. The five-level Transit Center will house two below-ground levels in the train box and three above-ground levels. Phase 1 is anticipated to be complete in 2017.

Phase 2 includes the extension of the existing Caltrain rail line to the Transit Center (also known as the Downtown Rail Extension or DTX), completion of the Transit Center below-grade levels for rail operations and construction of a new underground station along the DTX alignment at Fourth and Townsend Streets. Other improvements include a bus storage facility and a pedestrian tunnel between the Transit Center and the Embarcadero BART/Muni Metro station.

Proposed Refinements

The current consultation is focused on refinements to Phase 2, which are discussed in more detail in Enclosure 2. These changes have been proposed to further enhance connectivity and use of alternative modes of transportation. In addition, design refinements were added to Phase 2 as required by California High-Speed Rail Authority and the City and County of San Francisco. There are seven proposed refinements to Phase 2 of the Transbay Program:

1. modification of the throat structure, referred to as the "widened throat structure;"
2. extension of the underground levels of the Transit Center train box from Beale Street eastward to Main Street, referred to as the "train box extension;"
3. realignment of the underground Fourth and Townsend Street Station;
4. construction of a vent structure at Third and Townsend Streets;
5. modifications at the Fourth and King Streets Caltrain railyard at the western end of the proposed project limits, involving construction of a "tunnel box stub;"
6. installation of rock dowels in conjunction with construction of the mined tunnel segment; and
7. additional trackwork south of the Caltrain railyard.

History of Section 106 Consultation

Enclosure 3 includes a summary of the Section 106 consultation and tribal coordination for the Transbay Program. Highlights of the current consultation efforts with SHPO for the project changes are shown below:

- *September 11, 2015.* FTA initiates consultation under Section 106 for project refinements and requests comments from SHPO on the revised APE and efforts to identify historic resources as described in the report: *National Historic Preservation Act-Section 106 Supplemental Consultation: Definition of the Undertaking, Area of Potential Effect, and Identification of Historic Properties Transbay Transit Center* (AECOM 2015).
- *December 8, 2015.* FTA receives no objection from SHPO on revised APE and identification of historic properties.
- *December 1, 2016.* FTA requests SHPO concurrence on finding of effects to historic resources as a result of project refinements. Our December 1, 2016 consultation letter included a supporting technical study: *National Historic Preservation Act – Section 106 Supplemental Consultation: Final Finding of Effect Transbay Transit Center.*
- *January 3, 2017.* FTA receives comments from SHPO.

In 2015, the Native American groups and individuals identified by the Native American Heritage Commission (NAHC) were contacted to request information or concerns regarding the project. Seven of the nine individuals on the list provided by the NAHC have been successfully contacted, and two of those individuals have requested that a Native American monitor be present during project construction. As of June 2016, no new information on cultural resources within the APE was provided as a result of this consultation.

Area of Potential Effect

The archaeological APE is defined as all areas that may experience ground disturbance as a result of construction of the proposed project components. The vertical component of the APE includes the maximum depth of disturbance for each project component. The architectural APE includes any historic-period buildings, structures, or objects that may be directly or indirectly affected by implementation of the project. The architectural APE includes the extent of proposed construction for most project components (i.e., the footprint) and the area surrounding each component generally up to one parcel. An exception to the one-parcel area around a proposed project component was made for the rock dowels, the additional trackwork south of the Caltrain railyard (turnback track and MOW storage track), the bicycle/controlled vehicle ramp, the taxi staging area, the AC Transit bus storage facility parking, and the underground pedestrian connector. Your letter of December 8, 2015 indicated no objections to the delineation of the APE.

As shown in Enclosure 1, the APE was revised at the northeast corner of Third and Townsend Streets to account for a proposed vent structure (vent structure 2). The revised APE map that was provided with our letter dated December 1, 2016, included the parcels at the northeast corner of the intersection (699 Third and 180 Townsend Streets) where the vent structure would be located. However, the vertical component of the archeological APE was not specified at that time. The proposed vent structure at this location would require excavation at a depth of 70 feet. Therefore, the archaeological APE at this location would extend approximately 70 feet below the ground surface. There are no other changes in the APE maps provided in December 2016. In accordance with 36 CFR 800.4, FTA is requesting your comments on the revised APE.

Research and Survey Results

Archival materials at the Northwest Information Center (NWIC) at Sonoma State University and the Sacred Lands File with the Native American Heritage Commission (NAHC) were reviewed to identify historic resources and investigations in the study area that occurred after the 2003 Finding of Effect. In addition, several studies conducted after 2004 were reviewed to provide additional information on historic resources in the APE:

- TJPA developed and implemented Archaeological Research Design and Treatment Plans (ARDTPs) for the components of Phase 1 of the Transbay Program.
- San Francisco Municipal Transportation Agency conducted the archaeological studies for the Central Subway Project in 2010 and 2011.
- The 2012 Transit Center District Plan and Transit Tower Final Environmental Impact Report by the City and County of San Francisco contains historical and cultural resources analyses pertinent to the northern half of the proposed project components. These studies are pertinent to the DTX alignment between Townsend and Second Streets. Their findings both confirm and refine the understanding of the archaeological sensitivity within and in the immediate vicinity of the Transbay Program footprint.
- SF-480 Terminal Separation Rebuild Project and the San Francisco–Oakland Bay Bridge West Approach Replacement Project (SFOBB) provided additional information on the South of Market District.

The records search revealed that two archaeological sites (CA-SFR-151/H and CA-SFR-152H) have been recorded near the APE. Neither resource has been listed or evaluated for eligibility for listing in the National Register of Historic Places (NRHP).

CA-SFR-151/H. This site occupies the city block bound by Howard, First, Folsom, and Second Streets. The CA-SFR-151/H is outside of the APE but in the vicinity of the widened throat structure. The proximity of this resource, combined with the presence of dune sand, marsh deposits, and a top layer of Colma sand, all of which are sensitive for prehistoric Native American archaeological deposits and human remains, suggests that there is a high potential for encountering an as-yet undiscovered archaeological resource in the vicinity of the widened throat structure.

This conclusion is further reinforced by limited testing that has been performed for two other projects in the central portion of the block. The historical resources identified and investigated within CA-SFR-151/H (in the center of the City block and outside the revised APE for the widened throat structure) were conducted by the Sonoma State University Anthropological Studies Center related to the archaeological mitigation for the SFOBB Project from 2007 to 2009. In addition, a prehistoric shell midden buried in dune sand 11.5 feet below the ground surface in the vicinity of 41 Tehama Street was discovered during testing for the ARDTP for Phase 1 of the Transbay Program. As mapped, the shell midden appears to lie well outside of the Archaeological APE. Nonetheless, this discovery attests to the high sensitivity for prehistoric resources in the vicinity of the widened throat structure.

CA-SFR-152H. This site occupies the City block defined by Harrison, First, Bryant, and Second Streets and the extension of Essex Street. The farthest northwest corner of CA-SFR-152H is in the vicinity of the vent structure proposed on Second and Harrison Streets. During archaeological investigations for the SFOBB Project in the southeastern corner of the block, excavation conducted within CA-SFR-152H yielded late 19th-century ground surfaces, building foundations, and hollow-filled features. The proposed vent structure footprint falls outside of previously excavated analysis areas as well as all areas within the study area boundary of CA-SFR-152/H that were identified as "Historic Sensitive Area" in subsequent 2009 studies for the SFOBB Project. The proximity of this resource suggests sensitivity for resources in the vicinity of the vent structure at the southeast corner of Second and Harrison Streets.

Summarized in Table 1 below, the potential for encountering previously unidentified archaeological sites from the project refinements has been estimated based on of the type of subsurface materials expected, the proximity to other discovered resources, and testing completed by TJPA as part of Phase 1 construction and others as noted above. Please refer to the report, *National Historic Preservation Act – Section 106 Supplemental Consultation: Final Finding of Effect Transbay Transit Center,* submitted to your office in December 2016, for additional details regarding areas of archeological sensitivity.

Table 1: Archaeological Sensitivity near Proposed Undertaking Components

Widened Throat Structure	**Extended Train Box**	**Fourth and Townsend Station and Vent Structures**	**Vent Structure - Third and Townsend**	**Vent Structure - Second and Harrison**	**Tunnel Stub Box**	**Bike/ Controlled Vehicle Ramp**	**Under-ground Pedestrian Connector**
High Potential	Low Potential	Moderate Potential	Moderate Potential	Moderate Potential	Moderate Potential	N/A – covered by Phase 1	Very Low Potential

Effects Evaluation
Since no archeological resources listed or eligible for the NRHP were identified in the APE, the project refinements would not result in additional adverse effects to archeological resources listed or eligible for the NRHP. However, as shown on Table 1, the APE includes areas of moderate to high sensitivity to encounter as-yet undiscovered archaeological resources during construction of Phase 2.

Phase 2 would implement measures for the identification and evaluation of archeological resources as outlined in the MOA Stipulation IV.B (Treatment Plan) and Stipulation IV.C (Treatment Plan Reporting Requirements). The evaluation and treatment of discovered archaeological resources would be conducted consistent with 36 CFR 800.13 and as described in MOA Stipulation IV.D (Discoveries and Unanticipated Effects). Individual treatment plans (ARDTPs) are developed for those areas where archaeological deposits are expected to be encountered during construction. Each ARDTP presents information on the historical context, the archaeological sensitivity, the archaeological testing and treatment plan to identify and evaluate archaeological materials uncovered during construction, and options for data recovery; artifact analysis, curation, and documentation; and public outreach strategies to recognize the extra-scientific values contained in archaeological resources.

Native American Tribe consultation has evolved with Phase 1 construction and will continue with the implementation of Phase 2. Native American monitors participated in the archaeological testing for Phase 1 in May and June 2009. TJPA will continue the practice of retaining Native American monitors, in the areas with moderate to high potential to encounter prehistoric archaeological deposits.

Furthermore, as noted in our letter, dated December 8, 2015, five NHRP listed or eligible historic resources (See Section 5.2 of the November 2017 Report) were identified within the revised APE: Second and Howard Streets National Register of Historic Places (NRHP) Historic District, Rincon Point/South Beach Historic Warehouse-Industrial District, South End Historic District, Bluxome and Townsend Warehouse District, and San Francisco Fire Department Auxiliary Water Supply System Historic District. As noted in Table 2 below, no additional adverse effects are expected for the five historic resources in the APE. The refinements to the undertaking would not result in adverse effects to the Auxiliary Water Supply System Historic District, the Bluxome and Townsend Warehouse District, and the Second and Howard Street Historic District.

Three buildings at 589 Howard Street, 165-173 Second Street, and 180 Townsend Street, are not individually eligible for the NRHP, but are contributors to a historic district are located in the APE. These three properties were previously addressed in Section 106 consultation on August 29, 2003 with the findings summarized below.

- 589 Howard – adverse effect due to nearby construction; mitigated in the MOA per Stipulation III.A and Stipulation III.C, respectively.
- 165-173 Second Street – adverse effect due to demolition; mitigated in the MOA per Stipulation III.B.
- 180 Townsend Street– no adverse effect and no mitigation required.

Effects to these properties were re-evaluated in light of the refinements to the undertaking:

- 589 Howard Street – Construction would now pass under the 589 Howard Street building, rather than near it as reported in 2003. The existing Stipulations III.A and

III.C from the MOA would continue to apply and the building would be underpinned during construction. These measures would avoid adverse effects to this building.

- 165-173 Second Street (current address is 171 Second Street) – Construction would now avoid demolition. Since demolition will now be avoided, the prior adverse effect is no longer applicable. Construction would pass under the building, and the building is proposed to be protected by underpinning. This measure would avoid adverse effects to the building.
- 180 Townsend Street – Construction would now result in demolition of this building, but the effect would not be adverse because the integrity of the district to which this property contributes would remain, as documented in the *National Historic Preservation Act – Section 106 Supplemental Consultation: Final Finding of Effect Transbay Transit Center*.

Alternative sites to avoid the demolition of the 180 Townsend building were explored. Sites for the vent structures must be adjacent to the underground alignment in order to provide quick and efficient egress for train passengers and train personnel in the event of an emergency. An alternative site across the street but not in the historic district was considered, but that site has been approved for redevelopment and would not be available. Other locations further to the west or east along the rail alignment would not comply with the public safety and spacing requirements of the National Fire Protection Association. Sites further east of 180 Townsend would also have a greater effect on the Rincon Point/South Beach Historic Warehouse-Industrial District and South End Historic District, because removal of a building to the east for a vent structure would introduce a gap in the continuous row of contributor buildings that define the southern edge of the district and would detract from the design, setting, appearance, and feeling of this portion of the district.

As discussed above, underpinning the two properties at 589 Howard Street and 165-173 Second Street would protect and avoid potential effects to these properties, consistent with MOA Stipulation IV.B and Appendix A to the MOA (regarding protective measures for effects to contributing elements of the Second and Howard Streets Historic District and the Rincon Point/South Beach Historic Warehouse Industrial District). Underpinning would consist of the following eight steps:

1. install shoring walls around the building and excavate as necessary to construct the widened throat structure;
2. construct the widened throat structure and perform ground improvement under the building
3. vacate the building as necessary and remove the shoring walls where underpinning walls would be constructed in the building basement
4. construct concrete underpinning walls
5. install underpinning beam supports and transfer the building load onto the beam supports
6. excavate and shore the portion below the building
7. construct the remaining portions of the widened throat structure
8. backfill within and around the building, reconstruct the basement slab, and restore the building as required.

Although not anticipated, any inadvertent damage to any historic building in the Second Street and Howard Historic District and the Rincon Point/South Beach Historic Warehouse Industrial District resulting from the construction of Phase 2 will be repaired by TJPA in

accordance with the Secretary of the Interior's Standards for Rehabilitation and as outlined in MOA Stipulation III.C (Repair of Inadvertent Damage).

Table 2: Architectural Historic Property Effects by Proposed Undertaking Component

Historic Resource	Widened Throat Structure	Extended Train Box	Fourth and Townsend Station and Vent Structures	Vent Structure - Third and Townsend	Tunnel Stub Box	Bike/ Controlled Vehicle Ramp	Under-ground Pedestrian Connector
589 Howard Street, Contributor to Second and Howard Street District	No Adverse Effect	N/A	N/A	N/A	N/A	N/A	N/A
165-173 Second Street, Contributor to the Second and Howard Streets Historic District	No Adverse Effect	N/A	N/A	N/A	N/A	N/A	N/A
Auxiliary Water Supply System Historic District	No Adverse Effect	No Adverse Effect	N/A	N/A	N/A	N/A	No Adverse Effect
Bluxome and Townsend Warehouse District	N/A	N/A	No Adverse Effect	N/A	N/A	N/A	N/A
Rincon Point/South Beach Historic Warehouse-Industrial District and South End Historic District (180 Townsend Street)	N/A	N/A	No Effect	No Adverse Effect	N/A	N/A	N/A
Second and Howard Streets NRHP Historic District	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A – Not applicable because the APE for the component does not include the resource. As a result, these components would have No Effect on the historic resource.

Findings

In accordance with 36 CFR 800.4, FTA is requesting your comments on the revised APE. Per 36 CFR 800.5, FTA requests your concurrence that the refinements to the project would not result in additional adverse effects on historic properties.

Thank you for your assistance in this undertaking and consideration of an expedited review. If you have any questions about the project, please contact Ted Matley, Community Planner, at (415) 734-9468.

Sincerely,

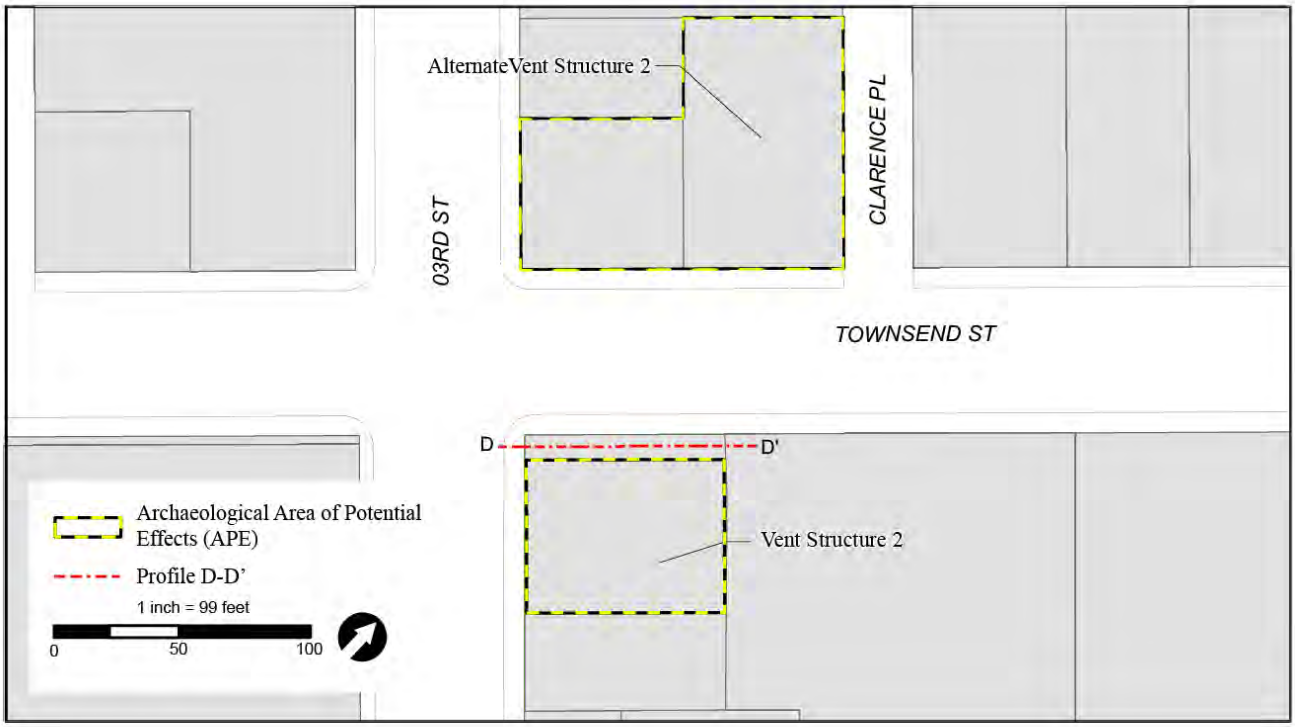
for Leslie T. Rogers
Regional Administrator

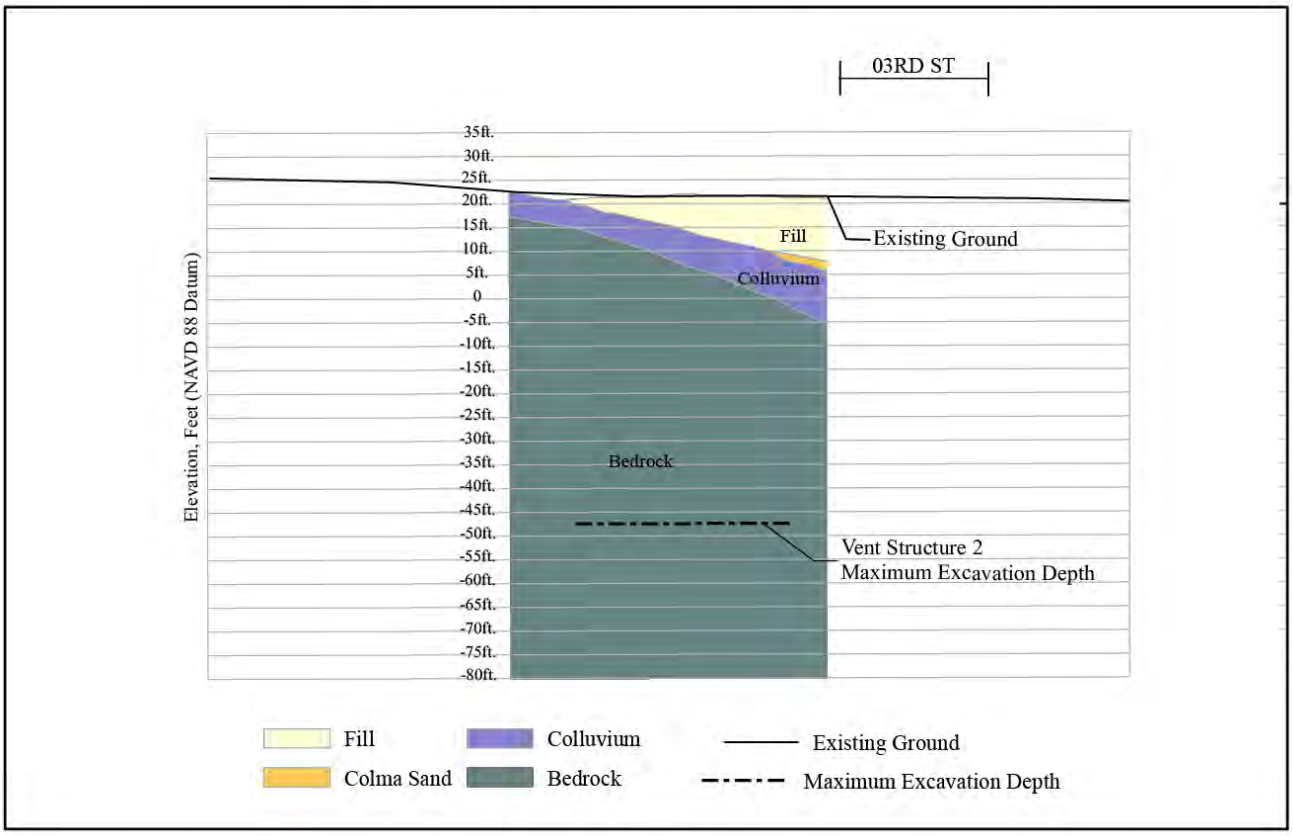
Enclosures:

1. Revised Area of Potential Effects map (Third and Townsend Street)
2. Description of Proposed Project Refinements
3. History of Section 106 Consultation for the Transbay Terminal/Caltrain Downtown Extension Redevelopment Project

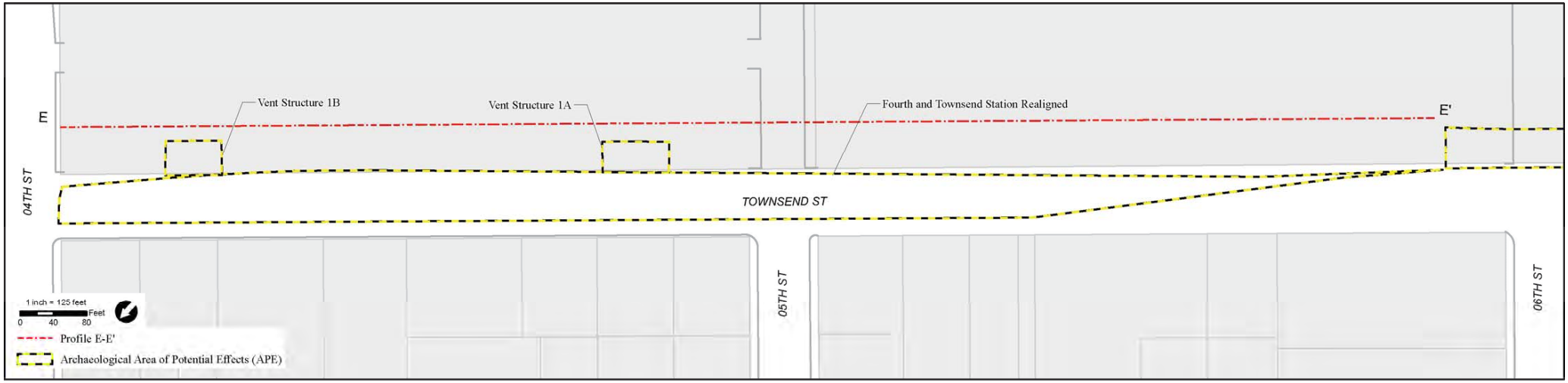
Enclosure 1:
Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project, San Francisco, California
Revised Area of Potential Effects

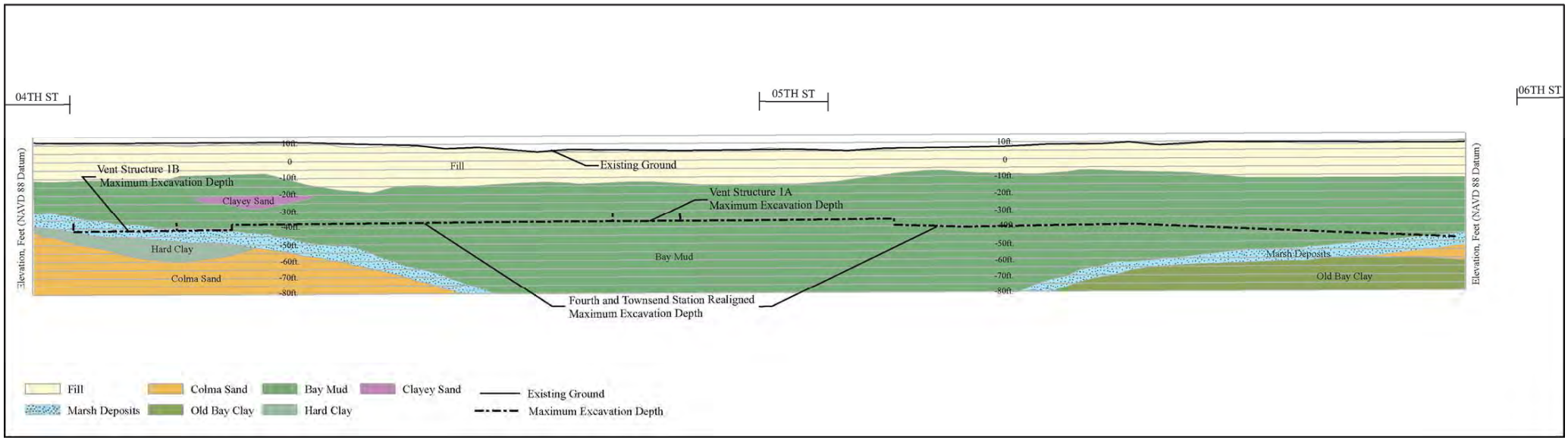
The State Historic Preservation Officer responded with no objection on the delineation of the Area of Potential of Effects (APE) on December 18, 2015. This revises the APE to add two areas (699 Third and 180 Townsend Streets) at the intersection of Third Street and Townsend Street where a vent structure is proposed, shown below. The depth of ground disturbance is expected to be roughly a depth of 70 feet below ground surface (nearly 50 feet below sea level).





Sources: City and County of San Francisco 2013; Compiled by AECOM 2015





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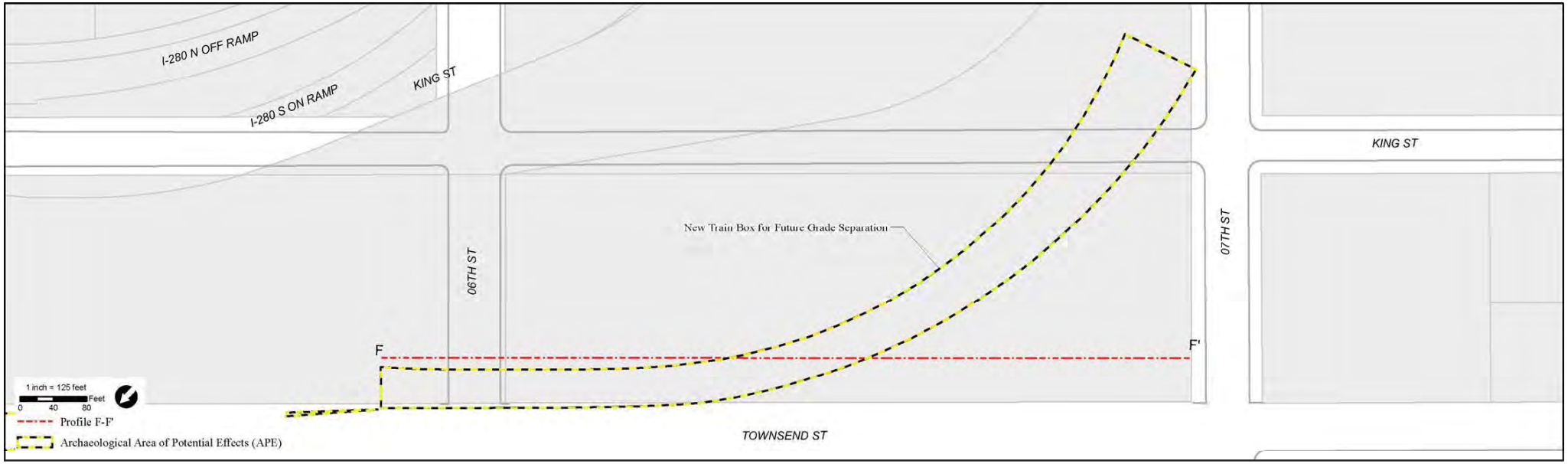

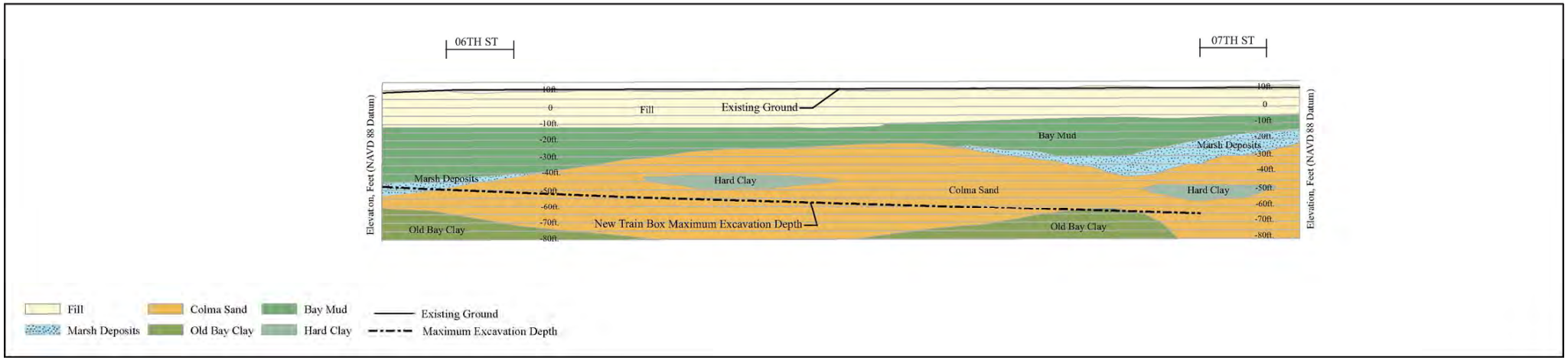

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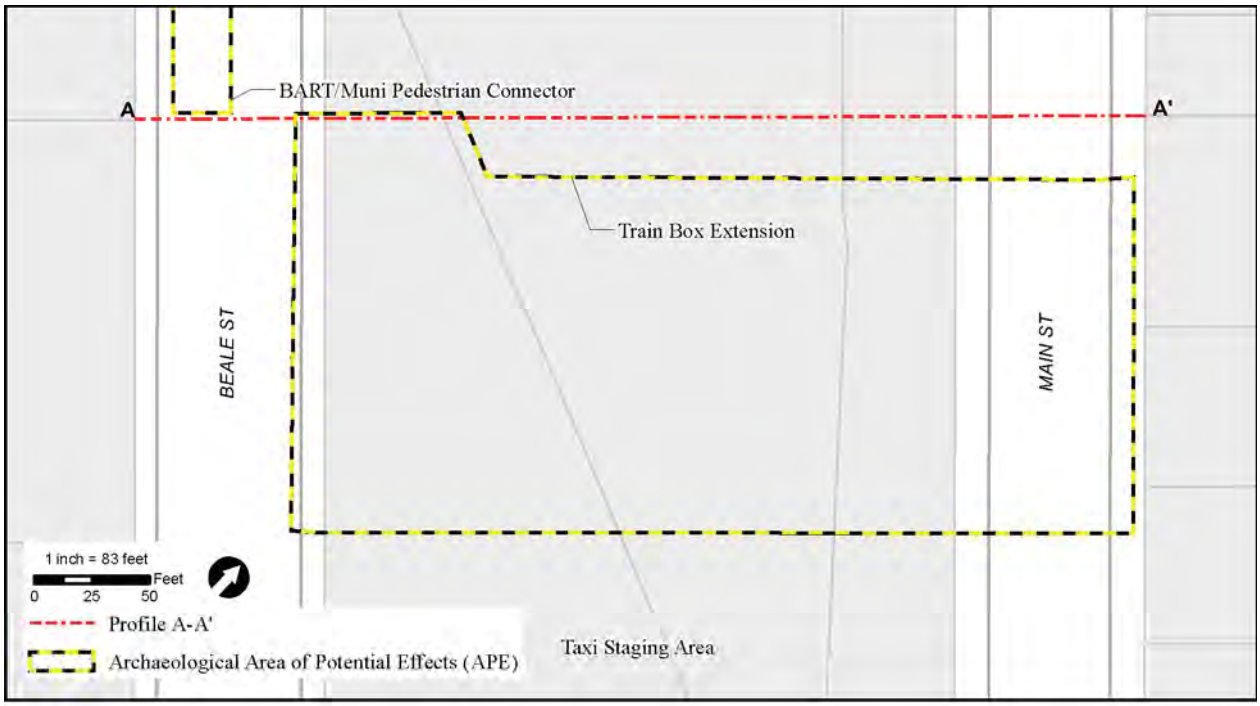

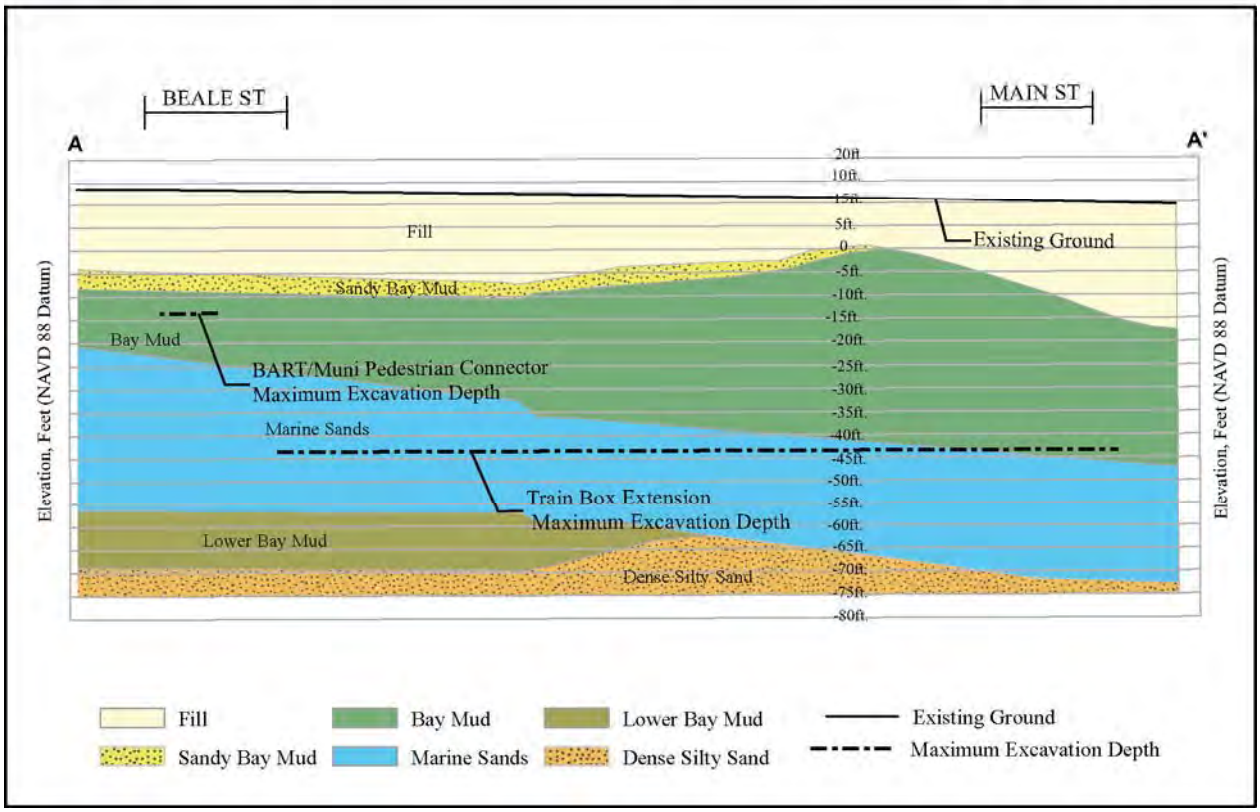

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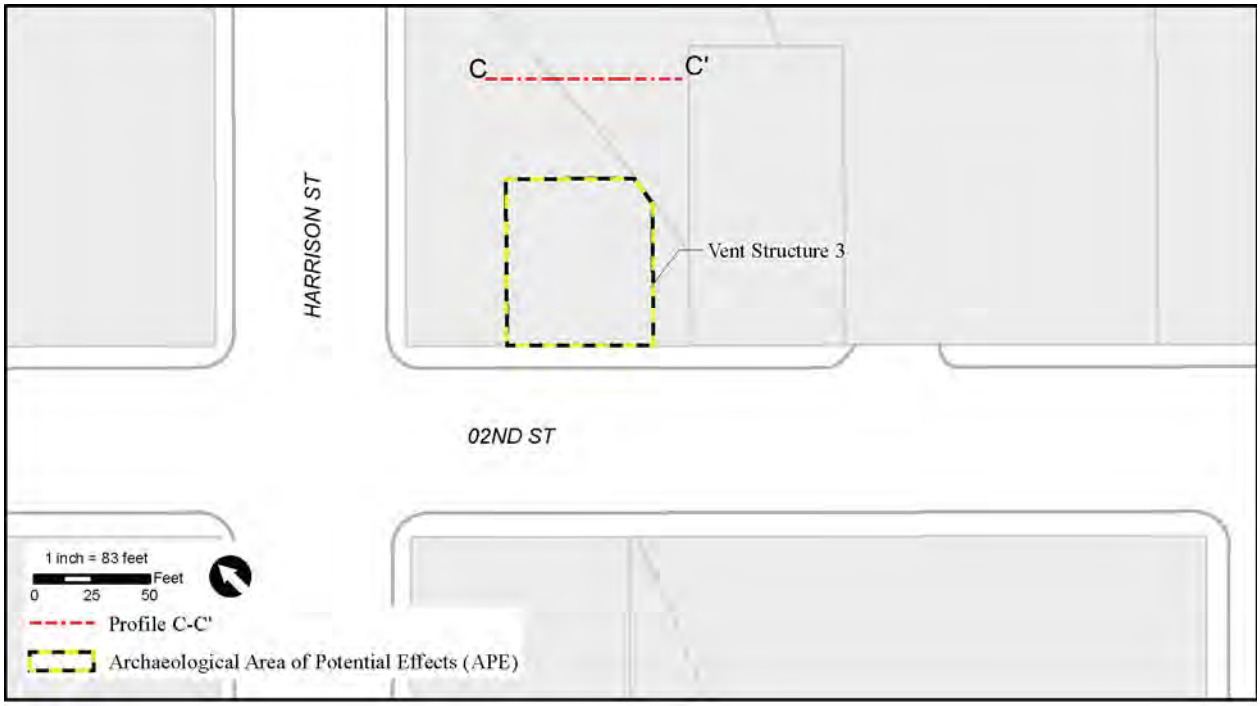

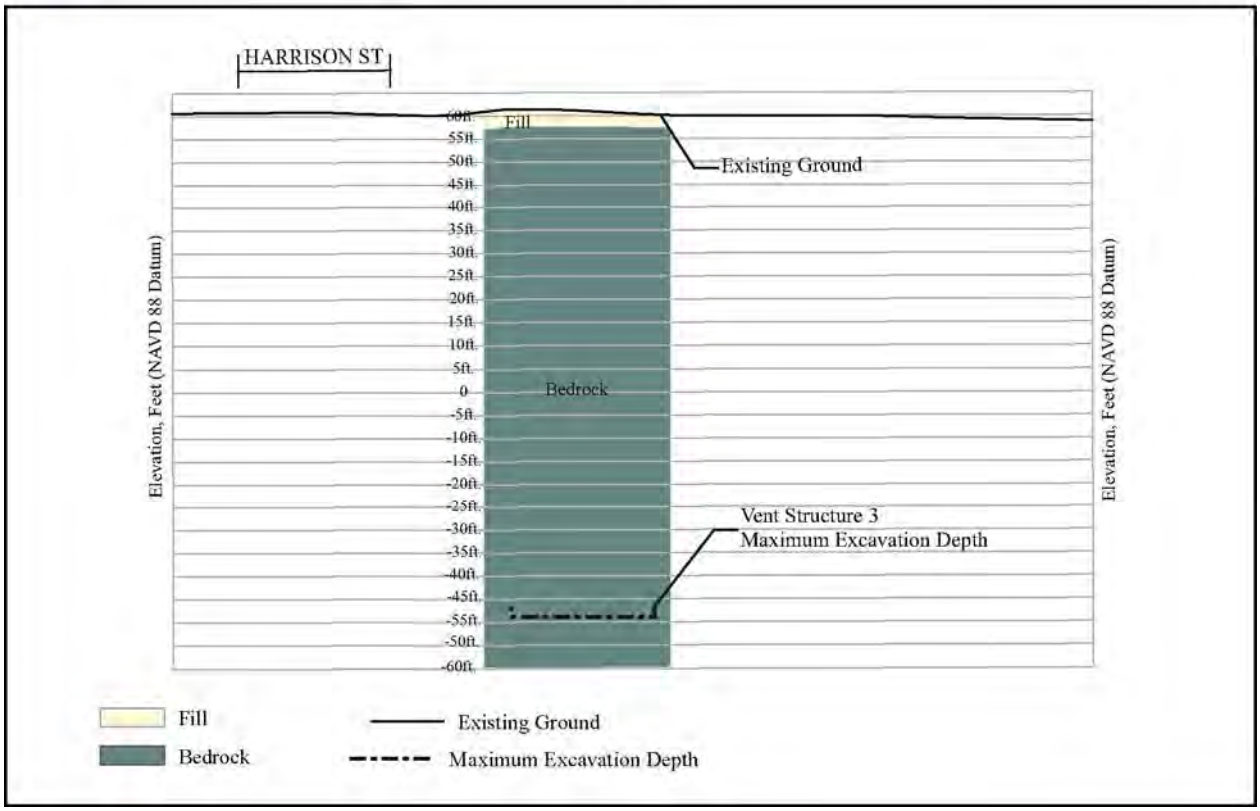

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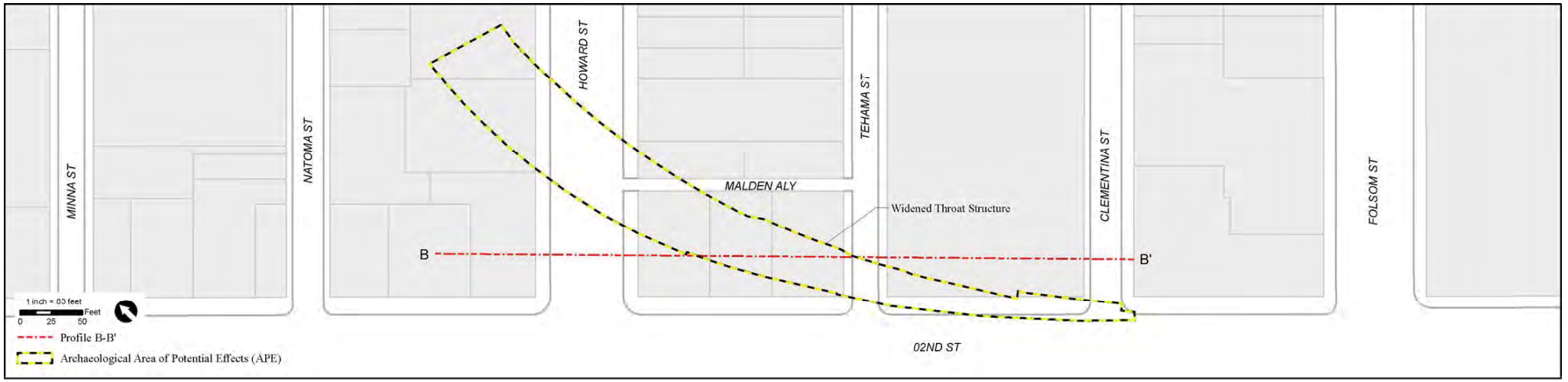

