CHAPTER 6: CONSTRUCTION

This chapter begins with a brief overview of activities that would occur prior to construction, and then introduces the proposed construction schedule. A description of the major elements within the schedule, including the construction methodology for activities associated with building a transit guideway, underground stations, and tunnel is provided. Also included in this chapter is the identification of construction staging areas other than the location of permanent facilities, which by default would be construction staging areas. Detailed information about construction of the alternatives is available in several technical reports that are listed in the bibliography and available upon request from VTA.

VTA would be responsible for construction of the BEP and SVRTP alternatives in accordance with the VTA/BART Comprehensive Agreement. This includes implementation of the mitigation measures associated with constructing the alternatives. Once construction is complete, BART would operate and maintain the system.

No construction activities would occur with implementation of the No Build Alternative without separate environmental documentation. Therefore, this alternative is only discussed generically in this section. However, the No Build Alternative projects (highway and transit improvements) would have the typical air quality, biology, cultural, hazardous materials, traffic, and noise construction effects and mitigation measures associated with these types of projects.

6.1 PRECONSTRUCTION ACTIVITIES

While many activities occur before construction of the BEP and SVRTP alternatives, the following major pre-construction activities are anticipated. Since the SVRTP Alternative includes a tunnel, some preconstruction activities apply only to this alternative. Such activities are indicated with a notation in the applicable heading.

6.1.1 GEOTECHNICAL INVESTIGATIONS

During the Preliminary Engineering phase, subsurface exploration consisted of geotechnical borings and cone penetrometer tests (CPTs). Other tests, including those that measure groundwater levels, were also conducted (see Section 4.7, Geology and Seismicity). The results of these investigations have been used to identify proposed construction techniques. During subsequent engineering phases, additional subsurface exploration will be conducted, and the results will be used to detail and finalize excavations and support systems to be used during construction for bridge and structure foundations and the retained cut, cut-and-cover, and tunnel portions of the alignment.

6.1.2 FINAL DESIGN AND DEVELOPMENT OF CONSTRUCTION CONTRACTS

The Final Design phase brings the design level to 100 percent, compared to the Preliminary Engineering design phase where the design level is at 35 percent. During the Final Design phase, VTA will work with property owners/developers planning to build new structures adjacent to the BEP and SVRTP alternative alignments to integrate construction of the alternatives with construction of these structures, thereby reducing adverse construction effects. Final Design will lead to refinements to construction contract packaging (plans and specifications), construction staging plans, sequencing, and durations.

6.1.3 CONSTRUCTION EDUCATION AND OUTREACH PLAN

Construction of the SVRTP Alternative would temporarily affect nearby businesses and residences along the entire alignment, including downtown San Jose, which has constraints on available space for construction. Prior to construction, a coordinated outreach effort will be implemented to address construction issues raised by local businesses and residents. The following mitigation measure will be implemented to address issues and to inform the public and other stakeholders of the construction schedule and associated activities:

Mitigation Measure CNST-1. A Construction Education and Outreach Plan will be developed by VTA to foster communication between VTA, various municipalities, and the public during the construction phase. The plan will be implemented to coordinate construction activities with existing business operations and other development projects, and establish a process that will adequately address the concerns of businesses and their customers, property owners, residents, and commuters. Critical components of this plan will include but are not limited to the following public outreach strategies:

- Frequent updates to stakeholder groups, business organizations, and municipalities;
- Public workshops and meetings with community members;
- Distribution of project information and advanced construction notification via flyers, emails, mailers and face-to-face visits;
- Continuous share of project information and contacts posted to the website;
- Media relations, i.e. news releases, news articles and interviews; and
- Onsite outreach coordinator/personnel.

Throughout development and implementation, the education and outreach activities will be: comprehensive, seeking widespread involvement; proactive, with efforts geared toward obtaining input, as well as disseminating information; responsive to various needs, including multiple languages and alternative formats; and timely, accurate, and results oriented.

6.1.4 PRE-CONSTRUCTION BUSINESS SURVEY

Prior to construction, VTA will contact and interview business owners along the alignment to gather information on business usage, delivery/shipping patterns, parking needs, and critical times of the day or year for business activities. The survey would assist in development of the Construction Education and Outreach Plan.

6.1.5 LAND AND EASEMENT ACQUISITION

Property acquisition would be required prior to construction, as discussed in Section 5.12, Socioeconomics. Property easements would be required for properties directly above the tunnel. Temporary construction easements and public service easements would be needed along the alignment to facilitate construction.

6.1.6 ENVIRONMENTAL PERMITS AND APPROVALS

VTA would acquire necessary environmental permits and approvals as identified in Section 11.3.3 of Chapter 11, Agency and Community Participation. Coordination with permitting agencies is an important aspect of VTA's construction management. In addition, cooperative agreements related to construction activities may be developed with affected agencies and jurisdictions.

6.1.7 PROCUREMENT OF THE TUNNEL BORING MACHINES

Under the SVRTP Alternative, VTA would procure two earth pressure balance (EPB) tunnel boring machines (TBMs) to construct the twin tunnel bores. Procurement would include the design and manufacture of the machines, factory assembly and testing, delivery to site, assistance with assembly onsite, support throughout tunnel construction, and supply of spare parts. The process of procurement would begin with pre-qualifying manufacturers who can then bid on the contract to provide VTA with the required machines.

6.2 MAJOR CONSTRUCTION ACTIVITIES

6.2.1 CONSTRUCTION SCHEDULE

The BEP and SVRTP alternatives would take approximately eight years to construct and perform testing and start-up activities. Passenger service would start in 2018 for either alternative, assuming funding is available. The schedule for major construction activities for the BEP Alternative is shown in Figure 6–1. The schedule for major construction activities for the SVRTP Alternative is shown in Figure 6-2. The following provides a description of the major activities.

6.2.2 UTILITY RELOCATION

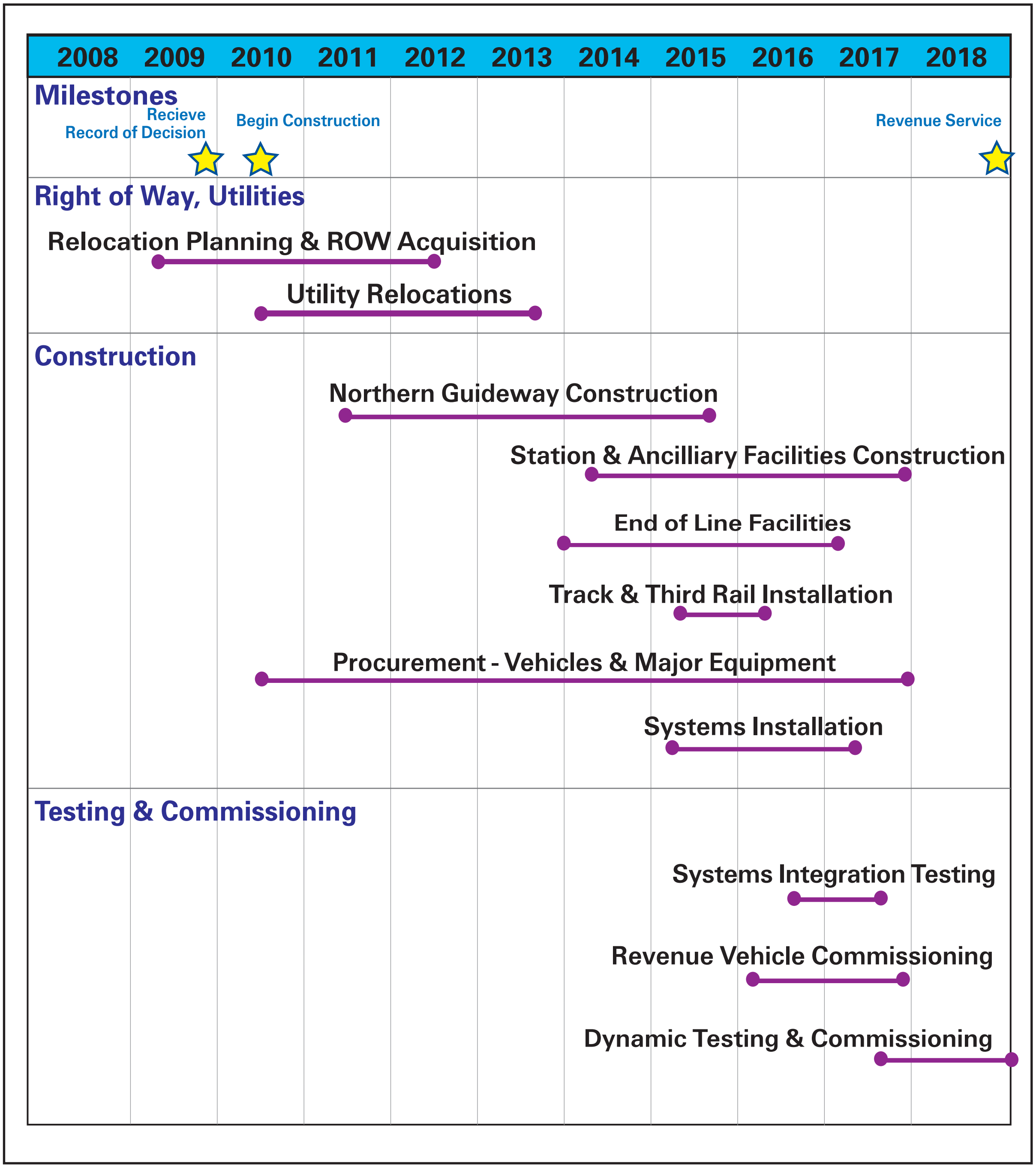
Utility relocation would be required for underground or overhead utilities depending on the location. Utilities to be relocated would include storm drains, sanitary sewers, water mains, petroleum and nitrogen lines, electricity and gas lines, and communication lines. A list of existing major utilities along the BEP and SVRTP alternative alignments is included in Section 4.13, Utilities.

Construction equipment typically required for utility relocation includes excavator/backhoes, trenchers, trucks, cranes, and generator/compressors. Concrete trucks, pavers, rollers, and power compactors are typically required for street restoration where streets are affected by the utility work.

From the Warm Springs Station to the east tunnel portal (including the Las Plumas Yard Option area), many utilities run parallel to, or cross the BEP and SVTRP alignments or roadways that may be reconfigured by VTA. These utilities would be protected in place, removed entirely, or relocated horizontally and/or vertically. Utilities relocations within the railroad corridor would be in accordance with BART Facilities Standards and UPRR criteria, where applicable. Existing UPRR electrical and communication lines that are no longer required due to VTA's purchase of much of the railroad ROW would be removed. Where utilities cannot be relocated within either the railroad or public street ROW, such as those that conflict with reconfigured roadways, new utility easements or property acquisition may be required.

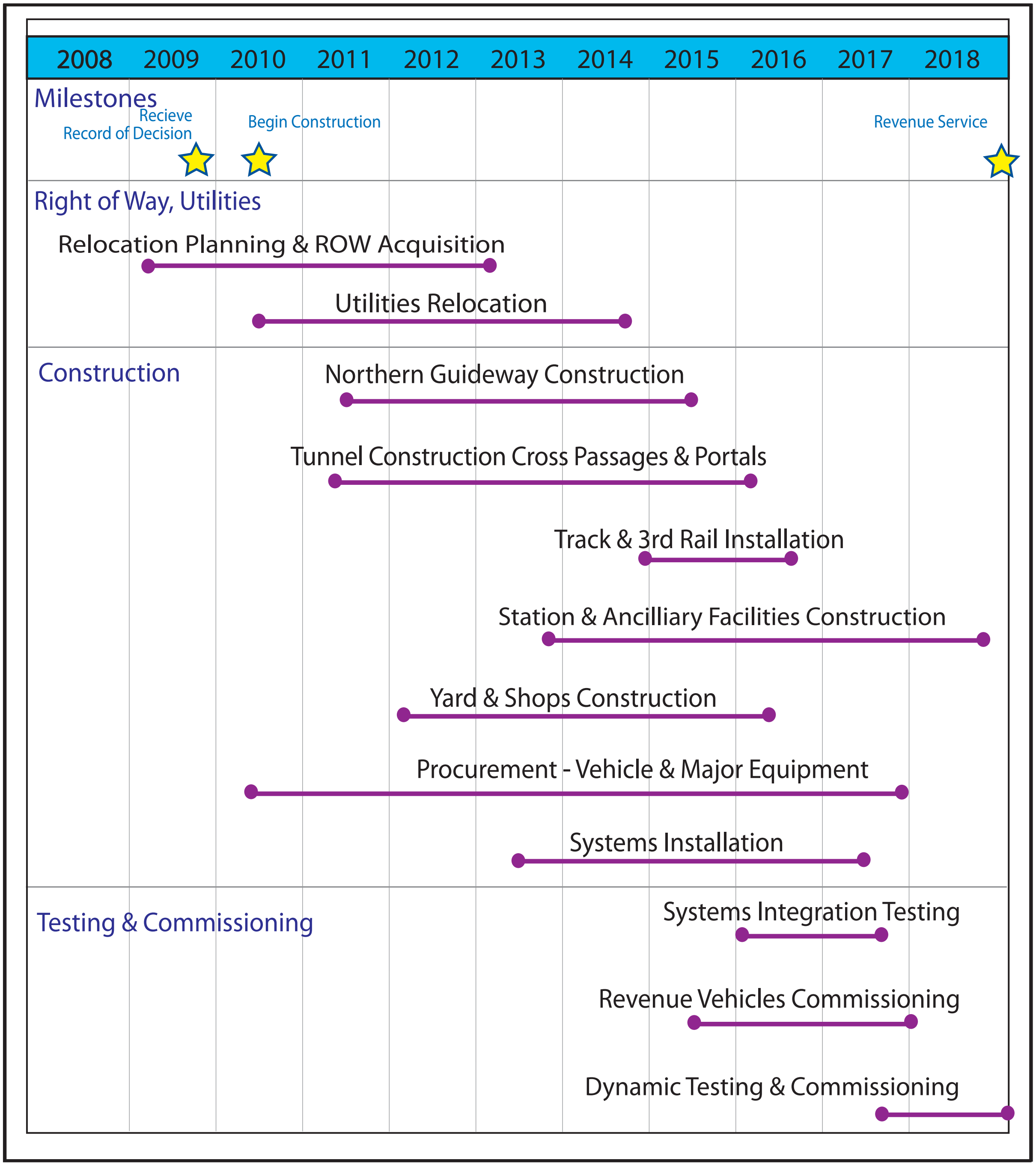
Specific to the SVRTP Alternative, for the tunnel alignment, utilities within the vicinity of cut-and-cover excavations that are in physical conflict with the SVRTP Alternative's permanent or temporary structures (cut-and-cover boxes for the portals and stations, vent shafts, temporary roadway decking, and bored tunnels) would require relocation. The major utility relocations for the five primary cut-and-cover excavations along the tunnel alignment would be as follows:

- Two sanitary sewer mains are in conflict with the cut and cover box for the east tunnel portal and would be relocated to the south of the portal above the bored tunnel.



Source: VTA, 2008.

Figure 6-1: BEP Alternative Proposed Construction Schedule



Source: VTA, 2008.

Figure 6-2: SVRTP Alternative Proposed Construction Schedule

- A storm drain is in conflict with the Alum Rock Station, a traction power substation, and parking garage. The storm drain would be relocated to avoid these structures. The northeasterly end of the Alum Rock Station encroaches into the Caltrans ROW and adversely affects another storm drain. This storm drain would require relocation prior to construction of the station box.

- Several communications duct banks with associated vaults, electrical ducts and vaults, gas lines, water lines, storm drains, and sanitary sewers are in conflict with the Downtown San Jose Station. Most of these utilities would require reconstruction and/or relocation.

- A sanitary sewer line is in conflict with the Diridon/Arena Station box and would be relocated to the east end of the station. For the most part, other utilities crossing the Diridon/Arena station at Autumn, Montgomery, and Cahill streets would be supported in place during construction but not relocated.

- A sanitary sewer and a storm drain are in conflict with the cut and cover box for the west tunnel portal and would be relocated to the south of the portal above the bored tunnel.

For the Santa Clara Station and Newhall Yard and Shops facility, also specific to the SVRTP Alternative, utilities would be protected in place or relocated horizontally and/or vertically. In general, all existing UPRR utilities within the Newhall Yard and Shops ROW would be abandoned by UPRR and removed. Likewise, all existing utilities within the Newhall Yard and Shops facility that serve the Federal Express Building would be abandoned and removed. Utilities near the Santa Clara Station and pedestrian bridge would be protected in place, as needed. In the tail track area of the yard and shops facility, a 60kV overhead electric line would be relocated in accordance with BART Facility Standards to a location outside the ROW. Also in the tail track area, two communication towers would be in conflict with the alignment and would be relocated. A communications line that conflicts with the vehicle turntable, non-revenue maintenance and engineering shop, and Santa Clara Station would be relocated to near Newhall Street outside the ROW. Utilities along Brokaw Road would be relocated as necessary to accommodate road widening for station access. Finally, an existing Silicon Valley Power Substation would be relocated within the Newhall Yard and Shops site.

6.2.3 LINE SEGMENT CONSTRUCTION

The “line” refers to the alignment along the railroad corridor from the planned BART Warm Springs Station to just south of Berryessa Station for both the BEP and SVRTP alternatives. Construction of the line segment includes grade separations between the BART alignment and several roadways followed by construction of the transit guideway.

The majority of the following discussion applies to both the BEP and SVRTP alternatives. Where indicated, some portions of the discussion describe the line civil construction for the SVRTP Alternative only.

Roadway Grade Separations

Construction along the line segment would include grade separations between the alignment and several roadways. The BEP and SVRTP alternatives would require that the following roadways be reconfigured by VTA (this list does not include roadway crossings that would be reconfigured by other agencies prior to construction of these alternatives).

- **Kato Road.** BART would cross at grade on a new bridge structure over Kato Road, which would be reconstructed as a roadway underpass.
- **Dixon Landing Road.** Under the At Grade Option, Dixon Landing Road (which is currently at grade) would be reconfigured as a new roadway underpass with BART passing over the roadway at grade on a new bridge structure. Also, Milmont Drive, a cross street adjacent to Dixon Landing Road and to the west of the railroad ROW would be lowered due to the slope of the Dixon Landing Road underpass. Under the retained cut option, BART would transition into a retained cut at the county and city lines to south of Dixon Landing Road. Dixon Landing Road would remain at grade, but be supported over the BART retained cut on a new roadway bridge structure. The UPRR crossing would also remain at grade.
- **Montague Expressway.** There are BART alignment options at Montague Expressway: Retained Cut Long and Retained Cut Intermediate. Under both alignment options, Montague Expressway would be supported above BART on a new roadway bridge structure.
- **Capitol Avenue.** Under both the Retained Cut Long and the Retained Cut Intermediate Option, Capitol Avenue would remain at grade, but be supported above BART on a new roadway bridge structure.
- **Trade Zone Boulevard.** Under both the Retained Cut Long and the Retained Cut Intermediate Option, Trade Zone Boulevard would remain at grade, but be supported above BART on a new roadway bridge structure.
- **Hostetter Road.** BART would pass under Hostetter Road in a retained cut. Hostetter Road would remain at grade, but be supported over the BART retained cut on a new roadway bridge structure.
- **Sierra Road/Lundy Avenue.** BART would pass under the Sierra Road/Lundy Avenue intersection. These roadways would remain at grade, but the intersection would be supported over the BART retained cut on a new roadway bridge structure.

- **Berryessa Road.** BART would pass over Berryessa Road on an aerial structure. Minor improvements such as restriping and median work would be required for the roadway. In addition, due to the span of the aerial structure over the roadway, a column support would be constructed in the center of Berryessa Road.

Transit Guideway Configurations

There are four types of transit guideways and construction methodologies for the line civil portion of the BEP and SVRTP alternatives: at grade, retained cut, retained fill, and aerial. In some cases, the methodology applies to structures as well, such a roadway reconfigured as an underpass (retained cut) or a station constructed aboveground (aerial). The locations where the different types of construction are utilized along the alignment are shown in Appendices B and C at the bottom of each drawing.

At Grade Configuration

Under an at grade configuration, the location of the transit guideway is at the same level as the ground surface. The portions of the BART alignment that would be at grade include the following locations:

- From the planned BART Warm Springs Station to just south of Dixon Landing Road. (Note that there are 2 options at Dixon Landing Road. The BART alignment would be at grade from the planned BART Warm Springs Station to just south of Dixon Landing Road only if the At Grade Option is chosen. If the Retained Cut Option is chosen, BART would be at grade from the planned Warm Springs Station to the Alameda/Santa Clara county and Fremont/Milpitas city line.)

