Handling and storage of fuels and solvents will follow California OSHA and local standards for fire protection and prevention. These measures include appropriate storage of flammable liquids and prohibition of open flames within 50 feet of flammable storage areas. Additionally, a Hazardous Materials Management/Business Plan would have to be filed with the CCSF Department of Public Health in addition to the handling and storage procedures described above. This is essentially the permit for the storage of these materials at the site.

5.16 VISUAL AND AESTHETICS

Visual changes attributable to the construction of a new Transbay Terminal, Caltrain Downtown Extension and implementation of the Redevelopment Area are described in this section, with resulting changes to views currently enjoyed by residents and other users of the area.

5.16.1 NO-PROJECT ALTERNATIVE

Under the No-Project Alternative, there would be no visual/aesthetic changes to the project area. The Transbay Terminal would remain in its current location and low-cost capital improvements would be made to the building. These improvements would most likely focus on the operational aspects of the Terminal, and it is unlikely that the Terminal's aesthetic condition would be markedly improved. The Terminal would continue to obstruct southerly views from the north of the district, especially from Mission and Market Street. The existing elevated ramps to the Terminal would continue to loop through the area in their current position and would be retrofitted. The Caltrain rail service would terminate at the existing Fourth and Townsend station, and no tunnel would be constructed downtown.

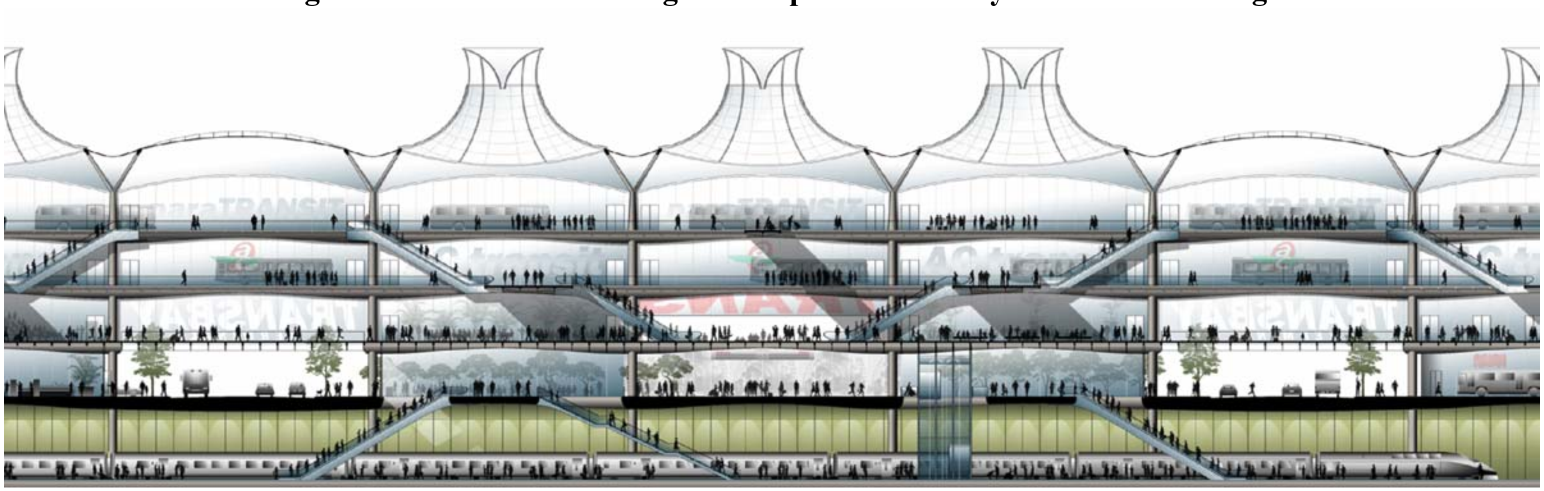
5.16.2 TRANSBAY TERMINAL

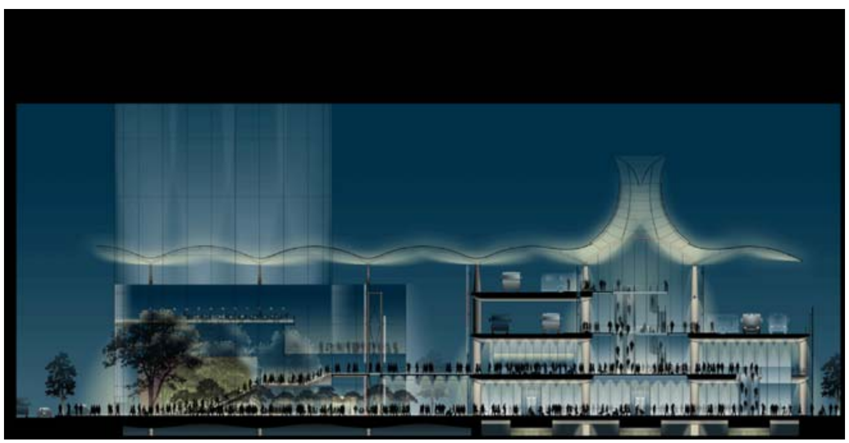
The new Transbay Terminal would be constructed on the site of the existing Terminal at First and Mission Streets. A current concept for the new Terminal would be about 109 feet tall to its roofline, with ten cone-shaped roof elements that would reach up to 156 feet above the street level. Under the Loop Ramp Alternative, the new Terminal would be about one story shorter.

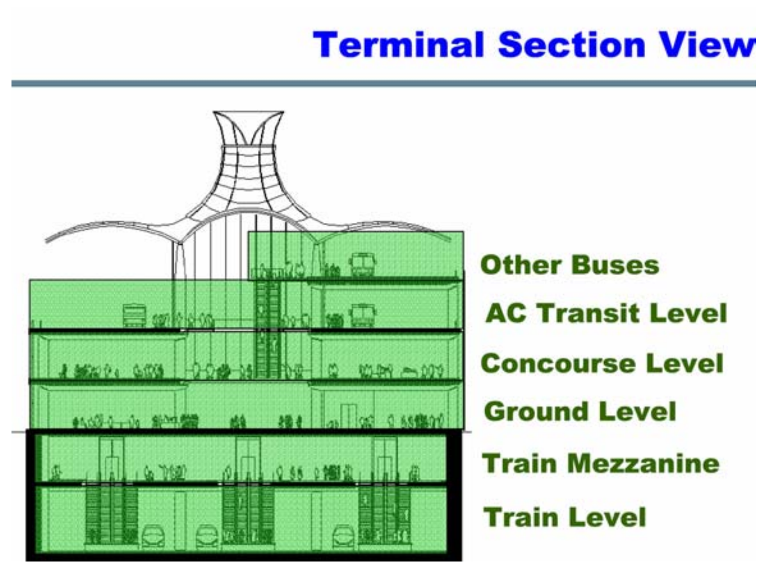
The Terminal itself would generally occupy the same building footprint as the existing Terminal structure, *but approximately 150 feet to the west.* The Terminal would span parts of the First *and* Fremont street blocks, for a maximum length of 1,300 linear feet. The building's horizontal orientation would contrast with the surrounding high-rise development, especially along its east (e.g., 100 Mission Street) and west sides (e.g. 199 Fremont Street).

The design of the proposed Transbay Terminal building would be contemporary and could become a point of visual interest in the Transbay Redevelopment Area. The current concept for design of the new Terminal is shown in Figure 5.16-1.

Figure 5.16-1: Current Design Concept for Transbay Terminal Building







The structure would be constructed out of glass and other transparent elements, with the intent of allowing natural light to penetrate the inside of the Terminal building. Due to the transparent nature of the proposed building, views of the built environment outside the new Terminal structure may be possible from within. The use of transparent building materials and the cone-shaped roof elements, along with gently curved roof-overhangs, would contribute to the visual identity of the area. A proposed plaza and landscaped pedestrian areas surrounding the Transbay Terminal to the east would visually enhance the pedestrian environment.

Under the West Ramp and Loop Ramp Alternatives, ramps leading in and out of the Terminal and to and from the Bay Bridge would be either stacked or split. *Figure 5.16-2 provides a visual simulation of the stacked ramps associated with the West Ramp Alternative.* The ramp spans would be supported by columns and abutments and contain a constant cross-section throughout to give the appearance of a relatively thin structure through strong thin edge lines and imposed shadow.

View from Howard Street
Near First Street
Looking Southwest

Existing Conditions

West Ramp Alternative Visual Simulation

SOURCE: Parsons Transportation Group

Figure 5.16-2: Visual Simulation of Stacked Ramps at Howard Street (West Ramp Alternative)

The proposed ramps would occupy considerably less area than the existing ramps, and would be split, breaking up the mass of the ramps and allowing views between the two new ramp sections. Although the new decks would be approximately 30 feet tall, they would be less visually intrusive due to their uniform appearance and minimal supporting structures.

The southern and eastern portions of the existing ramp network would be demolished under the West Ramp Alternative, eventually opening up the eastward and southward views outside of the Transbay Redevelopment Area. Removing the eastern section of the ramps would open up eastward views along Howard Street toward the Bay and the East Bay Hills. Views toward Rincon Hill, currently obstructed by the southern loop of the existing ramp network, would be opened up along Beale, Fremont, and First Streets. This segment of the ramp network would not interrupt northern views from Rincon Hill into the Transbay Redevelopment Area.

Under the Loop Ramp Alternative, such new views would not be possible, because the ramp network would be retrofitted and retained as it currently exists.

5.16.3 CALTRAIN DOWNTOWN EXTENSION

Visual/aesthetic changes would occur with either of the Caltrain Downtown Extension alternatives. A fenced and open trench with concrete retaining walls dropping to some 30 feet in depth would be constructed south of Townsend Street and to the west of Fifth Street along the northern edge of the current Fourth and Townsend Yard. The alignment would enter a tunnel portal near Fifth Street and continue below grade to the Transbay Terminal.

Construction of the cut-and-cover tunnel for the Caltrain Extension between Fifth Street and the Transbay Terminal would entail the acquisition and demolition of all existing buildings under which the alternative alignments would pass. Following construction of the underground extension, however, it is anticipated that new buildings would be constructed as vacant sites become available for resale. It is currently assumed that the new buildings would be similar or larger and higher than the buildings that are demolished on the sites. Other aesthetic effects would occur due to construction activities, and would be temporary in nature.

The buildings in the Second and Townsend Street area would not be demolished but would rather remain under the Tunneling Option for either Caltrain Extension Alternative. For more information regarding potential construction-related effects, please see Section 5.21, Construction Impacts.

5.16.4 REDEVELOPMENT

Development planned under the proposed redevelopment component would remove existing features with low visual value, including surface parking lots, and in some cases, deteriorated buildings, potentially enhancing the aesthetic quality of the Transbay Redevelopment Area. The overall character of the Transbay Redevelopment Area would continue to experience a change that has been underway for several years, from a predominately low-rise area dominated by early 20th century industrial buildings and interspersed with surface parking lots, to a more dense urban area of newer mid- and high-rise buildings over 80-foot high bases, interspersed with designated areas of open space.

Visual changes would occur under both redevelopment alternatives, in that the proposed redevelopment area would experience a relatively large increase in the number and size of buildings. Both the Full-Build and Reduced Scope alternatives would change the zoning on the former freeway parcels to allow for development at greater heights— up to a maximum building height of 400 feet on the north side of Folsom Street— 200 feet higher than is now permitted. An alternative urban design concept would produce taller and more slender structures with smaller floor plates. These structures could be on average up to fifty feet higher if developed to their full building-envelope potential. From an urban design standpoint, structures constructed under this alternative, while taller, would be less bulky and therefore would do more to preserve views.

Even under the No-Project Alternative, the former freeway parcels would ultimately be expected to be developed, as rezoning from the current P (Public) use district could occur over time. The height limit might not be raised, however, so any development could occur at a lesser scale.

With the West Ramp or Loop Ramp Alternative, development within and near the Terminal loop ramps would be expected to serve to some extent as a transition between the several office towers near Market Street and along Main and Spear Streets, and in the area south of Howard Street. This area now includes newer and renovated low- and mid-rise office, multi-media, and residential structures. Toward Market Street, there would likely be an increase in taller office towers, which would make up most of the office space anticipated in the Transbay Redevelopment Area, but whose visual effect would be lessened by the fact that these buildings would merely extend the downtown core and would not appear as a cluster of taller buildings in a low-rise environment.

Changes would be noticeable in the area inside the existing Transbay Terminal loop ramps. In particular, if a new Terminal is built at the First and Mission site under the West Ramp Alternative, the existing ramps east of Beale Street would be demolished, encouraging the replacement of many older, smaller structures with new development at a larger scale. Changes are anticipated within the existing terminal ramps, as evidenced by recently completed construction at Fremont and Howard Street (199 Fremont Street) and the Foundry Square project development at and near First and Howard Streets, currently under construction.

Of the existing visually cohesive areas within the study area, the least change would come to the New Montgomery-Second Street Conservation District and South Park, where building height limits would remain lower than in surrounding areas and zoning controls that encourage preservation and reuse of existing buildings would remain in place. Development of surrounding blocks (north of the Bay Bridge approach), however, would be expected to bring closer the backdrop of office towers that has until recently been limited to the north end of the district.

Folsom Street would undergo the most visible change in the district. The northern side of Folsom Street, from First to Spear Streets, would be developed with a mix of uses in structures that could range in height from 350 to 400 feet.

Figure 5.16-3 shows a *visual simulation* of the possible redevelopment in this area. Provisions along Folsom Street would include widening the sidewalk and the creation of public open space along the street frontage to enhance the street-level pedestrian environment. This scenario is not an actual proposal but a representation of the types and levels of development that have been conceived for this portion of the Redevelopment Area. *The simulation is of development as envisioned in the Draft Transbay Redevelopment Project Area Design for Development Vision (D4D), released by the San Francisco Redevelopment Agency in August 2003.* Actual development proposals would be defined and evaluated and undergo individual environmental review, *if necessary,* in subsequent steps of the redevelopment process *to make sure that the individual projects were covered.*

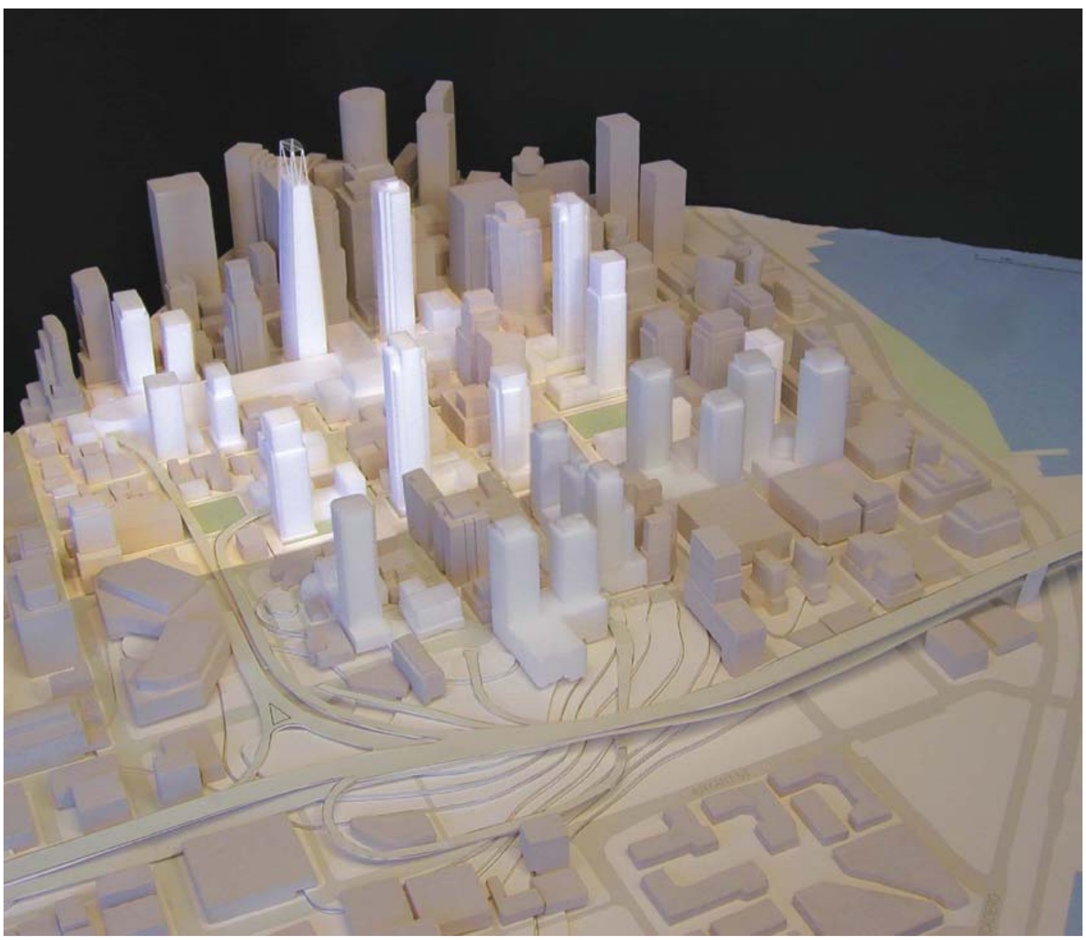
In addition to the widened north sidewalk of Folsom Street, it is anticipated that one or more large areas of open space would be provided in conjunction with the development of the Transbay Terminal and Redevelopment Area. Open space could be provided in the form of a public plaza, proposed to be located in front of the new Transbay Terminal on the western frontage of First Street, bounded by Mission Street to the north, Fremont Street to the east, and the proposed Terminal structure to the south. Other open spaces could add visual interest to mid-block areas and provide a buffer to the planned development in the Transbay Redevelopment Area.

Despite new construction, the Transbay Redevelopment Area would retain portions of its historic, smaller-scale development, notably in the New Montgomery-Second Street Conservation District. Second Street could also become a major visual pathway for pedestrian travel between downtown and the Transbay Redevelopment Area, and the adjacent neighborhoods of South Beach and China Basin.

5.16.5 CHANGES TO SCENIC VIEWS OR VISTAS

Increased development would result in the loss of some existing views, particularly across the study area, rather than along the streets. View corridors would remain, however, particularly along Folsom Street with the planned building setbacks along the north side of the street. Depending on the outcome of the Transbay Terminal component, removal of some of the existing elevated ramps could open up views from within the area now visually walled off by these elements. *The West Ramp Alternative has been identified for the Transbay Terminal component of the Locally Preferred Alternative (LPA). If the LPA is adopted as the project, this Transbay Terminal Alternative would remove the existing east loop ramp and open views to the east; new elevated ramps would be constructed in the same footprint as the existing west loop ramp.*

Figure 5.16-3 *Simulation of* Potential Redevelopment Sites and Scale



Views within and across the Transbay Redevelopment Area would generally be limited by new development. With the implementation of either the Full-Build or Reduced Scope alternative, possibilities for views across the district would be lessened. High-rises located in the Financial District north of the Transbay Redevelopment Area, which create a visual boundary between the Financial District and the generally lower-scale development south of Mission Street would gradually be developed within the Transbay Redevelopment Area. The clearly defined northern boundary of the Transbay Redevelopment Area would, over time, move southward, and the visual wall created by the existing high-rise development would become less pronounced when viewed from the Transbay Redevelopment Area.

Block sizes in the Transbay Redevelopment Area are up to four times larger than the blocks north of Market Street. Under either the Full-Build or Reduced Scope Alternative, larger footprints and taller buildings would likely define new development, with the blocks generally less densely developed than those blocks north of Mission Street. Thus, even though it is likely that land uses would be intensified, there would likely be more space between the towers than on the blocks north of Market Street. New development within the Transbay Redevelopment Area would contain mid-block pedestrian passageways to further reduce the scale of the blocks. Inner courtyards and pedestrian plazas proposed as part of both Redevelopment Alternatives would visually enhance the streetscapes along Folsom Street for pedestrians.

New development under either the Full-Build or the Reduced Scope Alternative would be required to follow urban design guidelines that the Redevelopment Agency would establish to enhance views and visual interest in the project area. New development proposed along Folsom Street would be set back 15 feet from the property line to preserve the existing view corridor (providing views of the Bay to the east) and to accommodate future landscaping, which would provide visual interest and create a green buffer against the traffic on the street. Under both alternatives, new towers would also have an 80-foot podium height, which would create an orderly and regular street wall.

Under both Redevelopment Alternatives, proposed new development along Folsom and Howard Streets would consist of dual towers above their 80-foot base. This would decrease the mass of the buildings above their base levels and provide more views of the sky and surrounding development, as well as increase solar access to lower levels. Under one urban design alternative, new towers above their 80-foot base would have an approximate diagonal dimension ranging from 160 to 190 feet. Under the optional design alternative, new towers would have a diagonal dimension ranging from 126 to 156 feet. Thus, the second alternative would create less bulky buildings with smaller floor plates, which would appear taller and more slender than the development proposed under the first. However, because both design variants would employ setbacks and create a regular street wall at the ground level, given the scale of existing development surrounding the Transbay Redevelopment Area, effects on existing views would not be considered adverse.

5.16.6 CHANGE IN THE CITYSCAPE

Potential changes to the San Francisco cityscape as a result of the proposed Redevelopment Area are shown in Figure 5.16-*3.* Views of the Transbay Redevelopment Area would become more differentiated as the stepping up of development heights towards downtown (north of Folsom Street) is realized. Assuming construction of the proposed Transbay Terminal and possible demolition of the eastern loop of the existing bus ramps, the wall that is composed of newer high-rise office construction would advance southward, with building heights decreasing towards Folsom Street. This change would be apparent from distant vantage points, such as from Dolores Park, Twin Peaks and Potrero Hill.

Changes to the height and bulk in the Transbay Redevelopment Area from their current limits (see Table 5.1-1) would generally follow the urban design policies contained in the San Francisco General Plan. The proposed height limits, with the tallest buildings located in the north of the Transbay Redevelopment Area toward Market and Mission Streets and then decreasing somewhat from their maximum heights to between 350 to 400 feet along Folsom, would become gradually shorter south of Folsom Street. Moving east toward the Bay, height limits would gradually step down from a maximum of 400 feet along Folsom to approximately 200 feet at Spear Street, then down to between 84 and 65 feet along The Embarcadero to protect views of the water.

Although the proposed new development would be expected to alter the existing aesthetic nature of the area, the visual features that would be introduced by the project are commonly accepted in urban areas and would not substantially degrade the existing visual quality or obstruct publicly accessible views. In addition, the Redevelopment Area's provision for design amenities such as open spaces and landscape features, view corridor preservation, and pedestrian enhancement suitably address the proposed growth and ensure that the resultant effects would be predominately positive. For this reason, the project would not result in a demonstrable negative aesthetic effect and as such, no mitigation measures are proposed.

5.16.7 LIGHT AND GLARE

New construction in the Transbay Redevelopment Area would generate additional night lighting in the area, but not in amounts unusual for a transportation hub in a developed urban area. As shown on Figure 5.16-1, the current concept for the Transbay Terminal entails the use of transparent building materials. This concept is intended to provide visual identity and increased security for passengers within the Terminal and in the surrounding pedestrian areas.

New buildings and vehicles would also produce additional glare. This would not be expected to result in a substantial change unless buildings were constructed with reflective glass. Although perceived as an appealing design element to some, mirrored glass is more likely to generate glare, and to create a potential annoyance and even safety hazard when directed by the sun towards the street or sidewalk. Mirrored glass is not permitted in San Francisco outside of redevelopment areas, per City Planning Code Resolution 9212; as a result, where it is used, it creates a more noticeable visual impact. Therefore, per the Design for Development, mirrored glass would not be permitted in the Transbay Redevelopment Area.

Although the proposed new development would be expected to alter the existing aesthetic nature of the area, the visual features that would be introduced by the project are commonly accepted in urban areas and would not substantially degrade the existing visual quality, obstruct publicly accessible views or generate obtrusive light or glare. In addition, the Redevelopment Area's provision for design amenities such as open spaces and landscape features, view corridor preservation, and pedestrian enhancement suitably address the proposed growth and ensure that the resultant effects would be predominately positive. For this reason, no mitigation measures are proposed.

5.16.8 DRAFT TRANSBAY REDEVELOPMENT AREA DESIGN FOR DEVELOPMENT VISION (AUGUST 2003)

All of the visual and aesthetic effects of the Draft Transbay Redevelopment Area Design for Development Vision would be similar to and less than those of the Full Build Alternative. Similar to the Full Build Alternative, the Design for Development Vision would contain towers over podiums and would create a continuous streetwall along Folsom Street. However, compared to the Full Build Alternative, each block of the Design for Development Vision would contain a single tall tower as a part of the Folsom Street frontage instead of two. Thus, the less-dense Design for Development Vision would have a more varied height pattern than would the Full Build Alternative because of a greater mix of building heights (65 feet to 550 feet). For that reason, the visual and aesthetic effects associated with the Design for Development Vision would be similar to, but less than those under the Full Build Alternative, and its effects also would not be substantially adverse.

5.17 SAFETY AND SECURITY

Safety refers to the prevention of accidents to the riding public, employees, or others present near the Transbay Terminal, Caltrain facilities, and in the Redevelopment Area. Transit vehicle accidents may be caused by events such as fires, faulty equipment, improper boarding or alighting of the transit vehicles or conflicts between trains, buses, automobiles, pedestrians, or non-motorized vehicles. Security refers to the prevention of unlawful acts resulting in harm to persons or damage to property. In a broader sense, it also implies freedom from threats or uncertainty about the likelihood of threatening acts. In this context, the No-Project Alternative does not present potential impacts; therefore, this section focuses on the proposed Project.

5.17.1 SAFETY AND SECURITY IN STATION AREAS

The San Francisco Police and Fire Departments would be responsible for safety and security in the redevelopment area. This remaining discussion focuses on the rail and bus transit facilities.

Passengers exiting the Transbay Terminal or the Caltrain stations at Fourth and Townsend would be transferring to another form of public transit or walking to their destination. The station and Terminal areas would be lighted and have designated walkways for pedestrians.

Bus or rail passengers disembarking at the Terminal would gain access to other public transportation typically at the street level. There could also be an underground concourse connecting the Transbay Terminal and Train Station to the Embarcadero BART/Muni Metro Station at Market Street. Passengers disembarking at either station and walking to their destinations would use sidewalks and crosswalks.

The separation of the AC Transit Buses and the Caltrain from the street levels would reduce the conflicts between these transit mode*s* and pedestrians, except at the platform and bus loading areas. Pedestrian impacts are discussed in more detail in Section 3.4.1.

Security at the Transbay Terminal would be the responsibility of the *TJPA*. Caltrain station security is currently provided by the JPB via its contract with Amtrak. Security would be increased over present levels commensurate with the increase in amount of activity at the Terminal and train station. The Terminal's bus and train loading areas and passageways would be open and clearly lighted and clear sight lines would be maintained. Public security would not be adversely affected by operation of the Transbay Terminal or the Caltrain Extension and new station.

Fire protection at the Terminal would be provided by the San Francisco Fire Department. Fire sprinklers, stand pipes, smoke/gas detectors and alarm systems would be placed throughout the Terminal and stations per City of San Francisco Fire Department requirements. Public fire safety would not be adversely affected by operation of Terminal or proposed Caltrain station. Refer to Section 5.21.17 on best construction management practices for the safety of construction workers, local residents, and employees during project construction.

5.18 ENERGY

Energy reliability and supply have become an increasing concern in California. The short-term situation has been very unstable for both price and availability of electricity and, to a lesser extent, natural gas. The Transbay Terminal/Caltrain Downtown Extension/Redevelopment

Project would require energy to construct, operate, and maintain the transit facilities and for the redevelopment land uses.

Energy for construction includes, in addition to the energy used by construction equipment and other activities at the worksite, the energy used to manufacture equipment, materials and supplied and transport them to the worksite. Energy consumed in the operation of transportation systems is primarily that used by vehicles transporting people or goods—propulsion energy—plus ongoing energy use of operating facilities. Energy for maintenance includes that for day-to-day upkeep of equipment and systems as well as the energy embedded in any replacement equipment, materials, and supplies.

Energy consumed in operation of transportation systems is typically referred to as direct energy. Energy consumed in construction and maintenance is referred to as indirect energy. Over the life of a transportation project, direct energy consumption is usually the largest component of total system energy use. Vehicle propulsion energy can amount to 60 percent of total system energy (Energy and Transportation Systems, Caltrans, Division of Engineering Services, July 1983). In the current environment, the ongoing energy requirements of new activities are of concern, including their long-term impacts on energy supplies. From an energy conservation standpoint, therefore, direct energy impacts are of more importance than indirect energy impacts. For these reasons, the energy analysis focuses on direct rather than indirect energy requirements of the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project. It compares estimated energy use in the regional transportation with and without the proposed project improvements. The analysis identifies the incremental change in transportation system energy use, including all major modes of ground transportation, associated with the project.

Electricity. Caltrain trains operating over the approximately 1.2 mile rail extension would be electrically powered. A number of facilities in the tunnel segment, station, Transbay *T*erminal, and associated facilities would use electricity to power equipment. Currently the City and County of San Francisco owns and operates the Hetch Hetchy hydroelectric power generating facilities in the Tuolumne River watershed (in Yosemite National Park). These facilities supply the majority of electrical power to the city, which is delivered to users by Pacific Gas & Electric Company's (PG&E) electrical transmission and distribution system. San Francisco does not require the full generating capacity of the Hetch Hetchy facilities and has entered into long-term power supply contracts with other agencies. Depending upon seasonal power generation capacity, contract obligations to others, local demand, and other circumstances, the city may receive power through the PG&E grid from other electrical generators, including PG&E itself. Redevelopment would use these or other currently available sources of energy.

When electrified, Caltrain would receive power through the PG&E system. Whether the City and County of San Francisco would be the generator/supplier is unknown. Under deregulation, Caltrain would have the option to purchase from any generator/supplier with generating facilities in the western United States. Deregulation is intended to introduce competition into the local supplier market to expand sources of power supply and ensure fair pricing. The structure of deregulation is open to scrutiny in California, however, as a consequence of the price and supply problems that became apparent in 2000. Although it is difficult to predict what changes may occur, it is anticipated that deregulation of the electric power market will be retained in some form. A number of power generating plants are under development in California and adjacent states by various private firms. The current supply problems and corresponding price volatility would diminish or disappear as these plants come online. Deregulation would allow Caltrain to contract with any number of generators/suppliers to ensure the long-term availability of power for operations, including operation of the Terminal/Extension Project.

Other Energy Sources. The Transbay Terminal / Caltrain Downtown Extension / *Redevelopment* Project would require energy in the form of natural gas, gasoline, diesel fuel, and possibly other forms of energy for facilities and equipment operations (e.g., heating, lighting, ventilation, and operation of non-revenue equipment). For natural gas, PG&E owns the final delivery and distribution systems. PG&E purchases natural gas from various suppliers. Natural gas produced within the state of California has decreased to below 16 percent of demand and therefore other regions and countries are now the major source of supply (California Energy Commission web site: www.energy.ca.gov). As of October 2000, there were 38 marketers/suppliers to the PG&E system. Despite some recent short-term volatility in gas prices, long-term supply is considered satisfactory. Interstate pipeline distribution systems have experienced capacity constraints; however, pipeline expansion is underway in some corridors and several applications for capacity additions are pending. Similarly for gasoline and diesel fuels, long term supply is not considered a critical issue; there are numerous suppliers. In the near term, refining capacity appears to be the major short-term constraint contributing to price volatility. Also, alternative fuel sources are emerging to provide substitute fuels for gas and diesel engines.

Impacts. The Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project would increase energy consumption for new land uses, train propulsion, and for transportation facility operations. However, it would also reduce the consumption of energy by other modes as a result of diverting travel *from* auto and bus to commuter rail service.

Changes in direct energy use by the *t*ransit providers affected by the project were estimated for 2020. Changes are relative to estimated energy use under the No-Project Alternative. The analysis evaluated travel patterns for three basic transportation modes: commuter rail; other transit in the form of bus; and auto as representative of roadway traffic. Commuter rail operations would increase with the Transbay Terminal/Caltrain Downtown Extension/ Redevelopment Project. The increase was quantified and expressed in terms of the additional vehicle miles of travel generated by operating *132* revenue trains a day along the approximately 1.2 mile downtown extension. Adjustments were also made to account for increased non-revenue movements and switching movements associated with operations on the extension.

Some bus operations would be reduced somewhat because commuter rail would be extended to downtown San Francisco and provide a higher-level transit alternative. SamTrans, for example, is expected to be able to convert several express routes *in the Caltrain Corridor* to Caltrain feeders and not need to continue bus service to downtown San Francisco. San Francisco Muni may be able to reduce some existing shuttle service between downtown and Fourth and Townsend Streets. The analysis, to be conservative, assumed Muni service would be redirected and only included the more identifiable changes to SamTrans bus service. The potential reduction in bus trips was calculated by assuming express service in the immediate corridor would become Caltrain station feeders; trips were converted to vehicle miles saved by multiplying by the one-way travel distance between the proposed feeder station and downtown San Francisco. Auto travel in the corridor would also be reduced as more people diverted to commuter rail service. The reduction in auto travel was estimated by assigning a weighted average trip length for all diverted trips, assumed to be represented by the number of new riders on Caltrain with the extension in place in 2020.