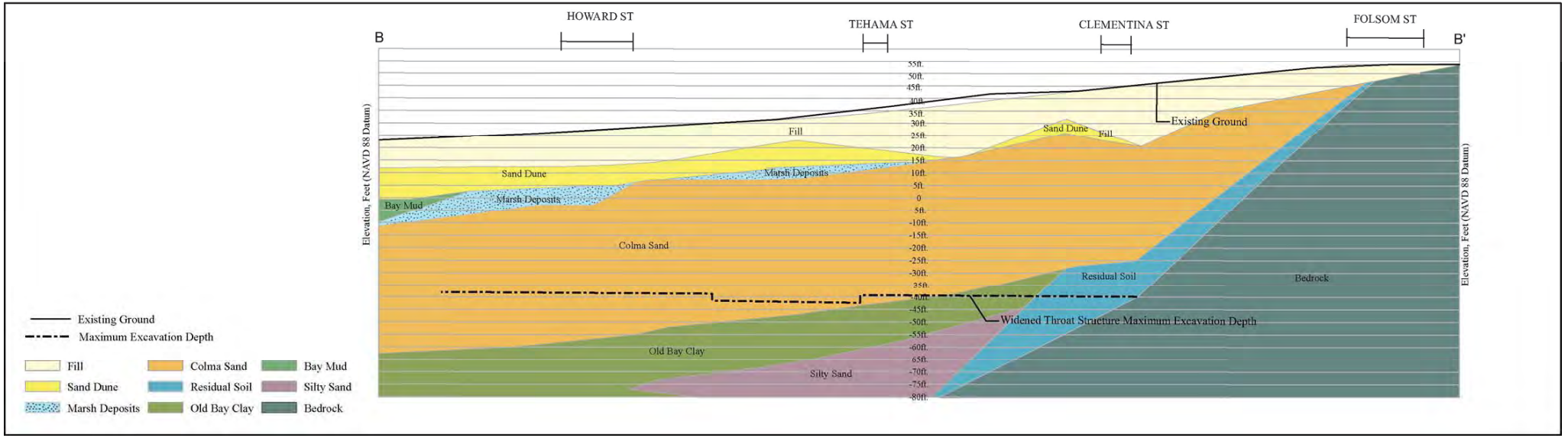

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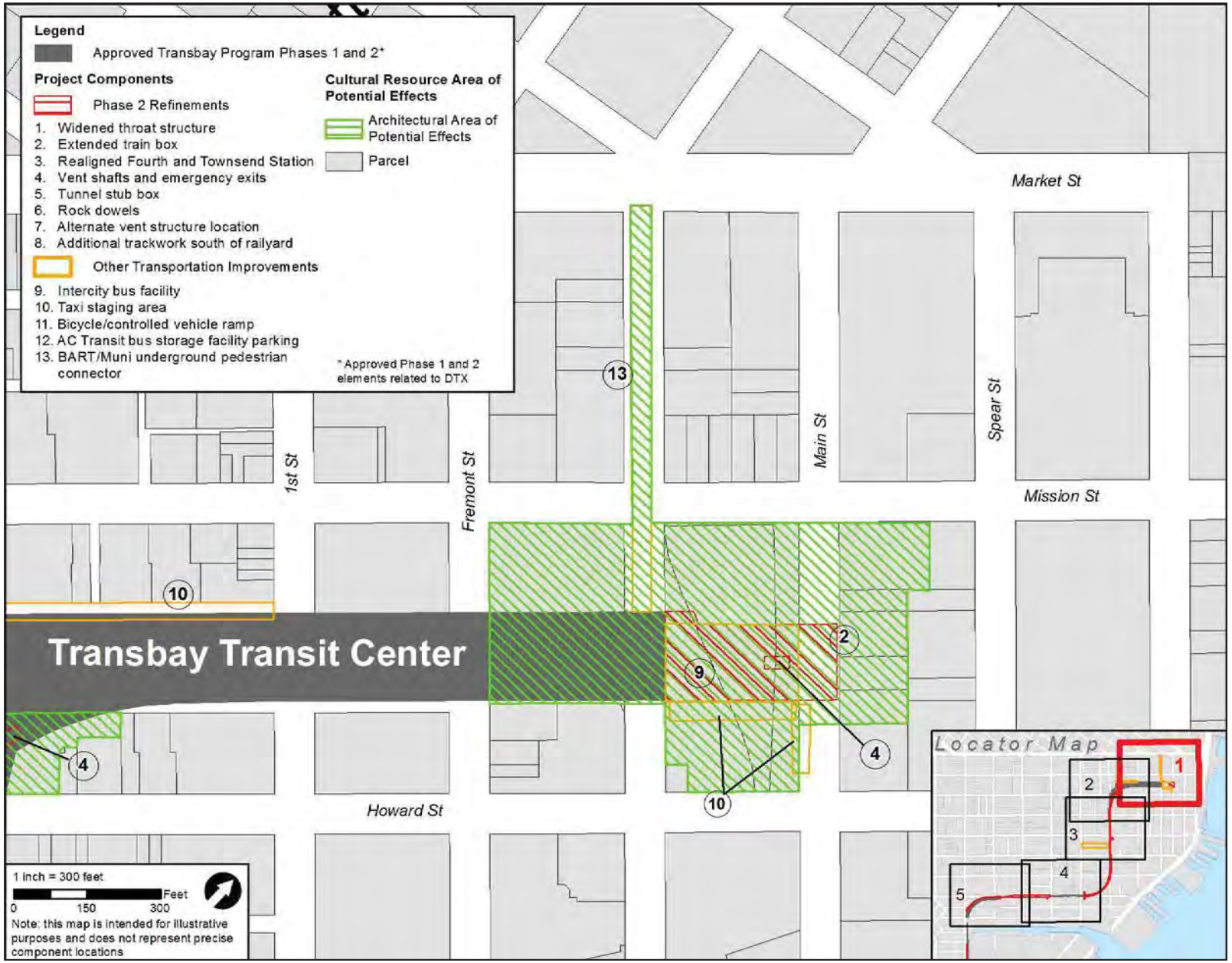

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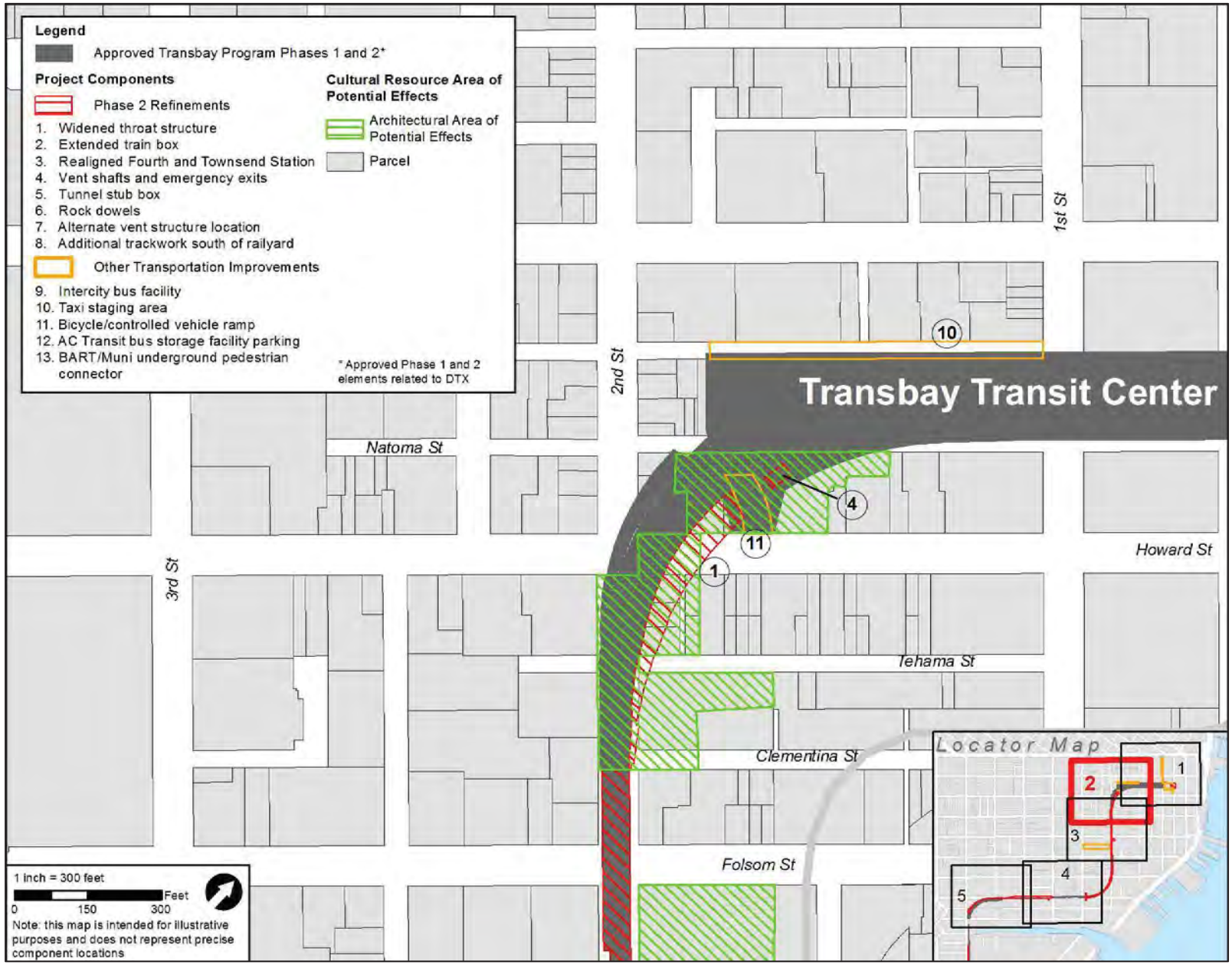

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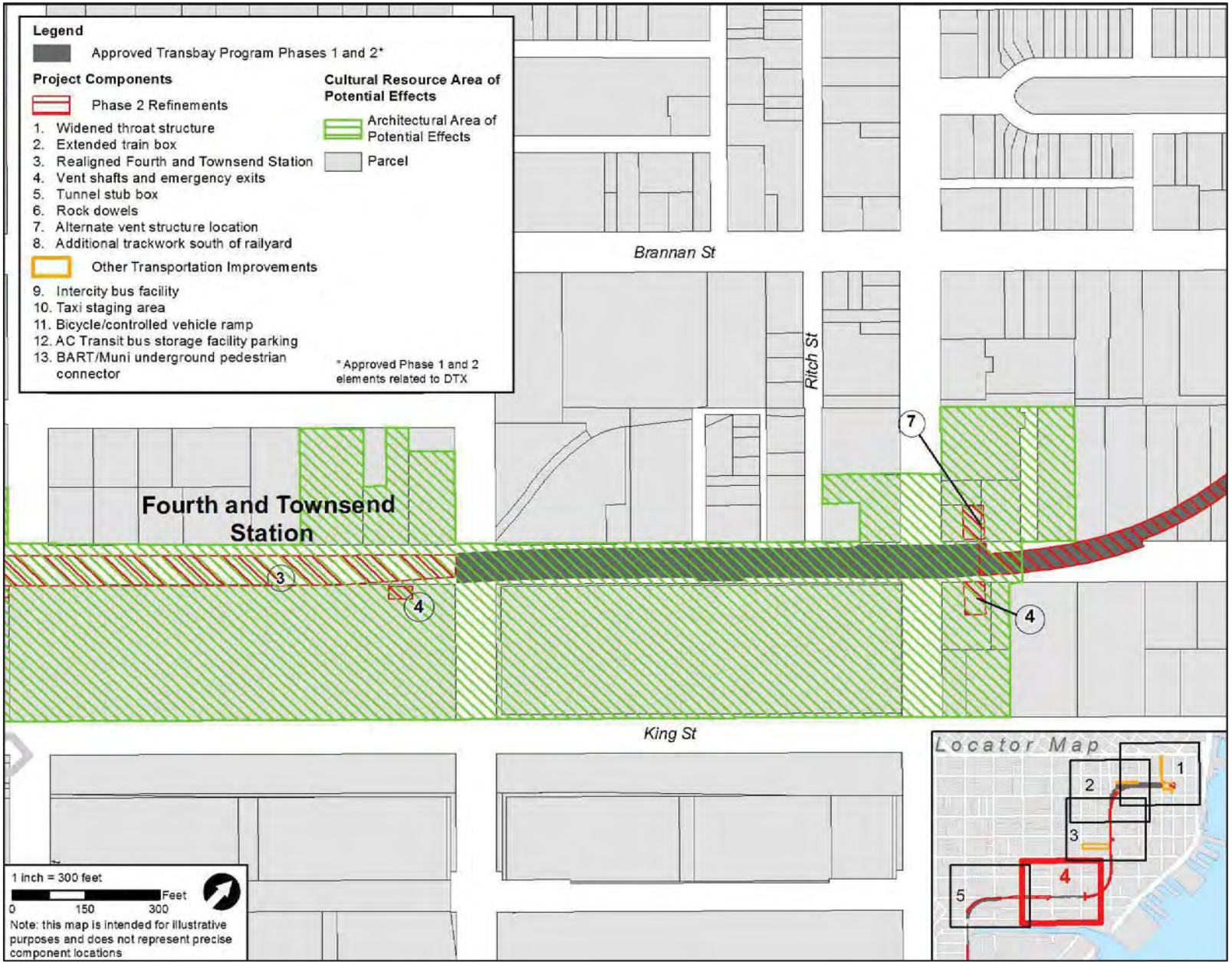

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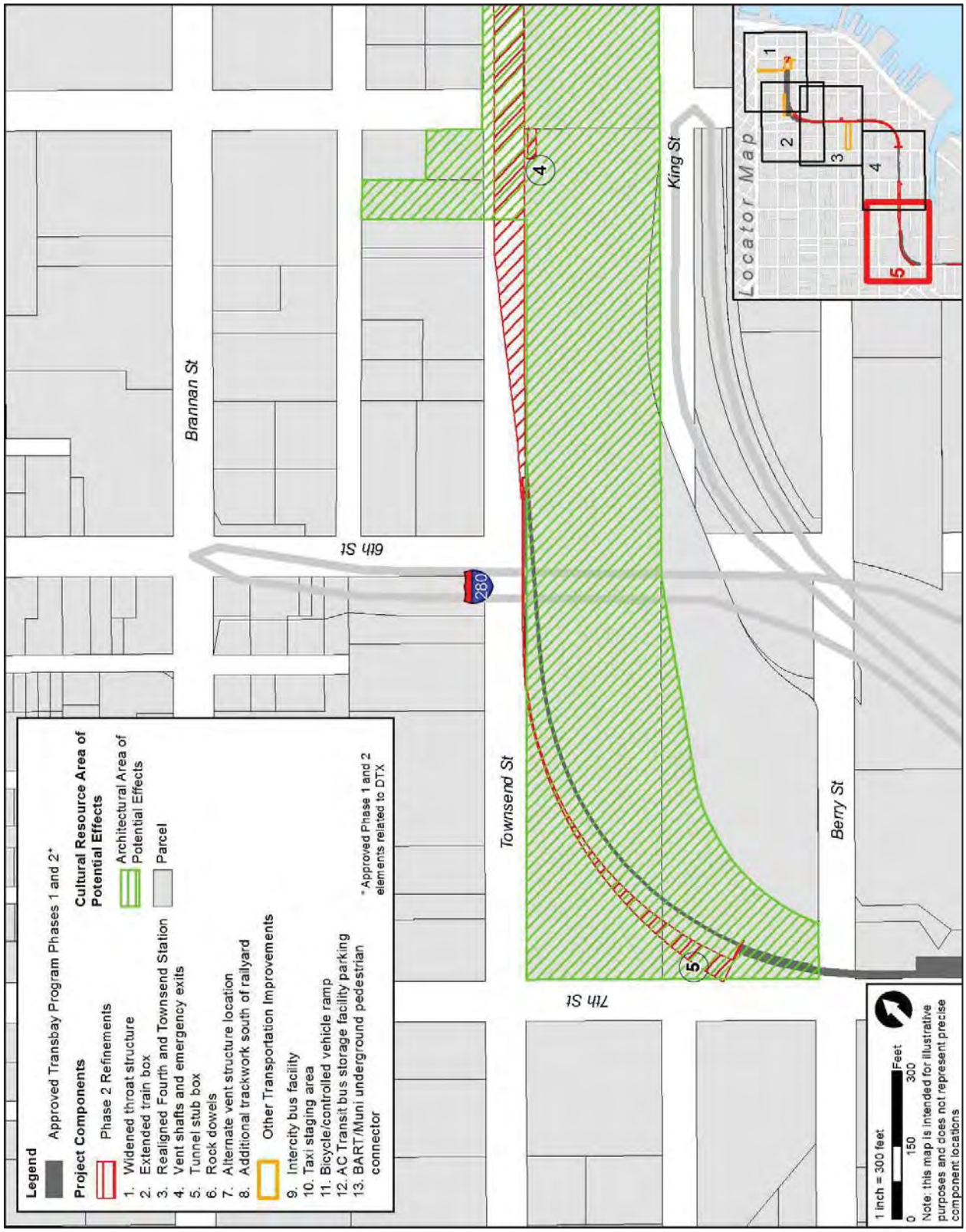

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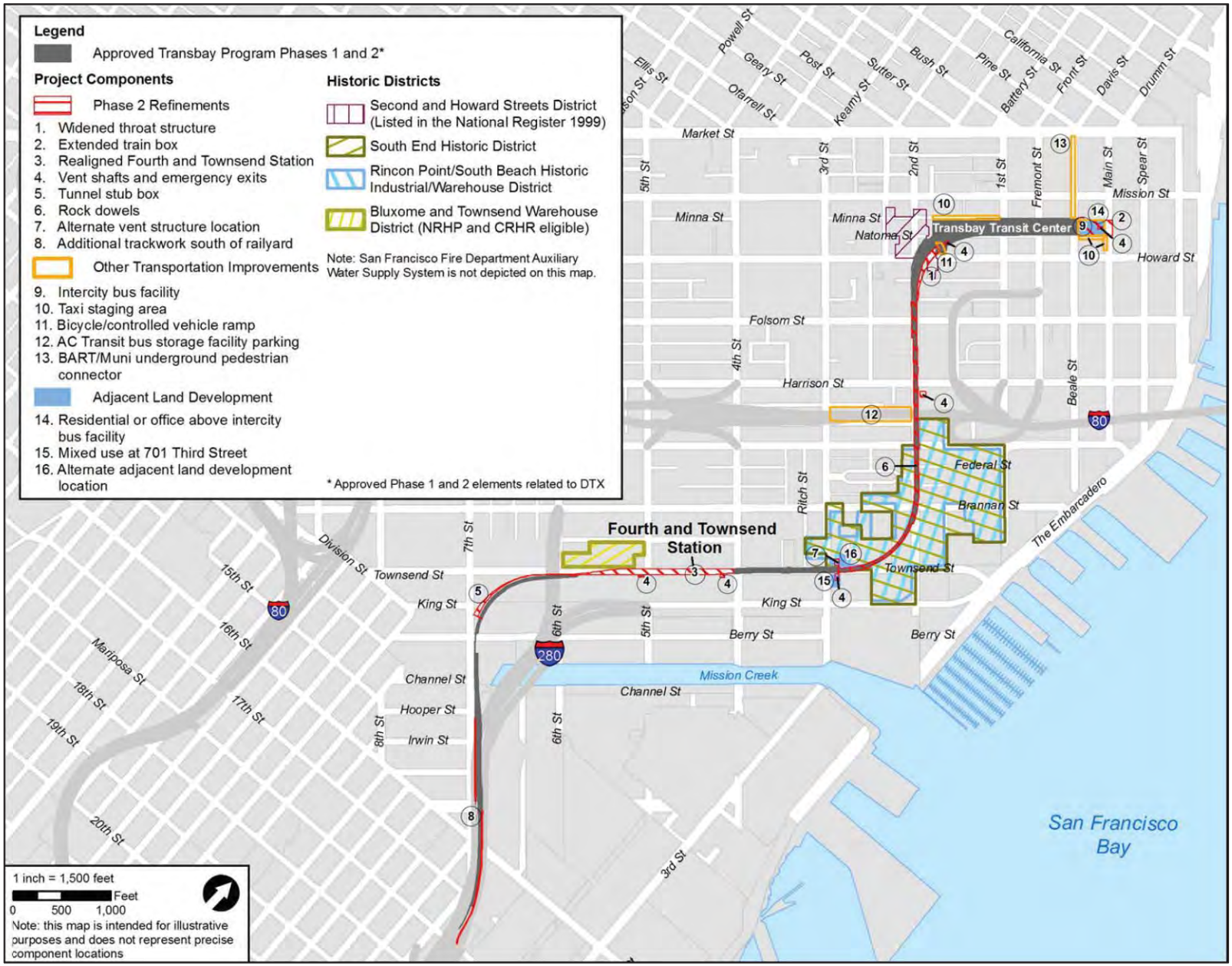

Sources: City and County of San Francisco 2013; Compiled by AECOM 2015

Supplemental Environmental Impact Statement/ Environmental Impact Report -- Proposed Refinements --

Phase 2 of the Transbay Program will bring both commuter and future HSR to downtown San Francisco. The previously approved scope includes the design and construction of the DTX tunnel, the build-out of the below-grade train station facilities at the Transit Center and construction of a new underground station along the DTX alignment at Fourth and Townsend Streets. Other improvements were also previously approved such as a Bus Storage Facility and a pedestrian tunnel between the Transit Center and the Embarcadero BART/ Muni Metro station. However, new requirements by CHSRA and the City, as well as other factors, have added or modified elements and are known as refinements to Phase 2.

Refinements

① Additional Trackwork

② Tunnel Stub Box

③ Fourth and Townsend Underground Station Realignment

④ Ventilation and Emergency Egress Structures

⑤ Widened Throat Structure

⑥ Train Box Extension

⑦ Rock Dowels

PROJECT DESCRIPTION

Phase 2 of the Transbay Program will bring both commuter and future HSR to downtown San Francisco. The previously approved scope includes the design and construction of the DTX tunnel, the build-out of the below-grade train station facilities at the Transit Center and construction of a new underground station along the DTX alignment at Fourth and Townsend Streets. Other improvements were also previously approved such as a Bus Storage Facility and a pedestrian tunnel between the Transit Center and the Embarcadero BART/ Muni Metro station. However, new requirements by CHSRA and the City, as well as other factors, have added or modified elements and are known as refinements to Phase 2.

PROPOSED REFINEMENTS

1) Additional Trackwork South of the Caltrain Railyard

Turnback Track. The Project would include additional trackwork in the existing Caltrain right-of-way, south of the Caltrain railyard and along Seventh Street. The first improvement would be a turnback track, which would be required for Caltrain to move trains between the Caltrain railyard and the Transbay Transit Center when not in use or when maintenance is required.

MOW Track. The second track improvement is a maintenance of way (MOW) storage track. This track would be constructed on the west side of the main tracks between Hooper Street on the north and Daggett Street to the south, for approximately 850 feet. The MOW storage track would be used for storage of equipment needed for railway maintenance.

2) ***Tunnel Stub***

A "tunnel stub," located in the Caltrain yard at Fourth and King Streets, is proposed as a connection point to allow construction of a future southward underground extension for Caltrain and HSR service without disruption to train operations. The future underground extension of the DTX southward would allow the train tracks to be grade separated from the current at-grade crossings with Mission Bay Drive and 16th Street.

3) ***Fourth and Townsend Street Station***

The Fourth and Townsend Street Station is proposed to be relocated entirely into the public right-of-way under Townsend Street, to allow for potential future development of the Caltrain Fourth and King Railyard; the previously approved station was aligned at an angle to Townsend Street and extended partially into the Caltrain railyard.

4) ***Ventilation and Emergency Egress Structures***

Construction of the DTX would require installation of six emergency ventilation/smoke evacuation structures that are co-located with emergency tunnel exits or stations (collectively referred to as vent structures). Under the Project, changes to the previous vent structure design have been made to comply with revisions to National Fire Protection Association Standard 130 which governs life safety features for fixed guideway systems, and to update the specific locations of these emergency structures. As identified in the Final SEIS/EIR, these structures would be located at the west end and the east end of the Fourth and Townsend Street Station; Third and Townsend Streets; Second and Harrison Street; and the west end and east end of the Transit Center. An alternative location for the Third and Townsend Street vent structure was analyzed in the Draft SEIS/EIR, but the original preferred site at 701 Third

Street is now unavailable because development of the site has been approved and is likely to begin in early 2017; therefore, the preferred location for this vent structure is at 699 Third Street and 180 Townsend Street.

5) ***Widened Throat Structure***

The Project would widen the throat structure on the northeast side of the DTX alignment entering the west side of the Transit Center. The throat structure provides the connection between the underground tracks and the train box below the Transit Center and is the area where the three-track system splits to six tracks to accommodate the three platforms. The previously approved throat structure at the southwest corner of the Transit Center was shifted eastward and widened to increase the footprint of the throat structure. This adjustment was to comply with updated design specifications that were released by the CHSRA in 2010 regarding track curvature and platform design. The widened throat structure has new right-of-way impacts yet also allows the TJPA to save a historic structure that was previously identified for demolition.

6) ***Transit Center Trainbox Extension***

The trainbox was designed prior to new requirements by the CHSRA that necessitate fully tangent platforms for 400 meter-long trains. Therefore, the trainbox must be extended east of Beale Street one block to Main Street to achieve the CHRSA design specifications for platforms at the Transit Center.

7) ***Rock Dowels***

Rock Dowels are approximately 15’ long rebar rods that would be installed along the tunnel mined segment to improve safety during construction. Construction of the mined tunnel segment from the Townsend Street curve onto and along Second Street that was adopted and included as part of the approved Transbay Program in the FTA 2005 ROD would require installation of rock dowels.

Enclosure 3:
History of Section 106 Consultation
for the Transbay Terminal/Caltrain Downtown Extension Redevelopment Project

Previous Section 106 consultation for the Transbay Program

- October 29, 2001 — The Federal Transit Administration (FTA) initiates Section 106 consultation with the California State Historic Preservation Officer (SHPO). Area of Potential Effect (APE) is submitted to SHPO for comment.
- February 14, 2002 — SHPO agrees that the delineation of the APE is adequate.
- May 23, 2003 — SHPO concurs on determinations of eligibility for the National Register of Historic Places.
- August 29, 2003 — FTA submits the Finding of Effect (FOE) to SHPO for concurrence.
- September 29, 2003 — SHPO agrees that the undertaking have result in adverse effects, but requests additional information on the eligibility of historic resources.
- November 25, 2003 — Additional information is provided and SHPO concurs on FOE.

Memorandum of Agreement (MOA)

- June 2004 — **MOA Executed**: Subsequent to the certification of the 2004 FEIS/EIR for the Transbay Program, the MOA was formally executed in June 2004 by FTA and SHPO, with the Transbay Joint Powers Authority (TJPA), the City and County of San Francisco (City), Peninsula Corridor Joint Powers Board (PCJPB), and Caltrans as concurring signatories. The following parties signed the MOA: FTA Regional Administrator, Deputy SHPO, TJPA Executive Director, the City Environmental Review Officer, PCJPB Chief Development Officer, and Caltrans Deputy District 4 Director.
- August 2010 — **Amendment 1**: FRA became a co-lead federal agency with the FTA for the Section 106 process, and the FRA was added as signatories to the MOA. TJPA was changed from a concurring party to a signatory party to the MOA to acknowledge TJPA's commitment to implementing the measures stipulated in the MOA.
- June 2016 — **Amendment 2:** The MOA had a term of 12 years from the time of execution in June 2004. MOA signatories agreed to an extension of 10 years, which was memorialized in a second amendment to the MOA. The MOA was extended through June 2026 when completion of construction of the Transit Center, OCII Redevelopment projects, and Phase 2 infrastructure is anticipated. The amendment also acknowledged completion of two stipulations, clarified topics to be addressed in the annual report, procedures for discovery of cultural deposits during ground-disturbing construction activities and emphasized reporting responsibilities.

Current Section 106 consultation for Transbay Program refinements

- July 2015 — Studies for Transbay Program refinements are underway. Background and archival materials from the Northwest Information Center of the California Historical Resources Information System at Sonoma State University and the Sacred Lands File with the Native American Heritage Commission were documented to identify investigations in the study area that occurred after 2004.
- September 11, 2015 — FTA initiates Section 106 consultation for the project refinements and requests comments from SHPO on the revised APE and identification of historic resources in the APE. Transmittal included the report: *National Historic Preservation Act-Section 106 Supplemental Consultation: Definition of the Undertaking, Area of Potential Effect, and Identification of Historic Properties Transbay Transit Center* (AECOM 2015).
- December 8, 2015 — SHPO provides no objections on the revised APE and identification of historic properties.
- December 1, 2016 — FTA responds to SHPO's comments and requests SHPO for concurrence on effects to historic resources as a result of project refinements.
- January 3, 2017 — SHPO requests additional clarification from FTA.

APPENDIX B.3

SHPO Letter of Concurrence on Finding of Effect

STATE OF CALIFORNIA – THE RESOURCES AGENCY
EDMUND G. BROWN, JR., *Governor*

OFFICE OF HISTORIC PRESERVATION
DEPARTMENT OF PARKS AND RECREATION
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calshpo@ohp.parks.ca.gov
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March 1, 2017

In Reply Refer To: FTA011108A

Leslie T. Rogers, Regional Administrator
Federal Transit Administration
90 Seventh Street
Suite 15-300
San Francisco, CA 94103-6701

Re: Finding of Effect Transbay Terminal/Caltrain Downtown Extension Redevelopment Project (Transbay Transit Center), San Francisco, CA

Dear Mr. Rogers:

Thank you for the letter received on February 21, 2017, continuing consultation on the above-referenced undertaking. The Federal Transportation Administration (FTA) is consulting pursuant to Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations found at 36 CFR § 800. FTA has requested an expedited review per 36 CFR § 800.3(g). Included with the letter were enclosures detailing the revised Area of Potential Effect (APE), proposed project refinements, and the consultation history for the undertaking. As stated in the consultation package, subsequent to the 2004 execution of the *Memorandum of Agreement Between the Federal Transit Administration and the California State Historic Preservation Officer Regarding the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project in San Francisco County, California* (MOA), the design for Phase 2 of the undertaking has been refined.

Phase 2 of the undertaking includes the extension of the existing Caltrain rail line to the new Transit Center (also known as the DTX), completion of the Transit Center below-grade levels for rail operations and construction of a new underground station along the DTX alignment at Fourth and Townsend Streets. Other improvements include a bus storage facility and a pedestrian tunnel between the Transit Center and the Embarcadero BART/Muni Metro station. Recent refinements to the design include the following:

- Modification of the throat structure
- Extension of the underground levels of the Transit Center train box from Beale Street eastward to Main Street
- Realignment of the underground Fourth and Townsend Street Station
- Construction of a vent structure at Third and Townsend Streets
- Construction of a tunnel stub box at the Fourth and King Streets Caltrain railyard at the western end of the proposed project limits

- Installation of rock dowels in conjunction with construction of the mined tunnel segment
- Additional track work south of the Caltrain railyard

The APE was previously revised to include the parcels located at 699 Third Street and 180 Townsend Street, but did not include the extent of ground disturbance. FTA has defined the vertical APE in the current consultation to extend to 70 feet below grade at the vertical shaft location.

Due to the design refinements, the buildings located at 165-173 Second Street will not be demolished. The building at 589 Howard Street will also remain, and both properties will be underpinned and protected per Stipulation IV of the MOA. However, the building located at 180 Townsend Street will be demolished to accommodate the vent structure. This building is a contributor to the previously identified Rincon Point/South Beach Historic District. It is not individually eligible for listing in the National Register of Historic Places (NRHP), and FTA has determined that its demolition will not result in an adverse effect to the Rincon Point/South Beach Historic District. Previous identification efforts have determined that the archaeological sensitivity of the APE is moderate to high, particularly near the location of the widened throat and vent structures.

Due to modifications in the Transbay Transit Center Program, FTA has requested comments on the revised APE, and concurrence that the refinements described above will not result in additional adverse effects to historic properties. After reviewing the information provided, I have the following comments:

- I concur that APE is sufficient for the proposed undertaking, per 36 CFR § 800.4(a)(1).
- I concur that the undertaking will not result in additional adverse effects to built environment properties only.
- However, as the APE is an urban environment and archaeological testing and identification cannot be completed prior to construction, FTA has proposed the preparation of an *Archaeological Research Design and Treatment Plan* (ARDTP) per Stipulation IV of the MOA. FTA will continue consultation with the identified consulting parties to determine the most appropriate course of action for archaeological testing and identification efforts in coordination with the proposed demolition and excavation for construction purposes.

I look forward to continuing consultation on these modifications to the Transbay Transit Center Program. If you require further information, please contact Kathleen Forrest at (916) 445-7022 or Kathleen.Forrest@parks.ca.gov.

Sincerely,

Julianne Polanco
State Historic Preservation Officer

APPENDIX C

Transportation Analysis Supplement

Appendix C
Transbay Transit Center Supplemental EIS/EIR
Transportation Analysis Supplement

This appendix presents the background information and methodology used to prepare the analysis of transportation impacts in the *Transbay Transit Center Program Draft Supplemental Environmental Impact Statement/Environmental Impact Report* ("*Transbay Transit Center Program Supplemental EIS/EIR*" or "*SEIS/EIR*") published in December 2015. This memorandum explains how the analysis in Section 3.2, "Transportation" of the *Transbay Transit Center Program Supplemental EIS/EIR* was prepared, including providing background information and other substantial evidence on the *SEIS/EIR* transportation analysis in a structure and format similar to a transportation impact study (TIS) prepared for projects for which the San Francisco Planning Department serves as lead agency under the California Environmental Quality Act (CEQA). Preparation of this appendix was completed in response to a number of comments on the Draft SEIS/EIR regarding the transportation analysis, especially the impact methodology and conclusions relative to other transportation impact analyses completed in the project vicinity over the past few years. This supplement, in addition to providing a more detailed explanation of the methodological approach for the transportation impacts, describes how more current analyses and data from other EIRs in the project vicinity have been used and incorporated into the analysis of the proposed project.

The memorandum consists of two sections:

- "Analysis Scope and Approach," outlining the methodology and key assumptions used in the *SEIS/EIR* analysis

- "Technical Appendices," compiling relevant analysis outputs to support the impact significance determinations made in the *SEIS/EIR*, including travel demand and level of service (LOS) calculations

Analysis Scope and Approach

The transportation analysis supporting the conclusions in the *Transbay Transit Center Program Supplemental EIS/EIR* was conducted according with the guidance and methodologies in *Transportation Impact Analysis Guidelines for Environmental Review* (October 2002) ("*SF Guidelines*"), published by the San Francisco Planning Department ("Planning Department"). The transportation analysis is also consistent with the methodologies and assumptions used in the *Transbay Terminal / Caltrain Downtown Extension / Redevelopment Project Final Environmental Impact Statement / Environmental Impact Report and Section 4(f) Evaluation* (State Clearinghouse No. 95063004; Planning Department Case No. 2000.048E) (March 2004) ("*2004 FEIS/EIR*") and the *Transbay Program Final EIS Reevaluation: Updating the Transbay Program 2004 Final EIS for Adoption by the Federal Railroad Administration* (May 2010) ("*2010 Reevaluation*").[(1)]

[(1)] On March 3, 2016, the San Francisco Planning Commission adopted changes to the San Francisco Planning Department's guidelines for transportation-related environmental review to comply with Senate Bill (SB) 743. These changes replace "automobile delay, as described solely by Level of Service (LOS) or similar measures of vehicular capacity or traffic congestion", with vehicle miles traveled (VMT) as an analysis metric for determining potential transportation impacts. As these changes were implemented after the commencement of the *SEIS/EIR* transportation analysis in 2012, the *SEIS/EIR* includes an analysis of LOS at selected intersections, in compliance with the 2002 guidelines that were in effect at the time during preparation of the *Draft SEIS/EIR*. This approach is also consistent and comparable with previous environmental documents related to the Transbay Program (such as the *2004 FEIS/EIR* and the *2010 Reevaluation*) which also included intersection LOS analyses.

The following subsections describe key components of the analysis methodology and assumptions:

- General Approach – overall framework for examining the transportation impacts of the project components and identification of relevant studies used in the analysis;
- Analysis Scenarios – description of the scenarios used to identify transportation impacts;
- Analytic Methodology by Impact Topic – methodological approach to identify traffic, transit, pedestrian, bicyclist, parking/loading, and emergency access impacts;
- Travel Demand – methodology used to estimate trips from proposed project components;
- Analysis Locations – study area intersections where proposed project components could affect circulation and safety; and
- Development of Cumulative Conditions – methodology to derive future transportation conditions in the year 2040.

General Approach

The proposed project covers a large geographic area in San Francisco, south of Market Street, encompassing multiple neighborhoods. Despite the overall length of the project limits of approximately 2.7 miles, the proposed project consists of individual refinements to Phase 2 of the approved Transbay Program (the "project components"), most of which are adjustments to discrete portions of the Phase 2 improvements and are likely to result in localized impacts, most of which have already been identified in previous environmental documents for the Transbay Program. In addition, most of the refinements are specific enough in nature that the likely scope of potential impacts would be confined to specific modes or impact categories (e.g., traffic, transit, bicycle, pedestrian, and parking / loading). In most cases, therefore, the potential transportation impacts associated with each of the proposed refinements would occur in the immediate vicinity of that component, and the analysis of the component's transportation impacts only needs to be evaluated for the relevant modes or impact categories.

Analysis of potential impacts associated with many of the project components requires consideration of recent planning and environmental review documents for other projects by the City and by project applicants. In addition to the *2004 FEIS/EIR* and the *2010 Reevaluation*, which were prepared for the Transbay Program as a whole, other plans and projects in various stages of planning, design, entitlement, and construction are relevant to the components of the proposed project, depending on the location of the proposed refinement. These plans and projects, for which the relevant planning and environmental documents were reviewed as part of preparing the transportation analysis for the *SEIS/EIR*, include community plans such as the Transit Center District Plan and Central SoMa Plan and transportation investment projects such as the Peninsula Corridor Electrification Project ("PCEP") and transit and streetscape enhancements along 16th Street as part of the San Francisco Municipal Transportation Agency's MUNI Forward program. Major land use developments that affect the localized setting of the proposed project components and were considered in the *SEIS/EIR* transportation analysis include, but are not limited to, the long-range development plan for the Mission Bay

Campus of the University of California San Francisco (UCSF) and the Golden State Warriors arena / event center and mixed-use development in Mission Bay that began construction in January 2017. As appropriate, the *SEIS/EIR* analysis considered consistency with the analyses and conclusions from the environmental documents for these other related plans and projects.

Based on this background and the changing setting in the project study area, to adequately assess the potential impacts of the proposed project, the *SEIS/EIR* considered each project component, conducting a screening analysis based on the geographical scope and proposed changes associated with the component, as well as the expected nature of potential effects generated by the component. This screening analysis helps to identify which types of transportation impacts require further analysis in the *SEIS/EIR*, as well as which reference plans or projects were relevant for consideration when conducting the impact analysis.

Table 1 summarizes these considerations in a matrix format to help the reader better understand how the SEIS/EIR analyzes impacts associated with each project component. The components are presented in the same order as in Table 2-3 of the SEIS/EIR.

An "×" under a given component signifies that the screening analysis determined that that component could result in potential impacts, and further analysis was conducted in the SEIS/EIR and incorporates information from those related documents that have an "×." A determination of no impact could result for various reasons, including the following:

- The component is specifically related to construction of transportation facilities to support the Transbay Program, and would not result in operational impacts. Examples include many of the proposed DTX refinements, which could result in impacts because of construction activities, but would not result in impacts once completed and in operation. Examples include the widening of the throat structure, extension of the train box, vent structures, installation of rock dowels under Second Street along the portion of the alignment that would be in mined tunnel, or the construction of the tunnel stub box within the Caltrain railyard. None of these project components would result in new trips or activities after construction that could result in any of the identified categories of impacts.

- The component is unlikely to result in identified categories of impacts. Examples of impacts that are unlikely to occur include pedestrian or bicycle impacts associated with use of the AC Transit bus parking facility for special event and nighttime public parking; and parking / loading and emergency access impacts associated with the underground pedestrian connector.

For components that were previously evaluated in the 2004 FEIS/EIR but involve refinements that could result in potential impacts, the SEIS/EIR analysis focuses on the extent to which the refinements substantially alter previously reported impacts and mitigations.

Table 1: Analysis Summary by Project Component

Project Component	Potential Impacts									Relevant References							
	TR-1: Circulation	TR-2: Transit	TR-3: Pedestrian	TR-4: Bicycle	TR-5: Parking / Loading	TR-6: Emergency Access	C-TR-7: Construction	CU-TR-8: Traffic (Cumulative)	CU-TR-9: Caltrain (Cumulative)	*2004 FEIS/EIR*	*2010 Reevaluation*	2012 Transit Center District Plan and EIR	2016 Central SoMa Plan and Draft EIR	2015 PCEP EIR	2014 Transit Effectiveness Project EIR	*2014 UCSF LRDP* and EIR	2015 Warriors Arena Project EIR
Transbay Program Phase 2 DTX Refinements																	
Widened throat structure							×										
Extended train box							×										
Realigned Fourth and Townsend Street Station			×	×	×	×	×		×				×	×			
Vent structures and emergency exits							×										
Tunnel stub box							×		×								
Rock dowels for Second Street mined tunnel							×										
Additional trackwork south of the Caltrain railyard	×	×	×	×	×	×	×	×	×					×	×	×	×
Other Transportation System Improvements																	
Intercity bus facility	×		×			×	×	×		×	×	×					
Taxi staging area	×				×	×		×		×	×	×					
Use of bicycle / controlled vehicle ramp	×			×		×	×	×		×	×	×					
AC Transit bus storage facility public parking	×	×			×	×		×		×	×	×	×				
Underground pedestrian connector (Beale Street alignment)	×	×	×				×	×		×	×	×					
Adjacent Land Development under CEQA																	
At the intercity bus facility site	×	×	×	×	×	×	×	×		×	×	×					
At the vent structure sites at Second/Harrison and Third/Townsend	×	×	×	×	×	×	×	×		×	×	×	×				

Analysis Scenarios

In general, the following scenarios were evaluated to identify the potential transportation impacts of the proposed project, consisting of refinements to the Caltrain Downtown Extension (DTX), other transportation improvements, and land development on portions of specific sites that would not be needed entirely for the proposed project:

- *Existing Conditions:* Generally representing existing physical conditions at the commencement of the transportation analysis for the *SEIS/EIR* in 2012 and 2013.

- *Existing plus Project Conditions:* Existing conditions plus the proposed project. Project-specific impacts are evaluated by comparing Existing-plus-Project Conditions to Existing Conditions, and then comparing the difference to the thresholds of significance.

- *2040 Cumulative Conditions:* Conditions in 2040 including reasonably foreseeable changes in land use and transportation infrastructure. Cumulative impacts are determined by evaluating the proposed project in combination with past, present, and reasonably foreseeable future projects and comparing the difference between future cumulative conditions with and without the project—or, in some cases, the project's contribution to future cumulative conditions—to the thresholds of significance.

Analysis of an existing-plus-project scenario and a future cumulative-plus-project scenario to determine potential project impacts is consistent with the approach outlined in the *SF Guidelines* and in the *CEQA Guidelines*, which are the relevant regulations implementing the California Environmental Quality Act (CEQA).

Additional Trackwork South of the Caltrain Railyard

In the case of potential impacts associated with the proposed turnback track, the analysis evaluates potential project-specific impacts compared to a future baseline condition in 2020 (rather than "existing conditions" in 2012 and 2013, as described above for other components of the proposed project).[(2)] This approach is consistent with the analysis methodology adopted in the *Peninsula Corridor Electrification Project Final Environmental Impact Report* (State Clearinghouse No. 2013012079) (January 2015) ("*PCEP FEIR*") for the analysis of the 16th Street / Caltrain Tracks / Seventh Street / Mississippi Street intersection and other intersections along the Caltrain corridor. While some of the other components of the proposed project, such as adjacent development at the vent structures and intercity bus facility, can be implemented independently, implementation of the proposed turnback track is predicated on prior electrification of Caltrain and other improvements proposed under the PCEP, which is not expected for completion until 2020. Therefore, analyzing the project compared to existing conditions for this particular project component would not provide useful information because that component is not planned to be constructed without prior improvements being completed. Comparison to a future baseline condition in 2020 more appropriately reflects conditions at the expected time of implementation of the turnback track and allows the analysis to accurately describe the associated potential impacts of that project component.

(2) This approach affects only the analysis of project-specific impacts related to the additional trackwork south of the Caltrain railyard. Cumulative impacts associated with this project component are evaluated under 2040 Cumulative Conditions, similar to the other project components.

After commencement of the transportation analysis for both the PCEP EIR and the *SEIS/EIR*, several major plans and projects have been approved in the area near the turnback track, including a new long-range development plan (LRDP) for the UCSF Mission Bay Campus, the Golden State Warriors arena / event center and mixed-use development on Mission Bay South Blocks 29–32 ("Warriors Arena Project"), and the SFMTA Transit Effectiveness Project ("TEP" or "MUNI Forward"), as shown in **Table 1**. Both the *UCSF 2014 Long Range Development Plan | Building on 150 Years: UCSF Plans for 2035* (Final) ("*UCSF LRDP*") and the accompanying *UCSF 2014 Long Range Development Plan Environmental Impact Report* (State Clearinghouse No. 2013092047) ("*UCSF LRDP EIR*") were published in November 2014. The University of California Board of Regents subsequently approved the *UCSF LRDP* and certified the *UCSF LRDP EIR* on November 20, 2014.

The *Event Center and Mixed-Use Development at Mission Bay Blocks 29–32 Draft Subsequent Environmental Impact Report* (State Clearinghouse No. 2014112045; Planning Department Case No. 2014.1441E; Office of Community Investment and Infrastructure Case No. ER 2014-919-97) ("*Warriors DSEIR*") was published on June 5, 2015 and the subsequent *Event Center and Mixed-Use Development at Mission Bay Blocks 29–32 Responses to Comments on the Draft Subsequent Environmental Impact Report*—which, together with the Warriors DSEIR, comprise the Final Subsequent Environmental Impact Report ("*Warriors FSEIR*") for the proposed Warriors Arena Project—was published on October 23, 2015. The Office of Community Investment and Infrastructure (OCII) subsequently approved the Warriors Arena Project and certified the *Warriors FSEIR* on November 3, 2015.

In addition to the *UCSF LRDP* and the Warriors Arena Project, there have also been changes proposed to the transportation network in the area surrounding the 16th Street / Caltrain tracks / Seventh Street / Mississippi Street intersection subsequent to commencement of the transportation analysis for both the PCEP EIR and the *SEIS/EIR*. In particular, the 22 Fillmore Transit Priority Project would implement improvements along 16th Street and is included in the Transit Effectiveness Project / Muni Forward program adopted by the SFMTA.

None of the changes associated with the *UCSF LRDP*, the Warriors Arena Project, or the 22 Fillmore Transit Priority Project were sufficiently reasonably foreseeable for analysis at the time of commencement of the analysis of the proposed project. At that time (2012/2013), the Golden State Warriors were contemplating an arena and mixed-use development at Piers 30–32, with information regarding the now approved Mission Bay site first published in April 2014. While UCSF had been conducting conceptual planning for the future of the Mission Bay Campus as early as 2010, the first community outreach meeting for the *UCSF LRDP* occurred in October 2012, with a draft plan document published in May 2014. The draft environmental impact report (EIR) for the Transit Effectiveness Project, which analyzed the changes associated with the 22 Fillmore Transit Priority Project, was published in June 2013.