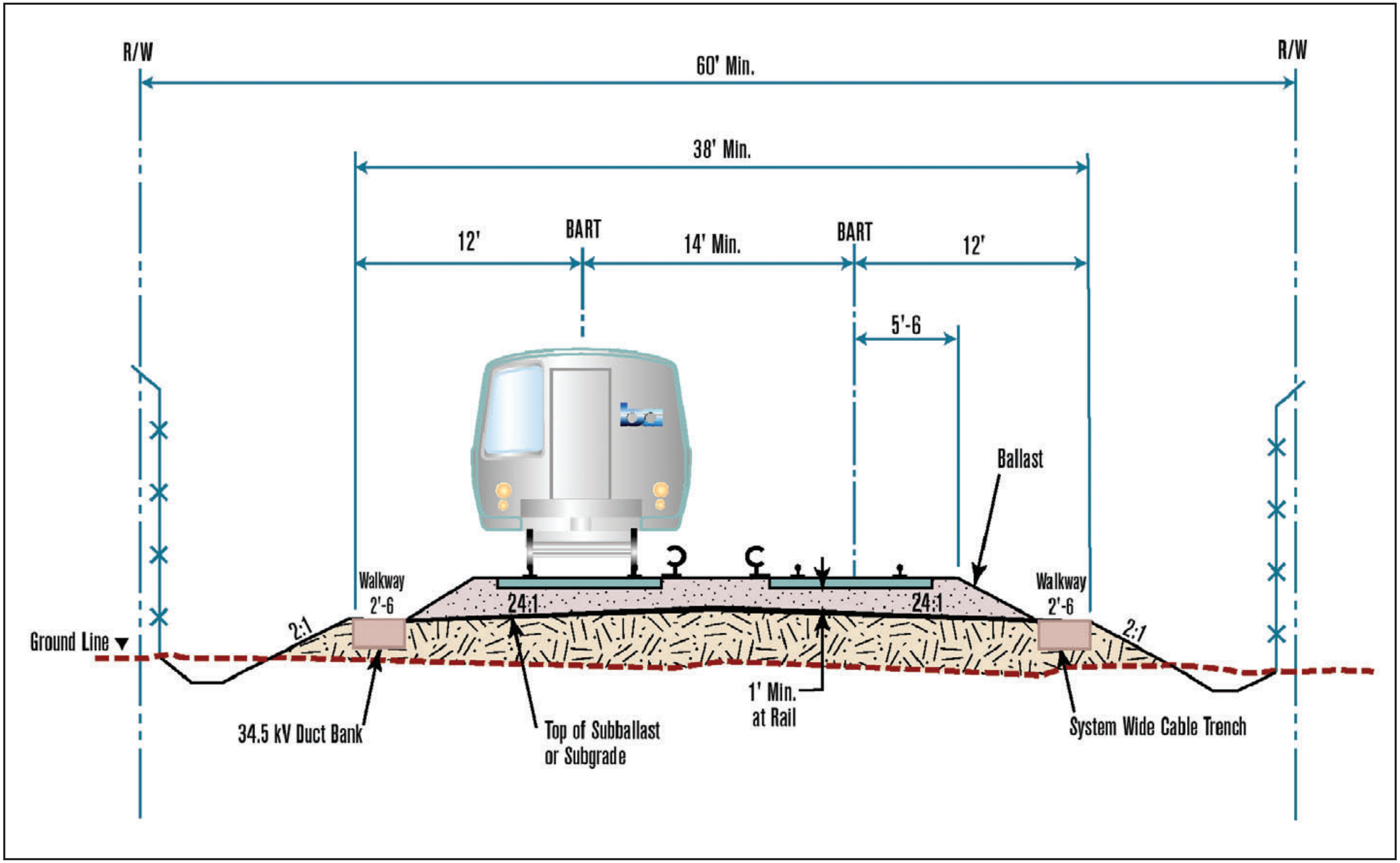
- Just south of Dixon Landing Road to just south of Curtis Avenue in Milpitas. (Note that end location for this at grade segment would vary depending on whether the Retained Cut Intermediate or Retained Cut Long Option is chosen.)

- From south of Trade Zone Boulevard to north of Hostetter Road.

- From south of Sierra Road/Lundy Avenue to north of Berryessa Road.

- From north of the west tunnel portal, through the Newhall Yard and Shops facility, to the end of the tail tracks just north of De La Cruz Boulevard. (SVRTP Alternative)

Figure 6-3 shows a conceptual cross section for a BART at grade guideway. At grade construction for a transit guideway begins with the removal of existing UPRR railroad tracks, ballast, and sub-ballast. Heavy construction equipment such as rubber-tired or track excavators, scrapers, loaders, and bulldozers are used to excavate and remove 2 to 3 feet of surface material. The excavated material is loaded onto trucks or railroad cars and transported from the site for disposal. Any excavated material that is



Source: VTA, 2007.

Figure 6-3: At-Grade Guideway

contaminated is transported to a disposal facility that handles such waste or encapsulated in fill in accordance with applicable regulations. After removal of the surface material, the subgrade soils are evaluated for their ability to support the guideway. If the subgrade soils are unsuitable for supporting the guideway, they are excavated and either recompacted or removed and replaced with suitable soils. Graders, scrapers, bulldozers, and similar earth-moving equipment are used to spread the excavated or replacement soil, and a sheep's foot, steel wheel, or rubber-tire rollers are typically used to compact the soil.

Construction of the BART tracks begins with a layer of compacted material similar to that used for roadways. Ballast, rails, and ties are installed next using specialized equipment. To provide for power to the electric third rail, 34.5-kilovolt ducts (conduits encased in concrete) are laid in a trench and covered with earth backfill. The actual power cables are installed later.

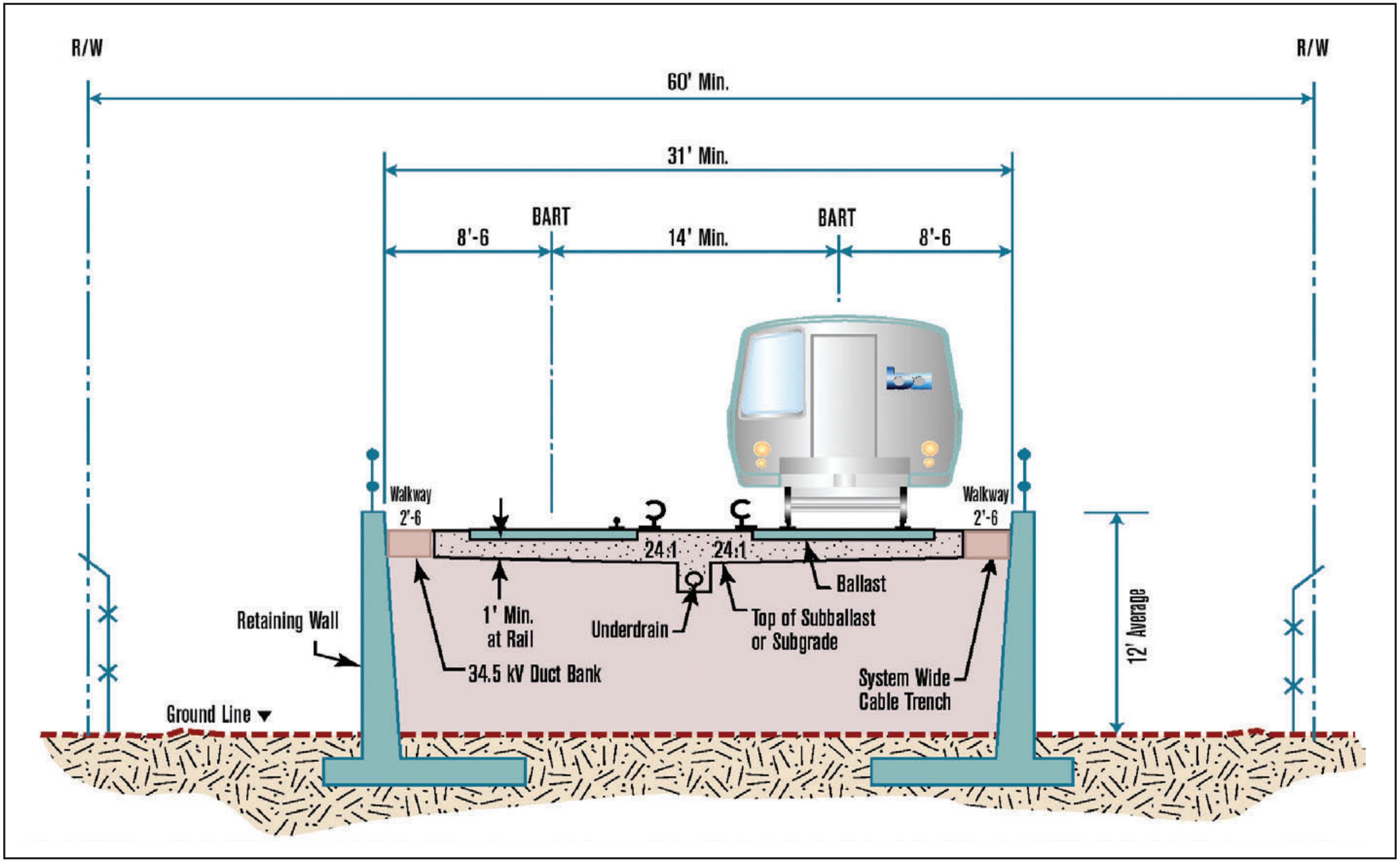
Retained Fill and Aerial Configurations

The retained fill portions of the alignment precede and/or follow the aerial sections, such as bridges or aerial guideways. For a retained fill configuration, the location of the transit guideway is elevated above the existing ground on fill material. For an aerial configuration, the location of the transit guideway is located above existing ground. The portions of the BART alignment that would be on retained fill and in an aerial configuration include the following locations:

- From north of Berryessa Road to either north of the east tunnel portal in the SVRTP Alternative or north of either the Las Plumas Yard Option facility or the tail tracks in the BEP Alternative, BART would be in an aerial configuration over Berryessa and Mabury roads. BART would be on retained fill on both sides of these aerial structures.

Figure 6-4 shows a conceptual cross section for a BART retained fill guideway. Construction begins with the excavation for retaining wall footings. This excavation is generally performed with excavators or backhoes. Due to seismic design requirements, retaining walls may require pile foundations. The piles are generally steel or concrete, and are driven into the ground with either conventional pile drivers or vibratory pile driving equipment, which creates less noise but may not be feasible in all soil types. Cast-in-drill-hole piles, consisting of concrete placed in a drilled hole, may be suitable for wall foundations and would create less noise and vibration than driven piles.

Next, reinforced concrete retaining walls or mechanically stabilized earth (MSE) walls are constructed. For concrete walls, reinforcing steel is installed and forms are created and filled with concrete. Reinforcing steel is generally pre-bent and fabricated and delivered to sites where it is unloaded by cranes. Concrete is delivered in ready-mix concrete trucks and usually pumped into the forms. If prefabricated forms are used, they are set in place with cranes. After the walls are constructed, the space in between the walls is filled with onsite or offsite soil material. The material is spread with graders and bulldozers and compacted with sheep's-foot, steel wheel, or rubber-tire rollers.



Source: VTA, 2007.

Figure 6-4: Retained Fill Guideway

MSE walls do not require an independent concrete wall be constructed. With these walls, an earth embankment forms a part of the structure (see Figure 6-5). Fill is stabilized with rebar as part of the wall construction, and backfill occurs concurrently in several lifts until the MSE wall reaches the final height. MSE walls are relatively easy to construct and require less construction time than cast-in-place concrete.

Figure 6-6 shows conceptual cross sections for BART aerial guideways. Construction begins with pile foundations that will support the weight of the structure, called "dead load," and the weight of the trains, called "live load." The main components of the foundation are the piles and pile cap. Steel or concrete piles are driven by pile driving equipment, unless cast-in-drilled-hole piles are used. The pile cap, which joins the tops of the piles, is constructed of reinforced concrete and is approximately 4 to 5 feet thick. Next, columns for the aerial guideway are constructed of reinforced concrete, which typically is poured inside a reusable steel form. The shape of a column can vary; however, a circular column approximately 5 feet in diameter is generally used. Aerial girders (the main supporting horizontal beams) are then installed after the column concrete has cured for a sufficient time, approximately 14 days. Aerial girders generally consist of pre-cast concrete segments that are fabricated offsite and brought to the construction site by truck, although steel girders can be used for long spans or special circumstances. The aerial girders are lifted into place by large cranes and secured to the columns. Erection of these girders over active roads generally must be done at night. Due to the size of the cranes, special staging areas close to the site are usually needed to set up the cranes and temporarily store the girders. Alternatively, cast-in-place concrete bridges can be constructed. These require falsework to support the forms. Depending on the lengths of the horizontal spans, falsework can be several feet deep. If a bridge is spanning a roadway, the bridge must be designed with sufficient clearance, usually 16½ feet. Clearance may be temporarily reduced during construction, and trucks and other vehicles may require detouring.

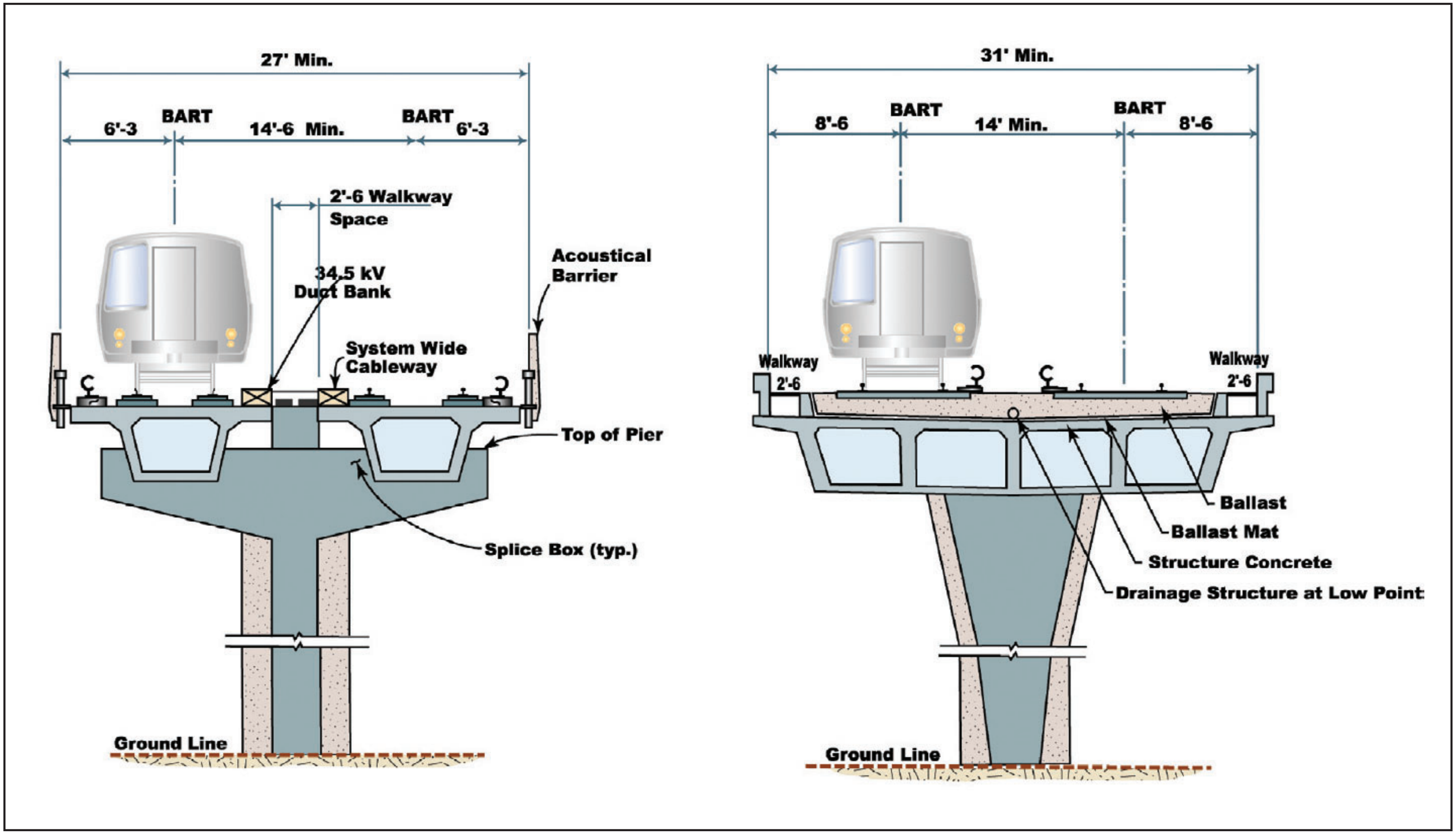
Retained Cut Configuration

Under a retained cut configuration, the transit guideway (or roadway underpass) is located below ground where existing material is excavated to form a trench. The earth excavated from a retained cut can either be used for embankment onsite (if found to be suitable) or hauled to a disposal site. The equipment used to move the material can vary, but normally includes backhoes, bulldozers, front-end loaders, trucks, and scrapers. The water from the dewatering of the excavation area may be placed in settling ponds, "Baker Tanks," or some other equivalent water containment to allow suspended solids in the water to settle out. Onsite treatment may be required if the water is contaminated prior to discharge into the storm or sanitary sewer system. Contaminated water that could not be treated onsite would be disposed of offsite.

- Concrete retaining walls are constructed on either side of the trench to support the adjacent ground. The transit guideway is placed either on subgrade or a concrete slab at the bottom of the trench. The concrete slab could just support the guideway or it could be connected and function structurally with the retaining walls. In this latter case,

Source: VTA, 2007.

Figure 6-5: Mechanically Stabilized Earth Wall



Source: VTA, 2007.

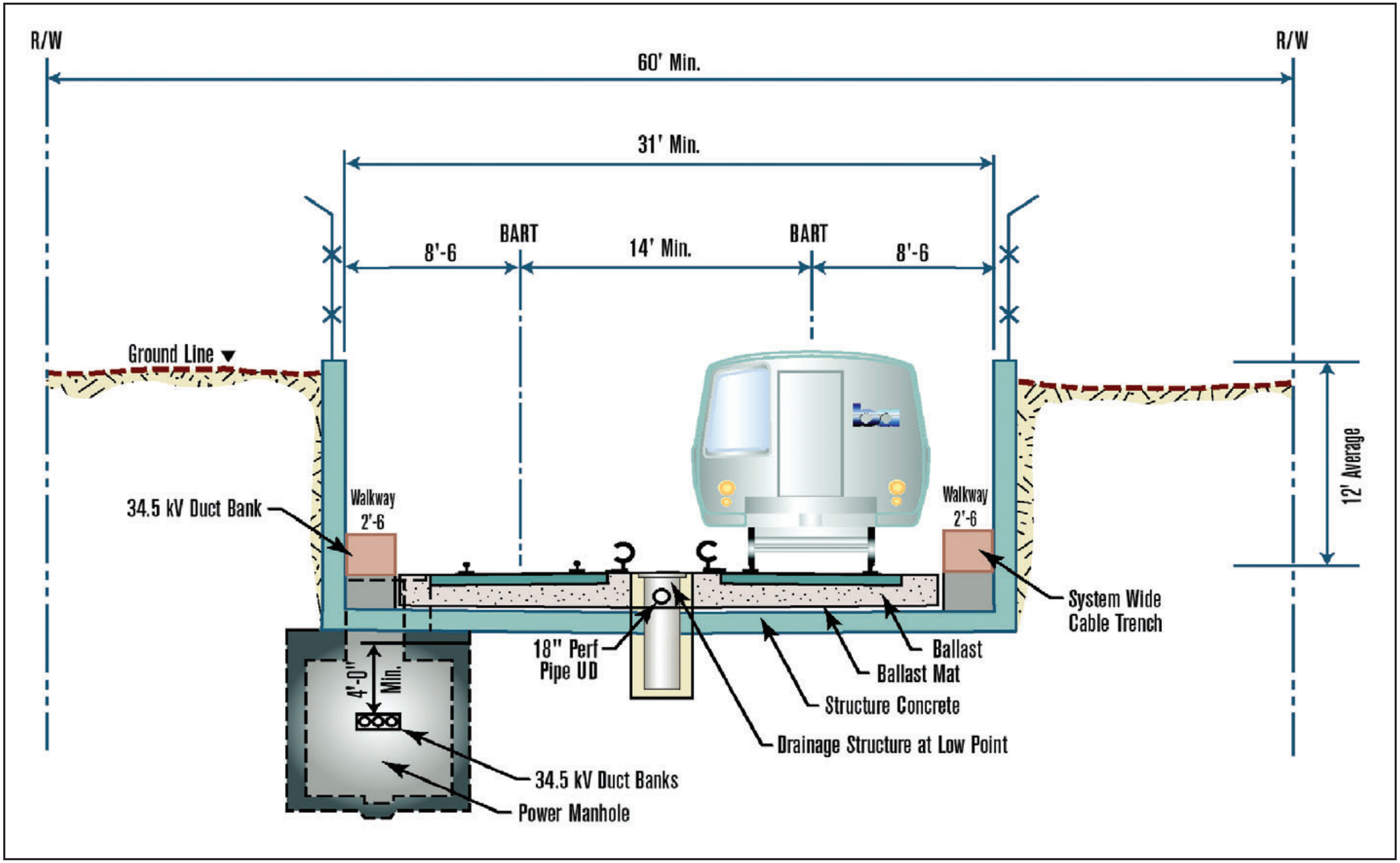
Figure 6-6: Aerial Guideways

the configuration is referred to as a "U-wall," as the wall and slab form a 'U' shape. For deepretained cuts requiring high walls in areas of high groundwater, the U-wall structure may require special provisions to resist uplift caused by the buoyant forces of the groundwater (hydrostatic pressure). The concrete slab may be thickened to provide extra weight, or the slab may extend beyond the walls into the adjacent ground, or piles may be required to hold down the base slab. The piles can be driven or placed in drilled holes. Auger piles or screw anchors may also be used. Figure 6-7 shows a conceptual cross section of a retained cut U-wall for BART.

The portions of the BART alignment that would be in a retained cut configuration include the following locations:

- Kato Road, which would be reconstructed as a roadway underpass in a retained cut with BART crossing over the road in an at grade configuration.
- Under the At Grade Option, Dixon Landing Road would be reconstructed as a roadway underpass in a retained cut. Under the Retained Cut Option, Dixon Landing Road would remain at grade, but be supported on a new roadway bridge structure over the BART alignment. The BART alignment would be in a retained cut from the county and city lines to just south of Dixon Landing Road.
- From south of Curtis Avenue, past the Milpitas/San Jose city line, to south of Trade Zone Boulevard, with the Retained Cut Long Option for the alignment south of Curtis Avenue (near the Great Mall). If the Retained Cut Intermediate Option were chosen, BART would transition into a retained cut farther south than under the Retained Cut Long Option (approximately 2,000 feet north of Montague Expressway), and continue past the Milpitas/San Jose city line to south of Trade Zone Boulevard.
- From north of Hostetter Road to south of the Sierra Road/Lundy Avenue, BART would be in a retained cut.
- A portion of the alignment just north of the east tunnel portal would be in a retained cut. (SVRTP Alternative)
- A portion of the alignment just north of the west tunnel portal would be in a retained cut. (SVRTP Alternative)

Due to the nature of soft soils, presence of high groundwater, and close proximity of adjacent buildings, temporary shoring walls would be needed to support the sides of retained cuts prior to construction of the permanent structures. Several methods can be used for temporary shoring walls including steel sheet piles, soldier piles and lagging, and soil nailing, which are briefly described below. These methods are preferred for retained cut construction where the excavations are shallower. Other methods may be used for deeper excavations, as necessary, and are described previously for the cut



Source: VTA, 2007.