Table 5.18-1 provides a summary of estimated propulsion energy effects of the Transbay Terminal and Caltrain Downtown Extension for these modes. For a common standard of comparison, energy in the form of electricity or fossil fuels consumed (or saved) is converted to British thermal units (BTUs). Energy use is expressed in terms of the direct energy content of electricity and fuels consumed (or saved) at the final source as well as the total energy content of these energy units, which accounts for generation/refining and transmission/transport losses. For instance, a kWh has a final energy content of 3,416 BTUs; but an additional approximately 7,100 BTUs of energy was required to generate, transmit and convert the kWh at its point of use. The total energy content of a kWh is estimated to be, therefore, approximately10,500 BTUs.

While the increased travel distance for commuter rail trains would require an additional *2.2* million kWhs annually, or *7.4* million direct BTUs and *22.7* million total BTUs, the savings in bus miles and auto vehicle miles no longer operated would be approximately 360 million direct BTUs and 430 million total BTUs. The net energy impact of the transit operations for the Transbay Terminal and Caltrain Extension would be an overall decrease, or savings, in propulsion energy use.

In addition to the propulsion energy effects of the Terminal/Extension transit operations, the operation of the rail station, tunnel, and Transbay *T*erminal would result in ongoing energy use, mainly in the form of electricity for lighting, ventilation, communications, escalators/elevators for people transport, and heating/cooling. A general estimate of annual electricity use by these facilities is 2.5 million kilowatts, equivalent to 8,540 million direct BTUs and 26,250 million total BTUs of energy.

There would be no offsetting reduction in energy use elsewhere; facilities energy represents a net new energy requirement. Adding the facility energy to propulsion energy requirements approximately doubles the energy consumed by the transit operations associated with the Project.

Table 5.18-1: Change in Propulsion Energy Consumption Resulting from Terminal/Extension Project (2020)

Model	Tech-nology [1]	Energy Use Per Vehicle Mile [2]	Incremental Change from No-Project (Project Minus No-Project)				
			Weekday Vehicle Miles	Annual Vehicle Miles[3]	Energy Units Consumed (Saved)	Direct Energy Consumed [4] (Saved) in Millions of BTUs	Total Energy Consumed [5] (Saved) in millions of BTUs
Commuter Rail	Electric	9.500 kWh	*785*	*228,000*	*2,166,000* kWh	*7,399.1*	*22,743.0*
Other Transit—Bus	Diesel	0.333 gal	(3,600)	(935,000)	(311,667) gal	(38,958.3)	(44,802.1)
Auto	Gasoline	0.035 gal	(260,000)	(83,200,000)	(2,912,000) gal	(321,484.8)	(385,781.8)
Total All Modes			***(262,815)***	***(83,907,000)***		***(353,044.0)***	***(407,840.9)***

[1] Actual fleets may be mixed with more than one significant propulsion technology (e.g., diesel, CNG, or hybrid buses; gasoline or hybrid autos/trucks). The technology listed is considered representative for the entire mode and provides a reasonable approximation of energy use in BTUs.

[2] Commuter rail electricity use rate is estimated consumption per passenger car mile for either electric locomotive propelled fleet or electric multiple unit (EMU) fleet. It assumes a 10 percent reduction in consumption due to regeneration, i.e., the return of electrical current to the power system by braking vehicles.

[3] Weekday forecasts of vehicle miles are annualized using the following factors: Commuter Rail = 290; Other Transit = 290; Auto = 320

[4] Direct energy is that consumed by the end user--the rail locomotives, buses, and autos. Direct energy content of energy units is as follows:

1 kWh= 3,416 BTUs (British Thermal Units)

1 gallon diesel = 125,000 BTUs

1 gallon gasoline = 110,400 BTUs

[5] Total energy includes the energy used to refine/generate and transport energy to the end user as well as the direct energy consumed, as follows:

1 kWh= 10,500 BTUs

1 gallon diesel = 143,750 BTUs

1 gallon gasoline = 132,480 BTUs

Sources: Caltrain 25kV, 60Hz, ac Electrification Program, Overview of Preliminary Engineering Operating and Maintenance Costs, Parsons, July 2001; Nelson\Nygaard Consulting Associates; Parsons Transportation Group

The combined propulsion and facilities electrical energy requirements would, however, still be more than offset by the estimated energy savings to other modes that result from the project (Table 5.18-1). New land uses under the Redevelopment portion of the Project would, however, consume additional energy.

No energy mitigation measures appear to be warranted. Moreover, current designs for the Transbay Terminal include "a wide ranging sustainable approach to the terminal building that uses the natural wind flows in downtown San Francisco to ventilate and cool the facility, harnesses solar energy for passive hearing and cooling, and established sustainability protocols for materials, construction procedures, and long-term building operations."[28] Additional measures would be included in the design and specification of equipment to ensure energy efficiency, thereby helping to reduce the long-term energy requirements and the operating costs of the project.

5.19 TRANSIT, TRAFFIC AND PARKING

Current transportation setting and projected No-Build conditions as well as projected Caltrain ridership and travel times for the Caltrain Extension Alternative are described in Chapter 3. Transportation impacts during construction are evaluated in Section 5.21.1. All other transportation effects of extending Caltrain to the Transbay Terminal Site are presented in this section.

5.19.1 TRANSIT OPERATIONAL IMPACTS

The Terminal/Extension Project includes two possible alignments for the Caltrain downtown extension, two design options for the new Transbay Terminal, and two scenarios for a redevelopment plan. In addition, there is an option for an underground pedestrian connection between the new Terminal and *t*he Embarcadero BART station.

With regard to transit operations, only the two alternatives for the Transbay Terminal design–the West Ramp and the Loop Ramp Alternatives–would have notably different effects on transit. As a result, this analysis of operating impacts is divided into two scenarios, one for each of the Transbay Terminal alternative*s*. The intermodal connections enabled by the pedestrian connection to BART are summarized at the end of this section.

Impacts on transit operations would differ across the two terminal alternatives in terms of:

- Terminal capacity
- Bus access to the Transbay Terminal from the Bay Bridge
- Bus access to the terminal from the street
- Internal bus circulation within the Transbay Terminal
- On-street bus circulation
- Bus storage
- Operating costs

[28] Transbay Terminal Improvement Plan, MTC, 2001, pg. 18.

Major operational differences between the two alternatives are described in Table 5.19-1.

5.19.1.1 West Ramp Alternative

The West Ramp Alternative would change the current configuration of how buses enter, exit, and park at the Transbay Terminal. Instead of traveling straight through the terminal and circulating back to the Bay Bridge along an external, aboveground loop, buses would turn around within the terminal using an internal loop. With the West Ramp *A*lternative, the on- and off-ramps connecting the terminal with the bridge would both be located at the west end of the terminal. The current *operating* distance *from* the *bridge to the* terminal *back to* the bridge is 6,500 feet. Under the West Ramp Alternative, this distance would increase to approximately 7,600 feet.[29] *It should be noted that this round trip distance is slightly longer than the similar path under the Loop Ramp Alternative because the terminal is slightly longer, owing to the use of two longer platforms rather than three somewhat shorter platforms.*

Table 5.19-1: Operational Differences Between Transbay Terminal Alternatives

Operational Issues	**Existing Terminal**	**West Ramp Alternative**	**Full Loop Alternative**
Total Number of Bus Bays	32	*48*	51
Location of Bus Storage	On-site Ramps	Off-site storage lot	On-site ramps and off-site storage lot
Travel Distances (in Feet)			
Bay Bridge to Terminal *to Bay Bridge*	6,500	7,600	6,500
Bay Bridge to Terminal to Storage Area (1)	N/A	7,600	6,500
Storage Area to Terminal to Bay Bridge (1)	N/A	7,600	6,500
Bay Bridge to Storage Area to Terminal to Bay Bridge (2)	N/A	8,100	7,000
From Ramp to Terminal	4,500	N/A	*4,500*
Travel Times (in Seconds)			
Bay Bridge and Terminal *to Bridge*	216	317	227
Bay Bridge to Terminal to Storage Area [1]	N/A	329	243
Storage Area to Terminal to Bay Bridge [1]	N/A	334	240
Bay Bridge to Storage Area to Terminal to Bay Bridge [2]	N/A	350	255
From Ramp to Terminal	60	N/A	*60*

Notes: [1] Trip refers to deadheading. Since the existing terminal accommodates bus parking on-site, no deadheading or off-site staging is currently involved with AC Transit operations.

[2] Trip refers to off-site staging at the bus storage area. Off-site staging is greatest for the West Ramp Alternative because there are only four to five on-site staging spaces on the ramps.

Source: SMWM, Working Paper 4.1 Evaluation of Terminal Site Alternatives, January 2000. Travel times and distances were estimated by Fehr & Peers based upon preliminary terminal designs for the West Ramp and Full Loop Alternatives.

[29] SMWM Working Paper 4.1 Evaluation of Terminal Site Alternatives, (January 2000), p.37

The existing east loop ramp leading from the Bay Bridge to the Transbay Terminal is currently used for midday-storage of AC Transit vehicles. The West Ramp Alternative would relocate AC Transit bus storage to an off-site area under the replacement Bay Bridge West Approaches, between Second and Third Streets. Storage of Golden Gate Transit buses would be moved from their current off-site storage at Main and Howard to beneath the Bay Bridge approaches between Third and Fourth Streets.

AC Transit buses would operate independently of local traffic between the Bay Bridge, the storage area, and the Transbay Terminal. Direct connections would be provided on elevated ramps constructed along the Essex Street right-of-way in approximately the same location as the existing west loop ramps. With the buses entering and exiting the terminal from the west end only, the existing east loops would be permanently removed.

The new Transbay Terminal would feature:

- Three center island rail platforms supporting the six future tracks in the basement level.
- Muni and Golden Gate Transit bus operations, patron entry, ticketing, joint development and a Greyhound store front on the street level.
- Pedestrian concourse with retail/joint development that runs the full three-block length of the Terminal, one level above the street.
- Thirty AC Transit bus bays serving a central platform two levels above the street.
- A platform for Greyhound, paratransit and private operators on the top level or upper bus deck.

Terminal Capacity. The West Ramp Alternative would significantly increase the passenger capacity of the Transbay Terminal. The new terminal would accommodate 35,000 rail and bus passengers during the peak hour. This is 11,000 more passengers than the 24,000 passengers projected for peak hour demand in 2020. The current peak hour passenger flow at the existing Terminal is 10,000 passengers. [30]

The terminal would also accommodate significant increases in transit service. Currently, AC Transit's highest peak utilization is 4.5 buses per bay per hour, which corresponds to average headways of 13.3 minutes per bay. The new terminal would accommodate eight-minute average headways at each of the 30 bus bays, thereby accommodating future demand and future growth.[31] The West Ramp Alternative would increase the total number of bus bays from 32 to *48, with 30 on the AC Transit level and another 18 on the upper bus level.*

[30] Arup, Working Paper 7.0 Pre-Concept Engineering Report, (April 2001), p. 5.

[31] Arup, p. 3-4

Bus Access to the Transbay Terminal from the Bay Bridge. Bus access to the terminal would no longer have separate points for entry and exit on opposite sides of the facility. Under the West Ramp Alternative, *each of the two bus decks would have dedicated, fully grade-separated ramps leading from the Bay Bridge into* the southwestern corner of the terminal. Although bus entrances would be provided on both the upper and lower bus decks, all buses would exit the Terminal from the lower deck.

The lower level ramp entrance would have two lanes and provide AC Transit buses with an inbound and outbound connection to the Terminal's lower bus deck. The upper level ramp entrance would have one lane and provide non-AC Transit buses with inbound access only to the terminal's upper bus deck. Buses exiting from the upper deck would travel down a ramp at the east end of the structure to the AC Transit level and proceed through the AC Transit level to the bus exit.

Buses from the East Bay would gain access to the stacked entrance ramps from the Bay Bridge using an exit at Fremont Street that also serves as a mixed-flow traffic off-ramp. The exit would lead to a two-way single-level bus ramp following the same alignment as the existing ramps. Just before the terminal, the ramp would split into the two levels for entry into either the lower or upper bus levels.

Buses returning to the East Bay would use the two-way single level bus ramp upon exiting from the terminal. At the approach to the Bay Bridge the ramp would split into two levels to connect with the two-level bridge. East Bay buses would follow the eastbound bridge ramp and proceed onto the lower level of the bridge.

Although requiring some future expansion, the ramp connecting the Bay Bridge with the Transbay Terminal would be designed to accommodate the potential implementation of light rail service from the East Bay.

Bus Access to the Terminal from the Street. Like the current facility, a direct connection between the Terminal and the surface streets was determined to be unnecessary for bus operations.[32] *S*ome bus service, including paratransit operations, Greyhound, and other private tour operations, would be able *to* access the Transbay Terminal from city streets through the bus storage areas.

Bus Circulation Inside the Transbay Terminal. The West Ramp Alternative adds an additional level to the Transbay Terminal's system of bus circulation. AC Transit would board and alight passengers on the lower of the two bus decks (which include the top two levels of the terminal). Buses would circulate clockwise around a central passenger platform using either of

[32] Arup, p. 28

two lanes: one for through traffic and one for turning in and out of the bus bays. The exit for the buses is located adjacent to the terminal entrance on the southwest corner, thus avoiding crossover. The deck would accommodate 30 bays including 26 for articulated buses and 4 for standard buses. The bays would be evenly divided between the northern and southern sides of the central platform. A saw tooth configuration has been adopted in accordance with AC Transit's stated design criteria.

The upper bus deck would be reserved for other transit operators, including Muni's Line 108 to Treasure Island, paratransit services, Greyhound, and private operators. The upper bus deck would accommodate four saw tooth bays and 700 feet of straight curb on the northern side of the terminal – *equal to about 18 additional bus bays*. Buses would circulate along a single-sided passenger platform with two bus lanes: one through-lane and one turnout/parking lane. Unlike the lower level, the upper bus deck circulation is only a half loop, terminating on the east end of the terminal in a ramp that travels back down to the lower bus deck.

The only vertical circulation between the two bus decks is the downward movement from the upper to the lower bus levels on a ramp forming the eastern face of the building. Occasional access from the lower deck to the upper deck would be possible through the external vertical circulation located in the bus storage areas.

On-Street Bus Circulation Outside the Terminal. Muni lines 5, 6, 38, and 38L would no longer terminate at the Transbay Terminal's "hump" on Mission Street between First and Fremont Streets. This loading area would be relocated to a mid-block passage under the terminal between Fremont and Beale Streets. *Under this service scenario, Muni buses would operate as they currently do on Market/First and would then make a right turn onto Mission Street. All buses would alight passengers on Mission between First and Fremont Streets. Buses would then continue empty on Mission to Beale and make a right turn and enter the new loading area under the terminal, midblock between Mission and Howard.* Assuming the implementation of a diamond (bus only) lane on Beale Street *South of Mission* Street and through the terminal's designated Muni loading area, the rerouting would add about 40 seconds to the average travel time of buses.[33]

The new loading area would also provide Muni passengers with a direct link to the concourse level of the terminal. Sufficient platform and staging areas would be provided to accommodate Muni's current routes plus at least one addition route. According to a bus operations simulation analysis, there would be excess capacity in two of the four aisles in the mid-block passage. A third aisle reserved for Muni's 38 and 38L would operate near capacity. The fourth aisle, reserved for Golden Gate Transit, would also operate near capacity. Consequently, any

[33] Fehr and Peers Associates, Transbay Terminal Bus Operations Report, (September 2000), p. 10

significant expansions in Muni or GGT capacity would require the staging of buses at an alternate location.[34]

Muni's 14 line would continue to board and alight passengers at surface bus stops along Mission Street. Muni's 10 and 76 lines would continue to load passengers at curbside bus stops along First and Fremont Streets. No significant change in operations would result from the West Ramp Alternative.

Inbound Golden Gate Transit Basic Service buses, which operate on Mission Street, would continue to terminate in front of the Transbay Terminal on Mission Street. The proposed Transbay Terminal mid-block boarding area would be used as the first revenue stop by outbound GGT Basic Service buses.

Inbound Golden Gate Transit Financial District Commute Service buses would continue to serve the Transbay Terminal by the bus stop on First Street, between Market and Mission Streets. Outbound Commute Service would continue to load passengers along Fremont Street between Mission and Market and between Mission and Folsom.

Bus Storage Areas. AC Transit currently stores all of its transbay buses laying over midday in San Francisco on the existing Transbay Terminal access ramps. Under the West Ramp Alternative, minimal bus staging and bus parking would be possible on the new access ramps. Instead, an off-site storage area would be located below the west approaches to the Bay Bridge between Second and Third Streets. Access to the storage area would be by a ramp connection to the two-way Bay Bridge/Transbay Terminal ramp. The area beneath the Bay Bridge is currently used for automobile parking.

AC Transit's bus storage lot would be at-grade with sufficient area to permit parking and circulation in accordance with AC Transit's projected future needs. Depending on the layout and operation of the bus storage area, up to 54 buses could be accommodated at-grade with fully independent access provided each parked bus; another nine buses could be parked on the access ramp. According to a bus operations simulations analysis *developed for the supplemental air quality analysis*, even with assumptions of 50 percent growth in AC Transit service, there would be a maximum of *70* buses (including those circulating) in the storage facility during the *45 minute* peak *period* for bus parking and staging.[35]

Golden Gate Transit buses would be provided bus storage space under the Bay Bridge west approaches between Third and Fourth Streets. Access to the lot would be via the same ramp connection to the AC Transit storage lot and an at-grade mid-block crossing of Third Street.

[34] Fehr and Peers Associates, p. 10
[35] *Supplemental Air Quality Analysis, Terry A. Hayes Associates, LLC, 2003.*

Approximately 140 buses could be accommodated at an at-grade paved lot. It would be occupied by Golden Gate Transit weekdays only and available for other uses in the evening and on weekends.

Approximately 43,000 square feet of space at the western end of the Golden Gate Transit storage area would be available for a single deck parking structure. This would allow approximately 300 public parking spaces to be built contiguous to the storage area.

Operating Costs. The annual operating costs for AC Transit would be higher under the West Ramp Alternative than under either the existing operation or the Full Loop Alternative (see below). Table 5.19-2 shows that the estimated annual operational and maintenance costs for AC Transit would be approximately $*1.3* million under the West Ramp Alternative, assuming no growth in service. This is about *40* percent higher than the estimated $939,000 for current AC operations.

Table 5.19-2: Estimated AC Transit Annual Operating Costs

Scenario Increase (Existing)	Operating Costs	Maintenance Costs	Total Costs	%
Existing	$ 508,972	$430,285	$939,257	
West Ramp Alternative	$*774,939*	$*530,839*	$*1,305,779*	*39%*
Full Loop Alternative	$*559,002*	$*455,468*	$*1,014,469*	*8%*

The cost analysis is based upon AC Transit's 1998-99 cost model, which indicates a marginal cost of $44 per hour and $1.78 per mile.

Source: SMWM, Working Paper 4.1 Evaluation of Site Terminal Alternatives, January 2000. Analysis is based on the demand assumptions described in Table 5.19-3.

The cost analysis shown in Table 5.19-2 is based on AC Transit's 1998-99 cost model, which indicates a marginal cost of $44 per hour and $1.78 per mile. The demand assumptions used to determine costs are shown in Table 5.19-3.

Operating costs for Golden Gate Transit would be lower for both Transbay Terminal options than under the existing conditions, given that the permanent bus storage facility would be closer to the Transbay Terminal than Golden Gate Transit's existing bus storage facility at Eighth and Harrison streets.

5.19.1.2 Full Loop Ramp Alternative

The Full Loop Ramp Alternative would not significantly change existing bus access and circulation between the Transbay Terminal and the Bay Bridge. Although a new terminal facility would be constructed, the location of the new loop ramps between the terminal and the

Bay Bridge would be generally the same. Unlike the West Ramp Alternative, AC Transit bus staging and storage would continue to be on the ramps with some additional off-site parking under the Bay Bridge's western approach at Second Street.

Under the Loop Ramp Alternative, the Transbay Terminal would feature:

- Three center island rail platforms supporting the six future tracks in the basement level. The street level would support patron entry, ticketing, and joint development.
- Street level bus service for Muni and Golden Gate would be provided in the block east of Beale Street (as opposed to the mid-block crossing between Fremont and Beale as proposed in the West Loop Alternative).
- A single elevated bus deck would accommodate the entire AC Transit transbay operation and all other bus services using the direct access ramps to and from the Bay Bridge. A total of 51 bus bays would be served by three one-way bus lanes.

Terminal Capacity. The terminal would be designed to accommodate the *35,000* transit passengers expected in the terminal during the peak hour in 2020. A bus operations analysis similar to the one conducted for the West Ramp Alternative was not conducted for the Full Loop Alternative. However, the Full Loop calls for 51 bus bays compared to the West Ramp's *48* bus bays. The latter number was determined to be more than adequate for projected terminal utilization by AC Transit in the foreseeable future.

Bus Access to the Transbay Terminal from the Bay Bridge. Under the Full Loop Alternative, bus connections between the Transbay Terminal and the Bay Bridge would be the same as today. There would be no changes in the loop circulation of the existing connecting bus ramps. Westbound buses would exit the Bay Bridge onto a ramp leading directly to the Transbay Terminal, proceed through the east end of the terminal building, and follow the looping ramp above city streets back to the Bay Bridge's approach for eastbound vehicle access

Bus Access to the Terminal Area from the Street. The new bus ramps would not require any change in terminal access at street level. However, Muni service currently terminating at the Terminal's "hump" on Mission Street would be relocated to a new staging area east of Beale Street *as in the West Ramp Alternative*.

Internal Bus Circulation within the Transbay Terminal. The Transbay Terminal is currently configured with *three* lanes and buses load parallel to the curb. However, to accommodate AC Transit's preferred standard of saw tooth bus bays, the *F*ull *L*oop *A*lternative would have three one-way bus lanes serving 51 bus bays. The bus structure would be somewhat longer than the existing terminal to accommodate the increased number of bays and the reduced number of lanes.

On-Street Bus Circulation. Muni lines 5, 6, 38 and 38L would board and alight passengers at a new loading area east of Beale Street and north of Howard Street. *As with* the West Ramp Alternative, buses would need to continue two extra blocks along *Mission* Street to access the terminal area through Beale Street. There would not be substantial changes in the existing on-street circulation of Golden Gate Transit and SamTrans under the Full Loop Alternative.

Bus Storage. AC Transit buses would continue to be staged on the ramps with parking available on the east side of the ramps. Additional storage for both AC Transit and Golden Gate Transit would be available beneath the western approach of the Bay Bridge at Second Street.

Operator Costs. As shown in Table 5.19-2, operating and maintenance costs for AC Transit would not be significantly higher under the Full Loop Alternative than under the existing situation. Combined annual costs would be approximately $*1.01*million or 8 percent higher than the $939,000 required for existing operations.

Operating costs for Golden Gate Transit would be lower for both Transbay Terminal options than under the existing conditions, given that the permanent bus storage facility would be closer to the Transbay Terminal than Golden Gate Transit's existing bus storage facility at Eighth and Harrison streets.

5.19.1.3 Intermodal Connectivity

Mezzanine. The West Ramp *and* Loop Ramp Alternatives would include a below-grade mezzanine. The mezzanine would be constructed between the terminal's ground floor and the rail platforms. Its configuration would consist of a simple bridge spanning across the platforms or a large floor area. The mezzanine would allow consolidation of the vertical circulation elements down from ground level and greatly increase the flexibility of the ground floor layout.

A rail mezzanine would enable escalator access between the upper bus decks, the street-level Muni loading area, and below ground rail platforms. The mezzanine could also facilitate a direct underground connection between the western end of the Transbay Terminal and a proposed Muni Third Street light rail station. By situating this connection at an underground mezzanine instead of along raised platforms of an on-street alignment, pedestrian movements would not be disrupted on the aboveground street grid (see Section 5.21.4).[36] The mezzanine would have no adverse effects on bus operations in the terminal or at street level.

Pedestrian Tunnel between Transbay Terminal and Market Street. The option for a pedestrian tunnel to Market Street under both terminal design alternatives would create a passageway between the Terminal and the Market Street subway. For either terminal alternative, the connection would be built below Fremont Street, providing a sheltered passenger connection

[36] SMWM Working Paper 12 Terminal Design Modifications and Refinements, (March 2001), p. 40.

between AC Transit bus service, Caltrain, Greyhound and the Muni/BART underground rail lines. The pedestrian tunnel is not anticipated to affect bus operations substantially although there is the potential for street bus movements, as for street traffic, to experience fewer conflicts and delays at intersections from reduced pedestrian volumes at crosswalks.

5.19.2 Impacts on Corridor Transit Patronage

The Transbay Terminal/Caltrain Downtown Extension Project would increase linked transit trips in the region in the year 2020 by an estimated 10,000 trips per day, from about 728,000 to 738,000 trips per day. As defined for this project, a linked transit trip consists of two or more unlinked trips, i.e., transit trips that involve two or more vehicles or modes. Thus an increase in linked transit trips in the corridor indicates that more people are choosing to use Caltrain instead of non-transit modes, compared with the No-Project Alternative.

Preliminary estimates of the transit mode shares have been made. The current transit mode share for work trips between San Mateo County and San Francisco is estimated to be 15.4 percent. Between Santa Clara County and San Francisco, the transit mode is estimated to be 13.1 percent. By 2020, these transit mode shares are expected to rise to 19.7 and 22.3 percent, respectively. With the Terminal/Extension Project, these transit mode shares are projected to be 22.2 and 28.5 percent, respectively.

5.19.3 Impacts on Other Transit Services

The Caltrain Extension would provide a terminus that is in downtown San Francisco and the Financial District. Current bus shuttles between these areas and the existing Caltrain terminus at Fourth and Townsend Streets would be eliminated or rerouted, with possible corresponding reductions in Muni's operating costs. With the extension, Caltrain would also provide better service to downtown San Francisco for some trip makers than would BART and SamTrans, with attendant patronage impacts on these systems. The Caltrain Extension would also have long-term impacts on transit services that currently utilize the Transbay Terminal.

5.19.3.1 BART

Ridership forecasts predict that the Transbay Terminal/Downtown Caltrain Extension Project would result in a *11* percent reduction in BART entries and exits in San Mateo County (at the Daly City, Colma, Hickey, Tanforan, SFO, and Millbrae BART stations). The analysis indicates that in 2020, there would be about 5,700 daily transfers between BART and Caltrain at the Peninsula intermodal transfer facility in Millbrae under the No-Build Alternative, and that this number would drop by about 4,400 (78 percent) if Caltrain were extended into downtown San

Francisco. An additional 700 transfers per day between BART and Caltrain is projected to occur in downtown San Francisco under the Terminal/Extension Project.

5.19.3.2 Muni

The following assumptions about Muni bus route changes with the Caltrain Extension Alternative were made:

- *Regarding the 30-Stockton and 45-Union, one of these will continue to serve Third and Fourth Streets between Market and Townsend, and will be extended into Mission Bay. The other will likely be terminated in the vicinity of Yerba Buena Center.*
- The 10 Townsend/47 Van Ness- would be rerouted to run along Harrison Street and Bryant Street between Fifth Street and Main Street.
- The 76-Marin Headlands and the 82X-Levi Plaza Express would be truncated and rerouted to serve the Transbay Terminal area.

The changes in Muni service are predicted to result in a reduction in annual revenue-hours and revenue-miles for Muni of 15,700 hours and 151,100 miles, respectively, resulting in an annual net cost savings of about $1.4 million. Muni would also reduce its peak fleet demand by four buses. In addition to re-routing existing Muni service to Caltrain's Fourth and Townsend Streets terminal, the existing Muni shuttle service (81x, 80x) to the Caltrain terminal could be eliminated saving the JPB approximately $558,000 for Muni shuttle service savings per year. Muni Metro N-Judah LRT service to Fourth and King Streets is assumed to continue to service to all stops south of the Embarcadero Station, including the reconfigured Caltrain station and the Third Street LRT extension, which is currently under construction.

Ridership forecasts predict that the Transbay Terminal/Downtown Caltrain Extension Project would result in a four percent decrease in Muni ridership.

5.19.3.3 SamTrans

The extension of Caltrain would also decrease the need for SamTrans express bus service from the Peninsula to the Transbay Terminal. SamTrans express routes including the KS, MX, NX, PX, RX, and TX would likely be eliminated. Consequently, the extension of Caltrain into downtown is projected to result in a reduction of 2,000 passengers in SamTrans daily bus ridership where a SamTrans bus was the primary mode of travel. Trips that use a SamTrans bus to gain access to a Caltrain or BART station are not included in this estimate. Additionally, local SamTrans routes would continue to serve downtown San Francisco in the Transbay Terminal area. This reduction in service would decrease SamTrans annual revenue-hours and revenue-miles by 16,500 hours and 405,200 miles, respectively. SamTrans would also require 32 fewer buses during the peak periods of operation. This would result in a $2.6 million reduction in annual operating and maintenance costs for Sam Trans.

Ridership forecasts predict that the Transbay Terminal/Downtown Caltrain Extension Project would result in a three percent reduction in SamTrans bus ridership.

5.19.3.4 AC Transit

A substantial change in AC Transit ridership was not projected by the model for the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project, although some increase in ridership is predicted due to the complementary nature of the Downtown Caltrain Extension. Extending Caltrain to the Transbay Terminal would likely encourage transfers from Caltrain to AC Transit buses, thereby increasing AC Transit bus ridership *somewhat.*

5.19.3.5 Golden Gate Transit

A substantial change in ridership on Golden Gate Transit was not projected by the model for the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project, although the increased proximity of the Caltrain terminal to Golden Gate Transit bus routes could increase the number of transfers from Caltrain to Golden Gate buses, thereby increasing Golden Gate bus ridership.

The proposed permanent off-site storage facility for Golden Gate Transit bus operations beneath the Western Approach of the Bay Bridge would be closer to the Transbay Terminal than Golden Gate Transit's existing bus storage facility at Eighth and Harrison streets. This will result in reduced deadheading and operating costs for Golden Gate Transit buses that layover at the storage facility between runs.

5.19.3.6 Other Transit Operators

Ridership forecasts predict that VTA ridership would decrease by two percent. However, Greyhound and other operators in the Transbay Terminal could potentially have their ridership enhanced by the closer connection with Caltrain.

5.19.4 IMPACTS ON VEHICULAR TRAFFIC

5.19.4.1 Travel Time Impacts in Caltrain Corridor

The ridership analysis projected that the Terminal/Extension Project would have a beneficial impact on traffic congestion. In every case, auto travel times in the A.M. peak period are expected to decrease under the Terminal/Extension Project. In 2020, the travel time improvements between origins in the U.S. 101 corridor and San Francisco are expected to typically be from two to four minutes[37]. Relocating Caltrain's San Francisco terminus to the Transbay Terminal area is expected to result in a seven percent reduction in the number of person hours of vehicle travel.[38] Morning peak hour delay is expected to be reduced by 20 percent. Implementation of the Terminal/Extension Project would result in daily travel time savings of 7,200 person hours, which includes 5,700 person hours saved for Caltrain riders and 1,500 person hours for roadway travelers in the corridor. Using FTA procedures, this represents an approximate $20 million per year savings (7,200 hours/day X $11.26/hour X 250 work days/year).

5.19.4.2 Vehicle Miles Traveled (VMT) Impacts in the Caltrain Corridor

Year 2020 vehicle miles traveled (VMT) on all roadways in the corridor is projected to decrease by 0.2 percent from 145,934,000 to 145,674,000 VMT, a savings of 260,000 VMT with the Terminal/Extension Project compared with the No-Project conditions

5.19.4.3 Intersection Level of Service Impacts around the Transbay Terminal

The San Francisco County Transportation Authority (SFCTA) countywide travel demand forecasting model (SFCTA Model) was used to develop the travel forecasts for development and growth through the year 2020 in the region, as well as to determine travel demand to and from the South of Market area (area roughly bounded by The Embarcadero, Market Street, South Van Ness Avenue and King Street). This approach results in an impacts assessment for year 2020 conditions that takes into account both the future development expected in the South of Market area, as well as the expected growth in housing and employment for the remainder of San Francisco and the nine-county Bay Area. The most up-to-date version of the SFCTA Model estimates future traffic and transit travel demand for the entire nine-county Bay Area region based on land use and employment forecasts prepared by the San Francisco Planning Department for the county, plus regional growth estimates developed and adopted by the Association of Bay Area Governments (ABAG) in 1998 (Projections '98) for the remainder of the Bay Area region. Travel demand was estimated for three land use scenarios:

- **2020 No-Project**, which assumed future development and growth, consistent with the ABAG forecasts for San Francisco and the Bay Area, and incorporates projects that have recently been approved or entitled in the South of Market area.

- **2020 Project**, which included the additional development associated with the Terminal/Extension Project.

[37] Ridership Forecasting Results Report, Korve Engineering, Inc., May 29, 1996. Adjusted to 2020 conditions by PTG, September 2001.

[38] August 27, 1996 memo from Korve Engineering to ICF Kaiser Engineers.

- **2020 Cumulative**, which incorporated other plans recently proposed in the South of Market area including the Rincon Hill Rezoning and the South of Market Redevelopment Area Plan, the Mid-Market Redevelopment Area Plan, as well as the Transbay Terminal / Downtown Caltrain Extension Project. As a result, the year 2020 cumulative conditions forecasts used in the analysis exceed the ABAG forecasts for San Francisco for employment by about 2.8 percent, and household population by about 1.4 percent.