Hence, the PCEP EIR contained the most recent comprehensive analysis of the 16th Street grade crossing at the time of commencement of the *SEIS/EIR*. Because the PCEP improvements involve changes to the physical design / layout and train activity at the 16th Street crossing similar to those that would be required of the turnback track, and the PCEP EIR specifically examined the effect of lowering safety gates when Caltrain passes through the at-

grade intersection,[3] the *PCEP FEIR* was the most appropriate reference document for the purposes of analyzing the potential effects of the turnback track. The *PCEP FEIR* also considered the effects of the 22 Fillmore Transit Priority Project and specifically evaluated the potential conflicts between Caltrain electrification and electric trolley bus operations at the 16th Street crossing. Therefore, the approach and results presented in the *SEIS/EIR* rely on and reference the *PCEP FEIR*, where relevant.

Analytic Methodology by Impact Topic

The following subsections describe in detail the approach to the analysis of specific impacts. The scope of the analysis and relevant project components considered under each impact topic were determined according to the results of the screening analysis summarized in Table 1.

Traffic

Traffic conditions were analyzed at 12 study intersections based on their proximity to proposed project components and the potential for each component to generate trips (or implement other changes) that could affect intersection operations. The screening analysis described in Table 1 was used to help define which components warranted a traffic impact analysis. Each of the 12 study intersections was analyzed for the weekday PM peak hour (generally 4:30 p.m. to 5:30 p.m.) of the evening peak period (4 p.m. to 6 p.m.). In addition, eight of the intersections were analyzed for the weekday AM peak hour (generally 7:30 a.m. to 8:30 a.m.) of the morning peak period (7 a.m. to 9 a.m.) because of the potential for future land use development to be constructed adjacent to some of the proposed project components and to generate a substantial amount of new trips during the morning commute period. All study intersections, except one, involved field observations and turning movement counts collected in December 2012; the exception is Intersection 12, for which data were taken from the *PCEP FEIR*. Data collection and field observations for this intersection and the majority of other intersections analyzed in the *PCEP FEIR* was conducted in 2013, approximately at the time of commencement of the *SEIS/EIR* analysis.

The analysis locations, including the time periods studied, are listed by associated proposed project component, below, and shown in **Figure 1**.

- Analysis locations associated with the adjacent land development at the proposed vent structure at 701 Third Street and the alternate vent structure site at 699 Third Street and 180 Townsend Street:
    1. Fourth Street / Townsend Street (both peak hours)
    2. Third Street / Townsend Street (both peak hours)
- Analysis locations associated with the adjacent land development at the proposed vent structure at the Second Street / Harrison Street intersection, as well as AC Transit bus storage facility parking:

[3] Standard approaches to intersection LOS analysis, such as those used in the *UCSF LRDP EIR* and the *Warriors FSEIR*, are generally suited to typical intersections without specialized features such as transit-only lanes or transit signal priority / preemption. The EIR for the PCEP evaluated operations at grade crossings in the Caltrain corridor based on a microsimulation analysis using the VISSIM software program, an approach that more accurately considers the various interactions in effect at the 16th Street crossing (such as train preemption).

Figure 1: Study Intersections

Sources: *SF OpenData* (http://data.sfgov.org), 2013; AECOM, 2014.

3. Third Street / Bryant Street (PM peak hour only)
4. Third Street / Perry Street (PM peak hour only)
5. Third Street / Harrison Street (both peak hours)
6. Second Street / Bryant Street (PM peak hour only)
7. Second Street / Harrison Street (PM peak hour only)

- Analysis locations associated with the proposed intercity bus facility, adjacent land development, and taxi queuing area:
  8. Beale Street / Howard Street (both peak hours)
  9. Beale Street / Mission Street (both peak hours)
  10. Main Street / Howard Street (both peak hours)
  11. Main Street / Mission Street (both peak hours)

- Analysis location associated with the proposed additional trackwork south of the Caltrain railyard:
  12. 16th Street / Caltrain Tracks / Seventh Street / Mississippi Street (both peak hours)

Intersection operations were characterized using LOS, a qualitative description of the performance of an intersection based on the average delay per vehicle. All study intersections were evaluated using the 2000 *Highway Capacity Manual* ("*HCM*") methodology,[4] as required by the *SF Guidelines.* For signalized intersections, this methodology determines the capacity of each lane group approaching the intersection and calculates an average delay (in seconds per vehicle) for each of the various movements at the intersection. A combined weighted average delay and LOS are then presented for the intersection. For unsignalized intersections, the average delay and LOS for the worst stop-sign-controlled approach at the intersection is presented. Intersection LOS ranges from LOS A, which indicates free flow or excellent conditions with short delays, to LOS F, which indicates congested or overloaded conditions with extremely long delays.

LOS definitions for signalized and unsignalized intersections are shown in **Table 2**.

Table 2: Intersection Levels of Service Criteria and Definitions

Level of Service	Description	Average Delay (seconds per vehicle)	
		Signalized Intersections	Unsignalized Intersections
A	Little or no delay	< 10.0	< 10.0
B	Short traffic delay	> 10.0 and < 20.0	> 10.0 and < 15.0
C	Average traffic delay	> 20.0 and < 35.0	> 15.0 and < 25.0
D	Long traffic delay	> 35.0 and < 55.0	> 25.0 and < 35.0
E	Very long traffic delay	> 55.0 and < 80.0	> 35.0 and < 50.0
F	Extreme traffic delay	> 80.0	> 50.0

Source: Transportation Research Board, *Highway Capacity Manual*, 2000.

In San Francisco, LOS A through LOS D are considered excellent to satisfactory levels of service, and LOS E and LOS F represent unacceptable levels of service, as specified in the *SF Guidelines*.[5]

The expected increase in vehicle traffic as a result of the proposed project was quantified to determine potential impacts to traffic conditions. However, some components of the proposed project would not be expected to result in a measurable increase in vehicle traffic or otherwise affect traffic circulation, and have not been analyzed further in the *SEIS/EIR*, as shown in Table 1. In addition, components associated with adjacent land development would generate vehicle

[4] Adjustments are typically made to the capacity of each intersection to account for various factors that reduce the ability of the streets to accommodate vehicles (such as the downtown nature of the area, number of pedestrians, bus stops, vehicle types, lane widths, grades, on-street parking, and queues).

[5] Delay for intersections operating at LOS F is typically reported as "greater than 80.0 seconds" for signalized intersections and "greater than 50.0 seconds" for unsignalized intersections, as 80.0 seconds and 50.0 seconds are generally considered the limits of the meaningful range of the analysis methodology for signalized and unsignalized intersections. However, since a substantial percentage of the analysis locations are projected to operate at LOS F under future-year scenarios, the volume-to-capacity (v/c) ratio is also reported in cases where the intersection average delay is greater than these limits, to facilitate comparison between scenarios.

traffic, but the net change in vehicle-trips after accounting for existing uses (and associated, existing trip activity) at these sites, which would be removed by the proposed project component, would either be negligible or less than zero.

Other impacts to traffic conditions as a result of the proposed project, such as potential traffic safety hazards and points of conflict, were qualitatively assessed.

Transit
The expected increase in transit ridership as a result of the proposed project was quantified to determine potential impacts to transit conditions. However, some components of the proposed project would not be expected to result in a measurable increase in transit ridership or otherwise affect transit operations, and have not been analyzed further in the *SEIS/EIR*, as shown in Table 1. In addition, components associated with adjacent land development would generate some transit ridership, but the net change in ridership after accounting for existing uses (and associated, existing trip activity) at these sites, which would be removed by the proposed project component, would either be negligible or less than zero. Therefore, an analysis of screenline ridership and capacity is not warranted.

Other impacts to transit conditions as a result of the proposed project, such as potential delays to or conflicts with transit operations, were qualitatively or semi-quantitatively assessed.

Pedestrians
Similar to traffic operations at intersections, the condition of pedestrian facilities was quantitatively described using LOS. Crosswalk counts were conducted in December 2012 at the Beale Street / Market Street and Beale Street / Mission Street intersections during the weekday midday (12 p.m. to 3 p.m.) and evening (4 p.m. to 6 p.m.) peak periods. These intersections were selected because they would be most affected by the proposed underground pedestrian connector connecting the Transbay Transit Center ("TTC") with San Francisco Bay Area Rapid Transit District ("BART") and San Francisco Municipal Railway's Muni Metro train services along Market Street. All other proposed project components are expected to generate relatively few additional pedestrians or would not be expected to substantially alter pedestrian circulation, as discussed in further detail below.

The analysis of pedestrian conditions evaluated the operation of pedestrian facilities during the peak 15-minute intervals of the weekday midday and PM peak periods. The operational performance of selected crosswalks and street corners was evaluated in accordance with the *SF Guidelines*, which considers use of the 2000 *HCM* methodology (an LOS-based methodology defined according to the available circulation area for pedestrians, calculated in square feet) as an acceptable methodology. Similar to traffic operations at intersections, the performance of pedestrian facilities ranges from LOS A, indicating free pedestrian flow, to LOS F, indicating congested conditions. In San Francisco, pedestrian LOS E and LOS F represent unacceptable levels of service.

The *HCM* methodology for crosswalks and street corners is shown in **Table 3**.

Table 3: Crosswalk and Street Corner Levels of Service Criteria and Definitions

Level of Service	Circulation Area (square feet per pedestrian)	
	Crosswalks	**Street Corners**
A	> 60	> 13
B	> 40 and ≤ 60	> 10 and ≤ 13
C	> 24 and ≤ 40	> 6 and ≤ 10
D	> 15 and ≤ 24	> 3 and ≤ 6
E	> 8 and ≤ 15	> 2 and ≤ 3
F	≤ 8	≤ 2

Source: Transportation Research Board, *Highway Capacity Manual*, 2000.

The expected increase in pedestrian activity as a result of the proposed project was quantified to determine potential impacts to pedestrian conditions. However, some components of the proposed project would not be expected to result in a measurable increase in pedestrian activity at nearby sidewalks and crosswalks or otherwise affect pedestrian circulation, and have not been analyzed further in the *SEIS/EIR*, as shown in Table 1. In addition, components associated with adjacent land development would generate pedestrian activity, but the net change in pedestrian trips after accounting for existing uses and trip activity at these sites that would be removed by the project would be negligible or less than existing conditions.

Other impacts to pedestrian conditions as a result of the proposed project, such as potential safety issues and points of conflict, were qualitatively assessed.

Bicyclists

The expected increase in bicycle activity as a result of the proposed project was quantified to determine potential impacts to bicycle conditions. However, some components of the proposed project would not be expected to result in a measurable increase in bicycle activity or otherwise affect bicycle circulation, and have not been analyzed further in the *SEIS/EIR*, as shown in Table 1. In addition, components associated with adjacent land development would generate some bicycle activity, but the net change in bicycle trips after accounting for existing uses and trip activity at these sites that would be removed by the project would be negligible or less than existing conditions.

Other impacts to bicycle conditions as a result of the proposed project, such as potential safety issues and points of conflict, were qualitatively assessed.

Parking and Loading

Impacts to parking and loading conditions as a result of the proposed project, such as potential increases in parking and loading demand and conflicts with parking and loading access for nearby properties, were qualitatively assessed.

It should be noted that Senate Bill (SB) 743 amended CEQA in 2013 by adding *Public Resources Code* §21099 regarding the analysis of parking impacts for certain urban infill

projects in transit priority areas.[6] *Public Resources Code* §21099(d) provides that "parking impacts of a residential, mixed-use residential, or employment center project on an infill site located within a transit priority area shall not be considered significant impacts on the environment." Thus, the analysis for the *SEIS/EIR* did not consider adequacy of parking in determining the significance of project impacts under CEQA as it relates to the adjacent development at the vent structure sites and intercity bus facility under the proposed project. However, the TJPA acknowledges that parking conditions may be of interest to the public and the decision makers, and is still relevant under the National Environmental Policy Act (NEPA). Therefore, parking conditions are presented in the analysis to evaluate effects and compare them to those identified in the *2004 FEIS/EIR*. The analysis of loading spaces is presented to address guidelines from the San Francisco Planning Department regarding the availability of sufficient loading areas.

Several of the proposed project components would not result in substantial changes to parking or loading conditions: the widened throat structure, extended train box, tunnel box stub, rock dowels, additional trackwork south of the Caltrain railyard, bicycle / controlled vehicle ramp, and BART / Muni underground pedestrian connector. These proposed project components would not involve uses or activities that generate a demand for parking or loading spaces and, consequently, are not evaluated further in the impact analysis of parking and loading conditions, as indicated in Table 1. The remaining components of the proposed project—the realigned Fourth and Townsend Street Station, the adjacent land development around the vent structures, the intercity bus facility and adjacent land development, the taxi staging area, and the AC Transit bus storage facility parking—could affect parking and loading conditions and are qualitatively evaluated for potential impacts. From a CEQA perspective, parking conditions associated with the adjacent land development are discussed for informational purposes.

Emergency Vehicle Access
Impacts to emergency vehicle access as a result of the proposed project, such as potential delays and points of conflict, were qualitatively assessed.

Travel Demand
Travel demand refers to the trip activity (vehicle, transit, pedestrian, and other trips) associated with a given land use. To determine the effects of potential new development associated with the proposed project on the surrounding transportation network, travel demand estimates for the adjacent development at the vent structure sites and intercity bus facility under the proposed project were estimated and compared to the existing trip activity associated with uses at these locations that would be displaced by the proposed project. The travel demand estimates were based on data and guidance contained in the *SF Guidelines* (including trip generation rates, mode share, trip distribution percentages, and other information) and the methodology and assumptions developed for the *Transit Center District Plan and Transit Tower Final Environmental Impact Report* (State Clearinghouse No. 2008072073; Planning Department Case Nos. 2007.0558E and 2008.0789E) ("*Transit Center District Plan FEIR*"), which analyzes the potential impacts associated with the overarching community plan for the Transbay

[6] A "transit priority area" is defined as an area within ½-mile of an existing or planned major transit stop. A "major transit stop" is defined in California *Public Resources Code* §21064.3 as a rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of service interval of 15 minutes or less during the morning and afternoon peak commute periods. A map of San Francisco's Transit Priority Areas is available online at http://sfmea.sfplanning.org/Map%20of%20San%20Francisco%20Transit% 20Priority%20Areas.pdf.

neighborhood and represents the most recent comprehensive transportation impact analysis for the area surrounding the Transbay Transit Center. The assumed land uses and development intensity at each of the development sites are consistent with applicable City plans and zoning.

Analysis Locations

As stated above, specific analysis locations for the intersection LOS analysis (for traffic impacts) and crosswalk and street corner LOS analysis (for pedestrian impacts) were selected based on their proximity to components of the proposed project, as well as the potential for components of the proposed project to negatively affect conditions at those locations.

In general, the magnitude of potential effects dissipates with distance from a given project component. In the case of the intersection LOS and crosswalk and street corner LOS analysis, traffic and pedestrian activity generated by the proposed project would be most concentrated at the site of specific project components, but would already begin dissipating at the next upstream or downstream intersections because this activity distributes itself across the available streets and pedestrian routes. Therefore, the selected intersections represent the locations where the proposed project's potential to result in significant impacts to intersection LOS or crosswalk and street corner LOS is greatest.

As described previously under "General Approach," most of the components of the proposed project would result in localized impacts that have already been identified in previous environmental documents for the Transbay Program. Therefore, the analysis in the *SEIS/EIR* focuses only on those locations where an in-depth evaluation is warranted because the proposed project could result in new significant impacts that were not previously analyzed or could result in impacts substantially more severe than previously reported. This is the approach required by CEQA when preparing supplemental environmental documents to analyze proposed changes in a previously approved project, and specifically addresses the impacts associated with the proposed changes to the previously approved Transbay Program.

Given the localized nature of each of the proposed project components, the geographical scope of selected analysis locations is more focused than, but still consistent with, previous environmental documents for the Transbay Program including the *2004 FEIS/EIR* and the *2010 Reevaluation*, as well as other relevant environmental documents including the *Transit Center District Plan FEIR,* the *PCEP FEIR, and the Central SoMa Plan DEIR*.

Development of Cumulative Conditions

Development of the cumulative analysis scenario relies on a combination of data from various sources including travel demand forecasting models and previous environmental documents. Consistent with the San Francisco Planning Department's standard approach for transportation impact analyses in the City and County of San Francisco, background growth in travel demand, including traffic and pedestrian volumes, was derived from forecasts produced by the San Francisco Chained Activity Modeling Process (SF-CHAMP) travel demand forecasting model maintained by the San Francisco County Transportation Authority.

The SF-CHAMP forecasts are derived using county-level population and employment growth estimates developed by the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) for the nine-county Bay Area for use in MTC's regional travel demand forecasting model. The Planning Department maintains a refined dataset of ABAG

growth estimates that allocates the county-level growth projected by ABAG and MTC for San Francisco across SF-CHAMP's smaller, finer-grained transportation analysis zone (TAZ) structure. The allocation specifically accounts for major land use changes in the cumulative timeframe both in the greater Downtown area and citywide, including community plans (e.g., Transit Center District Plan, Central SoMa Plan, and the Eastern Neighborhoods plans), major redevelopment areas (e.g., Mission Bay, Parkmerced, Treasure Island / Yerba Buena Island, Candlestick Point / Hunters Point Shipyard), and large development projects (e.g., Visitacion Valley, Executive Park, India Basin, Pier 70).[7] In particular, the future-year SF-CHAMP model run used in the *SEIS/EIR* analysis ("CC2040HF1wLU") was developed specifically for the Central SoMa Plan and associated environmental review and, therefore, includes the land use and transportation changes anticipated by this plan, which covers an area between Second and Sixth Streets, from Market Street to Townsend Street. Other land use and transportation improvements such as those in the Transit Center District Plan and the Mission Bay areas also are accounted for in this model run.

In addition to land use changes (and associated changes in population and employment), SF-CHAMP also assumes major reasonably foreseeable transportation investments such as the Transit Effectiveness Project / Muni Forward; the Central Subway and associated improvements to the T Third Street; Van Ness Avenue Bus Rapid Transit; Geary Corridor Bus Rapid Transit; the M Ocean View extension into Parkmerced; and expanded ferry service from WETA.

Future traffic volumes at the study intersections were derived by calculating annual growth rates for the roads approaching the intersection. The growth rates were derived by comparing the base-year (2012) and future-year (2040) SF-CHAMP model runs. Background growth in pedestrian activity within the study area was derived from growth rates calculated for forecasted pedestrian trips in SF-CHAMP's trip tables for the "Downtown" and "SoMa" neighborhoods. The calculated growth rates for study intersections and pedestrian activity were then applied to the Existing Conditions data (i.e., the counts made in the field) to derive forecasts for 2040 Cumulative Conditions without the proposed project.

For some of the analysis locations for which relevant reference plans or projects were identified, as shown in Table 1, adjustments were made in the *SEIS/EIR* analysis to ensure that the analytic approach and results were consistent with the environmental documents for the reference plans and projects. For example, adjustments were made to the forecasted traffic and pedestrian volumes and other associated analysis inputs at study locations for project components near the TTC to account for changes to the roadway network and changes in travel demand and travel behavior associated with construction and operation of the DTX and the Transit Center train box, as well as the new passenger activity associated with both Caltrain commuter rail and California High-Speed Rail Authority (CHSRA) intercity high-speed rail (HSR). These adjustments were based on data and analysis methodologies and assumptions from the FRA's *2010 Reevaluation*, which specifically evaluated the potential impacts of the

[7] The Golden State Warriors National Basketball Association (NBA) franchise did not announce their intention to relocate the proposed San Francisco arena from the previously proposed location on Piers 30–32 in the South Beach area to a new location on Blocks 29–32 in the Mission Bay South Redevelopment Area until 2014, after commencement of the SEIS/EIR analysis. Therefore, the SF-CHAMP model run used in the analysis ("CC2040HF1wLU") assumes that the new arena and event center and associated development would be at the previously proposed location on Piers 30–32. However, the model run also assumed some development on Mission Bay South Blocks 29–32 as already permitted under the Mission Bay South Redevelopment Plan.

DTX, the train box, and Caltrain and HSR passenger activity at and around the Transbay Transit Center in relation to the environmental effects of the Transbay Program that were evaluated in the *2004 FEIS/EIR*. Pedestrian activity generated by Caltrain and HSR service was derived from a model of Caltrain passenger walk trips to / from the Transit Center produced by Cambridge Systematics, with modifications to account for new estimates from the Transbay Transit Center Vehicle Traffic and Pedestrian Volume Assumptions memorandum (Arup, 2011).

To account for future changes to the roadway network as part of the approved Transit Center District Plan and the proposed Central SoMa Plan, manual adjustments were also made to the affected turning movements and circulation patterns. These adjustments were necessary to recognize modifications to the number of traffic lanes and direction of travel, physical alterations to pedestrian and bicycle facilities, changes to on-street parking, and transit improvements, for example. These network changes include proposals throughout the Transbay area (including the vicinity of the Transbay Transit Center) under the Transit Center District Plan's Public Realm Plan and the roadway and streetscape revisions proposed throughout Central SoMa (including the vicinity of Caltrain's Fourth and King Station) under the Central SoMa Plan.

Additional Trackwork South of the Caltrain Railyard and Realigned Fourth and Townsend Street Station

In the case of potential cumulative impacts associated with the proposed turnback track, the analysis describes and incorporates the approach and results from the *PCEP FEIR*, similar to the analysis of project-specific impacts. A similar approach was also adopted for potential cumulative impacts associated with the realigned Fourth and Townsend Street Station, where the analysis and results reference both the *PCEP FEIR* and the *Central SoMa Plan Draft Environmental Impact Report* (State Clearinghouse No. 2013042070; Planning Department Case No. 2011.1356E) (December 14, 2016) ("*Central SoMa Plan DEIR*"), the two most relevant documents for assessing future-year conditions near the proposed station.

The *PCEP FEIR* includes an analysis of potential pedestrian impacts at the existing Fourth and King Station associated with additional Caltrain service, while the *Central SoMa Plan DEIR* considers the effects of the area-wide land use and transportation changes proposed under the Central SoMa Plan, including specific development proposals on parcels in the immediate vicinity of the station. Using the analyses in these EIRs enabled the *SEIS/EIR* to more accurately characterize the significance of potential impacts associated with the realigned Fourth and Townsend Street Station in the context of other changes in the area in the cumulative timeframe.

Technical Appendices

This section compiles the following key analysis outputs supporting the impact significance determinations made in the *SEIS/EIR*, including travel demand and LOS calculations:

- Attachment A: Travel Demand Calculations
- Attachment B: Intersection Level of Service Calculations[8]
- Attachment C: Pedestrian Level of Service Calculations[9]

[8] LOS calculation worksheets are provided only for those intersections where new analysis was conducted specifically for the *SEIS/EIR*. For intersections where the results are referenced from other analyses or documents, such as the *PCEP FEIR* or the *Central SoMa Plan DEIR*, worksheets are not provided. Due to differences in software versions for Synchro with SimTraffic, the results shown in the calculation worksheets provided here may differ slightly from the results presented in the *SEIS/EIR*. In all such cases, however, the average delays reported in the *SEIS/EIR* are higher than those shown in the calculation worksheets and are, therefore, more conservative.

[9] LOS calculation worksheets are provided only for those intersections where new analysis was conducted specifically for the *SEIS/EIR*. For intersections where the results are referenced from other analyses or documents, such as the *Central SoMa Plan DEIR*, worksheets are not provided.

Attachment A
Travel Demand Calculations

TAZ	Project Name	Land Use Program						Trip Generation Rates (Weekday AM Peak Hour)[1]										Person Trips (Daily)						Person Trips (AM Peak Hour)					
								Residential[2]		Office[3]		General Retail[4]		Restaurant[5]		Fast Food(6)													
		Residential (DU)	Office (SF)	Retail (SF)	General Retail (SF)	Restaurant (SF)	Fast Food (SF)	Daily Rate	Peak Hour	Daily Rate	Peak Hour	Daily Rate	Peak Hour	Daily Rate	Peak Hour	Daily Rate	Peak Hour	Resi-dential	Office	General Retail	Rest-aurant	Fast Food	Total	Resi-dential	Office	General Retail	Rest-aurant	Fast Food	Total
Third / Townsend																													
Existing: Fast Food Restaurant (McDonald's)							-1,716	9.0	-	18.1	-	150.0	-	-	-	1400.0	25.4%	0	0	0	0	0	0	0	0	0	0	0	0
New: Office			72,000			4,000		9.0	-	18.1	8.8%	150.0	-	200.0	14.2%	-	-	0	0	0	0	0	0	0	0	0	0	0	0
Beale / Mission / Main / Howard																													
Existing: Office			-10,266					9.0	-	18.1	8.8%	150.0	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
New: Residential (Single-Room Occupancy)		128						7.5	17.6%	18.1	-	150.0	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
New: Office			45,000					9.0	-	18.1	8.8%	150.0	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
Alternate Vent Site																													
Existing: Retail (180 Townsend)					-13,708			9.0	-	18.1	-	150.0	2.5%	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
Existing: Office (180 Townsend)			-27,417					9.0	-	18.1	8.8%	150.0	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
Existing: Retail (699 Third)					-6,250			9.0	-	18.1	-	150.0	2.5%	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
New: Office			72,000					9.0	-	18.1	8.8%	150.0	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0

[1] The same assumptions were utilized for the AM peak hour as the PM peak hour trip generation; however, the peak hour percentage values were converted based on the *Institute of Transportation Engineers (ITE) Trip Generation Manual* (7th Edition). The conversion factor was determined based on the average trip generation rates for the AM and PM peak hours.

[2] Peak hour conversion factor based on ITE *Trip Generation* LU 233 (Luxury Condominium/Townhouse).

[3] Peak hour conversion factor based on ITE Trip Generation LU 710 (General Office Building).

[4] Peak hour conversion factor based on ITE Trip Generation LU 820 (Shopping Center).

[5] Peak hour conversion factor based on ITE Trip Generation LU 932 (High-Turnover Restaurant).

[6] Peak hour conversion factor based on ITE Trip Generation LU 933 (Fast-Food Restaurant without Drive-Through Window), Table 2, assuming daily rate equals 10 times the PM peak hour rate.

TAZ	Project Name	Work / Non-Work Split (Weekday AM Peak Hour) — Shares										Work / Non-Work Split (Weekday AM Peak Hour) — Trips									
		Residential		Office		General Retail		Restaurant		Fast Food		Residential		Office		General Retail		Restaurant		Fast Food	
		Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work
Third / Townsend																					
Existing: Fast Food Restaurant (McDonald's)		100.0%	0.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
New: Office		100.0%	0.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
Beale / Mission / Main / Howard																					
Existing: Office		100.0%	0.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
New: Residential (Single-Room Occupancy)		100.0%	0.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
New: Office		100.0%	0.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
Alternate Vent Site																					
Existing: Retail (180 Townsend)		100.0%	0.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
Existing: Office (180 Townsend)		100.0%	0.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
Existing: Retail (699 Third)		100.0%	0.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
New: Office		100.0%	0.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0

Weekday AM Peak Hour Summary

External Trip Share			
Auto	Transit	Walk	Other
95.9%	100.0%	67.4%	86.9%

Direction	Inbound / Outbound Split													
	Residential		Office		General Retail		Restaurant		Fast Food		Hotel		Institutional	
	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work
Inbound	0%	67%	100%	50%	100%	50%	100%	50%	100%	50%	100%	50%	100%	50%
Outbound	100%	33%	0%	50%	0%	50%	0%	50%	0%	50%	0%	50%	0%	50%

	Inbound External Trips						Outbound External Trips						Total External Trips					
	Auto	Transit	Walk	Other	Total	Veh.	Auto	Transit	Walk	Other	Total	Veh.	Auto	Transit	Walk	Other	Total	Veh.
Third / Townsend																		
Existing: Fast Food Restaurant (McDonald's)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New: Office	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beale / Mission / Main / Howard																		
Existing: Office	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New: Residential (Single-Room Occupancy)	0	0	0	0	0	0	23	78	35	16	152	18	23	78	35	16	152	18
New: Office	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alternate Vent Site																		
Existing: Retail (180 Townsend)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing: Office (180 Townsend)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing: Retail (699 Third)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New: Office	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TAZ	Project Name	Land Use Program						Trip Generation Rates (Weekday PM Peak Hour)										Person Trips (Daily)						Person Trips (PM Peak Hour)					
								Residential[1]		Office[2]		General Retail[3]		Restaurant[4]		Fast Food(5)													
		Residential (DU)	Office (SF)	Retail (SF)	General Retail (SF)	Restaurant (SF)	Fast Food (SF)	Daily Rate	Peak Hour	Daily Rate	Peak Hour	Daily Rate	Peak Hour	Daily Rate	Peak Hour	Daily Rate	Peak Hour	Resi-dential	Office	General Retail	Rest-aurant	Fast Food	Total	Resi-dential	Office	General Retail	Rest-aurant	Fast Food	Total
Third / Townsend																													
Existing: Fast Food Restaurant (McDonald's)							-1,716	9.0	-	18.1	-	150.0	-	-	-	1400.0	13.5%	0	0	0	0	0	0	0	0	0	0	0	0
New: Office			72,000			4,000		9.0	-	18.1	8.5%	150.0	-	200.0	13.5%	-	-	0	0	0	0	0	0	0	0	0	0	0	0
Beale / Mission / Main / Howard																													
Existing: Office			-10,266					9.0	-	18.1	8.5%	150.0	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
New: Residential (Single-Room Occupancy)		128						7.5	17.3%	18.1	-	150.0	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
New: Office			45,000					9.0	-	18.1	8.5%	150.0	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
Alternate Vent Site																													
Existing: Retail (180 Townsend)					-13,708			9.0	-	18.1	-	150.0	9.0%	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
Existing: Office (180 Townsend)			-27,417					9.0	-	18.1	8.5%	150.0	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
Existing: Retail (699 Third)					-6,250			9.0	-	18.1	-	150.0	9.0%	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
New: Office			72,000					9.0	-	18.1	8.5%	150.0	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0

[1] SF Guidelines. Residential unit type not provided. Assume 1 bedroom / studio (7.5 trips / unit) to 2+ bedrooms (10.0 trips / unit) ratio of 2:1.

[2] SF Guidelines, Table C-1, General Office.

[3] SF Guidelines, Table C-1, General Retail.

[4] SF Guidelines, Table C-1, Quality Sit-down Restaurant.

[5] Daily rate assumed to be equal to restaurant.

TAZ	Project Name	Work / Non-Work Split (Weekday PM Peak Hour) — Shares										Work / Non-Work Split (Weekday PM Peak Hour) — Trips									
		Residential		Office		General Retail		Restaurant		Fast Food		Residential		Office		General Retail		Restaurant		Fast Food	
		Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work
Third / Townsend																					
Existing: Fast Food Restaurant (McDonald's)		50.0%	50.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
New: Office		50.0%	50.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
Beale / Mission / Main / Howard																					
Existing: Office		50.0%	50.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
New: Residential (Single-Room Occupancy)		50.0%	50.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
New: Office		50.0%	50.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
Alternate Vent Site																					
Existing: Retail (180 Townsend)		50.0%	50.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
Existing: Office (180 Townsend)		50.0%	50.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
Existing: Retail (699 Third)		50.0%	50.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0
New: Office		50.0%	50.0%	83.0%	17.0%	4.0%	96.0%	4.0%	96.0%	4.0%	96.0%	0	0	0	0	0	0	0	0	0	0

Weekday PM Peak Hour Summary

External Trip Share			
Auto	Transit	Walk	Other
95.9%	100.0%	70.0%	91.1%

Direction	Inbound / Outbound Split													
	Residential		Office		General Retail		Restaurant		Fast Food		Hotel		Institutional	
	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work	Work	Non-Work
Inbound	100%	33%	0%	50%	0%	50%	0%	50%	0%	50%	0%	50%	0%	50%
Outbound	0%	67%	100%	50%	100%	50%	100%	50%	100%	50%	100%	50%	100%	50%

	Inbound External Trips						Outbound External Trips						Total External Trips					
	Auto	Transit	Walk	Other	Total	Veh.	Auto	Transit	Walk	Other	Total	Veh.	Auto	Transit	Walk	Other	Total	Veh.
Third / Townsend																		
Existing: Fast Food Restaurant (McDonald's)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New: Office	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beale / Mission / Main / Howard																		
Existing: Office	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New: Residential (Single-Room Occupancy)	14	52	25	10	101	11	5	26	13	5	49	5	19	78	38	15	150	16
New: Office	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alternate Vent Site																		
Existing: Retail (180 Townsend)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing: Office (180 Townsend)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing: Retail (699 Third)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New: Office	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Attachment B
Intersection Level of Service Calculations

HCM Signalized Intersection Capacity Analysis
1: Townsend Street & Fourth Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	79	284	48	9	0	120	0	326	121	136	196	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.95			0.95	0.95		0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.97			0.83	0.80		1.00	0.88	1.00	1.00	
Flpb, ped/bikes	0.83	1.00			0.98	1.00		1.00	1.00	0.97	1.00	
Frt	1.00	0.98			0.87	0.85		1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00			0.99	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	2563	3025			1120	1078		3185	1001	1541	1676	
Flt Permitted	0.71	1.00			0.95	1.00		1.00	1.00	0.52	1.00	
Satd. Flow (perm)	1915	3025			1068	1078		3185	1001	835	1676	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	86	309	52	10	0	130	0	354	132	148	213	0
RTOR Reduction (vph)	0	23	0	0	40	41	0	0	95	0	0	0
Lane Group Flow (vph)	86	338	0	0	29	30	0	354	37	148	213	0
Confl. Peds. (#/hr)	100		100	100		100	100		100	100		100
Parking (#/hr)									20			20
Turn Type	Perm	NA		Perm	NA	Perm		NA	Perm	pm+pt	NA	
Protected Phases		6			2			4		3	8	
Permitted Phases	6			2		2			4	8		
Actuated Green, G (s)	25.0	25.0			25.0	25.0		17.0	17.0	27.0	27.0	
Effective Green, g (s)	25.0	25.0			25.0	25.0		17.0	17.0	27.0	27.0	
Actuated g/C Ratio	0.42	0.42			0.42	0.42		0.28	0.28	0.45	0.45	
Clearance Time (s)	4.0	4.0			4.0	4.0		4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	797	1260			445	449		902	283	446	754	
v/s Ratio Prot		c0.11						c0.11		c0.03	0.13	
v/s Ratio Perm	0.04				0.03	0.03			0.04	0.12		
v/c Ratio	0.11	0.27			0.06	0.07		0.39	0.13	0.33	0.28	
Uniform Delay, d1	10.7	11.5			10.5	10.5		17.3	16.0	11.6	10.4	
Progression Factor	1.00	1.00			1.00	1.00		1.00	1.00	1.99	2.04	
Incremental Delay, d2	0.3	0.5			0.3	0.3		1.3	1.0	1.5	0.7	
Delay (s)	11.0	12.0			10.8	10.8		18.6	17.0	24.6	22.0	
Level of Service	B	B			B	B		B	B	C	C	
Approach Delay (s)		11.8			10.8			18.2			23.0	
Approach LOS		B			B			B			C	

Intersection Summary				
HCM 2000 Control Delay	16.7	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.33			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	50.0%	ICU Level of Service	A	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Townsend Street & Third Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	56	1096	109	204	320	0	0	281	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	4.0
Lane Util. Factor					0.86		1.00	1.00			1.00	1.00
Frpb, ped/bikes					0.98		1.00	1.00			1.00	0.80
Flpb, ped/bikes					0.99		0.97	1.00			1.00	1.00
Frt					0.99		1.00	1.00			1.00	0.85
Flt Protected					1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)					5552		1550	1676			1676	908
Flt Permitted					1.00		0.33	1.00			1.00	1.00
Satd. Flow (perm)					5552		546	1676			1676	908
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	61	1191	118	222	348	0	0	305	61
RTOR Reduction (vph)	0	0	0	0	25	0	0	0	0	0	0	44
Lane Group Flow (vph)	0	0	0	0	1345	0	222	348	0	0	305	17
Confl. Peds. (#/hr)				100		100	100		100	100		100
Parking (#/hr)				20		20			20			20
Turn Type				Perm	NA		pm+pt	NA			NA	Perm
Protected Phases					2		7	4			8	
Permitted Phases				2			4					8
Actuated Green, G (s)					25.0		27.0	27.0			17.0	17.0
Effective Green, g (s)					25.0		27.0	27.0			17.0	17.0
Actuated g/C Ratio					0.42		0.45	0.45			0.28	0.28
Clearance Time (s)					4.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)					2313		346	754			474	257
v/s Ratio Prot							c0.06	0.21			0.18	
v/s Ratio Perm					0.24		c0.22					0.02
v/c Ratio					0.58		0.64	0.46			0.64	0.07
Uniform Delay, d1					13.5		11.4	11.5			18.8	15.7
Progression Factor					1.00		1.32	0.51			1.00	1.00
Incremental Delay, d2					1.1		8.6	2.0			6.6	0.5
Delay (s)					14.5		23.7	7.8			25.4	16.2
Level of Service					B		C	A			C	B
Approach Delay (s)		0.0			14.5			14.0			23.9	
Approach LOS		A			B			B			C	

Intersection Summary				
HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.65			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	60.1%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Harrison Street & Third Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	185	1631	144	0	0	0	0	932	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5	4.5					4.5	
Lane Util. Factor				*0.70	*0.70	*0.70					*0.70	
Frpb, ped/bikes				1.00	1.00	0.88					0.98	
Flpb, ped/bikes				0.81	1.00	1.00					1.00	
Frt				1.00	1.00	0.85					0.99	
Flt Protected				0.95	1.00	1.00					1.00	
Satd. Flow (prot)				906	3521	700					3399	
Flt Permitted				0.95	1.00	1.00					1.00	
Satd. Flow (perm)				906	3521	700					3399	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	201	1773	157	0	0	0	0	1013	111
RTOR Reduction (vph)	0	0	0	14	0	79	0	0	0	0	3	0
Lane Group Flow (vph)	0	0	0	188	1773	79	0	0	0	0	1121	0
Confl. Peds. (#/hr)				100		100				100		100
Parking (#/hr)						20	20		20	20		20
Turn Type				Perm	NA	Perm					NA	
Protected Phases					2						8	
Permitted Phases				2		2						
Actuated Green, G (s)				30.0	30.0	30.0					21.0	
Effective Green, g (s)				30.0	30.0	30.0					21.0	
Actuated g/C Ratio				0.50	0.50	0.50					0.35	
Clearance Time (s)				4.5	4.5	4.5					4.5	
Lane Grp Cap (vph)				453	1760	350					1189	
v/s Ratio Prot					c0.50						c0.33	
v/s Ratio Perm				0.21		0.11						
v/c Ratio				0.41	1.01	0.22					0.94	
Uniform Delay, d1				9.5	15.0	8.4					18.9	
Progression Factor				0.43	0.42	0.18					0.80	
Incremental Delay, d2				1.0	14.5	0.5					14.4	
Delay (s)				5.1	20.8	2.1					29.6	
Level of Service				A	C	A					C	
Approach Delay (s)		0.0			18.0			0.0			29.6	
Approach LOS		A			B			A			C	

Intersection Summary				
HCM 2000 Control Delay	22.0	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.98			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.0	
Intersection Capacity Utilization	65.6%	ICU Level of Service	C	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Howard Street & Beale Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	73	243	204	0	0	0	0	261	37	24	216	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0			5.0	
Lane Util. Factor		0.91	*0.57					0.95			*0.80	
Frpb, ped/bikes		0.95	0.63					0.96			1.00	
Flpb, ped/bikes		0.96	1.00					1.00			0.98	
Frt		0.98	0.85					0.98			1.00	
Flt Protected		0.99	1.00					1.00			1.00	
Satd. Flow (prot)		2704	409					3008			2603	
Flt Permitted		0.99	1.00					1.00			0.90	
Satd. Flow (perm)		2704	409					3008			2357	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	264	222	0	0	0	0	284	40	26	235	0
RTOR Reduction (vph)	0	18	34	0	0	0	0	18	0	0	0	0
Lane Group Flow (vph)	0	374	139	0	0	0	0	306	0	0	261	0
Confl. Peds. (#/hr)	191		191				156		156	207		207
Parking (#/hr)	20		20						20			
Turn Type	Perm	NA	Perm					NA		Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6		6							8		
Actuated Green, G (s)		31.0	31.0					19.0			19.0	
Effective Green, g (s)		31.0	31.0					19.0			19.0	
Actuated g/C Ratio		0.52	0.52					0.32			0.32	
Clearance Time (s)		5.0	5.0					5.0			5.0	
Lane Grp Cap (vph)		1397	211					952			746	
v/s Ratio Prot								0.10				
v/s Ratio Perm		0.14	c0.34								c0.11	
v/c Ratio		0.27	0.66					0.32			0.35	
Uniform Delay, d1		8.1	10.6					15.6			15.8	
Progression Factor		0.60	0.71					1.00			0.51	
Incremental Delay, d2		0.4	13.4					0.9			1.2	
Delay (s)		5.3	20.9					16.5			9.2	
Level of Service		A	C					B			A	
Approach Delay (s)		10.1			0.0			16.5			9.2	
Approach LOS		B			A			B			A	

Intersection Summary				
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.54			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	49.3%	ICU Level of Service	A	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Mission Street & Beale Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	92	391	99	0	0	0	0	427	120	60	194	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0						4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91						*0.50		1.00	*0.50	
Frpb, ped/bikes	1.00	0.88						0.91		1.00	1.00	
Flpb, ped/bikes	0.64	1.00						1.00		0.88	1.00	
Frt	1.00	0.97						0.97		1.00	1.00	
Flt Protected	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (prot)	819	3890						1437		1365	1629	
Flt Permitted	0.95	1.00						1.00		0.17	1.00	
Satd. Flow (perm)	819	3890						1437		242	1629	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	100	425	108	0	0	0	0	464	130	65	211	0
RTOR Reduction (vph)	0	70	0	0	0	0	0	1	0	0	0	0
Lane Group Flow (vph)	100	463	0	0	0	0	0	593	0	65	211	0
Confl. Peds. (#/hr)	520		537						693	693		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	5%	5%	5%	5%	5%
Parking (#/hr)	20		20						20			
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6									8		
Actuated Green, G (s)	21.0	21.0						31.0		31.0	31.0	
Effective Green, g (s)	21.0	21.0						31.0		31.0	31.0	
Actuated g/C Ratio	0.35	0.35						0.52		0.52	0.52	
Clearance Time (s)	4.0	4.0						4.0		4.0	4.0	
Lane Grp Cap (vph)	286	1361						742		125	841	
v/s Ratio Prot		0.12						c0.41			0.13	
v/s Ratio Perm	c0.12									0.27		
v/c Ratio	0.35	0.34						0.80		0.52	0.25	
Uniform Delay, d1	14.4	14.4						11.9		9.6	8.1	
Progression Factor	1.00	1.00						1.00		0.89	0.94	
Incremental Delay, d2	3.3	0.7						8.8		13.7	0.7	
Delay (s)	17.8	15.1						20.7		22.3	8.2	
Level of Service	B	B						C		C	A	
Approach Delay (s)		15.5			0.0			20.7			11.5	
Approach LOS		B			A			C			B	

Intersection Summary				
HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.62			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0	
Intersection Capacity Utilization	55.3%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
10: Howard Street & Main Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	11	667	143	92	215	0	0	217	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					3.5			3.5			3.5	
Lane Util. Factor					0.91			*0.50			*0.60	
Frpb, ped/bikes					0.97			1.00			0.90	
Flpb, ped/bikes					1.00			0.99			1.00	
Frt					0.97			1.00			0.94	
Flt Protected					1.00			0.99			1.00	
Satd. Flow (prot)					4326			1628			1710	
Flt Permitted					1.00			0.71			1.00	
Satd. Flow (perm)					4326			1177			1710	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	12	725	155	100	234	0	0	236	148
RTOR Reduction (vph)	0	0	0	0	54	0	0	0	0	0	52	0
Lane Group Flow (vph)	0	0	0	0	838	0	0	334	0	0	332	0
Confl. Peds. (#/hr)				130		130	140		140	220		220
Parking (#/hr)												20
Turn Type				Perm	NA		pm+pt	NA			NA	
Protected Phases					2		7	4			8	
Permitted Phases				2			4					
Actuated Green, G (s)					20.0			33.0			25.0	
Effective Green, g (s)					20.0			33.0			25.0	
Actuated g/C Ratio					0.33			0.55			0.42	
Clearance Time (s)					3.5			3.5			3.5	
Lane Grp Cap (vph)					1442			677			712	
v/s Ratio Prot								c0.03			0.19	
v/s Ratio Perm					0.19			c0.24				
v/c Ratio					0.58			0.49			0.47	
Uniform Delay, d1					16.5			8.3			12.7	
Progression Factor					1.00			0.88			1.00	
Incremental Delay, d2					1.7			2.5			2.2	
Delay (s)					18.3			9.8			14.9	
Level of Service					B			A			B	
Approach Delay (s)		0.0			18.3			9.8			14.9	
Approach LOS		A			B			A			B	

Intersection Summary				
HCM 2000 Control Delay	15.7	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.57			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.0	
Intersection Capacity Utilization	57.2%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
11: Mission Street & Main Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	107	604	123	200	290	0	0	130	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.5			4.0	
Lane Util. Factor					0.91		1.00	1.00			0.95	
Frpb, ped/bikes					0.92		1.00	1.00			0.89	
Flpb, ped/bikes					0.96		0.91	1.00			1.00	
Frt					0.98		1.00	1.00			0.95	
Flt Protected					0.99		0.95	1.00			1.00	
Satd. Flow (prot)					3951		1401	1629			2600	
Flt Permitted					0.99		0.51	1.00			1.00	
Satd. Flow (perm)					3951		746	1629			2600	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	116	657	134	217	315	0	0	141	77
RTOR Reduction (vph)	0	0	0	0	40	0	0	0	0	0	53	0
Lane Group Flow (vph)	0	0	0	0	867	0	217	315	0	0	165	0
Confl. Peds. (#/hr)				275		275	290		290	325		325
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	5%	5%	5%	5%	5%
Parking (#/hr)				20		20			20			
Turn Type				Perm	NA		pm+pt	NA			NA	
Protected Phases					2		7	4			8	
Permitted Phases				2			4					
Actuated Green, G (s)					21.0		30.5	30.5			19.0	
Effective Green, g (s)					21.0		30.5	30.5			19.0	
Actuated g/C Ratio					0.35		0.51	0.51			0.32	
Clearance Time (s)					4.0		4.0	4.5			4.0	
Lane Grp Cap (vph)					1382		466	828			823	
v/s Ratio Prot							c0.06	0.19			0.06	
v/s Ratio Perm					0.22		c0.17					
v/c Ratio					0.63		0.47	0.38			0.20	
Uniform Delay, d1					16.2		8.8	9.0			15.0	
Progression Factor					0.56		0.66	0.64			1.00	
Incremental Delay, d2					1.8		2.3	0.9			0.5	
Delay (s)					10.8		8.0	6.7			15.5	
Level of Service					B		A	A			B	
Approach Delay (s)		0.0			10.8			7.2			15.5	
Approach LOS		A			B			A			B	