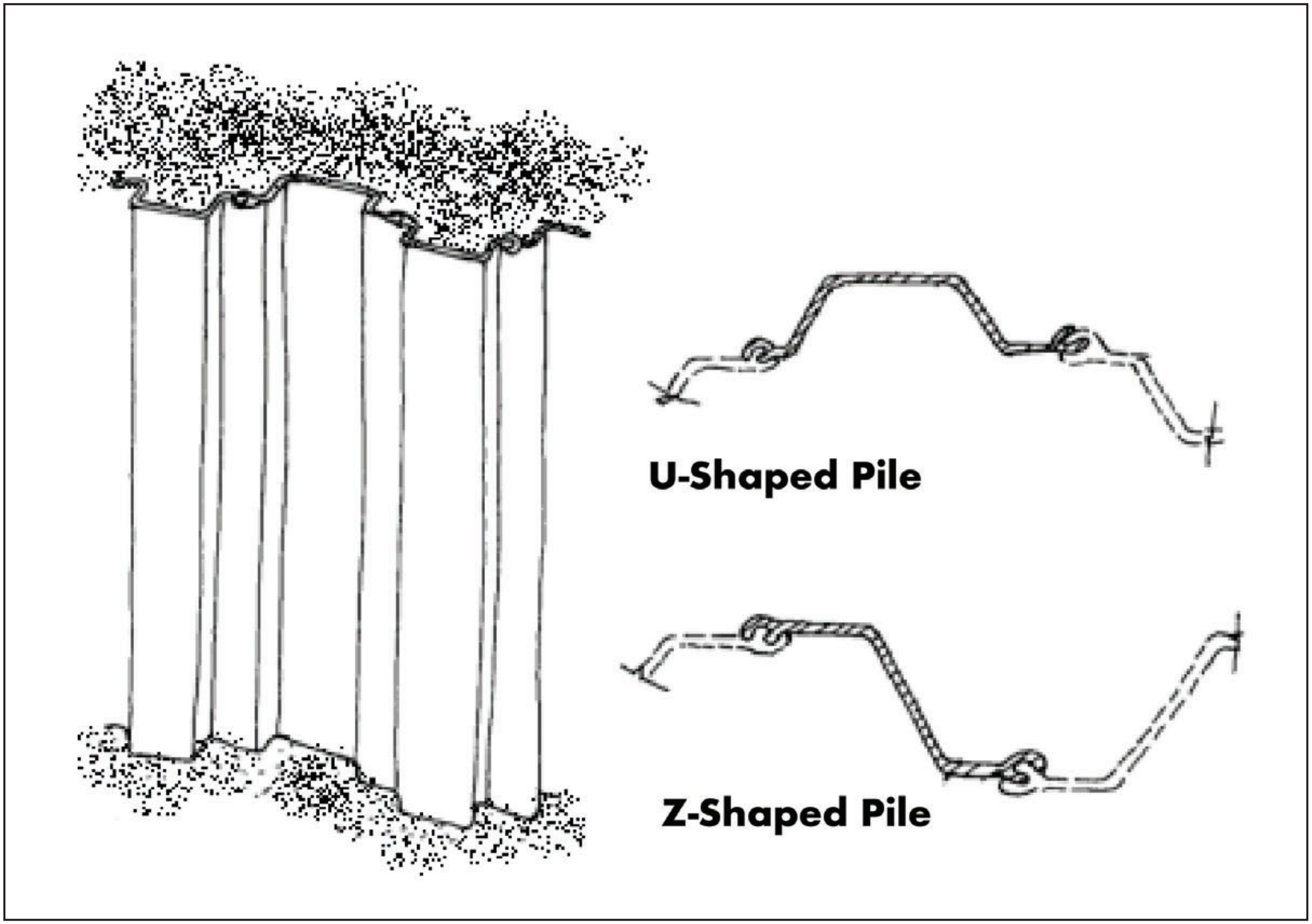
Figure 6-7: Retained Cut U-Wall

and cover cut portions of the alignment. One or more methods may be used at a single location depending on site-specific conditions. Depending on the method chosen for the temporary shoring walls and the depth of groundwater, varying degrees of dewatering would be required.

Steel sheet piles. Steel sheet piles consist of interlocking Z- or U-shaped steel sections that are driven into the ground by either a percussion or vibratory hammer prior to excavation (Figure 6-8). During excavation between the two sheet pile walls, horizontal steel beams are placed along the walls at designated spacing to transmit the soil and groundwater forces to lateral-bracing members. Typically the lateral-bracing members can be either struts composed of steel H-beams or steel pipes that span across the width of the excavation (Figure 6-9) or tieback anchors that can be placed in drilled holes through the sheet piles into the earth behind the walls and grouted to provide an anchor from outside the walls (Figure 6-10). The latter method provides an open, unrestricted trench area that does not interfere with the construction of the retained cut guideway. Use of the tieback method would depend on the nature of the soils and the availability of sufficient ROW behind the walls in which to install them, and could include temporary underground easements from the adjacent property owners. The equipment used to install steel sheet piles typically includes an impact pile driver or vibratory pile driver, material delivery trucks, and a crane.

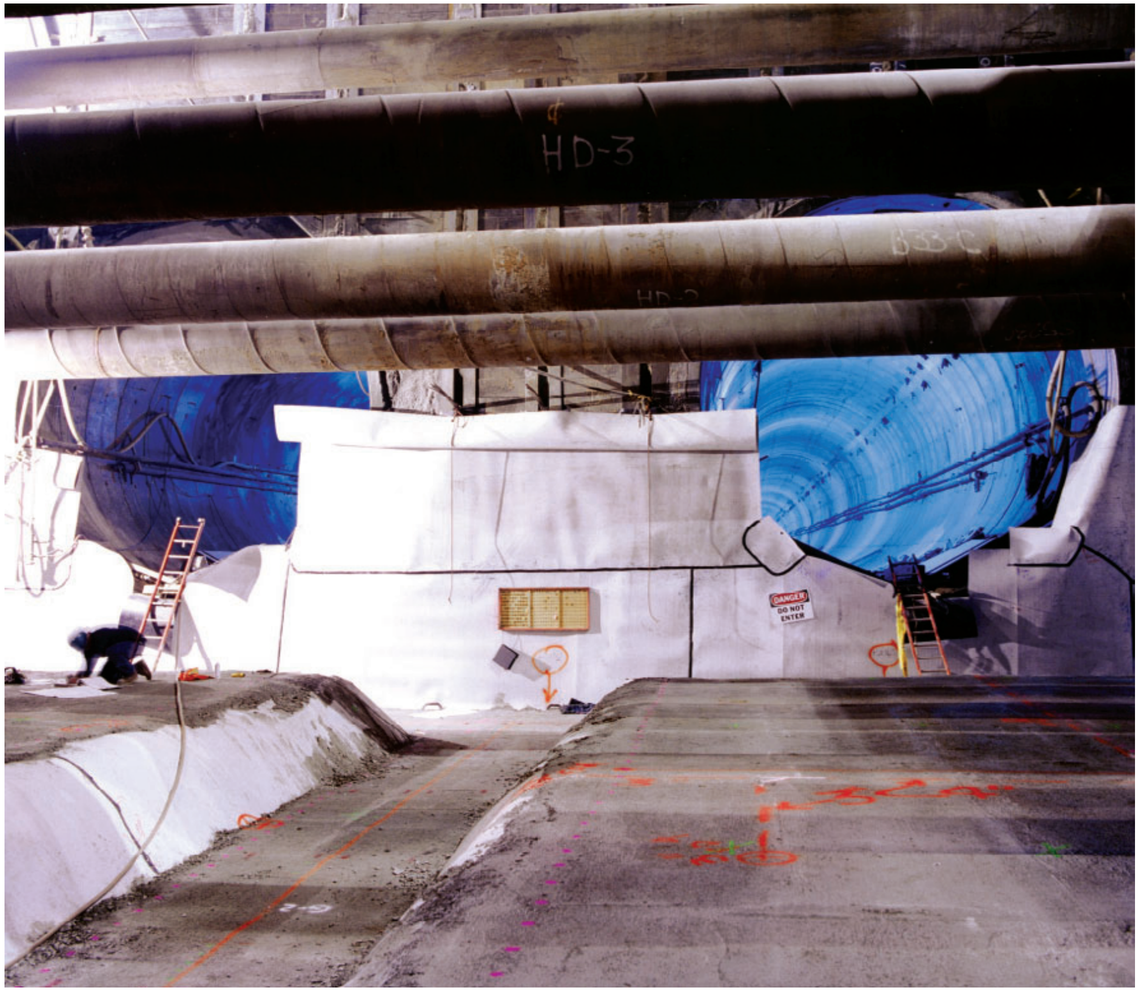
Soldier Piles and Lagging. Soldier piles are steel H-beam column sections placed either in predrilled holes, which are then filled with concrete, or driven into the ground using either a percussion or vibratory hammer, at a regular spacing of approximately 4 to 6 feet. Timber or steel planks (“lagging”) are placed between the H-beams as excavation proceeds from the top down. The end result is a wall composed of steel H-beam column sections with timber planks placed horizontally between them (Figure 6-11). This system also requires lateral bracing similar to the steel sheet pile walls described above. Typically the equipment used to install soldier steel piles and lagging includes an impact pile driver or vibratory pile driver, auger drill rig, material delivery trucks, crane, and spoils hauling trucks for material removed from the predrilled holes.

Soil nailing. Soil nailing is a method of reinforcing a soil mass so that the soil will act as a stable unit. Soil nails consist of reinforcing steel bars or other bar sections inserted in small-diameter holes that are drilled or augered into the exposed sides of an excavation as the excavation proceeds from the top down. The bars are grouted in place along their entire length. After soil nails are installed, a shotcrete facing approximately 4 inches thick is applied to the excavation face (Figure 6-12). Shotcrete is a concrete mixture that is pneumatically blown under pressure onto a mesh of reinforcement connected to the soil nails. The sequence of excavation, nail installation, and shotcreting is repeated until the final excavation grade is reached. The equipment used to install soil nails includes a drill rig, material delivery trucks, mobile crane, grout pump, and shotcrete pump.



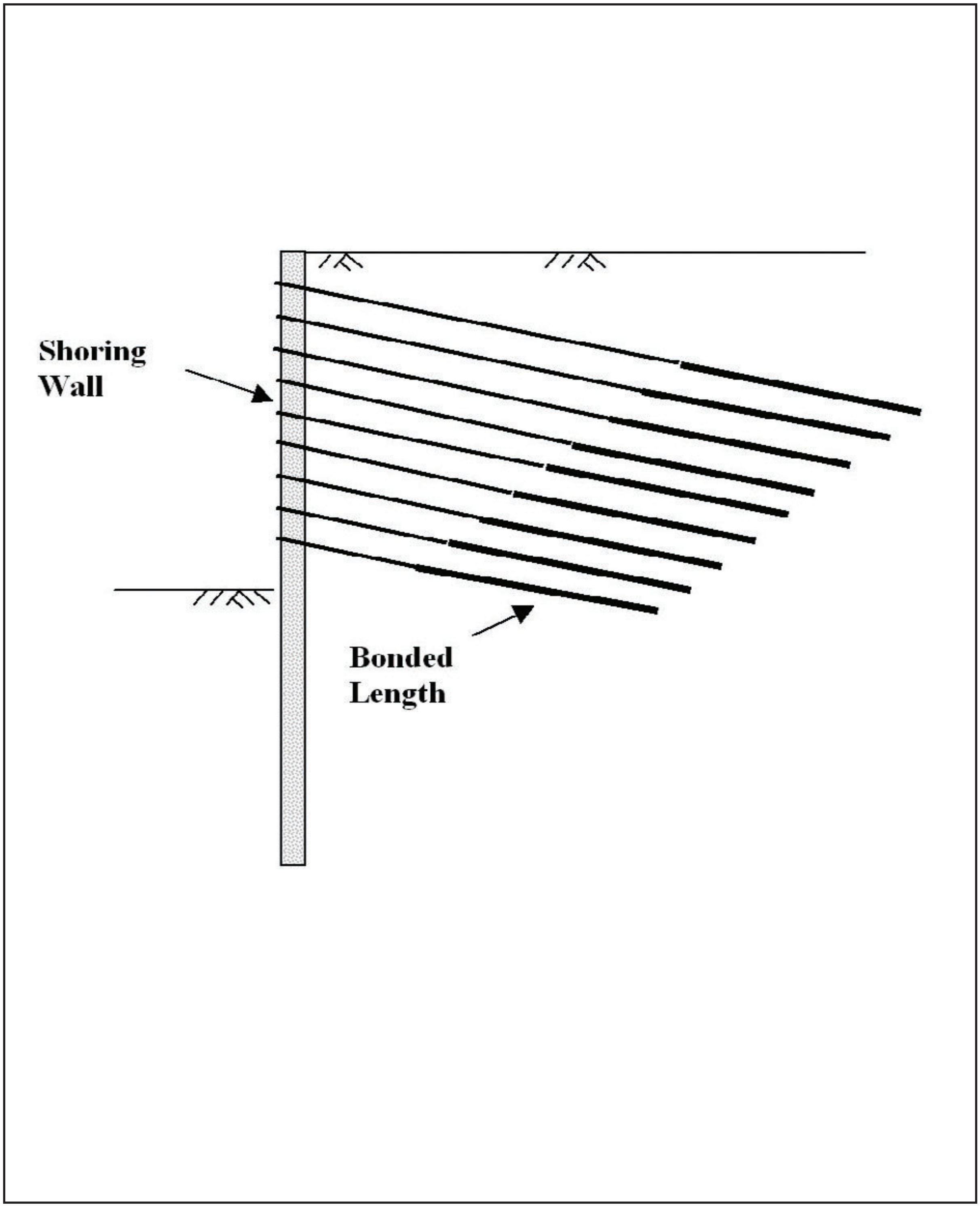
Source: VTA, 2007.

Figure 6-8: Steel Sheet Pipes



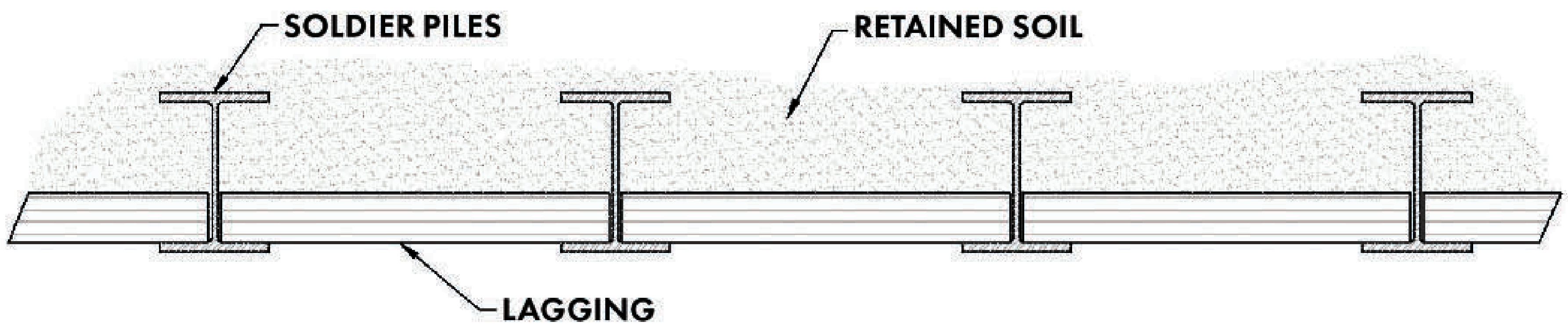
Source: VTA, 2007.

Figure 6-9: Lateral Bracing Members



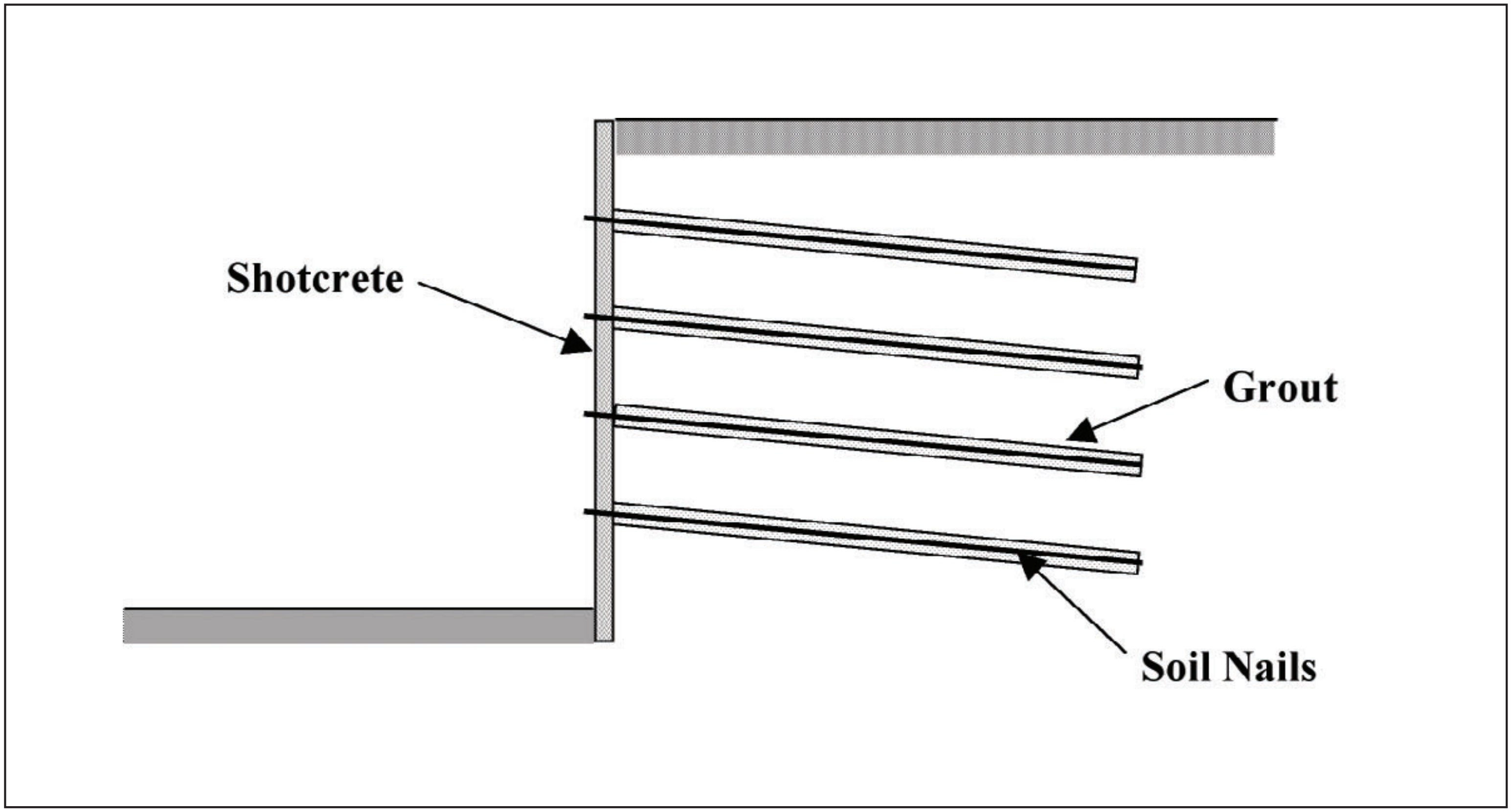
Source: VTA, 2007.

Figure 6-10: Basic Components of a Tieback Anchor



Source: VTA, 2007.

Figure 6-11: Soldier Piles and Lagging



Source: VTA, 2007.