An analysis for adverse effect from the project's impact to intersections within the project area was performed for the existing plus project and cumulative conditions. Table 5.19.3 shows all intersections with an adverse effect and notes all intersections that have a level of service (LOS) of E or F under the existing plus project and cumulative conditions (see also Table 5.19-4). *Under the City and County of San Francisco criteria, an adverse effect would occur if an intersection is degraded to a LOS of E or F. For an intersection that operates at LOS E or F in the without project conditions, there may be an adverse impact depending upon the magnitude of the project's contribution to the worsening of delay. In addition, a project would have an adverse effect if it would cause major traffic hazards, or would contribute considerably to the cumulative traffic increase.* For the purpose of this project, existing conditions are assumed to be year 2020 baseline, existing plus project is the 2020 baseline plus the Transbay Terminal project, and cumulative is the cumulative that includes all of the related City and Redevelopment projects.

Table 5.19-3: Project Impact Determination for Intersections at LOS E or F Under *2020 Baseline* Plus Project and *2020* Cumulative Conditions

Intersections	***2020 Baseline* Plus Project**	***2020* Cumulative**
First/Market	Adverse Effect	Adverse Effect
First/Mission	Adverse Effect	Adverse Effect
First/Howard	Adverse Effect	Adverse Effect
Fremont/Howard	Adverse Effect	Adverse Effect
Beale/Howard	Adverse Effect	Adverse Effect
Second/Folsom	Adverse Effect	Adverse Effect
First/Folsom	Not an Adverse Effect	Not an Adverse Effect
The Embarcadero/Folsom	Not LOS E or F under Existing Plus Project	Not an Adverse Effect
Second/Harrison	Not an Adverse Effect	Not an Adverse Effect
Harrison/Essex	Not an Adverse Effect	Not an Adverse Effect
Harrison/First	Not an Adverse Effect	Not an Adverse Effect
Harrison/Fremont	Not an Adverse Effect	Not an Adverse Effect
Main/Harrison	Not an Adverse Effect	Not an Adverse Effect
Second/Bryant	Adverse Effect	Adverse Effect

Source: San Francisco Planning Department, January 2002.

Table 5.19-4: Intersection Level of Service -- Existing and 2020 Conditions, Weekday P.M. Peak Hour

Intersection	Existing			2020 No-Project			2020 Term./Ext. Project			2020 Cumulative		
	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c
1. First/Market	25.9	D	–	34.9	D	–	54.9	E	1.16	>60	F	1.17
2. Fremont/Market	15.2	C	–	26.0	D	–	30.3	D	–	34.4	D	–
3. Second/Mission	10.2	B	–	16.1	C	–	21.1	C	–	31.6	D	–
4. First/Mission	27.1	D	–	58.5	E	1.13	>60	F	1.22	>60	F	1.22
5. Fremont/Mission	21.8	C	–	21.9	C	–	29.2	D	–	30.5	D	–
6. Beale/Mission	14.9	B	–	19.9	C	–	33.0	D	–	33.0	D	–
7. Main/Mission	15.6	C	–	20.3	C	–	22.6	C	–	26.6	D	–
8. Second/Howard	15.1	C	–	25.9	D	–	25.1	D	–	27.3	D	–
9. First/Howard	31.9	D	–	40.9	E	1.09	>60	F	1.21	>60	F	1.24
10. Fremont/Howard	20.1	C	–	28.7	D	–	44.3	E	1.03	42.4	E	1.03
11. Beale/Howard	16.2	C	–	28.1	D	–	>60	F	1.19	>60	F	1.21
12. Main/Howard	15.4	C	–	25.1	D	–	33.7	D	–	39.6	D	–
13. Spear/Howard	13.9	B	–	15.5	C	–	31.7	D	–	33.7	D	–
14. Second/Folsom	32.5	D	–	>60	F	1.15	>60	F	1.18	>60	F	1.24
15. First/Folsom	>60	F	1.17	>60	F	1.15	>60	F	1.21	>60	F	1.24
16. Fremont/Folsom	7.7	B	–	22.4	C	–	25.5	D	–	26.8	D	–
17. Beale/Folsom	14.5	B	–	14.7	B	–	15.8	C	–	15.8	C	–
18. Main/Folsom	12.1	B	–	15.9	C	–	34.6	D	–	34.1	D	–
19. Spear/Folsom	11.1	B	–	13.2	B	–	14.1	B	–	16.5	C	–
20. The Embarcadero/Folsom	18.2	C	–	26.5	D	–	39.0	D	–	47.5	E	0.95
21. Second/Harrison	44.9	E	1.11	>60	F	1.19	>60	F	1.26	>60	F	1.32
22. Essex/Harrison	>60	F	1.15	>60	F	1.17	>60	F	1.18	>60	F	1.19
23. First/Harrison	>60	F	1.26	>60	F	1.23	>60	F	1.29	>60	F	1.33
24. Fremont/Harrison	36.2	D	–	49.5	E	0.93	59.1	E	0.96	>60	F	0.99
25. Main/Harrison	32.0	D	–	40.9	F	0.83	56.1	F	0.89	>60	F	0.95
26. Spear/Harrison	15.4	C	–	30.4	C	–	31.9	D	–	37.0	D	–
27. Second/Bryant	>60	F	1.18	>60	F	1.23	>60	F	1.28	>60	F	1.31

Notes: Delay presented in seconds per vehicle. v/c = volume-to-capacity ratio for all intersections at LOS E or F.
Source: Wilbur Smith Associates, December 2001

***2020* Baseline Plus Project Conditions.** As shown in Table 5.19-4, the project's traffic contribution to the following intersections would be considered **not adverse** under the baseline plus project conditions:

- First/Folsom
- Second/Harrison
- Harrison/Essex
- Harrison/First
- Harrison/Fremont
- Main/Harrison

This was determined based on an examination of the traffic volumes for the traffic movements that determine overall LOS performance at these intersections. In most intersections where baseline plus project conditions were found to be not adverse, the project would add traffic movements that would continue to operate satisfactorily. In some instances, the project would add vehicles to movements at intersections that would not perform well under the 2020 baseline plus project conditions. However, in these instances, the project's contributions to these movements would be small. Finally, in one case, no adverse contribution was found because the project volumes and total volumes for the movement would be very small and would not materially affect the overall LOS performance at the affected intersection. For the intersections listed above, project traffic would also not represent a considerable contribution to the *2020* baseline plus project conditions, and the project would not have an adverse traffic impact at these intersections.

As shown in Table 5.19-4, the project's contribution to the following intersections would be considered **adverse** under the *2020* baseline plus project conditions:

- First/Market
- First/Mission
- First/Howard
- Fremont/Howard
- Beale/Howard
- Second/Folsom and
- Second/Bryant

The project would add substantial numbers of vehicles to some movements that determine overall LOS performance. Specifically, the project would add vehicles to movements that represent a considerable contribution to the baseline plus project traffic conditions and the project would have an adverse impact on these intersections.

***2020* Cumulative Condition**: As shown on Table 5.19-4, the *project's* traffic contribution to the following intersections would be considered **not adverse under *2020* cumulative conditions**.

- First/Folsom
- Second/Harrison
- Harrison/Essex
- Harrison/First
- Harrison/Fremont
- Main/Harrison

This was determined based on an examination of the traffic volumes for the traffic movements that determine overall LOS performance at these intersections. In most instances where cumulative conditions were found to be not adverse, the project would add vehicles to movements that would continue to operate satisfactorily. In some instances, the project would add vehicles to movements at intersections that would not perform well under cumulative conditions. However, in these instances, the project's contribution to these movements would be small. Finally, in one case, no adverse contribution was found because the project volumes and total volumes for the movements would be very small and would not materially affect overall LOS performance at the affected intersection. For the intersections listed above, project traffic would not represent a considerable contribution to the cumulative conditions, and the project would not have an adverse traffic impact at these intersections.

As shown in Table 5.19-4, the project's contribution to the following intersections would be considered **adverse under *2020* cumulative conditions** *(these are the same intersections that would experience adverse effects under the 2020 plus project condition)***:**

- *First/Market*
- *First/Mission*
- *First/Howard*
- *Fremont/Howard*
- *Beale/Howard*
- *Second/Folsom and*
- *Second/Bryant*

For these intersections, the project would add substantial numbers of vehicles to some movements that determine overall LOS performance. Therefore, the project would add vehicles to those movements that would represent a considerable contribution to the cumulative conditions and the project would have an adverse impact on these intersections.

The Terminal/Extension Project would result in a substantial increase in vehicle trips to and from new developments, particularly in the area bounded by Mission, Folsom, First and Main Streets. Along First and Howard Streets there is a high volume of traffic destined to the I-80/Bay Bridge on-ramp at First/Harrison and to the U.S. 101 southbound on-ramp at Fourth/Harrison (via Howard and Fourth Streets) to which the Terminal/Extension Project would contribute additional vehicles and result in increased congestion. Similarly, the planned modifications to the I-80 westbound off-ramp at Fremont Street would add a second leg that will provide access to Folsom Street and result in an increase in vehicles on Folsom Street. The combined increase in vehicles on Folsom Street due to the modified ramp and vehicle-trips generated by the Terminal/Extension Project would result in LOS E conditions at the intersection of The Embarcadero/Folsom Street.

Mitigation: The Project would result in adverse impacts at seven intersections under both the baseline plus project and cumulative conditions. Improvements at individual intersections may *reduce* localized congestion *somewhat*, but may not mitigate operating conditions to less than adverse levels. As a result of the constraints at downstream intersections and the I-80/U.S. 101 on-ramps and mainline, mitigation measures for the seven intersections have not been proposed, and the impacts associated with the Project would be considered adverse and unmitigable.

*T*o help improve 2020 Cumulative operating conditions, the San Francisco Department of Parking and Traffic (DPT) may request sponsors of development projects in the South of Market area to contribute to the new Integrated Transportation Management System (ITMS) program. This program is a citywide real-time electronic transportation management system that would include the installation of various Intelligent Transportation System (ITS) infrastructure components to improve traffic circulation within the City. The program would monitor and manage traffic by receiving real-time information at a Traffic Management Center via closed circuit TV cameras. The South of Market area has been identified as the area within which the first phase of the system would be implemented.

The implementation of the ITMS program would improve overall traffic conditions and reduce traffic congestion in the City. Although the implementation of ITMS may not directly mitigate the adverse impacts of the Project under 2020 Terminal/Extension Project conditions or 2020 Cumulative conditions, this program would result in overall traffic improvements and lessening of congestion, and would facilitate traffic circulation in the South of Market area.

5.19.4.4 Traffic Impacts Associated with Draft Transbay Redevelopment Project Area Design for Development Vision

To account for the increased demand for pedestrian and bicycle facilities with the new Transbay Terminal and the new development throughout the Transbay Area, the San Francisco Redevelopment Agency has developed a Draft Transbay Redevelopment Project Area Design for Development Vision (August 2003) that includes proposed sidewalk widenings with corresponding reduction in the adjoining street widths (as described in Section 2.2.4.2 of the Final EIS/EIR). This section reviews the traffic impacts associated with the sidewalk widening proposals.

To accomplish this review, the results of the traffic analysis described in the previous section were reevaluated for the 2020 Cumulative conditions. For each of the analysis intersections, the weekday P.M. peak hour intersection operating conditions were examined to see if it would be possible to reduce the number of travel lanes and still maintain acceptable operating conditions *(i.e., LOS D or better). In addition, the actual configuration of the streets was investigated to identify locations where: (A), lane imbalances were present (i.e., a street with two lanes on one side of an intersection and three lanes on the other side); (B), perpendicular/diagonal parking could be converted to parallel parking; or (C), turn lanes could be converted into turn pockets. Although these changes would not result in the complete elimination of travel lanes, they would allow for wider sidewalks to be created for portions of the streets. As part of this analysis, no changes were proposed or evaluated at intersections that were projected to operate with unacceptable conditions (i.e., LOS E or F) during the weekday P.M. peak hour.*

For the major vehicular corridors in the study area (such as Folsom, Howard, Fremont, First and Essex Streets), the potential to establish peak-period tow-away lanes was assessed. Since these streets accommodate substantial traffic during the morning and evening commute periods, it may be possible to eliminate travel lanes during off-peak times. As a result, the current capacity would be maintained during the weekday P.M. peak hour, and would not change the intersection operating conditions, but additional sidewalk space could be created.

In addition, the potential to extend westbound Folsom Street was assessed. Based on the projected weekday P.M. peak hour intersection operating conditions, it would be possible to extend westbound Folsom Street for two blocks (from Main Street to Fremont Street) and maintain acceptable intersection operating conditions.

Following are changes that could be made to the street network within the Transbay Area that are not anticipated to introduce new adverse traffic impacts.

***Spear Street** has two lanes southbound between Market Street and Howard Street. South of Howard Street, it widens to three lanes and continues as three lanes until Harrison Street. It would be possible eliminate a travel lane between Howard Street and Harrison Street, as long as three lanes are provided at the intersection with Harrison Street. The southbound left-turn pocket at the intersection of Spear/Harrison would need to be about 150 feet long.*

*North of Folsom Street, **Main Street** has three northbound lanes. It would be possible to narrow Main Street to two lanes at the north side of the intersection with Folsom Street, as long as three lanes were maintained at the intersection with Howard Street. The northbound left-turn pocket at the intersection of Main/Howard would need to be about 175 feet long.*

*Between Mission Street and Folsom Street, **Beale Street** has three southbound lanes. These lanes need to be maintained.*

*During the peak morning and evening commute periods, the current configuration of **Fremont and First Streets** would need to be maintained. During the off-peak hours, it would be possible to reduce the number of travel lanes on each street. As a result, peak period tow-away lanes could be established on one side of the street. A peak-period tow-away lane on Fremont Street was found not to be feasible due to the configuration of the street and the various lane requirements.*

Between Harrison and Folsom Streets, ***Essex Street*** *has two northbound and two southbound lanes. It would be possible to eliminate one northbound lane. In addition, it would be possible to establish a peak period tow-away lane in the southbound direction.*

Between Main Street and The Embarcadero, ***Folsom Street*** *has three eastbound lanes and one westbound lane. To the west of Main Street, Folsom Street has four eastbound lanes. Between Fremont Street and Main Street, it would be possible to eliminate one eastbound lane and establish a new westbound lane (an extension of the current two-way street for an additional two blocks). It should be noted that the infrastructure for this conversion to two-way traffic would be associated with the temporary terminal project.*

Howard Street *has two lanes between Fremont Street and The Embarcadero in the eastbound direction. For this entire length, only one eastbound lane would be necessary, except at the intersection with Main Street. At this location, an eastbound left-turn pocket would need to be provided.*

5.19.5 IMPACTS ON PARKING

A portion of the existing public and private parking facilities (parking lots) in or near the existing Transbay Terminal would be eliminated as a result of the Full Build Alternative. Approximately 1,950 (14 percent of study area parking) off-street parking spaces would be eliminated, including 260 spaces within the current Transbay Terminal building. Although the Full Build Alternative would eliminate off-street parking, new land use in the Transbay Terminal Redevelopment Area would have its own parking facilities.

With the loss of parking, vehicles previously bound for the displaced parking spaces would have to park in other parking facilities nearby or the people making these trips may now chose to use transit, given the reduced availability of parking*, and enhanced accessibility of transit services.*

Based on a review of a recent parking inventory, the current study area parking supply is at approximately 85 percent capacity during the weekday-midday. As a result of the reduction in parking spaces, usage is likely to reach capacity during the weekday midday. Given the first-in first-served nature of parking, with early morning commuters able to park closer to their destination, loss of area parking would mean that vehicles arriving later would have to park f*a*rther away from their destinations or chose another mode of transportation. The permanent loss of parking could deter commuters from driving, with a probable increase in public transit use. The provision of a new multi-modal transit facility that provides improved access to locations throughout the region would serve to mitigate the adverse parking capacity impacts.

The displacement of parking spaces is not generally considered a physical environmental effect but is a social effect and an inconvenience to those who must seek other parking. The displacement of parking spaces and any resulting parking deficits are also not considered to be a permanent condition as drivers my be induced to seek and find alternative parking facilities and shift to other modes of travel.

5.19.6 NON-MOTORIZED TRAFFIC IMPACTS

This section reviews the long-term effects of Terminal/Extension Project on pedestrian and bicycle conditions in the area surrounding the Transbay Terminal. *It should be noted that the following analysis did not take into account the proposed sidewalk widenings contained in the Draft Transbay Redevelopment Project Area Design for Development Vision released by the San Francisco Redevelopment Agency in August 2003. Implementation of any or all of the proposed sidewalk widenings would result in improved pedestrian capacity and flows in the area. Thus, the following analysis reports "worst-case" conditions.*

5.19.6.1 Pedestrian Impacts

Impacts on pedestrians were evaluated by modeling peak period walk trips with and without the Terminal/Extension Project and calculating pedestrian level of service at five intersections in the vicinity of the proposed new Transbay Terminal, which is the main area of pedestrian activity associated with the project.

Baseline surveys of existing pedestrian volumes were made in spring 2001 and future (2020) volumes projected based upon the level of transit and retail/commercial/other activity anticipated in the area. Two project alternatives were considered (1) no pedestrian tunnel between the terminal and Market Street and (2) a direct underground pedestrian tunnel connecting the Caltrain platform or mezzanine area with the BART/Muni mezzanine under Market Street.

The model is the San Francisco Transportation Authority travel model, modified to include assignment of future walk trips generated by increased transit access and higher land use densities from redevelopment. The study area was divided into various analysis zones, as shown in Figure 5.19-1. The modified model predicts pedestrian trips among the analysis zones that have the potential to generate pedestrian traffic and assigns them to certain pathways along city streets and through intersections. The baseline surveys provide a measure for calibrating estimated future pedestrian volumes and movements to ensure they are reasonable.

Projected pedestrian volumes moving through a crosswalk translate to an estimate of the surface square footage available to each pedestrian and expected pedestrian flow rates (pedestrians per minute per foot). Level of service (LOS) is based upon the estimated space per pedestrian and a corresponding flow rate during the peak 15 minutes of pedestrian activity. Levels of service criteria are drawn from the Highway Capacity Manual (Transportation Research Board, Chapter 13). Similar to traffic, a pedestrian volume-to-walkway capacity relationship can be derived. A pedestrian volume to walkway capacity ratio of 0.40 to 0.28 equates to LOS C, for instance; a V/C ratio of 1.00 or higher equates to LOS F. The corresponding square footage per pedestrian under LOS F is 6 or less, and the average pedestrian flow rate is 25 or more pedestrians per minute per foot.

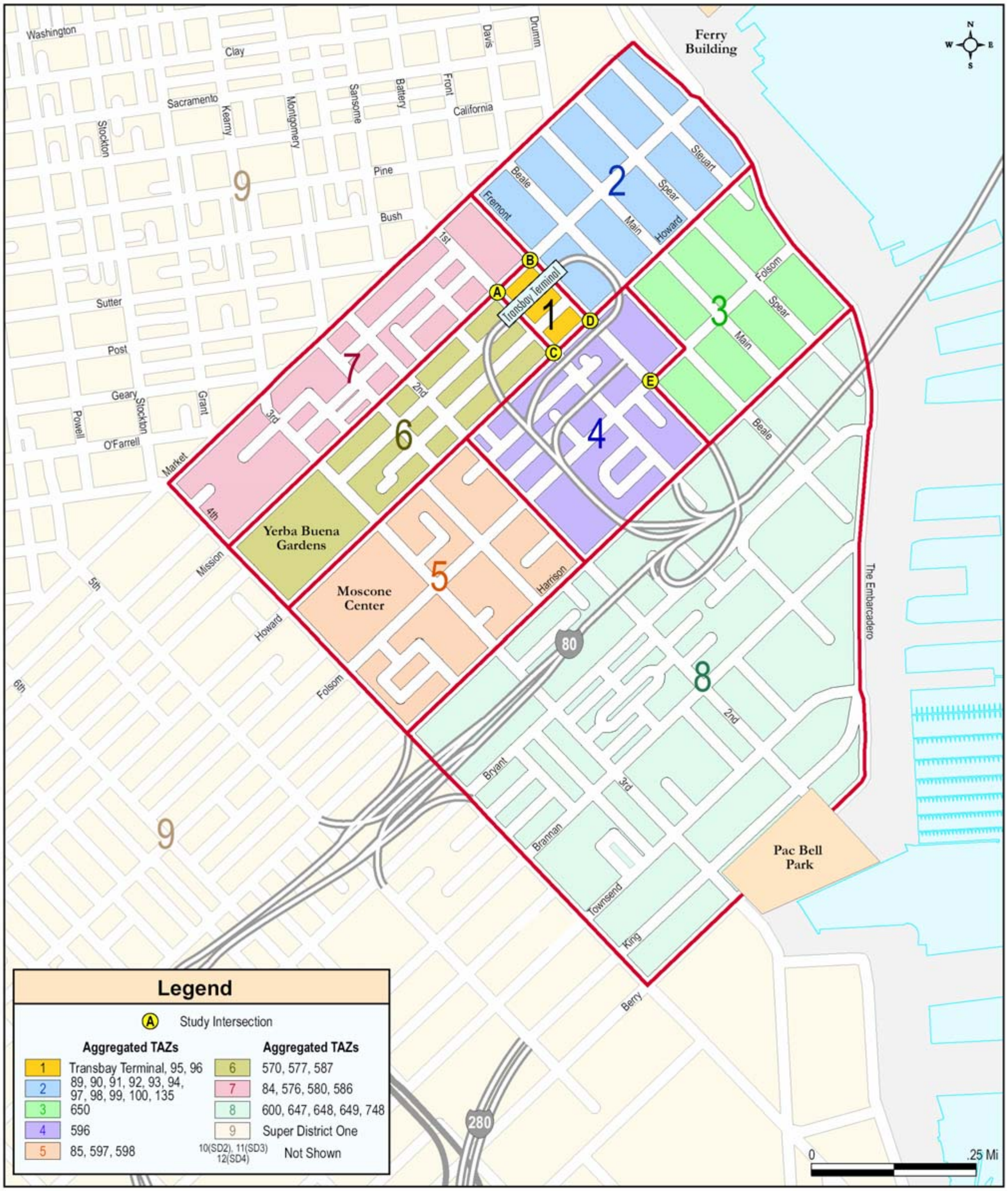


Figure 5.19-1 Aggregated TAZs used for Pedestrian/Bicycle Analysis

The five study area intersections where crosswalk LOS was evaluated are:

- Mission and First Streets
- Mission and Fremont Streets
- Howard and First Streets
- Howard and Fremont Streets
- Folsom and Beale Streets

Important parameters affecting pedestrian volumes in the study area are such items as the access mode splits for Caltrain, AC Transit and other transit riders, peak hour mode shares, increased street activity from redevelopment. Several important assumptions for the 2020 P.M. peak hour pedestrian forecasts are:

- 80 percent walk access for Caltrain riders commuting to San Francisco[39]
- 50 percent walk access for Caltrain riders reverse commuting to points south[40]
- 83 percent walk access for AC Transit riders[41]
- Substantial increases in background pedestrian traffic due to both continuing growth in the area and growth due to redevelopment.

2020 Pedestrian Volumes and LOS, Background Plus Project (Total Traffic). As a result of continuing growth in the study area and as a result of the proposed project improvements, pedestrian trips are projected to increase 59.5 percent between 2000 and 2020 in the analysis zones surrounding the Transbay Terminal. At the five individual study area intersections, where pedestrian activity or growth in activity would be concentrated, the percentage increases in pedestrian traffic during the P.M. peak hour would be substantially greater, from 300 percent to over 2000 percent, depending upon location.

All pedestrians are assumed to use surface streets to move among analysis zones, including through the five study area intersections evaluated. The total pedestrian counts for 2001 and the projected volumes under the background plus project scenario for 2020 are shown in Table 5.19-5. The volumes are for the 15-minute p.m. peak window of highest pedestrian activity.

[39] Source: Nelson\Nygaard Consulting: Based on existing mode split at the Fourth and Townsend Station (Source Parsons Transportation Group) and existing mode split at the Transbay Terminal (Source: May 2001 Transbay Terminal Patron Survey conducted by Nelson\Nygaard). Assumes that once Caltrain is extended to the Transbay Terminal, the walk split would increase from the existing condition at Fourth and Townsend to almost equal to that *of* AC Transit Transbay Terminal Patrons.

[40] Source: Based on the existing Caltrain mode splits at Fourth and Townsend Station and the assumption that the walk mode in the reverse commute direction would increase substantially if the Terminal station were moved.

[41] Source: Nelson\Nygaard Consulting, Transbay Terminal Spring 2001 patron survey.

Table 5.19-5: Pedestrian per Intersection: 2001 and 2020 Baseline Plus Project
(15-minute P.M. Peak Total Pedestrian Traffic)

Intersection	May 2001 Pedestrians	% Increase by 2020	Increase Due to Area Growth & Redevelopment	Increase Due to AC/Caltrain	2020 Total Peds/Intersection[1]
Mission & First	895	915%	8,185	454	9,534
Mission & Fremont	854	380%	3,247	141	4,243
Howard & First	228	2182%	4,967	294	5,489
Howard & Fremont	235	1765%	4,141	70	4,446
Folsom & Beale	117	839%	982	12	1,111

[1] Existing plus increase due to area growth and redevelopment and increase due to AC/Caltrain.

The percentage increases in pedestrian volumes due to area growth and redevelopment are high because they represent the change over a 20-year period. Pedestrian volumes in the area are anticipated to increase markedly with or with*out* the proposed project and additional redevelopment efforts. In addition, the current pedestrian volumes upon which the percentage change is based are quite small in many cases.

Intersection LOS. When a pedestrian arrives at a particular intersection, he or she may use a variety of combinations and crosswalks to move through the intersection. For example, at the first study intersection, Mission and First Streets, the May 2001 field survey showed that 895 pedestrians made 1,945 "movements" through the intersection. A movement is considered entering or exiting a crosswalk or turning the corner.

Pedestrian LOS accounts for all movements that pedestrians make through an intersection. Figure 5.19-2 shows pedestrian LOS associated with the pedestrian volumes and LOS summarized in Table 5.19-6. As shown, pedestrian LOS is projected to be poor, varying from LOS E to F, at four of the five intersections evaluated by 2020, with continuing growth in the area and as a result of project generated pedestrian activity.

Changes to Pedestrian LOS Due to Project Impacts Only. Not all of the increase in pedestrian activity listed in Table 5.19-6 is attributable to the Transbay Terminal/Caltrain Downtown Extension Project, including area redevelopment. A considerable increase in pedestrian movements results from area growth between 2001 and 2020.

According to output from the SFTA model, about seven percent of the increase in total pedestrian volumes by 2020 actually would be generated by the project (9,482 of 140,845 pedestrian trips among the traffic analysis zones analyzed). Following a similar methodology as that used to estimate total pedestrian trips from all sources, the impacts of just the project were estimated. Intersection pedestrian LOS was recalculated by adding Caltrain, AC Transit, and redevelopment-generated pedestrian trips to the 2001 activity level

Figure 5.19-2	Corner & Crosswalk Pedestrian Level of Service (LOS) 2020 Baseline & Project

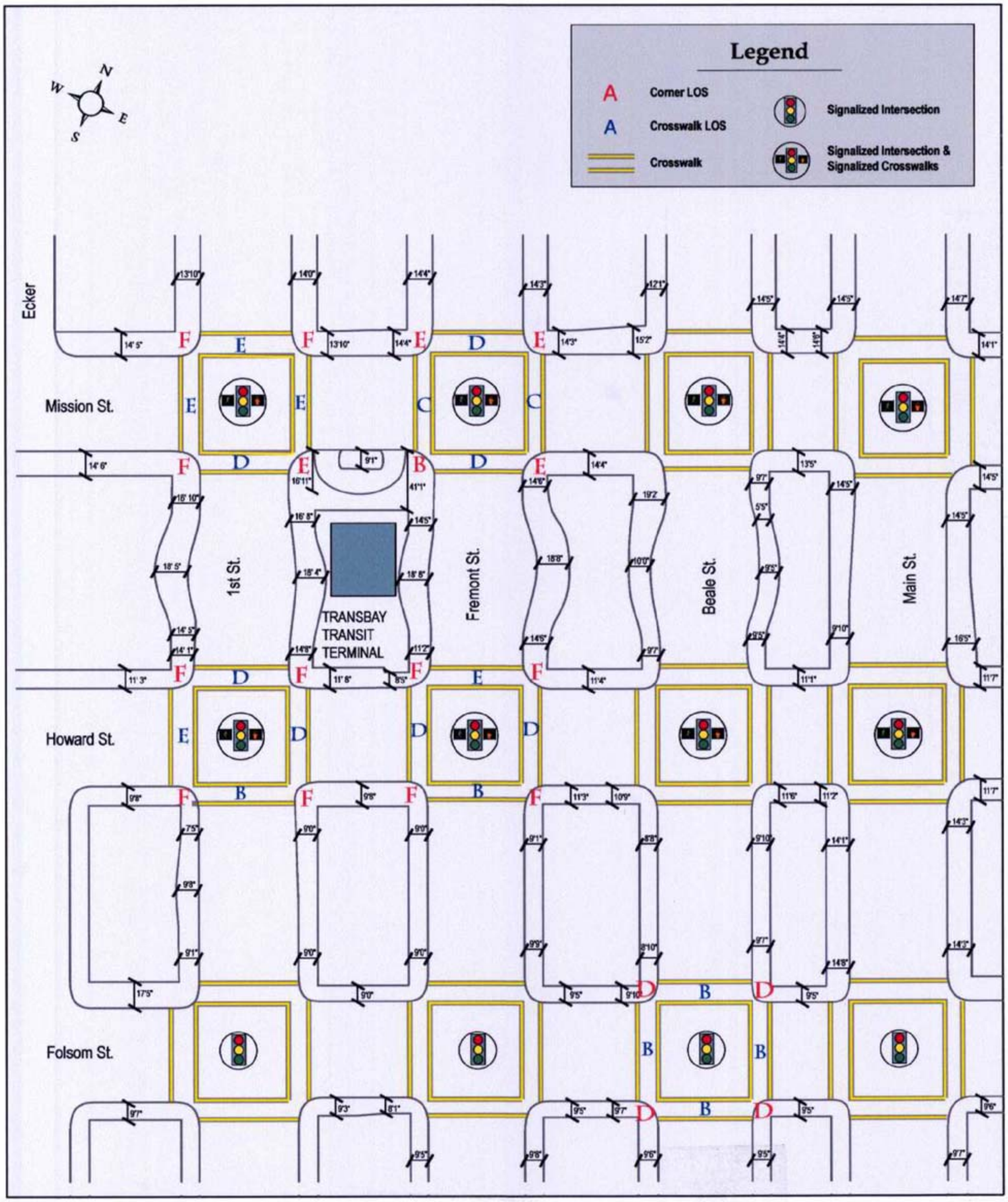


Table 5.19-6: Pedestrian LOS: P.M. Peak Conditions (Peak 15-minutes) 2020 Baseline Plus Project

Intersection	Cross-walk	Ped Space (sq ft/ped)	LOS	Surge LOS	Corner	Ped Space (sq ft/ped)	LOS
Mission & First	North	6	E	F	NW	-1.5	F
	East	12	E	E	NE	-1.2	F
	South	18	D	E	SW	4.4	F
	West	14	E	E	SE	7.9	E
Mission & Fremont	North	22	D	D	NW	6.6	E
	East	34	C	D	NE	8.7	E
	South	15	D	E	SW	42	B
	West	25	C	D	SE	8.9	E
Howard & First	North	16	D	E	NW	.47	F
	East	13	E	E	NE	4.3	F
	South	37	C	C	SW	-0.16	F
	West	13	E	E	SE	3.3	F
Howard & Fremont	North	6	E	F	NW	-2.1	F
	East	16	D	E	NE	-2.7	F
	South	43	B	C	SW	2.6	F
	West	18	D	E	SE	4.4	F
Folsom & Beale	North	73	B	B	NW	18	D
	East	114	B	B	NE	18	D
	South	49	B	B	SW	15	D
	West	53	B	B	SE	19	D

[1] Level of service (LOS) standards from Highway Capacity Manual (Chapter 13)

Design Option 1: No Pedestrian Tunnel between Transbay Terminal and Market Street. Under this design option, all pedestrians would use surface streets to move among analysis zones, including through the five study area intersections evaluated. The pedestrian volumes that would be generated by just the project, in 2020, are shown Table 5.19-7. The volumes are for the 15-minute p.m. peak window of highest pedestrian activity.

Table 5.19-7: 2020 Project Only Impacts: Increase in Pedestrian in Study Intersections (During 15-minute P.M. Peak -- No Pedestrian Tunnel)

Intersection	May 2001 Peds	% Increase Due to Project	Increase Due to Redevelopment	Increase Due to AC & Caltrain	2020 Project Peds/Intersection
Mission & First	895	118%	1,059	454	2,408
Mission & Fremont	854	74%	633	141	1,628
Howard & First	228	293%	666	294	1,188
Howard & Fremont	235	282%	662	70	967
Folsom & Beale	117	143%	168	12	297

The total number of pedestrians at each intersection in 2020 was assigned to the crosswalks and corners in proportion to existing travel patterns. Intersection LOS was calculated, as shown in Table 5.19-8 and illustrated in Figure 5.19-3.