Intersection Summary				
HCM 2000 Control Delay	10.3	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.56			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	55.3%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Townsend Street & Fourth Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	62	228	23	20	0	149	0	367	131	187	241	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.95			0.95	0.95		0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.98			0.85	0.80		1.00	0.88	1.00	1.00	
Flpb, ped/bikes	0.83	1.00			0.97	1.00		1.00	1.00	0.97	1.00	
Frt	1.00	0.99			0.89	0.85		1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00			0.99	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	2578	3083			1143	1078		3185	1001	1549	1676	
Flt Permitted	0.70	1.00			0.91	1.00		1.00	1.00	0.48	1.00	
Satd. Flow (perm)	1888	3083			1052	1078		3185	1001	775	1676	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	67	248	25	22	0	162	0	399	142	203	262	0
RTOR Reduction (vph)	0	13	0	0	53	55	0	0	102	0	0	0
Lane Group Flow (vph)	67	260	0	0	38	39	0	399	40	203	262	0
Confl. Peds. (#/hr)	100		100	100		100	100		100	100		100
Parking (#/hr)									20			20
Turn Type	Perm	NA		Perm	NA	Perm		NA	Perm	pm+pt	NA	
Protected Phases		6			2			4		3	8	
Permitted Phases	6			2		2			4	8		
Actuated Green, G (s)	25.0	25.0			25.0	25.0		17.0	17.0	27.0	27.0	
Effective Green, g (s)	25.0	25.0			25.0	25.0		17.0	17.0	27.0	27.0	
Actuated g/C Ratio	0.42	0.42			0.42	0.42		0.28	0.28	0.45	0.45	
Clearance Time (s)	4.0	4.0			4.0	4.0		4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	786	1284			438	449		902	283	426	754	
v/s Ratio Prot		c0.08						0.13		c0.05	0.16	
v/s Ratio Perm	0.04				0.04	0.04			0.04	c0.17		
v/c Ratio	0.09	0.20			0.09	0.09		0.44	0.14	0.48	0.35	
Uniform Delay, d1	10.6	11.1			10.6	10.6		17.6	16.1	13.2	10.8	
Progression Factor	1.00	1.00			1.00	1.00		1.00	1.00	1.90	2.05	
Incremental Delay, d2	0.2	0.4			0.4	0.4		1.6	1.1	2.2	0.7	
Delay (s)	10.8	11.5			11.0	11.0		19.2	17.1	27.2	22.8	
Level of Service	B	B			B	B		B	B	C	C	
Approach Delay (s)		11.4			11.0			18.6			24.8	
Approach LOS		B			B			B			C	

Intersection Summary				
HCM 2000 Control Delay	18.0	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.36			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	64.2%	ICU Level of Service	C	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Townsend Street & Third Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	57	1681	108	253	320	0	0	357	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	4.0
Lane Util. Factor					0.86		1.00	1.00			1.00	1.00
Frpb, ped/bikes					0.99		1.00	1.00			1.00	0.80
Flpb, ped/bikes					1.00		0.99	1.00			1.00	1.00
Frt					0.99		1.00	1.00			1.00	0.85
Flt Protected					1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)					5620		1572	1676			1676	908
Flt Permitted					1.00		0.23	1.00			1.00	1.00
Satd. Flow (perm)					5620		385	1676			1676	908
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	62	1827	117	275	348	0	0	388	99
RTOR Reduction (vph)	0	0	0	0	15	0	0	0	0	0	0	65
Lane Group Flow (vph)	0	0	0	0	1991	0	275	348	0	0	388	34
Confl. Peds. (#/hr)				100		100	100		100	100		100
Parking (#/hr)				20		20			20			20
Turn Type				Perm	NA		pm+pt	NA			NA	Perm
Protected Phases					2		7	4			8	
Permitted Phases				2			4					8
Actuated Green, G (s)					25.0		27.0	27.0			17.0	17.0
Effective Green, g (s)					25.0		27.0	27.0			17.0	17.0
Actuated g/C Ratio					0.42		0.45	0.45			0.28	0.28
Clearance Time (s)					4.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)					2341		291	754			474	257
v/s Ratio Prot							c0.09	0.21			0.23	
v/s Ratio Perm					0.35		c0.33					0.04
v/c Ratio					0.85		0.95	0.46			0.82	0.13
Uniform Delay, d1					15.8		14.1	11.5			20.1	16.0
Progression Factor					1.00		1.82	0.48			1.00	1.00
Incremental Delay, d2					4.1		39.3	1.9			14.5	1.1
Delay (s)					19.9		64.9	7.5			34.6	17.1
Level of Service					B		E	A			C	B
Approach Delay (s)		0.0			19.9			32.8			31.0	
Approach LOS		A			B			C			C	

Intersection Summary				
HCM 2000 Control Delay	24.2	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.95			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	76.8%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Bryant Street & Third Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	0	1734	467	290	587	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					3.5	3.5	3.5	3.5				
Lane Util. Factor					0.91	1.00	*0.40	*0.40				
Frpb, ped/bikes					1.00	0.88	1.00	1.00				
Flpb, ped/bikes					1.00	1.00	0.89	1.00				
Frt					1.00	0.85	1.00	1.00				
Flt Protected					1.00	1.00	0.95	1.00				
Satd. Flow (prot)					4577	1001	1018	2012				
Flt Permitted					1.00	1.00	0.95	1.00				
Satd. Flow (perm)					4577	1001	1018	2012				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	1885	508	315	638	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	59	5	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1885	449	310	638	0	0	0	0
Confl. Peds. (#/hr)				100		100	100		100			
Parking (#/hr)				20		20	20		20			
Turn Type					NA	Perm	Perm	NA				
Protected Phases					2			4				
Permitted Phases						2	4					
Actuated Green, G (s)					25.0	25.0	28.0	28.0				
Effective Green, g (s)					25.0	25.0	28.0	28.0				
Actuated g/C Ratio					0.42	0.42	0.47	0.47				
Clearance Time (s)					3.5	3.5	3.5	3.5				
Lane Grp Cap (vph)					1907	417	475	938				
v/s Ratio Prot					0.41			c0.32				
v/s Ratio Perm						c0.45	0.30					
v/c Ratio					0.99	1.08	0.65	0.68				
Uniform Delay, d1					17.4	17.5	12.3	12.5				
Progression Factor					1.00	1.00	1.00	1.00				
Incremental Delay, d2					18.1	66.2	6.8	4.0				
Delay (s)					35.4	83.7	19.1	16.5				
Level of Service					D	F	B	B				
Approach Delay (s)		0.0			45.7			17.3			0.0	
Approach LOS		A			D			B			A	

Intersection Summary				
HCM 2000 Control Delay	37.6	HCM 2000 Level of Service	D	
HCM 2000 Volume to Capacity ratio	0.87			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	7.0	
Intersection Capacity Utilization	58.1%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
4: Perry Street & Third Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	0	0	0	4	1956	4	2	0	0	0	0	7
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	4	2126	4	2	0	0	0	0	8
Pedestrians		100			100			100			100	
Lane Width (ft)		0.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			8			8			8	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		112			260							
pX, platoon unblocked	0.68						0.68	0.68		0.68	0.68	0.68
vC, conflicting volume	2230			100			748	2339	200	2337	2337	734
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	439			100			0	599	200	596	596	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	99
cM capacity (veh/h)	694			1366			550	235	679	193	236	674

Direction, Lane #	NW 1	NW 2	NW 3	NW 4	NE 1	SW 1
Volume Total	359	709	709	359	2	8
Volume Left	4	0	0	0	2	0
Volume Right	0	0	0	4	0	8
cSH	1366	1700	1700	1700	550	674
Volume to Capacity	0.00	0.42	0.42	0.21	0.00	0.01
Queue Length 95th (ft)	0	0	0	0	0	1
Control Delay (s)	0.1	0.0	0.0	0.0	11.6	10.4
Lane LOS	A				B	B
Approach Delay (s)	0.0				11.6	10.4
Approach LOS					B	B

Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	51.4%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis
5: Harrison Street & Third Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	388	1528	262	0	0	0	0	1291	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5	4.5					4.5	
Lane Util. Factor				*0.80	*0.80	*0.80					*0.80	
Frpb, ped/bikes				1.00	1.00	0.88					0.99	
Flpb, ped/bikes				0.81	1.00	1.00					1.00	
Frt				1.00	1.00	0.85					0.99	
Flt Protected				0.95	1.00	1.00					1.00	
Satd. Flow (prot)				1035	4024	801					3937	
Flt Permitted				0.95	1.00	1.00					1.00	
Satd. Flow (perm)				1035	4024	801					3937	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	422	1661	285	0	0	0	0	1403	91
RTOR Reduction (vph)	0	0	0	14	0	143	0	0	0	0	4	0
Lane Group Flow (vph)	0	0	0	409	1661	143	0	0	0	0	1490	0
Confl. Peds. (#/hr)				100		100				100		100
Parking (#/hr)						20	20		20	20		20
Turn Type				Perm	NA	Perm					NA	
Protected Phases					2						8	
Permitted Phases				2		2						
Actuated Green, G (s)				30.0	30.0	30.0					21.0	
Effective Green, g (s)				30.0	30.0	30.0					21.0	
Actuated g/C Ratio				0.50	0.50	0.50					0.35	
Clearance Time (s)				4.5	4.5	4.5					4.5	
Lane Grp Cap (vph)				517	2012	400					1377	
v/s Ratio Prot					c0.41						c0.38	
v/s Ratio Perm				0.39		0.18						
v/c Ratio				0.79	0.83	0.36					1.08	
Uniform Delay, d1				12.4	12.8	9.1					19.5	
Progression Factor				0.41	0.43	0.61					0.83	
Incremental Delay, d2				6.2	2.1	1.3					49.3	
Delay (s)				11.3	7.6	6.8					65.5	
Level of Service				B	A	A					E	
Approach Delay (s)		0.0			8.1			0.0			65.5	
Approach LOS		A			A			A			E	

Intersection Summary					
HCM 2000 Control Delay	30.3	HCM 2000 Level of Service		C	
HCM 2000 Volume to Capacity ratio	0.93				
Actuated Cycle Length (s)	60.0	Sum of lost time (s)		9.0	
Intersection Capacity Utilization	70.5%	ICU Level of Service		C	
Analysis Period (min)	15				

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Bryant Street & Second Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	11	537	0	0	364	163	318	583	33	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5			3.5	3.5	3.5	3.5				
Lane Util. Factor		*0.35			*0.35	*0.35	*0.35	*0.35				
Frpb, ped/bikes		1.00			1.00	0.80	1.00	0.99				
Flpb, ped/bikes		1.00			1.00	1.00	0.89	1.00				
Frt		1.00			1.00	0.85	1.00	0.99				
Flt Protected		1.00			1.00	1.00	0.95	1.00				
Satd. Flow (prot)		1137			1140	309	865	1678				
Flt Permitted		0.93			1.00	1.00	0.95	1.00				
Satd. Flow (perm)		1061			1140	309	865	1678				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	584	0	0	396	177	346	634	36	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	53	0	4	0	0	0	0
Lane Group Flow (vph)	0	596	0	0	396	124	346	666	0	0	0	0
Confl. Peds. (#/hr)	100		100	100		100	100		100			
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	2%	2%	2%
Parking (#/hr)			20			20	20		20			
Turn Type	Perm	NA			NA	Perm	Perm	NA				
Protected Phases		6			2			4				
Permitted Phases	6					2	4					
Actuated Green, G (s)		26.0			26.0	26.0	27.0	27.0				
Effective Green, g (s)		26.0			26.0	26.0	27.0	27.0				
Actuated g/C Ratio		0.43			0.43	0.43	0.45	0.45				
Clearance Time (s)		3.5			3.5	3.5	3.5	3.5				
Lane Grp Cap (vph)		459			494	133	389	755				
v/s Ratio Prot					0.35			0.40				
v/s Ratio Perm		c0.56				0.40	c0.40					
v/c Ratio		1.30			0.80	0.93	0.89	0.88				
Uniform Delay, d1		17.0			14.8	16.2	15.1	15.1				
Progression Factor		0.73			1.00	1.00	0.81	0.80				
Incremental Delay, d2		145.7			12.9	62.1	14.3	7.7				
Delay (s)		158.1			27.6	78.3	26.6	19.8				
Level of Service		F			C	E	C	B				
Approach Delay (s)		158.1			43.3			22.1			0.0	
Approach LOS		F			D			C			A	

Intersection Summary					
HCM 2000 Control Delay	64.8	HCM 2000 Level of Service		E	
HCM 2000 Volume to Capacity ratio	1.09				
Actuated Cycle Length (s)	60.0	Sum of lost time (s)		7.0	
Intersection Capacity Utilization	57.7%	ICU Level of Service		B	
Analysis Period (min)	15				

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Harrison Street & Second Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	76	302	192	20	223	483	26	275	18	97	594	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	5.0		5.0			5.0	
Lane Util. Factor		0.95			0.91	*0.45		*0.30			*0.50	0.95
Frpb, ped/bikes		0.96			0.90	0.80		0.99			1.00	0.99
Flpb, ped/bikes		0.99			1.00	1.00		1.00			0.96	1.00
Frt		0.95			0.93	0.85		0.99			1.00	0.99
Flt Protected		0.99			1.00	1.00		1.00			0.95	1.00
Satd. Flow (prot)		2847			2526	511		981			764	3118
Flt Permitted		0.81			0.92	1.00		0.87			0.19	1.00
Satd. Flow (perm)		2329			2329	511		861			153	3118
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	83	328	209	22	242	525	28	299	20	105	646	41
RTOR Reduction (vph)	0	22	0	0	86	86	0	2	0	0	8	0
Lane Group Flow (vph)	0	598	0	0	441	176	0	345	0	105	679	0
Confl. Peds. (#/hr)	100		100	100		100	100		100	100		100
Parking (#/hr)			20						20			20
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		6			2			4			8	
Permitted Phases	6			2		2	4			8		
Actuated Green, G (s)		29.0			29.0	29.0		21.0		21.0	21.0	
Effective Green, g (s)		29.0			29.0	29.0		21.0		21.0	21.0	
Actuated g/C Ratio		0.48			0.48	0.48		0.35		0.35	0.35	
Clearance Time (s)		5.0			5.0	5.0		5.0		5.0	5.0	
Lane Grp Cap (vph)		1125			1125	246		301		53	1091	
v/s Ratio Prot											0.22	
v/s Ratio Perm		0.26			0.19	c0.34		0.40		c0.69		
v/c Ratio		0.53			0.39	0.71		1.15		1.98	0.62	
Uniform Delay, d1		10.8			9.9	12.2		19.5		19.5	16.2	
Progression Factor		1.00			0.80	0.78		0.74		1.00	1.00	
Incremental Delay, d2		1.8			0.6	9.9		95.5		501.8	2.7	
Delay (s)		12.6			8.5	19.5		109.9		521.3	18.9	
Level of Service		B			A	B		F		F	B	
Approach Delay (s)		12.6			12.2			109.9			85.5	
Approach LOS		B			B			F			F	

Intersection Summary					
HCM 2000 Control Delay	48.4	HCM 2000 Level of Service		D	
HCM 2000 Volume to Capacity ratio	1.24				
Actuated Cycle Length (s)	60.0	Sum of lost time (s)		10.0	
Intersection Capacity Utilization	86.1%	ICU Level of Service		E	
Analysis Period (min)	15				

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Howard Street & Beale Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	52	521	484	0	0	0	0	126	81	71	413	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0			5.0	
Lane Util. Factor		0.91	*0.57					0.95			*0.80	
Frpb, ped/bikes		0.92	0.63					0.88			1.00	
Flpb, ped/bikes		0.98	1.00					1.00			0.96	
Frt		0.97	0.85					0.94			1.00	
Flt Protected		1.00	1.00					1.00			0.99	
Satd. Flow (prot)		2661	409					2639			2552	
Flt Permitted		1.00	1.00					1.00			0.86	
Satd. Flow (perm)		2661	409					2639			2222	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	57	566	526	0	0	0	0	137	88	77	449	0
RTOR Reduction (vph)	0	13	17	0	0	0	0	60	0	0	0	0
Lane Group Flow (vph)	0	784	335	0	0	0	0	165	0	0	526	0
Confl. Peds. (#/hr)	191		191				156		156	207		207
Parking (#/hr)	20		20						20			
Turn Type	Perm	NA	Perm					NA		Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6		6							8		
Actuated Green, G (s)		31.0	31.0					19.0			19.0	
Effective Green, g (s)		31.0	31.0					19.0			19.0	
Actuated g/C Ratio		0.52	0.52					0.32			0.32	
Clearance Time (s)		5.0	5.0					5.0			5.0	
Lane Grp Cap (vph)		1374	211					835			703	
v/s Ratio Prot								0.06				
v/s Ratio Perm		0.29	c0.82								c0.24	
v/c Ratio		0.57	1.59					0.20			0.75	
Uniform Delay, d1		9.9	14.5					14.9			18.4	
Progression Factor		0.39	0.65					1.00			0.62	
Incremental Delay, d2		1.1	277.5					0.5			2.6	
Delay (s)		4.9	286.9					15.5			13.9	
Level of Service		A	F					B			B	
Approach Delay (s)		91.3			0.0			15.5			13.9	
Approach LOS		F			A			B			B	

Intersection Summary					
HCM 2000 Control Delay	60.9	HCM 2000 Level of Service		E	
HCM 2000 Volume to Capacity ratio	1.27				
Actuated Cycle Length (s)	60.0	Sum of lost time (s)		10.0	
Intersection Capacity Utilization	65.9%	ICU Level of Service		C	
Analysis Period (min)	15				

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Mission Street & Beale Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	68	769	111	0	0	0	0	422	238	72	259	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0						4.0		4.0	4.0	
Lane Util. Factor	1.00	0.91						*0.50		1.00	*0.50	
Frpb, ped/bikes	1.00	0.90						0.86		1.00	1.00	
Flpb, ped/bikes	0.56	1.00						1.00		0.92	1.00	
Frt	1.00	0.98						0.95		1.00	1.00	
Flt Protected	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (prot)	714	4050						1322		1431	1629	
Flt Permitted	0.95	1.00						1.00		0.13	1.00	
Satd. Flow (perm)	714	4050						1322		194	1629	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	74	836	121	0	0	0	0	459	259	78	282	0
RTOR Reduction (vph)	0	32	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	74	925	0	0	0	0	0	718	0	78	282	0
Confl. Peds. (#/hr)	888		989						659	659		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	5%	5%	5%	5%	5%
Parking (#/hr)	20		20						20			
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6									8		
Actuated Green, G (s)	21.0	21.0						31.0		31.0	31.0	
Effective Green, g (s)	21.0	21.0						31.0		31.0	31.0	
Actuated g/C Ratio	0.35	0.35						0.52		0.52	0.52	
Clearance Time (s)	4.0	4.0						4.0		4.0	4.0	
Lane Grp Cap (vph)	249	1417						683		100	841	
v/s Ratio Prot		c0.23						c0.54			0.17	
v/s Ratio Perm	0.10									0.40		
v/c Ratio	0.30	0.65						1.05		0.78	0.34	
Uniform Delay, d1	14.1	16.4						14.5		11.7	8.5	
Progression Factor	1.00	1.00						1.00		1.02	1.06	
Incremental Delay, d2	3.0	2.4						48.7		41.1	1.0	
Delay (s)	17.2	18.8						63.2		53.1	9.9	
Level of Service	B	B						E		D	A	
Approach Delay (s)		18.7			0.0			63.2			19.3	
Approach LOS		B			A			E			B	

Intersection Summary				
HCM 2000 Control Delay	33.9	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.89			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0	
Intersection Capacity Utilization	60.5%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis
10: Howard Street & Main Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	14	597	127	69	90	0	0	461	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					3.5			3.5			3.5	
Lane Util. Factor					0.91			*0.50			*0.60	
Frpb, ped/bikes					0.97			1.00			0.92	
Flpb, ped/bikes					1.00			1.00			1.00	
Frt					0.97			1.00			0.95	
Flt Protected					1.00			0.98			1.00	
Satd. Flow (prot)					4324			1641			1753	
Flt Permitted					1.00			0.63			1.00	
Satd. Flow (perm)					4324			1051			1753	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	15	649	138	75	98	0	0	501	245
RTOR Reduction (vph)	0	0	0	0	53	0	0	0	0	0	39	0
Lane Group Flow (vph)	0	0	0	0	749	0	0	173	0	0	707	0
Confl. Peds. (#/hr)				130		130	140		140	220		220
Parking (#/hr)												20
Turn Type				Perm	NA		pm+pt	NA			NA	
Protected Phases					2		7	4			8	
Permitted Phases				2			4					
Actuated Green, G (s)					20.0			33.0			25.0	
Effective Green, g (s)					20.0			33.0			25.0	
Actuated g/C Ratio					0.33			0.55			0.42	
Clearance Time (s)					3.5			3.5			3.5	
Lane Grp Cap (vph)					1441			617			730	
v/s Ratio Prot								c0.02			c0.40	
v/s Ratio Perm					0.17			0.14				
v/c Ratio					0.52			0.28			0.97	
Uniform Delay, d1					16.1			7.2			17.1	
Progression Factor					1.00			0.69			1.00	
Incremental Delay, d2					1.3			1.1			26.4	
Delay (s)					17.5			6.0			43.5	
Level of Service					B			A			D	
Approach Delay (s)		0.0			17.5			6.0			43.5	
Approach LOS		A			B			A			D	

Intersection Summary				
HCM 2000 Control Delay	27.6	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.73			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.0	
Intersection Capacity Utilization	65.5%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis
11: Mission Street & Main Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	162	596	141	155	298	0	0	136	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.5			4.0	
Lane Util. Factor					0.91		1.00	1.00			0.95	
Frpb, ped/bikes					0.92		1.00	1.00			0.89	
Flpb, ped/bikes					0.95		0.91	1.00			1.00	
Frt					0.98		1.00	1.00			0.95	
Flt Protected					0.99		0.95	1.00			1.00	
Satd. Flow (prot)					3852		1402	1629			2631	
Flt Permitted					0.99		0.50	1.00			1.00	
Satd. Flow (perm)					3852		744	1629			2631	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	176	648	153	168	324	0	0	148	73
RTOR Reduction (vph)	0	0	0	0	45	0	0	0	0	0	50	0
Lane Group Flow (vph)	0	0	0	0	932	0	168	324	0	0	171	0
Confl. Peds. (#/hr)				275		275	290		290	325		325
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	5%	5%	5%	5%	5%
Parking (#/hr)				20		20			20			
Turn Type				Perm	NA		pm+pt	NA			NA	
Protected Phases					2		7	4			8	
Permitted Phases				2			4					
Actuated Green, G (s)					21.0		30.5	30.5			19.0	
Effective Green, g (s)					21.0		30.5	30.5			19.0	
Actuated g/C Ratio					0.35		0.51	0.51			0.32	
Clearance Time (s)					4.0		4.0	4.5			4.0	
Lane Grp Cap (vph)					1348		465	828			833	
v/s Ratio Prot							0.05	c0.20			0.07	
v/s Ratio Perm					0.24		0.14					
v/c Ratio					0.69		0.36	0.39			0.21	
Uniform Delay, d1					16.7		8.4	9.1			15.0	
Progression Factor					0.52		0.73	0.68			1.00	
Incremental Delay, d2					2.3		0.7	0.5			0.6	
Delay (s)					11.0		6.9	6.6			15.5	
Level of Service					B		A	A			B	
Approach Delay (s)		0.0			11.0			6.7			15.5	
Approach LOS		A			B			A			B	

Intersection Summary				
HCM 2000 Control Delay	10.3	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.55			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	60.5%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis
2: Townsend Street & Third Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	79	1212	345	283	296	0	0	295	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	4.0
Lane Util. Factor					0.86		1.00	1.00			1.00	1.00
Frpb, ped/bikes					0.96		1.00	1.00			1.00	0.80
Flpb, ped/bikes					0.99		0.98	1.00			1.00	1.00
Frt					0.97		1.00	1.00			1.00	0.85
Flt Protected					1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)					5303		1555	1676			1676	908
Flt Permitted					1.00		0.31	1.00			1.00	1.00
Satd. Flow (perm)					5303		515	1676			1676	908
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	86	1317	375	308	322	0	0	321	77
RTOR Reduction (vph)	0	0	0	0	81	0	0	0	0	0	0	55
Lane Group Flow (vph)	0	0	0	0	1698	0	308	322	0	0	321	22
Confl. Peds. (#/hr)				100		100	100		100	100		100
Parking (#/hr)				20		20			20			20
Turn Type				Perm	NA		pm+pt	NA			NA	Perm
Protected Phases					2		7	4			8	
Permitted Phases				2			4					8
Actuated Green, G (s)					25.0		27.0	27.0			17.0	17.0
Effective Green, g (s)					25.0		27.0	27.0			17.0	17.0
Actuated g/C Ratio					0.42		0.45	0.45			0.28	0.28
Clearance Time (s)					4.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)					2209		335	754			474	257
v/s Ratio Prot							c0.09	0.19			0.19	
v/s Ratio Perm					0.32		c0.32					0.02
v/c Ratio					0.77		0.92	0.43			0.68	0.08
Uniform Delay, d1					15.0		14.6	11.2			19.1	15.8
Progression Factor					1.00		1.61	0.45			1.00	1.00
Incremental Delay, d2					2.6		29.9	1.6			7.6	0.6
Delay (s)					17.7		53.4	6.6			26.6	16.4
Level of Service					B		D	A			C	B
Approach Delay (s)		0.0			17.7			29.5			24.7	
Approach LOS		A			B			C			C	

Intersection Summary				
HCM 2000 Control Delay	21.3	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.90			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	73.2%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Harrison Street & Third Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	210	2010	270	0	0	0	0	1450	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5	4.5					4.5	
Lane Util. Factor				*0.80	*0.80	*0.80					*0.80	
Frpb, ped/bikes				1.00	1.00	0.88					0.98	
Flpb, ped/bikes				0.81	1.00	1.00					1.00	
Frt				1.00	1.00	0.85					0.98	
Flt Protected				0.95	1.00	1.00					1.00	
Satd. Flow (prot)				1035	4024	801					3868	
Flt Permitted				0.95	1.00	1.00					1.00	
Satd. Flow (perm)				1035	4024	801					3868	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	228	2185	293	0	0	0	0	1576	196
RTOR Reduction (vph)	0	0	0	14	0	147	0	0	0	0	1	0
Lane Group Flow (vph)	0	0	0	215	2185	147	0	0	0	0	1771	0
Confl. Peds. (#/hr)				100		100				100		100
Parking (#/hr)						20	20		20	20		20
Turn Type				Perm	NA	Perm					NA	
Protected Phases					2						8	
Permitted Phases				2		2						
Actuated Green, G (s)				30.0	30.0	30.0					21.0	
Effective Green, g (s)				30.0	30.0	30.0					21.0	
Actuated g/C Ratio				0.50	0.50	0.50					0.35	
Clearance Time (s)				4.5	4.5	4.5					4.5	
Lane Grp Cap (vph)				517	2012	400					1353	
v/s Ratio Prot					c0.54						c0.46	
v/s Ratio Perm				0.21		0.18						
v/c Ratio				0.41	1.09	0.37					1.31	
Uniform Delay, d1				9.5	15.0	9.2					19.5	
Progression Factor				0.54	0.46	0.43					0.80	
Incremental Delay, d2				1.6	45.0	1.7					144.5	
Delay (s)				6.7	51.9	5.7					160.1	
Level of Service				A	D	A					F	
Approach Delay (s)		0.0			43.1			0.0			160.1	
Approach LOS		A			D			A			F	

Intersection Summary				
HCM 2000 Control Delay	89.4	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.18			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.0	
Intersection Capacity Utilization	86.9%	ICU Level of Service	E	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Howard Street & Beale Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	81	269	226	0	0	0	0	367	52	30	274	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0			5.0	
Lane Util. Factor		0.95	*0.57					1.00			*0.80	
Frpb, ped/bikes		1.00	0.63					0.96			1.00	
Flpb, ped/bikes		0.92	1.00					1.00			0.99	
Frt		1.00	0.85					0.98			1.00	
Flt Protected		0.99	1.00					1.00			1.00	
Satd. Flow (prot)		2888	409					1585			2629	
Flt Permitted		0.99	1.00					1.00			0.81	
Satd. Flow (perm)		2888	409					1585			2148	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	292	246	0	0	0	0	399	57	33	298	0
RTOR Reduction (vph)	0	0	26	0	0	0	0	9	0	0	0	0
Lane Group Flow (vph)	0	380	220	0	0	0	0	447	0	0	331	0
Confl. Peds. (#/hr)	191		191				156		156	207		207
Parking (#/hr)	20		20						20			
Turn Type	Perm	NA	Perm					NA		Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6		6							8		
Actuated Green, G (s)		31.0	31.0					19.0			19.0	
Effective Green, g (s)		31.0	31.0					19.0			19.0	
Actuated g/C Ratio		0.52	0.52					0.32			0.32	
Clearance Time (s)		5.0	5.0					5.0			5.0	
Lane Grp Cap (vph)		1492	211					501			680	
v/s Ratio Prot								c0.28				
v/s Ratio Perm		0.13	c0.54								0.15	
v/c Ratio		0.25	1.04					0.89			0.49	
Uniform Delay, d1		8.1	14.5					19.5			16.6	
Progression Factor		0.59	0.68					1.00			0.53	
Incremental Delay, d2		0.3	67.6					20.8			1.9	
Delay (s)		5.1	77.5					40.4			10.6	
Level of Service		A	E					D			B	
Approach Delay (s)		33.6			0.0			40.4			10.6	
Approach LOS		C			A			D			B	

Intersection Summary				
HCM 2000 Control Delay	30.4	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.98			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	56.0%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Mission Street & Beale Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	102	433	110	0	0	0	0	600	169	76	246	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95	1.00					*0.50	1.00	1.00	*0.50	
Frpb, ped/bikes		1.00	0.39					1.00	0.60	1.00	1.00	
Flpb, ped/bikes		0.93	1.00					1.00	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		0.99	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		2940	445					814	664	1547	814	
Flt Permitted		0.99	1.00					1.00	1.00	0.13	1.00	
Satd. Flow (perm)		2940	445					814	664	210	814	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	111	471	120	0	0	0	0	652	184	83	267	0
RTOR Reduction (vph)	0	0	78	0	0	0	0	0	9	0	0	0
Lane Group Flow (vph)	0	582	42	0	0	0	0	652	175	83	267	0
Confl. Peds. (#/hr)	520		537						693	693		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	5%	5%	5%	5%	5%
Parking (#/hr)	20		20						20			
Turn Type	Perm	NA	Perm					NA	Perm	Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6		6						4	8		
Actuated Green, G (s)		21.0	21.0					31.0	31.0	31.0	31.0	
Effective Green, g (s)		21.0	21.0					31.0	31.0	31.0	31.0	
Actuated g/C Ratio		0.35	0.35					0.52	0.52	0.52	0.52	
Clearance Time (s)		4.0	4.0					4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)		1029	155					420	343	108	420	
v/s Ratio Prot								c0.80			0.33	
v/s Ratio Perm		0.20	0.09						0.26	0.39		
v/c Ratio		0.57	0.27					1.55	0.51	0.77	0.64	
Uniform Delay, d1		15.8	14.0					14.5	9.5	11.6	10.4	
Progression Factor		1.00	1.00					1.00	1.00	0.88	0.84	
Incremental Delay, d2		2.3	4.3					260.1	5.4	34.2	5.9	
Delay (s)		18.1	18.3					274.6	14.9	44.5	14.7	
Level of Service		B	B					F	B	D	B	
Approach Delay (s)		18.1			0.0			217.4			21.7	
Approach LOS		B			A			F			C	

Intersection Summary				
HCM 2000 Control Delay	107.0	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.15			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0	
Intersection Capacity Utilization	102.9%	ICU Level of Service	G	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
10: Howard Street & Main Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	13	764	164	129	302	0	0	276	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					3.5			3.5			3.5	
Lane Util. Factor					0.95			*0.50			*0.60	
Frpb, ped/bikes					0.95			1.00			0.90	
Flpb, ped/bikes					1.00			0.99			1.00	
Frt					0.97			1.00			0.94	
Flt Protected					1.00			0.99			1.00	
Satd. Flow (prot)					2954			819			1710	
Flt Permitted					1.00			0.53			1.00	
Satd. Flow (perm)					2954			439			1710	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	14	830	178	140	328	0	0	300	188
RTOR Reduction (vph)	0	0	0	0	29	0	0	0	0	0	51	0
Lane Group Flow (vph)	0	0	0	0	993	0	0	468	0	0	437	0
Confl. Peds. (#/hr)				130		130	140		140	220		220
Parking (#/hr)												20
Turn Type				Perm	NA		pm+pt	NA			NA	
Protected Phases					2		7	4			8	
Permitted Phases				2			4					
Actuated Green, G (s)					20.0			33.0			25.0	
Effective Green, g (s)					20.0			33.0			25.0	
Actuated g/C Ratio					0.33			0.55			0.42	
Clearance Time (s)					3.5			3.5			3.5	
Lane Grp Cap (vph)					984			266			712	
v/s Ratio Prot								c0.12			0.26	
v/s Ratio Perm					0.34			c0.85				
v/c Ratio					1.01			1.76			0.61	
Uniform Delay, d1					20.0			13.5			13.7	
Progression Factor					1.00			1.61			1.00	
Incremental Delay, d2					30.9			351.0			3.9	
Delay (s)					50.9			372.7			17.6	
Level of Service					D			F			B	
Approach Delay (s)		0.0			50.9			372.7			17.6	
Approach LOS		A			D			F			B	

Intersection Summary				
HCM 2000 Control Delay	118.8	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.57			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.0	
Intersection Capacity Utilization	84.2%	ICU Level of Service	E	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
11: Mission Street & Main Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	122	691	141	281	407	0	0	165	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.5			4.0	4.0
Lane Util. Factor					0.95		1.00	1.00			1.00	1.00
Frpb, ped/bikes					0.92		1.00	1.00			1.00	0.68
Flpb, ped/bikes					0.96		0.90	1.00			1.00	1.00
Frt					0.98		1.00	1.00			1.00	0.85
Flt Protected					0.99		0.95	1.00			1.00	1.00
Satd. Flow (prot)					2750		1392	1629			1629	943
Flt Permitted					0.99		0.51	1.00			1.00	1.00
Satd. Flow (perm)					2750		754	1629			1629	943
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	133	751	153	305	442	0	0	179	98
RTOR Reduction (vph)	0	0	0	0	23	0	0	0	0	0	0	62
Lane Group Flow (vph)	0	0	0	0	1014	0	305	442	0	0	179	36
Confl. Peds. (#/hr)				275		275	290		290	325		325
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	5%	5%	5%	5%	5%
Parking (#/hr)				20		20			20			
Turn Type				Perm	NA		pm+pt	NA			NA	Perm
Protected Phases					2		7	4			8	
Permitted Phases				2			4					8
Actuated Green, G (s)					21.0		30.5	30.5			19.0	19.0
Effective Green, g (s)					21.0		30.5	30.5			19.0	19.0
Actuated g/C Ratio					0.35		0.51	0.51			0.32	0.32
Clearance Time (s)					4.0		4.0	4.5			4.0	4.0
Lane Grp Cap (vph)					962		468	828			515	298
v/s Ratio Prot							c0.09	0.27			0.11	
v/s Ratio Perm					0.37		c0.24					0.04
v/c Ratio					1.05		0.65	0.53			0.35	0.12
Uniform Delay, d1					19.5		9.6	10.0			15.7	14.6
Progression Factor					0.88		0.79	0.68			1.00	1.00
Incremental Delay, d2					27.1		0.6	0.2			1.9	0.8
Delay (s)					44.3		8.3	7.0			17.6	15.4
Level of Service					D		A	A			B	B
Approach Delay (s)		0.0			44.3			7.5			16.8	
Approach LOS		A			D			A			B	

Intersection Summary				
HCM 2000 Control Delay	27.3	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.87			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	102.9%	ICU Level of Service	G	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Townsend Street & Fourth Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	570	270	0	280	200	0	410	510	290	460	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor		*0.92			*0.92	*0.92		*0.92	*0.92	*0.92	*0.92	
Frpb, ped/bikes		0.93			1.00	0.80		1.00	0.88	1.00	0.98	
Flpb, ped/bikes		1.00			1.00	1.00		1.00	1.00	0.98	1.00	
Frt		0.95			1.00	0.85		1.00	0.85	1.00	0.99	
Flt Protected		1.00			1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)		2744			1542	1044		3085	921	1433	1490	
Flt Permitted		1.00			1.00	1.00		1.00	1.00	0.42	1.00	
Satd. Flow (perm)		2744			1542	1044		3085	921	640	1490	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	620	293	0	304	217	0	446	554	315	500	54
RTOR Reduction (vph)	0	82	0	0	0	127	0	0	75	0	7	0
Lane Group Flow (vph)	0	831	0	0	304	90	0	446	479	315	547	0
Confl. Peds. (#/hr)	100		100	100		100	100		100	100		100
Parking (#/hr)									20			20
Turn Type		NA			NA	Perm		NA	Perm	pm+pt	NA	
Protected Phases		6			2			4		3	8	
Permitted Phases						2			4	8		
Actuated Green, G (s)		25.0			25.0	25.0		17.0	17.0	27.0	27.0	
Effective Green, g (s)		25.0			25.0	25.0		17.0	17.0	27.0	27.0	
Actuated g/C Ratio		0.42			0.42	0.42		0.28	0.28	0.45	0.45	
Clearance Time (s)		4.0			4.0	4.0		4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)		1143			642	435		874	260	367	670	
v/s Ratio Prot		c0.30			0.20			0.14		0.09	c0.37	
v/s Ratio Perm						0.09			c0.52	0.30		
v/c Ratio		0.73			0.47	0.21		0.51	1.84	0.86	0.82	
Uniform Delay, d1		14.6			12.7	11.2		18.0	21.5	16.5	14.4	
Progression Factor		1.00			1.00	1.00		1.00	1.00	1.65	1.84	
Incremental Delay, d2		4.1			2.5	1.1		2.1	394.4	2.6	1.1	
Delay (s)		18.7			15.2	12.3		20.1	415.9	29.9	27.4	
Level of Service		B			B	B		C	F	C	C	
Approach Delay (s)		18.7			14.0			239.4			28.3	
Approach LOS		B			B			F			C	

Intersection Summary				
HCM 2000 Control Delay	87.3	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.17			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	97.9%	ICU Level of Service	F	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: Townsend Street & Third Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	75	1916	488	271	299	0	0	593	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.0			4.0	4.0
Lane Util. Factor					*0.70		1.00	1.00			1.00	1.00
Frpb, ped/bikes					0.96		1.00	1.00			1.00	0.80
Flpb, ped/bikes					1.00		1.00	1.00			1.00	1.00
Frt					0.97		1.00	1.00			1.00	0.85
Flt Protected					1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)					4352		1593	1676			1676	908
Flt Permitted					1.00		0.19	1.00			1.00	1.00
Satd. Flow (perm)					4352		319	1676			1676	908
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	82	2083	530	295	325	0	0	645	150
RTOR Reduction (vph)	0	0	0	0	74	0	0	0	0	0	0	65
Lane Group Flow (vph)	0	0	0	0	2622	0	295	325	0	0	645	85
Confl. Peds. (#/hr)				100		100	100		100	100		100
Parking (#/hr)				20		20			20			20
Turn Type				Perm	NA		pm+pt	NA			NA	Perm
Protected Phases					2		7	4			8	
Permitted Phases				2			4					8
Actuated Green, G (s)					25.0		27.0	27.0			17.0	17.0
Effective Green, g (s)					25.0		27.0	27.0			17.0	17.0
Actuated g/C Ratio					0.42		0.45	0.45			0.28	0.28
Clearance Time (s)					4.0		4.0	4.0			4.0	4.0
Lane Grp Cap (vph)					1813		270	754			474	257
v/s Ratio Prot							c0.11	0.19			c0.38	
v/s Ratio Perm					0.60		0.38					0.09
v/c Ratio					1.45		1.09	0.43			1.36	0.33
Uniform Delay, d1					17.5		15.0	11.3			21.5	17.0
Progression Factor					1.00		2.11	0.42			1.00	1.00
Incremental Delay, d2					203.8		78.9	1.6			175.6	3.4
Delay (s)					221.3		110.7	6.4			197.1	20.4
Level of Service					F		F	A			F	C
Approach Delay (s)		0.0			221.3			56.0			163.7	
Approach LOS		A			F			E			F	

Intersection Summary				
HCM 2000 Control Delay	185.3	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.38			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	103.7%	ICU Level of Service	G	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: Bryant Street & Third Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	0	1909	608	401	1081	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					3.5	3.5	3.5	3.5				
Lane Util. Factor					0.91	1.00	*0.40	*0.40				
Frpb, ped/bikes					1.00	0.88	1.00	1.00				
Flpb, ped/bikes					1.00	1.00	0.89	1.00				
Frt					1.00	0.85	1.00	1.00				
Flt Protected					1.00	1.00	0.95	1.00				
Satd. Flow (prot)					4577	1001	1018	2012				
Flt Permitted					1.00	1.00	0.95	1.00				
Satd. Flow (perm)					4577	1001	1018	2012				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	2075	661	436	1175	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	12	5	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	2075	649	431	1175	0	0	0	0
Confl. Peds. (#/hr)				100		100	100		100			
Parking (#/hr)				20		20	20		20			
Turn Type					NA	Perm	Perm	NA				
Protected Phases					2			4				
Permitted Phases						2	4					
Actuated Green, G (s)					25.0	25.0	28.0	28.0				
Effective Green, g (s)					25.0	25.0	28.0	28.0				
Actuated g/C Ratio					0.42	0.42	0.47	0.47				
Clearance Time (s)					3.5	3.5	3.5	3.5				
Lane Grp Cap (vph)					1907	417	475	938				
v/s Ratio Prot					0.45			c0.58				
v/s Ratio Perm						c0.65	0.42					
v/c Ratio					1.09	1.56	0.91	1.25				
Uniform Delay, d1					17.5	17.5	14.8	16.0				
Progression Factor					1.00	1.00	1.00	1.00				
Incremental Delay, d2					49.1	262.3	23.7	122.5				
Delay (s)					66.6	279.8	38.5	138.5				
Level of Service					E	F	D	F				
Approach Delay (s)		0.0			118.1			111.5			0.0	
Approach LOS		A			F			F			A	

Intersection Summary				
HCM 2000 Control Delay	115.6	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.40			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	7.0	
Intersection Capacity Utilization	77.7%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
4: Perry Street & Third Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	0	0	0	4	2118	4	3	0	0	0	0	9
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	4	2302	4	3	0	0	0	0	10
Pedestrians		100			100			100			100	
Lane Width (ft)		0.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			8			8			8	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		112			260							
pX, platoon unblocked	0.66						0.66	0.66		0.66	0.66	0.66
vC, conflicting volume	2407			100			794	2515	200	2513	2513	778
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	570			100			0	735	200	731	731	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			99	100	100	100	100	99
cM capacity (veh/h)	606			1366			535	192	679	151	192	658

Direction, Lane #	NW 1	NW 2	NW 3	NW 4	NE 1	SW 1
Volume Total	388	767	767	388	3	10
Volume Left	4	0	0	0	3	0
Volume Right	0	0	0	4	0	10
cSH	1366	1700	1700	1700	535	658
Volume to Capacity	0.00	0.45	0.45	0.23	0.01	0.01
Queue Length 95th (ft)	0	0	0	0	0	1
Control Delay (s)	0.1	0.0	0.0	0.0	11.8	10.6
Lane LOS	A				B	B
Approach Delay (s)	0.0				11.8	10.6
Approach LOS					B	B

Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	54.0%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis
5: Harrison Street & Third Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	380	1740	390	0	0	0	0	2010	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5	4.5					4.5	
Lane Util. Factor				*0.80	*0.80	*0.80					*0.80	
Frpb, ped/bikes				1.00	1.00	0.88					0.99	
Flpb, ped/bikes				0.81	1.00	1.00					1.00	
Frt				1.00	1.00	0.85					0.99	
Flt Protected				0.95	1.00	1.00					1.00	
Satd. Flow (prot)				1035	4024	801					3931	
Flt Permitted				0.95	1.00	1.00					1.00	
Satd. Flow (perm)				1035	4024	801					3931	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	413	1891	424	0	0	0	0	2185	152
RTOR Reduction (vph)	0	0	0	14	0	212	0	0	0	0	2	0
Lane Group Flow (vph)	0	0	0	400	1891	212	0	0	0	0	2335	0
Confl. Peds. (#/hr)				100		100				100		100
Parking (#/hr)						20	20		20	20		20
Turn Type				Perm	NA	Perm					NA	
Protected Phases					2						8	
Permitted Phases				2		2						
Actuated Green, G (s)				30.0	30.0	30.0					21.0	
Effective Green, g (s)				30.0	30.0	30.0					21.0	
Actuated g/C Ratio				0.50	0.50	0.50					0.35	
Clearance Time (s)				4.5	4.5	4.5					4.5	
Lane Grp Cap (vph)				517	2012	400					1375	
v/s Ratio Prot					c0.47						c0.59	
v/s Ratio Perm				0.39		0.26						
v/c Ratio				0.77	0.94	0.53					1.70	
Uniform Delay, d1				12.2	14.1	10.2					19.5	
Progression Factor				0.49	0.49	1.85					0.82	
Incremental Delay, d2				4.8	5.0	2.2					317.2	
Delay (s)				10.8	12.0	21.0					333.3	
Level of Service				B	B	C					F	
Approach Delay (s)		0.0			13.2			0.0			333.3	
Approach LOS		A			B			A			F	