Figure 6-12: Soil Nail Wall

6.2.4 TUNNEL PORTALS, UNDERGROUND STATIONS, AND MID-TUNNEL VENTILATION STRUCTURES

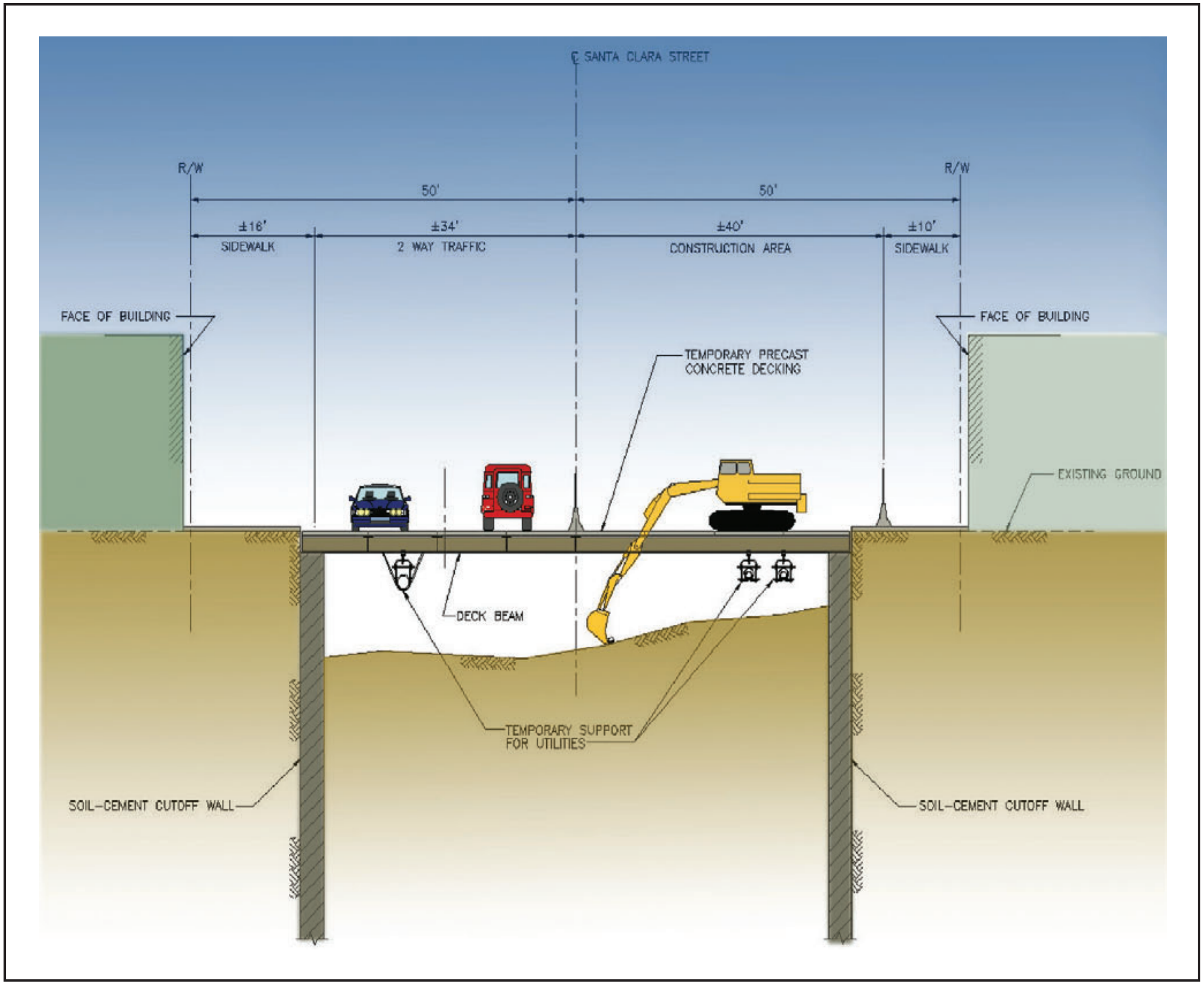
The major activity associated with the tunnel portals and underground stations (Alum Rock, Downtown San Jose, and Diridon/Arena stations), as well as the mid-tunnel vent structures and downtown crossover, would be cut and cover construction. These activities are specific to the SVRTP Alternative. Cut and cover construction would occur at the following locations:

- At the east tunnel portal, cut and cover would occur between the portal and the tunnel headwall, where the portal equipment room would be located.
- Cut and cover would occur at the Alum Rock Station.
- West of Coyote Creek, there are five alternate locations for Tunnel Ventilation Structure FSS. One potential location is on the south side of East Santa Clara Street between 15th and 16th streets. Another location is also on the south side of East Santa Clara Street between 14th and 15th streets. On the north side of East Santa Clara Street just west of 17th Street, one potential location includes a site on the former San Jose Medical Center property. The last locations are also on the north side of East Santa Clara Street between 13th and 14th streets and between 12th and 13th streets. Depending on which site is required for the vent shaft associated with the ventilation structure.
- Cut and cover would occur at the Downtown San Jose Station for both the station box and the crossover located to the east of the station.
- Cut is selected, cut and cover construction within the street ROW may and cover would occur at the Diridon/Arena Station.
- On the east side of Stockton Avenue between approximately Schiele Avenue and Villa Avenue, there are optional locations for Tunnel Ventilation Structure STS, an aboveground facility with an associated vent shaft, and Auxiliary Power Substation SST (STA 786+00 to STA 791+00). One potential location is on the east side of Stockton Avenue near Schiele Avenue. Three other locations are also on the east side of Stockton Avenue near Villa Avenue.
- At the west tunnel portal, cut and cover would occur between the portal and the tunnel headwall, where the portal equipment room would be located.

Cut-and-cover construction includes excavation from the street or ground level down. If a large excavation is located within a street (as with the underground stations and mid-tunnel vent structures), a temporary deck would be installed shortly after excavation begins to allow activity to resume on the street while the remaining excavation and cut-and-cover construction continues (Figure 6-13 and Figure 6-14). Material excavated from the street level or below the temporary deck would be transported to a disposal

Source: VTA, 2007.

Figure 6-13: Temporary Deck Installation



Source: VTA, 2007.

Figure 6-14: Ongoing Excavation After Temporary Deck Installation site permitted to accept the material. Equipment typically used for excavation and installation of temporary decking includes crawler dozer/loader, rubber-tired loader/bobcat, pavement breaker, excavator/backhoe, conveyer system, truck, crane, generator/compressor, water pump, forklift, and haul trucks.

Utilities within the subsurface construction area that do not require relocation 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 10 feet of the street surface (e.g., telephone, traffic, electric). These utilities would be reinforced, if necessary, and supported during construction by hanging from support beams spanning across the excavation (Figure 6-15).

Due to the nature of soft soils, presence of high groundwater, and close proximity of adjacent buildings particularly in downtown San Jose, temporary shoring walls would be installed to support the sides of cut and cover excavations. Several methods can be used for temporary shoring walls including soil-cement mix wall and slurry diaphragm wall, which are briefly described below. These methods are preferred for cut and cover construction where the excavations are deeper, such as the underground stations and downtown crossover. Other methods may be used for shallower excavations such as the tunnel portals, and are described below for the retained cut portions of the BART alignment. One or more methods may be used at a single location depending on site-specific conditions. Depending on the method chosen for the temporary shoring walls and the depth of groundwater, varying degrees of dewatering would be required.

Soil-Cement Mix Wall. A soil-cement mix wall is typically constructed deep enough to penetrate into an impermeable soil layer below the base of an excavation so that groundwater seepage is minimized. This type of wall can be constructed in several ways. One method for constructing a soil-cement mix wall as temporary shoring is Deep Soil Mix (DSM). This method involves mixing cement with in-situ soil using a multi-axis hollow stem auger rig that can drill as many as six columns in one operation (Figure 6-16). The augers (up to six) are fitted with rotating paddles that mix the soil with cement as the augers advance into the ground and as they are pulled out. Mixing is performed during both penetration and withdrawal of the augers. The result is a continuous and nearly waterproof wall made up of individual overlapping columns of soil mixed with cement. Every other column of the soil-cement mix is then structurally reinforced with steel soldier piles that are inserted into the soil-cement mixture before the mixture sets and hardens (Figure 6-17).

Another method for constructing a soil-cement mix wall is trench remixing and deep-wall method (TRD). Instead of drilling individual columns that overlap each other as in the DSM method, this method involves the use of a single hydraulic-driven cutting and mixing arm that resembles a huge vertical chain saw. As it digs a continuous trench into the ground, the arm mixes cement with in-situ soil in a continuous trench to construct the soil-cement mix wall into which vertical steel soldier piles are then inserted (Figure 6-18).

Source: VTA, 2007.

Figure 6-15: Temporary Utility Support in an Excavation

Figure 6-16: Deep Soil Mix and Auger Rig Installation

Source: VTA, 2007.

Figure 6-17: Deep Soil Mix and Steel Soldier Pipes

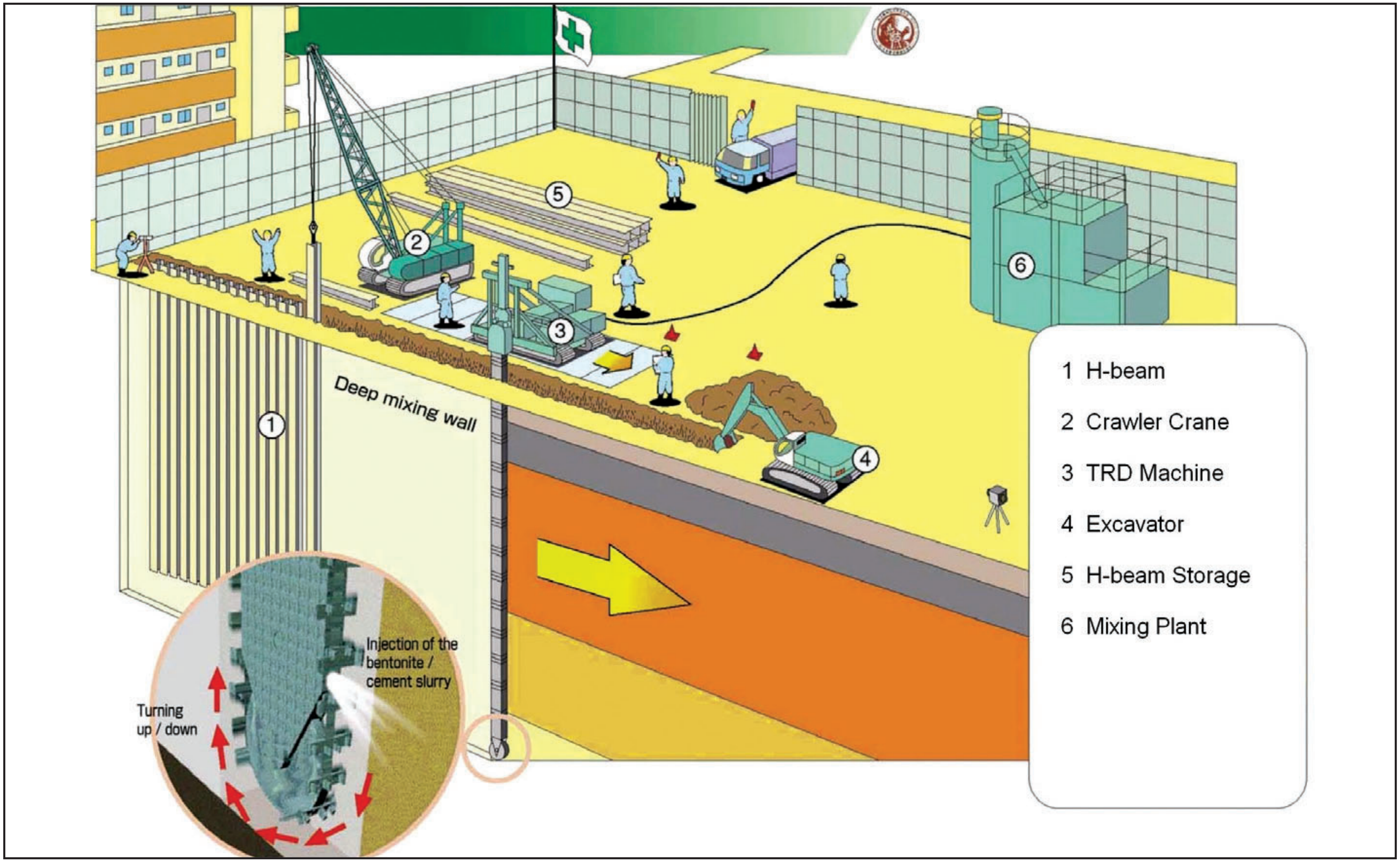


Figure 6-18: Trench Remixing and Deep-Wall Method (TRD)

Supporting equipment used for both methods of constructing soil-cement mix walls typically includes a boom rig, soil-mix wall batch plant for cement slurry preparation, crane, back hoe, rubber tired loaders, hauling trucks, and similar large construction equipment.

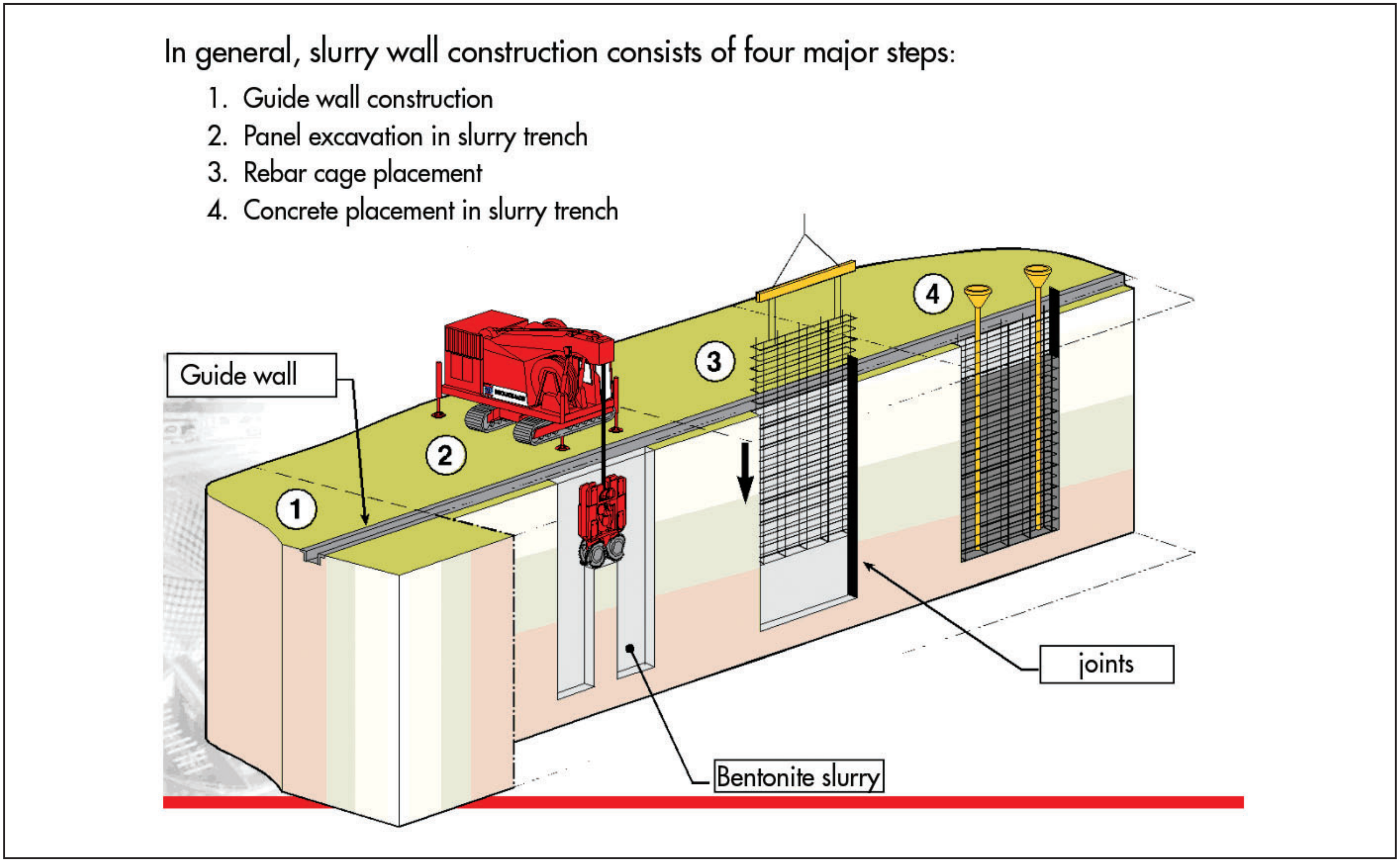
Slurry Diaphragm Wall. Another method to minimize groundwater seepage is a slurry diaphragm wall. This wall can be constructed as a combined temporary and permanent wall, resulting in a single permanent wall. This method involves excavating short sections of deep trenches in the ground where the wall is to be located, placing steel reinforcement cages into the trenches, and then filling them with concrete (Figure 6-19). To stabilize the trenches, bentonite slurry is placed in the trench during excavation. This slurry has the ability to support the walls of the trench until the trench can be fully excavated and the concrete poured. The bentonite slurry is then displaced during concrete placement and can be reused for subsequent sections of slurry wall. The slurry diaphragm wall method produces a concrete wall that can serve as the permanent wall. The drawbacks of this technique are potentially high cost, slow production, and management of displaced slurry. However, it can reduce the need for dewatering during the excavation process. The equipment used to install a slurry diaphragm wall typically includes a crane with a specialized excavation attachment, a crane to lift steel reinforcement cages, a backhoe, dump trucks, bentonite slurry mixers/storage tanks, a pump and pipe network for bentonite slurry, concrete mixer trucks, and similar large construction equipment.

After installation of the soil-cement or slurry diaphragm walls, excavation and installation of the support system would continue until the excavation is deep enough for the construction of the base slab. If the temporary support system is used, permanent sidewalls are constructed. Intermediate slabs and the roof slab are then installed. After the underground structure has been completed and the roof slab is allowed to cure for a specified period, backfilling can begin. During backfilling operations, any temporarily relocated utilities are restored to their permanent locations. When the backfill reaches the underside of the temporary deck, the permanent street is constructed. With the restoration of utilities, roadway pavement, and vehicular traffic, the surface work on the structure is completed and any other activity involving station finishes, equipment installations, and so forth continues beneath the surface with little, if any, disruption to the street level.

6.2.5 TUNNEL BORES AND CROSS PASSAGES

<u>Tunnel Bores</u>

For the SVRTP Alternative, twin bore tunnels, with one track in each, would be excavated starting at the tunnel portals. The average length of the two tunnel bores would be approximately 22,780 feet and the depth would be between 10 feet below ground surface at the tunnel portals to 75 feet below ground surface to avoid obstructions such as bridge and retaining wall foundations. Each tunnel bore would have a diameter of 17 feet 10 inches. Center-to-center tunnel bore spacing would be



Source: VTA, 2007.

Figure 6-19: Construction of a Diaphragm Slurry Wall

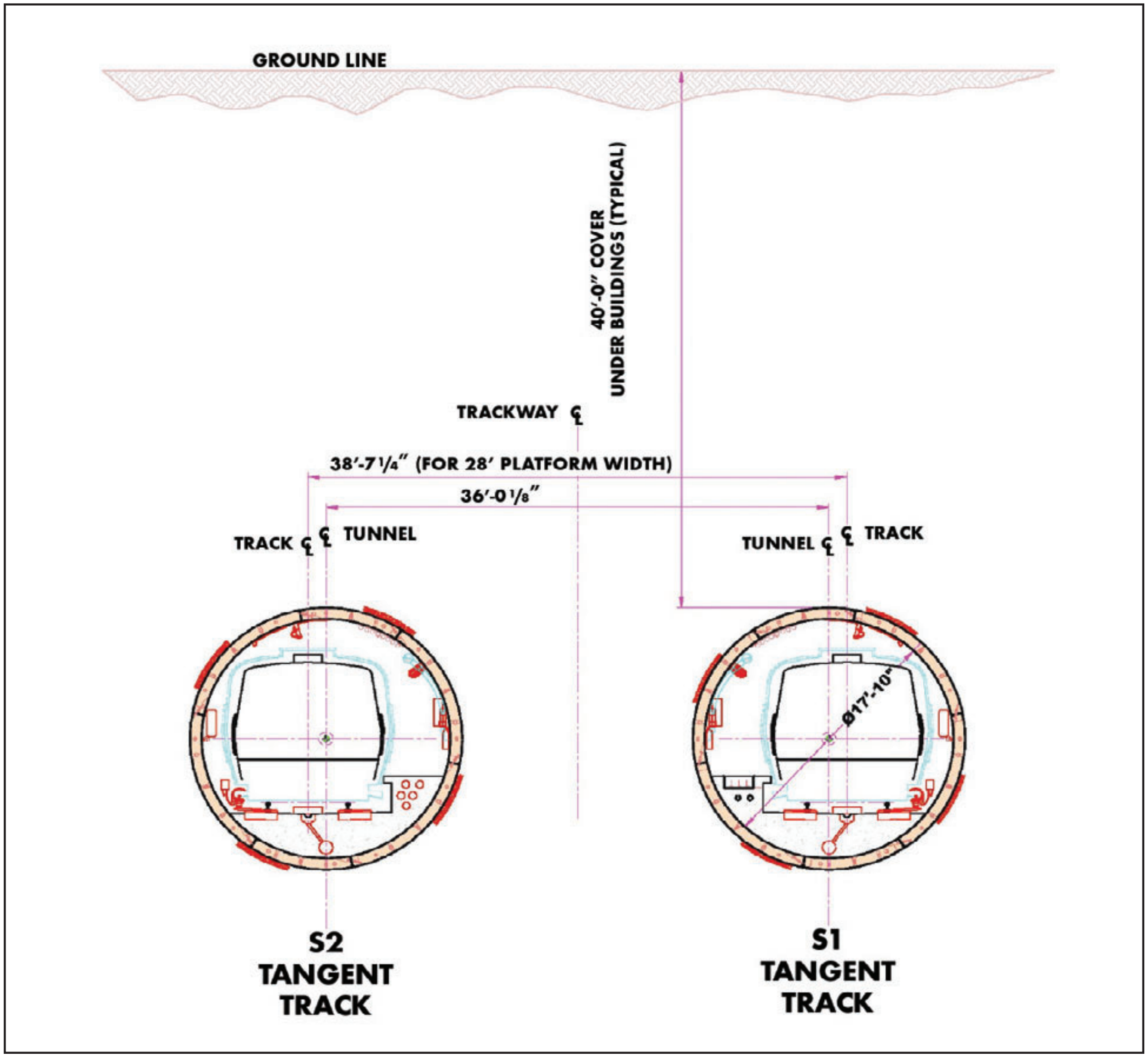
approximately 40 feet, providing a pillar width between the tunnels of about one tunnel diameter, which is generally sufficient for the 28-foot-wide center platforms within the underground stations (Figure 6-20). An example of twin tunnel bores is shown in Figure 6-21.

The tunnel bores would be constructed using two earth pressure balanced (EPB) tunnel-boring machines (TBMs). This is a type of closed-face TBM that is fully shielded by a cylindrical steel shell (Figure 6-22). The purpose of a closed face machine is to balance the surrounding ground pressure by creating a pressure within the excavation chamber at the front of the TBM (Figure 6-23). Closed-face TBMs keep out groundwater, stabilize the tunnel face, and minimize settlement. The use of EPB TBMs also minimizes adverse construction effects on residences and businesses. Other methods to construct a tunnel, such as cut and cover, are too disruptive.