Table 5.19-8: Pedestrian LOS: P.M. Peak Conditions (Peak 15-minutes)
2020 Project Only -- No Pedestrian Tunnel

Intersection	Cross-walk	Ped Space (sq ft/ped)	LOS	Surge LOS	Corner	Ped Space (sq ft/ped)	LOS
Mission & First	North	24	C	D	NW	12	E
	East	47	B	C	NE	9	E
	South	72	B	B	SW	34	C
	West	55	B	C	SE	36	C
Mission & Fremont	North	57	B	B	NW	24	C
	East	90	B	B	NE	30	C
	South[1]	39	**C**	**C**	SW	112	B
	West	66	B	B	SE	31	C
Howard & First	North	75	B	B	NW	19	D
	East	61	B	C	NE	34	C
	South	171	A	B	SW	16	D
	West	45	B	C	SE	27	C
Howard & Fremont	North	28	C	D	NW	14	E
	East	75	B	B	NE	17	D
	South	196	A	A	SW	50	B
	West	85	B	B	SE	31	C
Folsom & Beale	North	271	A	A	NW	81	B
	East	426	A	A	NE	81	B
	South	194	A	A	SW	62	B
	West	200	A	A	SE	86	B

[1] Under the Pedestrian Tunnel Design Option, LOS at this crosswalk would improve to LOS B. Otherwise, intersection pedestrian LOS is not anticipated to change with a pedestrian tunnel in place.

Design Option 2: Underground Pedestrian Tunnel to Market Street. The terminal and extension design alternatives allow for an optional pedestrian connection between the terminal and Muni Metro and BART, which are located one block away on Market Street. If an underground pedestrian connection to BART were included in the project, some of the *peak period* pedestrian trips in Figure 5.19-3 would be diverted *from the intersections shown in that figure. This following analysis looks at the impact of the underground tunnel on pedestrian LOS in the peak 15-minute period at the intersection of Fremont and Mission Streets.*

Assuming that many transit users of the Transbay Terminal would find the pedestrian connection underneath Fremont Street convenient just to cross Market Street away from traffic and weather, Table 5.19-9 illustrates with high and low estimates what the numbers of users might be. Those connecting to BART and Muni would make up about one-third of the total low case, or about 2,400 daily users.

Figure 5.19-3	Corner & Crosswalk Pedestrian Level of Service (LOS) 2020 Project

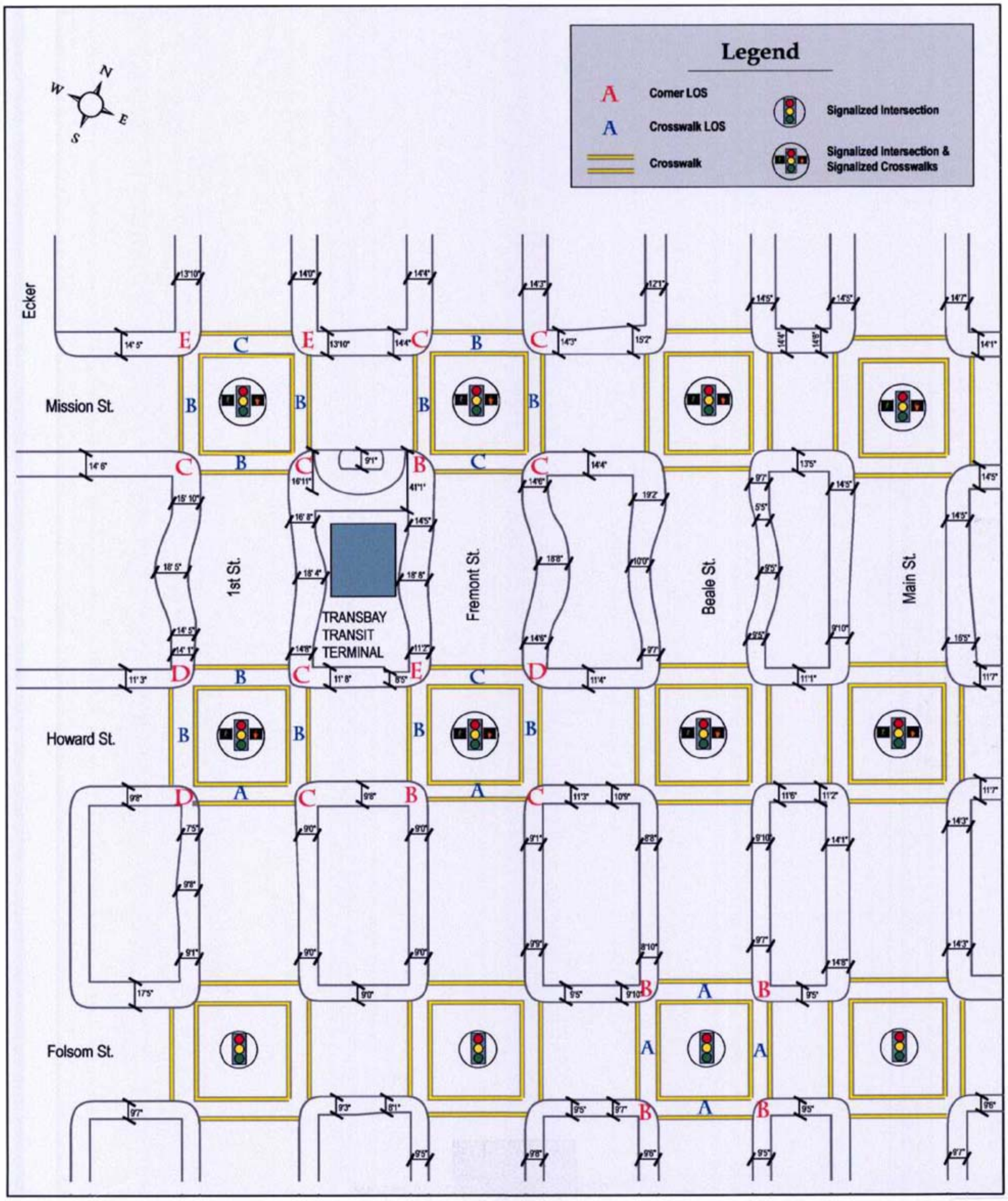


Table 5.19-9: Potential Daily Users of the Proposed Fremont Street Pedestrian Tunnel

Case	*High-Speed Rail*	*Caltrain*	*AC Transit*	*Total*
Low Estimate	*2,300*	*3,400*	*2,400*	*8,100*
High Estimate	*4,700*	*6,800*	*5,400*	*16,900*

Note: Assumes range of 10% (low) to 25% (high) of transit passengers using the tunnel to cross Market Street in addition to those connecting with BART or Muni Metro.
Source: Parsons Corporation, September 2003.

- **Pedestrian Travel Due to Redevelopment.**

Pedestrians traveling between analysis zones immediately surrounding the terminal were not anticipated to travel underground for one block of their journey. A small amount of pedestrian traffic generated by redevelopment in the Transbay Terminal area might, however, use the underground connection to grain access to BART *or* Muni Metro. The propensity for these people to use the underground connection is limited since either their origin or destination would be above ground. *As a result, in the peak 15-minute period, only one pedestrian trip is expected to be diverted from the Fremont & Mission intersection.*[42]

- **Pedestrian Travel Due to Increased AC Transit Ridership.**

AC Transit riders traveling between the Transbay Terminal and analysis zones to the north of Market Street *could use* the underground connection, *but the* propensity for these people to use the connection is limited since AC Transit buses arrive above ground and destinations are also above ground. *For AC Transit riders transferring to BART and Muni Metro, however,* it is assumed that 50 percent would use the underground connection.[43] *The combined impact of transfers and those using the underground passageway to walk between AC Transit and areas north of Market Street is estimated to divert 52 pedestrian trips from the Fremont & Mission intersection during the 15-minute peak period.*[44] The May 2001 Terminal Patron Survey showed that, of the 1,078 AC Transit patrons surveyed, 11 patrons (one percent) transferred between AC Transit and BART, and 42 (about four percent) transferred between AC Transit and Muni Metro.

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[42] SFTA model projections for 2020 Baseline + Project conditions = 472 peak period pedestrian trips between the Transbay Terminal and north of Market Street. Assuming 25% travel through Fremont & Mission, and 10% use underground connection = 1 trip.

[43] Because AC Transit riders would enter the terminal above ground, it is assumed that one-half would make the connection on surface streets and one-half would use the tunnel.

[44] AC Transit projections show 5,469 peak hour AC Transit riders in 2020. Assuming 83% access the terminal as pedestrians = 1,531 ped trips in the peak 15-minute period. The SFTA model predicts 44.5% of pedestrians traveling from/to the terminal will be from/going to north of Market Street = 566 pedestrians. Assuming 25% walk through Fremont & Mission and 10% use the underground connection = 14 pedestrian trips. 1% of the peak 15-minute AC Transit trips are estimated to transfer to BART. Assuming 50% use underground walkway = 7 ped trips. 4% of the peak 15-minute AC Transit trips are estimated to transfer to BART. Assuming 50% use underground walkway = 31 ped trips.

- **Pedestrian Travel Due to Caltrain Ridership**

Those traveling between the train level at the Transbay Terminal and analysis zones to the north of Market Street might use the underground connection, given that the passageway would be on the same level as the Caltrain mezzanine. *In addition, it* is expected that two percent of Caltrain riders would transfer between Caltrain and BART in downtown San Francisco and that all transferring riders would use the underground connection. It is also expected that three percent of Caltrain riders would transfer between Caltrain and Muni Metro in downtown San Francisco and that all transferring riders would use the underground passageway. *The combined impact of transfers and those walking between Caltrain and areas north is estimated to divert 55 pedestrian trips from the Fremont & Mission intersection during the 15-minute peak period.*[45]

A total of 108 pedestrian trips are expected to be diverted from the Fremont and Mission Streets intersection *during the 15-minute peak period.* The pedestrian LOS impacts *would* not change at this intersection under any future scenario except for 2020 Project Only Impacts. The south crosswalk would improve from LOS C to LOS B.

- **Other Pedestrian Conditions**

Under the West Ramp Alternative, a street-level bus boarding area would be located between Fremont and Beale Streets. Muni bus lines 2/3, 5, 6/7, 38 and 38L and Golden *Gate* Transit basic bus service lines 20, 30, 50, 80 and 90 would use the street-level boarding area. The Muni buses listed currently board and alight on the "hump" area in front of the terminal, while the Golden Gate Transit lines currently board along Mission and Fremont Streets. As a result of the project, more pedestrians would have to cross Fremont Street to reach the street-level bus boarding area. About 100 buses would pull out of this area between approximately 5:00 p.m. and 7:00 p.m.

To facilitate transit access between the bus boarding area and Fremont Street, the Terminal/Extension Project designs include a new traffic signal on Fremont Street between Mission and Howard Streets. This signal would be located just south of the terminal and may also include a full stop phase to facilitate pedestrian flows crossing Fremont Street.

Pedestrian Mitigation Measures. Under the 2020 Baseline plus Terminal/Extension Project condition, eleven corners and two crosswalks fall to pedestrian Level of Service F. Isolating the *P*roject *O*nly impacts from the 2020 Baseline plus Project condition indicates that the project itself does not cause the level F conditions. The lowest pedestrian levels of service associated with the project occur at First and Mission Streets where two corners fall to LOS E, and at Howard and Fremont Streets where one corner falls to LOS E.

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[45] 548 15-minute peak Caltrain-generated pedestrian trips. If 44.5% travel from the terminal to north of Market Street and 25% of those walk through the Fremont & Mission intersection, and if 25% of those use underground tunnel, this equals 15 ped trips. There are 785 predicted peak 15-minute total Caltrain trips. Of these, 2% (16 trips) are expected to transfer to/from BART and 3% (24 trips) are expected to transfer to/from Muni, all of which would use the underground connection.

Pedestrian mitigation measures that can be considered include:

- Preventing narrowing of sidewalks through future construction;
- Using 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 Missions Streets,
    - The northeast corner of First and Missions 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;
- Ensuring that Transbay Terminal design increases corner and sidewalk widths at the four intersections immediately surrounding the Transbay Terminal;
- Eliminating or reducing sidewalk street furniture on corners, such as newspaper boxes and magazine racks. For example, sidewalk furniture on the four corners of Mission and First currently reduce*s* effective corner space, block*s* pedestrian movements, and/or exacerbate*s* space issues associated with bus queuing;
- Re-timing traffic light signalization. This could improve pedestrian levels of service at each of the intersections studies that fall into LOS F;
- Providing cross-walk count-down signals. This would be most valuable at the intersections and cross-walks immediately surrounding the terminal, especially since pedestrians are more likely to dash on a flashing hand when trying to catch a bus or train;
- Providing 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, and
- Providing crosswalk signalization at intersections where they do not exist already, such as Folsom and Beale Streets.

5.19.6.2 Bicycle Impacts

Bicycle traffic growth with and without the project was estimated by comparing existing bicycle volumes, obtained from field surveys, with estimated volumes for the 2020 Baseline plus the Transbay Terminal/Caltrain Downtown Extension Project condition and the 2020 Project condition.

While there is no standard for determining bicycle *l*evels of *s*ervice, the increase in bicycle traffic was estimated between existing conditions, the 2020 Baseline plus Project, and the 2020 Project Only conditions. The estimate was based on the San Francisco County Transportation Authority's transportation model outputs showing bicycle traffic between the analysis zones, assuming full Transbay Terminal Project build-out and redevelopment. The bicycles added to the street due to increased AC Transit ridership and Caltrain ridership were also estimated.

The estimates show that peak bicycle traffic at the five study intersections could increase substantially over the next twenty years. It was estimated that up to 425 bicycle trips could travel through the five study intersections in the 15-minute peak window under the 2020 Baseline plus Project condition and 290 under the 2020 Project condition compared to a total of 45 counted in the Spring of 2001. It should be noted, however, that there is no standard for determining bicycle level of service.

Some Caltrain riders are projected to ride bicycles between Caltrain and their ultimate destinations. It is estimated that the new terminal will attract about 6,800 primary-direction, peak period commuters (traveling inbound to the Transbay Terminal in the a.m.) and about 3,125 reverse-direction, peak-period commuters (traveling outbound from the Transbay Terminal in the a.m.).

Existing data on bike usage of Caltrain passengers at the Fourth and Townsend Station indicates that approximately 5 percent of primary-direction, peak period commuters and 15 percent of reverse-direction, peak period commuters use a bicycle as part of their total commute trip.

Assuming these same proportions of bike trips to and from the new Transbay Terminal, it is estimated that there will be 340 primary-direction bike/Caltrain commuters and 469 reverse-direction bike/Caltrain commuters. However, not all of these commuters will require bike parking at the Transbay Terminal. Assuming that 20% of the primary-direction commuters and 35% of the reverse direction commuters require bike parking, a total of 232 bicycle storage spaces would be needed.

The San Francisco Department of Parking and Traffic is considering an extension of the Howard Street bike lane (that currently runs between Fifth and Eleventh streets) to Fremont Street and the provision of a new bike lane on Second Street. The addition of these lanes would improve the quality and comfort of bicycling in the area around the Transbay Terminal.

5.20 CONSTRUCTION STAGING AND METHODS

Project construction activities that would occur with the Transbay Terminal/Caltrain Downtown Extension/Redevelopment Project would not occur for the No-Project Alternative. Even though project construction activity would be relatively short-term and geographically limited, potential construction impacts were an important factor in the selection of the proposed alternatives considered in this DEIS/DEIR.

For example, the Tunneling Option for the Caltrain Extension was evaluated in part due to its reduced impacts on adjoining land uses during construction. Tunneling in lieu of cut-and-cover could be used for that portion of the alignment with underlying rock geologic formations. These formations occur along the alignment from approximate*ly* Station 51+00 (Townsend and Third Streets) to Station 81+00 (Second and Folsom Streets).

Since construction impacts of the project are of concern to the community, this section describes the proposed construction process and methods. Section 5.21 describes potential impacts and mitigation measures for construction.

This section divides the construction process into several steps based upon the type of construction and when it would occur. Section 5.20.1 summarizes preconstruction activities. Section 5.20.2 summarizes construction activities.

5.20.1 PRE-CONSTRUCTION ACTIVITIES

A summary of preconstruction activities is provided in Table 5.20-1 and discussed individually in the following.

Table 5.20-1: Pre-construction Activities -- Caltrain Extension
• Undertake Detailed Geotechnical Investigation • Prepare Final Design and Construction Contracts • Prepare Vehicular and Pedestrian Traffic Control/Detour Plans • Undertake Building Data Survey • Undertake Pre-Construction Business Survey • Establish Construction-Related Community Information / Outreach Program • Acquire Property and Easements: o Easements involve specific parcels along: Seventh, Townsend, Stanford, Second, Colin P. Kelly, Brannan, DeBoom, Federal Way, Bryant, Tehama, Howard, and Natoma o Full acquisitions include properties along Brannan, Howard, Natoma, Minna, Tehama, Beale, and the existing Transbay Terminal Site

***Preliminary Engineering*, Development of Construction Contracts, and Final Design**. During *preliminary engineering and* final design, detailed design elements of the Transbay Terminal and Caltrain Downtown Extension would be developed, reflecting, among other subjects, final geotechnical investigations. *Construction contract packaging will be determined as part of the Preliminary Engineering activities.* As part of the final design, *t*he TJPA and the JPB would work with property owners planning to build new structures adjacent to the proposed Project components to integrate construction of the Caltrain project with construction of the private structures to reduce Project construction impacts.

Vehicular and Pedestrian Traffic Plans. Construction of the Project would temporarily interfere with the normal flow of traffic, causing some lanes and streets to be closed to vehicles for various durations. Some streets would be subject to lane and temporary closures as summarized in Table 5.20-2. During final design, street traffic control plans would be developed in cooperation with Caltrans, the City/County of San Francisco (DPT, police and fire departments, and Muni) to accommodate required pedestrian and traffic movements. To the extent practical, traffic lanes would be maintained in the appropriate directions, particularly during peak traffic hours.

Table 5.20-2: Street Closures During Construction
Townsend Street (Fifth to Clarence Place). Cut-and-cover construction would be progressed on a block by block basis, so approximately one block would be affected at a time. There would be no on-street parking during construction of a particular block. A limited *number* of complete closures to all traffic would occur during cut-and-cover construction until a temporary street deck is placed over the subway construction. A limited *number* of complete closures *are* also required for removal of the deck and reconstruction of the roadway. Cross street traffic would also be subject to limited closures. Eight business driveways would be *affected* by the closures. If tunneling construction is chosen for a portion of the alignment it would begin on Townsend Street just east of Third Street. The temporary decking installed for the cut-and-cover construction in the area of the beginning of the tunnel would remain in place until tunneling was completed. A limited number of complete closures would then be required for removal of the decking and pavement reconstruction.
Clarence Place (Between Townsend and Brannan) For both cut-and-cover and tunneling construction alternatives the south end of this block would be completely closed for limited times while construction on Townsend Street, east of Third Street, occurs.
Stanford Street (Between Townsend and Brannan) For the cut-and-cover construction alternative, the south end of this block would be completely closed during construction of the line segment for this block. During construction, access from Brannan would remain available**.** This street would not be *affected* by the tunneling alternative.
Second Street (Brannan to Howard). For the Cut-and-Cover Option, construction would be progressed on an approximate block-by-block basis, so approximately one block would be affected at a time. There would be no on-street parking during construction. A limited *number* of complete closures to all traffic would occur during cut-and-cover construction until a temporary street deck is placed over the subway construction. A limited *number* of complete closure*s would* also *be* required for removal of deck and reconstruction of the roadway. Cross street traffic would also be subject to limited closures. Eight (8) business driveways and three (3) residential driveways *would be affected*. Temporary alternative access would be required to maintain access to dead end streets at De Boom, Federal, Dow Place, and Tehama. Temporary access would be provided through easements across through private property such as parking lots. For the Tunneling Option, there would be very limited impacts to streets. It is anticipated that tunneling would progress from two locations in this segment, midway between Brannan and Bryant, and just south of Folsom. At these locations vertical shafts will be constructed and temporary decking installed. A limited *number* of complete closures would be required during construction of the vertical shafts and placement of temporary decking. A limited amount of on-street parking will be lost during tunneling operations. Traffic would be maintained throughout tunnel construction. A limited *number* of complete closures would be required for removal of the temporary decks and pavement reconstruction.
Natoma Street (Between First and Second) During construction of the Transbay Terminal this street would be subject to temporary closure for this portion of its alignment.

Table 5.20-2: Street Closures During Construction
First Street (Between Howard and Mission) During construction of the Transbay Terminal this street would be subject to limited closures while temporary bridging was installed to allow for subterranean construction under the road.
Minna Street (Between First and Second) During construction of the Transbay Terminal this street would be subject to temporary closure for this portion of its alignment.
Fremont Street (Between Howard and Mission) During construction of the Transbay Terminal this street would be subject to limited closures while temporary bridging was installed to allow for subterranean construction under the road.
Beale Street (Between Howard and Mission) During construction of the Transbay Terminal the street would be subject to limited closures while temporary bridging was installed to allow for subterranean construction under the road.
Main Street (From Just South of Bryant to Howard) Construction would be progressed on an approximate block-by-block basis, so approximately one block would be affected at a time. There would be no on-street parking during construction of each block. A limited *number* of complete closures to all traffic would occur during cut-and-cover construction until a temporary street deck is placed over the subway construction. A limited n*umber* of complete closures would also be required for removal of the temporary deck and reconstruction of the roadway. Cross street traffic would also be subject to limited closures. Eight (8) business driveways would be *affected* by the closures.
Mission Street (Beale to The Embarcadero) Construction would be progressed block by block, so approximately only one block would be affected at a time. There would be no on-street parking during construction of each block. A limited *number* of complete closures to all traffic would occur during cut-and-cover construction until a temporary street deck is placed over the subway construction. A limited *number* of complete closure*s would* also *be* required for removal of *the* deck and reconstruction of the roadway. Cross street traffic would also be subject to limited closures. Four (4) business driveways would be *affected* by the closures.
First, Fremont and Beale Streets (Between Howard and Folsom) Temporary night time closures would be required for construction of the temporary and permanent access ramps to the permanent and temporary bus terminals. Some limited amount of on-street parking would be lost during construction activities.
Howard, Tehama, Clementina, Folsom and Harrison Streets (Between First and Second) Temporary night time closures would be required for construction of the permanent access ramps to the Transbay Terminal. Some limited amount of on-street parking would be lost during construction activities.
Essex (Between Folsom and Harrison) Some on-street parking would be temporarily eliminated during construction of the permanent access ramps to the Transbay Terminal.

Building Data Survey. A pre-construction structural survey would be completed to determine the integrity of existing buildings adjacent to and over the proposed extension. This survey would be used to finalize detailed construction techniques along the alignment and as the baseline for monitoring construction impacts during and following construction. During construction, the TJPA and JPB would monitor adjacent buildings for movement and, if movement is detected, take immediate action to control the movement.

Detailed Geotechnical Investigation. During final design, additional sampling (drilling and core samples) and analyses of subsurface soil/rock conditions would be used to detail and finalize the excavation and its support system to be used in the retained cut, cut-and-cover and tunnel portions of the extension. Current data, including subsurface sampling conducted in 1995 and 1996 for the 1997 Caltrain DEIS/DEIR have been used to identify the proposed construction techniques presented in the following sections, which form the basis for the impact analysis that follows in Section 5.21.

Pre-Construction Business Survey. Prior to construction, the TJPA and JPB would contact and interview individual businesses along the alignment to gather information and develop an understanding of how these businesses carry out their work. This survey would identify business usage, delivery/shipping patterns, and critical times of the day or year for business activities. The survey would assist in: (a) the identification of possible techniques during construction to maintain critical business activities, (b) the analysis of alternative access routes for customers and deliveries to these businesses, (c) the development of traffic control and detour plans, and (d) the final determination of construction practices.

Establishment of Construction Community Information/Outreach Program. A community construction coordination program would be established to provide on-going dialogue *among* the TJPA, the JPB and the affected community regarding construction impacts and possible mitigation/solutions. The program would include dedicated personnel, including an outreach office in the construction area, to deal with construction coordination. An important element of this program would be the dissemination of information in a timely manner regarding anticipated construction activities.

Land and Easement Acquisition. Properties would need to be acquired prior to construction of the project. In addition, property easements would be obtained for those properties above the proposed tunnel portion. See Section 5.2 for a complete discussion of these acquisitions, including a review of relocation assistance that would be provided.

5.20.2 CONSTRUCTION ACTIVITIES

Types, location, and lengths of construction activities that would occur for the Project are provided in Table 5.20-3 and are discussed below.

Underground Utility Relocation. To the extent possible the Caltrain extension has been located to avoid conflicts with the space occupied by major utilities. In certain instances, the positioning of the alignment, station, and ancillary facilities would require that conflicting utilities be relocated. Relocation of utilities to a new permanent location so that they would not be affected by alignment or station construction would generally be performed prior to construction of the extension. Construction equipment typically required for utility relocation and restoration includes: excavator/backhoes, trenchers, trucks, cranes and generator/compressors. Cement trucks, pavers, rollers, and power compactors are typically required for street restoration.

Table 5.20-3: Construction Activities

Construction Activities	Location	Length in Feet
Relocate Utility Lines	See Section 5.12 – Utilities	Not Applicable
Demolish Buildings	As required along Townsend, Stanford, *Second*, Howard, and Streets. Also station platforms and maintenance buildings at current Caltrain San Francisco Station and Yard.	Not Applicable
Construct Temporary Bus Terminal and Access Ramps	Needed to facilitate construction of the permanent Transbay Bus Terminal. See Chapter 2 of this EIS/EIR *for* location of proposed facilities.	Not Applicable
Construct New San Francisco Yard Support Tracks	Within the existing JPB right of way between Common Street and 16th Avenue.	1,550
Construct New Fourth and Townsend Station Tracks, Platforms *and Ancillary Facilities*	Within the existing JPB right of way and San Francisco Yard, from Seventh to Fourth Street.	3,000
Construct Retained-Cut Section	In existing San Francisco Yard between Common and Fifth Streets along Seventh and Townsend Streets.	1,850
Construct Cut-and-Cover Section *and Ancillary Facilities*	**Cut-and-Cover Option – Both Alternatives:** Along Townsend Street from between Fifth and Fourth Streets up to Second Street. Along Second Street to Howard Street. From Howard Street into the Transbay Terminal.	3,550
	Second-to-Main Alternative: From Transbay Terminal along Main Street to just south of Harrison Street.	2,050
	Second-to-Mission Alternative: From Transbay Terminal along Mission St., ending just before The Embarcadero.	1,450
Tunnel Option	Construction of tunnel *and ancillary facilities* from Townsend Street starting just east of Third Street, crossing under Stanford Street and entering Second Street at Brannan Street, continuing up Second Street to Folsom Street.	3,000
Construct New Transbay Terminal, *Ancillary Facilities*, and Permanent Access Ramps	See Chapter 2 of this EIS/EIR for description of the alternatives for the permanent Transbay Terminal and Access Ramps.	1,300
Construct Permanent Offsite Bus Storage and Access Ramps	Needed for permanent current Transbay Bus Terminal operations. See Chapter 2 of this EIS/EIR for a description of these permanent facilities.	Not Applicable.
Reconstruct Streets	**San Francisco Yard to Transbay Terminal Corridor (Cut and Cover Option):** Along Townsend St. from between Fifth and Fourth Streets up between Third and Second Streets. Along Second Street from Brannan St. to Howard St. A portion of Howard Street between Second and First Streets	5,250
	Main St. Alignment Cut and Cover Option: From Transbay Terminal along Main Street from Howard to just south of Harrison St.	1,450

Table 5.20-3: Construction Activities

Construction Activities	Location	Length in Feet
	Mission Alignment Cut and Cover Option: From Transbay Terminal along Mission St., ending just before The Embarcadero.	1,300
	San Francisco Yard to Transbay Terminal Corridor Cut-and-Cover and Tunneling Options: Tunneling a portion of the alignment would reduce the amount of street reconstruction. Tunneling would start on Townsend Street just east of Third Street, then would go under the buildings located in the block at the corner of Townsend and Second Streets. The tunnel would then extend down Second Street to Folsom Street.	3,180

Utilities, such as high-pressure water mains and gas lines, that are not to be permanently relocated away from the work site, would be temporarily removed from the construction area. For these relocations, no or very brief disruption (less than a day) could occur to utility service. The utilities would be relocated temporarily at the early stages of construction and reset in essentially their original locations during the final backfilling above the construction.

Utilities within the subsurface construction area that do not need to be relocated, either permanently or temporarily, would be uncovered during the early stages of excavation. These buried utilities, with the possible exception of sewers, are generally found within several feet of the street surface. They would be reinforced, if necessary, and supported during construction by hanging from support beams spanning across the excavation.

If tunneling is used for a portion of the alignment, utility issues would be eliminated in those areas.

Building Demolition. The Caltrain Downtown Extension alignment has been selected to minimize, to the extent possible, impacts on adjoining buildings and on the communities through which it passes. Still, for cut-and-cover construction methods, some properties would have to be acquired and the structures on these properties demolished. No building demolitions would be required in areas where the Tunneling Option is constructed.

Equipment typically involved in demolition includes: crawler cranes, crawler dozer/loaders, pavement breakers, rubber-tired loader/bob cats, trucks, excavator/backhoes, generator/compressors, and water trucks for dust control.

Building Underpinning. Where the Tunneling Option is applied, existing buildings above the tunnel alignment would be underpinned. This underpinning would support the building in case of a partial tunnel collapse during construction. Equipment typically involved in underpinning includes: specialized pile drivers, air compressors, pneumatic tools such as jack hammers, front end loaders and dump trucks.

Surface Rail Line and Station Construction. Both Caltrain Extension Alternatives would require removal and reconstruction of the existing yard tracks at the Fourth and Townsend Station including the removal and reconstruction of station platforms and the removal of existing maintenance buildings. Track removal and reconstruction would begin just north of Sixteenth Street and end at the existing station at Fourth Street. This work would provide the required track connections and yard space for the new mainlines crossing through the existing yard as they descend into the alignment proceeding down Townsend Street. This work would occur immediately after mobilization.

Equipment used for removal of existing rail and platform and building improvements and construction of new track and station improvements include: crawler dozer/loaders, surface graders, rubber-tired loaders/bob cats, compactors, generators/compressors, rollers, small cranes, excavators/backhoes, trucks, concrete trucks, railroad track-laying equipment, welding machines, and water trucks for dust control

Retained Cut Section. Prior to entering the subterranean subway section near *Fifth* Street, the new extension main track alignments would transition from surface to subsurface in a retained cut (depressed section) portion of the alignment (Station 12+50 to 31+00). This would occur in the existing San Francisco Yard between 7th Street (near Berry Street) and Townsend Street (near *Fifth* Street). Immediately adjacent to these main track alignments, in the area bounded by the corner of *Seventh* and Townsend Streets, is a fully depressed area that will accommodate yard tracks. This depressed yard area will also be part of a retained cut section.

General Approach to Temporary and Permanent Structures. A temporary structural support system is required to retain the cut during excavation of material. After excavation this temporary system will be incorporated into the permanent retained cut structure.

Temporary Structures and Excavation. This area of the project involves soft soils, including extensive deposits of soft Bay Mud and liquefiable fills. Due to the significant lateral loads expected from these soils on the retained cut side walls, horizontal support would be required. Temporary struts and rakers would be installed at various levels as excavation proceeds.

Rigid and impermeable cut off would be used for the temporary side walls. The most economical method for building the cut-off walls is the Deep Mixing Method (DMM). This produces a wall commonly referred to as a soil cement wall. This method involves mixing of cement slurry with in-situ soil to construct a continuous and practically impermeable wall made up of individual columns. Each column is structurally reinforced with vertical steel beams that are inserted into the soil-cement mix while the mix is still fluid (i.e., before it sets and hardens). Such walls have the advantage that they are competitive economically, they minimize the risk for adverse impacts associated with ground deformations during excavation, and eliminate the need for costly dewatering.

A specialized auger (Figure 5.20-1) is used in this process. This construction technique involves some displacement of soil (25-30 percent), which bubbles out of the auger hole onto the ground. This soil, which is mixed with the cement, would be left to harden and then be removed by truck.

The soil cement walls are typically constructed to extend deep and tie into an impermeable layer below the base of the planned excavation so that under seepage into the excavation can be minimized. The soil-cement walls would be used not only for temporary excavation support but also for permanent groundwater cutoff, a critical concern in this area where high ground water levels are anticipated. Figure 5.20-2 shows the drilling of auger holes and the creation of a soil cement wall.

Equipment used for installation of soil-cement walls typically includes: a soil-mix wall rig for in situ soil mixing (see Figures 5.20-1 and 5.20-2), a soil-mix wall batch plant for grout preparation, a crane for installation of soldier piles, back hoe, rubber tired loaders and trucks.

After the cut-off walls have been constructed, excavation would proceed from top down. The walls of the depressed yard area excavation would be supported with rakers and struts. Rakers would consist of heavy steel pipes. The first level of rakers is usually installed at a shallow depth. The excavation would then progress sequentially, and would not extend more than two to three feet below the level of the next required raker support, until the rakers are in place and secure. For the depths of excavation contemplated, three to four levels of supports are anticipated in the vertical plane. The walls of the adjacent depressed mainline track corridor would be strutted near the existing ground line for the deeper cut sections with heavy steel pipes. Groundwater within the excavation would be collected in sumps and pumped to a settling basin before it is disposed in accordance with applicable regulations.