Intersection Summary				
HCM 2000 Control Delay	160.9	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.25			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	9.0	
Intersection Capacity Utilization	91.9%	ICU Level of Service	F	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
6: Bryant Street & Second Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	495	0	0	492	120	287	1278	89	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5			3.5	3.5	3.5	3.5				
Lane Util. Factor		*0.35			*0.35	*0.35	*0.35	*0.35				
Frpb, ped/bikes		1.00			1.00	0.80	1.00	0.99				
Flpb, ped/bikes		1.00			1.00	1.00	0.89	1.00				
Frt		1.00			1.00	0.85	1.00	0.99				
Flt Protected		1.00			1.00	1.00	0.95	1.00				
Satd. Flow (prot)		570			1140	309	865	1671				
Flt Permitted		1.00			1.00	1.00	0.95	1.00				
Satd. Flow (perm)		570			1140	309	865	1671				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	538	0	0	535	130	312	1389	97	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	5	0	4	0	0	0	0
Lane Group Flow (vph)	0	538	0	0	535	125	312	1482	0	0	0	0
Confl. Peds. (#/hr)	100		100	100		100	100		100			
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	2%	2%	2%
Parking (#/hr)			20			20	20		20			
Turn Type		NA			NA	Perm	Perm	NA				
Protected Phases		6			2			4				
Permitted Phases						2	4					
Actuated Green, G (s)		26.0			26.0	26.0	27.0	27.0				
Effective Green, g (s)		26.0			26.0	26.0	27.0	27.0				
Actuated g/C Ratio		0.43			0.43	0.43	0.45	0.45				
Clearance Time (s)		3.5			3.5	3.5	3.5	3.5				
Lane Grp Cap (vph)		247			494	133	389	751				
v/s Ratio Prot		c0.94			0.47			c0.89				
v/s Ratio Perm						0.40	0.36					
v/c Ratio		2.18			1.08	0.94	0.80	1.97				
Uniform Delay, d1		17.0			17.0	16.2	14.2	16.5				
Progression Factor		0.66			1.00	1.00	1.04	1.01				
Incremental Delay, d2		535.1			64.8	63.2	1.7	438.2				
Delay (s)		546.3			81.8	79.4	16.4	454.8				
Level of Service		F			F	E	B	F				
Approach Delay (s)		546.3			81.3			378.7			0.0	
Approach LOS		F			F			F			A	

Intersection Summary				
HCM 2000 Control Delay	342.9	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	2.07			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	7.0	
Intersection Capacity Utilization	65.6%	ICU Level of Service	C	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: Harrison Street & Second Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	276	219	0	131	723	24	554	33	120	823	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0		5.0		5.0	5.0	
Lane Util. Factor		1.00	1.00		0.95	*0.45		*0.30		*0.50	0.95	
Frpb, ped/bikes		1.00	0.88		0.86	0.80		0.99		1.00	0.99	
Flpb, ped/bikes		1.00	1.00		1.00	1.00		1.00		1.00	1.00	
Frt		1.00	0.85		0.90	0.85		0.99		1.00	0.99	
Flt Protected		1.00	1.00		1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1676	1001		1223	511		983		796	3138	
Flt Permitted		1.00	1.00		1.00	1.00		0.90		0.15	1.00	
Satd. Flow (perm)		1676	1001		1223	511		885		129	3138	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	300	238	0	142	786	26	602	36	130	895	39
RTOR Reduction (vph)	0	0	22	0	56	56	0	2	0	0	5	0
Lane Group Flow (vph)	0	300	216	0	416	400	0	662	0	130	929	0
Confl. Peds. (#/hr)	100		100	100		100	100		100	100		100
Parking (#/hr)			20						20			20
Turn Type		NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		6			2			4			8	
Permitted Phases			6	2		2	4			8		
Actuated Green, G (s)		24.0	24.0		24.0	24.0		26.0		26.0	26.0	
Effective Green, g (s)		24.0	24.0		24.0	24.0		26.0		26.0	26.0	
Actuated g/C Ratio		0.40	0.40		0.40	0.40		0.43		0.43	0.43	
Clearance Time (s)		5.0	5.0		5.0	5.0		5.0		5.0	5.0	
Lane Grp Cap (vph)		670	400		489	204		383		55	1359	
v/s Ratio Prot		0.18			0.34						0.30	
v/s Ratio Perm			0.22			c0.78		0.75		c1.01		
v/c Ratio		0.45	0.54		0.85	1.96		1.73		2.36	0.68	
Uniform Delay, d1		13.2	13.8		16.4	18.0		17.0		17.0	13.7	
Progression Factor		1.00	1.00		0.97	0.90		0.84		1.00	1.00	
Incremental Delay, d2		2.2	5.2		8.0	440.3		337.4		665.9	2.8	
Delay (s)		15.3	19.0		23.9	456.5		351.7		682.9	16.5	
Level of Service		B	B		C	F		F		F	B	
Approach Delay (s)		16.9			236.4			351.7			97.9	
Approach LOS		B			F			F			F	

Intersection Summary				
HCM 2000 Control Delay	177.3	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	2.15			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	86.6%	ICU Level of Service	E	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Howard Street & Beale Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	55	555	515	0	0	0	0	207	133	94	549	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0			5.0	
Lane Util. Factor		0.95	*0.57					1.00			*0.80	
Frpb, ped/bikes		1.00	0.63					0.88			1.00	
Flpb, ped/bikes		0.97	1.00					1.00			0.97	
Frt		1.00	0.85					0.95			1.00	
Flt Protected		1.00	1.00					1.00			0.99	
Satd. Flow (prot)		3068	409					1397			2589	
Flt Permitted		1.00	1.00					1.00			0.71	
Satd. Flow (perm)		3068	409					1397			1857	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	603	560	0	0	0	0	225	145	102	597	0
RTOR Reduction (vph)	0	0	17	0	0	0	0	39	0	0	0	0
Lane Group Flow (vph)	0	663	543	0	0	0	0	331	0	0	699	0
Confl. Peds. (#/hr)	191		191				156		156	207		207
Parking (#/hr)	20		20						20			
Turn Type	Perm	NA	Perm					NA		Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6		6							8		
Actuated Green, G (s)		31.0	31.0					19.0			19.0	
Effective Green, g (s)		31.0	31.0					19.0			19.0	
Actuated g/C Ratio		0.52	0.52					0.32			0.32	
Clearance Time (s)		5.0	5.0					5.0			5.0	
Lane Grp Cap (vph)		1585	211					442			588	
v/s Ratio Prot								0.24				
v/s Ratio Perm		0.22	c1.33								c0.38	
v/c Ratio		0.42	2.57					0.75			1.19	
Uniform Delay, d1		8.9	14.5					18.4			20.5	
Progression Factor		0.53	0.45					1.00			0.67	
Incremental Delay, d2		0.2	710.5					11.1			86.6	
Delay (s)		4.9	717.0					29.4			100.5	
Level of Service		A	F					C			F	
Approach Delay (s)		330.9			0.0			29.4			100.5	
Approach LOS		F			A			C			F	

Intersection Summary				
HCM 2000 Control Delay	212.0	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	2.04			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	75.1%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
9: Mission Street & Beale Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	72	819	118	0	0	0	0	692	390	96	344	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95	1.00					*0.50	1.00	1.00	*0.50	
Frpb, ped/bikes		1.00	0.22					1.00	0.61	1.00	1.00	
Flpb, ped/bikes		0.96	1.00					1.00	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3060	256					814	673	1547	814	
Flt Permitted		1.00	1.00					1.00	1.00	0.13	1.00	
Satd. Flow (perm)		3060	256					814	673	210	814	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	890	128	0	0	0	0	752	424	104	374	0
RTOR Reduction (vph)	0	0	83	0	0	0	0	0	9	0	0	0
Lane Group Flow (vph)	0	968	45	0	0	0	0	752	415	104	374	0
Confl. Peds. (#/hr)	888		989						659	659		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	5%	5%	5%	5%	5%
Parking (#/hr)	20		20						20			
Turn Type	Perm	NA	Perm					NA	Perm	Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6		6						4	8		
Actuated Green, G (s)		21.0	21.0					31.0	31.0	31.0	31.0	
Effective Green, g (s)		21.0	21.0					31.0	31.0	31.0	31.0	
Actuated g/C Ratio		0.35	0.35					0.52	0.52	0.52	0.52	
Clearance Time (s)		4.0	4.0					4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)		1071	89					420	347	108	420	
v/s Ratio Prot								c0.92			0.46	
v/s Ratio Perm		0.32	0.18						0.62	0.49		
v/c Ratio		0.90	0.50					1.79	1.20	0.96	0.89	
Uniform Delay, d1		18.5	15.4					14.5	14.5	13.9	13.0	
Progression Factor		1.00	1.00					1.00	1.00	0.84	0.84	
Incremental Delay, d2		12.3	18.9					365.2	113.2	61.8	17.3	
Delay (s)		30.8	34.3					379.7	127.7	73.4	28.2	
Level of Service		C	C					F	F	E	C	
Approach Delay (s)		31.2			0.0			288.8			38.1	
Approach LOS		C			A			F			D	

Intersection Summary				
HCM 2000 Control Delay	142.6	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.43			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0	
Intersection Capacity Utilization	123.1%	ICU Level of Service	H	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
10: Howard Street & Main Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	17	737	157	113	148	0	0	613	299
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					3.5			3.5			3.5	
Lane Util. Factor					0.95			*0.50			*0.60	
Frpb, ped/bikes					0.96			1.00			0.92	
Flpb, ped/bikes					1.00			1.00			1.00	
Frt					0.97			1.00			0.95	
Flt Protected					1.00			0.98			1.00	
Satd. Flow (prot)					2953			820			1753	
Flt Permitted					1.00			0.17			1.00	
Satd. Flow (perm)					2953			146			1753	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	18	801	171	123	161	0	0	666	325
RTOR Reduction (vph)	0	0	0	0	29	0	0	0	0	0	39	0
Lane Group Flow (vph)	0	0	0	0	961	0	0	284	0	0	952	0
Confl. Peds. (#/hr)				130		130	140		140	220		220
Parking (#/hr)												20
Turn Type				Perm	NA		pm+pt	NA			NA	
Protected Phases					2		7	4			8	
Permitted Phases				2			4					
Actuated Green, G (s)					20.0			33.0			25.0	
Effective Green, g (s)					20.0			33.0			25.0	
Actuated g/C Ratio					0.33			0.55			0.42	
Clearance Time (s)					3.5			3.5			3.5	
Lane Grp Cap (vph)					984			125			730	
v/s Ratio Prot								c0.15			0.54	
v/s Ratio Perm					0.33			c1.10				
v/c Ratio					0.98			2.27			1.30	
Uniform Delay, d1					19.8			13.5			17.5	
Progression Factor					1.00			2.46			1.00	
Incremental Delay, d2					23.5			590.0			146.7	
Delay (s)					43.3			623.2			164.2	
Level of Service					D			F			F	
Approach Delay (s)		0.0			43.3			623.2			164.2	
Approach LOS		A			D			F			F	

Intersection Summary				
HCM 2000 Control Delay	168.9	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.87			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	11.0	
Intersection Capacity Utilization	87.6%	ICU Level of Service	E	
Analysis Period (min)	15			

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
11: Mission Street & Main Street

1/9/2014

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	0	0	0	200	736	174	254	489	0	0	181	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.0		4.0	4.5			4.0	4.0
Lane Util. Factor					0.95		1.00	1.00			1.00	1.00
Frpb, ped/bikes					0.92		1.00	1.00			1.00	0.68
Flpb, ped/bikes					0.95		0.91	1.00			1.00	1.00
Frt					0.98		1.00	1.00			1.00	0.85
Flt Protected					0.99		0.95	1.00			1.00	1.00
Satd. Flow (prot)					2681		1406	1629			1629	943
Flt Permitted					0.99		0.49	1.00			1.00	1.00
Satd. Flow (perm)					2681		728	1629			1629	943
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	217	800	189	276	532	0	0	197	97
RTOR Reduction (vph)	0	0	0	0	25	0	0	0	0	0	0	63
Lane Group Flow (vph)	0	0	0	0	1181	0	276	532	0	0	197	34
Confl. Peds. (#/hr)				275		275	290		290	325		325
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	5%	5%	5%	5%	5%
Parking (#/hr)				20		20			20			
Turn Type				Perm	NA		pm+pt	NA			NA	Perm
Protected Phases					2		7	4			8	
Permitted Phases				2			4					8
Actuated Green, G (s)					21.0		30.5	30.5			19.0	19.0
Effective Green, g (s)					21.0		30.5	30.5			19.0	19.0
Actuated g/C Ratio					0.35		0.51	0.51			0.32	0.32
Clearance Time (s)					4.0		4.0	4.5			4.0	4.0
Lane Grp Cap (vph)					938		460	828			515	298
v/s Ratio Prot							0.08	c0.33			0.12	
v/s Ratio Perm					0.44		0.22					0.04
v/c Ratio					1.26		0.60	0.64			0.38	0.11
Uniform Delay, d1					19.5		9.3	10.8			15.9	14.5
Progression Factor					0.83		0.80	0.58			1.00	1.00
Incremental Delay, d2					117.2		0.5	0.4			2.1	0.8
Delay (s)					133.5		8.0	6.6			18.1	15.3
Level of Service					F		A	A			B	B
Approach Delay (s)		0.0			133.5			7.1			17.2	
Approach LOS		A			F			A			B	

Intersection Summary				
HCM 2000 Control Delay	74.4	HCM 2000 Level of Service	E	
HCM 2000 Volume to Capacity ratio	0.96			
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	123.1%	ICU Level of Service	H	
Analysis Period (min)	15			

c Critical Lane Group

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Attachment C
Pedestrian Level of Service Calculations

Crosswalk LOS (Existing Conditions – Weekday Midday Peak Hour)										
Crosswalk			Ped	Pedestrians per 15 minutes			Right Turn	# of cycles per		
Intersection	Location	Direction	Green Time	Inbound (Vdi)	Outbound (Vdo)	N_{TV}	Vehicles	hour	Length (Ld)	Width (Wd)
1	Beale & Market	North	24	25	180	3	162	60	90	36
		East	25	161	35	0	0	60	50	30
		South	24	199	92	5	292	60	60	36
		West	25	37	15	3	209	60	50	30
2	Beale & Mission	North	29	110	122	0	0	60	60	14
		East	23	60	47	0	0	60	60	14
		South	29	128	69	4	238	60	50	14
		West	23	92	63	2	111	60	46	14
Crosswalk				pedestrians per cycle						
Intersection	Location	Direction	TS_E	Inbound (Vdi)	Outbound (Vdo)	N	t	T	M	LOS
1	Beale & Market	North	32215	2	12	9	30	404	79.7	A
		East	26786	11	2	2	18	230	116.2	A
		South	26318	13	6	4	21	401	65.6	A
		West	22606	2	1	1	18	61	371.5	A
2	Beale & Mission	North	17160	7	8	6	21	331	51.8	B
		East	12120	4	3	2	21	148	81.7	A
		South	13079	9	5	3	18	238	55.1	B
		West	9544	6	4	3	17	175	54.5	B

Crosswalk LOS (Existing Conditions – Weekday Midday Peak Hour)										
Crosswalk			Ped	Pedestrians per 15 minutes			Right Turn	# of cycles per		
Intersection	Location	Direction	Green Time	Inbound (Vdi)	Outbound (Vdo)	N_{TV}	Vehicles	hour	Length (Ld)	Width (Wd)
1	Beale & Market	North	24	93	94	3	162	60	90	36
		East	25	67	70	0	0	60	50	30
		South	24	100	88	5	292	60	60	36
		West	25	40	55	3	209	60	50	30
2	Beale & Mission	North	31	141	66	0	0	60	60	14
		East	21	69	217	0	0	60	60	14
		South	31	103	96	4	238	60	50	14
		West	21	158	159	2	111	60	46	14
Crosswalk				pedestrians per cycle						
Intersection	Location	Direction	TS_E	Inbound (Vdi)	Outbound (Vdo)	N	t	T	M	LOS
1	Beale & Market	North	32215	6	6	5	29	365	88.3	A
		East	26786	4	5	3	18	162	164.9	A
		South	26318	7	6	4	21	259	101.6	A
		West	22606	3	4	3	18	112	201.4	A
2	Beale & Mission	North	18840	9	4	3	21	288	65.3	A
		East	10440	5	14	11	22	429	24.4	C
		South	14479	7	6	4	18	243	59.7	B
		West	8256	11	11	8	18	379	21.8	D

Street Corner LOS (Existing Conditions – Weekday Midday Peak Hour)

Intersection			Flow, p/15-min					Flow, P/15 min * 1/60 = p/s					
			Vdi_{major}	Vdo_{major}	Vci_{minor}	Vco_{minor}	$V_{a,b}$	Vci_{minor}	Vdi_{major}	Vdo_{major}	Vci_{minor}	$V_{a,b}$	V_{tot}
22	Beale & Market	NE_{corner}	25	180	161	35	20.05	0.03	0.20	0.18	0.04	0.02	0.47
		SE_{corner}	199	92	35	161	24.35	0.22	0.10	0.04	0.18	0.03	0.57
		SW_{corner}	92	199	37	15	17.15	0.10	0.22	0.04	0.02	0.02	0.40
		NW_{corner}	180	25	15	37	12.85	0.20	0.03	0.02	0.04	0.01	0.30
24	Beale & Mission	NE_{corner}	110	122	60	47	16.95	0.12	0.14	0.07	0.05	0.02	0.40
		SE_{corner}	128	69	47	60	15.2	0.14	0.08	0.05	0.07	0.02	0.35
		SW_{corner}	69	128	92	63	17.6	0.08	0.14	0.10	0.07	0.02	0.41
		NW_{corner}	122	110	63	92	19.35	0.14	0.12	0.07	0.10	0.02	0.45

			R	$W_{a,major}$	$W_{b,minor}$	C	R_{major}	R_{minor}	Q_{tco}	Q_{tdo}	TS	TS_c	M	LOS
22	Beale & Market	NE_{corner}	15	30	10	60	31	29	84	19	15098	14584	129.9	A
		SE_{corner}	15	16	10	60	31	29	43	86	6698	6053	44.4	A
		SW_{corner}	15	16	10	60	31	29	93	8	6698	6193	64.5	A
		NW_{corner}	15	30	10	60	31	29	12	20	15098	14940	207.6	A
24	Beale & Mission	NE_{corner}	15	10	8	60	35	25	42	32	1898	1526	16.1	A
		SE_{corner}	15	10	8	60	35	25	24	41	1898	1574	18.5	A
		SW_{corner}	15	10	8	60	35	25	44	43	1898	1461	14.8	A
		NW_{corner}	15	10	8	60	35	25	38	63	1898	1393	12.9	B

Street Corner LOS (Existing Conditions – Weekday PM Peak Hour)

Intersection			Flow, p/15-min					Flow, P/15 min * 1/60 = p/s					
			Vdi_{major}	Vdo_{major}	Vci_{minor}	Vco_{minor}	$V_{a,b}$	Vci_{minor}	Vdi_{major}	Vdo_{major}	Vci_{minor}	$V_{a,b}$	V_{tot}
22	Beale & Market	NE_{corner}	93	94	67	70	16.2	0.10	0.10	0.07	0.08	0.02	0.38
		SE_{corner}	100	88	70	67	16.25	0.11	0.10	0.08	0.07	0.02	0.38
		SW_{corner}	88	100	40	55	14.15	0.10	0.11	0.04	0.06	0.02	0.33
		NW_{corner}	94	93	55	40	14.1	0.10	0.10	0.06	0.04	0.02	0.33
24	Beale & Mission	NE_{corner}	141	66	69	217	24.65	0.16	0.07	0.08	0.24	0.03	0.58
		SE_{corner}	103	96	217	69	24.25	0.11	0.11	0.24	0.08	0.03	0.57
		SW_{corner}	96	103	158	159	25.8	0.11	0.11	0.18	0.18	0.03	0.60
		NW_{corner}	66	141	159	158	26.2	0.07	0.16	0.18	0.18	0.03	0.61

			R	$W_{a,major}$	$W_{b,minor}$	C	R_{major}	R_{minor}	Q_{tco}	Q_{tdo}	TS	TS_c	M	LOS
22	Beale & Market	NE_{corner}	15	30	10	60	31	29	44	37	15098	14691	161.9	A
		SE_{corner}	15	16	10	60	31	29	41	36	6698	6313	69.4	A
		SW_{corner}	15	16	10	60	31	29	47	29	6698	6317	79.7	A
		NW_{corner}	15	30	10	60	31	29	43	21	15098	14773	187.1	A
24	Beale & Mission	NE_{corner}	15	10	8	60	35	25	23	148	1898	1045	7.6	C
		SE_{corner}	15	10	8	60	35	25	33	47	1898	1496	11.0	B
		SW_{corner}	15	10	8	60	35	25	36	108	1898	1178	8.2	C
		NW_{corner}	15	10	8	60	35	25	49	108	1898	1115	7.6	C

Crosswalk LOS (2040 Cumulative Conditions – Weekday Midday Peak Hour)										
Crosswalk			Ped	Pedestrians per 15 minutes			Right Turn	# of cycles per		
Intersection	Location	Direction	Green Time	Inbound (Vdi)	Outbound (Vdo)	N_{TV}	Vehicles	hour	Length (Ld)	Width (Wd)
1	Beale & Market	North	24	31	224	3	162	60	90	36
		East	25	200	44	0	0	60	50	30
		South	24	248	115	5	292	60	60	36
		West	25	46	19	3	209	60	50	30
2	Beale & Mission	North	29	137	152	0	0	60	60	14
		East	23	75	58	0	0	60	60	14
		South	29	159	86	4	238	60	50	14
		West	23	115	78	2	111	60	46	14
Crosswalk				pedestrians per cycle						
Intersection	Location	Direction	TS_E	Inbound (Vdi)	Outbound (Vdo)	N	t	T	M	LOS
1	Beale & Market	North	32215	2	15	11	30	506	63.7	A
		East	26786	13	3	2	18	288	93.2	A
		South	26318	17	8	6	21	503	52.4	B
		West	22606	3	1	1	18	76	296.9	A
2	Beale & Mission	North	17160	9	10	7	22	417	41.1	B
		East	12120	5	4	3	21	185	65.4	A
		South	13079	11	6	4	18	298	43.9	B
		West	9544	8	5	4	17	220	43.4	B

Crosswalk LOS (2040 Cumulative Conditions – Weekday PM Peak Hour)										
Crosswalk			Ped	Pedestrians per 15 minutes			Right Turn	# of cycles per		
Intersection	Location	Direction	Green Time	Inbound (Vdi)	Outbound (Vdo)	N_{TV}	Vehicles	hour	Length (Ld)	Width (Wd)
1	Beale & Market	North	24	138	141	3	162	60	90	36
		East	25	102	116	0	0	60	50	30
		South	24	169	175	5	292	60	60	36
		West	25	65	96	3	209	60	50	30
2	Beale & Mission	North	31	241	113	0	0	60	60	14
		East	21	115	316	0	0	60	60	14
		South	31	183	157	4	238	60	50	14
		West	21	236	237	2	111	60	46	14
Crosswalk				pedestrians per cycle						
Intersection	Location	Direction	TS_E	Inbound (Vdi)	Outbound (Vdo)	N	t	T	M	LOS
1	Beale & Market	North	32215	9	9	7	29	547	58.8	B
		East	26786	7	8	6	18	261	102.5	A
		South	26318	11	12	9	21	481	54.7	B
		West	22606	4	6	5	18	192	117.6	A
2	Beale & Mission	North	18840	16	8	5	21	503	37.5	C
		East	10440	8	21	16	23	674	15.5	D
		South	14479	12	10	7	19	426	34.0	C
		West	8256	16	16	12	19	589	14.0	E

Street Corner LOS (2040 Cumulative Conditions – Weekday Midday Peak Hour)

Intersection			Flow, p/15-min					Flow, P/15 min * 1/60 = p/s					
			Vdi_{major}	Vdo_{major}	Vci_{minor}	Vco_{minor}	$V_{a,b}$	Vci_{minor}	Vdi_{major}	Vdo_{major}	Vci_{minor}	$V_{a,b}$	V_{tot}
22	Beale & Market	NE_{corner}	31	224	200	44	24.95	0.03	0.25	0.22	0.05	0.03	0.58
		SE_{corner}	248	115	44	200	30.35	0.28	0.13	0.05	0.22	0.03	0.71
		SW_{corner}	115	248	46	19	21.4	0.13	0.28	0.05	0.02	0.02	0.50
		NW_{corner}	224	31	19	46	16	0.25	0.03	0.02	0.05	0.02	0.37
24	Beale & Mission	NE_{corner}	137	152	75	58	21.1	0.15	0.17	0.08	0.06	0.02	0.49
		SE_{corner}	159	86	58	75	18.9	0.18	0.10	0.06	0.08	0.02	0.44
		SW_{corner}	86	159	115	78	21.9	0.10	0.18	0.13	0.09	0.02	0.51
		NW_{corner}	152	137	78	115	24.1	0.17	0.15	0.09	0.13	0.03	0.56

			R	$W_{a,major}$	$W_{b,minor}$	C	R_{major}	R_{minor}	Q_{tco}	Q_{tdo}	TS	TS_c	M	LOS
22	Beale & Market	NE_{corner}	15	30	10	60	31	29	105	23	15098	14457	103.5	A
		SE_{corner}	15	16	10	60	31	29	54	107	6698	5895	34.7	A
		SW_{corner}	15	16	10	60	31	29	116	10	6698	6067	50.6	A
		NW_{corner}	15	30	10	60	31	29	14	25	15098	14902	166.3	A
24	Beale & Mission	NE_{corner}	15	10	8	60	35	25	53	39	1898	1436	12.2	B
		SE_{corner}	15	10	8	60	35	25	30	51	1898	1493	14.1	A
		SW_{corner}	15	10	8	60	35	25	55	53	1898	1356	11.1	B
		NW_{corner}	15	10	8	60	35	25	48	78	1898	1268	9.4	C

Street Corner LOS (2040 Cumulative Conditions – Weekday PM Peak Hour)

Intersection			Flow, p/15-min					Flow, P/15 min * 1/60 = p/s					
			Vdi_{major}	Vdo_{major}	Vci_{minor}	Vco_{minor}	$V_{a,b}$	Vci_{minor}	Vdi_{major}	Vdo_{major}	Vci_{minor}	$V_{a,b}$	V_{tot}
22	Beale & Market	NE_{corner}	138	141	102	116	24.85	0.15	0.16	0.11	0.13	0.03	0.58
		SE_{corner}	169	175	116	102	28.1	0.19	0.19	0.13	0.11	0.03	0.66
		SW_{corner}	175	169	65	96	25.25	0.19	0.19	0.07	0.11	0.03	0.59
		NW_{corner}	141	138	96	65	22	0.16	0.15	0.11	0.07	0.02	0.51
24	Beale & Mission	NE_{corner}	241	113	115	316	39.25	0.27	0.13	0.13	0.35	0.04	0.92
		SE_{corner}	183	157	316	115	38.55	0.20	0.17	0.35	0.13	0.04	0.90
		SW_{corner}	157	183	236	237	40.65	0.17	0.20	0.26	0.26	0.05	0.95
		NW_{corner}	113	241	237	236	41.35	0.13	0.27	0.26	0.26	0.05	0.96

			R	$W_{a,major}$	$W_{b,minor}$	C	R_{major}	R_{minor}	Q_{tco}	Q_{tdo}	TS	TS_c	M	LOS
22	Beale & Market	NE_{corner}	15	30	10	60	31	29	66	62	15098	14458	103.9	A
		SE_{corner}	15	16	10	60	31	29	82	54	6698	6016	38.2	A
		SW_{corner}	15	16	10	60	31	29	79	51	6698	6046	42.8	A
		NW_{corner}	15	30	10	60	31	29	64	35	15098	14602	118.5	A
24	Beale & Mission	NE_{corner}	15	10	8	60	35	25	39	215	1898	626	2.8	E
		SE_{corner}	15	10	8	60	35	25	55	78	1898	1234	5.7	D
		SW_{corner}	15	10	8	60	35	25	64	161	1898	773	3.4	D
		NW_{corner}	15	10	8	60	35	25	84	161	1898	676	2.9	E

APPENDIX D

2018 Final SEIS/EIR Mitigation Measures and Monitoring Program

APPENDIX D.1

2018 Final SEIS/EIR List of Mitigation Measures

UPDATED MITIGATION MEASURES PRESENTED AND ANALYZED IN FINAL EIS/EIR AND SEIS/EIR AS ADOPTED*

CONTENTS

* SEIS/EIR Section references refer to the Draft SEIS/EIR

1. W – WIND (EIS/EIR Section 5.1.2)

See discussion of wind impacts in Section 5.1.2 of the Final EIS/EIR. Mitigation measures include:

W 1 – The San Francisco Redevelopment Agency (Agency) shall consider potential wind effects of an individual project for the Redevelopment area. If necessary, perform wind tunnel testing in accordance with City Planning Code Section 148. If exceedences of the wind hazard criterion should occur for any individual project, require design modifications or other mitigation measures to mitigate or eliminate these exceedences. Tailor mitigation measures to the individual needs of each project. Examples of mitigation measures include articulation of building sides and softening of sharp building edges.

2. Prop – PROPERTY ACQUISITION/RELOCATION (EIS/EIR Section 5.2)

See discussion of property acquisition impacts, Section 5.2 of the Final EIS/EIR. Mitigation measures include:

Prop 1 – TJPA shall apply federal Uniform Relocation Act (Public Law 91-646) and California Relocation Act (Chapter 16, Section 7260 et seq. of the Government Code) and related laws and regulations governing both land acquisition and relocation. All real property to be acquired will be appraised to determine its fair market value before an offer is made to each property owner. (Minimum relocation payments are detailed in the laws, and include moving and search payments for businesses.) Provide information, assistance, and payments to all displaced businesses in accordance with these laws and regulations.

3. Saf – SAFETY AND EMERGENCY SERVICES (EIS/EIR Section 5.4)

See discussion of safety and emergency services, Section 5.4 of the Final EIS/EIR. Mitigation measures include:

Saf 1 – TJPA shall provide Project plans to the San Francisco Fire Department for its review to ensure that adequate life safety measures and emergency access are incorporated into the design and construction of Project facilities.

Saf 2 – TJPA shall prepare a life safety plan including the provision of on-site measures such as a fire command post at the Terminal, the Fire Department's 800-megahertz radio system and all necessary fire suppression equipment.

Saf 3 – TJPA shall prepare a risk analysis to accurately determine the number of personnel necessary to maintain an acceptable level of service at Project facilities.

4. NoiO – NOISE-OPERATIONS (EIS/EIR Section 5.8, SEIS/EIR Section 3.12)

See discussion of noise impacts, Section 5.8 of the Final EIS/EIR and Section 3.12 of the Supplemental EIS/EIR (SEIS/EIR). Mitigation measures include:

NoiO 1 – TJPA shall apply noise mitigation at the following locations adjacent to the bus storage facility:

- Provide sound insulation to mitigate noise impacts at the residences north of the AC Transit Facility at the corner of Perry and Third Street. At a minimum, apply sound insulation to the façade facing the bus storage facility (the south façade).

- Construct two noise barriers to mitigate noise impacts to Residences south of the AC Transit Facility along Stillman Street. The first noise barrier would be approximately 10-12 feet high and run along the southern edge of the AC Transit storage facility. The second noise barrier would be approximately 5-6 feet high and would be located on the portion of the ramp at the southwestern corner of the AC Transit facility. Treat the noise barriers with an absorptive material on the side facing the facility to minimize the potential for reflections off the underside of the freeway.
- Construct a noise barrier to mitigate noise impacts to residences south of the Golden Gate Transit Facility along Stillman Street. The barrier would be approximately 10-12 feet high and run along the southern and a portion of the eastern edge of the Golden Gate Transit storage facility. Treat the noise barriers with an absorptive material on the side facing the facility to minimize the potential for reflections off the underside of the freeway.

NoiO 2 – TJPA shall landscape the noise walls. Develop the actual design of the walls in cooperation with area residents.

NoiO 3 – TJPA shall construct noise walls prior to the development of the permanent bus facilities.

New-MM-NO-1.1 – *Design Ventilation Shaft to Avoid Noise Effects on Nearby Uses.* Ventilation shafts shall be designed in accordance with the APTA guidance for controlling noise, which includes a 60 dBA noise level at 50 feet from the facility, at the setback line of the nearest building, or at the nearest occupied area, whichever is nearest to the source. Treatments may include applying acoustical absorption materials to shaft surfaces or attaching silencers to fans.

5. NoiC – NOISE-CONSTRUCTION (EIS/EIR Section 5.21.10)

See discussion of construction noise impacts, Section 5.21.10 of the Final EIS/EIR. Mitigation measures include:

NoiC 1 – TJPA shall comply with San Francisco noise ordinance. The noise ordinance includes specific limits on noise from construction. The basic requirements are:

- Maximum noise level from any piece of powered construction equipment is limited to 80 dBA at 100 ft. This translates to 86 dBA at 50 feet.
- Impact tools are exempted, although such equipment must be equipped with effective mufflers and shields. The noise control equipment on impact tools must be as recommended by the manufacturer and approved by the Director of Public Works.
- Construction activity is prohibited between 8 p.m. and 7 a.m. if it causes noise that exceeds the ambient noise plus 5 dBA.

The noise ordinance is enforced by the San Francisco DPW, which may waive some of the noise requirements to expedite the Project or minimize traffic impacts. For example, along Townsend Street where much of the land use is commercial, business owners may prefer nighttime construction since it would reduce disruption during normal business hours. The DPW waivers usually allow most construction processes to continue until 2 a.m., although construction processes that involve impacts are rarely allowed to extend beyond 10 p.m. This category would include equipment used in demolition such as jackhammers and hoe rams, and pile driving. It is not anticipated that the construction documents would have specific limits on nighttime construction. There may be times when nighttime construction is desirable (e.g., in commercial districts where nighttime construction would be less disruptive to businesses in the area) or necessary to avoid unacceptable traffic disruptions. Since the construction

would be subject to the requirements of the San Francisco noise regulations, in these cases, the contractor would need to work with the DPW to come up with an acceptable approach balancing interruption of the business and residential community, traffic disruptions, and reducing the total duration of the construction.

NoiC 2 – TJPA shall conduct noise monitoring. The purpose of monitoring is to ensure that contractors take all reasonable steps to minimize noise.

NoiC 3 – TJPA shall conduct inspections and noise testing of equipment. This measure will ensure that all equipment on the site is in good condition and effectively muffled.

NoiC 4 – TJPA shall implement an active community liaison program. This program would keep residents informed about construction plans so they can plan around periods of particularly high noise levels and would provide a conduit for residents to express any concerns or complaints about noise.

NoiC 5 – TJPA shall minimize use of vehicle backup alarms. Because backup alarms are designed to get people's attention, the sound can be very noticeable even when their sound level does not exceed the ambient, and it is common for backup alarms at construction sites to be major sources of noise complaints. A common approach to minimizing the use of backup alarms is to design the construction site with a circular flow pattern that minimizes backing up of trucks and other heavy equipment. Another approach to reducing the intrusion of backup alarms is to require all equipment on the site to be equipped with ambient sensitive alarms. With this type of alarm, the alarm sound is automatically adjusted based on the ambient noise. In nighttime hours when ambient noise is low, the backup alarm is adjusted down.

NoiC 6 – TJPA shall include noise control requirements in construction specifications. These should require the contractor to:

- Perform all construction in a manner to minimize noise. The contractor should be required to select construction processes and techniques that create the lowest noise levels. Examples are using predrilled piles instead of impact pile driving, mixing concrete offsite instead of onsite, and using hydraulic tools instead of pneumatic impact tools.
- Use equipment with effective mufflers. Diesel motors are often the major noise source on construction sites. Contractors should be required to employ equipment fitted with the most effective commercially available mufflers.
- Perform construction in a manner to maintain noise levels at noise sensitive land uses below specific limits.
- Perform noise monitoring to demonstrate compliance with the noise limits. Independent noise monitoring should be performed to check compliance in particularly sensitive areas.
- Minimize construction activities during evening, nighttime, weekend and holiday periods. Permits would be required before construction can be performed in noise sensitive areas during these periods.
- Select haul routes that minimize intrusion to residential areas. This is particularly important for the trench alternatives that will require hauling large quantities of excavation material to disposal sites.

Controlling noise in contractor work areas during nighttime hours is likely to require some mixture of the following approaches:

- Restrictions on noise producing activities during nighttime hours.

- Laying out the site to keep noise producing activities as far as possible from residences, to minimize the use of backup alarms, and to minimize truck activity and truck queuing near the residential areas.
- Use of procedures and equipment that produce lower noise levels than normal. For example, some manufacturers of construction equipment can supply special noise control kits with highly effective mufflers and other materials that substantially reduce noise emissions of equipment such as generators, tunnel ventilation equipment, and heavy diesel power equipment including mobile cranes and front-end loaders.
- Use of temporary barriers near noisy activities. By locating the barriers close enough to the noise source, it is possible to obtain substantial noise attenuation with barriers 10 to 12 feet high even though the residences are 30 to 40 feet higher than the construction site.
- Use of partial enclosures around noisy activities. It is sometimes necessary to construct shed-like structures or complete buildings to contain the noise from nighttime activities.

6. VibO – VIBRATION-OPERATIONS (EIS/EIR Section 5.8.8)

See discussion of vibration impacts, Section 5.8.8 of the Final EIS/EIR. Mitigation measures include:

VibO 1 – TJPA shall use high-resilience track fasteners or a resiliently supported tie system for the Caltrain Downtown Extension for areas projected to exceed vibration criteria, including the following locations: (1) Live/Work Condos, 388 Townsend Street (Hubbell and Seventh), (2) San Francisco Residences on Bryant (Harrison Parking Lot Site), (3) Clock Tower Building, and Second Street High Rise and (4) new Marriott Courtyard (Marine Firefighter's Union).[1]

7. VibC – VIBRATION-CONSTRUCTION (EIS/EIR Section 5.21.10)

See discussion of construction vibration impacts, Section 5.21.10 of the Final EIS/EIR.

Mitigation measures include:

VibC 1 – TJPA shall limit or prohibit use of construction techniques that create high vibration levels. At a minimum, processes such as pile driving would be prohibited at distances less than 250 feet from residences.

VibC 2 – TJPA shall restrict procedures that contractors can use in vibration sensitive areas. (It is often possible to employ alternative techniques that create lower vibration levels. For example, unrestricted pile driving is one activity that has considerable potential for causing annoying vibration. Using the cast-in-drilled-hole piling method instead will eliminate most potential for vibration impact from the piling.)

VibC 3 – TJPA shall require vibration monitoring during vibration intensive activities.

[1] After mitigation, groundborne noise impact at 388 Townsend Street and vibration impact at the Clocktower Building would still exceed the FTA impact threshold by one decibel. This level of impact would not constitute a substantial adverse change requiring further mitigation, in terms of FTA guidance. The next level of vibration buffering that would be effective would be to install floating slab under the Caltrain alignment trackage for 600 to 800 feet on either side of each building (at a construction cost of $1,000 per linear foot), which would add installed costs approaching one million dollars or even more per building. Such high costs would not be a prudent and reasonable expenditure to eliminate the last one decibel of impact at these two sites. Per FTA guidelines, "to be feasible, the measure, or combination of measures, must be capable of providing a significant reduction of the vibration levels, at least 5 dB, while being reasonable from the standpoint of the added cost."

VibC 4 – TJPA shall restrict the hours of vibration intensive activities such as pile driving to weekdays during daytime hours.

VibC 5 – TJPA shall investigate alternative construction methods and practices to reduce the impacts in coordination with the construction contractor if resident annoyance from vibration becomes a problem.

VibC 6 – TJPA shall include specific limits, practices and monitoring and reporting procedures for the use of controlled detonation. Control and monitor use of controlled detonation to avoid damage to existing structures. Include specific limits, practices, and monitoring and reporting procedures within contract documents to ensure that such construction methods, if used, would not exceed safety criteria.

8. SG – SOILS/GEOLOGY (EIS/EIR Sections 5.9, 5.20, 5.21.17, SEIS/EIR Section 3.9)

See discussion of geologic impacts in Section 5.9 and construction impacts and approaches in Sections 5.20 and 5.21.17 of the Final EIS/EIR and Section 3.9 of the Supplemental EIS/EIR (SEIS/EIR). Mitigation measures include:

SG 1 – TJPA shall monitor adjacent buildings for movement and, if movement is detected, take immediate action to control the movement.

SG 2 – TJPA shall apply geotechnical and structural engineering principles and conventional construction techniques similar to the design and construction of high-rise buildings and tunnels throughout the downtown area. Apply design measures and utilize pile-supported foundations to mitigate potential settlement of the surface and underground stations.

SG 3 – TJPA shall design and construct structural components of the Project to resist strong ground motions approximating the maximum anticipated earthquake (0.5g). The cut-and-cover portions will require pile supports to minimize non-seismic settlement in soft compressible sediments (Bay Mud). The underground Caltrain station at Fourth and Townsend will require pile-supported foundations due to the presence of underlying soft sediments.

SG 4 – TJPA shall underpin existing building, where deemed necessary, to protect existing structures from potential damage that could result from excessive ground movements during construction. Design the tunneling and excavation procedures (and construction sequence), and design of the temporary support system with the objective of controlling ground deformations within small enough levels to avoid damage to adjacent structures. Where the risk of damage to adjacent structures is too great, special measures will be implemented such as: (1) underpinning, (2) ground improvement, and/or (3) strengthening of existing structures to mitigate the risks.

As part of the initial studies performed in 1996, preliminary plans were developed to protect/strengthen existing structures to mitigate the risk of adverse impacts of tunneling on existing structures. Underpinning, if it is deemed necessary, is one of the options for mitigating adverse effects of tunneling on the existing buildings. Underpinning involves modification of the foundations of the building so that the superstructure loads can be transferred beyond the zone of influence of tunneling. Underpinning may include internal strengthening of the superstructure, bracing, reinforcing the existing foundations, or replacing existing foundations with deep foundations embedded outside the tunnel zone of influence. Alternatives, in lieu of underpinning, involve strengthening the rock between the building and the crown of the tunnel. Grouting in combination with inclined pin piles can be used not only to strengthen the rock but make the rock mass over the tunnel act as a rigid beam, allowing construction of tunnels with no adverse effects on the buildings supported on shallow foundations over the tunnel.

Preliminary plans for underpinning have been developed that allow cost estimates to be made for underpinning. During the detailed design phase of the Project, underpinning plans will be developed specific to each of the buildings that may require it. It is not necessary at this stage of the Project to develop detailed underpinning plans.

These issues will be addressed on a case by case basis, along the alignment, during the detailed design phase of the Project. The methodology that is proposed for the Caltrain Downtown Extension, i.e., to design the support system to control ground deformations within tolerances and selectivity strengthen structures that may be too weak to resist even small deformations, was successfully used for the Muni Metro Turnback project, and are deemed to be effective for the Caltrain Downtown Extension Project as well.

SG 5 – TJPA shall assure proper design and construction of pile-supported foundations for structures to control potential settlement of the surface. Stability of excavations and resultant impacts on adjacent structures can be controlled within tolerable limits by proper design and implementation of the excavation shoring systems.

New-MM-C-GE-4.1 - *Groundwater Control during Construction.* Groundwater control shall be implemented to reduce ground instability in the construction area, where excavations encroach into the prevailing groundwater table.

- For excavations with the cut-and-cover technique, the groundwater level within the footprint of the excavation shall be maintained a minimum of 2 feet or more beneath the bottom of the excavation throughout construction to minimize the potential for failure of the base of the excavation due to high groundwater seepage at construction sites. The groundwater level outside of the excavation footprint shall remain unchanged.

- For excavations with the SEM construction method in rock, groundwater intrusion into the tunnel excavation is expected to be minimal and localized at joints in the rock. Groundwater seeping into the excavation shall be controlled locally by panning and piping channel inflows to sump pumps located in the portal area.

- For excavations with the SEM construction method in soft ground conditions (i.e., sands and clays), the groundwater level shall be locally drawn down to below the bottom of the excavation in order to increase the strength of the ground and reduce potential ground instability.

9. Util – UTILITIES ((EIS/EIR Sections 5.12, 5.21.12)

See discussion of utility impacts, Sections 5.12 and 5.21.12 of the Final EIS/EIR. Mitigation measures include:

Util 1 – TJPA shall coordinate with utility providers during preliminary engineering, continuing through final design and construction. Utilities would be avoided, relocated, and/or supported as necessary during construction activities to prevent damage to utility systems and to minimize disruption and degradation of utility service to local customers.

10. CH – CULTURAL AND HISTORIC RESOURCES (EIS/EIR Section 5.14, SEIS/EIR Section 3.6)

See discussion of cultural and historic resources impacts, Section 5.14 of the Final EIS/EIR and Section 3.6 of the Supplemental EIS/EIR (SEIS/EIR). Mitigation measures include:

CH 1 –Comply with the provision of the signed Memorandum of Agreement (MOA) between the Federal Transit Administration (FTA), the State Historic Preservation Officer (SHPO), and the TJPA.[2]

CH 2 – **Professional Qualifications.** Assure all activities regarding history, historic preservation, historic architecture, architectural history, historic and prehistoric archaeology are carried out by or under the direct supervision of persons meeting, at a minimum, the Secretary of the Interior's professional qualifications standards (48 FR 44738-9) (PQS) in these disciplines. Nothing in this stipulation may be interpreted to preclude any signatory or any agent or contractor thereof from using the properly supervised services or persons who do not meet the PQS.

Historic Preservation Standards. Assure all activities regarding history, historic preservation, historic architecture, architectural history, historic and prehistoric archaeology are carried out to reasonably conform to the Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716-44740) as well as to applicable standards and guidelines established by SHPO.