At the front of the cylindrical steel shell, or shield, is a rotating cutterhead. As the machine moves forward, it excavates to a pre-determined diameter that is dictated by the cutting tool selection and cutter-head configuration. The size of the tunnel diameter is designed for the most extreme horizontal and vertical alignment, taking into account train vehicle envelopes, walkways, trackbed and third rail clearances, drainage facilities, mechanical/electrical equipment, and appropriate tolerances.

Within the shield, pre-cast gasketed segmental concrete lining units are assembled with specialized equipment. Six or seven units are mechanically connected to each other to form a single ring that connects to the previous ring. This system is referred to as a Precast Concrete Tunnel Lining (PCTL) and is a one-pass system that has no inner lining; therefore, the rings form the permanent tunnel walls (Figure 6-24). The annular space around the segmental lining units is continuously grouted, and the tunnel lining is made watertight by rubber gaskets around each unit. Once a complete ring is constructed, the TBM thrusts itself off the leading edge of the ring far enough (typically 5 feet) to allow the next ring to be built. Forward propulsion of the TBM is achieved by powerful hydraulic rams installed within the shield reacting off the most recently constructed ring.

While underground, the TBM's excavation chamber is filled with soils excavated from the tunnel face. Conditioning agents are added to the soil in the chamber to aid in maintaining the correct face pressure. By maintaining the chamber pressure close to in-situ (pre-tunneling) water and earth pressure in the ground, groundwater inflows and excessive ground losses are almost completely eliminated, thereby minimizing ground settlement at the surface. Excess material called muck is removed from the chamber by screw conveyor and transported through the bored tunnels and out the tunnel portals by rail muck cars or by conveyor belts mounted on the sidewalls of the tunnel bores (Figure 6-25). Once outside the tunnel, the muck is stockpiled for use as fill material or loaded onto trucks for disposal in accordance with applicable laws and regulations. There are areas of 2.6 acres and 2.8 acres at the east and west portals, respectively, set aside for accumulation of muck from TBM operations. At the east tunnel portal, a continuation of the tunnel conveyor system would carry the muck over Mabury Road to the Berryessa Station construction staging area (see Section 6.2.11). This would avoid



Source: VTA, 2007.

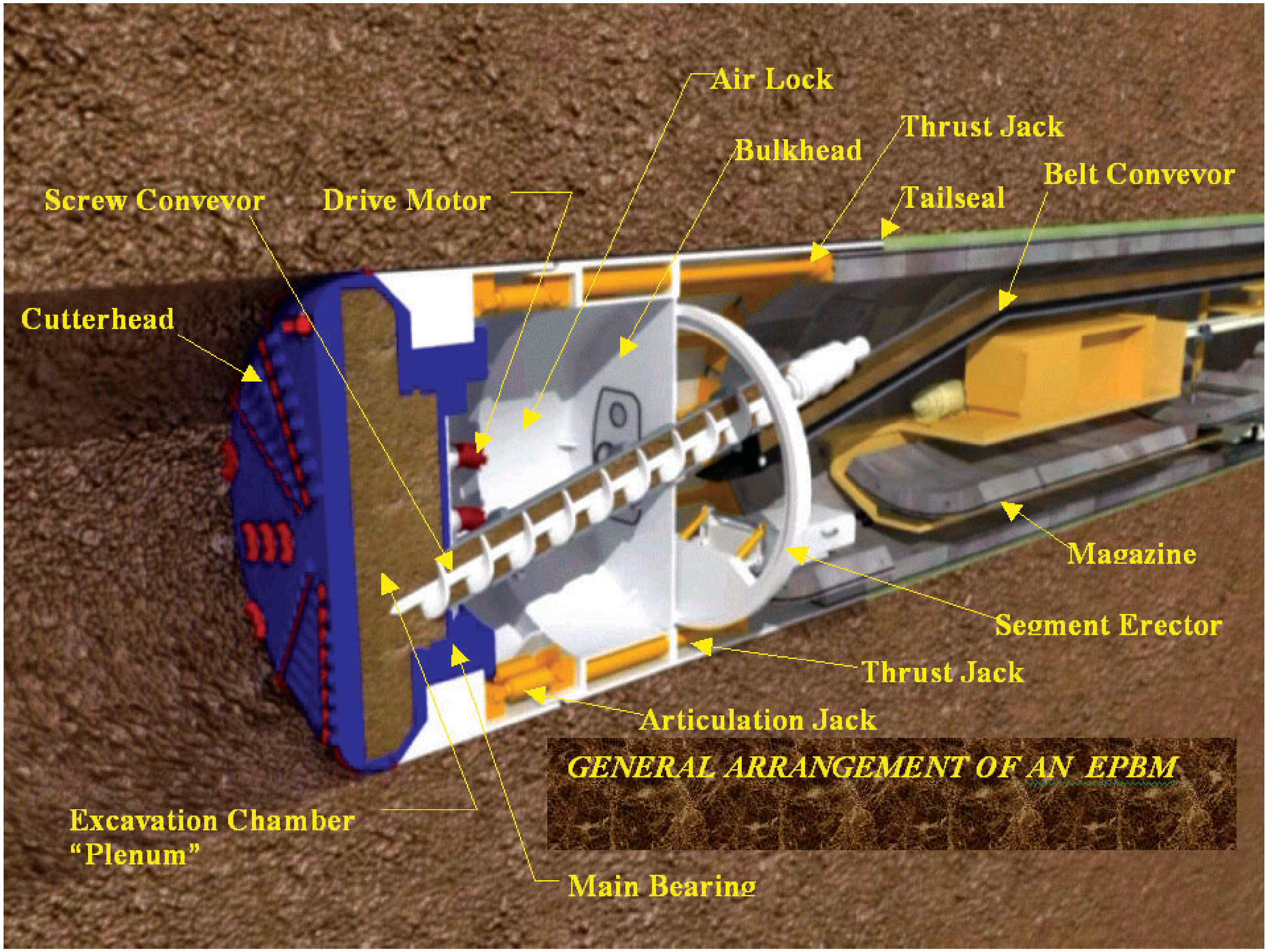
Figure 6-20: Diameter and Spacing of Tunnel Bores (TRD)

Source: VTA, 2007.

Figure 6-21: Twin Tunnel Bores

Source: VTA, 2007.

Figure 6-22: Examples of Tunnel Boring Machines



Source: VTA, 2007.

Figure 6-23: General Arrangement of an Earth Pressure Balanced Tunnel Boring Machine

Source: VTA, 2007.

Figure 6-24: Example of Segmental Concrete Lining Units and Rings

Source: VTA, 2007.

Figure 6-25: Conveyor System

double-handling and additional truck movements. With a typical progress rate of 65 feet/day for the TBMs, approximately 1,210 cubic yards per day per tunnel of bulked spoil would be generated. Berms would be required to retain wet spoil and settling/drainage ponds would be required to retain and treat surplus water from the muck.

The potential reuse of muck was evaluated during the Preliminary Engineering design phase to include use as fill above cut and cover structures and within mechanically stabilized earth walls of retained cut structures, or use as fill at other nearby construction projects. Reuse of muck in construction of the alternatives or nearby would minimize transportation and disposal costs, and may require processing of the muck to reduce moisture content and make the soils suitable. However, it should be noted that tunnel muck reuse may not be an option. In that case, such material would be disposed of in accordance with applicable laws and regulations.

To ensure accuracy of tunnel bore mining, a highly sophisticated computerized guidance system is installed in each machine. The system includes hardware and software that continuously determine the position of the TBM. Information is fed to a data-logger that both records and communicates in real-time the information to both the control room on the machine and remote computers at the surface (Figure 6-26). The guidance system predicts where each machine is going (its current position and orientation) relative to the design alignment. Adjustments are made as necessary to keep the machines on track.

To provide construction power for operation of the tunnel boring machines (TBMs) during construction, a temporary power substation would be located near each tunnel portal, which would be decommissioned and removed after completion of construction. At the east tunnel portal, the substation would be supplied from a PG&E 115 kV transmission line and would transform the incoming power to 12 kV for service to the TBMs. The substation facility would consist of: 115 kV switchgear; a 115 kV/12 kV transformer; and a 12 kV switchgear enclosure. There are four alternate locations for the temporary substation. The first alternate location would be within the San Jose Mabury Yard adjacent to and north of US 101. This substation would be served from a temporary extension of the 115 kV line along Las Plumas Avenue that would ultimately supply High Voltage Substation SMR. The second alternate location would be within a commercial parking area near the end of Las Plumas Avenue and east of the railroad ROW. This substation would be served from the permanent 115 kV line along Las Plumas Avenue. The third alternate location would be on the east side of Nipper Avenue. A fourth location would be at the south end of Nipper Avenue. Both the third and fourth locations would be served from the permanent 115 kV line along Las Plumas Avenue. However, as these sites are the farthest from the railroad ROW, the 12 kV switchgear enclosure would be located closer to the east tunnel portal within the commercial parking area near the end of Las Plumas Avenue and east of the railroad ROW.

Source: VTA, 2007.

Figure 6-26: TBM Data Centers

At the west tunnel portal, a temporary power substation would be located at the site of High Voltage Substation SNH. This temporary substation would be served from PG&E's FMC substation by a 115 kV line, which would be constructed to also serve the permanent high voltage substation. There are two alternate routes for this 115 kV line connection. The first alternate route would begin at the high voltage substation, run north to Newhall Street, then run east on upgraded poles along Newhall Street, and south on an existing line along Stockton Avenue. A second alternate route would also run north to Newhall Street and then run east on upgraded poles along Newhall Street, but a new line would be constructed to traverse the PG&E substation site.

Ground treatment may be required during construction of the tunnel (and during construction of cross passages – as discussed subsequently) to stabilize problematic variable soils and provide for safe tunneling excavation. Ground treatment may be particularly helpful during launching and exiting of the TBMs to reduce potential settlement of surface structures and utilities. There are various ground treatment methods available depending on the intended purpose, localized geotechnical and easement conditions, potentially affected structures and utilities, and adjacent construction activity. These methods include:

- Soil replacement using jet grouting to establish consolidated blocks of soil where existing unstable soil is replaced entirely with cement grout or is partially replaced with cement grout that is mixed into the soil to obtain the appropriate strength, permeability, and other engineering characteristics.
- Soil displacement where a slurry material is injected into the soil to replace lost soil and densify loose material.
- Soil modification where permeation grouting with cementitious or chemical grouts is used to increase cohesion and/or strength, reduce permeability, or modify the properties of the soil.
- Ground freezing where soil is treated by using calcium chloride brine, ethylene glycol, ammonia, or liquid nitrogen.
- Dewatering where water is extracted from the soil to reduce pore pressure, resulting in improved soil stability and reduction of ground water level.

The construction of the underground stations would be timed with the construction of the tunnel bores, where the cut and cover excavations at station sites are done separately from the TBM tunneling. Station structural concrete work must either be completed prior to tunneling operations in that station, or start after the tunneling operation in that station is finished, i.e., as long as the underground rail muck car or conveyor system for the tunnel muck is still moving through the station box, station concrete work is restricted. Once tunneling operations are moved to another location and the conveyor is no longer passing through the station, station structural work can proceed.

Cross Passages

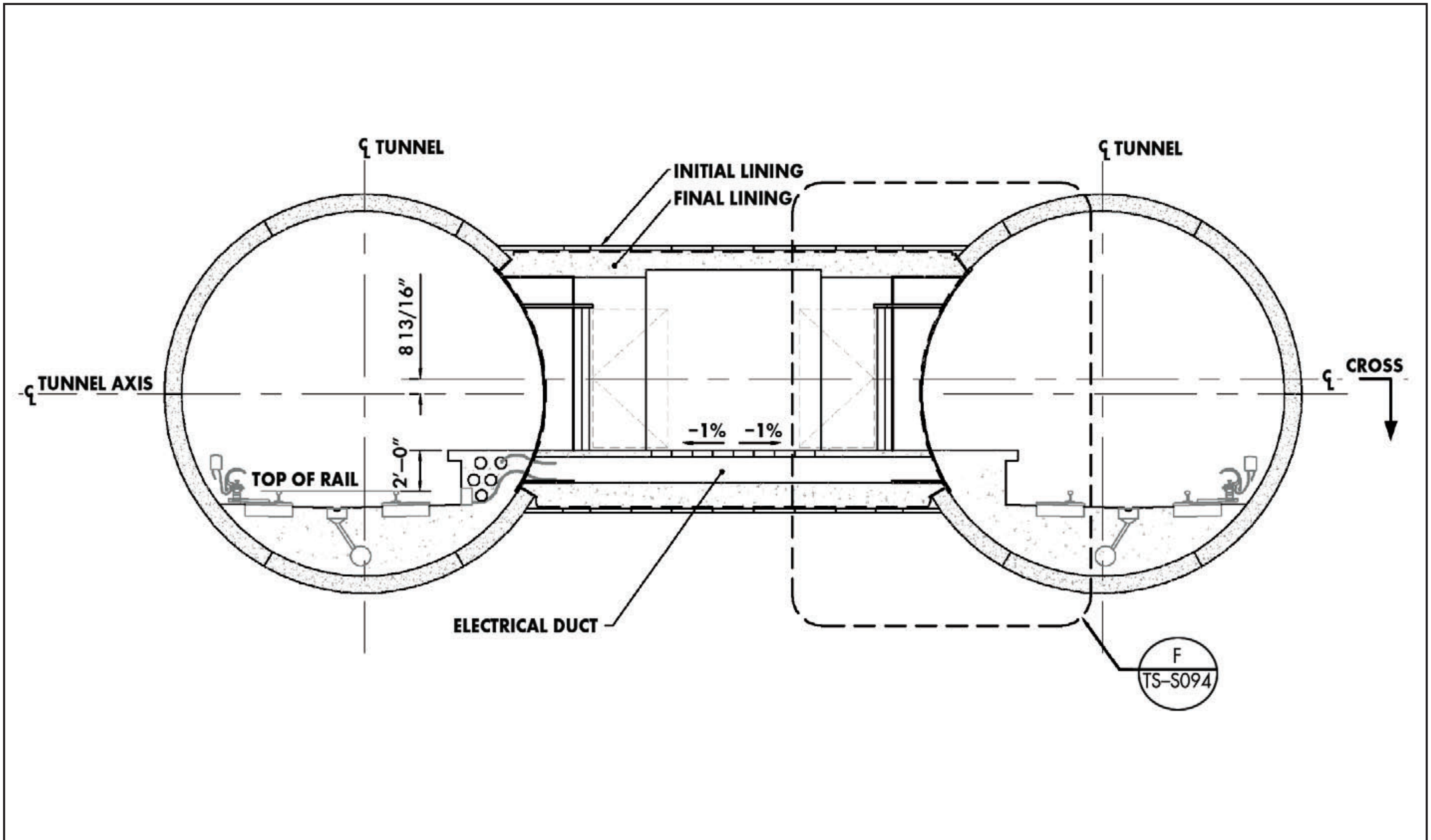
The twin bore tunnels would be connected to each other by cross passages at regular intervals along the tunnel alignment (Figure 6-27). Cross passages would be excavated from within the bored tunnels through preformed breakout panels installed as part of the tunnel segmental lining units. Once the TBMs have passed by, the anticipated ground and groundwater conditions would be verified by investigation from within the tunnels at each cross passage location. Ground treatment, as needed, would precede construction of the cross passage, which would start with removal of one of the breakout panels and excavation. Once the other tunnel bore is reached, the second breakout panel would be removed, allowing construction of the passage to be completed. Installation of equipment, and location and routing of utilities and services would be performed after installation of the permanent lining. In the final configuration, each cross passage would be approximately 11 feet in diameter and approximately 17 feet in length.

6.2.6 ABOVEGROUND STATIONS AND FACILITIES

The construction of aboveground facilities would include the aboveground stations, parking structures, pedestrian overcrossings, bus transit centers, new utilities, roadway and sidewalk improvements, drainage improvements, outdoor lighting, and landscaping.

Construction of aboveground structures would include demolition and relocation/protection of utilities, if applicable. Equipment typically involved in building demolition includes: crawler cranes, crawler dozer/loaders, pavement breakers, rubber-tired loader/bobcats, trucks, excavator/backhoes, generator/compressors, and water trucks for dust control. Site preparation would follow, such as grading, and building or structures would be constructed using typical construction equipment such as bobcats, forklifts, cranes, and concrete and materials/equipment trucks.

The number of parking spaces proposed at the BEP and SVRTP alternatives' stations is based on Year 2030 parking projections (see Chapter 3, Transportation and Transit). However, passenger service for these alternatives is expected to begin in 2018. In this year, the number of parking spaces required would be less than the number required for Year 2030. Therefore, surface parking may be initially provided in areas identified as either a parking structure and/or as surface parking/future transit facilities, with a parking structure constructed at a later time.



Source: VTA, 2007.

Figure 6-27: Cross-Passage Connecting the Tunnel Bores

6.2.7 INSTALLATION OF SYSTEMS

Systems and related facilities include traction power substations, sectionalizing stations, high voltage substations, switching stations, gap breaker stations, auxiliary power substations, emergency ventilation facilities, railroad intrusion detection system, train control buildings and rooms, other communication facilities such as emergency telephone systems, and associated equipment such as cables, conduits, and wires. BART-furnished equipment such as automatic fare collection, destination signs, and other station communications and computer-related systems are also included. In general, construction of these facilities involves manufacturing, factory testing, delivery, installation, and field-testing.

Many of the stand-alone structures that house the equipment are aboveground along the alignment or within aboveground station areas. Some of the facilities are integrated into the stations themselves, whether aboveground or within the ancillary areas of underground stations. Facilities located above-ground would be constructed using methodology typical for moderately sized sites and structures, including demolition, site preparation, and building construction. Facilities located underground at the Alum Rock, Downtown San Jose, and Diridon/Arena stations would be constructed as part of the SVRTP Alternative underground structures. The two mid-tunnel ventilation shafts that are part of the SVRTP Alternative would be constructed using cut-and-cover methods.

Installation of some systems and related facilities would extend beyond the immediate sites and continue along the guideway, such as installation of electrical cabling in duct banks beside the BART tracks and other electrical devices at periodic locations.

The following aboveground sites along the alignment may require construction of an access road:

- Traction Power Substation SWA and Train Control Building S24 would be located south of East Warren Avenue on the east side of the railroad ROW (STA 78+50), with access provided to Mission Falls Court.
- Traction Power Substation SKR and Train Control Building S26 would be located south of Scott Creek/Line A on the west side of the railroad ROW, immediately south of Scott Creek (STA 175+00), with access provided to Milmont Drive.
- High Voltage Substation SRC, Traction Power Substation SRR, Switching Station SRR, and Train Control Building S28 would be located south of the Berryessa Creek crossing (north of Railroad Court) (STA 259+00), with access provided from Railroad Court.
- A high rail vehicle access point would be located just south of Calaveras Boulevard/SR 237(STA 289+00), with access provided from Railroad Avenue.

- Traction Power Substation SMB would be located south of Trade Zone Boulevard partially within commercial parking areas on the west side of the railroad ROW (STA 416+00), with access provided to Qume Drive.
- Gap Breaker Station SXB and Train Control Building S56 would be located south of Mabury Road on the west side of the ROW (STA 551+00), with access provided to DOT Way (a private street that leads to the San Jose Mabury Yard).

Systems and related facilities are tested incrementally as the individual sites are completed. This effort is generally contained within the structures or rooms that house the equipment. Testing is primarily electrical in nature; noise and construction activity would be negligible.

6.2.8 YARD AND SHOPS

Construction of either the Las Plumas Yard Option or the Newhall Yard and Shops would include a number of activities, starting with street and building demolition and site preparation. Site preparation would include additional environmental site investigations, removal of any hazardous materials, and removal of abandoned UPRR tracks and miscellaneous structures. Utilities would be would be protected, removed, or relocated. Ground improvements would potentially include the process of surcharging the site where buildings would be located with 3 to 4 feet of fill material to reduce settlement. Temporary construction fencing would be installed to secure the site and storage of construction materials. Foundations for the yard and shops buildings would be constructed. Underground system conduits, duct-banks, new incoming services to all buildings, sub-drains, and storm drain piping would be installed. New or widened roadways, building shells and finishes, and other facilities would be constructed. The BART mainline, maintenance, storage, and tail tracks would be installed. Permanent perimeter fencing, gates, and lighting would be installed. Testing and start-up of elements associated with the yard and shops facility, including the revenue vehicle maintenance shop, maintenance and engineering shops, non-revenue vehicle maintenance shop, storage facilities, mainline tracks, and tail tracks, would be performed.

Equipment used for construction at the yard and shops facilities includes dozers, end-loaders, cranes, wrecking balls, forklifts, and haul trucks for demolition and track removal. Backhoes, dozers, jackhammers, forklifts, and trucks are used for utility relocation work. Site preparation requires graders and compactors. Buildings are constructed using equipment common to the construction of heavy industrial and office buildings.

6.2.9 VEHICLE PROCURMENT

The passenger vehicles procured for the BEP and SVRTP alternatives would be similar to and fully compatible with existing BART facilities and vehicles. The new vehicles would be delivered and tested for acceptance over a period of time at designated locations where simulated operations for both trains and individual cars would be performed. These tests would verify that the new cars meet all requirements for revenue service.

6.2.10 START-UP AND COMMISSIONING

The start-up and commissioning phase is the extension of the testing activities as previously described and includes a level of testing that is beyond individual sites and subsystems in order to test the complete BART operations. During this phase, the interconnections and functioning of equipment that operate throughout the BEP and SVRTP alternatives would be verified and operating procedures, personnel training, and maintenance would be reviewed. As such, a major portion of this activity would be the testing of equipment and functions that involve multiple sites including the Operations Control Center for the entire BART system. This is sometimes termed Systems Integration Testing (shown on Figure 6-1 and 6-2 as a separate activity). This phase also includes the extensive training of all staff in the operation and maintenance of the system through the implementation of plans and testing procedures.