Permanent Structure Installation. After excavation is complete piles would be driven through out the bottom of the retained cut areas. These are required for the support of the permanent bottom slab. After piles are driven then the bottom slab would be constructed. The interior face of the soil cement piles would be removed to expose the flange of the steel pile. Steel shear connectors would be welded to the flange and reinforced concrete fascia wall would be cast against the steel piles to form the permanent side walls of the retained cut section. Interior support columns would be constructed next followed by permanent strut systems. A top slab would be constructed last over the depressed yard area. The strut and slab system over the depressed yard area would be used for parking or useable yard area.

Equipment typically used for permanent subway structure construction includes: cranes, concrete trucks, trucks, concrete pumps, welding machines, generator/compressors, rubber-tired loader/bobcat and fork lift.

Cut-And-Cover Construction. Cut-and-cover construction would be used from near *Fifth* Street at Station 31+00 to the west end to the Transbay Terminal at approximate*ly* Station 90+50, and from the east end of the terminal at approximate*ly* Station 104+50 to the end of the line at 122+95 (Main Street Alternative). An alternative tunneling construction method is proposed as an alternative for a portion of this alignment from Station 51+00 to 81+00. This alternative method is described below and shown in Figure 5.20-3. In addition the Transbay Terminal will be constructed using similar methods to cut and cover and this is also described below.

Figure 5.20-1: Soil Cement Wall Augers In Use

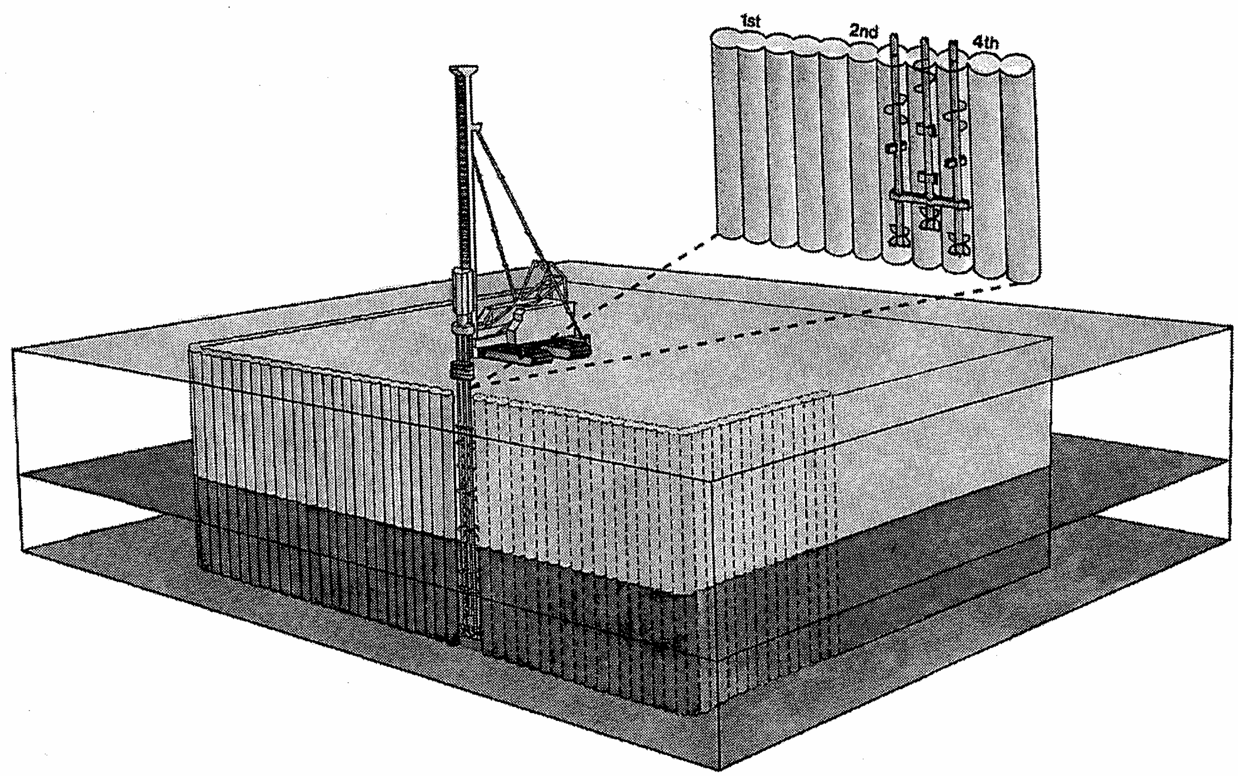


Figure 5.20-2:Column Construction for Soil Cement Walls

Support of Adjacent Structures. The first step in cut-and-cover construction is to assure support for foundations of buildings adjacent to the excavation. Underpinning of buildings adjacent to the cut-and-cover sections is not anticipated at this point. Instead, control of potential movement of adjacent structures is proposed to be accomplished by use of excavation support systems, which, in conjunction with proper excavation and bracing or tie-back procedures, can serve as protection for the adjacent structures. This is common practice for the Bay Area and was successfully used for the Muni Metro Turnaround project at the east end of Market Street.

The excavation support system currently proposed for this project is described in the following sections. During construction, adjacent buildings would be monitored for movement and, if movement is detected, take immediate action to control the movement.

General Approach to Temporary and Permanent Structures. The same approach will be followed as with retained cut construction wherein the temporary structure will be incorporated into the permanent structure. One exception will be in the area of the Transbay Terminal. The Transbay Terminal construction will construct separate temporary and permanent structures as described below.

Temporary Structures and Excavation. The methods of excavation support vary with the ground conditions. The cut and cover alignment can be divided into three segments: (1) areas where the ground consists predominantly of soft soils with high groundwater conditions (along Townsend Street east of *Fifth* Street); (2) areas where the subsurface soils consist of stiff clays and/or dense sands (all remaining areas not described in segments 1 & 3); and (3) areas where the excavation will be in rock (along *Second* Street between Brannan and Folsom and along Main Street between Folsom and Harrison). The temporary support and structure systems that would be used within each of these three areas are described below

Excavations in Soft Soils/Stiff Clays/Dense Sands – Excavation support and excavation in these soils will be the similar to that for the retained cut work in that soil cement walls would first be constructed. Prior to excavation deck beams and temporary decking would be installed at the top of the proposed excavation as described below. The deck beams and temporary deck maintain vehicular traffic during construction. After temporary decking is installed, excavation would proceed from top down. The walls of the excavation would be supported with internal struts or ground anchors (tie-backs) as excavation proceeds.

The use of tie-backs is preferred over internal struts because they provide more of an unobstructed work area for excavation. Tie-backs, however, are not suitable for use in soft soils. In soft soils internal struts would be used. Tie-backs would be used in stiff clays and dense sands.

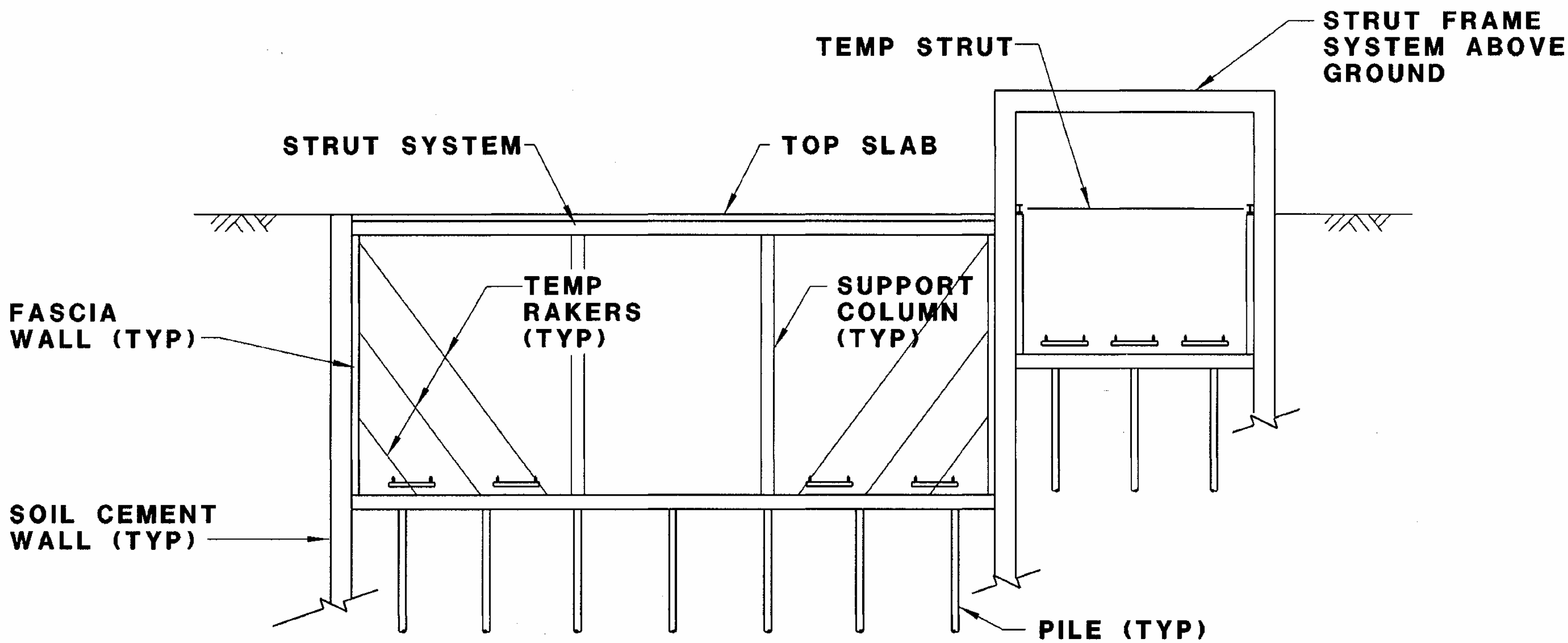


Figure 5.20-3:Retained Cut Construction

In those locations tie-backs would be drilled from inside the excavation and could extend between 50 and 75 feet back from the face of excavation. The tie-backs consist of drilling a small diameter (5 to 6 inches) hole, installing the anchorage element, and filling the hole with grout. During the drilling process, the hole would be supported with steel casing to avoid caving of the ground, which can cause undesirable settlements. After the grout ha*d* gained sufficient strength, the anchors would be stressed and secured against the excavation walls.

Because tie-backs would extend outside the excavation limits, and in many cases extend under existing structures along the project alignment, installation of tie-backs would require permission from the owners of the adjacent structures to install the temporary tie-backs under their property. This is a normal process and usually the necessary agreements between the project owner and the property can be negotiated.
Internal struts, if used, would consist of heavy steel pipes spaced every 15 to 18 feet horizontally and 10 to 12 feet vertically.

The excavation progresses sequentially, and does not extend more than two to three feet below the level of each horizontal support (tie-back or strut), until the supporting struts are in place and secure. For the depths of excavation contemplated for the downtown extension project, three to four levels of struts are anticipated. Groundwater within the excavation is collected in sumps and pumped to a settling basin before it is disposed in accordance with applicable regulations.

Excavations in Rock - The Deep Mixing Method is not suitable in areas where rock is encountered. The most likely method of excavation support is to use cast in drilled hole (CIDH) piles spaced 8 to 10 feet along the alignment. The piles are constructed by using an auger to drill a hole (approximately 36” in diameter for this project) to a depth of 5 to 10 feet below bottom of permanent subway structure. Steel columns are then set in the holes and encased in concrete. The exposed rock in the spaces between the piles is sprayed with shotcrete to hold the rock in place.

After the CIDH piles have been installed along both sides of the excavations, deck beams and temporary decking is installed as described below. Excavation then progresses in stages from top down. Lateral support for the excavation would be provided using either internal struts or rock anchors. Rock anchors are generally preferred over internal struts because they provide an unobstructed area in the excavation. This makes operation of excavation equipment much easier than if struts were present. Rock anchors would be spaced about 10 foot horizontally and 14 foot vertically.

Excavation of the rock would be carried out, most likely using heavy excavating and ripping equipment. Where hard rock is encountered, blasting may be required. However, given the condition of the rock in the study area, which is highly fractured and weathered, blasting, if required, is anticipated to be minimal.

Dewatering from inside the excavation would be required. *T*he quantities of seepage should be small enough to be manageable with interior sumps and pumps. It is anticipated that predraining using deep wells will not be effective in the Franciscan rock formation to be encountered.

The equipment required for installing excavation support and for excavation is identified in the Retained-Cut section above.

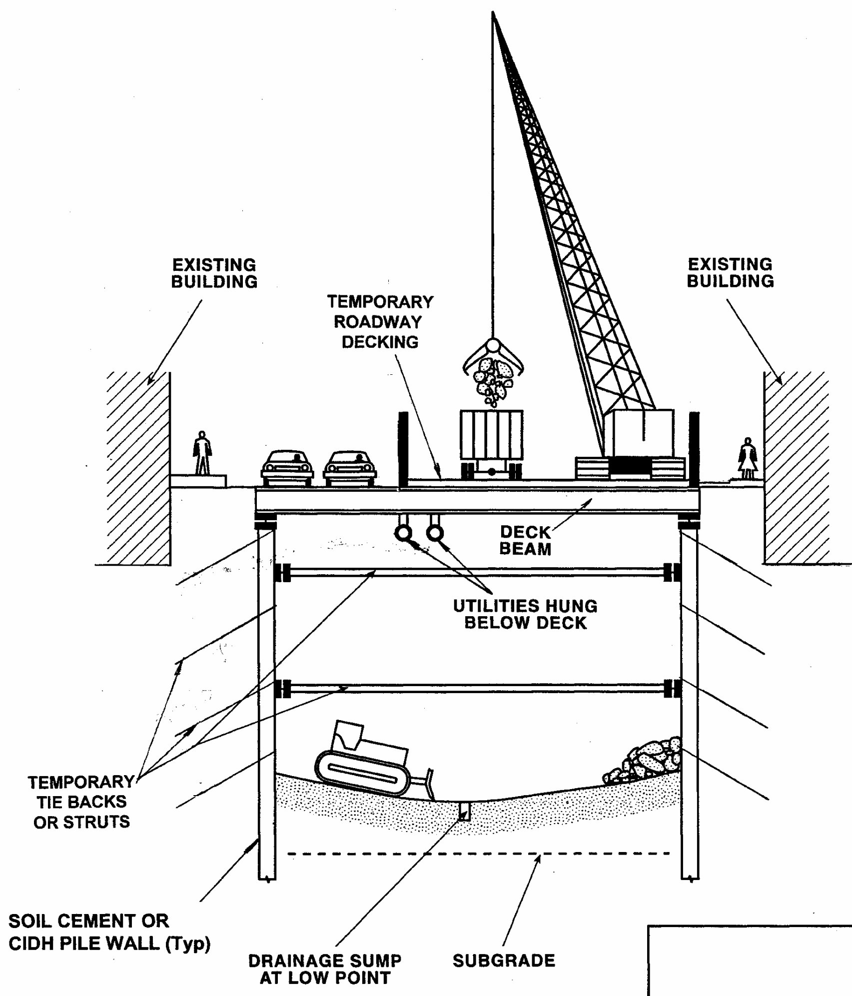
Temporary Decking Installation. Temporary roadway decking would be installed in progressive stages over the proposed cut. Prior to beginning of excavation of the cut, lateral trenches would be excavated across the alignment from one sidewall to the other to permit installation of deck beams. These trenches are generally excavated during the nighttime and covered to permit normal traffic flow during the day. When a sufficient number of deck beams have been installed, a shallow excavation of approximately eight feet in between the deck beams is made. This excavation is designed to uncover buried utilities and to provide room for continuing the excavation after the temporary decking is erected.

As deck beams are installed, the utilities that can remain in the trench area (e.g., telephone, traffic, electric) would be cradled, picked up, and hung from the deck beams. Sewer lines may exist at this shallow depth and likewise would be hung from the deck beams during the initial excavation stage. Utilities located deeper would be uncovered fully after additional depth of excavation had been accomplished. Sometimes heavy utilities such as large sewer pipes are supported by an auxiliary set of beams spanning between the side walls rather than hanging them from the deck beams. When utilities cannot be relocated outside the excavation or when they are being moved, there is a small chance of damage during excavation, causing a utility outage that can last for a few minutes to a few days. Most of the risk of hitting utilities is caused by actual utility locations being different from those shown on construction drawings. Utility service will be returned as quickly as possible after an outage.

Decking is then placed on top of the deck beams. It is proposed that the decking be set flush with the existing street and sidewalk levels. Roadway traffic can then be restored while excavation will proceed underneath. Figure 5.20-4 illustrates the cut-and-cover excavation and decking process. Decking at cross-streets would be installed in stages to allow at least half of the existing traffic lanes to be maintained. After installation of the deck, full cross-street traffic could be maintained for the duration of construction.

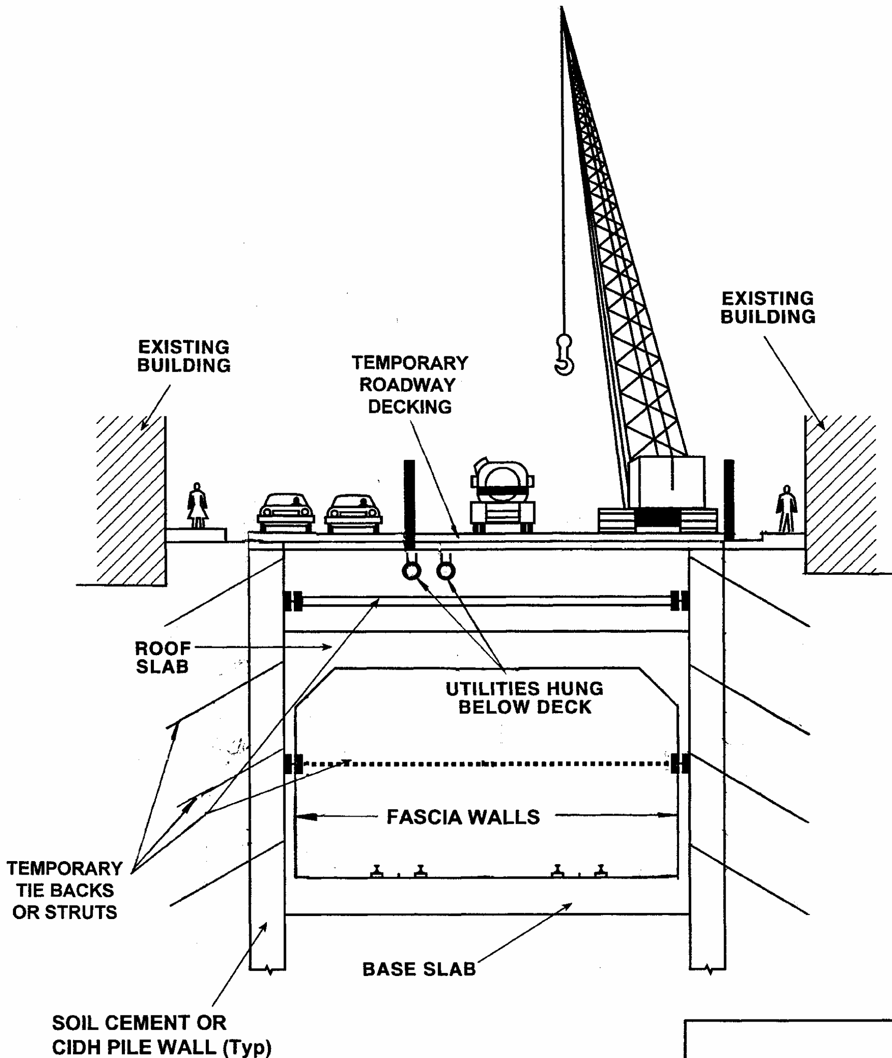
Equipment typically used for decking, excavation, and bracing includes: crawler dozer/loader, water pump, rubber-tired loader/bob cat, pavement breaker, excavator/backhoe, conveyer system, truck, crane, generator/compressor, and fork lift.

Permanent Structure Installation and Backfill. After completion of excavation the permanent subway structure would be constructed. In the areas of soft ground encountering Bay Mud, piles would be driven to support the base slab of the permanent structure, followed by construction of the base slab itself. In other locations where the soils under the base slab are more suitable, the base slab would be poured on grade. After the base slab is constructed the vertical fascia walls would be constructed starting at the bottom and proceeding up. The internal struts are removed one by one as the walls of the box structure are raised. The concrete encasement on the internal face of the CIDH piles would be removed back to the face of the steel column. Steel shear connectors would be welded to the column and a reinforced concrete fascia wall would be cast against the steel columns to act together to form the permanent sidewalls. In the deeper cut sections intermediate level permanent struts constructed of reinforced concrete would be installed between the sidewalls to provide permanent lateral support. Also in wider cuts intermediate columns would be constructed to support the top slab. A top slab constructed of reinforced concrete would be installed last following by backfilling of 8 to 10 feet of earth fill. Road reconstruction would then occur on top of this backfill. Figure 5.20-5 illustrates installation of the permanent subway structure.



CUT-AND-COVER EXCAVATION AND TEMPORARY DECKING

Figure 5.20-4



CUT-AND-COVER SUBWAY CONSTRUCTION

Figure 5.20-5

Equipment typically used for permanent subway structure construction includes: cranes, concrete trucks, trucks, concrete pumps, welding machines, generator/compressors, rubber-tired loader/bobcat and fork lift.

Alternative Tunnel Construction. The use of tunneling methods *i*s an alternative to cut-and-cover construction in areas of rock formations. Core drillings were taken in the corridor in 1996, and the rock was identified as "fractured rock." A panel of experts[46] recommended that a "specialized tunneling" technique known as "spiling" be used in this rock. Because the proposed Caltrain Extension Alternatives Tunneling Option includes a larger tunnel (three tracks instead of two) than was proposed in 1996 and passes under historic structures, a tunneling technique known as "*stacked* drift" is now proposed. Due to the poor nature of the rock quality and the large clear spans required for the tunnel structure, this special tunneling method would be employed to minimize the risk of cave-ins during construction. The Tunneling Option is proposed for Station 51+00 (Townsend Street just east of Third Street) to Station 81+00 (Second and Folsom Streets).

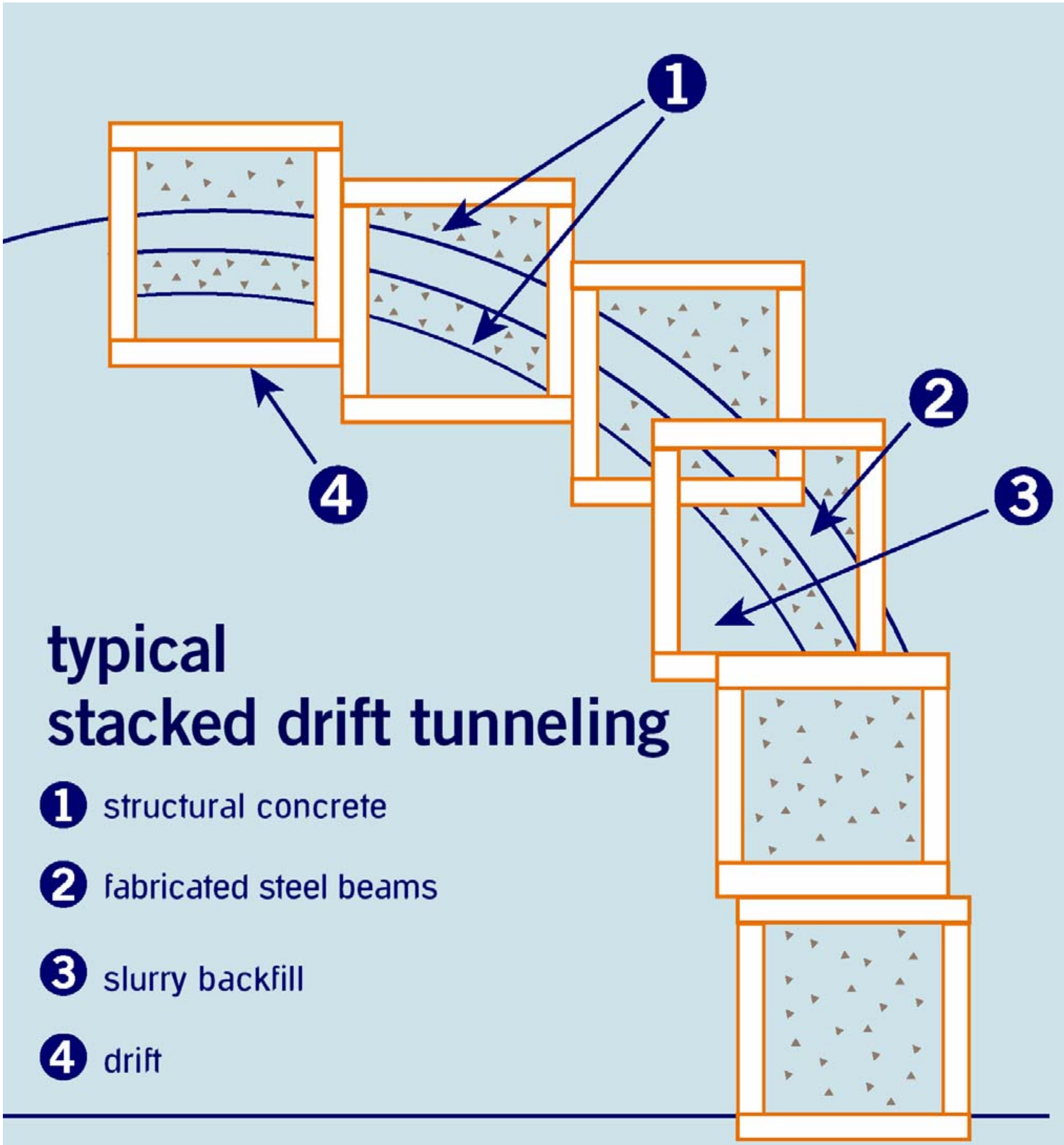
A series of contiguous drifts approximately nine feet wide and about nine feet tall would be constructed around the perimeter of the tunnel sidewalls and roof, starting from the invert and moving towards the crown of the tunnel. (See Figure 5.20-6).

The individual drifts would be excavated by hand mining methods, using spiling as required, to maintain stability of the roof, and using steel support members in combination with timber lagging to support the walls and stabilize the tunnel (see Figure 5.20-7). Once a drift is completed, a specially fabricated segmented ring support beam would be installed in the drift and encased in concrete. Steel reinforcement would be provided to develop the necessary strength. The portion of the drift that will eventually become part of the final tunnel excavation would be filled with slurry concrete that can be easily excavated during tunnel excavation to expose the ring beam and tunnel lining.

After construction of the tunnel support system (concrete encased ring beam), the tunnel itself is excavated in stages using a top heading and a bench. Road headers and other suitable excavating equipment can be used to excavate the rock cavern within the already constructed ring beam. Because the rock is viable, some limited blasting may be required. Access to the tunnel's construction would be from either end and from a vertical access shaft near *Second and Brannan Streets.* From the midpoint access construction of the tunnel would proceed in either direction to speed construction of the tunnel to meet schedule demands. These three access points would be used for equipment and labor access and for egress of excavated material.

[46] The panel included *P*rofessor Thomas D. O'Rourke of Cornell University, Professor Tor L. Brekke of the University of California, Berkeley, and Mr. Norman A. Nadel, of Nadel Associates, Brewster, New York. The Panel was chaired by Demetrious Koutsoftas, URS, San Francisco, who has extensive experience with development and tunnel projects in the Project Area and a substantial knowledgeable regarding the Project area's geology.

Figure 5.20-6: Stacked Drift Tunnel Construction



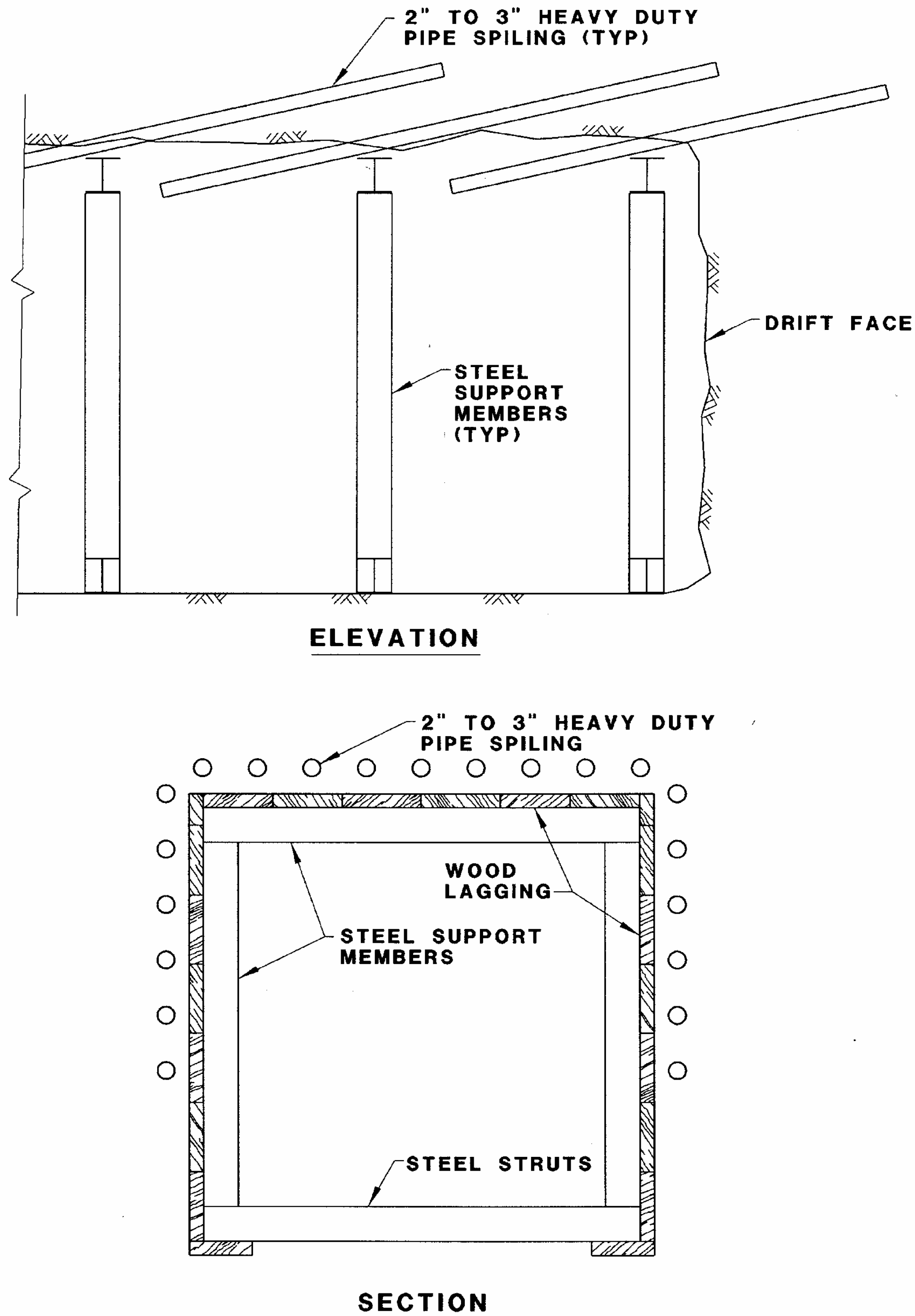


Figure 5.20-7: Typical Tunnel Drift Construction

Equipment used for tunnel construction includes: rubber tired front end loader/bobcats, air compressors, generators/compressors, pneumatic tools, fork lifts, dump trucks, small rubber tired cranes.

Transbay Terminal and Related Facilities Construction. Transbay Terminal construction would be very similar to cut-and-cover and retained cut construction methods as it will also make use of soil cement walls and ground anchors. *I*t will differ in that the soil cement walls will be used *only* in the temporary condition. The permanent terminal structure will be constructed inside the soil cement walls as an independent structure. After the permanent structure is constructed the temporary soil cement walls and ground anchors are abandoned in place. After the soil cement walls are constructed then excavation would proceed from top down. Excavation would not proceed more than two to three feet below the level of the next required level of ground anchors until they were installed.

Related Temporary and Permanent Facilities. There are proposed facilities to be constructed in the general area south of the Transbay Terminal that provides for the operation of temporary and permanent bus service. These facilities include the following:

- Permanent Transbay Terminal and Access Ramps
- Temporary Transbay Terminal
- Permanent Offsite Bus Storage and Access Ramps

All bus access ramps would be aerial structures most likely constructed of reinforced concrete. In areas with shallow underlying rock, the foundations would be concrete spread footings. In softer underlying soils, pile supported foundations would be constructed. Falsework would be required to support the forms for constructing the elevated structures. Falsework would span over existing roadways to be kept them open during construction.

The temporary Transbay Terminal and permanent offsite bus storage areas are simple facilities constructed on existing grades. Existing minor improvements on these sites would be removed and the sites graded for the new improvements. New improvements would consist mainly of paving for bus storage or travel ways. In the temporary terminal pedestrian platforms and walkway areas would be constructed along with some with canopy shelters.

Equipment for construction of these facilities would include: pile drivers, trucks, dump trucks, air compressors, graders, front end loaders, excavators, backhoes, and small rubber tired cranes.

Quantity of Excavated Materials. Table 5.20-4 identifies the estimated number of cubic yards of material to be removed during construction of the track corridor alignment and Transbay Terminal. Excavation quantities for the other related projects to the Transbay Terminal can be considered as negligible in comparison to the below quantities.