Curation and Curation Standards. Ensure that FTA and TJPA shall, to the extent permitted under sections 5097.98 and 5097.991.[sic] of the California Public Resources Code, materials and records resulting from any archaeological treatment or data recovery that may be carried out pursuant to this MOA, are curated in accordance with 36 CFR Part 79.

CH 3 – Integrate into the design of the new terminal a dedicated space for a permanent interpretive exhibit. The interpretive exhibit will include at a minimum, but is not necessarily limited to: plaques or markers, a mural or other depiction of the historic Transbay Transit Terminal (TTT), ramps, or Key System, or other interpretive material.

CH 4 – Consult with the State Department of Transportation (Department) regarding the availability of historical documentary materials for the creation of the permanent interpretive display of the history of the original TTT building and its association with the San Francisco-Oakland Bay Bridge. Department will assist TJPA in planning the scope and content of the proposed interpretive exhibit. Invite the Oakland Heritage Alliance, the San Francisco Architectural Heritage, the California State Railroad Museum, and the Western Railway Museum to participate in this consultation. While retaining responsibility for the development of the exhibit, TJPA will jointly consider the Department's and participating invitees' recommendations when finalizing the exhibit design. TJPA will produce, install, and maintain the exhibit.

CH 5 – Consult with the City of Oakland about its possible interest in having a similar interpretive exhibit in the East Bay. If agreement is reached prior to completion of final design of the Transbay Terminal, TJPA will provide and deliver exhibit materials to a venue that is mutually satisfactory to TJPA and the City of Oakland.

CH 6 – Identify, in consultation with Department, elements of the existing TTT that may be suitable for salvage and interpretive use by museums. Within two years following execution of this MOA by FTA and SHPO, TJPA will offer any elements identified as suitable for salvage and interpretive use to San Francisco Architectural Heritage, the California State Railroad Museum, Sacramento, the Western

[2] A copy of the Memorandum of Agreement is included as Appendix G of the Final EIS/EIR.

Railway Museum, the Oakland Museum, and any other interested parties. Remove any elements selected in a manner that minimizes damage and deliver with legal title to the recipient. Items not accepted by interested parties for salvage or interpretive use within the time frame specified herein will receive no further consideration.

CH 7 – **Oakland Museum of California Exhibit** – Consult with Department and the Oakland Museum about contributing to Department's exhibit and the production of an interpretive video at the Oakland Museum relating to the history and engineering of the major historic state bridges of the San Francisco Bay Area. TJPA will propose contributions to such an exhibit and video that would be related to the history of the TTT, bus ramp loop structures, and the Key System. Items contributed by TJPA to such an exhibit may include photographs, drawings, videotape, models, oral histories, and salvaged components from the TTT.

CH 8 – Assist the Oakland Museum by contributing up to $50,000 toward the cost of preparing and presenting the exhibit and preparing an exhibit catalog or related museum publication in conjunction with the exhibit, in a manner and to the extent that is mutually satisfactory to TJPA, Department, and the Oakland Museum. A separate agreement will outline the negotiated financial contributions.

Work with the Oakland Museum and assist in the preparation of an exhibit and interpretive video if consultation results in agreement between TJPA and the Oakland Museum prior to demolition of the existing TTT.

CH 9 – Request that SHPO, prior to the start of any work that would have an adverse effect on components of the Bay Bridge that are historic properties, determine whether these components, including the TTT and associated ramps, have been adequately recorded in existing documents. If SHPO determines that, collectively, such documents, which include the Department's past recordation of a series of remodeling and seismic retrofit project that have occurred since 1993, adequately document the TTT and ramps, then no further documentation will be necessary.

Seek, with the assistance of the Department, to obtain the original drawings of the TTT by architect T. Pflueger.

If SHPO determines that existing documentation is adequate, compile such documentation into a comprehensive record. Components to be included in the review of past documentation are:

- 425 Mission Transbay Transit Terminal (APN 3719-003, 3720-001, 3721-006);
- Upper Deck San Francisco Approaches or North Connector, Bridge #34-116F;
- Upper Deck San Francisco Approaches or Center Ramps, Bridge #34-118L;
- San Francisco Approaches or Lower Deck On-Ramp, Bridge #34-118R;
- Transbay Terminal Loop ramp, Bridge #34-119Y; and
- Harrison Street over-crossing Bridge #34-120Y.

Consult further with SHPO, if SHPO determines that existing documentation does not constitute adequate recordation of the Bay Bridge components addressed hereunder. SHPO will determine what level and type of additional documentation is necessary.

Provide xerographic copies of this documentation to the SHPO and the Department Headquarters Library, upon a written determination by SHPO that all documentation prescribed hereunder is satisfactory, to the History Center at the San Francisco Public Library, San Francisco Architectural Heritage, the Oakland History Room of the Oakland Public Library, the Oakland Museum of California, the Western Railway

Museum, and Department District 4 Office. Thereafter, TJPA may proceed with that aspect of the Project that will adversely affect the historic properties documented hereunder.

CH 10 – Within 180 days after FTA determines that the Project has been completed, TJPA, in consultation with FTA and SHPO, will re-evaluate the Bay Bridge, a property listed on the NRHP, and determine whether the National Register nomination should be amended or whether the bridge no longer qualifies for listing and should be removed from the National Register. As appropriate, TJPA will prepare and submit to the FTA and SHPO either an amended nomination or petition for removal, to be processed according to the procedures set forth in 36 CFR Part 60 (60.14 and 60.15).

CH 11 – Develop and implement measures, in consultation with the owners of historic properties immediately adjoining the construction sites, to protect the contributing elements of the Second and Howard Streets Historic District and the Rincon Point/South Beach Historic Warehouse Industrial District from damage by any aspect of the Project. Such measures will include, but are not necessarily limited to those identified in the MOA.

The protective measures herein stipulated will be developed and implemented by TJPA prior to the commencement of any aspect of the Project that could have an adverse effect on historic properties immediately adjoining the construction sites herein identified. In addition, TJPA will monitor the effectiveness of the protective measures herein stipulated and will supplement or modify these measures as and where necessary in order to ensure that they are effective. The historic properties covered by the terms of this paragraph are shown in the following table.

Affected Historic Properties During Construction

Address/ Assessors Parcel Number	NRHP Status	Contributing Element of	Const. Date	Type of Impact
589-591 Howard Street/3736-098	1D	Second & Howard District & New Montgomery/Second Street	1906	Cut-and-cover construction ~~nearby;~~ need easement
163 Second Street/3721-048	1D		1907	Cut-and-cover construction nearby
165-173 Second Street/3721-025	1D		1906	Cut-and-cover construction; need easement
166-78 Townsend Street/3788-012	3D	Rincon Point/South Beach District & South End District	1910 [1] 1988 [2]	Cut-and-cover construction nearby. Need construction easement
640 Second Street/3788-002	252	Rincon Point/South Beach District & South End District	1926	Tunnel under or near property
650 Second Street/3788-049 through 3788-073	252		1922	
670-680 Second Street/3788-043, 3788-044	252 (670), 3D (680)		1913	
301-321 Brannan Street/3788-037	3D		1909	
130 Townsend Street/3788-008	3D		1910 [1] 1895-6 [2]	
136 Townsend Street/3788-009	3D		1902 [1] 1913 [2]	
144-46 Townsend Street/3788-009A	3D		1922	
148-54 Townsend Street/3788-010	3D		1922	
162-164 Townsend Street/3788-081	3D		1919	

Notes: National Register Status Codes are as follows:
1 Listed on the NRHP
2S1 Determined eligible for listing by the Keeper of the Register
2S2 Determined eligible for listing by the consensus of the SHPO and federal agency
1D Listed on the National Register as a contributor to a district or multi-resource property
2D2 Determined eligible as a contributor by consensus determination
3D Appears eligible as a contributor to a fully documented district
[1] Caltrans, 1983, [2] Corbett and Bradley, 1996
Source: JRP Historical Consulting, Parsons Transportation Group, 2001

CH 12 – TJPA will take the effect of the Project on the ~~three~~ historic properties listed below into account by recording these properties in accordance with the terms herein set forth. These buildings are:

- 191 2nd Street, (APN: 3721-022), and
- 580-586 Howard Street, (APN: 3721-092 through 3721-106)~~, and~~
- ~~165-173 2nd Street, (APN: 3721-025)~~.

Prior to taking any action that could adversely affect these properties, consult SHPO and SHPO will determine the type and level of recordation that is necessary for these properties. Upon a written determination by SHPO that all documentation prescribed hereunder is complete and satisfactory, submit a copy of this documentation to SHPO, with xerographic copies to the History Center at the San Francisco Public Library, San Francisco Architectural Heritage, and the Oakland History Room of the Oakland Public Library. Thereafter, proceed with that aspect of the Project that will adversely affect the historic properties documented hereunder.

If SHPO does not respond within 45 days of receipt of each submittal of documentation prescribed herein, assume that SHPO has determined that said documentation is adequate and may proceed with that aspect of the Project that will adversely affect the historic properties documented hereunder.

CH 13 – Repair, in accordance with the Secretary of the Interior's Standards for Rehabilitation, any damage to contributing elements of the Second and Howard Streets Historic District and the Rincon Point/South Beach Historic Warehouse Industrial District resulting from the Project.

Photograph the condition of the contributing elements prior to the start of the Project to establish the baseline condition for assessing damage. Consult with property owner(s) about the appropriate level of photographic documentation of building interiors and exteriors. Provide a copy of this photographic documentation to the property owner(s), and retain on file.

Submit repair plans and specifications to SHPO for review and comment, if repair of inadvertent damage resulting from the Project is necessary, to ensure that the work conforms to the Secretary of the Interior's Standards for Rehabilitation. Consult with SHPO to establish a mutually satisfactory time frame for the SHPO's review. TJPA will carry out any repairs required hereunder in accordance with the comments of SHPO.

CH 14 – Within 180 days after FTA determines that the Project has been completed, TJPA, in consultation with FTA and SHPO, will re-evaluate the Second and Howard Streets Historic District and determine whether the National Register nomination should be amended or whether the district no longer qualifies for listing and should be removed from the National Register. As appropriate, TJPA will prepare and submit to the FTA and SHPO either an amended nomination or petition for removal, to be processed according to the procedures set forth in 36 CFR Part 60 (60.14 and 60.15).

CH 15 – Within 45 days following execution of MOA, consult with FTA, SHPO, JPB and CCSF to initiate the process of determining how archaeological properties that may be affected by the Project will be identified, whether and how the NRHP eligibility of such properties may be addressed, and whether and how the Project's effects, if any, on those archaeological properties that may be considered historic properties for purposes of this MOA, may be taken into account. FTA and TJPA to invite Caltrans to participate in this consultation. Determine the time frame for this consultation with the consulting parties through consensus.

Consultation will at minimum be informed by, and take into account, the following documents:

Attachment 6, "Standard Treatment of Archaeological Sites: Data Recovery Plan," of the "Programmatic Agreement among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Office, and the California Department of Transportation regarding compliance with Section 106 of the National Historic Preservation Act, as it pertains to the Administration of the Federal Aid Highway Program in California;" "Archaeological Research Design and Treatment Plan for SF-480 Terminal Separation Rebuild" (Praetzellis and Praetzellis, 1993) and "The San Francisco-Oakland Bay Bridge, West Approach Replacement: Archaeological Research Design and Treatment Plan" (Ziesing, 2000); "Revised Historical Archaeology Research Design for the Central Freeway Replacement Project" (Thad M. Van Bueren, Mary Praetzellis, Adrian Praetzellis, Frank Lortie, Brian Ramos, Meg Scantlebury and Judy D. Tordoff).

CH 16 – If the consulting parties agree that a treatment plan for archaeological properties should be prepared, prepare a Treatment Plan for archeological resources that provides for the identification, evaluation, and treatment of archaeological properties that may be affected by the Project and that conform to the requirements above of item CH13 1) and take into account the information contained in item~~s~~ CH13 2) and CH13 3) and conform to any other standards, documentation, or guidance that the consulting parties may specify.

If the consulting parties agree that the Treatment Plan will address historic archaeological properties as well as prehistoric archaeological properties, ensure that appropriately qualified historians prepare a historic context(s) that will be used by an interdisciplinary team consisting at a minimum of historians and historic archaeologist.

The historic context will, at a minimum:

1) identify significant research themes and topics that relate to the historic period(s) addressed by the historic context(s)

2) determine what types of historic archaeological properties, if any, that may usefully and significantly contribute to research themes and topics deemed by the historic context(s) study to be important

3) identify the specific components and constituents (features, artifacts, etc., if any, of historic archaeological property types that can factually and directly, contribute data important to our understanding of significant historic research themes and topics

4) determine the amount (sample size, etc.) of archaeological excavation and related activity that is needed to provide the range and type of factual data that will contribute to our understanding of significant historic research themes and topics

Submit the draft Treatment Plan to the other consulting parties for review and comment. The consulting parties have 45 days from receipt of the draft Treatment Plan to comment in writing to FTA and TJPA. Failure of the consulting parties to respond within this time frame shall not preclude FTA and TJPA from finalizing the draft Treatment Plan to their satisfaction.

Before finalizing the draft Treatment Plan, FTA and TJPA to provide the consulting parties with written documentation indicating whether and how the draft Treatment Plan will be modified. Unless any consulting party objects to this documentation in writing to FTA and TJPA within 15 days following receipt, finalize the draft Treatment Plan as deemed appropriate by FTA and TJPA, and proceed to implement the final Treatment Plan.

If FTA and TJPA propose to modify the final Treatment Plan, they will notify the consulting parties concurrently in writing about the proposed modifications. The consulting parties will have 15 days from receipt of notification to comment in writing to FTA and TJPA. Failure of the consulting parties to respond within this time frame shall not preclude FTA and TJPA from modifying the final Treatment Plan to their satisfaction.

Before modifying the final Treatment Plan, FTA and TJPA will provide the consulting parties with written documentation indicating whether and how the final Treatment Plan will be modified. Unless any consulting party objects to this documentation in writing to FTA and TJPA within 15 days following receipt, modify the final Treatment Plan as appropriate, and proceed to implement the modified final Treatment Plan.

CH 17 - 1) Within two years after FTA, in consultation with TJPA, has determined that all fieldwork required by the Treatment Plan has been completed, prepare a draft technical report that documents the results of implementing the Treatment Plan and distributes this draft technical report to the other MOA signatories for review. The reviewing parties will be afforded 60 days following receipt of the draft technical report to submit any written comments to FTA and TJPA. Failure of the reviewing parties to respond within this time frame shall not preclude FTA from authorizing TJPA to revise the draft technical report as FTA and TJPA deem appropriate. FTA will provide the reviewing parties with a written documentation indicating modifications in accordance with any reviewing party comments. Unless the reviewing parties object to this documentation in writing to FTA and TJPA within 30 days following receipt, modify the draft technical report as FTA and TJPA deem appropriate. Thereafter, issue the technical report in final form and distribute this document in accordance with paragraph CH15 2).

2) Distribute copies of the final technical report documenting the results of the Treatment Plan implementation to the other signatory parties, to any consulting Native American Tribe if prehistoric, protohistoric or ethnographic period archaeological properties were located and addressed under the Treatment Plan, and to the appropriate California Historical Resources Information Survey (CHRIS) Regional Information Center, subject to the terms of Stipulation IV.E (CH19).

3) Prepare a written draft document that communicates in lay terms the results of Treatment Plan implementation to members of the interested public. Distribute this written draft document for review and comment concurrently with and in the same manner as that prescribed for the draft written technical report prescribed by paragraph C.1. of this stipulation. If the draft document prescribed hereunder is a publication such as a report or brochure, then distribute such publication to the other signatory parties, to any consulting Native American Tribe as applicable, and to any other entity that the signatory parties and, as applicable, any consulting Native American Tribe, through consultation as appropriate, subject to the terms of Stipulation IV.E (CH19).

4) Prepare a written annual report describing the status of its efforts to comply with the terms of Stipulations II – IV, inclusive, of this MOA. Prepare the annual report following the end of each fiscal year (July 1 to June 30) that this MOA is in effect and distributed it to all MOA signatories by July 30 of each year until FTA and the SHPO through consultation determine that the requirements of stipulations II – IV, inclusive of this MOA have been satisfactorily completed.

CH 18 - If the consulting parties agree that a plan for treatment of archaeological properties will not be prepared, then address any archaeological properties discovered during implementation of any aspect of the Project pursuant to 36 CFR 800.13(b)(3).

If the consulting parties agree that a plan for treatment of archaeological properties will not be prepared, then any archaeological properties discovered during implementation of any aspect of the Project will be addressed by TJPA pursuant to 36 CFR 800.13(b)(3).

CH 19 - The signatories to the MOA acknowledge that historic properties covered by this MOA are subject to the provisions of Section 304 of the National Historic Preservation Act of 1966, as amended, and Section 6254.10 of the California Government Code (Public Records Act), relating to the disclosure of archaeological site information and, having so acknowledged, will ensure that all actions and documentation prescribed by this Agreement are consistent with Section 304 of the National Historic Preservation Act of 1966, as amended, and Section 6254.10 of the California Government Code.

CH 20 - The parties to the MOA agree that Native American burials and related items discovered during implementation of the terms of the MOA and of the Project will be treated in accordance with the requirements of Section 7050.5(b) of the California Health and Safety Code. If, pursuant to Section 7050.5(c) of the California Health and Safety Code, the county coroner/medical examiner determines that the human remains are, or may be of Native American origin, then the discovery shall be treated in accordance with the provisions of Section 5097.98(a)-(d) of the California Public Resources Code. TJPA will ensure that to the extent permitted by applicable law and regulation, the views of any consulting Native American Tribe and the Most Likely Descendant(s) are taken into consideration when decisions are made about the disposition of other Native American archaeological materials and records.

New-MM-C-CR-4.1 - *Minimize Potential Impacts to Paleontological Resources.* To minimize potential adverse impacts on previously unknown, potentially unique, scientifically important paleontological resources, the TJPA shall do the following:

- Before the start of any earthmoving activities, the TJPA shall retain a qualified paleontologist to train all construction personnel involved with earthmoving activities, including the project superintendent, regarding the possibility of encountering fossils, the appearance and types of fossils likely to be seen during construction, and the proper notification procedures should be followed if fossils are encountered.
- The construction crew shall immediately cease ground-disturbing work in the vicinity of the find and notify the TJPA.
- The TJPA shall retain a qualified paleontologist to evaluate the resource and prepare a recovery plan, in accordance with Society of Vertebrate Paleontology guidelines (SVP 1996). The recovery plan may include a field survey, construction monitoring, sampling and data recovery procedures, museum storage coordination for any specimen recovered, and a report of findings. Necessary and feasible recommendations in the recovery plan shall be implemented before construction activities are resumed at the site where the paleontological resource was discovered.

11. HWO – HAZARDOUS MATERIALS/WASTE-OPERATIONS (EIS/EIR Section 5.15)

See discussion of hazardous material and waste impacts, Section 5.15 of the Final EIS/EIR. Mitigation measures include:

HWO 1 – The Peninsula Corridor Joint Powers Board (JPB) – the agency responsible for operating Caltrain – shall construct and operate any fueling facility in compliance with local, state and Federal regulations regarding handling and storage of hazardous materials.

HWO 2 – JPB shall equip diesel fuel pumps with emergency shut-off valves and, in compliance with U.S. EPA requirements, fuel Underground Storage Tanks (USTs) would be equipped with leak detection and monitoring systems.

HWO 3 – JPB shall employ the use of secondary containment systems for any aboveground storage tanks.

HWO 4 – JPB shall store cleaning solvents in 55-gallon drums, or other appropriate containers, within a bermed area to provide secondary containment.

HWO 5 – JPB shall slope paved surfaces within the fueling facility and the solvent storage area to a sump where any spilled liquids could be recovered for proper disposal.

HWO 6 – JPB shall follow California OSHA and local standards for fire protection and prevention for the handling and storage of fuels and solvents.

HWO 7 – JPB shall prepare a Hazardous Materials Management/Business Plan and file with the San Francisco Department of Public Health.

12. HMC – HAZARDOUS MATERIALS/WASTE-CONSTRUCTION (EIS/EIR Section 5.21.15)

See discussion of hazardous material and waste impacts during construction, Section 5.21.15 of the Final EIS/EIR. Mitigation measures include:

HMC 1 – TJPA shall follow California OSHA and local standards for fire protection and prevention. Handling and storage of fuels and other flammable materials during construction will conform to these requirements, which include appropriate storage of flammable liquids and prohibition of open flames within 50 feet of flammable storage areas.

HMC 2 – TJPA shall perform detailed investigations of the potential presence of contaminants in soil and groundwater prior to construction, using conventional drilling, sampling, and chemical testing methods. Based on the chemical test results, a mitigation plan will be developed to establish guidelines for the disposal of contaminated soil and discharge of contaminated dewatering effluent, and to generate data to address potential human health and safety issues that may arise as a result of contact with contaminated soil or groundwater during construction. The investigation and mitigation plan will follow the requirements of the City and County of San Francisco's Article 22A in the appropriate areas along the alignment.

With construction projects of this nature and magnitude, there are typically two different management strategies that can be employed to address contaminated soil handling and disposal issues. Contaminated soil can be excavated and stockpiled at a centralized location and subsequently sampled and analyzed for disposal profiling purposes in accordance with the requirements of the candidate disposal landfill. Alternatively, soil profiling for disposal purposes can be done in-situ so when soil is excavated it is loaded directly on to trucks and hauled to the appropriate landfill facility for disposal based on the in-situ profiling results. A project of this nature could also combine both strategies.

HMC 3 – TJPA shall cover with plastic sheeting soils removed during excavation and grading activities that remain at a centralized location for an extended period of time to prevent the generation of fugitive dust emissions that migrate offsite.

HMC 4 – TJPA shall use a licensed waste hauler, applying appropriate manifests or bill of lading procedures, as required to haul soil for disposal at a landfill or recycling facility.

HMC 5 – TJPA shall use chemical test results for groundwater samples along the alignment to obtain a Batch Discharge Permit under Article 4.1 of the San Francisco Department of Public Works as well as to evaluate requirements for pretreatment prior to discharge to the sanitary sewer. Effluent produced during the dewatering of excavations will be collected in onsite storage tanks and periodically tested, as required under discharge permit requirements, for potential contamination to confirm the need for any treatment prior to discharge. If required, treatment may include:

- Settling to allow particulate matter (total suspended solids) to settle out of the effluent in order to reduce the sediment load as well as reduce elevated metal and other contaminant concentrations that may be associated with suspended sediments; and/or
- Construction of a small-scale batch waste water treatment system to remove dissolved contaminants (mainly organic constituents such as petroleum hydrocarbons (gas, diesel, and oils), BTEX, and VOCs) from the dewatering effluent prior to discharge to the sanitary sewer. A treatment system would also likely employ the use of filtration to remove suspended solids.

HMC 6 – TJPA shall develop a detailed mitigation plan for the handling of potentially contaminated soil and groundwater prior to starting Project construction.

HMC 7 – TJPA shall design dewatering systems to minimize downward migration of contaminants that can result from lowering the water table if necessary based on environmental conditions. As necessary, shallow soils with detected contamination would be dewatered first using wells screened only in those soils. Dewatering of deeper soils would then be performed using wells screened only in the zone to be dewatered. Dewatering wells would be installed using drilling methods that prohibit shallow contaminated soils from being carried deeper into the boreholes.

HMC 8 – TJPA shall require that workers performing activities on site that may involve contact with contaminated soil or groundwater have appropriate health and safety training in accordance with 29 CFR 1910.120.

A Worker Health and Safety Plan (HSP) will be developed for the Project and monitored for the implementation of the plan on a day-to-day basis by a Certified Industrial Hygienist (CIH). The HSP will include provisions for:

- Conducting preliminary site investigations and analysis of potential job hazards;
- Personnel protective equipment;
- Safe work practices;
- Site control;
- Exposure monitoring;
- Decontamination procedures; and
- Emergency response actions.

The HSP will specify mitigation of potential worker and public exposure to airborne contaminant migration by incorporating dust suppression techniques in construction procedures. The plan will also specify mitigation of worker and environmental exposure to contaminant migration via surface water runoff pathways by implementation of comprehensive measures to control drainage from excavations and saturated materials excavated during construction.

HMC 9 – TJPA shall review existing asbestos surveys, abatement reports, and supplemental asbestos surveys, as warranted. Perform an asbestos survey for buildings to be demolished, as required. Asbestos-containing building materials (ACM) will require abatement prior to building demolition. Removal and disposal of ACM will be performed in accordance with applicable local, state, and federal regulations.

HMC 10 – TJPA shall perform a lead-based paint survey for buildings to be demolished to determine areas where lead-based paint is present and the possible need for abatement prior to demolition.

13. Ped – PEDESTRIANS (EIS/EIR Section 5.19.6.1)

See discussion of pedestrian impacts, Section 5.19.6.1 of the Final EIS/EIR. Mitigation measures include:

Ped 1 – Agency and City shall use future construction or redevelopment as opportunities to increase building set-backs thereby increasing sidewalk widths. Particular areas where such widening is most needed include:

- Southeast corner Fremont/Mission Street;
- Northeast corner First/Mission Street;
- North side of Mission Street between First and Fremont; and
- Sidewalks south of Howard Street along Folsom, First, Fremont, and Beale that are less than 10 feet wide.

Ped 2 – Agency and City shall eliminate or reduce sidewalk street furniture such as newspaper boxes and magazine racks in the immediate Transbay Terminal area on corners.

Ped 3 – City shall retime traffic light signalization. This could improve pedestrian levels of service at each of the intersections studies that fall into LOS F.

Ped 4 – City shall provide crosswalk signalization at intersections where they do not exist already, such as Folsom and Beale streets.

Ped 5 – City shall provide cross-walk count-down signals at intersections and cross-walks immediately surrounding the new Transbay Terminal.

Ped 6 –TJPA shall ensure that Transbay Terminal design increases corner and sidewalk widths at the four intersections immediately surrounding the Transbay Terminal.

Ped 7 – TJPA shall provide lights within crosswalks to warn when pedestrians are present in the crosswalk, such as at the cross-walk associated with the mid-block bus loading area.

14. PC – PRE-CONSTRUCTION ACTIVITIES (EIS/EIR Sections 5.20.1, SEIS/EIR Section 3.7)

See discussion of construction impacts, Section 5.20.1 of the Final EIS/EIR and Section 3.7 of the Supplemental EIS/EIR (SEIS/EIR). Mitigation measures include:

PC 1 – TJPA shall complete a pre-construction building structural survey to determine the integrity of existing buildings adjacent to and over the proposed Caltrain Downtown Extension. Use this survey to finalize detailed construction techniques along the alignment and as the baseline for monitoring construction impacts during and following construction.

PC 2 – TJPA shall contact and interview individual businesses along the Caltrain Extension alignment to gather information and develop an understanding of how these businesses carry out their work. This survey will identify business usage, delivery/shipping patterns, and critical times of the day or year for business activities. Use this information to assist in: (a) the identification of possible techniques during construction to maintain critical business activities, (b) analyze alternative access routes for customers and deliveries to businesses, (c) develop traffic control and detour plans, and (d) finalize construction practices.

PC 3 – TJPA shall complete detailed geotechnical investigation, including additional sampling (drilling and core samples) and analyses of subsurface soil/rock conditions. Use this information to design the excavation and its support system to be used in the retained cut, cut-and-cover, and tunnel portions of the Caltrain Downtown Extension.

PC 4 – TJPA shall establish community construction information/outreach program to provide on-going dialogue among the TJPA and the affected community regarding construction impacts and possible mitigation/solutions. Include dedicated personnel for an outreach office in the construction area to deal with construction coordination.

PC 5 – TJPA shall establish site and field offices located along the Caltrain Downtown Extension alignment. Field office staff, in conjunction with other staff, will:

- Provide the community and businesses with a physical location where information pertaining to construction can be exchanged,
- Enable TJPA and JPB to better understand community/business needs during the construction period,
- Allow TJPA and JPB to participate in local events in an effort to promote public awareness of the Project,
- Manage construction-related matters pertaining to the public,
- Notify property owners, residences, and businesses of major construction activities (e.g., utility relocation/disruption and milestones, re-routing of delivery trucks),
- Provide literature to the public and press,
- Promote and provide presentations on the Project via a Speakers Bureau,
- Respond to phone inquiries,
- Coordinate business outreach programs,
- Schedule promotional displays, and
- Participate in community committees.

PC 6 – TJPA shall implement an information phone line to provide community members and businesses the opportunity to express their views regarding construction. Review calls received and, as appropriate, forward the message to the necessary party for action (e.g., utility company, fire department, the Resident Engineer in charge of construction operations). Information available from the telephone line will include current Project schedule, dates for upcoming community meetings, notice of construction impacts, individual problem solving, construction complaints and general information. Phone service would be provided in English, Cantonese, and Spanish and would be operated on a 24-hour basis.

PC 7 – TJPA shall develop traffic management plans. Traffic management plans to maintain access to all businesses will be prepared for areas affected by surface or cut-and-cover construction. In addition, daily cleaning of work areas would be performed by contractors for the duration of the construction period. Provisions would be contained in construction contracts to require the maintenance of driveway access to businesses to the extent feasible.

New-MM-C-BR-1.1 – *Require Pre-Construction Bird Surveys.* Pre-construction bird surveys shall be required when trees or buildings and/or structures with potential nesting habitat would be disturbed as part of an individual project component. Pre-construction bird surveys shall be conducted on affected potential nesting habitat by a qualified biologist during the nesting season (February 1 through August 15) if construction activities are scheduled to take place during that period. Surveys shall be performed not more than 2 weeks prior to construction in an affected area. If special-status bird or migratory bird species are not found, work may proceed and no further mitigation action is required.

If special-status bird or migratory bird species are found to be nesting in or near any work area (at a distance to be determined by a qualified biologist) or, for compliance with federal and state law concerning migratory birds, if birds protected under the federal MBTA or the California Fish and Game Code are found to be nesting in or near any work area, an appropriate no-work buffer zone (e.g., 100 feet for songbirds, 250 feet for raptors) shall be designated by the biologist. Depending on the species involved, the qualified biologist may require input from CDFW and/or the USFWS Division of Migratory Bird Management regarding the most appropriate ways to avoid disturbance to nesting birds. As recommended by the biologist, no activities shall be conducted within the no-work buffer zone that could harass birds or disrupt bird nesting. Outside of the nesting season (August 16 through January 31), or after young birds have fledged, as determined by the biologist, work activities may proceed. Birds that establish nests during the construction period are considered habituated to such activity, and no buffer shall be required, except as needed to avoid direct destruction of the nest, which shall be prohibited.

15. GC – GENERAL CONSTRUCTION MEASURES (EIS/EIR Sections 5.20, 5.21)

See discussion of construction staging and methods and construction impacts, Sections 5.20 and 5.21 of the Final EIS/EIR. Mitigation measures include:

GC 1 – TJPA shall disseminate information to community in a timely manner regarding anticipated construction activities.

GC 2 – TJPA shall provide signage. Work with establishments affected by construction activities to develop appropriate signage for display that directs both pedestrian and vehicular traffic to businesses via alternate routes.

GC 3 – TJPA shall install level deck. Install decking at the cut-and-cover sections to be flush with the existing street or sidewalk levels.

GC 4 – TJPA shall provide for efficient sidewalk design and maintenance. Wherever feasible, maintain sidewalks at the existing width during construction. Where a sidewalk must be temporarily narrowed during construction (e.g., deck installation), restore it to its original width during the majority of construction period. (In some places this may require placing the temporary sidewalk on the deck.) Each sidewalk design should be of good quality and approved by the Resident Engineer prior to construction. Handicapped access will be maintained during construction where feasible.

GC 5 – TJPA shall provide construction site fencing of good quality, capable of supporting the accidental application of the weight of an adult without collapse or major deformation. Where covered walkways or other solid surface fencing is installed, establish a program to allow for art work (e.g., by local students) on the surface(s).

16. AC – AIR EMISSIONS-CONSTRUCTION (EIS/EIR Section 5.21.19, SEIS/EIR Section 3.13)

See discussion of air emission impacts from construction, Section 5.21.9 of the Final EIS/EIR and Section 3.13 of the Supplemental EIS/EIR (SEIS/EIR). The following mitigation measures are derived from the "basic control measures" and the "enhanced control measures" recommended by the Bay Area Air Quality Management District (BAAQMD). Mitigation measures include:

AC 1 – TJPA shall assure that, as part of the contract provisions, the Project contractor is required to implement the measures below at all Project construction sites.

AC 2 – TJPA shall water all active construction areas at least twice daily. Ordinance 175-91, passed by the San Francisco Board of Supervisors on May 6, 1991, requires that non-potable water be used for dust control activities; therefore, the Project contractor would be required to obtain reclaimed water from the City's Clean Water Program or other appropriate sources.

AC 3 – TJPA shall cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard.

AC 4 – TJPA shall pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.

AC 5 – TJPA shall sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites.

AC 6 – TJPA shall sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets.

AC 7 – TJPA shall install sandbags or other erosion control measures to prevent silt runoff to public roadways.

AC 8 – TJPA shall replant vegetation in disturbed areas as quickly as possible.

AC 9 – TJPA shall minimize use of on-site diesel construction equipment, particularly unnecessary idling.

AC 10 – TJPA shall shut off construction equipment to reduce idling when not in direct use.

AC 11 – TJPA shall, where feasible, replace diesel equipment with electrically powered machinery.

AC 12 – TJPA shall locate diesel engines, motors, or equipment as far away as possible from existing residential areas.

AC 13 – TJPA shall properly tune and maintain all diesel power equipment.

AC 14 – TJPA shall suspend grading operations during first and second stage smog alerts, and during high winds, i.e., greater than 25 miles per hour.

AC 15 – TJPA, shall, upon completion of the construction phase, buildings with visible signs of dirt and debris from the construction site shall be power washed and/or painted (given that permission is obtained from the property owner to gain access to and wash the property with no fee charged by the owner).

New-MM-C-AQ-5.1 – *Prepare and Implement an Emissions Plan*. The TJPA shall comply with the following measures to reduce construction emissions:

A. *Construction Emissions Minimization Plan*. Prior to issuance of a construction permit, the TJPA shall prepare a Construction Emissions Minimization Plan (Emissions Plan) detailing project compliance with the following requirements:

1. All off-road equipment greater than 25 horsepower and operating for more than 20 total hours over the entire duration of construction activities shall meet the following requirements:
   a. Where alternative sources of power are available, portable diesel engines shall be prohibited.
   b. All off-road equipment shall have the following:
      i. engines that meet or exceed either EPA or CARB Tier 2 off-road emissions standards, and
      ii. engines that are retrofitted with a CARB Level 3 Verified Diesel Emissions Control Strategy (VDECS).
   c. Exceptions:
      i. Exceptions to A(1)(a) may be granted if the TJPA has evidence that an alternative source of power is limited or infeasible at the project site, and that the requirements of this exception provision apply. Under this circumstance, the TJPA shall prepare the documentation indicating compliance with A(1)(b) for on-site power generation.
      ii. Exceptions to A(1)(b)(ii) may be granted if the TJPA has evidence that a particular piece of off-road equipment with an CARB Level 3 VDECS is (1) technically not feasible, (2) would not produce desired emissions reductions due to expected operating modes, (3) installing the control device would create a safety hazard or impaired visibility for the operator, or (4) there is a compelling emergency need to use off-road equipment that are not retrofitted with a CARB Level 3 VDECS.
      iii. If an exception is made pursuant to (A)(1)(c)(ii), the TJPA shall provide the next cleanest piece of off-road equipment, as provided by the step-down schedule below.

Off-Road Equipment Compliance Step-Down Schedule		
Compliance Alternative	**Engine Emissions Standard**	**Emissions Control**
1	Tier 2	CARB Level 2 VDECS
2	Tier 2	CARB Level 1 VDECS
3	Tier 2	Alternative Fuel (Not a VDEC)
Notes: *CARB = California Air Resources Board; VDECS = Verified Diesel Emissions Control Strategy* *Source: data compiled by AECOM in 2014*		

   If the requirements of (A)(1)(b) cannot be met, then the TJPA shall meet Compliance Alternative 1. If the TJPA is not able to supply off-road equipment meeting Compliance Alternative 1, then Compliance Alternative 2 shall be met. If the TJPA is not able to supply off-road equipment meeting Compliance Alternative 2, then Compliance Alternative 3 shall be met.

2. The TJPA shall require idling times for off-road and on-road equipment to be limited to no more than 2 minutes, except as provided in exceptions to the applicable state regulations regarding idling for off-road and on-road equipment. Legible and visible signs shall be posted in multiple languages

(English, Spanish, Chinese) in designated queuing areas and at the construction site to remind operators of the 2-minute idling limit.

3. The TJPA shall require that construction operators properly maintain and tune equipment in accordance with manufacturer specifications.
4. The Emissions Plan shall include estimates of the construction timeline by phase, with a description of each piece of off-road equipment required for every construction phase. Off-road equipment descriptions and information shall include equipment type, equipment manufacturer, equipment identification number, engine model year, engine certification (Tier rating), horsepower, engine serial number, expected fuel usage, and hours of operation. For VDECS-installed equipment, reporting shall indicate technology type, serial number, make, model, manufacturer, CARB verification number level, installation date, and hour meter reading on installation date. For off-road equipment using alternative fuels, reporting shall indicate the type of alternative fuel being used.
5. The Emissions Plan shall be kept on-site and be available for review by any persons requesting it. A legible sign shall be posted at the perimeter of the construction site indicating to the public the basic requirements of the Emissions Plan and a way to request a copy of the plan. The TJPA shall provide copies of the Emissions Plan to members of the public as requested.

B. *Reporting*. Monthly reports shall be prepared to indicate the construction phase and off-road equipment information used during each phase, including the information required in A(4). In addition, for off-road equipment using alternative fuels, reporting shall include the actual amount of alternative fuel used.

Within 6 months of completion of construction activities, the TJPA shall prepare a final report summarizing construction activities. The final report shall indicate the start and end dates and duration of each construction phase. For each phase, the report shall include detailed information required in A(4). In addition, for off-road equipment using alternative fuels, reporting shall include the actual amount of alternative fuel used.

C. *Certification Statement and On-Site Requirements.* Prior to the commencement of construction activities, the TJPA shall certify (1) compliance with the Emissions Plan and (2) all that applicable requirements of the Emissions Plan have been incorporated into contract specifications.

17. AQ – AIR EMISSIONS-OPERATIONS (SEIS/EIR Section 3.13)

See discussion of operational air emissions impacts in Section 3.13 of the Supplemental EIS/EIR (SEIS/EIR). Mitigation measures include:

New-MM-AQ-3.1 – *Equip Diesel Generators with Applicable Tiered Emissions Standards*. All diesel generators shall have engines that meet Tier 4 Final or Tier 4 Interim emissions standards or meet Tier 2 emissions standards and are equipped with a CARB Level 3 Verified Diesel Emissions Control Strategy.

New-MM-AQ-3.2 – *Require and Implement Ventilation Plans for Proposed Residential Land Development*. For residential development on the intercity bus facility or ventilation structure sites, the project sponsor shall comply with the following measures:

a. *Air Filtration and Ventilation Requirements.* Prior to receipt of any residential building permit, the project sponsor shall submit a ventilation plan for the proposed building(s). The ventilation plan shall show that the building ventilation system removes at least 80 percent of the outdoor PM2.5 concentrations from habitable areas and be designed by an engineer certified by the ASHRAE. The engineer shall provide a written report documenting that the system meets the 80

percent performance standard identified in this measure and offers the best available technology to minimize outdoor-to-indoor transmission of air pollution.

b. *Maintenance Plan.* Prior to receipt of any building permit, the project sponsor shall present a plan that ensures ongoing maintenance for the ventilation and filtration systems.

c. *Disclosure to Buyers and Renters.* The project sponsor shall ensure disclosure to buyers and/or renters that the building is located in an area with existing sources of air pollution and that the building includes an air filtration and ventilation system designed to remove 80 percent of outdoor particulate matter. Occupants shall be informed of the proper use of the installed air filtration system.

18. VA – VISUAL/AESTHETICS-CONSTRUCTION (EIS/EIR Section 5.21.16)

See discussion of visual/aesthetic impacts from construction, Section 5.21.16 of the Final EIS/EIR. Short-term visual changes as a result of construction activities are a common and accepted feature of the urban environment, and generally, mitigation is not required. Nonetheless, mitigation measures include:

VA 1 – TJPA shall assure that construction crews working at night direct any artificial lighting onto the work site in order to minimize "spill over" light or glare effects on adjacent areas.

VA 2 – TJPA shall assure that contractors make all efforts possible to minimize specific aesthetic and visual effects of construction identified by neighborhood businesses and residents.

19. TR – TRANSPORTATION (SEIS/EIR Section 3.2)

See discussion of transportation impacts in Section 3.2 of the Supplemental EIS/EIR (SEIS/EIR). Mitigation measures include:

New-MM-TR-1.1 – *Modify Signal Operations at the 16th Street Intersection with Seventh Street/Mississippi Street, the Caltrain tracks, and Owens Street.* If Caltrain's service and operations plan requires the use of the turnback track during the AM/PM peak hours in the future, prior to Caltrain making any such changes, the TJPA, in conjunction with Caltrain, shall conduct further traffic and train operation analysis of the turnback and maintenance of way tracks to evaluate traffic operations along 16th Street at Seventh/Mississippi Street, the Caltrain turnback track, and Owens Street. Changes to the PCEP OCS and specialty trackwork, such as control points, switches, and train signals, will be undertaken by the TJPA to allow Caltrain to continue its operations at the level of service defined in the PCEP EIR. In addition, if the traffic/train operation analysis shows that the traffic delays attributable to the gate downtime during the AM/PM peak hours would increase at Seventh/Mississippi Street or at Owens Street (already operating at LOS E and F) such that the overall intersection v/c ratio would worsen by more than 10 percent (i.e., a v/c ratio increase of more than 0.10), then improvements shall be implemented so the resulting v/c ratio is no greater than 10 percent above the v/c ratio without use of the turnback track during the AM/PM peak hours. Actions or improvements that could achieve the performance standard, either individually or in combination, include but are not limited to:

- Signal timing adjustments;
- Signal phasing modifications;
- Lane reconfiguration/re-striping in conjunction with phasing modification;
- Left-turn pocket lengthening;
- Pre-empt, pre-signal or queue cutters provision or modification as necessary to manage queues; and/or

- Other improvements identified in the future due to technology advancement.

The TJPA and Caltrain shall coordinate with the City and shall be responsible for reasonable costs of design, permitting, and construction of the necessary improvements at these crossings to attain the v/c performance standard. These changes to the crossing will also satisfy the performance standard for safe pedestrian and bicycle circulation identified in New-MM-TR-3.1.

New-MM-TR-3.1 – *Modify 16th Street Intersection with the Caltrain and turnback track to provide a safe crossing for pedestrians and bicyclists.* At the time of the construction and operation of the proposed turnback track, the Caltrain electrification project (including mitigation measures adopted by Caltrain for this intersection), SFTMA's 22 Fillmore Transit Priority Project, and the Warriors Arena project may have been implemented. The combination of these projects will modify the intersection configuration and operation at the time of the proposed project. As a result, the TJPA is using a safety-based performance standard, explained below, to guide future improvements for pedestrian and bicyclist safety.

At the time of final design, the TJPA shall determine the then-current overall time required by pedestrians and bicyclists traveling along 16th Street to cross the Seventh Street/Mississippi Street intersection, the Caltrain mainline tracks, and the turnback track, and the TJPA shall coordinate and consult with Caltrain, the California Public Utilities Commission, and the City to identify the changes to the intersection and grade crossing warning devices, including signal timing, that are needed to provide adequate time, as determined by the Institute of Transportation Engineers, Caltrans, and the City, for pedestrians and bicyclists to safely cross the widened intersection that results from the construction of the turnback track.

The TJPA shall commit to implementing changes necessary to protect pedestrians and bicyclists from potential safety issues, prior to operation of the new turnback track. Specific changes are expected to be determined during final design, which will be after the location of the crossing gates for the turnback track along 16th Street has been determined and based on the then-current signal timing at that time and which is expected to account for other major development and transit projects in the vicinity. The changes to the intersection due to the turnback track will be included in the design specifications for the project. Possible improvements that may attain the above performance standard include:

- Adjust signal timing for the warning devices and adjacent traffic signals. The warning phase before the gates start to come down shall be extended to take into account the additional time needed for pedestrians and bicyclists to clear the track zone based on industry standards (such as the Caltrans California Manual on Uniform Traffic Control Devices or the Institute of Transportation Engineers' Design and Safety of Pedestrian Facilities) or City guidelines that define the walking speed of a pedestrian.
- Provide sufficient refuge areas for pedestrians and bicyclists to wait while the crossing gates are down. The refuge, or waiting, area shall be sufficient to accommodate the projected pedestrians and bicyclists and be ADA compliant.
- Install a smooth surface in the areas next to and between the rails to reduce tripping hazards and unintended forces on bicycle tires.

20. WQ – WATER RESOURCES AND WATER QUALITY (SEIS/EIR Section 3.8)

See discussion of water resources and water quality impacts in Section 3.8 of the Supplemental EIS/EIR (SEIS/EIR). Mitigation measures include:

New-MM-WQ-4.1 – *Modify DTX Design Criteria to Avoid Flood Hazards*. The TJPA shall modify the DTX Design Criteria to protect project elements from flood hazards. Specifically, the TJPA shall design

and construct Transbay Program Phase 2 within the area delineated as being within a 100-year floodplain to prevent inundation of the project rail alignment and associated infrastructure and to remain operational for the predicted flood level. Changes to the current DTX Design Criteria will include designing station entrances and other points of access to below-ground portions of the DTX system to maintain sufficient freeboard above the 100-year base flood elevation to protect the rail facilities and the public from 100-year storm water entering the stations and the tunnel. Changes to the design criteria will be completed prior to the next phase of design so that these standards can be incorporated into the 30 percent Preliminary Engineering design for DTX. In updating project designs to meet the modified DTX Design Criteria, the TJPA shall consider the cost-benefit of flood-proofing measures and designs which do not preclude other measures that may be more practicable and effective when the future flood risks become more evident. Because implementation of the proposed project would occur at a future date, the TJPA shall amend and update the DTX Design Criteria to incorporate new information related to San Francisco's FEMA FIRM or climate-informed science predictions and mapping of sea-level rise.