Final Safety Certification is received when systems are operating as intended and all command and control subsystems and procedures are adequate to provide the intended services. Both normal operations and a series of abnormal (failure) conditions are simulated to reach a level of confidence that the system is safe for revenue service. This phase is the final step in the construction program that leads, when successfully completed, to revenue service.

6.2.11 CONSTRUCTION STAGING AREAS

Construction staging areas would be required along the alignment to construct the BEP and SVRTP alternatives. These areas would be used for construction vehicle parking, construction equipment storage and usage, and materials storage. Materials may also be stored within the railroad ROW. In addition, the footprints of permanent facilities, such as the 130 acres within the station areas, the 95 acres within the yard and shops facilities, and additional acreage within the smaller sites housing electrical and communication facilities, would be used as construction staging areas. For example, the Newhall Yard and Shops area would serve as a construction staging area including the accommodation of the 2.8 acres needed at the west tunnel portal for accumulation of tunnel muck before reuse or disposal.

The following list includes proposed construction staging areas identified during the Preliminary Engineering phase of the project for the BEP and/or SVRTP alternatives. These staging areas are shown in Figures 6-28 to 6-38, and are exclusive of the footprints of permanent facilities. All of these staging areas would require temporary construction easements or property acquisition (see Section 6.5).

- **Mission Falls Court.** This area would include 5.3 acres between Mission Falls Court and the railroad ROW, which currently consists primarily of a vacant parcel. The area is within an industrial subdivision. Access to the site would be from Mission Falls Court. (BEP and SVRTP alternatives)

- **Calaveras Boulevard.** This area would include 8.0 acres south of Calaveras Boulevard between the railroad ROW and Wrigley Creek. Access to the site would be from Industrial Way. (BEP and SVRTP alternatives)

- **Capitol Avenue.** This area would include 9.45 acres west of the railroad ROW between Capitol Avenue and the East Penitencia Channel. Access to the site would be from Capitol Avenue. (BEP and SVRTP alternatives)

- **Trade Zone Boulevard.** This area would include 1.1 acres north of Trade Zone Boulevard and east of the railroad ROW and 1.2 acres south of Trade Zone Boulevard and east of the railroad ROW. Access to the site would be from Trade Zone Boulevard. (BEP and SVRTP alternatives)

- **Berryessa Road.** This area would include 13.6 acres north of Berryessa Road and west of the rail ROW. Access to the site would be from Berryessa Road. (BEP and SVRTP alternatives)

- **Mabury Road and US 101.** This area would include 11.49 acres both east and west of the railroad ROW between Mabury Road and US 101. Access to the site would be from Mabury Road and Las Plumas Avenue. This area would accommodate alternative locations for a temporary substation that would provide power to the TBMs during construction (see Section 6.2.5). (SVRTP Alternative)

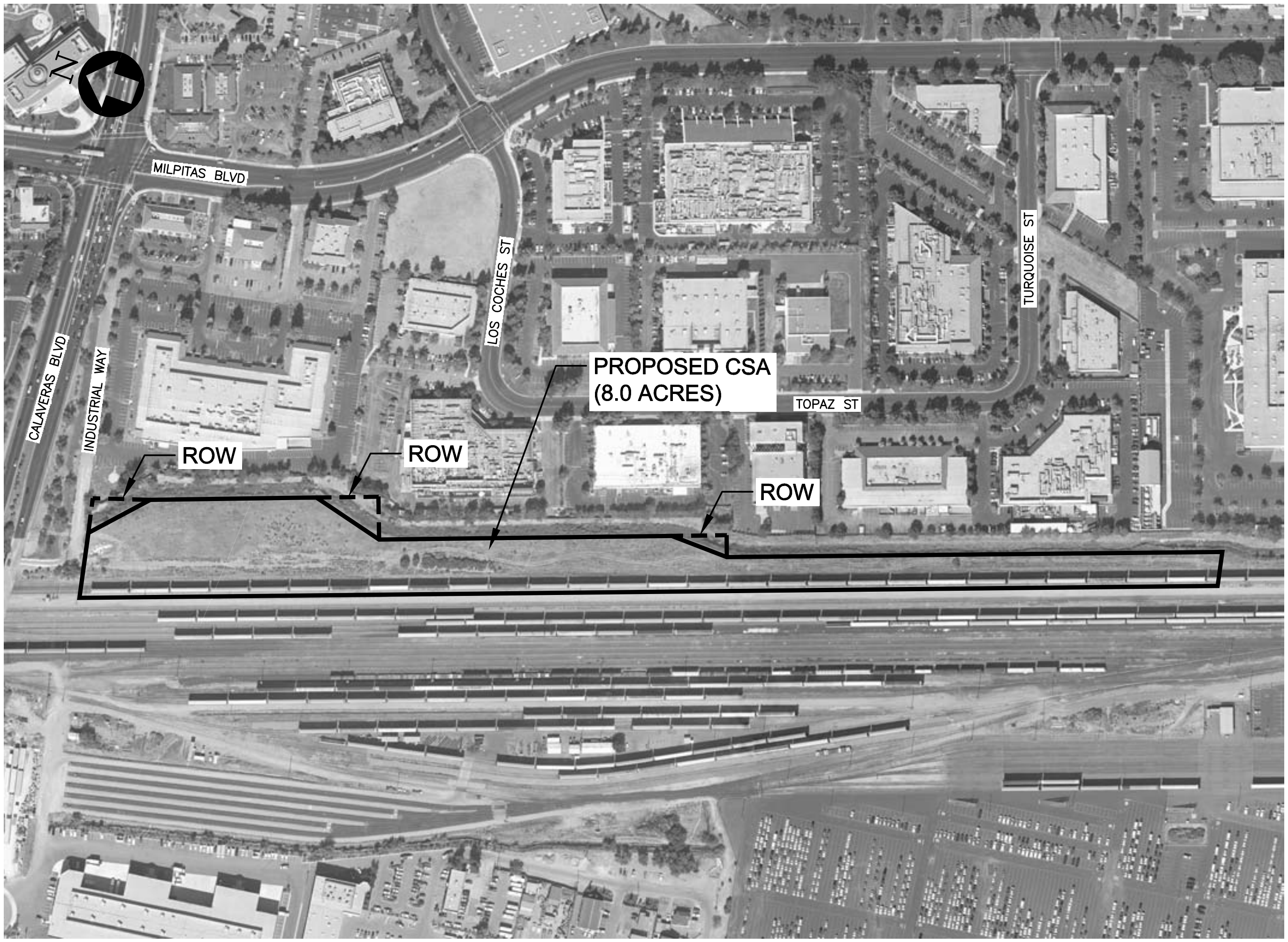
- **Alum Rock.** This area would include 0.33 acres along the west side of 28th Street and north of East Santa Clara Street. Access to the site would be from 28th Street. (SVRTP Alternative)

- **17th Street.** This area would include 0.69 acres at the northwest corner of 17th and East Santa Clara streets. Access to the site would be from East Santa Clara Street. (SVRTP Alternative)

- **Downtown San Jose.** The downtown construction staging area would include three separate sites. The first site would include 3.64 acres north of West Santa Clara Street between Market and 1st street, which is owned by VTA (the former Mitchell Block site). The second site would include 0.20 acres north of Santa Clara Street between 2nd and 3rd streets. There are

Source: VTA, 2008.

Figure 6-28: Proposed Mission Falls Construction Staging Area

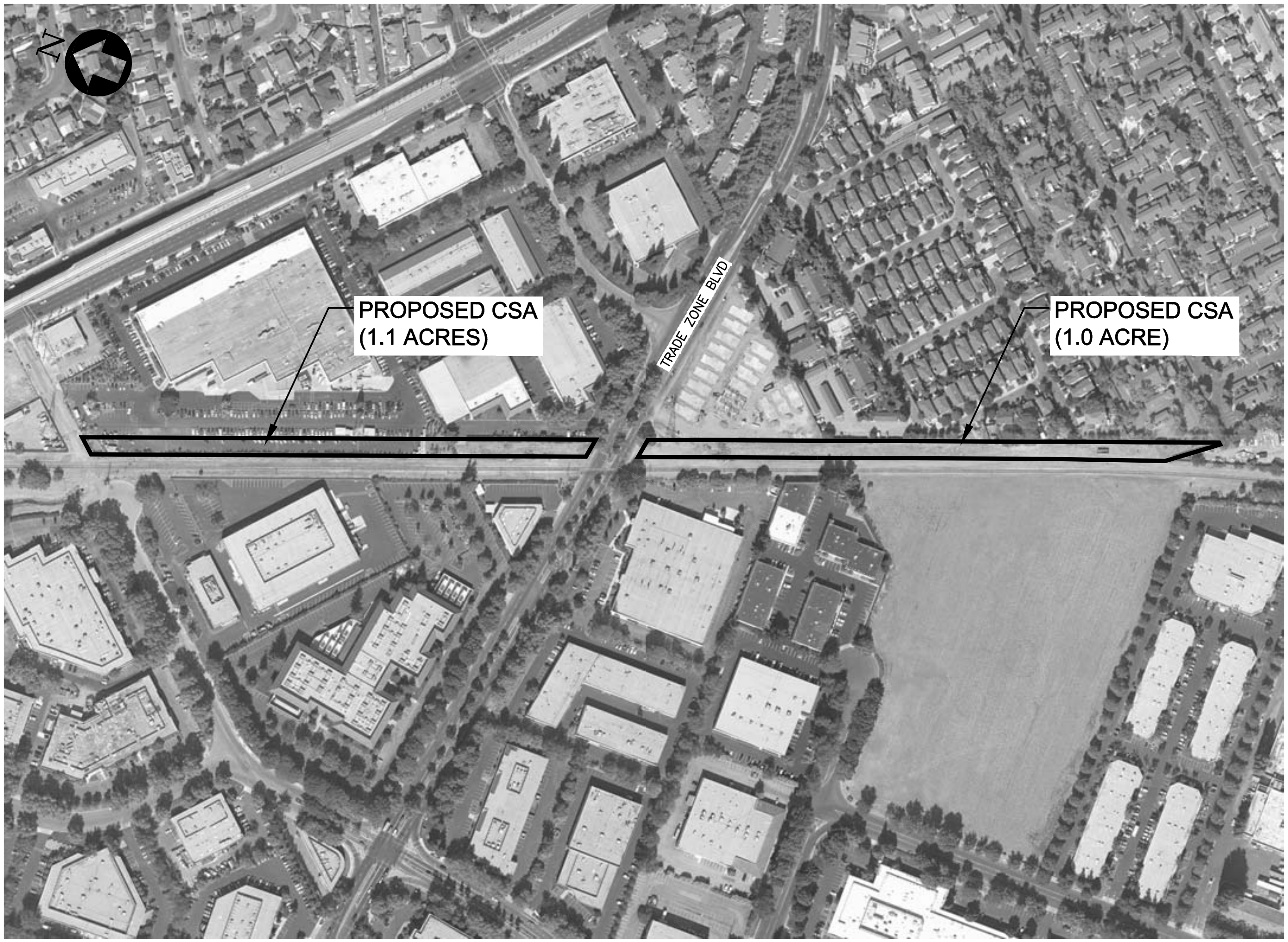


Source: VTA, 2008.

Figure 6-29: Proposed Calaveras Boulevard Construction Staging Area

Source: VTA, 2008.

Figure 6-30: Proposed Capitol Avenue Construction Staging Areas

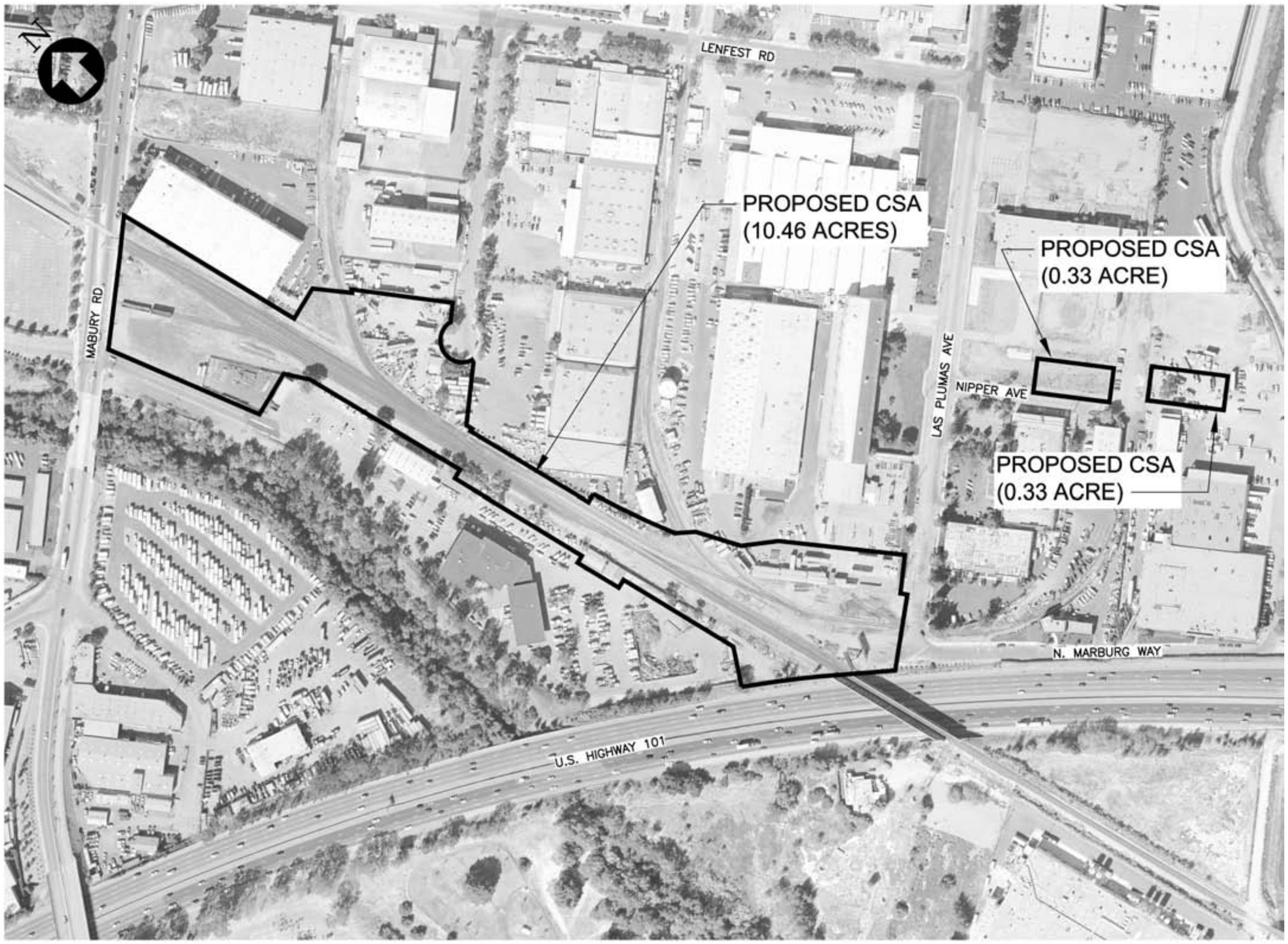


Source: VTA, 2008.

Figure 6-31: Proposed Trade Zone Boulevard Construction Staging Areas

Source: VTA, 2008.

Figure 6-32: Proposed Berryessa Road Construction Staging Areas

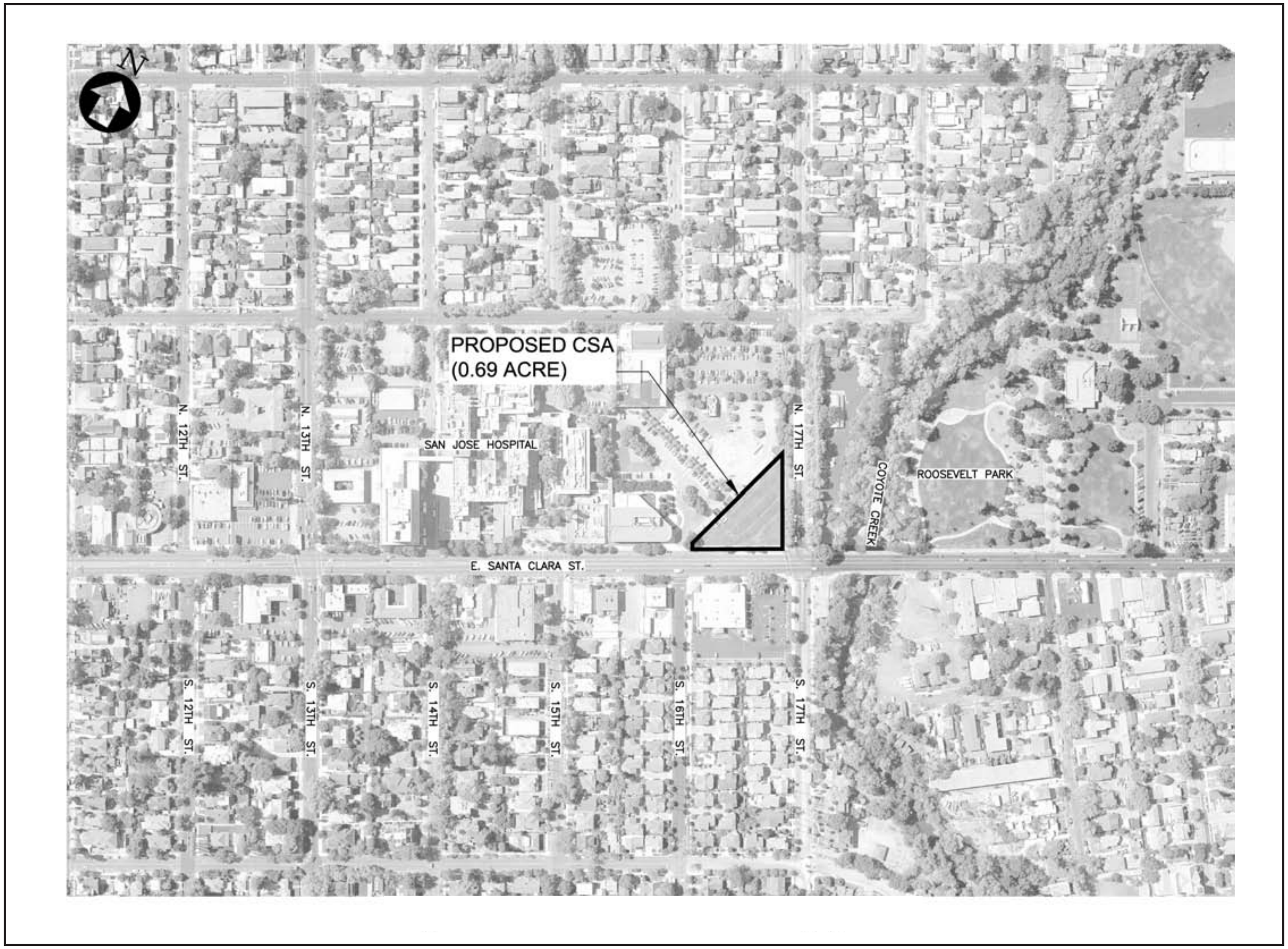


Source: VTA, 2008.

Figure 6-33: Proposed Mabury Road and U.S. 101 Construction Staging Area

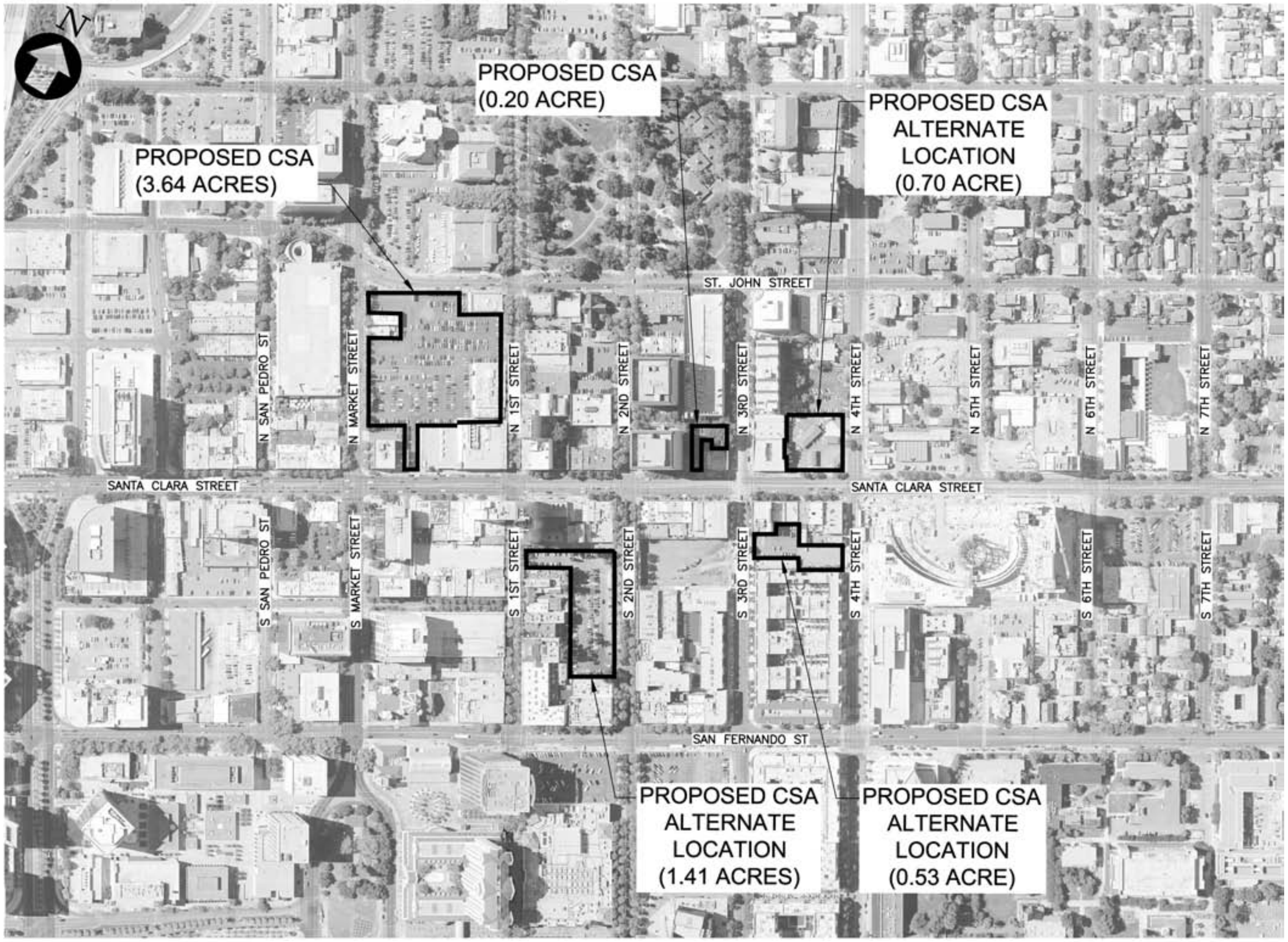
Source: VTA, 2008.