Table 5.20-4: Estimated Amounts of Excavation Materials

Construction Site Location	**Estimated Cubic Yards [a]**
Second-to-Main Alternative (Retained Cut, Cut and Cover)	
Ex. Yard and Townsend Street	729,400
Second Street to Transbay Terminal	*999,000*
Transbay Terminal	658,100
Transbay Terminal to End	322,200
Total	***2,708,700***
Second to Mission Alternative (Retained Cut, Cut and Cover)	
Ex. Yard and Townsend Street	729,400
Second Street to Transbay Terminal	999,000
Transbay Terminal	658,100
Transbay Terminal to End	486,800
Total	**2,873,300**
Second-to-Main Alternative (Retained Cut, Cut & Cover, Tunneling)	
Ex. Yard and Townsend Street	729,400
Tunnel from Townsend to Second Street at Folsom Street	*336,000*
Second Street at Folsom Street to Transbay Terminal	301,300
Transbay Terminal	658,100
Transbay Terminal to End	322,200
Total	***2,347,000***
Second-to-Mission Alternative (Retained Cut, Cut & Cover, Tunneling)	
Ex. Yard and Townsend Street	729,400
Tunnel from Townsend to Second Street at Folsom Street	*336,000*
Second Street at Folsom Street to Transbay Terminal	301,300
Transbay Terminal	658,100
Transbay Terminal to End	486,800
Total	***2,511,600***
Note: [a] This column includes an estimated 1.15 expansion factor for soil and 1.5 expansion factor for rock and demolished concrete due to bulking upon excavation/demolition.	

Street Reconstruction. To fully restore permanent street traffic, temporary decking would be removed, the remainder of cut-and-cover sections would be backfilled, permanent utility restoration would occur, and the permanent street improvements would be installed. With restoration of roadway pavement and vehicular traffic, the surface work on the project would be completed and continuing activity involving subway finishes and equipment installations (e.g., installation of tracks, power, signals, and communication systems) could continue beneath the surface with minimal disruption to street use by vehicles and pedestrians.

Equipment typically used for street reconstruction includes: rubber-tired loaders/ bobcat, roller/ compactors, dump trucks, and paving machines.

5.20.3 CONTRACTOR WORK AREAS

Contractor work areas (or construction staging areas) would be needed for the surface, retained cut, and cut-and-cover construction segments of the proposed extension. Following are the proposed contractor work areas:

1. East of Seventh Street, between Berry and Townsend Streets at the westernmost end of the existing Caltrain Yard.
2. North of Townsend Street, east of Clarence Place and west of Stanford Street, at the site of buildings that would be taken and demolished for the Caltrain Downtown Extension.
3. The Southwest quadrant of the intersection of Second and Brannan streets, at the location of buildings to be demolished for the construction of the Caltrain Downtown Extension.
4. The northeast quadrant of the Howard Street/Second Street intersection, at the site of buildings to be demolished for the construction of the Caltrain Downtown Extension.
5. The parking lot west of Main Street between Howard and Mission streets.

Contractor work areas, if alternative tunneling construction methods were used, would be as follows. There are fewer areas due to the reduction in demolition of existing buildings.

1. East of Seventh Street, between Berry and Townsend Streets at the westernmost end of the existing Caltrain Yard.
2. *North* of the intersection of Second and Brannan Streets.
3. The northeast quadrant of the Howard Street/Second Street intersection, at the site of buildings to be demolished for the construction of the Caltrain Downtown Extension.
4. The parking lot west of Main Street between Howard and Mission streets.

Activities that would occur at these sites primarily include stockpiling of materials and storage of equipment. It is expected the contractor would rent local office space for their construction office to house administrative staff. Equipment employed for cut-and-cover is typically heavy duty, high volume machinery. Such equipment requires certain amounts of space when standing still, more for turning, and additional for maneuvering.

5.20.4 ANCILLARY FACILITIES

Ventilation and emergency access shafts will be required for the tunnel portion of the Caltrain Downtown Extension. Following is a discussion of anticipated locations and impacts of these facilities. The final locations for these shafts are subject to change during final design.

Tunnel shafts and ventilation systems provide the following capabilities:

- ***Heat Removal*** *- During normal conditions, tunnel ventilation is achieved by natural ventilation consisting primarily of train piston-action induced airflows. Fans housed in shafts are provided to augment the natural ventilation provided by the train piston action during* *normal operations and, when necessary, provide the primary means of limiting the tunnel temperatures when train piston action induced airflows are no longer present.*

- ***Smoke Control*** *- An "emergency" mode of operation for smoke control and discharge is provided using remote and overriding local fan controls.*
- ***Air Movement (piston action) Relief*** *- Vent shafts are typically provided at each end of underground stations to reduce excessive air movement within stations due to piston-action of trains*
- ***Emergency Egress*** *– National Fire Protection Association Standard (NFPA) 130 requires exit shafts to the surface at maximum 2,500 foot centers (reference NFPA 130 2003, paragraph 6.2.4.2). Where practical, ventilation shafts may also include emergency stairways. The portal at the Townsend station may be considered an exit since this station is proposed as an open cut section.*
- ***Air Intake/Exhaust*** *– In the case of a dead end tunnel, a means of providing an air intake and/or exhaust shaft is necessary for the ventilation system to function properly.*

Ventilation Shafts. *For the Locally Preferred Alternative, it is assumed that ventilation shafts housing fans and bypass dampers would be provided at each end of the new Transbay Terminal These shafts would house a minimum of two reversible fans and associated equipment consisting of sound attenuators and fan dampers. Bypass dampers would also be provided for additional air movement (piston-action) relief. The ventilation equipment would be located above the train tracks. The discharge of each shaft would be incorporated into the terminal structure. The foot print for these facilities would be approximately 200 square feet (10 by 20 feet).*

Air intake/exhaust shafts would also be located in the sidewalks along Main Street just north of Harrison, near the end of the proposed tail tracks. These shafts would also include emergency exits. Since the Townsend Street Station is in an open cut, ventilation shafts would not be required at this station.

Emergency Exit Shafts. *In addition to the emergency exits assumed north of Harrison Street in the Main Street sidewalks as described above, tunnel emergency exit shafts are also assumed at Second and Brannan Streets and at Second and Howard Streets. With emergency exits also assumed at both ends of the Transbay Terminal, this would result in an average distance between shafts of approximately 1,610 feet – within the requirements of NFPA 130. The shafts would be constructed as part of the cut-and-cover construction for the Second at Folsom and Main at Harrison locations and as part of the tunnel construction access shaft assumed at Second and Brannan Streets. At completion, the shafts would lead to a metal door located in and flush with the sidewalks along Second and along Main Streets. These emergency access shaft doors would be locked from the surface and would open from the underside leading from exit stairways in an emergency.*

Emergency Generator. *A diesel-powered emergency generator, to operate critical terminal functions (e.g., emergency lighting, escalators), would be installed at one end of the terminal. This facility would also need to be vented to the surface. The generator would need to be tested, typically at one month intervals, so noise mitigation would be provided.*

Environmental Impacts. *No long-term impacts (visual, noise, etc.) would be associated with the anticipated emergency exits given that they would be flush with the sidewalk surface. Construction impacts from these facilities are described below for the cut-and-cover construction that would occur at these locations.*

It is assumed that the fan located at the west end of the terminal would be operated only during emergencies. During normal operations (i.e., trains moving more or less as scheduled), piston action is typically sufficient to prevent heat build-up.

Local codes will require some means of ventilation for the tail track, which would be provided by the fan located at the east end of the terminal. It is assumed that one of the two fans serving the tail tracks would be operated during periods when the light train servicing is occurring. Both fans would operate if an emergency occurred. As an option, both fans could be operated at a reduced speed.

Walls would be located around the surface access for both fan facilities and around the emergency generator to mitigate noise and prohibit public access to the ventilation equipment for security purposes. Noise walls would be designed to assure adherence with FTA noise levels. Land uses immediately surrounding the new terminal at either end are primarily commercial/office.

The land uses immediately surrounding the vent structure and emergency exits at Main just north of Harrison are also commercial/office. This shaft would operate as an air intake/exhaust shaft to provide make-up air for the tunnel ventilation fans installed at the terminal. The shaft would be located near the far end of the tail track to allow fan induced airflow to sweep the entire length of the tail track tunnel. This shaft would terminate at the surface, under local sidewalks, with a grating. Air/intake shaft mechanical equipment would be limited to a damper that opens whenever the tunnel ventilation fans operate and closes upon fan shutdown. Given the surrounding land uses and facility operation, no environmental impacts are anticipated.

5.20.5 CONSTRUCTION PHASING

Figure 5.20-8 shows the schedule for construction of the Transbay Terminal and the Caltrain Downtown Extension.

Figure 5.20-8: Estimated Construction Phasing for Transbay Terminal and Caltrain Downtown Extension [a]

Calendar Years	***2004***		***2005***		***2006***		***2007***		***2008***		***2009***		***2010***		***2011***	
Activity / ***Months***	***1-6***	***7-12***	***13-18***	***19-24***	***25-30***	***31-36***	***37-42***	***43-48***	***49-54***	***55-60***	***61-66***	***67-72***	***73-78***	***79-84***	***85-90***	***91-96***
Operations Analysis, Preliminary Engineering, Geotechnical Engineering		■	■	■												
Program Review/Value Engineering			■		■											
Final Design & Permitting – Transbay Terminal				■	■	■										
Final Design & Permitting – Caltrain Extension			■	■	■	■	■									
Acquire Property, Design, Construct Temporary Terminals (Transit and Greyhound)				■	■	■										
Acquire Property & Demolish Buildings along Caltrain Extension				■	■	■										
Design and Relocate Utility Lines along Caltrain Extension					■	■	■									
Construct Surface Rail & Improvements at Caltrain Fourth and Townsend Yard							■	■								
Construct Cut-and-Cover and Retained-Cut – Caltrain Extension								■	■	■	■					
Reconstruct Streets											■	■	■		■	
Construct Caltrain Tunnel									■	■	■	■	■	■		
Construct Caltrain Track & Systems Facilities												■	■	■	■	
Demolish Existing Transbay Terminal & Ramps, Construct New Terminal & Ramps								■	■	■	■	■	■	■		
Construct Permanent Off Site Bus Storage Facility													■	■		

[a] Assumes West Ramp, Second–to–Main, Tunnel Option

5.21 CONSTRUCTION IMPACTS

The following sections evaluate the impacts and mitigation measures for the construction scenarios described above.

5.21.1 TRANSIT OPERATIONS

This section reviews the effects of Terminal/Extension Project construction on transit operations. Construction of the Transbay Terminal and underground Caltrain Station would require the establishment of a temporary bus terminal, the rerouting of transit lines, and the reconfiguration of roadways surrounding the temporary bus terminal. Transit operations on other roadways in the project area would also likely be affected and are addressed at the end of this section.

The impacts assessment is based upon preliminary planning for the temporary terminal as described in SMWM's Working Paper 12 "Terminal Design Modifications and Refinements" and in Section 3 of Arup's Working Paper 7.0 Pre-Concept Engineering Report.

5.21.1.1 Temporary Terminal Operations

The temporary terminal would be built on the single square block defined by Main/Beale/Folsom/Howard Streets. The core of the temporary terminal would serve AC Transit's transbay operations and midday bus storage. The perimeter of the terminal would accommodate Muni drop-off, layover, and pick-ups as well as Golden Gate Transit pick-ups. Greyhound buses would board and alight passengers at a separate, adjacent terminal on the west side of Beale Street between Folsom and Howard Streets (see Figure 5.21-1).

New overhead power distribution wires would be required for the rerouting of Muni Trolley buses on Folsom Street between Beale and Main; Howard Street between Beale and Main; Main Street between Howard and Folsom, Beale Street between Mission and Folsom; and Fremont Street between Mission and Howard.

Proposed Access to/from the Temporary Terminal for AC Transit Buses

In response to public comment regarding the need to reduce overall project costs, the co-lead agencies have identified alternate AC Transit bus access to the temporary terminal to avoid the need for a temporary bus ramp between the Bay Bridge and the temporary terminal during operation of the temporary facility. Without a temporary bus ramp, the buses exiting the freeway would use local streets to gain access to the temporary terminal between Main, Beale, Folsom, and Howard Streets. AC Transit buses exiting the I-80 freeway would go north up Fremont from the Harrison Street ramp, turn east on Folsom and proceed eastbound toward the temporary terminal. For the return trips, there would be a contra-flow lane along Folsom from Main Street to Essex Street for buses exiting the terminal. Buses would then have a protected left-turn movement from Folsom onto Essex Street. Once on Essex, the buses would travel on a dedicated *bus lane toward the freeway on ramp. Figure 5.21-2 shows these access routes for buses while approaching and leaving the temporary terminal.*

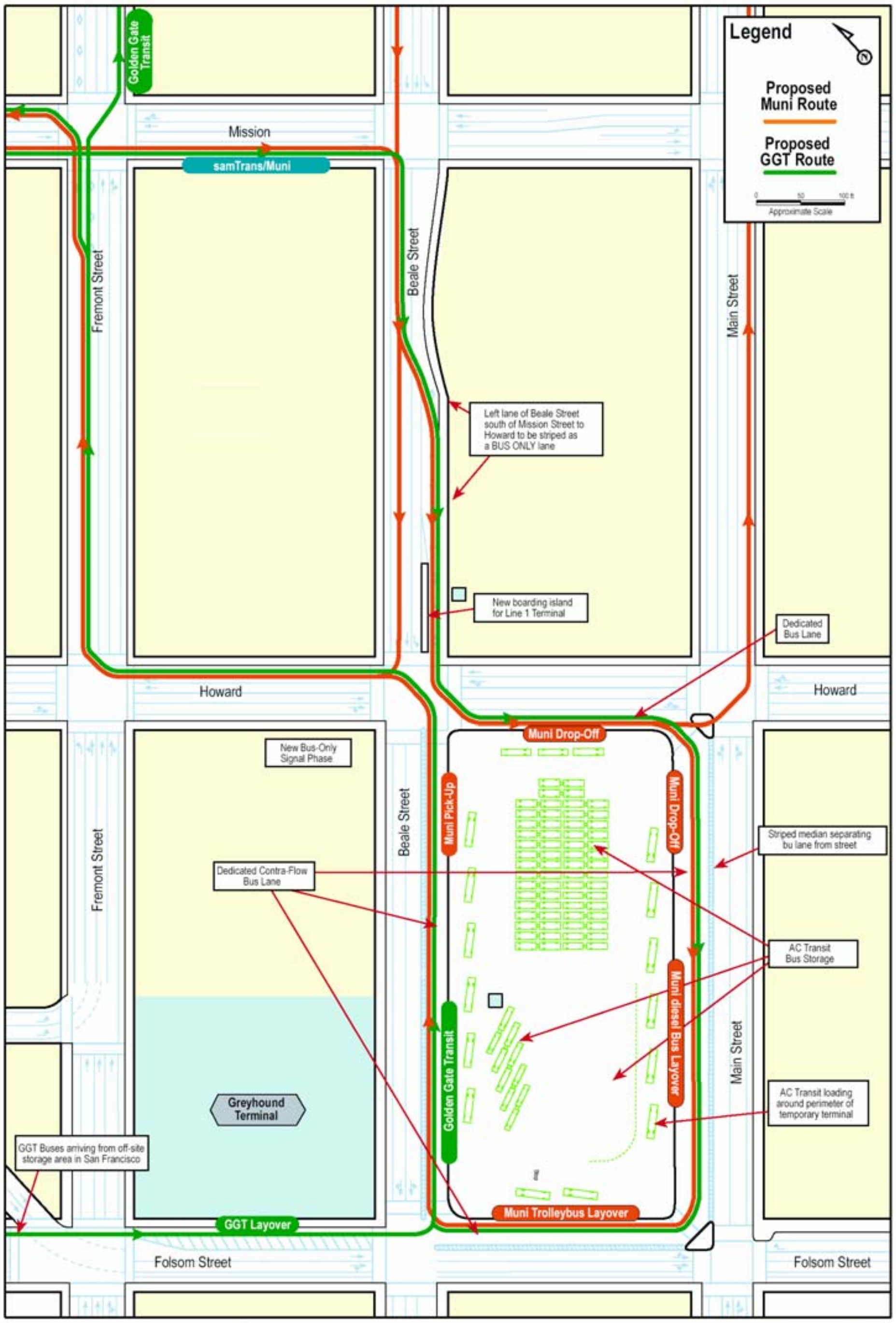


Figure 5.21-1 AC Transit, Muni, and Golden Gate Transit Access to the Temporary Terminal

Traffic turning movement data for 2000 and 2020 were obtained from an earlier study done by Wilbur Smith Associates. The traffic volumes for 2006 were determined by linear interpolation. Traffic analysis was done for the P.M. peak period – from 5:00 to 6:00 p.m. AC transit bus counts were obtained from AC Transit, through their check sheet for buses at Transbay Terminal. Golden Gate buses were assumed to add 30 buses per hour to the eastbound traffic on Folsom Street as they returned from the off-site storage in the P.M.-peak period. Using SIGNAL 94 from TEAPAC, key intersections were analyzed for the "with" and "without a temporary ramp" condition to the temporary terminal. The analysis year for all construction detour analyses was 2006 – the midpoint of the construction schedule.

Table 5.21-1 summarizes the intersection traffic and level of service data on the selected five intersections near the temporary terminal, with and without the additional buses and with contra-flow lane. For the no-ramp condition, there were no intersections that would degrade to Level of Service E or F assuming the operation of the bus lane along Folsom Street. At intersections where the contributions of the additional buses and the contra-flow lane were found to be adverse, traffic would be added to movements that would continue to operate satisfactorily.

There are two intersections in the Bay Bridge queue, however, that are projected to operate at LOS F both with and without the bus lane: First and Folsom, and Essex and Harrison. With the contra-flow lane, First and Folsom would have a slightly higher V/C ratio while Essex and Harrison would be about the same. The increase in the V/C from 1.35 to 1.38 at First and Folsom is not an adverse effect under the City and County of San Francisco criteria. It should be noted that at this intersection, the southbound traffic on First Street represents the major volumes at the intersection, thus contributing heavily toward the high V/C at the intersection. The east-west bound traffic on Folsom is much lower, and the buses, although an addition to the existing traffic during 2020, would travel on a dedicated lane, westbound on Folsom. Hence, the contribution to the traffic conditions from the buses in the dedicated lane would not be severe.

At the Essex and Harrison intersection, the northbound lanes of Essex Street that currently have very light traffic would be converted to southbound lanes. With two mixed-flow lanes and a dedicated bus lane in the southbound direction on Essex, the V/C ratio at Essex and Harrison would slightly improve from the existing condition.

As a result, the traffic generated by the additional buses and contra-flow lane would not represent a considerable contribution to the existing conditions and there would be no severe adverse traffic impacts at these intersections.

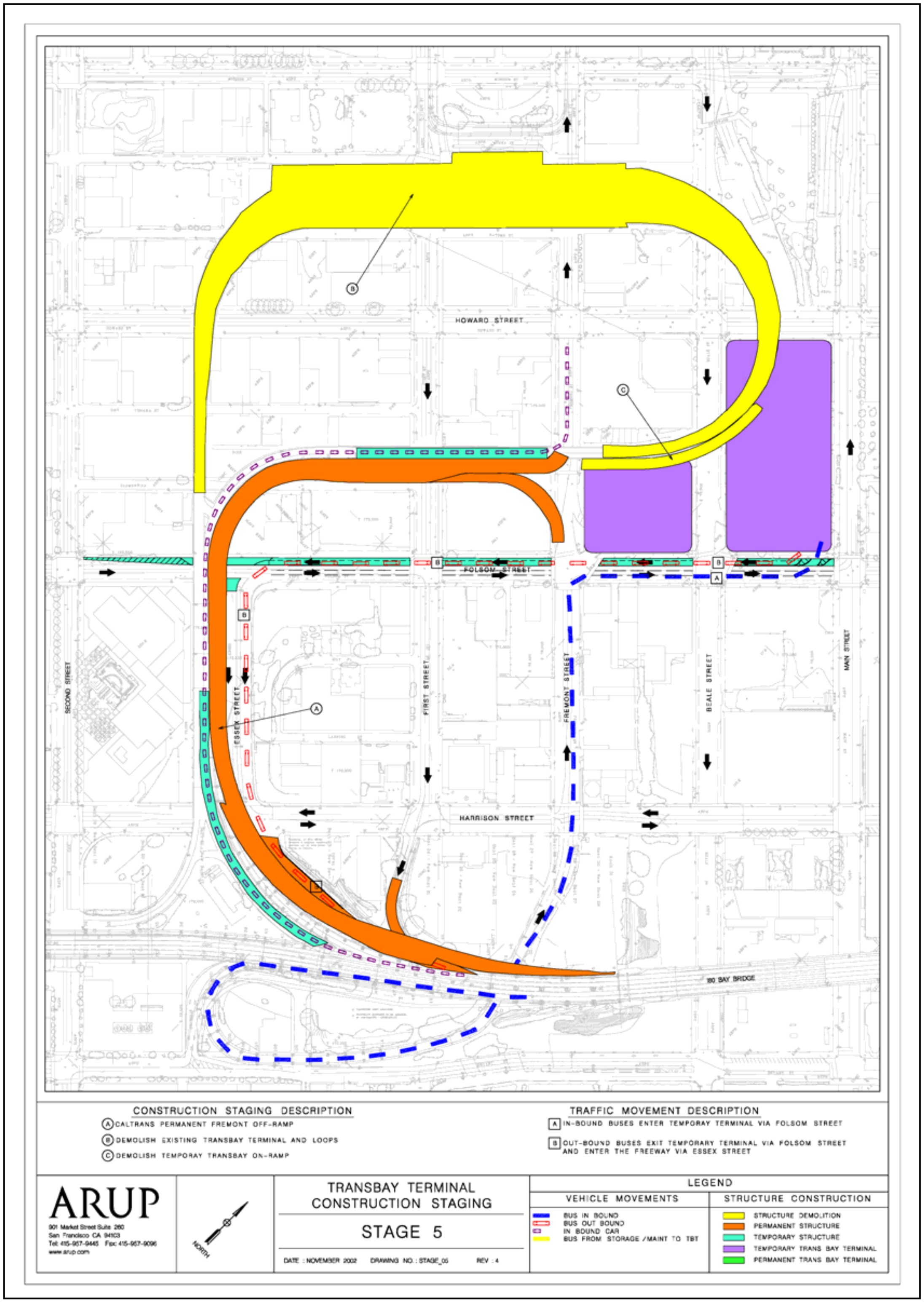


Figure 5.21-2: AC Transit Access Routes to/from the Temporary Terminal

Table 5.21-1: Level of Service Calculations for Contra-Flow Bus Lane from Temporary Bus Terminal to Bay Bridge via Folsom

Intersection	*2006 Conditions with and without the Additional Buses and Contra-Flow Bus Lane*					
	Without Buses			*With Buses*		
	V/C	*Delay*	*LOS*	*V/C*	*Delay*	*LOS*
Main and Folsom	*0.29*	*6.6*	*B*	*0.86*	*35.5*	*D*
Beale and Folsom	*0.47*	*8.4*	*B*	*0.65*	*10.4*	*B*
Fremont and Folsom	*0.34*	*7.4*	*B*	*0.43*	*6.3*	*B*
First and Folsom	*1.35*	*>60**	*F*	*1.38*	*>60**	*F*
Essex and Folsom	*Unsignalized Intersection*			*0.8*	*15.8*	*C*
Essex and Harrison with two southbound mixed flow lanes	*1.25*	*>60**	*F*	*1.22*	*>60**	*F*
Fremont and Harrison	*0.77*	*13.1*	*B*	*0.78*	*14*	*B*

**LOS is based on V/C ratios for intersections with V/C > 1.*
Source: Parsons, July 2003.

5.21.1.2 Transit Operations

The creation of a temporary Transbay Terminal would allow uninterrupted service for AC Transit, Muni, Golden Gate Transit, SamTrans, and Greyhound while the permanent facility is under construction. Each of these transit services would be required to modify operations during the operation of the temporary terminal.

AC Transit. The temporary facility is designed to fully accommodate AC Transit operations. Sufficient midday bus storage would be provided within the temporary terminal; therefore, AC Transit would not incur additional operating costs due to deadheading. AC Transit buses would circulate counterclockwise around a central bus parking lot. Surrounding the bus right of way would be 16 saw tooth bays. Passengers would board and alight from the perimeter sidewalk around the terminal and no internal crosswalks would be needed.[47]

The operation of AC Transit in the temporary terminal was analyzed using a local area network simulation model, VISSIM. The analysis determined that the temporary terminal had sufficient capacity for AC Transit to operate and store buses during afternoon peak conditions when occupancy of the terminal's center area, including the buses operating within the AC Transit storage/staging area, is highest. The study also demonstrated there would be sufficient bus bays available in the temporary facility during maximum occupancy. Maximum queues (8 buses) in the circulation area would dissipate in about one minute.[48]

[47] Arup, Working Paper 7.0 Pre-Concept Engineering Report, p. 23
[48] SMWM Working Paper 12 Terminal Design Modifications and Refinements, p. 68 -71

Muni. Muni routes currently serving the Transbay Terminal include lines 5, 6, 38, and 38L. They would be rerouted to board and alight passengers around the periphery of the temporary terminal. Muni lines 2 and 3 are also expected to serve the temporary terminal.

Terminal-bound Muni routes would be extended an extra one or two blocks on Market Street, proceed south down Beale Street, and continue along Howard Street to access the temporary facility. Buses would circulate clockwise around the terminal's perimeter, enabling passengers to load on the opposite side of the same curb/loading area used by AC Transit buses circulating counterclockwise within the terminal. Muni trolley buses would use drop-off bays along the south side of Howard Street and lay over along Folsom Street at the south end of the temporary terminal. Diesel operated buses would use two drop-off bays located along Main Street. All Muni vehicles would board passengers at the four northernmost bays along Beale Street.

Muni estimates that the additional annual operating and maintenance costs associated with the Temporary Transbay Terminal will be just under $1 million in FY 2000 dollars. These additional costs are expected to result from the rerouting of the 2,5,6, and 38/38L lines.

Simulation modeling demonstrated that there would be adequate capacity within the facility to accommodate Muni's existing service during peak periods. The maximum queue exiting the terminal at Beale and Howard Streets would be four vehicles. This assumes the addition of a bus-only left-turn phase to the intersection's existing signal.[49]

Golden Gate Transit. The temporary terminal would accommodate Golden Gate Transit staging, boarding and alighting but not midday storage. Since AC Transit is expected to use the full storage capacity of the temporary terminal, Golden Gate Transit would require an off-site storage location and likely incur additional operating costs due to deadheading between the location and the temporary terminal. The preferred location of an off-site storage area and a rerouting plan have not been identified. Golden Gate is currently evaluating alternative bus staging areas with the pending loss of its lease for the current storage site. The lease termination is not an effect of the proposed project.

Buses would access the temporary facility proceeding eastbound on Folsom Street and turning left onto Beale Street. Passengers could board at any of three bays reserved for Golden Gate along the eastern edge of Beale Street. An additional bay would be available on Beale Street for use by either Muni or Golden Gate Transit. A staging area for buses waiting to board and alight passengers would be available along the northern edge of Folsom Street between Fremont and Beale Streets. The precise access route for Golden Gate Transit to the temporary terminal will depend on the location chosen for its off-site storage area.

[49] SMWM, p.72.

Greyhound. Greyhound buses would not be accommodated within the temporary terminal but have a separate boarding area on the southern end of the block bounded by Beale/Fremont/Folsom/Howard Streets. The proximity of this location to the temporary terminal would facilitate connections between Greyhound, AC Transit, and Muni.

SamTrans. During the construction phase, SamTrans express bus service would operate via Mission, Beale, Folsom and Main Streets to an endpoint terminal on Beale between Howard and Folsom, or as an alternative, on Main between Folsom and Howard. Buses would alight passengers at all bus stops prior to the endpoint. Leaving the endpoint, buses would be in service and stop at all bus stops for passenger boarding. This operation would result in the elimination of 11 parking spaces on the south side of Mission Street between Fremont and Beale Streets.

5.21.1.3 Changes to Surrounding Road Network

In order to facilitate movements to and around the temporary transbay facility, several physical and operational improvements would be made to the surrounding roadways. These changes are shown in Figures 5.21-1 *and 5.21-2.* The effects on bus operations are described by arterial.

Beale Street. The segment of Beale Street between Howard and Folsom would be reconfigured to accommodate a northbound contra-flow dedicated bus lane and a separate lane for bus loading and staging along the curbside of the temporary Terminal. The contra-flow bus line would be used by both Muni and Golden Gate Transit. The northernmost end of the bus-loading lane would be used for Muni boarding and alighting. The southernmost end would be used by Golden Gate Transit. New overhead power distribution wires would be added to support Muni trolleybuses.

Reconfiguring Beale Street would require the elimination of two southbound traffic lanes and 12 curbside parking spaces on Beale Street. A four-foot-wide median would be built between the two remaining southbound lanes and the new bus lane. Additionally, the casual carpool lane, currently on the east side of Beale Street, would be relocated to the west side of the street.

The segment of Beale Street between Mission and Howard would also be reconfigured to accommodate a new boarding island for Muni's Line 1 and a southbound bus-only lane. New overhead wires would also be provided above this segment to accommodate Muni trolleybuses.

Folsom Street. Folsom Street between Beale and Main Streets would be reduced from four lanes eastbound to two lanes of eastbound traffic with the addition of a westbound contra-flow bus-only lane for Muni and Golden Gate Transit. The bus lane and the traffic lanes would be separated by a four-foot-wide striped median. Nine automobile parking spaces would be removed along the north curb of Folsom Street and replaced with a bus loading/staging lane. The bike lane and parking on the south side of Folsom would not be changed. New overhead wires would be added to support Muni trolleybuses.

Main Street. Main Street's three northbound traffic lanes between Howard and Folsom Streets would be changed to provide two lanes northbound and a southbound contraflow bus-only lane. All 48 motorcycle parking spaces and nine automobile spaces would be removed from the west side of Main Street and replaced with a curbside bus loading/staging lane. Overhead wires would be installed to accommodate Muni trolleybuses.

Howard Street. Existing traffic lanes on Howard Street, the northern border of the temporary terminal, would not be changed during construction of the new Transbay Terminal but on-street parking would be removed between Beale and Main Streets. The north parking lane would be converted to provide another westbound travel lane and the south parking lane would become a bus loading/unloading area for Muni.

5.21.1.4 Other Construction Impacts

Construction of the new Transbay Terminal will also affect transit operations on other roads in the study area.

Mission Street. Muni, Golden Gate Transit, and SamTrans would continue to operate along Mission Street in front of the terminal site during construction. However, construction generated traffic could potentially result in temporary delays for these operations. *The Second-to-Mission Alternative would also require block-by-block closures on Mission Street to construct the cut-and-cover subway between Beale Street and The Embarcadero. Muni's Line 14 line currently operates on Mission Street and would be rerouted or turned back temporarily in sequence with construction activity. The bus circulation via a contra-flow bus lane on Main Street for the temporary terminal would not be affected since the buses would be moved back to the new Transbay Terminal before the block between Howard and Folsom would be affected.*

Second Street. The cut-and-cover construction of the Caltrain rail tunnel would require block-by-block closures of Second Street. Muni's Line 10 line currently operates on Second Street and would be rerouted temporarily in sequence with construction activity.

Third Street. In order to accommodate construction on Second Street, Third Street may be restriped to accommodate southbound vehicular traffic. The additional traffic could affect the performance of Muni's service on Third Street, including lines 15, 30, 45 and 81x.

Main Street. *The Second-to-Main Alternative would also require block-by-block closures on Main Street to construct the cut-and-cover subway from south of Howard Street to just south of Harrison Street. Muni's 1, 80X, and 82X lines and multiple Golden Gate lines currently operates on Main Street and would be rerouted temporarily in sequence with construction activity.*

5.21.2 VEHICULAR TRAFFIC

5.21.2.1 Construction Trucks and Staging Areas

The number of construction trucks projected to be on the city streets for this analysis is based on the estimated volume of debris to be removed, the amount of materials to be brought in, the average capacity of the trucks, and the approximate time of operation. The following analysis is for the Cut-and-Cover Second-to-*Mission* Alternative, which has *2.8* million cubic yards of material to be excavated *(Table 5.20-4)*. This option represents a "worst case analysis." Fewer trucks would be required for the Second-to-Main Alternative. Moreover, substantially fewer trucks would be required for the Tunneling Option for either alternative, in that the tunneling option would have sizably less excavated material. *The Locally Preferred Alternative is the Second-to-Main Tunneling Option, which would generate about 20 percent less total excavated material than assumed in this worst case analysis.*

For the Second-to-*Mission* Cut-and-Cover Option analysis, the construction period is assumed to be two years, with an average hauling period of eight hours per day for 360 days per year less ten percent. Truck size is assumed to be 20 cubic yards. Soil is assumed to expand by 15 percent and rock by 50 percent. In general, it is assumed that spoils will be hauled by truck to the Caltrain yard adjacent to Seventh and Townsend and loaded onto trains for disposal out of the area. *Disposition of the excavated materials will be the responsibility of the contractor. Any hazardous materials will need to be disposed of according to federal and state laws and regulations governing its hauling and disposition (see Section 5.21.15.). The actual location for the use (e.g., as fill material) or disposal of non-hazardous excavated materials will depend on the demand for such materials at the time of construction and/or the ability to dispose of these materials at a site to be determined by the contractor.* Construction materials would be brought in only by truck.