New-MM-CU-WQ-9.1 – *Prepare a Sea-Level Rise Adaptation Plan.* Based on the vulnerabilities identified from inundation maps of year 2100 sea-level rise, the TJPA will prepare a Sea-Level Rise Adaptation Plan identifying measures that will be taken to protect the new project facilities as well as the existing TJPA facilities from potential damage due to future flooding from sea-level rise. The TJPA will coordinate with other entities with facilities close to the San Francisco Bay with an equal or greater sea-level rise vulnerability, such as the City and County of San Francisco, San Francisco Bay Conservation and Development Commission, the Port of San Francisco, BART, the California Department of Transportation, and the San Francisco Municipal Transportation Agency.

Specifically, the TJPA shall design its infrastructure system and buildings so that they remain resilient and adaptable over time. The strategies to implement such protection will evolve from the ongoing sessions with other local jurisdictions and agencies, and the performance standard to be achieved will protect the proposed project from the sea-level rise depths projected by the City for the year 2100. It is recognized that the projected flood depths may be refined over time and that new regional and citywide strategies to address sea-level rise will be identified. To the extent feasible, the TJPA shall amend and update its Adaptation Plan and the performance standard to incorporate this new information.

The TJPA shall complete the first Sea-Level Rise Adaptation Plan as part of DTX final design. The Plan shall include the following:

a. Review of available scientific information on sea-level rise data and projections for the subsequent 50 years. Where data and projections indicate different rates of sea-level rise than previously applied, the TJPA will adjust the proposed project's vulnerability assessment and flood design criteria to reflect a median-point of then-current projections.
b. Improvements will meet the flood design criteria as feasible and unconstrained by surrounding development not owned by the TJPA.
c. The plan may also rely on flood improvements implemented separately by agencies other than the TJPA, but that will also provide flood risk reduction benefits for Transbay Program Phase 2 facilities.
d. Opportunities for partnership with other local and regional parties for sea-level rise adaptation or where regional efforts will address flooding risks to TJPA facilities.
e. Consideration of the cost-benefit of flood-proofing measures and designs that do not preclude other measures that may be more practicable and effective when the future flood risks become more evident.

Where the TJPA's adaptation options are constrained because of adjacent infrastructure (such as adjacent roadways and structures not owned by the TJPA), the TJPA will work with adjacent landowners and infrastructure managers to identify opportunities to improve rail system protection in cooperation with other local or regional parties.

21. EF – ELECTROMAGNETIC FIELDS (SEIS/EIR Section 3.11)

See discussion of electromagnetic field impacts in Section 3.11 of the Supplemental EIS/EIR (SEIS/EIR). Mitigation measures include:

New-MM-EF-1.1 – *Evaluate EMI Effects on Nearby Medical Facilities during Final Design of the Additional Trackwork South of the Caltrain Railyard.* During final design, the TJPA shall conduct a site-specific electromagnetic interference (EMI) analysis, based on the OCS alignment, to determine the extent, if any, of disturbance to sensitive electric equipment from the addition of the turnback track, which would be aligned closer to medical and research facilities, such as the University of California San Francisco campus on the east side of the Caltrain right-of-way. If EMI levels result in disturbance to sensitive electric equipment, the TJPA will be responsible for costs related to evaluate, design, monitor, and remediate project-related EMI disruption. More specifically, the following steps will be followed as part of this mitigation measure:

- During final design, the TJPA shall evaluate the specific EMI levels associated with the turnback track at the identified sensitive facilities and determine the appropriate controls necessary to avoid disruption of sensitive equipment prior to testing and commissioning of the proposed project.
- During the testing and commissioning period for the proposed project, EMI levels shall be measured and the TJPA shall coordinate with the identified sensitive facilities to evaluate whether substantial EMI effects are occurring due to system operations. Where substantial EMI effects are detected that disrupt operations of the sensitive electric equipment, the TJPA shall remedy the disruption prior to commissioning of electrified operations through EMF controls and/or shall provide shielding of the sensitive equipment.
- After commissioning of the proposed project, EMI levels shall be monitored during the first year of project operation and reporting of the results shall be shared with any identified sensitive facilities. Identified disruption of sensitive electric equipment during this period shall be immediately remedied through additional modifications to EMF-generating equipment along the turnback track and/or additional shielding of the sensitive electric equipment.

EMI can be reduced at the project level through designs that minimize arcing and radiation of radiofrequency energy. Additional mitigation by shielding of sources is not always practical, but susceptibility to EMI can be reduced by choosing devices designed for a high degree of electromagnetic compatibility. The following strategies will be considered, as appropriate by the TJPA, in identifying feasible and effective mitigation for nearby medical electronic equipment:

- passive engineering controls (e.g., shielding with metallic materials at the medical facility where excessive EMI levels are projected);
- partial cancellation of magnetic field with a wire loop, in which an induced current creates a magnetic field of opposite direction;
- active shielding, that requires a power supply and feedback loop to control the induced current and magnetic field direction and magnitude; and
- design modifications to place EMF from the OCS further away or higher up.

APPENDIX D.2

2018 Final SEIS/EIR Mitigation Monitoring and Reporting Program

TRANSBAY TERMINAL/CALTRAIN DOWNTOWN EXTENSION/ REDEVELOPMENT PROJECT MITIGATION MONITORING AND REPORTING PROGRAM

INTRODUCTION

Assembly Bill (AB) 3180 was enacted by the State Legislature to provide a mechanism to ensure that mitigation measures adopted through the California Environmental Quality Act ("CEQA") process are implemented in a timely manner and in accordance with the terms of project approval. Under AB 3180, local agencies are required to adopt a monitoring or reporting program designed to ensure compliance during project implementation.

The Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project Mitigation Monitoring and Reporting Program ("Mitigation Monitoring Program"), pursuant to AB 3180, CEQA Section 21081.6 and CEQA Guidelines Section 15091, provides the basic framework through which adopted mitigation measures will be monitored to ensure implementation.

Changes to the Mitigation Monitoring Program adopted by the TJPA Board in 2004 to incorporate updates from the Final Supplemental Environmental Impact Statement/Environmental Impact Report (SEIS/EIR) are indicated by underlining for new text and ~~strikethroughs~~ for deleted text.

ORGANIZATION

The Mitigation Monitoring Program is organized in a table format, keyed to each adopted Final EIS/EIR mitigation measure. For each measure, the table: (1) lists the mitigation measure; (2) specifies the party responsible for implementing the measure; (3) establishes a schedule for mitigation implementation; (4) assigns mitigation monitoring responsibility; and (5) establishes monitoring actions and a schedule for mitigation monitoring.

IMPLEMENTATION

While the Mitigation Monitoring Program generally outlines the actions, responsibilities and schedule for mitigation monitoring, it does not attempt to specify the detailed procedures to be used to verify implementation (e.g., interactions between the Project Sponsor – the Transbay Joint Powers Authority, the San Francisco Redevelopment Agency and City departments, use of private consultants, signed-off on plans, site inspections, etc.). Specific monitoring procedures are either contained in approval documents or will be developed at a later date, closer to the time the mitigation measures will actually be implemented.

The majority of the measures will be monitored primarily by the Transbay Joint Powers Authority (TJPA), in consultation with other City and non-City agencies, as part of the site permit, building permit processes or other report.

TRANSBAY TERMINAL/CALTRAIN DOWNTOWN EXTENSION/REDEVELOPMENT PROJECT
FEIS/FEIR AND SEIS/EIR MITIGATION MONITORING AND REPORTING PROGRAM

MITIGATION MEASURE	Responsibility for Implementation	Mitigation Schedule	Monitoring Responsibility	Monitoring Actions/Schedule
Wind				
W 1 – Consider potential wind effects of an individual project for the Redevelopment area. If necessary, perform wind tunnel testing in accordance with City Planning Code Section 148. If exceedences of the wind hazard criterion should occur for any individual project, require design modifications or other mitigation measures to mitigate or eliminate these exceedences. Tailor mitigation measures to the individual needs of each project. Examples of mitigation measures include articulation of building sides and softening of sharp building edges.	San Francisco Redevelopment Agency (Agency)	During environmental review process preceding approval of each individual project in Transbay Redevelopment Area	Agency	Apply project review procedures for wind when projects are developed by or proposed to Agency.
Property Acquisition/Relocation				
Prop 1 – Apply federal Uniform Relocation Act (Public Law 91 646) and California Relocation Act (Chapter 16, Section 7260 et seq., of the Government Code) and related laws and regulations governing both land acquisition and relocation. All real property to be acquired will be appraised to determine its fair market value before an offer is made to each property owner. (Minimum relocation payments are detailed in the laws, and include moving and search payments for businesses.) Provide information, assistance, and payments to all displaced businesses in accordance with these laws and regulations.	City and County of San Francisco (CCSF), Agency, and TJPA	Prior to and during property acquisition and relocation activities	TJPA	TJPA to report to Board on compliance during acquisition and relocation activities.
Safety and Emergency Services				
Saf 1 – Provide project plans to the San Francisco Fire Department for its review to ensure that adequate life safety measures and emergency access are incorporated into the design and construction of Project facilities.	Transbay Joint Powers Authority (TJPA)	Prior to project facility permitting and during construction	TJPA	Project facility plans to be forwarded to CCSF Fire Department prior to permit issuance. Inspect installation during construction.
Saf 2 – Prepare a life safety plan including the provision of on-site measures such as a fire command post at the Terminal, the Fire Department's 800-megahertz radio system and all necessary fire suppression equipment.	TJPA	Prior to project facility permitting	TJPA	TJPA to develop life safety plan during facility design phases and implement during testing and startup up phase.
Saf 3 – Prepare a risk analysis to accurately determine the number of personnel necessary to maintain an acceptable level of service at Project facilities.	TJPA	Prior to project facility permitting	TJPA	TJPA to develop risk analysis during facility design phase.

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Noise – Operations				
NoiO 1 – Apply noise mitigation at the following locations adjacent to the bus storage facility: • Provide sound insulation to mitigate noise impacts at the residences north of the AC Transit Facility at the corner of Perry and Third Street. At a minimum, apply sound insulation to the façade facing the bus storage facility (the south façade). • Construct two noise barriers to mitigate noise impacts to residences south of the AC Transit Facility along Stillman Street. The first noise barrier would be approximately 10 to 12 feet high and run along the southern edge of the AC Transit storage facility. The second noise barrier would be approximately 5 to 6 feet high and would be located on the portion of the ramp at the southwestern corner of the AC Transit facility. Treat the noise barriers with an absorptive material on the side facing the facility to minimize the potential for reflections off the underside of the freeway. • Construct a noise barrier to mitigate noise impacts to residences south of the Golden Gate Transit Facility along Stillman Street. The barrier would be approximately 10 to 12 feet high and run along the southern and a portion of the eastern edge of the Golden Gate Transit storage facility. Treat the noise barriers with an absorptive material on the side facing the facility to minimize the potential for reflections off the underside of the freeway.	TJPA	During construction	TJPA	TJPA to design detailed noise mitigation during preliminary and final design phases. TJPA engineering staff to inspect installation and/or construction of mitigation measures.
NoiO 2 – Landscape the noise walls. Develop the actual design of the walls in cooperation with area residents.	TJPA	During preliminary and final design	TJPA	TJPA to work with area residents during design of noise walls.
NoiO 3 – Construct noise walls prior to the development of the permanent bus facilities.	TJPA	During schedule development, construction document preparation and construction	TJPA	TJPA to develop program schedule and contract documents to implement this construction sequencing requirement.

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New-MM-NO-1.1 – *Design Ventilation Shaft to Avoid Noise Effects on Nearby Uses.* Ventilation shafts shall be designed in accordance with the APTA guidance for controlling noise, which includes a 60 dBA noise level at 50 feet from the facility, at the setback line of the nearest building, or at the nearest occupied area, whichever is nearest to the source. Treatments may include applying acoustical absorption materials to shaft surfaces or attaching silencers to fans.	TJPA	During final design	TJPA	TJPA to incorporate noise abatement and control features and measures as part of the ventilation shaft design during final design and include appropriate specifications in the contract documents. TJPA engineering staff to inspect installation and/or construction of ventilation shafts.
Noise – Construction				
NoiC 1 – Comply with San Francisco noise ordinance. The noise ordinance includes specific limits on noise from construction. The basic requirements are: • Maximum noise level from any piece of powered construction equipment is limited to 80 dBA at 100 feet. This translates to 86 dBA at 50 feet. • Impact tools are exempted, although such equipment must be equipped with effective mufflers and shields. The noise control equipment on impact tools must be as recommended by the manufacturer and approved by the Director of Public Works. • Construction activity is prohibited between 8 p.m. and 7 a.m. if it causes noise that exceeds the ambient noise plus 5 dBA. The noise ordinance is enforced by the San Francisco DPW, which may waive some of the noise requirements to expedite the project or minimize traffic impacts. For example, along Townsend Street where much of the land use is commercial, business owners may prefer nighttime construction since it would reduce disruption during normal business hours. The DPW waivers usually allow most construction processes to continue until 2 a.m., although construction processes that involve impacts are rarely allowed to extend beyond 10 p.m. This category would include equipment used in demolition such as jackhammers and hoe rams, and pile driving. It is not anticipated that the construction documents would have specific limits on nighttime construction. There may be times when nighttime construction is desirable (e.g., in commercial districts where nighttime construction would be less disruptive to businesses in the area) or necessary to avoid unacceptable traffic disruptions. Since the construction would be subject to the requirements of the San Francisco noise regulations, in these cases, the contractor would need to work with the DPW to come up with an acceptable approach balancing interruption of the business and residential community, traffic disruptions, and reducing the total duration of the construction.	TJPA	During preparation of construction contract documents and construction	TJPA	TJPA to work with CCSF Department of Public Works (DPW) regarding construction noise mitigation program.

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NoiC 2 – Conduct noise monitoring. The purpose of monitoring is to ensure that contractors take all reasonable steps to minimize noise.	TJPA	During construction	TJPA	Monitoring data to be provided to CCSF DPW.
NoiC 3 – Conduct inspections and noise testing of equipment. This measure will ensure that all equipment on the site is in good condition and effectively muffled.	TJPA	During construction	TJPA	Perform monitoring during construction.
NoiC 4 – Implement an active community liaison program. This program would keep residents informed about construction plans so they can plan around periods of particularly high noise levels and would provide a conduit for residents to express any concerns or complaints about noise.	TJPA	During construction	TJPA	TJPA to develop and initiate community liaison program during final design prior to construction. Program will continue during construction.
NoiC 5 – Minimize use of vehicle backup alarms. Because backup alarms are designed to get people's attention, the sound can be very noticeable even when their sound level does not exceed the ambient, and it is common for backup alarms at construction sites to be major sources of noise complaints. A common approach to minimizing the use of backup alarms is to design the construction site with a circular flow pattern that minimizes backing up of trucks and other heavy equipment. Another approach to reducing the intrusion of backup alarms is to require all equipment on the site to be equipped with ambient sensitive alarms. With this type of alarm, the alarm sound is automatically adjusted based on the ambient noise. In nighttime hours when ambient noise is low, the backup alarm is adjusted down.	TJPA	During construction document preparation and construction	TJPA	Review contract specifications during final design and inspect construction.
NoiC 6 – Include noise control requirements in construction specifications. These should require the contractor to • Perform all construction in a manner to minimize noise. The contractor should be required to select construction processes and techniques that create the lowest noise levels. Examples are using predrilled piles instead of impact pile driving, mixing concrete offsite instead of onsite, and using hydraulic tools instead of pneumatic impact tools. • Use equipment with effective mufflers. Diesel motors are often the major noise source on construction sites. Contractors should be required to employ equipment fitted with the most effective commercially available mufflers. • Perform construction in a manner to maintain noise levels at noise sensitive land uses below specific limits. • Perform noise monitoring to demonstrate compliance with the noise limits. Independent noise monitoring should be performed to check compliance in particularly sensitive areas. • Minimize construction activities during evening, nighttime, weekend and holiday periods. Permits would be required before construction can be performed in noise sensitive areas during these periods.	TJPA	Final design and construction	TJPA	TJPA to develop detailed noise control requirements during preliminary engineering and final design. Ensure contractor obtains permits if necessary. Inspect construction activities for compliance and monitor noise levels. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as CCSF Department of Parking and Traffic (DPT) and DPW.

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• Select haul routes that minimize intrusion to residential areas. This is particularly important for the trench alternatives that will require hauling large quantities of excavation material to disposal sites. Controlling noise in contractor work areas during nighttime hours is likely to require some mixture of the following approaches: • Restrictions on noise producing activities during nighttime hours. • Laying out the site to keep noise producing activities as far as possible from residences, to minimize the use of backup alarms, and to minimize truck activity and truck queuing near the residential areas. • Use of procedures and equipment that produce lower noise levels than normal. For example, some manufacturers of construction equipment can supply special noise control kits with highly effective mufflers and other materials that substantially reduce noise emissions of equipment such as generators, tunnel ventilation equipment, and heavy diesel power equipment including mobile cranes and front-end loaders. • Use of temporary barriers near noisy activities. By locating the barriers close enough to the noise source, it is possible to obtain substantial noise attenuation with barriers 10 to 12 feet high even though the residences are 30 to 40 feet higher than the construction site. • Use of partial enclosures around noisy activities. It is sometimes necessary to construct shed-like structures or complete buildings to contain the noise from nighttime activities.				
Vibration – Operations				
VibO1 – Use high-resilience track fasteners or a resiliently supported tie system for the Caltrain Downtown Extension for areas projected to exceed vibration criteria, including the following locations: (1) Live/Work condos, 388 Townsend Street (Hubbell an Seventh), (2) San Francisco Residences on Bryant (Harrison Parking Lot Site), (3) Clock Tower Building, and Second Street High Rise and (4) new Marriott Courtyard (Marine Firefighter's Union).	TJPA	During preliminary engineering, final design and construction	TJPA	TJPA to develop locations/use of resilience track fasteners or resiliently supported tie system during preliminary engineering and final design. Review construction documents and inspect installation. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as CCSF Department of Building Inspection (DBI) and DPW.

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Vibration – Construction				
VibC 1 – Limit or prohibit use of construction techniques that create high vibration levels. At a minimum, processes such as pile driving would be prohibited at distances less than 250 feet from residences.	TJPA	During preliminary engineering, final design and construction	TJPA	TJPA to ensure preliminary design, final design and contract documents preclude use of pile driving equipment within 250 feet of residences. Construction management and inspection will monitor contractors' activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW.
VibC 2 – Restrict procedures that contractors can use in vibration sensitive areas. (It is often possible to employ alternative techniques that create lower vibration levels. For example, unrestricted pile driving is one activity that has considerable potential for causing annoying vibration. Using the cast-in-drilled-hole piling method instead will eliminate most potential for vibration impact from the piling.)	TJPA	During preliminary engineering, final design and construction	TJPA	TJPA to establish construction vibration design standards during final design. Include provisions in contract documents and monitor contractors' activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW.
VibC 3 – Require vibration monitoring during vibration intensive activities.	TJPA	During construction	TJPA	TJPA to include provisions for vibration monitoring in construction contract documents or perform monitoring under a separate contract. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW.

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VibC 4 – Restrict the hours of vibration intensive activities such as pile driving to weekdays during daytime hours.	TJPA	During design and construction	TJPA	TJPA to include provisions in contract documents and monitor contractors' activities to ensure compliance.
VibC 5 – Investigate alternative construction methods and practices to reduce the impacts in coordination with the construction contractor if resident annoyance from vibration becomes a problem.	TJPA	During final design and during construction	TJPA	TJPA to include provisions in contract documents and monitor contractors' activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW.
VibC 6 – Include specific limits, practices and monitoring and reporting procedures for the use of controlled detonation. Control and monitor use of controlled detonation to avoid damage to existing structures. Include specific limits, practices, and monitoring and reporting procedures within contract documents to ensure that such construction methods, if used, would not exceed safety criteria.	TJPA	During final design and during construction	TJPA	TJPA to establish detailed limits, practices, and monitoring program for controlled detonation during final design. Include provisions in contract documents and monitor contractors' activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW.
Soils/Geology				
SG 1 – Monitor adjacent buildings for movement, and if movement is detected, take immediate action to control the movement.	TJPA	During construction	TJPA	TJPA to include provisions in contract documents requiring such monitoring and corrective measures and inspect contractors' activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW.

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SG 2 – Apply geotechnical and structural engineering principles and conventional construction techniques similar to the design and construction of high-rise buildings and tunnels throughout the downtown area. Apply design measures and utilize pile-supported foundations to mitigate potential settlement of the surface and underground stations.	TJPA	During preliminary engineering and final design	TJPA	TJPA to review design and contract documents to ensure implementation. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW.
SG 3 – Design and construct structural components of the project to resist strong ground motions approximating the maximum anticipated earthquake (0.5g). The cut-and-cover portions will require pile supports to minimize non-seismic settlement in soft compressible sediments (Bay Mud). The underground Caltrain station at Fourth and Townsend will require pile-supported foundations due to the presence of underlying soft sediments.	TJPA	During preliminary engineering, final design and construction	TJPA	TJPA to design structural components to meet seismic standards during preliminary engineering and final design. Review design, contract documents and construction activities to ensure implementation. Where applicable, coordinate with JPB and CCSF departments with jurisdiction over activities, such as DBI and DPW.
SG 4 – Underpin existing building, where deemed necessary, to protect existing structures from potential damage that could result from excessive ground movements during construction. Design the tunneling and excavation procedures (and construction sequence), and design of the temporary support system with the objective of controlling ground deformations within small enough levels to avoid damage to adjacent structures. Where the risk of damage to adjacent structures is too great, special measures will be implemented such as: (1) underpinning, (2) ground improvement, and/or (3) strengthening of existing structures to mitigate the risks. Underpinning may include internal strengthening of the superstructure, bracing, reinforcing existing foundations, or replacing existing foundations with deep foundations embedded outside the tunnel zone of influence. Alternatives, in lieu of underpinning, involve strengthening the rock between the building and crown of tunnel. Grouting in combination with inclined pin piles can be used not only to strengthen the rock, but also make the rock mass over the tunnel act as a rigid beam, allowing construction of tunnels with no adverse effects on the buildings supported on shallow foundations over the tunnel.	TJPA	During preliminary engineering, final design and construction	TJPA	TJPA to design tunneling, excavation procedures, underpinning, strengthening existing structures or ground improvement to protect existing structures from damage. Include provisions in contract documents requiring contractors to implement measures during construction. Monitor construction activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW.

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SG 5 – TJPA shall assure proper design and construction of pile-supported foundations for structures to control potential settlement of the surface. Stability of excavations and resultant impacts on adjacent structures can be controlled within tolerable limits by proper design and implementation of the excavation shoring systems.	TJPA	During preliminary engineering, final design and construction	TJPA	TJPA to ensure foundations and excavation shoring systems are designed and constructed to minimize and control settlement and impacts on adjacent structures. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DBI and DPW.
New-MM-C-GE-4.1 – *Groundwater Control during Construction.* Groundwater control shall be implemented to reduce ground instability in the construction area, where excavations encroach into the prevailing groundwater table. • For excavations with the cut-and-cover technique, the groundwater level within the footprint of the excavation shall be maintained a minimum of 2 feet or more beneath the bottom of the excavation throughout construction to minimize the potential for failure of the base of the excavation due to high groundwater seepage at construction sites. The groundwater level outside of the excavation footprint shall remain unchanged. • For excavations with the SEM construction method in rock, groundwater intrusion into the tunnel excavation is expected to be minimal and localized at joints in the rock. Groundwater seeping into the excavation shall be controlled locally by panning and piping channel inflows to sump pumps located in the portal area. • For excavations with the SEM construction method in soft ground conditions (i.e., sands and clays), the groundwater level shall be locally drawn down to below the bottom of the excavation in order to increase the strength of the ground and reduce potential ground instability.	TJPA	During construction	TJPA	TJPA to design DTX facilities to protect structures from damage related to high seepage gradients. Include provisions in contract documents requiring contractors to implement measures during construction. Monitor construction activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities.
Utilities				
Util 1 – Coordinate with utility providers during preliminary engineering, continuing through final design and construction. Utilities would be avoided, relocated, and/or supported as necessary during construction activities to prevent damage to utility systems and to minimize disruption and degradation of utility service to local customers.	TJPA	During preliminary engineering, final design and construction	TJPA	TJPA to identify utilities; design relocations or protection measures where required; and include requirements in contract documents. Monitor construction activities to ensure implementation of all required measures.

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Cultural and Historic Resources				
CH 1 – Comply with the provision of the signed Memorandum of Agreement (MOA) between the Federal Transit Administration, the State Historic Preservation Officer, and the TJPA.	TJPA	During preliminary engineering, final design and construction	TJPA	TJPA will assure compliance with MOA provisions during preliminary engineering, final design and construction, as described below.
CH 2 – **Professional Qualifications.** Assure all activities regarding history, historic preservation, historic architecture, architectural history, historic and prehistoric archaeology are carried out by or under the direct supervision of persons meeting, at a minimum, the Secretary of the Interior's professional qualifications standards (48 FR 44738-9) (PQS) in these disciplines. Nothing in this stipulation may be interpreted to preclude any signatory or any agent or contractor thereof from using the properly supervised services or persons who do not meet the PQS. **Historic Preservation Standards.** Assure all activities regarding history, historic preservation, historic architecture, architectural history, historic and prehistoric archaeology are carried out to reasonably conform to the Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716-44740) as well as to applicable standards and guidelines established by SHPO. **Curation and Curation Standards.** Ensure that FTA and TJPA shall, to the extent permitted under sections 5097.98 and 5097.991.[sic] of the California Public Resources Code, materials and records resulting from any archaeological treatment or data recovery that may be carried out pursuant to this MOA, are curated in accordance with 36 CFR Part 79.	TJPA	During preliminary engineering, final design and construction	TJPA	Prior to initiation of design and construction activities, TJPA will require submission of and review qualifications of professionals performing the MOA activities to assure that Secretary of Interior standards are met.
CH 3 – Integrate into the design of the new terminal a dedicated space for a permanent interpretive exhibit. The interpretive exhibit will include at a minimum, but is not necessarily limited to: plaques or markers, a mural or other depiction of the historic Transbay Transit Terminal (TTT), ramps, or Key System, or other interpretive material.	TJPA	During preliminary engineering and final design	TJPA	TJPA will include space for interpretive exhibit in terminal during design. Review contract documents and construction submittals and activities to ensure implementation.

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CH 4 – Consult with the State Department of Transportation (Department) regarding the availability of historical documentary materials for the creation of the permanent interpretive display of the history of the original TTT building and its association with the San Francisco-Oakland Bay Bridge. Department will assist TJPA in planning the scope and content of the proposed interpretive exhibit. Invite the Oakland Heritage Alliance, the San Francisco Architectural Heritage, the California State Railroad Museum, and the Western Railway Museum to participate in this consultation. While retaining responsibility for the development of the exhibit, TJPA will jointly consider the Department's and participating invitees' recommendations when finalizing the exhibit design. TJPA will produce, install, and maintain the exhibit.	TJPA	During preliminary engineering and final design	TJPA	TJPA will consult with Department regarding availability of documentary materials. TJPA will invite participation in this review from the other designated parties. TJPA will produce, install, and maintain the exhibit in the new Transbay Terminal.
CH 5 – Consult with the City of Oakland about its possible interest in having a similar interpretive exhibit in the East Bay. If agreement is reached prior to completion of final design of the Transbay Terminal, TJPA will provide and deliver exhibit materials to a venue that is mutually satisfactory to TJPA and the City of Oakland.	TJPA	During preliminary engineering and final design	TJPA	During preliminary engineering and final design, TJPA will consult with City of Oakland regarding its possible interest in establishing an exhibit. TJPA will provide and deliver exhibit materials to a venue in the City of Oakland that is mutually satisfactory to TJPA and the City of Oakland should such an exhibit be developed.
CH 6 – Identify, in consultation with Department, elements of the existing TTT that may be suitable for salvage and interpretive use by museums. Within two years following execution of this MOA by FTA and SHPO, TJPA will offer any elements identified as suitable for salvage and interpretive use to San Francisco Architectural Heritage, the California State Railroad Museum, Sacramento, the Western Railway Museum, the Oakland Museum, and any other interested parties. Remove any elements selected in a manner that minimizes damage and deliver with legal title to the recipient. Items not accepted by interested parties for salvage or interpretive use within the time frame specified herein will receive no further consideration.	TJPA	During preliminary engineering and final design	TJPA	Acceptance of items by interested parties must be completed at least 90 days prior to demolition of the Transbay Terminal.
CH 7 – Consult with Department and the Oakland Museum about contributing to Department's exhibit and the production of an interpretive video at the Oakland Museum relating to the history and engineering of the major historic state bridges of the San Francisco Bay Area. TJPA will propose contributions to such an exhibit and video that would be related to the history of the TTT, bus ramp loop structures, and the Key System. Items contributed by TJPA to such an exhibit may include photographs, drawings, videotape, models, oral histories, and salvaged components from the TTT.	TJPA	During preliminary engineering and final design	TJPA	TJPA will produce and deliver to the Oakland Museum agreed-upon materials for such an exhibit and interpretive video.

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CH 8 – Assist the Oakland Museum by contributing up to $50,000 toward the cost of preparing and presenting the exhibit and preparing an exhibit catalog or related museum publication in conjunction with the exhibit, in a manner and to the extent that is mutually satisfactory to TJPA, Department, and the Oakland Museum. A separate agreement will outline the negotiated financial contributions. Work with the Oakland Museum and assist in the preparation of an exhibit and interpretive video if consultation results in agreement between TJPA and the Oakland Museum prior to demolition of the existing TTT.	TJPA	During preliminary engineering and final design	TJPA	TJPA will work with Oakland Museum and assist in the preparation of an exhibit and an interpretive video if consultation results in an agreement between TJPA and Oakland Museum prior to demolition of the existing Transbay Terminal.
CH 9 – Request that SHPO, prior to the start of any work that would have an adverse effect on components of the Bay Bridge that are historic properties, determine whether these components, including the TTT and associated ramps, have been adequately recorded in existing documents. If SHPO determines that, collectively, such documents, which include the Department's past recordation of a series of remodeling and seismic retrofit project that have occurred since 1993, adequately document the TTT and ramps, then no further documentation will be necessary.	TJPA	During preliminary engineering and final design	TJPA	TJPA will consult with the SHPO regarding adequacy of prior recordation efforts.
Seek, with the assistance of the Department, to obtain the original drawings of the TTT by architect T. Pflueger.				TJPA will work with Department to seek original drawings of the Transbay Transit Terminal.
If SHPO determines that existing documentation is adequate, compile such documentation into a comprehensive record. Components to be included in the review of past documentation are: • 425 Mission Transbay Transit Terminal (APN 3719-003, 3720-001, 3721-006); • Upper Deck San Francisco Approaches or North Connector, Bridge #34-116F; • Upper Deck San Francisco Approaches or Center Ramps, Bridge #34-118L; • San Francisco Approaches or Lower Deck On-Ramp, Bridge #34-118R; • Transbay Terminal Loop ramp, Bridge #34-119Y; and • Harrison Street over-crossing Bridge #34-120Y.				If SHPO determines that existing documentation is adequate, compile such documentation into a comprehensive record.

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Consult further with SHPO, if SHPO determines that existing documentation does not constitute adequate recordation of the Bay Bridge components addressed hereunder. SHPO will determine what level and type of additional documentation is necessary.				If SHPO determines that existing documentation does not constitute adequate recordation of the Bay Bridge components, then TJPA and SHPO will consult further and SHPO will determine what level and type of additional documentation is necessary. If no response from SHPO within 45 days of receipt of each submittal of documentation, TJPA may assume that said documentation is adequate and may proceed with the project.
Provide xerographic copies of this documentation to the SHPO and the Department Headquarters Library, upon a written determination by SHPO that all documentation prescribed hereunder is satisfactory, to the History Center at the San Francisco Public Library, San Francisco Architectural Heritage, the Oakland History Room of the Oakland Public Library, the Oakland Museum of California, the Western Railway Museum, and Department District 4 Office. Thereafter, TJPA may proceed with that aspect of the Project that will adversely affect the historic properties documented hereunder.				TJPA will ensure that these records are accepted by SHPO prior to demolition of the TTT and provide copies of the documentation to designated agencies. Then, TJPA will proceed with the aspect of the project that will adversely affect the historic properties documented.
CH 10 – Within 180 days after FTA determines that the Project has been completed, TJPA, in consultation with FTA and SHPO, will re-evaluate the Bay Bridge, a property listed on the NRHP, and determine whether the National Register nomination should be amended or whether the bridge no longer qualifies for listing and should be removed from the National Register. As appropriate, TJPA will prepare and submit to the FTA and SHPO either an amended nomination or petition for removal, to be processed according to the procedures set forth in 36 CFR Part 60 (60.14 and 60.15).	TJPA	Within 180 days after FTA determines that the Project has been completed	TJPA	As appropriate, TJPA will prepare and submit to the FTA and SHPO either an amended nomination or petition for removal, to be processed according to the procedures set forth in 36 CFR part 60 (60.14 and 60.15). TJPA will coordinate these efforts with the CCSF Planning Department.

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CH 11 – Develop and implement measures, in consultation with the owners of historic properties immediately adjoining the construction sites, to protect the contributing elements of the Second and Howard Streets Historic District and the Rincon Point/South Beach Historic Warehouse Industrial District from damage by any aspect of the Project. Such measures will include, but are not necessarily limited to those identified in the MOA. The protective measures herein stipulated will be developed and implemented by TJPA prior to the commencement of any aspect of the Project that could have an adverse effect on historic properties immediately adjoining the construction sites herein identified. In addition, TJPA will monitor the effectiveness of the protective measures herein stipulated and will supplement or modify these measures as and where necessary in order to ensure that they are effective. The historic properties covered by the terms of this paragraph are: • 589-591 Howard Street/3736-098, NRHP Status: 1D, Contributing Element of Second & Howard District & New Montgomery/Second Street, Const. Date: 1906, Type of Impact: Cut-and-cover construction ~~nearby~~; need easement. • 163 Second Street/3721-048, NRHP Status: 1D, Contributing Element of Second & Howard District & New Montgomery/Second Street, Const. Date: 1907, Type of Impact: Cut-and-cover construction nearby. • 165-173 Second Street/3721-025, NRHP Status: 1D, Contributing Element of Second & Howard District & New Montgomery/Second Street, Const. Date: 1906, Type of Impact: Cut-and-cover construction; need easement. • 166-78 Townsend Street/3788-012, NRHP Status: 3D Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1910 [1], 1988 [2], Type of Impact: Cut-and-cover construction nearby. Need construction easement. • 640-Second Street/3788-002, NRHP Status: 252, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1926, Type of Impact: Tunnel under or near property. • 650 Second Street/3788-049 through 3788-073, NRHP Status: 252, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1922, Type of Impact: Tunnel under or near property. • 670-680 Second Street/3788-043, 3788-044, NRHP Status: 252 (670), 3D (680), Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1913, Type of Impact: Tunnel under or near property.	TJPA	During preliminary engineering, final design, and construction	TJPA	TJPA will contact owners of record of historic properties that will be affected (but that will not be acquired and demolished) by the Project. TJPA will provide and review this mitigation monitoring program with the owners via correspondence and/or public and face-to-face meetings. TJPA will coordinate these efforts with the CCSF Planning Department prior to commencement of any aspect of the project that could have any adverse effect on historic properties immediately adjoining the construction sites herein identified. TJPA will monitor the effectiveness of the protective measures and will supplement or modify these measures as and where necessary in order to ensure that they are effective.

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• 301-321 Brannan Street/3788-037, NRHP Status: 3D, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1909, Type of Impact: Tunnel under or near property. • 130 Townsend Street/3788-008, NRHP Status: 3D, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1910 [1], 1895-6 [2], Type of Impact: Tunnel under or near property. • 136 Townsend Street/3788-009, NRHP Status: 3D, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1902 [1], 1913 [2], Type of Impact: Tunnel under or near property. • 144-46 Townsend Street/3788-009A, NRHP Status: 3D, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1922, Type of Impact: Tunnel under or near property. • 148-54 Townsend Street/3788-010, NRHP Status: 3D, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1922, Type of Impact: Tunnel under or near property. • 162-164 Townsend Street/3788-081, NRHP Status: 3D, Contributing Element of Rincon Point/South Beach District & South End District, Const. Date: 1919, Type of Impact: Tunnel under or near property. Notes: National Register Status Codes are as follows: 1 – Listed on the NRPH 251 – Determined eligible for listing by the Keeper of the Register 252 – Determined eligible for listing by the consensus of the SHPO and federal agency 1D – Listed on the National Register as a contributor to a district or multi-resource property				

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CH 12 –TJPA will take the effect of the Project on the ~~three~~ historic properties listed below into account by recording these properties in accordance with the terms herein set forth. These buildings are: • 191 2nd Street, (APN: 3721-022), and • 580-586 Howard Street, (APN: 3721-092 through 3721-106), ~~and~~ ~~• 165-173 2nd Street, (APN: 3721-025).~~	TJPA	During preliminary engineering and final design	TJPA	TJPA will consult SHPO and SHPO will determine the type of recordation necessary for the properties.
Prior to taking any action that could adversely affect these properties, consult SHPO and SHPO will determine the type and level of recordation that is necessary for these properties. Upon a written determination by SHPO that all documentation prescribed hereunder is complete and satisfactory, submit a copy of this documentation to SHPO, with xerographic copies8 to the History Center at the San Francisco Public Library, San Francisco Architectural Heritage, and the Oakland History Room of the Oakland Public Library. Thereafter, proceed with that aspect of the Project that will adversely affect the historic properties documented hereunder.				TJPA will submit a copy of this documentation to SHPO, upon a written determination by SHPO that all documentation prescribed hereunder is complete and satisfactory, with copies to the designated agencies.
If SHPO does not respond within 45 days of receipt of each submittal of documentation prescribed herein, assume that SHPO has determined that said documentation is adequate and may proceed with that aspect of the Project that will adversely affect the historic properties documented hereunder.				If no response from SHPO within 45 days of receipt of each submittal of documentation, then TJPA may proceed with the project.

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CH 13 – Repair, in accordance with the Secretary of the Interior's Standards for Rehabilitation, any damage to contributing elements of the Second and Howard Streets Historic District and the Rincon Point/South Beach Historic Warehouse Industrial District resulting from the Project.	TJPA	Prior to, during, and following construction	TJPA	TJPA will repair any damage to contributing elements.
Photograph the condition of the contributing elements prior to the start of the Project to establish the baseline condition for assessing damage. Consult with property owner(s) about the appropriate level of photographic documentation of building interiors and exteriors. Provide a copy of this photographic documentation to the property owner(s), and retain on file.				TJPA will photograph condition of contributing properties prior to the start of the Project to establish the baseline condition for assessing damage. TJPA will consult with property owner(s) about the appropriate level of photographic documentation of building interiors and exteriors, provide a copy of this photographic documentation to the property owner(s), and retain copy on file by TJPA.
Submit repair plans and specifications to SHPO for review and comment, if repair of inadvertent damage resulting from the Project is necessary, to ensure that the work conforms to the Secretary of the Interior's Standards for Rehabilitation. Consult with SHPO to establish a mutually satisfactory time frame for the SHPO's review. TJPA will carry out any repairs required hereunder in accordance with the comments of SHPO.				TJPA will submit repair plans and specifications to SHPO for review and comment, if repair of inadvertent damage is necessary, to ensure conformance to the Secretary of the Interior's Standards for Rehabilitation.

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CH 14 – Within 180 days after FTA determines that the Project has been completed, TJPA, in consultation with FTA and SHPO, will re-evaluate the Second and Howard Streets Historic District and determine whether the National Register nomination should be amended or whether the district no longer qualifies for listing and should be removed from the National Register. As appropriate, TJPA will prepare and submit to the FTA and SHPO either an amended nomination or petition for removal, to be processed according to the procedures set forth in 36 CFR Part 60 (60.14 and 60.15).	TJPA	Within 180 days after FTA determines that the Project has been completed	TJPA	As appropriate, TJPA will prepare and submit to the FTA and SHPO either an amended nomination or petition for removal, to be processed according to the procedures set forth in 36 CFR part 60 (60.14 and 60.15). TJPA will coordinate these efforts with the CCSF Planning Department.
CH 15 – Within 45 days following execution of MOA, consult with FTA, SHPO, JPB and CCSF to initiate the process of determining how archaeological properties that may be affected by the Project will be identified, whether and how the NRHP eligibility of such properties may be addressed, and whether and how the Project's effects, if any, on those archaeological properties that may be considered historic properties for purposes of this MOA, may be taken into account. FTA and TJPA to invite Caltrans to participate in this consultation. Determine the time frame for this consultation with the consulting parties through consensus. Consultation will at minimum be informed by, and take into account, the following documents: • Attachment 6, "Standard Treatment of Archaeological Sites: Data Recovery Plan," of the "Programmatic Agreement among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Office, and the California Department of Transportation regarding compliance with Section 106 of the National Historic Preservation Act, as it pertains to the Administration of the Federal Aid Highway Program in California;" • "Archaeological Research Design and Treatment Plan for SF-480 Terminal Separation Rebuild" (Praetzellis and Praetzellis, 1993) and "The San Francisco-Oakland Bay Bridge, West Approach Replacement: Archaeological Research Design and Treatment Plan" (Ziesing, 2000); • "Revised Historical Archaeology Research Design for the Central Freeway Replacement Project" (Thad M. Van Bueren, Mary Praetzellis, Adrian Praetzellis, Frank Lortie, Brian Ramos, Meg Scantlebury and Judy D. Tordoff).	TJPA	During preliminary engineering phase	TJPA	SHPO, FTA, SHPO, TJPA, JPB, and CCSF will consult to determine how archaeological properties will be identified, whether and how the NRHP eligibility of such properties may be addressed, and whether and how the Project's effects, if any, on those archaeological properties that may be considered historic properties may be taken into account. Invite Caltrans to participate in this consultation. The consultation will take into account the designated documents.

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CH 16 – If the consulting parties agree that a treatment plan for archaeological properties should be prepared, prepare a Treatment Plan for archeological resources that provides for the identification, evaluation, and treatment of archaeological properties that may be affected by the Project and that conform to the requirements above of item CH13 1) and take into account the information contained in items CH13 2) and CH13 3) and conform to any other standards, documentation, or guidance that the consulting parties may specify.	TJPA	During preliminary engineering	TJPA	TJPA will assure completion of comprehensive treatment plan consistent with the content required in the MOA, if the consulting parties agree that a treatment plan for archaeological properties is to be prepared.
If the consulting parties agree that the Treatment Plan will address historic archaeological properties as well as prehistoric archaeological properties, ensure that appropriately qualified historians prepare a historic context(s) that will be used by an interdisciplinary team consisting at a minimum of historians and historic archaeologist.				TJPA shall transmit this plan to the signatories of the MOA.
The historic context will, at a minimum: • identify significant research themes and topics that relate to the historic period(s) addressed by the historic context(s) • determine what types of historic archaeological properties, if any, that may usefully and significantly contribute to research themes and topics deemed by the historic context(s) study to be important • identify the specific components and constituents (features, artifacts, etc., if any, of historic archaeological property types that can factually and directly, contribute data important to our understanding of significant historic research themes and topics • determine the amount (sample size, etc.) of archaeological excavation and related activity that is needed to provide the range and type of factual data that will contribute to our understanding of significant historic research themes and topics				TJPA will ensure that appropriately qualified historians prepare a historic context(s) that includes the specified information for use by an interdisciplinary team consisting at a minimum of historians and historic archaeologist, if the consulting parties agree that the Treatment Plan will address historic archaeological properties as well as prehistoric archaeological properties.
Submit the draft Treatment Plan to the other consulting for review and comment. The consulting parties have 45 days from receipt of the draft Treatment Plan to comment in writing to FTA and TJPA. Failure of the consulting parties to respond within this time frame shall not preclude FTA and TJPA from finalizing the draft Treatment Plan to their satisfaction. Before finalizing the draft Treatment Plan, FTA and TJPA to provide the consulting parties with written documentation indicating whether and how the draft Treatment Plan will be modified. Unless any consulting party objects to this documentation in writing to FTA and TJPA within 15 days following receipt, finalize the draft Treatment Plan as deemed appropriate by FTA and TJPA, and proceed to implement the final Treatment Plan.	TJPA	During preliminary engineering phase	TJPA and FTA	TJPA will submit the draft Treatment Plan to the consulting parties for review and comment. Before finalizing the draft Treatment Plan, FTA and TJPA will provide the consulting parties whether and how the draft Treatment Plan will be modified.

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If FTA and TJPA propose to modify the final Treatment Plan, they will notify the consulting parties concurrently in writing about the proposed modifications. The consulting parties will have 15 days from receipt of notification to comment in writing to FTA and TJPA. Failure of the consulting parties to respond within this time frame shall not preclude FTA and TJPA from modifying the final Treatment Plan to their satisfaction.				TJPA will ensure that the consulting parties have 15 days following receipt of notification of the modifications to comment in writing about the proposed modifications. Unless consulting party objects, FTA and TJPA will finalize the draft Treatment Plan as they deem appropriate, and TJPA and FTA will implement the final Treatment Plan.
Before modifying the final Treatment Plan, FTA and TJPA will provide the consulting parties with written documentation indicating whether and how the final Treatment Plan will be modified. Unless any consulting party objects to this documentation in writing to FTA and TJPA within 15 days following receipt, modify the final Treatment Plan as appropriate, and proceed to implement the modified final Treatment Plan.	TJPA	During preliminary engineering phase	TJPA and FTA	FTA and TJPA will provide the consulting parties whether and how the final Treatment Plan will be modified. TJPA will ensure that the consulting parties have 15 days following receipt of notification of the modifications to comment in writing about the proposed modifications. Unless consulting party objects, FTA and TJPA will modify the final Treatment Plan as they deem appropriate, and TJPA and FTA will proceed to implement the modified final Treatment Plan.