Figure 6-34: Alum Rock Construction Staging Area



Source: VTA, 2008.

Figure 6-35: Proposed 17th Street Construction Staging Area

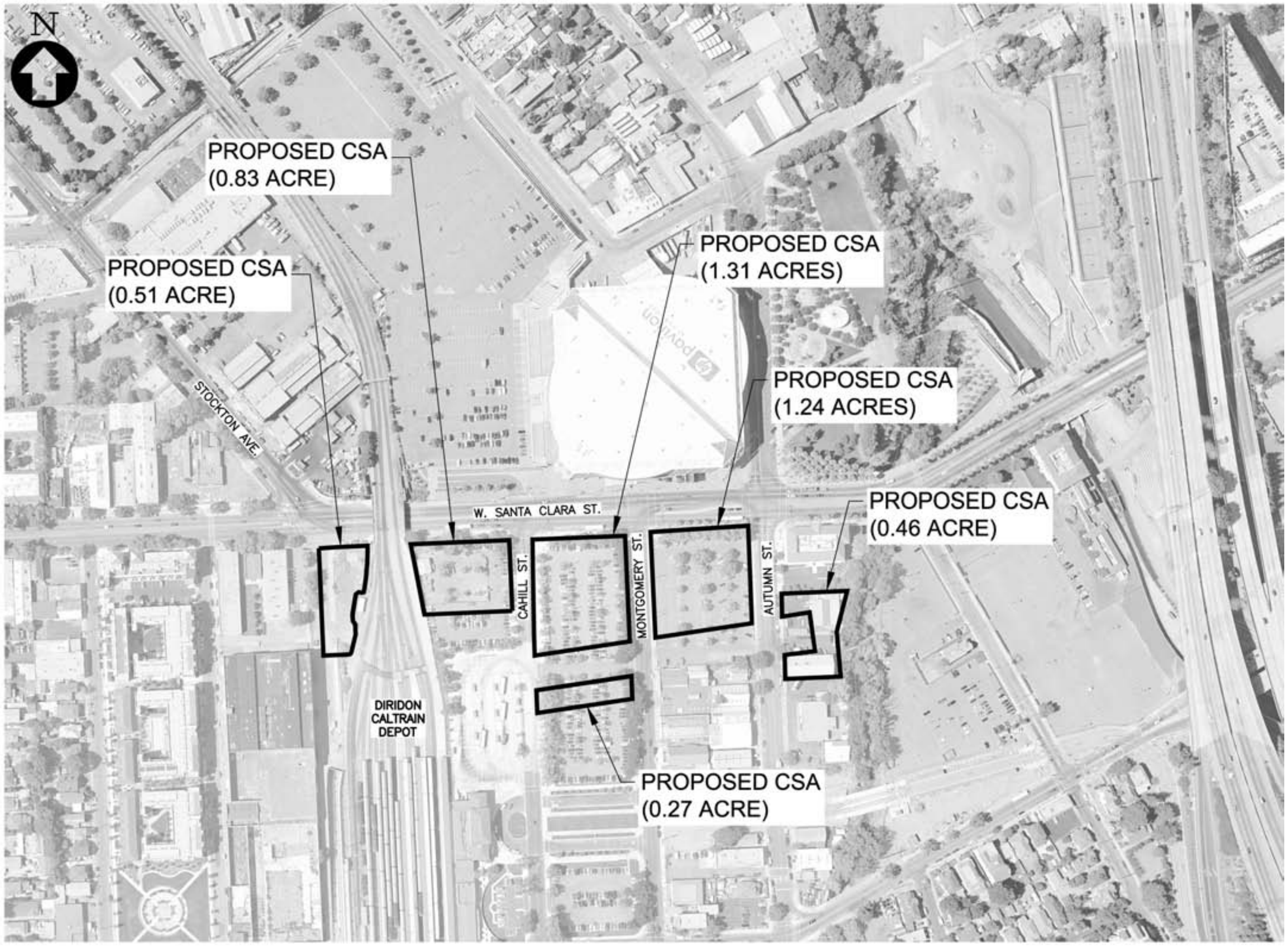


Source: VTA, 2008.

Figure 6-36: Proposed Downtown San Jose Construction Staging Areas

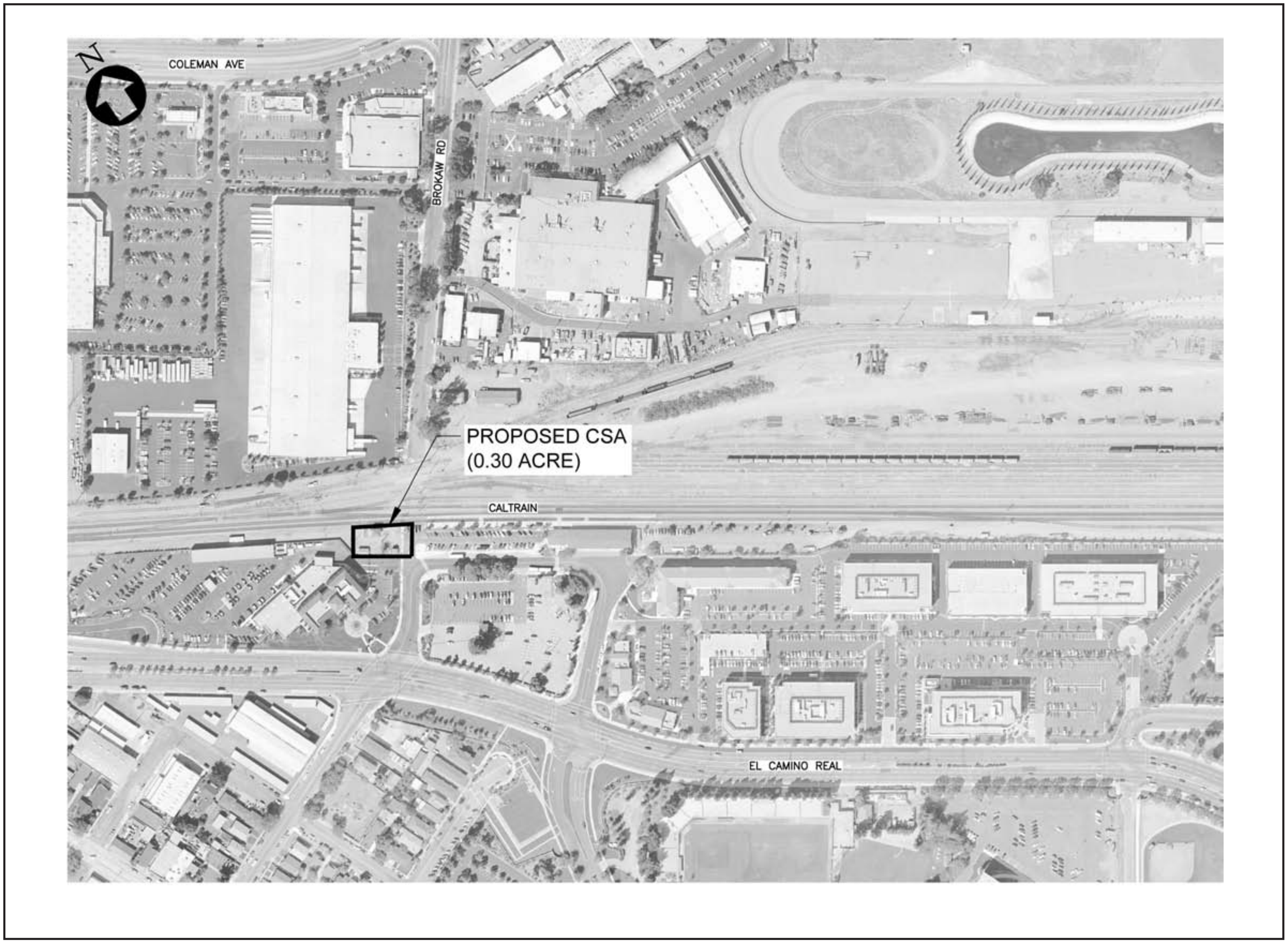
Source: VTA, 2008.

Figure 6-37: Proposed SR 87 Construction Staging Area



Source: VTA, 2008.

Figure 6-38: Proposed Diridion / Arena Station Construction Staging Areas



Source: VTA, 2008.

Figure 6-39: Proposed Santa Clara Station Construction Staging Area three alternate locations for the third site: north of East Santa Clara Street between 3rd and 4th streets (0.70 acres), and south of East Santa Clara Street between either 1st and 2nd streets (1.41 acres) or 3rd and 4th streets (0.53 acres). Access to any of these sites would be from East/West Santa Clara Street and/or along the north/south intersecting streets. (SVRTP Alternative)

- **SR 87.** This area would include 0.34 acres south of West Santa Clara Street and east of the Guadalupe River, and would be almost entirely under the SR 87 overpass. Access to the site would be from West Santa Clara Street. (SVRTP Alternative)

- **Diridon / Arena Station.** This area would include six sites for a total of 3.43 acres that surround the cut and cover station area. Access to these sites would be from Cahill, Montgomery, and Autumn streets. (SVRTP Alternative)

- **Santa Clara Station.** This area would include 0.3 acres north of Benton Street and east of the Caltrain tracks. Access to the site would be from Benton Street. The historic Santa Clara Station tower and sheds are currently located at this site. As a part of the SVRTP Alternative, these buildings would be relocated to south of the historic depot (see Sections 4.4 and 5.4, Cultural Resources, and Chapter 7, Section 4(f)), allowing the site to then be used for construction staging and materials storage. (SVRTP Alternative)

6.2.12 TRUCK HAUL ROUTES

The BEP Alternative would require the removal of excavated soil to primarily construct the retained cuts, roadway underpasses, and building foundations for stations and facilities. The SVRTP Alternative would require the removal of considerably more material due to the addition of cut and cover stations and the tunnel bores. Some of the excavated soil may be used in the retained fills and over the cut and cover stations depending on its suitability. However, there would still be considerable amount of material that would need to be hauled away from construction sites.

An estimate has been made of the volume of material to be hauled away and the number of trucks required. Table 6-1 presents an estimate for the line segment, which includes the BEP Alternative and a portion of the SVRTP Alternative.

This table identifies the haul routes by major roadway; however, trucks may use other streets, excluding residential streets, to travel to and from various construction access points along the line segment. Table 6-2 presents an estimate of the total of material for the SVRTP Alternative tunnel segment. This table identifies the haul routes by facility name, where the material is to be transported from one construction site only.

Table 6-1: Warms Springs to Berryessa Road Haul Road Volumes and Numbers of Trucks for the BEP and SVRTP Alternatives

Haul Road	Haul Volume Cubic Yards	Estimated Number of Trucks[a]
East Warren Avenue using I-880 or I-680 via Mission Boulevard	60,000	3,010
Kato Road using I-880 or I-680	9,000	470
Dixon Landing Road using I-880	78,000	3,910
Calaveras Boulevard using I-880 or I-680	70,000	3,510
Montague Expressway using I-880 or I-680	130,000	6,530
Hostetter Road using I-880 or I-680	136,000	6,845
Berryessa Road using US 101	20,000	1,035
Totals	503,000	25,310

[a] Based on approximately 20 cubic yards per truck.

Source: Earth Tech, Inc., 2003.

Table 6-2: Haul Road Volumes and Numbers of Trucks (SVRTP Alternative Tunnel Portion Only)

Station/Structure	Haul Volume Cubic Yards[a]	Estimated Number of Trucks[b]	Estimated Number of Typical Peak Hour Trucks
Alum Rock Station	172,960	8,648	4 [c]
Downtown San Jose Station and Crossover Structure	285,850	28,585	8 [d]
Diridon Station	179,025	17,903	8 [e]
FSS Vent Structure	22,395	2,240	4 [f]
STS Vent Structure	22,395	2,240	4 [g]
West Portal	90,728	4,536	7 [h]
East Portal	70,678	3,534	11 [i]
Tunnel (muck) – WP to DSJS	316,682	15,834	5 [j]
Tunnel (muck) – EP to DSJS	309,172	15,459	5 [k]
Totals	**1,469,885**	**98,979**	n/a

[a] Includes swell factors of 25 percent for cut-and-cover soil excavation and TBM muck excavation.

[b] Based on approximately 10 cubic yards per truck at the DSJS/Crossover, Diridon Station and FSS & STS Vent Structures and approximately 20 cubic yards per truck at Alum Rock Station and west and east Portals.

[c] 8,648 trucks for AR station excavation in 7 month period, 48 work weeks per year (assume 28 weeks total), 5 days per week, 2 eight-hour shifts per day => 62 trucks per day or 62 trucks day / 16 hours per day => 4 trucks per hour.

[d] 28,585 trucks for DSJS station excavation in 11 month period, 48 work weeks per year (assume 44 weeks total), 5 days per week, 2 eight-hour shifts per day => 130 trucks per day or 130 trucks day / 16 hours per day => 8 trucks per hour.

[e] 17,903 trucks for Diridon station excavation in 7 month period, 48 work weeks per year (assume 28 weeks total), 5 days per week, 2 eight-hour shifts per day => 128 trucks per day or 128 trucks day / 16 hours per day => 8 trucks per hour.

[f] 2,240 trucks for FSS vent structure excavation in 2 month period, 48 work weeks per year (assume 8 weeks total), 5 days per week, 2 eight-hour shifts per day => 56 trucks per day or 56 trucks day / 16 hours per day => 4 trucks per hour.

[g] 2,240 trucks for STS vent structure excavation in 2 month period, 48 work weeks per year (assume 8 weeks total), 5 days per week, 2 eight-hour shifts per day => 56 trucks per day or 56 trucks day / 16 hours per day => 43 trucks per hour.

[h] 4,536 trucks for west portal excavation in 2 month period, 48 work weeks per year (assume 8 weeks total), 5 days per week, 2 eight-hour shifts per day => 113 trucks per day or 113 trucks day / 16 hours per day => 7 trucks per hour.

[i] 3,534 trucks for east portal excavation in 1 month period, 48 work weeks per year (assume 4 weeks total), 5 days per week, 2 eight-hour shifts per day => 177 trucks per day or 177 trucks day / 16 hours per day => 11 trucks per hour.

[j] 15,834 trucks for tunnel boring in 11 month period, 48 work weeks per year (assume 44 weeks total), 5 days per week, 2 eight-hour shifts per day => 72 trucks per day or 72 trucks day / 16 hours per day => 5 trucks per hour.

[k] 15,459 trucks for tunnel boring in 11 month period, 48 work weeks per year (assume 44 weeks total), 5 days per week, 2 eight-hour shifts per day => 71 trucks per day or 71 trucks day / 16 hours per day => 5 trucks per hour.

Source of Haul Volumes: HMM/Bechtel, April 2008.

Restrictions on haul routes can be incorporated into construction specifications, and any request by the contractor to change the routes would be subject to approval by the applicable city. The proposed truck haul routes for the tunnel alignment are shown in Figures 6-40 through 6-46, which show routes from specific sites, as follows:

- **East Tunnel Portal Truck Haul Route.** Trucks would use either Las Plumas Avenue or Mabury Road to access the east tunnel portal construction site. To get to the site from Highway 101, trucks would exit the McKee Road/East Julian Street/US 101 interchange, travel east on McKee Road, north on King Road, and then west either on Las Plumas Avenue or Mabury Road. Trucks would use these same streets to return to the freeway.

- **Alum Rock Station Truck Haul Route.** Alum Rock Station is just west of Highway 101 near the McKee Road/East Julian Street/US 101 interchange. To get to the construction site from Highway 101, trucks would exit at this interchange, travel west on East Santa Clara Street, and then south on 28th Street. Trucks would use these same streets to return to the freeway.

- **Ventilation Structure FSS Truck Haul Route.** This ventilation structure and vent shaft have alternate locations. All locations would be accessed from East Santa Clara Street. To get to the construction site from Highway 101, trucks would exit the Alum Rock Avenue/East Santa Clara Street/US 101 interchange, then travel west on East Santa Clara Street. Trucks would use

East Santa Clara Street to return to the freeway. To get to the construction site from I-280, trucks would exit the 10th Street/11th Street/I-280 interchange, then travel north on 11th Street to East Santa Clara Street. Trucks would travel south on 10th Street to return to the freeway.

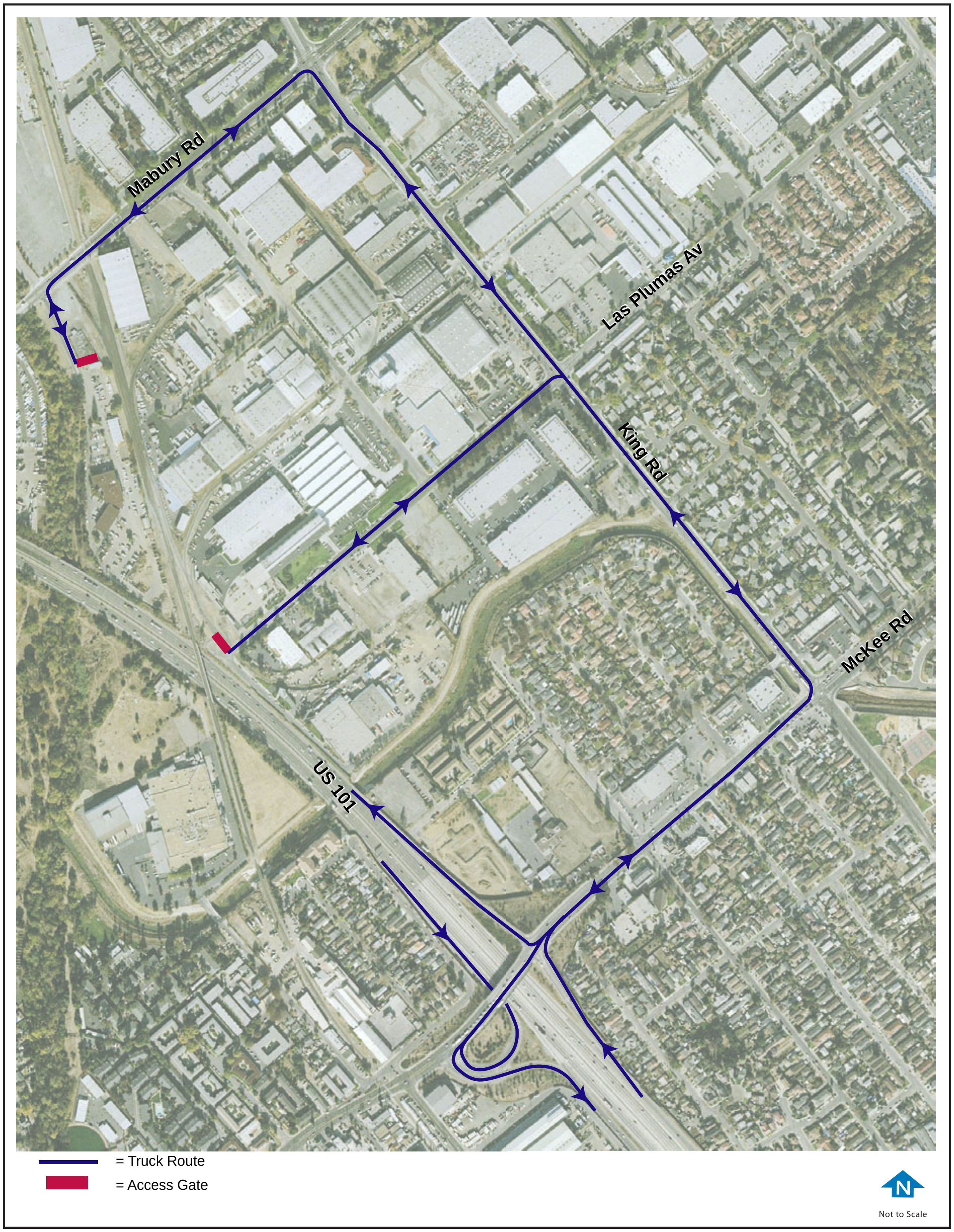
- **Downtown San Jose Truck Haul Route.** Excavated material from this cut and cover station would be removed at both ends of the station. To get to the west end of the station, trucks would travel from the SR 87/West Julian Street interchange, then east on St. James Street, then south on Market Street to West Santa Clara Street. To return to the freeway, trucks would travel west on West Santa Clara Street, then north on Notre Dame Street, then access one of the freeway on-ramps from West Julian Street. This haul route configuration basically forms a loop from the freeway to the construction site and back to the freeway. To get to the east end of the station, trucks would travel exit the 10th Street/11th Street/I-280 interchange, travel north on 11th Street to East Santa Clara Street, then west to the station area. Trucks would travel east on East Santa Clara Street, then south on 10th Street to return to the freeway.