The planned staging areas are the following:

- Portions of the Seventh and Townsend yard,
- Along the corners of the Second Street alignment between Brannan and Townsend,
- Northeast quadrant of Howard and Second, and
- Northwest quadrant of Howard and Main.

The volume of haul debris has been estimated based on planned dimensions of the cut and station (Table 5.21-*2*). For segment No. 1, adjacent to the yard and Townsend Street, only 40 percent of the trucks are assumed to use City streets; the remainder are assumed to stay internal to the yard in conveying material to trains for disposal. For the remaining three segments, all material is assumed to be hauled by truck to the yard. This is a conservative assumption because rail may be used to directly haul almost all of the material from segments Nos 1 and 2 instead of only 60 percent of No. 1. Trucks bringing construction materials are estimated to be ten percent of those removing excavated material.

Table 5.21-2: Projected Construction Truck Volumes

Construction Segment	Excavation Volume (cu yd)	Trucks/hr* (Round Trips)	Minutes/Truck
No. 1. Yard & Townsend St.	*292,000***	*1*	*42*
No. 2. Second St. to Terminal	*999,000*	*16*	*3.8*
No. 3. Terminal	*658,000*	*8*	*7.6*
No. 4. *To end of Mission* St.	*487,000*	*6*	*10*
Total	***2,436,000***	***31***	***1.9***

Notes:
*Also includes trucks carrying construction materials to sites.
***Reduced by 60% to account for rail hauling.*

Source: Parsons Corporation, September *2003*

Under these assumptions, it was estimated that a total of *31* construction truck round trips per hour would be required to haul the debris or bring in construction materials. But due to the phasing of the construction, with segments Nos. 1 and 4 potentially being constructed in parallel and segments Nos. 2 and 3 being constructed later, the maximum number of trucks that would be circulating would be *7* trucks/hour for Nos. 1 and 4 combined and *24* trucks/hour for Nos. 2 and 3 combined. Since the process would be a continuous cycle in which trucks would be arriving and departing, it is projected that, on the average, there would be between *14* and *48* construction truck trips on the local street network during each operating hour. These trucks would be operating on several different streets and arriving or departing from several different construction sites, as listed above. However, under the assumption that most of the excavated material would be hauled away by train, all of the haul trucks would converge at Seventh and Townsend to load the spoil onto trains.

5.21.2.2 Truck Routes

Delivery trips from the staging areas along the alignment are combined with the excavation removal. Truck routes by segment would be as follows:

1. Yard and Townsend Street—Trucks will circulate from the yard to Seventh to Brannan to Fourth, Third, or Second and back to Townsend to yard. The volume will be *1* truck/hr. This pattern combines with No. 4 to give a total of *7* trucks per hour.
2. Second to Terminal—Trucks will circulate up Seventh to Brannan to Third, cross over to Second and return down Second to Townsend to Seventh and yard. The volume will be *16* trucks/hr. It is sequential to No. 1/No. 4 and parallel No. 3 to give *24* trucks per hour.
3. Terminal—Trucks will circulate from the yard to Seventh to Bryant to Fremont to Terminal to Howard to Fourth to Townsend/Brannan to Seventh to yard. The volume will be *8* trucks/hr. This segment will be excavated at the same time as No. 2, giving a total of *24* trucks per hour.
4. Terminal down *Mission* Street—Trucks will circulate from the yard down Seventh to *Townsend to Embarcadero to Mission*, returning via *Embarcadero* to Townsend to

Seventh to yard. The volume will be 6 trucks per hour, giving a total of *7* trucks per hour when combined with No. 1.

Under this "worst case" analysis *for the cut-and-cover option*, *all of the trucks would travel along* Seventh Street, *departing or returning to the Caltrain Fourth and Townsend yard. B*ecause of the relatively low existing volumes on Seventh Street, *24 truck round trips per hour would not cause deterioration in the level of service on Seventh Street*. The *greatest impact under this* worst case *analysis* would be *24* trucks per hour being added to Howard Street at Third Street, but that is only one percent or less of the P.M. peak hour movement. The assumption of eight haul hours per day allows for avoidance of peak periods between 7 a.m. and 5 p.m., so the haul volumes can be scheduled outside the peak periods if necessary. *Impacts under the LPA would be lower than this worst case cut-and-cover scenario.* The next subsection analyzes the P.M. peak hour primary construction detour traffic with these haul movements superimposed.

5.21.2.3 Detour for Second Street Closures

For the Cut-and-Cover Option, Second Street would be closed to through traffic one block at a time between Townsend Street and Howard Street to facilitate construction of the cut-and-cover trench. Each block would be closed for an estimated month or two except for maintaining essential local access. See Subsection 5.21.2.5 for a discussion of access to driveways.

During these rolling closures of the five blocks on Second Street between Townsend Street and Howard Street, through traffic would be detoured onto parallel streets, primarily Third and Fourth Streets. Third Street, currently one-way northbound, would be restriped to give three lanes northbound and two lanes southbound. On-street parking would be prohibited on Third Street for the duration of the detour. The bus lane on Third Street would become a mixed flow lane for the duration of the detour, although it also functions well as a combined bus/right-turn lane where there is a substantial number of right turns, such as at Harrison or Bryant Streets.

The Third Street detour can be accomplished in two phases. During any closure of Second Street south of Harrison Street, the two-way portion of Third Street would be from Harrison Street to King Street. In this phase, Third Street could remain one-way northbound north of Harrison Street. During any closure of Second Street north of Harrison Street, the two-way portion of Third Street will be from Howard Street to King Street. It is anticipated that the cut-and-cover trench on Second Street would be constructed from south to north, starting at Townsend Street and going to Howard Street.

During the closure of a block on Second Street, the two-way portion of Third Street would facilitate detouring traffic around the closed block. Because some of the cross streets are one way, through traffic would often be diverted for two blocks or more instead of around just one block. It is expected that much of the I-80 and I-280 traffic on Second Street would shift over to Fourth Street for the southbound portion of the detour and to Third Street for the northbound portion of the detour. *The LPA would use cut-and-cover construction only between Folsom and*

Howard streets, and the two-way portion of Third Street would be limited to just the portion between Folsom and Howard streets to accommodate the southbound traffic in the closed block. Northbound traffic would have to be detoured two blocks on Third Street, from Harrison Street to Howard Street, but would use the existing northbound lanes on Third Street.

5.21.2.4 Intersection Analysis

Key intersections for detour traffic conflicts include Third/Howard, Third/Harrison, and Fourth/Harrison. Table 5.21-3 summarizes LOS calculations under detour and truck haul conditions for each closed block compared with baseline conditions in 2005, the expected midpoint of construction.

Table 5.21-3: Intersection Delay and LOS for Third Street Detour -- 2005 Conditions

		Intersection*			
		Third/Howard			
Block Closed of Second Street		**Base**	**Mitigated**	**Third/Harrison**	**Fourth/Harrison**
None	LOS	B		B	B
	Delay	14.5		10	11.4
Howard/Folsom**	LOS	E	D	D	B
	Delay	42.4	39.9	28.7	11.3
Folsom/Harrison	LOS	E	D	D	B
	Delay	42.4	39.9	30	11.3
Harrison/Bryant	LOS	B		D+	B
	Delay	14.5		26.4	11.7
Bryant/Brannan	LOS	B		D+	B
	Delay	14.5		26.4	11.7
Brannan/Townsend	LOS	B		D+	B
	Delay	14.5		26.4	11.7

*Delay and level of service are based on 1994 Highway Capacity Manual (SIGNAL94). Delay is in seconds.
**NB lanes consist of two through lanes and one RT/bus lane

The intersection affected with the most diverted turning movements, Third/Howard, dropped from LOS B to E with a lane configuration of two northbound mixed flow lanes and one bus lane. Elimination of the bus lane to give three northbound mixed flow lanes and the addition of a left turn lane on Howard resulted in the projected LOS reaching LOS D. None of the other key intersections affected by the detour were projected to have impacts from the detour.

5.21.2.5 Other Detour Routes

Construction methods for the cut-and-cover tail track section of the Second-to-Mission Alternative would require that Mission Street be closed except for one lane in each direction with no parking for up to two years. As part of the construction phasing, Mission Street would have to be completely closed for an additional one to three months at both the start and finish of *construction to put on a temporary deck and to restore the street surface. Cross streets of Beale, Main, and Stuart would also require closure to through traffic at staggered periods of one to three months.*

Similarly, construction methods for the cut-and-cover tail track section of the Second-to-Main Alternative would require that two lanes on Main Street be closed for up to two years. As part of the construction phasing, Main Street would have to be completely closed for an additional one to three months at both the start and finish of construction to put on a temporary deck and to restore the street surface. Cross streets of Folsom and Harrison would also require closure to through traffic at staggered periods of one to three months.

The detours in street traffic for either of these alternatives would result in adverse effects on intersection operations at several intersections in the downtown area. The detours would last two years and would add vehicular traffic to already congested movements and/or create new demand for movements that conflict with other high demand movements. Affected intersections for the Second-to-Mission Alternative would include:

- *Beale/Howard*
- *Main/Howard*
- *Stuart/Howard*
- *Howard/Embarcadero*
- *Beale/Folsom*
- *Main/Folsom*
- *Folsom/Embarcadero*

Affected intersections for the Second-to-Main Alternative would include:

- *Embarcadero/Mission*
- *Embarcadero/Howard*
- *Embarcadero/Folsom*
- *Embarcadero/Harrison*

5.21.2.6 Coordination with Third Street Light Rail/Central Subway

Potential exists for conflict between the traffic detour plans of the Central Subway project and the Caltrain extension alternatives. Both the Cut-and-Cover Option and the Tunnel Option would close portions of Second Street to through traffic while Third Street would be designated as a primary detour route. In contrast, the Central Subway project would close portions of Third Street to through traffic and would designate Second Street as a primary detour route. The schedules for the two projects, however, show that the Caltrain LPA would largely, if not entirely, avoid this conflict. Based on the current schedule for construction of the LPA, Second Street would be closed between Folsom Street and Howard Street for about two years, reopening in mid 2009. The proposed detour for this closure is discussed at the end of Subsection 5.21.2.3 *above. The Central Subway project is currently scheduled to begin cur-and-cover station construction on Third Street between Folsom Street and Howard Street in mid 2009, avoiding the period when the LPA would use Third Street as a detour and when Second Street would not be available for the Central Subway detour. The Central Subway would have utility relocation activities that would precede the station construction, but the LPA schedule has potential to be accelerated to avoid conflict with those activities. The ISCOT Committee, an interdepartmental staff committee on Traffic and Transportation in the City and County of San Francisco, will be utilized to minimize or avoid the traffic detour conflicts between these two projects.*

5.21.2.7 Driveway Access

The Second Street segment of the Second-to-Main and Second-to-Mission alternatives has the highest number of driveways that would be affected by cut-and-cover construction, and the following analysis represents a "worst-case" evaluation. The Tunneling Option for either Caltrain Downtown Extension alternative would have substantially fewer effects on driveways. Between Brannan and Howard Streets, there are 13 locations (i.e., parking lots, businesses, residents, etc.). In addition to these locations, four dead end streets cross Second Street at De Boom and Federal Streets, Dow Place, and Tehama Streets. These dead end streets provide access to numerous private parking lots, loading docks, and public parking. Easements would be required to maintain access at Tehama Street and Dow Place. Temporary alternative access would be acquired through private property between Federal and De Boom Streets. A list of driveways that would be affected by construction on Townsend, Second, Main, and Mission Streets is included in Table 5.21-4.

Table 5.21-4: Driveways and Streets Temporary Blocked By Construction

Street Segment	Address	Land Use	Description
Townsend Street (Both Caltrain Extension Alternatives – (Cut-and-Cover or Tunnel Option)			
Fifth to Fourth Street	310 Townsend	Office	Garage Entrance/Exit
	306 Townsend	Office	Garage Entrance/Exit
Fourth to Third Street	292, 294, 296 Townsend	Retail	Parking entrance for numerous businesses.
	290 Townsend	Retail	Loading Dock.
	On southern side of Townsend	Vacant/Under Construction	Driveways to new mixed use development.
Third Street to Clarence Place (Cut-and-Cover Option only)	701 Third	Food	Townsend Street drive thru entrance and exit.
	179 Third	Office	Garage and parking lot entrance and exit.
	178 Third	Parking	Parking Garage Entrance.
Second Street			
Brannan To Bryant (Cut-and-Cover Option only)	Brannan @ Second (northwest side)	Vacant/Under Construction	Delivery Entrance.
	South Park @ Second (southwest side)	Vacant/Under Construction	Delivery/Driveway Entrance.

Table 5.21-4: Driveways and Streets Temporary Blocked By Construction

Street Segment	Address	Land Use	Description
	577 Second	Retail	Driveway Entrance.
	522 and 524 Second	Light Industrial	Driveway Entrance.
Bryant To Harrison (Cut-and-Cover Option only)	461 Second	Residential	*Driveway* Entrance.
	Underneath I-80 Freeway	Parking	Parking Lot Entrance/Exit.
	425 Second	Residential	Delivery Entrance/Exit.
	Not Available	Parking	Parking Lot Entrance/Exit.
	Second @ Harrison (southeast corner)	Parking	Parking Lot Entrance/Exit.
Harrison To Folsom (Cut-and-cover Option only)	On west side of Second	Parking	Parking Lot Entrance/Exit.
Folsom To Howard (Cut-and-Cover or Tunneling Option)	Folsom @ Second (northeast corner)	Hotel	Driveway of New Building.
	246 Second	Residential	Driveway Entrance/Exit.
	Howard @ Second (southeast corner)	Parking	Parking Lot Entrance/Exit.
Second-to-Main Alternative Only (Cut-and-Cover or Tunnel Option)			
Main Street			
Harrison To Folsom	365 Main	Vacant/Under Construction	Shipping/Receiving Driveways
	390 Main	Public Services	Parking Lot Entrance/Exit.
	Folsom @ Main (southeast corner)	Parking	Parking Lot Entrance/Exit.
Folsom To Howard			
	160 Folsom	Retail	Driveway Entrance on Main Street.
	On east side of Main	Parking	Parking Lot Entrance/Exit.
	250 Main	Transportation	Three Parking Lot Entrances.
	272 and 276 Main	Office	Parking Lot Entrance/Exit.
	221 Main	Office	Underground Parking Lot Entrance/Exit.
Second-to-Mission Alternative (Cut-and-Cover or Tunnel Option)			
Mission Street			
Main To Spear	77 Beale	Office	Driveway Exit.
	110 Mission	Office	Parking Lot Entrance/Exit.
At The Embarcadero	On north side of Mission	Parking	Muni/Public Parking Entrance/Exit.
Transbay Terminal Impacts	500 Mission	Office	Four Loading Docks on Minna Street.

Loss of access to any property would be minimized via prompt construction of the roadway decks, first on one side and then the other. The construction contractor or construction representative would work with and notify property owners, businesses, and residents regarding the temporary loss of access.

Prior to initiating construction of each segment, outreach efforts would be performed to inform residents, businesses, and property owners of the proposed construction program. A community construction coordination program would be established to encourage communication between the affected community, both residential and business, and the TJPA and JPB regarding construction impacts and possible mitigation and solutions.

Prior to and during construction, the TJPA and JPB staff would contact and interview individual businesses and property owners potentially affected by construction activities. Interviews with commercial establishments would provide knowledge and understanding of how these businesses carry out their work, and identify business usage, delivery and shipping patterns and critical times of the day and year for business activities. Data gathered from these interviews would assist the JPTA and JPB as they work with the DPT to develop the worksite traffic control plans. Among other elements, these plans will identify alternate access routes to maintain critical business activities.

The mitigation measures described in the following sections would be implemented by a combination of construction contract specifications, drawings, and provisions, as well as public affairs programs. TJPA and JPB staff would be assigned to work directly with the public to provide project information and to resolve construction-related problems. The TJPA and JPB will work with community residents, elected officials, local businesses, and community organizations to tailor the mitigation program to best meet community needs. Contractors will be monitored to assure that mitigation measures contained in the Final EIS/EIR are met.

The TJPA and JPB would inform the public of its progress in implementing the measures selected through a quarterly program of auditing, monitoring, and reporting. A quarterly status report would be made available to the public.

Site and Field Offices. During construction of the Terminal/Extension Project, TJPA and JPB staff would establish an information field office located along the alignment. The field office staff in conjunction with other staff would serve multiple purposes:

- 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 inquires,
- Coordinate business outreach programs,
- Schedule promotional displays, and
- Participate in community committees.

The information office would be open various days of the work week for the duration of the construction period. A schedule will be developed before construction begins.

Information Line. A telephone information line would be available to provide community members and businesses the opportunity to express their views regarding construction. Calls received would be reviewed by TJPA and JPB staff and would, as appropriate, be forwarded 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 would include current project schedule, dates for upcoming community meetings, notice of construction impacts, individual problem solving, construction complaints and general information. During construction of the project, phone service would be provided in English, Cantonese, and Spanish and would be operated on a 24-hour basis.

Signage. The TJPA and JPB would work with establishments affected by construction activities. Appropriate signage would be developed and displayed to direct both pedestrian and vehicular traffic to businesses via alternate routes.

Traffic Management Plans. Traffic management plans to maintain access to all businesses would 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.

Deck Level. Decking at the under-street cut-and-cover sections would be installed flush with the existing street or sidewalk levels.

Sidewalk Design and Maintenance. Wherever feasible, sidewalks would be maintained at the existing width during construction. Where a sidewalk must be temporarily narrowed during construction (e.g., deck installation), it would be restored to its original width during the majority of construction period. In some places this may require placing the temporary sidewalk actually on the deck. Each sidewalk design should be of good quality and approved by the Resident Engineer prior to construction. Handicapped access would be maintained during construction where feasible.

Construction Site Fencing. Construction site fencing should be of good quality, capable of supporting the accidental application of the weight of an adult without collapse or major deformation. Fence designs or examples would be submitted to the Resident Engineer for approval prior to installation. Where covered walkways or other solid surface fencing is installed, a program will be implemented to allow for art work (e.g., by local students) on the surface(s).

5.21.3 PARKING

On-street parking would be temporarily removed along specific streets for a set amount of time during construction. Under the Cut-and-Cover Option, parking on Second Street would be closed and re-opened on a block-by-block basis due to construction. To mitigate the closure of Second Street, traffic would need to detour to Third Street. When Second Street is closed south of Harrison, no parking would be allowed on Third between Harrison and King Streets. When Second Street is closed north of Harrison, no parking would be allowed on Third between Howard and King Streets. See Section 5.21.2.3 for details of the Second Street detour. The contractor would post dates and times of parking closures and openings. Loss of parking could affect local businesses, as discussed in Section 5.21.2.5. Table 5.21-*5* includes segments where on-street parking would be temporarily removed during construction and the number of temporarily removed parking spaces removed is also shown.

The Caltrain ridership forecast did not assume parking capacity expansion at any stations that had reached parking capacity under the 2020 No-Project conditions. Therefore, there are no long-term adverse impacts to parking projected for Caltrain stations as a result of the Terminal/Extension Project.

Table 5.21-5: On-Street Parking Removed During Construction

Second-to-Main and Second-to-Mission Alternatives	Direction of On-Street Parking	
Townsend Street	**Eastbound**	**Westbound**
Fifth to Fourth Street	Diagonal parking	Perpendicular parking
Fourth to Third Street	No parking (construction zone)	Parallel parking
Third Street to Clarence Place	Parallel parking	Parallel parking
Second Street	**Northbound**	**Southbound**
Brannan to Bryant	Parallel parking, 11 auto spaces	Parallel parking, 10 auto spaces
Bryant to Harrison	Parallel parking, 9 auto spaces	Parallel parking, 10 auto spaces
Harrison to Folsom	Parallel parking, 17 auto and 4 motorcycle spaces	Parallel parking, 15 auto spaces
Folsom to Howard	Parallel parking, 12 auto spaces	Parallel parking, 11 auto spaces
Third Street	**Northbound**	**Southbound**
King to Townsend	Parallel parking, 13 auto spaces	Parallel parking, 13 auto spaces
Townsend to Brannan	Parallel parking, 21 auto spaces	Parallel parking, 23 auto spaces
Brannan to Bryant	Parallel parking, 3 auto spaces	Parallel parking, 23 auto spaces
Bryant to Harrison	Parallel parking, 11 auto spaces	Parallel parking, 11 auto spaces
Harrison to Folsom	Parallel parking, 18 auto spaces	Parallel parking, 25 auto spaces
Folsom to Howard	No parking	No parking
Second-to-Main Alternative	**Northbound**	**Southbound**
Midway from Bryant to Howard	Parallel parking	Parallel parking
Second-to-Mission Alternative	**Eastbound**	**Westbound**
Main to Spear	Parallel parking	Parallel parking
Spear to Steuart	Parallel parking	Parallel parking
Steuart to The Embarcadero	Parallel parking	No parking

5.21.4 PEDESTRIANS

Before construction of the Transbay Terminal/Extension Project begins, two one-story temporary terminals would be built. A terminal for AC Transit buses would be located on the block bounded by Beale/Howard/Main/Folsom Streets, and a terminal for Greyhound buses would be located on Folsom Street between Fremont and Beale Streets. Temporary bus terminals would be located contiguous to the P.M. casual carpool queuing area. Because the temporary terminals would disrupt this queue activity, the casual carpool queues would be moved to the west side of Beale Street.

The temporary AC Transit terminal would be located two blocks east and one block south of the existing terminal, while the Greyhound terminal would be located one block east and one block south of the existing Transbay Terminal. The existing (2000) pedestrian travel patterns to and from the Transbay Terminal as determined by the SFTA model indicate that 70 percent of pedestrians going to and from the terminal would have up to a four block longer walk than under the existing situation. An additional 22 percent would have to walk up to three additional blocks to reach the terminal, while 4 percent would have to walk about one additional block to reach the terminal. About four percent of pedestrian walk distances would not be affected or would be shorter. For those with up to a four block additional walk, this represents about 800 additional feet of travel distance. At a pedestrian pace of 200 feet per minute, the additional 4-block walk is estimated to take four minutes.

5.21.5 BICYCLES

The temporary relocation of the Transbay Terminal during construction would increase bike travel distance to the terminal for the majority of bicyclists. The distance would increase by up to four blocks, which would add about two additional minutes of bicycle travel time. No mitigation measures are proposed other than that bicycles would be allowed to use temporary street improvements made for transit.

5.21.6 NEIGHBORHOODS AND BUSINESSES

In general, business and residential impacts would include changes in traffic circulation attributable to street closures, some loss of on-street parking, increased truck as well as auto traffic on designated haul routes and detours, increased noise in the vicinity of surface construction, and views obstructed or worsened by construction activity.

The most substantial construction-phase effects on neighborhoods and businesses would occur on the four streets affected by the Cut-and-cover Option of both Caltrain Downtown Extension Alternatives. The disruption of residents and businesses during construction is an important concern of the TJPA and JPB. Measures would be incorporated in the construction program to minimize impacts to residents and businesses.

Impacts to Residential Areas. Although most land uses along affected streets are commercial uses, there are some live/work lofts along Townsend Street and additional residential uses along Second Street, including live/work units at the Clock Tower Building, a residential building near Tehama Street, and the Courtyard Marriott hotel. During construction the residential uses would be subject to reduced vehicular access, increased traffic congestion, increased noise and construction-related dust.

Impacts to Businesses. Most of the land uses along the Caltrain Downtown Extension Alternative alignments are commercial, and the majority of these commercial establishments consist of office uses. There are also retail uses, particularly on the ground floors of buildings along each of the affected streets, and there are warehouse and light-industrial uses on Second and Townsend Streets. Cut-and-cover construction effects on businesses would include reduced vehicular access and increased traffic congestion, increased noise and debris, and decreased visibility of operating businesses. These disruptions would most likely have the greatest impact on the retail establishments, many of which rely more heavily on walk-in traffic and street visibility for sales activity than office uses and warehouse businesses also located in these areas. There is a potential reduction in the ability of large trucks to access warehouse and storage facilities.

The Muni Metro Turnback Project in downtown San Francisco serves as a meaningful case study from which to predict how businesses would be affected by project construction. During construction of the Muni Metro Project, businesses located along The Embarcadero – fronting the cut-and-cover construction of the project – experienced partial or complete loss of visibility and access. Where possible, these businesses reoriented themselves to Steuart Street. Several hotel and restaurant owners whose businesses were affected by severe noise and debris were successful in negotiating to cease all construction activity between 12:30 and 1:30 p.m. daily, in order to allow for more comfortable lunch hour operations. One small delicatessen, which lost all visibility due to construction fences that were assembled around the project, was offered reduced rent by the building owner for the duration of construction to offset sales losses.

The loss of on-street parking spaces also raises issues related to economic impacts. Several blocks of unmetered parallel parking spaces would be temporarily lost along Townsend Street during construction of the Townsend alignment, potentially exacerbating difficult conditions for local business owners, particularly the small retailers.

Prior to initiating construction on major elements of the Terminal/Extension Project, outreach efforts would be performed to inform residents, businesses, and property owners of the proposed construction program. A community construction coordination program as described above in Section 5.21.2.5 would be established to encourage communication between the affected community, both residential and business, and the TJPA and JPB regarding construction impacts and possible mitigation and solutions.

5.21.7 COMMUNITY FACILITIES AND SERVICES

None of the community facilities identified in Section 4.3 would be affected by construction activities, except to the extent that traffic delays caused by temporary detours and congestion may inconvenience persons gaining access to these facilities.

Safety and security services during construction would be provided by the San Francisco Police Department and other security personnel identified in Sections 4.3 and 5.17. The San Francisco Police Department would likely assign officers to monitor traffic congestion and detours along surface streets during construction. It is likely that existing officers would be assigned to this task, and at this time no additional costs to the Department are anticipated. While emergency access would potentially be affected by any change in traffic conditions in the area, the traffic impacts of the project would be very minor and should not affect emergency response times.

The Fire Department would review project plans at time of permitting to ensure that adequate life safety measures and emergency access are provided during construction of the Terminal/Extension Project. To reduce the potential for impacts to occur a life safety plan would be developed and implemented, as described in Section 5.4.

The City's Solid Waste Management Program has indicated that the amount of construction debris generated and disposed of could be adequately accommodated by existing landfills (Kevin Drew, Solid Waste Management Program Associate, responses to questionnaire, June 13, 2001). Mitigation measures are identified in Section 5.21.6.2, however, in order to help San Francisco achieve the 50 percent reduction goal specified in the California Integrated Solid Waste Management Act of 1989 (AB 939). In addition, the Terminal/Extension Project would comply with all City and County ordinances regarding the minimization of waste though recycling.

To reduce the short-term solid waste impacts associated with construction, the construction specifications will require the use recycled construction materials where feasible, and will include specification regarding the recycling of construction and demolition materials.

5.21.8 PARKLANDS, SCHOOLS, AND CHURCHES

None of the parks, schools, or churches identified in Section 4.4 would be affected by construction activities, except to the extent that traffic delays caused by temporary detours and congestion may inconvenience persons gaining access to these facilities.

5.21.9 AIR QUALITY

Construction activities can cause pollutant emissions in a number of ways, including emissions of nitrogen oxides, carbon monoxide, and sulfur oxides from diesel-powered construction equipment; carbon monoxide emissions from worker vehicles; dust or PM_{10} emissions from vehicles traveling on unpaved surfaces and/or grading and other earthmoving activities; and reactive organic gas emissions from asphalt placement and architectural coatings. There are no quantitative emissions thresholds for construction activities, which are by their nature temporary and occur over a large area, potentially affecting different receptors at different times. The Bay Area Air Quality Management District's (BAAQMD) approach to the analysis of construction impacts is to emphasize implementation of effective and comprehensive control measures rather than detailed quantification of emissions.

Specific construction practices can minimize or control certain emissions, and the following mitigation measures, which are derived from the "basic control measures" and the "enhanced control measures" recommended by the BAAQMD, are proposed as part of the project.

As part of the contract provisions, the project contractor would be required to implement the following measures at all project construction sites:

- 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.
- Cover all trucks hauling soil, sand, and other loose materials *or* require all trucks to maintain at least two feet of freeboard.
- 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.
- Sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites.
- Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets.
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways.
- Replant vegetation in disturbed areas as quickly as possible.

- *Minimize use of on-site diesel construction equipment, particularly unnecessary idling.*
- *Shut off construction equipment to reduce idling when not in direct use.*
- *Where feasible, replace diesel equipment with electrically powered machinery.*
- *Locate diesel engines, motors, or equipment as far away as possible from existing residential areas.*
- *Properly tune and maintain all diesel power equipment.*
- *Suspend grading operations during first and second stage smog alerts, and during high winds, i.e., greater than 25 miles per hour.*

Additionally, 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).

5.21.10 CONSTRUCTION NOISE AND VIBRATION

5.21.10.1 Impacts

Temporary intrusion from noise and vibration is associated with most large construction projects. Because of the short-term nature of the intrusion, construction noise and vibration are not usually considered impacts unless, as is the case for this project, the construction will last for an extended period of time.

Construction noise varies greatly depending on the construction process, type and condition of equipment used, and layout of the construction site. Many of these factors are traditionally left to the contractor's discretion, which makes it difficult to accurately estimate levels of construction noise. The noise impact assessment for a construction site is based on:

- An estimate of the type of equipment that will be used during each phase of the construction and the average daily duty cycle for each category of equipment,
- Typical noise emission levels for each category of equipment, and
- Estimates of noise attenuation as a function of distance from the construction site.

Although the lack of specific information at the time of the environmental assessment makes estimates of construction noise approximate, the projections do provide a good picture of where noise impacts are likely to occur and the general types of noise mitigation that will be required to mitigate the impacts.

Table 5.21-*6* summarizes some of the available data on noise emissions of construction equipment from the FTA Guidance Manual. Shown are the average of the L_{max} values at a distance of 50 feet. Although the noise levels in the table represent typical values, there can be wide fluctuations in the noise emissions of similar equipment. In fact, several of the cited noise levels would exceed the limit in the San Francisco noise regulation that is discussed below.

Table 5.21-6: Construction Equipment Noise Emission Levels

Equipment Type	**Typical Sound Level at 50 ft (dBA)**
Backhoe	80
Bulldozer	85
Compactor	82
Compressor	81
Concrete Mixer	85
Concrete Pump	82
Crane, Derrick	88
Crane, Mobile	83
Generator	81
Loader	85
Pavement Breaker	88
Paver	89
Pile Driver, Impact	101
Pump	76
Roller	74
Shovel	82
Truck	88

Source: Harris Miller Miller and Hanson, September 2001

Construction noise at a given noise-sensitive location depends on the magnitude of noise during each construction phase, the duration of the noise, and the distance from the construction activities. Projecting construction noise requires a construction scenario of the equipment likely to be used and the average utilization factors or duty cycles (i.e., the percentage of time during operating hours that the equipment operates under full power during each phase). Using the typical sound emission characteristics, as given in Table 5.21-*6*, it is then possible to estimate L_{eq} or L_{dn} at various distances from the construction site.

Table 5.21-*7* is an example of the noise projections for equipment that is often used during cut-and-cover subway construction. For the calculations it is assumed that all the equipment is located at the geometric center of the construction work site. Based on this scenario, a 12-hour L_{eq} of 88 dBA should be expected at a distance of 50 feet from the geometric center of the work site. This is equivalent to an L_{eq} of approximately 76 dBA at a distance of 200 feet from the construction site, significantly higher than the normal daytime L_{eq} in the project area even in locations where ambient noise exposure is relatively high because of traffic on I-80. On cut-and-cover construction, once roadway decking is in place over the excavated trench, most of the construction activities will be shielded by the decking material, resulting in substantially lower noise levels for buildings adjacent to the construction site.

Table 5.21-7: Typical Equipment List, Subway Excavation			
Equipment Item	**Typical Sound Level at 50 ft (dBA)**	**Equipment Utilization Factor (%)**	**L_{eq} (dBA)**
Air Compressor	81	50%	78
Backhoe	80	40%	76
Crane, Derrick	88	10%	78
Dozer	85	40%	81
Generator	81	80%	80
Loader	85	40%	81
Pavement Breaker	88	4%	74
Shovel	82	40%	78
Dump Truck	88	16%	80
Total workday L_{eq} at 50 feet (12-hour workday)			89
Source: Harris Miller Miller and Hanson, September 2001			

The construction phases of this project and the potential for noise and vibration impacts are summarized below:

Utility Relocation: Relocating the utilities that conflict with the construction would not have much potential for noise impact. The equipment used is typical of normal street work. This construction would not normally warrant nighttime construction except in areas where the relocation efforts would cause unacceptable interference with traffic.

Demolition: A number of buildings along the corridor would be demolished in preparation for cut-and-cover construction. No residential receptors are located near any of the buildings likely to be removed on Townsend Street. During the demolition of the Transbay Terminal, noise from impact equipment such as jackhammers, pavement breakers, and hoe rams could be disturbing to occupants of buildings near the Transbay Terminal. The land uses closest to the Transbay Terminal are primarily commercial and office space. Impacts on these spaces would be temporary and would not disrupt normal use of the buildings.