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CH 17 – Within two years after FTA, in consultation with TJPA, has determined that all fieldwork required by the Treatment Plan has been completed, prepare a draft technical report that documents the results of implementing the Treatment Plan and distributes this draft technical report to the other MOA signatories for review. The reviewing parties will be afforded 60 days following receipt of the draft technical report to submit any written comments to FTA and TJPA. Failure of the reviewing parties to respond within this time frame shall not preclude FTA from authorizing TJPA to revise the draft technical report as FTA and TJPA deem appropriate.	TJPA	Within two years of completed fieldwork	TJPA and FTA	TJPA will prepare a draft technical report that documents the results of implementing the Treatment Plan and distribute this draft technical report to the other MOA signatories for review.
FTA will provide the reviewing parties with a written documentation indicating modifications in accordance with any reviewing party comments. Unless the reviewing parties object to this documentation in writing to FTA and TJPA within 30 days following receipt, modify the draft technical report as FTA and TJPA deem appropriate. Thereafter, issue the technical report in final form and distribute this document in accordance with paragraph CH15 2).				FTA to authorize TJPA to revise draft as deemed appropriate by FTA and TJPA. FTA will provide the reviewing parties with a written documentation indicating modifications in accordance with any reviewing party comments. Unless any reviewing party objects, FTA and TJA to issue technical report in final form and distribute in accordance with paragraph CH15 2).
Distribute copies of the final technical report documenting the results of the Treatment Plan implementation to the other signatory parties, to any consulting Native American Tribe if prehistoric, protohistoric or ethnographic period archaeological properties were located and addressed under the Treatment Plan, and to the appropriate California Historical Resources Information Survey (CHRIS) Regional Information Center, subject to the terms of Stipulation IV. E (CH19).				TJPA will distribute copies of the final technical report documenting the results of Treatment Plan implementation to other signatory parties, to any consulting Native American Tribe, as applicable, and to the appropriate CHRIS Regional Information Center.

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Prepare a written draft document that communicates in lay terms the results of Treatment Plan implementation to members of the interested public. Distribute this written draft document for review and comment concurrently with and in the same manner as that prescribed for the draft written technical report prescribed by paragraph C.1. of this stipulation. If the draft document prescribed hereunder is a publication such as a report or brochure, then distribute such publication to the other signatory parties, to any consulting Native American Tribe as applicable, and to any other entity that the signatory parties and, as applicable, any consulting Native American Tribe, through consultation as appropriate, subject to the terms of Stipulation IV.E (CH 19).				TJPA will prepare a written draft document that communicates in lay terms the results of Treatment Plan implementation to members of interested public.
Prepare a written annual report describing the status of its efforts to comply with the terms of Stipulations II – IV, inclusive, of this MOA. Prepare the annual report following the end of each fiscal year (July 1 to June 30) that this MOA is in effect and distributed it to all MOA signatories by July 30 of each year until FTA and the SHPO through consultation determine that the requirements of stipulations II – IV, inclusive of this MOA have been satisfactorily completed.	TJPA	During preliminary engineering, final design, and construction	TJPA	TJPA will prepare an annual report describing its efforts to comply with the terms of stipulations II-IV.
CH 18 – If the consulting parties agree that a plan for treatment of archaeological properties will not be prepared, then address any archaeological properties discovered during implementation of any aspect of the Project pursuant to 36 CFR 800.13(b)(3).	TJPA	During construction phase	TJPA	If treatment plan not prepared, TJPA will address any archaeological properties discovered during implementation of any aspect of the Project pursuant to 36 CFR 800.13(b)(3).
CH 19 – The signatories to the MOA acknowledge that historic properties covered by this MOA are subject to the provisions of Section 304 of the National Historic Preservation Act of 1966, as amended, and Section 6254.10 of the California Government Code (Public Records Act), relating to the disclosure of archaeological site information and, having so acknowledged, will ensure that all actions and documentation prescribed by this Agreement are consistent with Section 304 of the National Historic Preservation Act of 1966, as amended, and Section 6254.10 of the California Government Code.	TJPA	During preliminary engineering phase	TJPA	TJPA will acknowledge that historic properties covered by the MOA are subject to the provisions specified in the MOA, relating to the disclosure of archaeological site information. TJPA will ensure that actions and documentation are consistent with same.

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CH 20 – The parties to the MOA agree that Native American burials and related items discovered during implementation of the terms of the MOA and of the Project will be treated in accordance with the requirements of Section 7050.5(b) of the California Health and Safety Code. If, pursuant to Section 7050.5(c) of the California Health and Safety Code, the county coroner/medical examiner determines that the human remains are, or may be of Native American origin, then the discovery shall be treated in accordance with the provisions of Section 5097.98(a)-(d) of the California Public Resources Code. TJPA will ensure that to the extent permitted by applicable law and regulation, the views of any consulting Native American Tribe and the Most Likely Descendant(s) are taken into consideration when decisions are made about the disposition of other Native American archaeological materials and records.	TJPA	Prior to, during, and following construction	TJPA	TJPA agree that Native American burials and related items discovered during implementation of the terms of the MOA and of the Project will be treated in accordance with the requirements specified. If, pursuant to Section 7050.5(c) of the California Health and Safety Code, the county coroner/medical examiner determines that the human remains are, or may be of Native American origin, then the discovery shall be treated in accordance with the provisions specified. TJPA will ensure that to the extent permitted by applicable law and regulation, the views of any consulting Native American Tribe and the Most Likely Descendant(s) are taken into consideration when decisions are made about the disposition of other Native American archaeological materials and records.
New-MM-C-CR-4.1 – *Minimize Potential Impacts to Paleontological Resources*. To minimize potential adverse impacts on previously unknown, potentially unique, scientifically important paleontological resources, the TJPA shall do the following: • Before the start of any earthmoving activities, the TJPA shall retain a qualified paleontologist to train all construction personnel involved with earthmoving activities, including the project superintendent, regarding the possibility of encountering fossils, the appearance and types of fossils likely to be seen during construction, and the proper notification procedures should be followed if fossils are encountered.	TJPA	Before and during construction	TJPA	Include provisions in contract documents requiring construction personnel to be trained prior to construction on procedures for notification if resources are detected. Implement measures during construction. Monitor construction activities to ensure compliance.

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• The construction crew shall immediately cease ground-disturbing work in the vicinity of the find and notify the TJPA. • The TJPA shall retain a qualified paleontologist to evaluate the resource and prepare a recovery plan, in accordance with Society of Vertebrate Paleontology guidelines (SVP 1996). The recovery plan may include a field survey, construction monitoring, sampling and data recovery procedures, museum storage coordination for any specimen recovered, and a report of findings. Necessary and feasible recommendations in the recovery plan shall be implemented before construction activities are resumed at the site where the paleontological resource was discovered.				
Hazardous Materials/Waste – Operations				
HWO 1 – Construct and operate any Caltrain fueling facility in compliance with local, state and Federal regulations regarding handling and storage of hazardous materials. (Caltrain Joint Powers Board (JPB)/TJPA).	Caltrain Joint Powers Board (JPB)	During construction and operations	TJPA	Review design and contract documents to ensure compliance with all applicable regulations. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations. Inspect operations, and comply with all permitting and reporting requirements.
HWO 2 – Equip diesel fuel pumps with emergency shut-off valves and, in compliance with U.S. EPA requirements, fuel Underground Storage Tanks (USTs) would be equipped with leak detection and monitoring systems.	JPB	During operations	TJPA	Review design and contract documents to ensure compliance with all applicable regulations. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations. Inspect operations, and comply with all permitting and reporting requirements.
HWO 3 – Employ the use of secondary containment systems for any aboveground storage tanks.	JPB	During operations	TJPA	Secondary containment to be included in facility design and construction and maintained during operations.

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HWO 4 – Store cleaning solvents in 55-gallon drums, or other appropriate containers, within a bermed area to provide secondary containment.	JPB	During operations	TJPA	Inspect operations, and comply with all permitting and reporting requirements.
HWO 5 – Slope paved surfaces within the fueling facility and the solvent storage area to a sump where any spilled liquids could be recovered for proper disposal.	JPB	During construction and operations	TJPA	Sloped paved surfaces and sump to be included in facility design.
HWO 6 – Follow California OSHA and local standards for fire protection and prevention for the handling and storage of fuels and solvents.	JPB	During operations	TJPA	Review design and contract documents to ensure compliance with all applicable regulations. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations. Inspect operations, and comply with all permitting and reporting requirements.
HWO 7 – Prepare a Hazardous Materials Management/Business Plan and file with the CCSF Department of Public Health.	JPB	During final design	TJPA	JPB to prepare and TJPA to file Hazardous Materials Management/Business Plan with CCSF Department of Public Health (DPH).
Hazardous Materials/Waste – Construction				
HMC 1 – Follow California OSHA and local standards for fire protection and prevention. Handling and storage of fuels and other flammable materials during construction will conform to these requirements, which include appropriate storage of flammable liquids and prohibition of open flames within 50 feet of flammable storage areas.	TJPA	During construction	TJPA	Review design and contract documents to ensure compliance with all applicable regulations. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations.

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HMC 2 – Perform detailed investigations of the potential presence of contaminants in soil and groundwater prior to construction, using conventional drilling, sampling, and chemical testing methods. Based on the chemical test results, a mitigation plan will be developed to establish guidelines for the disposal of contaminated soil and discharge of contaminated dewatering effluent, and to generate data to address potential human health and safety issues that may arise as a result of contact with contaminated soil or groundwater during construction. The investigation and mitigation plan will follow the requirements of the City and County of San Francisco's Article 22A in the appropriate areas along the alignment. With construction projects of this nature and magnitude, there are typically two different management strategies that can be employed to address contaminated soil handling and disposal issues. Contaminated soil can be excavated and stockpiled at a centralized location and subsequently sampled and analyzed for disposal profiling purposes in accordance with the requirements of the candidate disposal landfill. Alternatively, soil profiling for disposal purposes can be done in-situ so when soil is excavated it is loaded directly on to trucks and hauled to the appropriate landfill facility for disposal based on the in-situ profiling results. A project of this nature could also combine both strategies.	TJPA	During construction	TJPA	Review design and contract documents to ensure compliance with all applicable regulations. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DPH and DPW.
HMC 3 – Cover with plastic sheeting soils removed during excavation and grading activities that remain at a centralized location for an extended period of time to prevent the generation of fugitive dust emissions that migrate offsite.	TJPA	During construction	TJPA	Review design and contract documents to ensure compliance. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations.
HMC 4 – Use a licensed waste hauler, applying appropriate manifests or bill of lading procedures, as required to haul soil for disposal at a landfill or recycling facility.	TJPA	During construction	TJPA	Review design and contract documents to ensure compliance. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations.

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HMC 5 – Use chemical test results for groundwater samples along the alignment to obtain a Batch Discharge Permit under Article 4.1 of the San Francisco Department of Public Works as well as to evaluate requirements for pretreatment prior to discharge to the sanitary sewer. Effluent produced during the dewatering of excavations will be collected in onsite storage tanks and periodically tested, as required under discharge permit requirements, for potential contamination to confirm the need for any treatment prior to discharge. If required, treatment may include: • Settling to allow particulate matter (total suspended solids) to settle out of the effluent in order to reduce the sediment load as well as reduce elevated metal and other contaminant concentrations that may be associated with suspended sediments; and/or • Construction of a small-scale batch waste water treatment system to remove dissolved contaminants (mainly organic constituents such as petroleum hydrocarbons [gas, diesel, and oils], BTEX, and VOCs) from the dewatering effluent prior to discharge to the sanitary sewer. A treatment system would also likely employ the use of filtration to remove suspended solids.	TJPA	During construction	TJPA	Review design and contract documents to ensure compliance. Obtain all applicable permits. Inspect construction to ensure compliance with contract documents and regulations. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DPH and DPW.
HMC 6 – Develop a detailed mitigation plan for the handling of potentially contaminated soil and groundwater prior to starting project construction.	TJPA	During final design	TJPA	Review detailed mitigation plan, include provisions in contract documents and inspect construction to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DPH and DPW. Obtain all applicable permits.
HMC 7 – Design dewatering systems to minimize downward migration of contaminants that can result from lowering the water table if necessary based on environmental conditions. As necessary, shallow soils with detected contamination would be dewatered first using wells screened only in those soils. Dewatering of deeper soils would then be performed using wells screened only in the zone to be dewatered. Dewatering wells would be installed using drilling methods that prohibit shallow contaminated soils from being carried deeper into the boreholes.	TJPA	During final design and construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DPH and DPW.

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HMC 8 – Require that workers performing activities on site that may involve contact with contaminated soil or groundwater have appropriate health and safety training in accordance with 29 CFR 1910.120. A Worker Health and Safety Plan (HSP) will be developed for the project and monitored for the implementation of the plan on a day-to-day basis by a Certified Industrial Hygienist (CIH). The HSP will include provisions for: • Conducting preliminary site investigations and analysis of potential job hazards; • Personnel protective equipment; • Safe work practices; • Site control; • Exposure monitoring; • Decontamination procedures; and • Emergency response actions. The HSP will specify mitigation of potential worker and public exposure to airborne contaminant migration by incorporating dust suppression techniques in construction procedures. The plan will also specify mitigation of worker and environmental exposure to contaminant migration via surface water runoff pathways by implementation of comprehensive measures to control drainage from excavations and saturated materials excavated during construction.	TJPA	During construction	TJPA	Provide health-and-safety training prior to start of and at timely intervals during construction. Include requirements in contract documents and monitor construction activities to ensure compliance.
HMC 9 – Review existing asbestos surveys, abatement reports, and supplemental asbestos surveys, as warranted. Perform an asbestos survey for buildings to be demolished, as required. Asbestos-containing building materials (ACM) will require abatement prior to building demolition. Removal and disposal of ACM will be performed in accordance with applicable local, state, and federal regulations.	TJPA	During preliminary engineering, final design and construction phases	TJPA	Determine extent of ACM throughout project site. Perform abatement work prior to demolition. Include all regulatory requirements in contract documents and inspect construction to ensure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DPH. Obtain all applicable permits.

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HMC 10 – Perform a lead-based paint survey for buildings to be demolished to determine areas where lead-based paint is present and the possible need for abatement prior to demolition.	TJPA	During preliminary engineering prior to building demolitions	TJPA	Determine extent of lead contamination throughout project site. Perform abatement work prior to demolition if necessary. Include all regulatory requirements in contract documents and inspect construction to insure compliance. Where applicable, coordinate with CCSF departments with jurisdiction over activities, such as DPH. Obtain all applicable permits.
Pedestrians				
Ped 1 – Use future construction or redevelopment as opportunities to increase building set-backs thereby increasing sidewalk widths. Particular areas where such widening is most needed include: • The southeast corner of Fremont and Mission streets, • The northeast corner of First and Mission streets, • The north side of Mission Street between First and Fremont, and • Sidewalks south of Howard Street along Folsom, First, Fremont and Beale that are less than 10 feet wide.	Agency and CCSF	During future project reviews in Transbay Terminal area	Agency and CCSF	TJPA will forward guidance to Agency, CCSF Planning Department and DPW.
Ped 2 – Eliminate or reduce sidewalk street furniture such as newspaper boxes and magazine racks in the immediate Transbay Terminal area on corners.	Agency and CCSF	Prior to opening of new Transbay Terminal	Agency and CCSF	TJPA will forward guidance to Agency, CCSF Planning Department and DPW.
Ped 3 – Retime traffic light signalization. This could improve pedestrian levels of service at each of the intersections studies that fall into LOS F.	CCSF	Prior to opening of new Transbay Terminal	CCSF	TJPA will forward guidance to CCSF DPT.
Ped 4 – Provide crosswalk signalization at intersections where they do not exist already, such as Folsom and Beale streets.	CCSF	Prior to opening of new Transbay Terminal	CCSF	TJPA will forward guidance to CCSF DPT.

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Ped 5 – Provide cross-walk count-down signals at intersections and cross-walks immediately surrounding the new Transbay Terminal.	CCSF	Prior to opening of new Transbay Terminal	CCSF	TJPA will forward guidance to CCSF DPT.
Ped 6 – Ensure that Transbay Terminal design increases corner and sidewalk widths at the four intersections immediately surrounding the Transbay Terminal.	TJPA and CCSF, DPW	During Transbay Terminal design phase	TJPA	TJPA and CCSF DPW, where applicable, to include sidewalk width expansion during preliminary and final design of new Transbay Terminal.
Ped 7 – Provide lights within crosswalks to warn when pedestrians are present in the crosswalk, such as at the cross-walk associated with the mid-block bus loading area.	TJPA	Prior to opening of new Transbay Terminal	TJPA	TJPA to work with CCSF DPT to install cross-walk warnings.
Pre-Construction Activities				
PC 1 – Complete a pre-construction building structural survey to determine the integrity of existing buildings adjacent to and over the proposed Caltrain Downtown Extension. Use this survey to finalize detailed construction techniques along the alignment and as the baseline for monitoring construction impacts during and following construction.	TJPA	Prior to preliminary engineering, final design and construction	TJPA	TJPA to perform building surveys during preliminary engineering. TJPA to include measures to protect existing buildings in final design and construction documents. TJPA to review design submittals, contract documents and construction activities to ensure implementation.

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PC 2 – Contact and interview individual businesses along the Caltrain Downtown Extension alignment to gather information and develop an understanding of how these businesses carry out their work. This survey will identify business usage, delivery/shipping patterns, and critical times of the day or year for business activities. Use this information to assist in: (a) the identification of possible techniques during construction to maintain critical business activities, (b) analyze alternative access routes for customers and deliveries to businesses, (c) develop traffic control and detour plans, and (d) finalize construction practices. (TJPA)	TJPA	During preliminary engineering, final design and construction	TJPA	TJPA to perform business activity survey during preliminary engineering. TJPA to include measures to maintain business activities and access in final design and construction documents. TJPA to review design submittals, contract documents and construction activities to ensure implementation.
PC 3 – Complete detailed geotechnical investigation, including additional sampling (drilling and core samples) and analyses of subsurface soil/rock conditions. Use this information to design the excavation and its support system to be used in the retained cut, cut-and-cover, and tunnel portions of the Caltrain Downtown Extension.	TJPA	During preliminary engineering and final design	TJPA	TJPA to obtain necessary permits from CCSF prior to performing drilling. TJPA to perform detailed geotechnical investigation during preliminary engineering. TJPA to review design submittals, contract documents and construction activities to ensure proper utilization of information obtained during investigation.
PC 4 – Establish community construction information/outreach program to provide on-going dialogue between the TJPA and the affected community regarding construction impacts and possible mitigation/solutions. Include dedicated personnel for an outreach office in the construction area to deal with construction coordination.	TJPA	During construction	TJPA	TJPA to establish program during final design prior to construction.

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PC 5 – Establish site and field offices located along the Caltrain Downtown Extension alignment. Field office staff, in conjunction with other staff, will: • Provide the community and businesses with a physical location where information pertaining to construction can be exchanged, • Enable TJPA and JPB to better understand community/business needs during the construction period, • Allow TJPA and JPB to participate in local events in an effort to promote public awareness of the project, • Manage construction-related matters pertaining to the public, • Notify property owners, residences, and businesses of major construction activities (e.g., utility relocation/disruption and milestones, re-routing of delivery trucks), • Provide literature to the public and press, • Promote and provide presentations on the project via a Speakers Bureau, • Respond to phone inquiries, • Coordinate business outreach programs, • Schedule promotional displays, and • Participate in community committees.	TJPA and JPB	During construction	TJPA	TJPA to establish program during final design and continue during construction.
PC 6 – Implement an information phone line to provide community members and businesses the opportunity to express their views regarding construction. Review calls received and, as appropriate, forward the message to the necessary party for action (e.g., utility company, fire department, the Resident Engineer in charge of construction operations). Information available from the telephone line will include current project schedule, dates for upcoming community meetings, notice of construction impacts, individual problem solving, construction complaints and general information. Phone service would be provided in English, Cantonese, and Spanish and would be operated on a 24-hour basis.	TJPA	During construction	TJPA	TJPA to establish informational "Hot Line" during final design and continue during construction.
PC 7 – Develop traffic management plans. Traffic management plans to maintain access to all businesses will be prepared for areas affected by surface or cut-and-cover construction. In addition, daily cleaning of work areas would be performed by contractors for the duration of the construction period. Provisions would be contained in construction contracts to require the maintenance of driveway access to businesses to the extent feasible.	TJPA	During preliminary engineering, final design and construction	TJPA	TJPA to forward traffic management plans to CCSF DPT for review and approval. Include all requirements in construction documents and inspect implementation during construction.

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New-MM-C-BR-1.1 – *Require Pre-Construction Bird Surveys*. Pre-construction bird surveys shall be required when trees or buildings and/or structures with potential nesting habitat would be disturbed as part of an individual project component. Pre-construction bird surveys shall be conducted on affected potential nesting habitat by a qualified biologist during the nesting season (February 1 through August 15) if construction activities are scheduled to take place during that period. Surveys shall be performed not more than 2 weeks prior to construction in an affected area. If special-status bird or migratory bird species are not found, work may proceed and no further mitigation action is required. If special-status bird or migratory bird species are found to be nesting in or near any work area (at a distance to be determined by a qualified biologist) or, for compliance with federal and state law concerning migratory birds, if birds protected under the federal MBTA or the California Fish and Game Code are found to be nesting in or near any work area, an appropriate no-work buffer zone (e.g., 100 feet for songbirds, 250 feet for raptors) shall be designated by the biologist. Depending on the species involved, the qualified biologist may require input from CDFW and/or the USFWS Division of Migratory Bird Management regarding the most appropriate ways to avoid disturbance to nesting birds. As recommended by the biologist, no activities shall be conducted within the no-work buffer zone that could harass birds or disrupt bird nesting. Outside of the nesting season (August 16 through January 31), or after young birds have fledged, as determined by the biologist, work activities may proceed. Birds that establish nests during the construction period are considered habituated to such activity, and no buffer shall be required, except as needed to avoid direct destruction of the nest, which shall be prohibited.	TJPA	Before construction	TJPA	Include provisions in contract documents to perform surveys and to comply with requirements for consultation and measures to protect nesting birds.
General Construction Measures				
GC 1 – Disseminate information to community in a timely manner regarding anticipated construction activities.	TJPA	During construction	TJPA	TJPA to initiate program during final design and continue during construction.
GC 2 – Provide signage. Work with establishments affected by construction activities to develop appropriate signage for display that directs both pedestrian and vehicular traffic to businesses via alternate routes.	TJPA	Prior to and during construction	TJPA	TJPA to initiate signage program during final design and monitor contractors' installation during construction.
GC 3 – Install level deck. Install decking at the cut-and-cover sections to be flush with the existing street or sidewalk levels.	TJPA	During construction	TJPA	TJPA to design flush decking during preliminary and final design, include in construction documents and ensure installation during construction.

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GC 4 – Provide for efficient sidewalk design and maintenance. Wherever feasible, maintain sidewalks at the existing width during construction. Where a sidewalk must be temporarily narrowed during construction (e.g., deck installation), restore it to its original width during the majority of construction period. (In some places, this may require placing the temporary sidewalk on the deck.) Each sidewalk design should be of good quality and approved by the Resident Engineer prior to construction. Handicapped access will be maintained during construction where feasible.	TJPA	During preliminary engineering and construction	TJPA	TJPA to work with CCSF DPW on design of sidewalk plans during preliminary and final design and ensure installation during construction.
GC 5 – Provide construction site fencing of good quality, capable of supporting the accidental application of the weight of an adult without collapse or major deformation. Where covered walkways or other solid surface fencing is installed, establish a program to allow for art work (e.g., by local students) on the surface(s).	TJPA	During design and construction	TJPA	TJPA to work with CCSF DPW, incorporate requirements in construction documents and inspect installation during construction.
Air Emissions – Construction				
AC 1 – Assure that, as part of the contract provisions, the project contractor is required to implement the measures below at all project construction sites.	TJPA	During development of contract documents	TJPA	Include requirement in contract documents.
AC 2 – Water all active construction areas at least twice daily. Ordinance 175-91, passed by the San Francisco Board of Supervisors on May 6, 1991, requires that non-potable water be used for dust control activities; therefore, the project contractor would be required to obtain reclaimed water from the City's Clean Water Program or other appropriate sources.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
AC 3 – Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
AC 4 – Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
AC 5 – Sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.

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AC 6 – Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
AC 7 – Install sandbags or other erosion control measures to prevent silt runoff to public roadways.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
AC 8 – Replant vegetation in disturbed areas as quickly as possible.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
AC 9 – Minimize use of on-site diesel construction equipment, particularly unnecessary idling.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
AC 10 – Shut off construction equipment to reduce idling when not in direct use.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
AC 11 – Where feasible, replace diesel equipment with electrically powered machinery.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
AC 12 – Locate diesel engines, motors, or equipment as far away as possible from existing residential areas.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
AC 13 – Properly tune and maintain all diesel power equipment.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.

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AC 14 – Suspend grading operations during first and second stage smog alerts, and during high winds, i.e., greater than 25 miles per hour.	TJPA	During and following construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
AC 15 – Upon completion of the construction phase, buildings with visible signs of dirt and debris from the construction site shall be power washed and/or painted (given that permission is obtained from the property owner to gain access to and wash the property with no fee charged by the owner).	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
New-MM-C-AQ-5.1 – *Prepare and Implement an Emissions Plan*. The TJPA shall comply with the following measures to reduce construction emissions: A. *Construction Emissions Minimization Plan*. Prior to issuance of a construction permit, the TJPA shall prepare a Construction Emissions Minimization Plan (Emissions Plan) detailing project compliance with the following requirements: 1. All off-road equipment greater than 25 horsepower and operating for more than 20 total hours over the entire duration of construction activities shall meet the following requirements: a. Where alternative sources of power are available, portable diesel engines shall be prohibited. b. All off-road equipment shall have the following: i. engines that meet or exceed either EPA or CARB Tier 2 off-road emissions standards, and ii. engines that are retrofitted with a CARB Level 3 Verified Diesel Emissions Control Strategy (VDECS). c. Exceptions: i. Exceptions to A(1)(a) may be granted if the TJPA has evidence that an alternative source of power is limited or infeasible at the project site, and that the requirements of this exception provision apply. Under this circumstance, the TJPA shall prepare the documentation indicating compliance with A(1)(b) for on-site power generation. ii. Exceptions to A(1)(b)(ii) may be granted if the TJPA has evidence that a particular piece of off-road equipment with an CARB Level 3 VDECS is (1) technically not feasible, (2) would not produce desired emissions reductions due to expected operating modes, (3) installing the control device would create a safety hazard or impaired visibility for the operator, or (4) there is a compelling emergency need to use off-road equipment that are not retrofitted with a CARB Level 3 VDECS. iii. If an exception is made pursuant to (A)(1)(c)(ii), the TJPA shall provide the next	TJPA	Before and during construction	TJPA	Prepare Construction Emissions Minimization Plan. Prior to construction, include provisions in contract documents requiring preparation of emissions plan, reporting requirements, and certification that measures from the emissions plan have been incorporated. Monitor construction activities to ensure compliance and prepare monthly reports and final report within 6 months of completion of construction.

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cleanest piece of off-road equipment, as provided by the step-down schedule below).

Off-Road Equipment Compliance Step-Down Schedule		
Compliance Alternative	**Engine Emissions Standard**	**Emissions Control**
1	Tier 2	CARB Level 2 VDECS
2	Tier 2	CARB Level 1 VDECS
3	Tier 2	Alternative Fuel (Not a VDEC)
Notes: *CARB = California Air Resources Board; VDECS = Verified Diesel Emissions Control Strategy* *Source: data compiled by AECOM in 2014*		

If the requirements of (A)(1)(b) cannot be met, then the TJPA shall meet Compliance Alternative 1. If the TJPA is not able to supply off-road equipment meeting Compliance Alternative 1, then Compliance Alternative 2 shall be met. If the TJPA is not able to supply off-road equipment meeting Compliance Alternative 2, then Compliance Alternative 3 shall be met.

2. The TJPA shall require idling times for off-road and on-road equipment to be limited to no more than 2 minutes, except as provided in exceptions to the applicable state regulations regarding idling for off-road and on-road equipment. Legible and visible signs shall be posted in multiple languages (English, Spanish, Chinese) in designated queuing areas and at the construction site to remind operators of the 2-minute idling limit.
3. The TJPA shall require that construction operators properly maintain and tune equipment in accordance with manufacturer specifications.
4. The Emissions Plan shall include estimates of the construction timeline by phase, with a description of each piece of off-road equipment required for every construction phase. Off-road equipment descriptions and information shall include equipment type, equipment manufacturer, equipment identification number, engine model year, engine certification (Tier rating), horsepower, engine serial number, expected fuel usage, and hours of operation. For VDECS-installed equipment, reporting shall indicate technology type, serial number, make, model, manufacturer, CARB verification number level, installation date, and hour meter reading on installation date. For off-road equipment using alternative fuels, reporting shall indicate the type of alternative fuel being used.

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5. The Emissions Plan shall be kept on-site and be available for review by any persons requesting it. A legible sign shall be posted at the perimeter of the construction site indicating to the public the basic requirements of the Emissions Plan and a way to request a copy of the plan. The TJPA shall provide copies of the Emissions Plan to members of the public as requested. B. *Reporting*. Monthly reports shall be prepared to indicate the construction phase and off-road equipment information used during each phase, including the information required in A(4). In addition, for off-road equipment using alternative fuels, reporting shall include the actual amount of alternative fuel used. 1. Within 6 months of completion of construction activities, the TJPA shall prepare a final report summarizing construction activities. The final report shall indicate the start and end dates and duration of each construction phase. For each phase, the report shall include detailed information required in A(4). In addition, for off-road equipment using alternative fuels, reporting shall include the actual amount of alternative fuel used. C. *Certification Statement and On-Site Requirements.* Prior to the commencement of construction activities, the TJPA shall certify (1) compliance with the Emissions Plan and (2) all that applicable requirements of the Emissions Plan have been incorporated into contract specifications.				
Air Emissions – Operations				
New-MM-AQ-3.1 – *Equip Diesel Generators with Applicable Tiered Emissions Standards.* All diesel generators shall have engines that meet Tier 4 Final or Tier 4 Interim emissions standards or meet Tier 2 emissions standards and are equipped with a CARB Level 3 Verified Diesel Emissions Control Strategy.	TJPA	During development of contract documents and during construction	TJPA	Prior to construction, include provisions in contract documents regarding diesel generator air emissions specifications. Monitor construction activities to ensure compliance.
New-MM-AQ-3.2 – *Require and Implement Ventilation Plans for Proposed Residential Land Development*. For residential development on the intercity bus facility or ventilation structure sites, the project sponsor shall comply with the following measures: A. *Air Filtration and Ventilation Requirements.* Prior to receipt of any residential building permit, the project sponsor shall submit a ventilation plan for the proposed building(s). The ventilation plan shall show that the building ventilation system removes at least 80 percent of the outdoor PM2.5 concentrations from habitable areas and be designed by an engineer certified by the ASHRAE. The engineer shall provide a written report documenting that the system meets the 80 percent performance standard identified in this measure and offers the best available technology to minimize outdoor-to-indoor transmission of air pollution.	TJPA	Prior to acquisition of building permits, prior to renting or selling buildings	TJPA	Prior to sale or lease of surplus property, include provisions in sale or lease documents that any future residential development will need to prepare and implement ventilation and filtration plans and systems.

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B. *Maintenance Plan.* Prior to receipt of any building permit, the project sponsor shall present a plan that ensures ongoing maintenance for the ventilation and filtration systems. C. *Disclosure to Buyers and Renters.* The project sponsor shall ensure disclosure to buyers and/or renters that the building is located in an area with existing sources of air pollution and that the building includes an air filtration and ventilation system designed to remove 80 percent of outdoor particulate matter. Occupants shall be informed of the proper use of the installed air filtration system.				
Visual/Aesthetics – Construction				
VA 1 – Assure that construction crews working at night direct any artificial lighting onto the work site in order to minimize "spill over" light or glare effects on adjacent areas.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
VA 2 – Assure that contractors make all efforts possible to minimize specific aesthetic and visual effects of construction identified by neighborhood businesses and residents.	TJPA	During construction	TJPA	Include requirements in contract documents and monitor construction activities to ensure compliance.
Transportation				
New-MM-TR-1.1 – *Modify Signal Operations at the 16th Street Intersection with Seventh Street/Mississippi Street, the Caltrain tracks, and Owens Street*. If Caltrain's service and operations plan requires the use of the turnback track during the AM/PM peak hours in the future, prior to Caltrain making any such changes, the TJPA, in conjunction with Caltrain, shall conduct further traffic and train operation analysis of the turnback and maintenance of way tracks to evaluate traffic operations along 16th Street at Seventh/Mississippi Street, the Caltrain turnback track, and Owens Street. Changes to the PCEP OCS and specialty trackwork, such as control points, switches, and train signals, will be undertaken by the TJPA to allow Caltrain to continue its operations at the level of service defined in the PCEP EIR. In addition, if the traffic/train operation analysis shows that the traffic delays attributable to the gate downtime during the AM/PM peak hours would increase at Seventh/Mississippi Street or at Owens Street (already operating at LOS E and F) such that the overall intersection v/c ratio would worsen by more than 10 percent (i.e., a v/c ratio increase of more than 0.10), then improvements shall be implemented so the resulting v/c ratio is no greater than 10 percent above the v/c ratio without use of the turnback track during the AM/PM peak hours. Actions or improvements that could achieve the performance standard, either individually or in combination, include but are not limited to:	TJPA and Caltrain	Proposal by Caltrain to change its service and operation plan to use the turnback track during the AM/PM peak hours	TJPA	TJPA and Caltrain to conduct traffic and train operations analysis to identify signal operations and feasible intersection design improvements, which shall be implemented if necessary to achieve the performance standard.

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• Signal timing adjustments; • Signal phasing modifications; • Lane reconfiguration/re-striping in conjunction with phasing modification; • Left-turn pocket lengthening; • Pre-empt, pre-signal or queue cutters provision or modification as necessary to manage queues; and/or • Other improvements identified in the future due to technology advancement. The TJPA and Caltrain shall coordinate with the City and shall be responsible for reasonable costs of design, permitting, and construction of the necessary improvements at these crossings to attain the v/c performance standard. These changes to the crossing will also satisfy the performance standard for safe pedestrian and bicycle circulation identified in New-MM-TR-3.1.				
New-MM-TR-3.1 – *Modify 16th Street Intersection with the Caltrain and turnback track to provide a safe crossing for pedestrians and bicyclists.* At the time of the construction and operation of the proposed turnback track, the Caltrain electrification project (including mitigation measures adopted by Caltrain for this intersection), SFTMA's 22 Fillmore Transit Priority Project, and the Warriors Arena project may have been implemented. The combination of these projects will modify the intersection configuration and operation at the time of the proposed project. As a result, the TJPA is using a safety-based performance standard, explained below, to guide future improvements for pedestrian and bicyclist safety. At the time of final design, the TJPA shall determine the then-current overall time required by pedestrians and bicyclists traveling along 16th Street to cross the Seventh Street/Mississippi Street intersection, the Caltrain mainline tracks, and the turnback track, and the TJPA shall coordinate and consult with Caltrain, the California Public Utilities Commission, and the City to identify the changes to the intersection and grade crossing warning devices, including signal timing, that are needed to provide adequate time, as determined by the Institute of Transportation Engineers, Caltrans, and the City, for pedestrians and bicyclists to safely cross the widened intersection that results from the construction of the turnback track. The TJPA shall commit to implementing changes necessary to protect pedestrians and bicyclists from potential safety issues, prior to operation of the new turnback track. Specific changes are expected to be determined during final design, which will be after the location of the crossing gates for the turnback track along 16th Street has been determined and based on the then-current signal timing at that time and which is expected to account for other major development and transit projects in the vicinity. The changes to the intersection due to the turnback track will be included in the design specifications for the project. Possible improvements that may attain the above performance standard include:	TJPA	During final design	TJPA	TJPA to work with CCSF, Caltrain, and CPUC on signal operations and intersection design during final design and ensure installation during construction.

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• Adjust signal timing for the warning devices and adjacent traffic signals. The warning phase before the gates start to come down shall be extended to take into account the additional time needed for pedestrians and bicyclists to clear the track zone based on industry standards (such as the Caltrans California Manual on Uniform Traffic Control Devices or the Institute of Transportation Engineers' Design and Safety of Pedestrian Facilities) or City guidelines that define the walking speed of a pedestrian. • Provide sufficient refuge areas for pedestrians and bicyclists to wait while the crossing gates are down. The refuge, or waiting, area shall be sufficient to accommodate the projected pedestrians and bicyclists and be ADA compliant. • Install a smooth surface in the areas next to and between the rails to reduce tripping hazards and unintended forces on bicycle tires.				
Water Resources and Water Quality				
New-MM-WQ-4.1 – *Modify DTX Design Criteria to Avoid Flood Hazards*. The TJPA shall modify the DTX Design Criteria to protect project elements from flood hazards. Specifically, the TJPA shall design and construct Transbay Program Phase 2 within the area delineated as being within a 100-year floodplain to prevent inundation of the project rail alignment and associated infrastructure and to remain operational for the predicted flood level. Changes to the current DTX Design Criteria will include designing station entrances and other points of access to below-ground portions of the DTX system to maintain sufficient freeboard above the 100-year base flood elevation to protect the rail facilities and the public from 100-year storm water entering the stations and the tunnel. Changes to the design criteria will be completed prior to the next phase of design so that these standards can be incorporated into the 30 percent Preliminary Engineering design for DTX. In updating project designs to meet the modified DTX Design Criteria, the TJPA shall consider the cost-benefit of flood-proofing measures and designs which do not preclude other measures that may be more practicable and effective when the future flood risks become more evident. Because implementation of the proposed project would occur at a future date, the TJPA shall amend and update the DTX Design Criteria to incorporate new information related to San Francisco's FEMA FIRM or climate-informed science predictions and mapping of sea-level rise.	TJPA	During final design	TJPA	Modify DTX design criteria and ensure measures to avoid flood hazards are incorporated into construction documents.

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MITIGATION MEASURE	Responsibility for Implementation	Mitigation Schedule	Monitoring Responsibility	Monitoring Actions/Schedule
New-MM-CU-WQ-9.1 – *Prepare a Sea-Level Rise Adaptation Plan.* Based on the vulnerabilities identified from inundation maps of year 2100 sea-level rise, the TJPA will prepare a Sea-Level Rise Adaptation Plan identifying measures that will be taken to protect the new project facilities as well as the existing TJPA facilities from potential damage due to future flooding from sea-level rise. The TJPA will coordinate with other entities with facilities close to the San Francisco Bay with an equal or greater sea-level rise vulnerability, such as the City and County of San Francisco, San Francisco Bay Conservation and Development Commission, the Port of San Francisco, BART, the California Department of Transportation, and the San Francisco Municipal Transportation Agency. Specifically, the TJPA shall design its infrastructure system and buildings so that they remain resilient and adaptable over time. The strategies to implement such protection will evolve from the ongoing sessions with other local jurisdictions and agencies, and the performance standard to be achieved will protect the proposed project from the sea-level rise depths projected by the City for the year 2100. It is recognized that the projected flood depths may be refined over time and that new regional and citywide strategies to address sea-level rise will be identified. To the extent feasible, the TJPA shall amend and update its Adaptation Plan and the performance standard to incorporate this new information. The TJPA shall complete the first Sea-Level Rise Adaptation Plan as part of DTX final design. The Plan shall include the following: • Review of available scientific information on sea-level rise data and projections for the subsequent 50 years. Where data and projections indicate different rates of sea-level rise than previously applied, the TJPA will adjust the proposed project's vulnerability assessment and flood design criteria to reflect a median-point of then-current projections. • Improvements will meet the flood design criteria as feasible and unconstrained by surrounding development not owned by the TJPA. • The plan may also rely on flood improvements implemented separately by agencies other than the TJPA, but that will also provide flood risk protection benefits for Transbay Program Phase 2 facilities. • Opportunities for partnership with other local and regional parties for sea-level rise adaptation or where regional efforts will address flooding risks to TJPA facilities. • Consideration of the cost-benefit of flood-proofing measures and designs that do not preclude other measures that may be more practicable and effective when the future flood risks become more evident.	TJPA	During final design	TJPA	Prepare Sea-Level Rise Adaptation Plan, and discuss results and potential actions with other agencies that have facilities in the City that may be similarly affected.

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• Where the TJPA's adaptation options are constrained because of adjacent infrastructure (such as adjacent roadways and structures not owned by the TJPA), the TJPA will work with adjacent landowners and infrastructure managers to identify opportunities to improve rail system protection in cooperation with other local or regional parties.				
Electromagnetic Fields				
New-MM-EF-1.1 – *Evaluate EMI Effects on Nearby Medical Facilities during Final Design of the Additional Trackwork South of the Caltrain Railyard*. During final design, the TJPA shall conduct a site-specific electromagnetic interference (EMI) analysis, based on the OCS alignment, to determine the extent, if any, of disturbance to sensitive electric equipment from the addition of the turnback track, which would be aligned closer to medical and research facilities, such as the University of California San Francisco campus on the east side of the Caltrain right-of-way. If EMI levels result in disturbance to sensitive electric equipment, the TJPA will be responsible for costs related to evaluate, design, monitor, and remediate project-related EMI disruption. More specifically, the following steps will be followed as part of this mitigation measure: • During final design, the TJPA shall evaluate the specific EMI levels associated with the turnback track at the identified sensitive facilities and determine the appropriate controls necessary to avoid disruption of sensitive equipment prior to testing and commissioning of the proposed project. • During the testing and commissioning period for the proposed project, EMI levels shall be measured and the TJPA shall coordinate with the identified sensitive facilities to evaluate whether substantial EMI effects are occurring due to system operations. Where substantial EMI effects are detected that disrupt operations of the sensitive electric equipment, the TJPA shall remedy the disruption prior to commissioning of electrified operations through EMF controls and/or shall provide shielding of the sensitive equipment. • After commissioning of the proposed project, EMI levels shall be monitored during the first year of project operation and reporting of the results shall be shared with any identified sensitive facilities. Identified disruption of sensitive electric equipment during this period shall be immediately remedied through additional modifications to EMF-generating equipment along the turnback track and/or additional shielding of the sensitive electric equipment. EMI can be reduced at the project level through designs that minimize arcing and radiation of radiofrequency energy. Additional mitigation by shielding of sources is not always practical, but susceptibility to EMI can be reduced by choosing devices designed for a high degree of electromagnetic compatibility. The following strategies will be considered, as appropriate by the	TJPA	During final design, during the testing and commissioning period, after commissioning through first year of operation	TJPA	Conduct EMI analysis to determine appropriate design modifications if necessary. Measure EMI levels during testing and commissioning period and for the first year of project operation. Include provisions in contract documents to comply with requirements for consultation and measures to avoid electromagnetic effects.

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TJPA, in identifying feasible and effective mitigation for nearby medical electronic equipment: • passive engineering controls (e.g., shielding with metallic materials at the medical facility where excessive EMI levels are projected); • partial cancellation of magnetic field with a wire loop, in which an induced current creates a magnetic field of opposite direction; • active shielding, that requires a power supply and feedback loop to control the induced current and magnetic field direction and magnitude; and • design modifications to place EMF from the OCS further away or higher up.				
Environmental Commitments Included as Part of the Project (Avoidance Measures)				
1. Modify as necessary the overhead catenary system of the Electronic Trolley Bus and Caltrain at the 16th Street crossing.	TJPA	During final design	TJPA	In cooperation with the Peninsula Corridor Joint Powers Board and SFMTA, identify the necessary technical changes to the overhead catenary system and provide the appropriate funding to implement the necessary changes.
2. Mitigate construction-related effects to the Caltrain station at Fourth and King and on the existing Caltrain support facilities, including administration and storage buildings, bike storage, employee parking, and crew facilities.	TJPA	During final design	TJPA	Identify necessary mitigation actions with Caltrain and provide funding to implement identified actions.
3. Coordinate with SFMTA and enter into a Memorandum of Understanding (MOU), or similar agreement, to avoid impacts to the Muni T-Line (including the Central Subway project) during DTX construction. The MOU would identify construction phasing, sequencing, and timing that work for both agencies and minimize both delays to construction of the DTX, including the underground station at Fourth and Townsend, and disruption to T-Line operations.	TJPA	During final design	TJPA	Identify the phasing, sequencing, and timing for construction that works for both TJPA and SFMTA, and minimizes both delays to construction of the underground station and disruption to T-Line operations.

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4. Design the ventilation structures with City input and in accordance with context sensitive design guidelines, which seek to preserve and enhance, to the extent feasible, scenic, aesthetic, historic, community, and environmental resources, while improving or maintaining safety, mobility, and infrastructure.	TJPA	During final design	TJPA	Coordinate with the San Francisco Planning Department to design the appearance of the vent structures to be visually compatible with the surrounding built environment and, where appropriate, to follow accepted preservation guidelines for context-sensitive infill development in historic districts.
5. New-I-TR-1.1 Traffic Improvement and Adaptive Management Plan. A traffic improvement plan and adaptive management plan will be developed for the two at-grade intersections along the turn-back track length (7th Street/Mission Bay Drive and 16th Street/Mississippi Street/7th Street) which will outline all aspects of avoiding, minimizing, and compensating for all temporary and permanent impacts associated with the project. The traffic improvement plan will be reviewed and approved by the City and County of San Francisco prior to implementation. Final monitoring requirements for the area will be determined through coordination with regulatory agencies (including San Francisco, Caltrain and California High Speed Rail Authority (CHSRA)) and details will be included in the improvement plan approved by the City and County of San Francisco. A minimum of two monitoring events of the compensatory mitigation will take place after implementation for the first six years after implementation (or until CHSRA serves San Francisco whichever comes first), and one monitoring event for three additional years is required. Additional monitoring after this time period may be necessary based on impacts and any adaptive management applied. After each monitoring event, a report will be submitted to the City and County of San Francisco which will include, but not be limited to, a narrative of the site conditions, representative analysis including traffic counts, gate down time, and delays, and the performance metrics included in the City and County of San Francisco-approved mitigation plan.	TJPA	After construction	TJPA	The monitoring events and their timing are specified in the improvement measure. A report will be submitted to the city after each monitoring event, per the schedule identified in the improvement measure.