The other major demolition effort would be removing the existing bus ramps leading from the current western exit of the Transbay Terminal. Again, the impact equipment used in the demolition is the most likely to cause intrusive noise. The land uses closest to the ramps are primarily commercial and office space. Impacts on these spaces would be temporary, typically a month or two while the nearest ramp is being demolished, and would not disrupt normal use of the buildings.

Surface Rail Line and Station Construction: Surface rail line and station construction would primarily affect buildings along Townsend Street from Seventh Street to the subway portal. Existing land uses are primarily commercial, industrial or office space with some mixed-use residential buildings along Townsend Street west of Fourth Street. Noise from daytime construction, particularly pile driving, may be intrusive on an intermittent basis, however, compliance with the limits of the San Francisco noise regulations would avoid significant noise impacts. Nighttime construction could result in noise impacts to mixed-use residential buildings within a block of Townsend Street.

Retained Cut/Portal Construction: The construction of the retained cut and the portal would include drilling a number of auger holes to build the soil-cement walls, excavation between the walls, and construction of the track bed and track. The land uses most affected by the construction would be along Townsend Street, which is primarily commercial and industrial with some office space. Some nighttime construction might be advantageous to avoid disruptions during normal business hours, but could result in noise impacts to mixed-use residential buildings within the blocks of Townsend Street to the west of Fourth Street.

Tunnel Construction and Street Reconstruction: This section addresses noise and vibration impacts of subway construction. The subway track sections between Townsend Street and the Transbay Terminal and on down Main Street or Mission Street would be constructed using cut-and-cover construction, or a combination of cut-and-cover and stacked-drift construction methods (to tunnel the portion of the alignment from Townsend Street to Folsom Street). It is anticipated that subway construction would last for a total period of approximately three and a half to four years, with up to 36 months required for the stacked-drift tunnel portion.

Cut-and-Cover Construction. The noisiest phases of cut-and-cover construction are the initial construction of the support walls and installation of the roadway decking. To minimize traffic disruption during installation of decking where the alignment passes under Beale Street, First Street and Fremont Street, some construction would be done during nighttime hours with trenches covered to allow normal traffic flow during the daytime. This nighttime construction would not cause noise impacts since there are no residential land uses in these areas. Once the decking is in place for cut-and-cover construction, excavation and construction would continue under the decking. During the excavation and bracing phases, above-ground activities would consist primarily of cranes removing excavated material and trucks hauling the excavated material away. Surface activities would not be a major factor for the remainder of cut-and-cover construction with the exception of street reconstruction at the very end of the project.

Vibration impacts from cut-and-cover construction methods would result primarily from the use of impact equipment such as hoe-rams. These impacts would be expected to produce some short-term annoyance exceeding frequent event criterion levels of 72 VdB throughout the duration of the cut-and-cover construction; mitigation measures are proposed. Impacts exceeding the damage criterion level are not anticipated.

Stacked-drift Tunneling. Construction machinery used for the stacked-drift tunneling method would include tracked vehicles, excavation equipment, and vibratory compactors. No noise impacts of stacked-drift tunneling are anticipated because land uses at the surface would be shielded from construction activities. The vibration produced by tunneling equipment would, however, be of sufficient magnitude to be perceptible and annoying at times for the occupants of residences closest to the construction. Exceedences of the frequent event criterion of 72VdB are expected to be even greater than with cut-and-cover construction. Mitigation measures are identified.

Vibration Effects on Historic Buildings. Because vibration from construction activities and equipment can be of sufficient magnitude to damage fragile historic buildings, a special study was done to determine whether vibration impacts of the project would exceed criteria levels for such sensitive land uses. These criteria are listed in Table 5.21-*8*.

Table 5.21-8: Construction Vibration Impact Criteria

Level of Impact	Land Use	Vibration Criterion, PPV (in.sec)
Threshold of Potential (Cosmetic) Damage	Fragile, Historic Structures	0.5
Threshold of Minor Structural Damage	Fragile, Historic Structures	0.3
Threshold of Potential (Cosmetic) Damage	Non-Fragile Structures	0.2
Threshold of Minor Structural Damage	Non-Fragile Structures	0.12
Source: FTA		

Based on the study, no damage from construction vibration is anticipated at any of the buildings in this area from typical construction methods. Comparing the highest anticipated construction vibration levels to these criteria confirms that anticipated construction activities would not be sufficient to cause structural damage, even to the most fragile historic structures.

Controlled Detonation. Controlled detonation may be required during tunnel construction through rock for both the cut-and-cover and stacked-drift construction methods, subject to additional geotechnical investigations and other considerations that would be determined during the final design and construction phases of the project. Any use of controlled detonation would be closely controlled and monitored to avoid damage to existing structures. Specific limits, practices, and monitoring and reporting procedures would be included within the contract documents to ensure that such construction methods, if used, would not exceed safety criteria.

Contractor Work Areas: The specific construction activities that would occur at these sites would vary, depending on their location, however, there would be a considerable amount of heavy equipment operations at the sites. These sites would be the proposed locations for removal of much of the excavated material from retained cut, cut-and-cover, and stacked-drift tunnel construction. Activities would include temporary muck storage, muck removal, trucks transporting material to the construction site, cranes lowering and lifting materials from the access shafts, heavy equipment such as front end loaders, ready-mix trucks delivering concrete to the job, and tunnel ventilation equipment. The six contractor staging/work areas being considered for cut-and-cover construction are:

1. East of Seventh Street, between Berry and Townsend Streets. This site is sufficiently removed from noise-sensitive receptors that the contractor would not have problems complying with the San Francisco noise regulations.

2. North of Townsend Street, between Clarence Place and Stanford Street. This would be the staging area for the demolition of buildings at the southern end of the cut-and-cover tunnel section. There are no noise-sensitive locations near this area.

3. Southwest corner of the intersection of Second and Brannan Streets. This site is located within 600 feet of multiple residences, however, several large buildings stand between the staging area and sensitive receptors. These buildings would provide adequate shielding between this staging area and nearby noise sensitive sites.

4. Northeast corner of the intersection at Howard Street and Second Street. This site is located within 500 feet of the apartment building at 246 Second Street and the Marriott Hotel along Second Street. Based on preliminary calculations, the Leq over an 8-hour shift would be approximately 69 dBA at the apartment building. An L_{eq} of 57 dBA was measured at these residences for a one-hour period during the evening commute period. It is estimated that the 24-hour noise exposure is about 60 dBA.

   Depending on the layout of the construction site and the specific equipment used during nighttime hours, meeting the nighttime noise limit in the San Francisco noise regulations of ambient plus 5 dBA is likely to require 7 to 10 dBA of noise reduction. Because of the elevation of the high-rise apartments, a sound wall around the perimeter of the site would provide mitigation only for residents on the lower floors. It is expected that the contractor will work with the San Francisco Department of Public Works (DPW) to avoid noise impacts to the closest residences.

5. Parking lot on Main Street between Howard Street and Mission Street. There are no noise-sensitive land uses near this area.

6. The parking lot west of Main Street between Howard and Mission Streets. This site is sufficiently removed from noise-sensitive receptors that the contractor would not have problems complying with the San Francisco noise regulations.

Haul Routes: Deliveries to the construction sites and excavated material from the project will be moved along pre-selected haul routes. Most of the routes are along relatively busy streets with primarily commercial and industrial land uses. There are some intermixed office space and residential land uses along several of the planned haul routes. Because of the *relatively high volumes of existing traffic on the haul routes during the daytime, the addition of construction trucks would not increase total traffic volumes to the extent that they would increase overall noise to levels that would create noise impacts at sensitive receptors along the routes. At nighttime, when existing traffic volumes are lower than during the day, the addition of construction trucks could influence traffic volumes to the extent that noise impacts would occur* in the following areas: Fourth Street, one block on Howard Street, and Brannan Street near Fourth Street.

5.21.10.2 Mitigation Measures

Noise: The following mitigation measures are proposed to reduce construction noise impacts:

1. Comply with the 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.

2. Conduct Noise Monitoring. The purpose of monitoring is to ensure that contractors take all reasonable steps to minimize noise.

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

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.

5. Minimize the Use of Vehicle Backup Alarms. A particular concern is for backup alarms on construction vehicles operating during nighttime hours. 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.

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.
   - 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.

7. 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: The following procedures will be used to minimize the potential for annoyance or damage from construction vibration:

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.

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.

3. Require vibration monitoring during vibration intensive activities.

4. Restrict the hours of vibration intensive activities such as pile driving to weekdays during daytime hours.

5. If resident annoyance from vibration becomes a problem, alternative construction methods and practices would be investigated in coordination with the construction contractor to reduce the impacts.

6. Include specific limits, practices and monitoring and reporting procedures for the use of controlled detonation, if this construction technique is determined to be necessary.

5.21.11 WATER RESOURCES

Construction grading, tunneling, and utility excavations would increase the sediment load to storm sewers during rainfall events. Sediment sources created during construction include soil stockpiles; soil tracked across construction areas, staging areas, and public roads; and soil transported to these areas by wind. Because stormwater in the study area discharges to the City's combined storm/sanitary sewer system, sediment transported by stormwater would not affect surface water bodies in the project area (China Basin and San Francisco Bay). However, wind-transported soils could contain contaminants that would affect nearby surface waters.

Construction dewatering would locally result in the temporary lowering of the water table and could promote the downward migration of contaminants from the uppermost groundwater zone to deeper groundwater zones. If dewatering lowers the water table in areas where free-phase petroleum hydrocarbons are floating on the water table, the resulting decrease in the water-table elevation would smear the hydrocarbons across soils that otherwise may be only minimally affected. The impacts associated with handling and disposal of contaminated dewatering effluent are further discussed in Section 5.21.14.

Construction excavation spoils will be appropriately managed so as to minimize wind dispersion of potentially contaminated soil particles. Spoils management practices are to include covering stockpiles with plastic sheeting, periodically spraying water on exposed soil areas to suppress dust generation, and decontamination of vehicles prior to departure from construction and staging areas.

As discussed in Section 5.21.15, construction dewatering would be performed in stages in order to minimize downward migration of contaminants in shallow groundwater. Dewatering effluent will be discharged to the sanitary sewer and, therefore, would not affect nearby surface waters.

Chemical test results for groundwater samples along the alignment would be used to obtain a batch discharge permit from the San Francisco Department of Public Works and to evaluate requirements for treatment prior to discharge to the sanitary sewer. Effluent produced during the dewatering of excavations would be collected in onsite storage tanks and periodically screened for potential contamination to confirm the need for treatment prior to discharge. If necessary, treatment may include:

I. Allowing sediment to settle out of the effluent in order to reduce elevated metals concentrations that can result from high quantities of suspended sediment; and/or

II. Carbon filtering to remove fuel hydrocarbons and PAHs.

5.21.12 UTILITIES

Impacts to utilities for the overall project are discussed in Section 5.12. If necessary, disruptions to service during construction would be short-term and carefully scheduled with advance notice given to affected customers.

5.21.13 ELECTROMAGNETIC FIELDS

There would be no electromagnetic field impacts associated with construction of the Terminal/Extension Project.

5.21.14 HISTORICAL AND CULTURAL RESOURCES

5.21.14.1 Archaeological Resources

Long-term impacts to archaeological resources that may exist within the project Area of Effects (APE) – including measures to be taken in the event of unanticipated discoveries during construction – are discussed in Section 5.14, Historic and Cultural Resources.

If buried cultural materials are unearthed during construction, work in the vicinity of the find would be halted until a qualified archaeologist can assess their significance. If human remains are encountered during construction, State Health and Safety Code Section 7050.5 states that no further disturbance shall occur until the County Coroner has made the necessary findings as to origin and disposition pursuant to Public Resources Code 5097.88. In either instance, TJPA, JPB, the City and County of San Francisco, and the Redevelopment Agency would be immediately notified. *Please see Section 5.14.2 for a more detailed discussion of archaeology mitigation measures.*

5.21.14.2 Historical Architectural Resources

Project impacts on historical architectural resources within the project APE are described in Section 5.14, Historic and Cultural Resources. Section 5.14 also describes suggested mitigation measures for long-term impacts to these resources; actual mitigation measures will be determined in consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation and reported in the Final EIS/EIR.

A construction easement will be required into the southeast corner of the 166-178 Townsend Street property, which is a contributor to the significance of the Rincon Point / South Beach Historic Warehouse – Industrial District. To avoid impacts to the building during and following construction of the subway, it is proposed to underpin the building prior to initiation of construction activities.

5.21.15 CONSTRUCTION HAZARDOUS MATERIALS IMPACTS

Two main types of hazardous materials/wastes may cause construction impacts: those used in the construction process and those that would be encountered or generated during construction.

Some hazardous materials, primarily fuels and motor oils, would be used during construction. Construction of aboveground facilities would also use paints and other cleaners or degreasers. While these are commonly used materials, they are considered hazardous materials (fuels, for example, are flammable) based on their physical properties, and improper handling could potentially endanger workers and the public and also could result in contamination of soil and/or water.

Contact with contaminants in the study area could potentially have adverse effects on worker, public, and environmental health and safety. During project construction, workers could be exposed to soil and/or groundwater containing hazardous substances via direct contact (ingestion or dermal contact) with contaminated soil and groundwater or via airborne pathways (inhalation of vapors). The public and environment could be exposed to contaminants transported offsite during construction. The degree of hazard associated with these impacts on human or environmental receptors would be a function of the chemical properties, concentrations and volume of contaminants, nature and duration of construction activities, and contaminant migration pathways. However, the largest degree of potential exposure risk is with the construction worker.

Construction activities such as excavation, installation of deep foundations, or site dewatering within existing contaminated areas could potentially increase the spread of contaminants to surface water and other groundwater zones along the proposed alignment. Disposal of contaminated soil would transport contaminants out of the study area as well.

As noted in Section 4.17, a total of 37 regulatory agency lists were searched to identify listed facilities within the project area. For purposes of this analysis, the 41 identified hazardous materials sites in the study area have been classified into three categories:

- Locations that would be directly affected by construction along the proposed extension alignments;
- Locations adjacent to or near the proposed project alignments that could be affected by project construction or that could provide sources of contaminants to the construction areas; and,
- Properties with essentially no anticipated adverse impacts due to the distance from the proposed construction areas and nature of contamination.

Table 5.21-*9* presents a breakdown of the identified sites into these categories.

Storage Yard Area. Most of the identified hazardous materials sites located near the proposed storage yard are included on agency lists due to releases from underground storage tanks (USTs). According to the agencies' information, the types of petroleum hydrocarbons that have been released from USTs near the proposed storage yards and surface tracks include diesel fuel, gasoline, motor oil, and various fuel oils.

Construction of the storage yard and trenching for the alignment would result in disturbance of surface soils. None of the excavations are expected to be deep enough to encounter groundwater. Therefore, impacts to construction of the storage yard from UST releases would be limited to spoils handling and worker health and safety precautions for hydrocarbon-contaminated soil.

Because of their close proximity to the planned alignment, the following sites have the greatest likelihood to affect storage yard and track construction:

- Southern Pacific Transportation, 329 Townsend Street, Site 30
- Flair Electro Sales, 516 Townsend Street, Site 34

Properties that are listed by the agencies to have remediation completed or deemed unnecessary are listed under the non-hazardous category. In addition to UST-related hydrocarbons, other potentially hazardous constituents that may affect yard and surface track construction include metals (primarily lead), PAHs, and VOCs (mainly solvents). PAHs and elevated concentrations of lead were detected during Embarcadero roadway-related investigations and construction along King Street (Site 32). Additionally, lead contamination is prevalent in fill material in the South of Market area (SOMA) and is likely to be encountered in fill disturbed by yard and track construction. Although coal tar has not been specifically identified in the storage yard and surface track area, PAHs associated with coal tar residues and other past land uses may be encountered in the fill.

Townsend Street Cut-and-Cover Area. Two identified sites, Sun Chemical Corporation No. 1 (Site 24) and the San Francisco Iron Foundry (Site 26), lie in or adjacent to the Townsend Street cut-and-cover subway segment. The Sun Chemical Corporation site is listed as requiring no further action by the California Department of Toxic Substances Control (DTSC). No information was available in the agencies' databases regarding the nature of contamination at the San Francisco Iron Foundry site. However, based on the type of industry implied by the site name, it is reasonable to expect that soils at that site may contain elevated metals concentrations.

Table 5.21-9: Classification of Potential Hazards Associated with Hazardous Materials Sites

Site No[1]	Site Name and Location	Potential Construction-Related Hazard		
		None [2]	Indirect [3]	Direct [4]
1	Federal Reserve Bank, SE Corner of Mission and Main Streets		X	
2	Talco Inc., 621 First Street		X	
3	San Francisco Gas & Light Co., 401 Howard Street		X**[5]**	
4	Caltrans (Transbay Terminal), 150 First Street			X
5	San Francisco Gas Light Co., 166 Fremont Street, 498 Howard Street			X
6	U.S. Marine Corps – Supply Depot, 160 Harrison Street		X	
7	524 Howard Street HOA	X		
8	Transportation the Department, 434 Main St	X		
9	Caltrans, 120 Richards Street		X	
10	Dahl Beck Electric Co., 580 Howard Street		X	
11	141 New Montgomery, 171 New Montgomery Street	X		
12	Oriental Warehouse		X	
13	Unspecified Site, Second and Townsend Streets	X		
14	Pacific Bell, 611 Folsom Street			X
15	600 Harrison Street		X	
16	Photosynthesis LTD Chromeworks, 425 Bryant Street	X		
17	George Lithograph CO, 650 Second Street		X	
18	San Francisco Fire Dept., 698 Second Street		X	
19	Commercial Building, 35 Stanford Street	X		
20	Commercial Building, 101 Townsend Street	X		
21	San Francisco Gas & Electric Co., 120 King Street		X	
22	Pacific Gas Improvement Co., 169 Townsend Street		X	
23	McDonalds Corp., 701 Third Street		X	
24	Sun Chemical Corporation No. 1, 252 Townsend Street			X
25	Unspecified (Embarcadero Roadway Project)		X	
26	San Francisco Iron Foundry, 260 Townsend Street			X
27	Heublin, Inc., 601 Fourth Street		X	
28	San Pacific Imports, 530 Brannan Street		X	
29	Commercial Building, 542 Brannan Street		X	
30	Southern Pacific Transportation, 329 Townsend Street			X
31	SF Newspaper Agency, 590 Brannan Street		X	
32	Unspecified (Embarcadero Roadway Project)		X	
33	California Poultry Company, 777 Brannan Street		X	
34	Flair Electro Sales, 516 Townsend Street,		X	
35	Independent Electric Supply, 550 Townsend Street			X
36	Baker/ Hamilton Building, 638 King Street		X	
37	Baker/ Hamilton Properties, LLC, 650 King Street		X	
38	Golden Gate Disposal Co., 900 7th Street		X	
39	Former Southern Pacific Co., 415 Channel Street		X	
40	Greyhound, Hooper/ Seventh Street		X	
41	The Glidden Company, 1400 Seventh Street		X	

Notes:
[1] Site numbers correspond to site location numbers shown on Figure 4.17-1.
[2] Sources of potential contamination are judged to be sufficiently far from proposed construction activities that environmental impacts are not anticipated.
[3] Properties adjacent to proposed construction areas or properties where the presence of potential sources is not well defined relative to planned construction.
[4] Properties where proposed construction may pass directly through areas of known contamination.
[5] Contamination may extend beyond site boundaries into areas that would be directly affected by construction.

Source: Dames & Moore, 1996

No other identified hazardous materials sites located near the Townsend Street cut-and-cover tunnel section are expected to have affected soil that would be disturbed during construction of the Townsend Street segment.

Several identified UST release locations (Sites 16, 27, 28, 29, and 31) may be located hydrogeologically upgradient of the cut-and-cover tunnel section; therefore, groundwater affected by fuel hydrocarbons may be encountered during construction dewatering.

The most substantial UST release site near the proposed Fourth and Townsend Street subsurface station is SF Newspaper Agency (Site 31), which reportedly has gasoline product floating on the water table. Depending on the lateral extent of the floating product, dissolved-phase gasoline constituents, and groundwater flow direction, gasoline hydrocarbons from this site could affect construction dewatering and worker health and safety.

Townsend Street. The subway portion of Townsend Street potentially intersects an additional three identified hazardous materials sites (Sites 30 and 34). Potential impacts associated with Sites 30 and 34 are similar to those discussed above for the storage yard and surface tracks, with the following exceptions:

- Soil disposal costs may be increased due to the large quantity of soils that would be excavated during cut-and-cover construction; and
- The subway excavation would require dewatering of groundwater potentially contaminated by fuel hydrocarbon constituents.

Construction of the cut-and-cover subway would require disturbance of fill that potentially contains lead and PAHs in addition to fuel hydrocarbons, as is the case with other components of the surface track, storage yard, and Townsend Street alignments.

The Tunnel Option would extend through bedrock and would be below the current groundwater table throughout the entire alignment. Because fuel hydrocarbons associated with UST sites have a tendency to float on the groundwater table, it is unlikely that hydrocarbon-affected bedrock would be encountered. Therefore, impacts from potential UST release sites would be limited to contaminated groundwater or floating product that could enter the tunnel excavation or require special disposal when intercepted by the tunnel dewatering system. Entry of dissolved-phase or free-phase fuel hydrocarbons into the tunnel could create explosion or inhalation hazards. If present in the dewatering system effluent, fuel hydrocarbons may prevent direct discharge of the effluent to the sanitary sewer without appropriate treatment.

Identified UST release sites near the tunnel section (Sites 15, 17, 18, 20, and 27), are either unconfirmed releases or listed as requiring no further remedial action. Sites 12, 13, 14, 16, 19, and 21 do not have a current status listed in the agency reports. Floating product was reportedly present at an unspecified commercial building at 101 Townsend Street (Site 20), however the agency reports a current status of "remediation completed or deemed unnecessary."

Metals and PAHs have been detected at sites in the Townsend Street vicinity (Sites 12, 13, and 25). These contaminants are encountered in fill material and, to a limited extent, may extend down into underlying native soils but are not expected to be present in bedrock. In addition, low concentrations of metals and PAHs may be present in groundwater intercepted by the tunnel dewatering system. Contamination in soil would not likely affect this section of the tunnel. Soils overlying bedrock may contain metals, PAHs, and/or fuel hydrocarbons at sufficient concentrations to require worker health and safety precautions and special handling and disposal of excavated soil.

Folsom to Transbay Terminal Segment

Three of the identified hazardous materials sites are located near the cut-and-cover subway segment north of Folsom Street to the proposed underground terminal. The first site, Pacific Bell (Site 14), is shown as the site of a release of diesel into surrounding soil. It is also listed as a small quantity generator of hazardous wastes. The second site is located at 171 New Montgomery Street (Site 11) and is listed with a status of "remediation completed or deemed unnecessary." Dahl Beck Electric Company (Site 10) is reported as having a gasoline release to soil with a status of "remediation completed or deemed unnecessary."

This cut-and-cover section is located outside of known areas of coal tar residues, but may still have been affected by low concentrations of PAHs. Similarly, this subway section is not included within the Article 22A[50] zone but may encounter fill soils that contain elevated concentrations of lead or other metals.

Transbay Terminal. UST release sites located near this cut-and cover section include sites 1, 2, 4, 6, 7, and 8. All of these sites are listed as either unconfirmed, "case closed," or "remediation completed or deemed unnecessary." There are known coal tar deposits in this area from the former San Francisco Gas Light Co. (Sites 3 and 5). The identified UST release sites include the Federal Reserve Bank (Site 1), Talco Inc. (Site 2), the Caltrans-Transbay Terminal site (Site 4), the former U.S. Marine Corps Supply Depot (Site 6), 524 Howard Street HOA (Site 7), and the Transportation Department (Site 8). Details regarding the nature of contamination at these sites are discussed below, with contamination from UST releases for all three sites discussed first, followed by specifics related to the presence of asbestos at the Transbay Terminal itself.

Construction of the new Caltrain underground terminal would require excavating potentially contaminated soils and dewatering of groundwater that may include hazardous contaminants. A portion of the underground terminal is located within the Article 22A zone, indicating that soils encountered during construction are likely to have elevated concentrations of lead and other metals and possibly PAHs. In addition, coal tar deposits are likely to be encountered in the eastern half of the terminal excavation while surrounding soils are expected to contain PAHs associated with coal tar residues. The underground terminal would be located adjacent to a former coal gas plant, the San Francisco Gas Light Company (Sites 3 and 5). Elevated levels of

[50] Article 22A of the San Francisco Public Health Code (Maher Ordinance).

PAHs in soil have been detected at several nearby sites, including the Oriental Warehouse (Site 12) and an unspecified site at Second and Townsend Streets (Site 13), as well as several other sites along Howard Street between Fremont and Main Streets. In addition to soil contamination, groundwater contamination associated with the coal tar residues has also been detected in these areas and may potentially affect dewatering operations.

In addition, there is one UST site near the proposed underground terminal that has the potential to affect construction of the station. The Federal Reserve Bank (Site 1) is located approximately 400 feet from the proposed underground terminal and is reported to have had an unconfirmed release of gasoline that affected groundwater.

Based on the presence of UST releases at and near the proposed terminal, and on the probability that other unreported UST releases have occurred in the area, it is likely that some soils encountered during construction would have detectable concentrations of fuel hydrocarbons. Depending on the lateral extent of dissolved-phase constituents and groundwater flow direction during dewatering, gasoline hydrocarbons from past UST releases and groundwater contamination associated with coal tar residues could affect construction dewatering and worker health and safety. If present in the dewatering system effluent, fuel hydrocarbons may prevent direct discharge of the effluent to the sanitary sewer without appropriate treatment.

Asbestos-Containing Building Materials at the Transbay Terminal Building. Caltrans performed an asbestos survey of the Transbay Terminal in 1986 that identified asbestos-containing building materials (ACM) including domestic water and heating pipe insulation, mechanical equipment insulation, and floor tiles. As part of its 1993 renovation of the terminal building, Caltrans removed asbestos-containing thermal systems insulation, vinyl floor tile and mastic, and transite ducting from various areas of the terminal. Also in 1993, the reinforced concrete roof of the terminal was replaced with a lightweight metal roof. This replacement included the removal of approximately 100,000 square feet of built-up asphalt and gravel roofing, vent pipes, and cold joint fillers, all of which were reported to contain asbestos.

Based on this information, some or all of the identified ACM has been removed from the Transbay Terminal. The presence of additional ACM cannot be ruled out without additional survey. Demolition of the terminal without prior abatement of ACM could result in exposure of construction workers and the general public to asbestos fibers.

Mitigation Measures. Handling and storage of fuels and other flammable materials during construction would follow California OSHA and local standards for fire protection and prevention. These measures include appropriate storage of flammable liquids and prohibition of open flames within 50 feet of flammable storage areas.

Prior to construction, the potential presence of contaminants in soil and groundwater would be investigated using conventional drilling, sampling, and chemical testing methods. Based on the chemical test results, a mitigation plan would 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 would follow the requirements of 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.

Soils removed during excavation and grading activities that remain at a centralized location for an extended period of time would be covered with plastic sheeting to prevent the generation of fugitive dust emissions that migrate offsite. Additionally, dust control measures would be implemented during construction grading and excavation as necessary to minimize offsite migration of contaminants. Soil for disposal at a landfill or recycling facility would be transported by a licensed waste hauler, under appropriate manifests or bill of lading procedures, as required.

Chemical test results for groundwater samples along the alignment would be used 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 would 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.

A detailed mitigation plan for the handling of potentially contaminated soil and groundwater will be developed prior to starting project construction.

Dewatering systems would be designed 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.

Workers performing activities on site that may involve contact with contaminated soil or groundwater would be required to have appropriate health and safety training in accordance with 29 CFR 1910.120. A Worker Health and Safety Plan (HSP) would 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 would 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 would specify mitigation of potential worker and public exposure to airborne contaminant migration by incorporating dust suppression techniques in construction procedures. The plan would 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.

Mitigation measures for ACM would include identification of all available asbestos survey and abatement reports and supplemental asbestos surveys, as warranted. Identified ACM would require abatement prior to building demolition. Removal and disposal of ACM would be performed in accordance with applicable local, state, and federal regulations. In addition to ACM, lead-based paint may also require abatement prior to building demolition. A lead-based paint survey would be required to determine areas where lead-based paint is present and the possible need for abatement prior to demolition.

5.21.16 AESTHETICS & VISUAL IMPACTS

As described in Section 5.20, project construction for all three components would be multi-phased and would occur in different locations at different times. Wherever and whenever construction occurs, construction equipment and supplies would be visible, and evidence of construction activity would be noticeable to area residents, employees, and visitors. 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, the TJPA and JPB would require the project contractors to ensure 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. The TJPA and JPB, through its on-site field office, would make all efforts possible to minimize specific aesthetic and visual effects of construction identified by neighborhood businesses and residents.

5.21.17 GEOLOGIC IMPACTS ON PROJECT CONSTRUCTION

The primary geologic units that could adversely affect construction activities of the Terminal/Extension Project include artificial fill and bedrock. Impacts associated with these units are discussed in the following sections.

Fill. Fill soils possess adverse characteristics such as rubble, heterogeneity of composition and depth, and locally high permeability. Because of localized areas of high permeability, fill soils may be difficult to dewater during construction of tunnels and building foundations. Dewatering requirements affect the cost of constructing tunnels and the underground station by increasing the cost to (1) install and operate dewatering systems for the tunnel and station excavations, and (2) discharge the dewatering effluent if the water contains contaminants such as metals or petroleum hydrocarbons. The impacts associated with handling and disposal of contaminated dewatering effluent are further discussed in Section 5.21.14.

Bedrock. Impacts to the Terminal/Extension Project from poor quality bedrock would be limited to the cut-and-cover section under Second Street from Brannan Street to Folsom Street. Cut-and-cover construction in this area will make use of special shoring techniques discussed in Section 5.20.

5.21.18 SAFETY AND SECURITY

Evaluation of long-term project impacts on public safety and security is presented in Section 5.17. This section focuses only on the short-term safety and security impacts of construction activities.

Best construction management practices would be required to be in place to ensure the safety of construction workers, local residents, and employees during project construction. Fencing and lighting of construction and staging areas, and recognized safety practice requirements for the use of heavy equipment and the movement of construction materials would be implemented to avoid accidents. During construction, the Construction Manager would be responsible for job site safety and security. Emergency response personnel within San Francisco would be available for immediate response on an as-needed basis.

5.22 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The No-Project Alternative would not directly involve the use of resources, except insofar as it assumes implementation of planned and programmed capital improvements, which require money, materials, and labor to construct. This would include electrification of the entire Caltrain line from Gilroy to the Fourth and Townsend Streets Station in San Francisco and the need to upgrade or retrofit the existing Transbay Terminal to meet current seismic safety requirements. The Transbay Terminal / Caltrain Downtown Extension / Redevelopment project would involve major capital improvements, which would require money, materials, and labor, as shown in Tables 2.2-1, 2.2-2 and 2.2-3. Total project costs for the Locally Preferred Alternative are estimated to be $2.083 billion year-of-expenditure costs, including all project components.

Because the Transbay Terminal and Caltrain Downtown Extension Alternatives would reduce vehicle miles of travel within the region when compared to the No-Project Alternative, it would also reduce the level of vehicular fossil fuel consumption. Further reductions could occur because local transit operators (Muni and SamTrans) would no longer have to serve the Fourth and Townsend Streets terminal.

Operation of trains on the 1.3-mile extension would require the use of electricity for power, and would have greater propulsion energy requirements than the No-Project Alternative, although the energy requirements per passenger trip would be similar or less.

Operation of the new terminal would require the use of energy for lighting, heating, cooling, but the terminal would be designed to incorporate the latest sustainable features that would allow the building to use site-specific wind, daylight, and shading to reduce the building's energy needs. The design of the roof and exterior walls would facilitate natural ventilation and natural lighting of the interior. Use of mechanical cooling would be limited to enclosed office areas and data equipment rooms. Photovoltaic panels are proposed on the roof structure to capture solar energy. Rainwater would be collected and used for maintenance and irrigation of landscaping.

The new development proposed in the surrounding vicinity would also use energy for lighting, heating, and cooling, but this use would be somewhat offset by a reduction in the use of vehicular fuel, since these new residential, commercial, and retail spaces would be very close to a regional multi-modal transit hub. Automobile use should be less than it would be were the same level of development to be constructed in other, non-transit-oriented locations.

5.23 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The Transbay Terminal / Caltrain Downtown Extension / Redevelopment Alternatives would involve short-term uses of the environment during the construction period through the use of fuel and construction materials, through increases in noise levels and air pollutants, and through increases in traffic congestion and detours around construction sites. These short-term effects and uses of resources would result in long-term benefits such as improved access to downtown San Francisco from the Peninsula, improved connectivity between and among Caltrain and other regional transit systems, and a more vital mix of transit-oriented land uses in the Transbay Terminal vicinity, including housing. These improvements, when combined with the decrease in vehicle miles of travel on the regional highway network, improved air quality, and greater efficiency in energy consumption, would contribute to the long-term livability, and therefore productivity, of the region.

The current Transbay Terminal concept includes "a wide ranging sustainable approach to the terminal building that uses the natural wind flows in downtown San Francisco to ventilate and cool the facility, harnesses solar energy for passive hearing and cooling, and established sustainability protocols for materials, construction procedures, and long-term building operations."[51] Additional measures would be included in the design and specification of equipment to ensure energy efficiency, thereby helping to reduce the long-term energy requirements and the operating costs of the project.

[51] Transbay Terminal Improvement Plan, MTC, 2001, pg. 18.