- **Diridon/Arena Station Truck Haul Route.** From the station area, trucks may be traveling to or from either SR 87 or I-280. From southbound SR 87, trucks would exit at West Julian Street, cross West Julian Street to travel south on Almaden Boulevard to West Santa Clara Street, then west on West Santa Clara Street, then south on Montgomery Street. From north bound SR 87, trucks would exit at West Santa Clara Street, then west on West Santa Clara Street, then south on Montgomery Street. To return to SR 87, trucks would travel north on Autumn Street, then east on West Santa Clara Street, then north on Notre Dame Street, and then access one of the freeway on-ramps from West Julian Street.

  From the I-280/Bird Avenue Bird interchange, trucks would travel north on Bird Avenue to Autumn Street. To return to I-280, trucks would travel south on Montgomery Street, which becomes Bird Avenue, then access one of the freeway on-ramps from Bird Avenue.

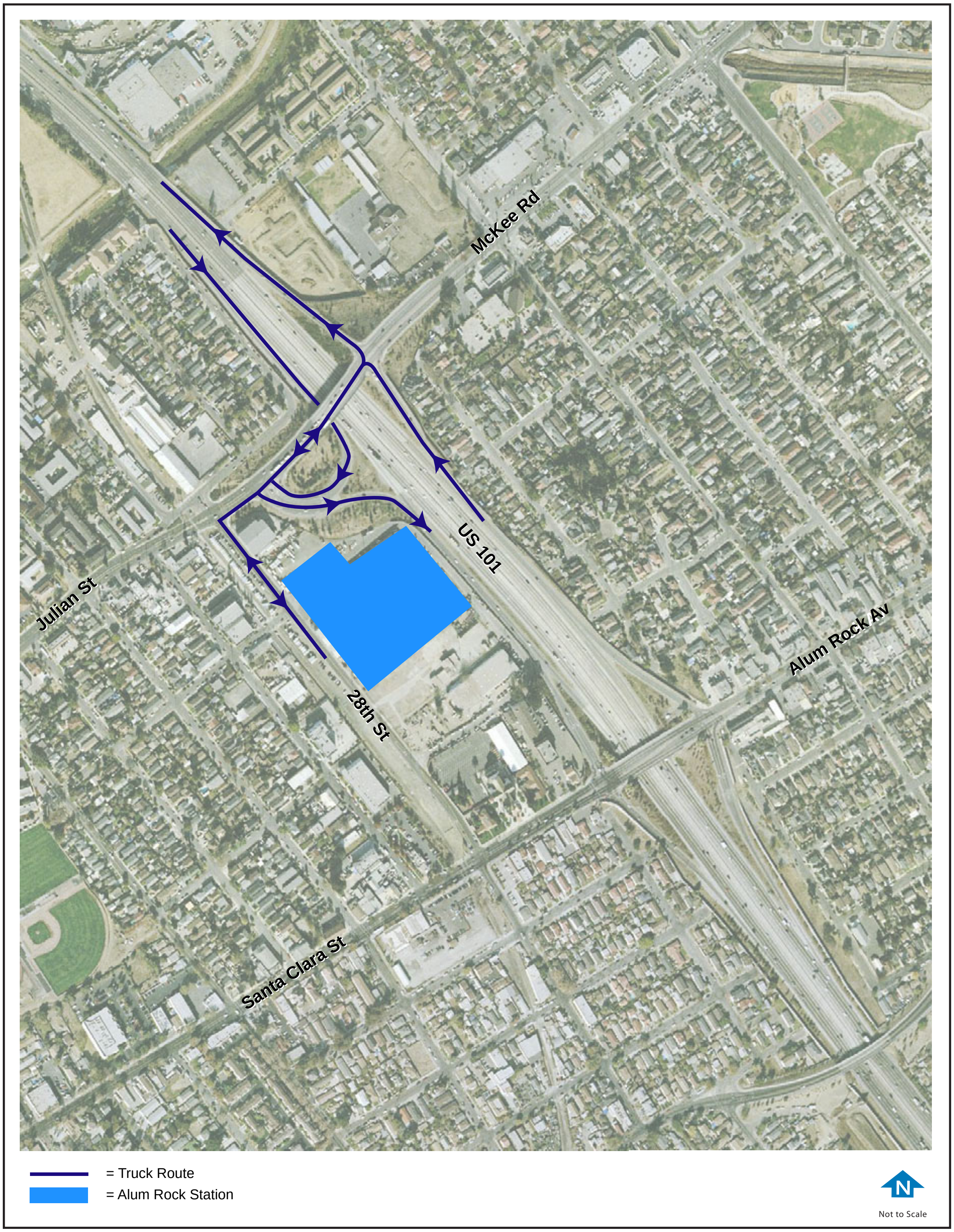
- **Ventilation Structure STS.** This ventilation structure and vent shaft have alternate locations. All locations would be accessed from Stockton Avenue. To get to the construction site from SR 87, trucks would exit at the Taylor Street/SR 87 interchange, and then travel west on Taylor Street, then south on Stockton Avenue. Trucks would use these same streets to return to the freeway (Figure 6-45).

- **West Tunnel Portal Truck Haul Route.** Trucks would use either Newhall Drive to access the west tunnel portal construction site. To get to the site from I-880, trucks would exit the Coleman Avenue/I-880 interchange, then travel north on Coleman Avenue, then travel west on Newhall Drive. Trucks would use these same streets to return to the freeway.



Source: HexagonTransportation Consultants, Inc., 2008.

Figure 6-40: East Portal Truck Haul Route



Source: HexagonTransportation Consultants, Inc., 2008.

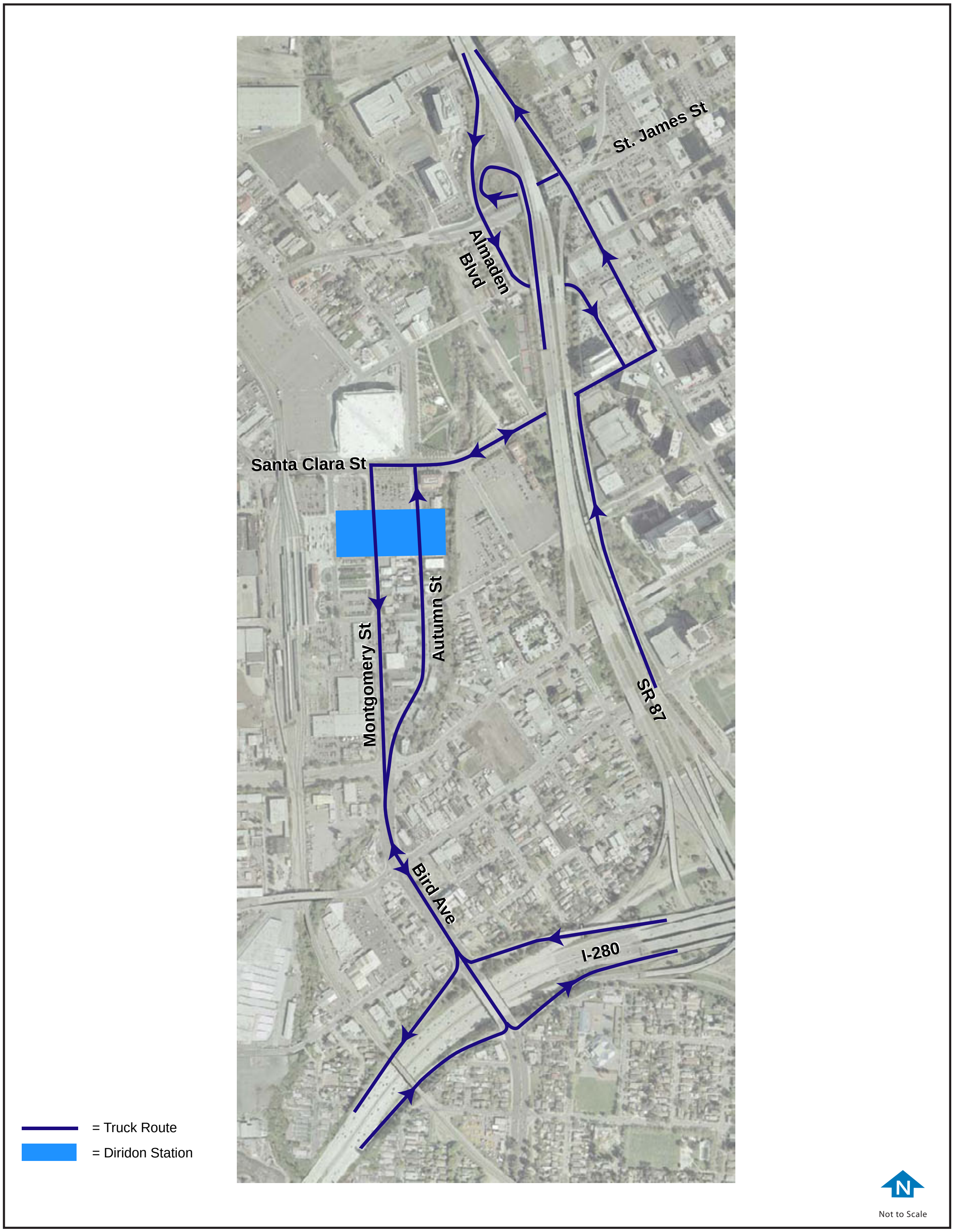
Figure 6-41: Alum Rock Station Truck Haul Route

Source: HexagonTransportation Consultants, Inc., 2008.

Figure 6-42: Ventilation Structure FSS Truck Haul Route

Source: HexagonTransportation Consultants, Inc., 2008.

Figure 6-43: Downtown San Jose Truck Haul Route

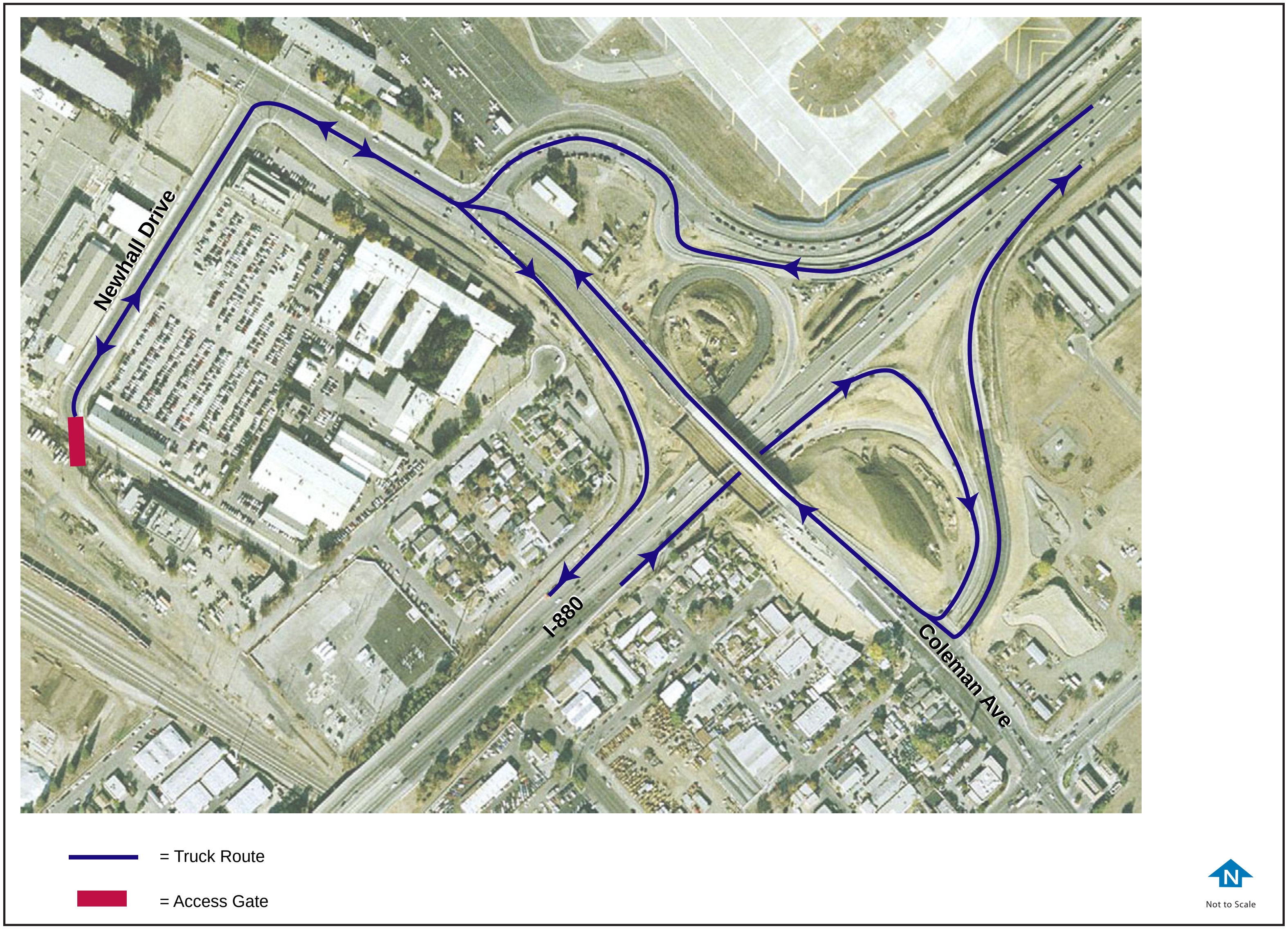


Source: HexagonTransportation Consultants, Inc., 2008.

Figure 6-44: Diridon / Arena Station Truck Haul Route

Source: HexagonTransportation Consultants, Inc., 2008.

Figure 6-45: Ventilation Structure STS Truck Haul Route



Source: HexagonTransportation Consultants, Inc., 2008.

Figure 6-46: West Portal Truck Haul Route

6.3 CONSTRUCTION IMPACTS

6.3.1 TRANSPORTATION AND TRANSIT

Transit

No Build Alternative

Construction effects on transit would be similar to those typically associated with transit, facilities, and roadway projects. Projects would undergo separate environmental review to determine the effects to transit and the appropriate mitigation measures.

BEP and SVRTP Alternatives

During construction of either Build Alternative, some bus routes would be temporarily re-routed and some bus stops would be temporarily relocated. VTA will coordinate with AC Transit, Santa Cruz Metro, Amtrak, Monterey/Salinas Transit, as necessary, to ensure that appropriate measures are taken to re-route bus routes and to relocate bus stops during construction. Notification to the media and general public will be provided in accordance with the Construction Education Outreach Plan. No mitigation is required.

The BEP and SVRTP alternatives would also involve connecting the southern terminus of the BART Warm Springs Extension to the new BEP or SVRTP alternative tracks. Construction of this connection has the potential to disrupt existing BART revenue service. To avoid the disruption, construction would be scheduled during non-revenue hours.

The construction of the Kato Road, Dixon Landing Road, Montague Expressway, Capitol Avenue, Trade Zone Boulevard, Hostetter Road, Sierra Road/Lundy Avenue, Berryessa, and Mabury Road crossings would cause minimal adverse affects to freight operations. Construction of the crossings would require temporary (evenings and weekends) closures of freight tracks. VTA will work with UPRR to minimize adverse affects to freight operations during construction of the crossings.

During construction of the Downtown San Jose Station for the SVRTP Alternative only, light rail service would be interrupted at East Santa Clara Street for certain construction activities such as installation of the temporary shoring walls. Light rail service would be interrupted one block or one block and one intersection, or two blocks and one intersection at a time – for periods of up to 3 months at a time. Interruption to light rail service for up to 3 months at a time during construction of the Downtown San Jose Station would cause an unavoidable adverse effect.

Mitigation Measure CNST-TR-1: VTA will work with the city, and the public would be informed in accordance with the Construction Education Outreach Plan. Bus bridges would be in implemented to transfer light rail passengers around the construction area.

Parking

No Build Alternative

Construction period affects to parking would be those typically associated with transit, facilities, and roadway projects. Projects would undergo separate environmental review to determine parking effects and mitigation measures.

BEP and SVRTP Alternatives

Refer to 6.3.13 *Socioeconomics & Environmental Justice* for a discussion of the adverse effects from the temporary displacement of parking during the construction of the BEP and SVRTP alternatives. Permanent loss to parking due to the alternatives is discussed in Section 5.12, Socioeconomics and Environmental Justice.

Pedestrians and Bicyclists

No Build Alternative

Construction period affects to pedestrians and bicyclists typically associated with the construction of transit, facilities, and roadway projects. Projects would undergo separate environmental review to determine bicycle effects and mitigation measures.

BEP and SVRTP Alternatives

With the SVRTP Alternative, crosswalks on both sides of Market Street, San Pedro Street, 1st Street, 2nd Street, and 3rd Street across East/West Santa Clara Street would be temporarily closed for up to 30 days during construction of the Downtown San Jose Station. The sidewalks along East/West Santa Clara Street would be maintained on both sides of the street during construction.

Autumn Street would be closed south of West Santa Clara Street near the station area during construction of Diridon/Arena Station. Pedestrian and bicycle traffic would be detoured to Montgomery Street. Montgomery Street and Cahill Street would be closed from The Alameda to the south side of the station area. Pedestrian and bicycle traffic would be detoured to Autumn Street south of the station area. A minimum 12-foot-wide bicycle/pedestrian path would be provided to connect the HP Pavilion and San Jose Caltrain Station during construction.

With certain sidewalks maintained and detours provided, the construction of the Downtown San Jose and Diridon/Arena stations would not result in an adverse effect. Mitigation is not required.

Vehicular Traffic

No Build Alternative

Construction-period affects to vehicular traffic would be effects typically associated with transit, facilities, and roadway projects. Intersection level of service can be adversely impacted at some locations. Projects would undergo separate environmental review to determine adverse effects and mitigation measures.

BEP and SVRTP Alternatives

Construction along the line segment includes grade separations between the BEP Alternative or SVRTP Alternative alignment and several roadway crossings, as described below. As part of the Construction Education and Outreach Plan (see Section 6.1.3 of this chapter), VTA will inform the media and public (local residents, business owners, and motorists) of the construction activities, schedules, lane closures, and detours for the crossings. In addition, VTA will work with police departments to monitor lane closures and provide manual traffic control on detour routes as necessary; work with the cities to modify green times at key intersections during construction; set up event timers at key intersections for time of day when closures are planned; modify timing to allow longer gap and maximum times for detour movements at key intersections; provide flag control or temporary signalization at un-signalized intersections; and provide early signage of potential construction delays for motorists to choose alternate routes.

Kato Road Crossing. The BART alignment would cross at grade on a new bridge structure over Kato Road, which would be reconstructed as a roadway underpass. Construction of the Kato Road underpass would take approximately 18 months. Within these 18 months, Kato Road would require full closure for approximately 6 months in the area near the BART alignment. The full closure would affect traffic at the following two intersections: 1) Dixon Landing Road/North Milpitas Boulevard and 2) Kato Road-Scott Creek Road/Warm Springs Boulevard. Increased traffic congestion would result from both the diversion of east-west traffic from the Kato Road/Milmont Drive intersection and the inability of existing regional commute cut-through traffic to use the Kato Road-Milmont Drive path. The 6-month closure of the Kato Road crossing would be scheduled to avoid the 6-month closure of the Dixon Landing Road crossing (see below).

- **Dixon Landing Road/North Milpitas Boulevard.** Currently, the southbound right-turn volume increases considerably in the morning peak and the eastbound left turn volume increases in the evening peak. The southbound approach (north leg) is currently striped with a wide shoulder that is used as a bike lane and right turn lane, two through lanes, and one left turn lane. The eastbound approach (west leg) is currently striped with one left-turn lane, one through lane, and one shared through-right lane.

During construction, the southbound approach would be modified to two right turn lanes, a bike pocket, one through lane, and one left turn lane. Temporary warning signs would be provided for bicyclists entering the bike pocket and southbound drivers turning right to yield to pedestrians. The eastbound approach would be modified to one left-turn lane, one shared left-through lane, and one through-right lane, and the traffic signal phasing would be modified to an east/west “split” phasing to accommodate the shared left-through lane. The combined effect of re-striping and traffic signal phase sequence modifications would result in a LOS F operation in both the AM and PM peak hours. To achieve LOS D, road widening would be required, which would not be feasible since this would require additional ROW that would affect private property and add substantial project cost.

- **Kato Road-Scott Creek Road/Warm Springs Boulevard.** Currently, the northbound right-turn volume and the westbound left-turn volumes increase considerably in the morning peak. The northbound approach (south leg) is currently striped for two left-turn lanes, two through lanes, and one right-turn lane. The westbound approach (east leg) is currently striped for one left-turn lane, two through lanes, and one right-turn lane.

During construction, the northbound approach will be modified to one left-turn lane, two through lanes, and two right-turn lanes. During construction, the westbound approach will be modified to two left-turn lanes, one through lane, and one right-turn lane. The combined effect of re-striping and traffic signal phase sequence modifications results in an LOS F operation in the AM peak hour and LOS D in the PM peak hour. To achieve LOS D in the AM peak hour, road widening would be required, which would not be feasible since it would affect adjacent private property and add additional project cost.

The full closure of Kato Road in the area near the BART alignment for 6 months, in addition to the traffic effects at Dixon Landing Road/North Milpitas Boulevard and Kato Road-Scott Creek Road/Warm Springs Boulevard, would result in an unavoidable adverse effect. Mitigation measures to reduce the adverse effects from the full closure of Kato Road are not feasible due to ROW constraints. However, the following mitigation measure would help reduce the severity of this adverse effect.

> Mitigation Measure CNST-TR-2: VTA will work with the City of Fremont to develop a Traffic Management Plan for construction of Kato Road Crossing.

Dixon Landing Road Crossing. There are two alignment options at Dixon Landing Road – Retained Cut Option and At Grade Option.

Under the Retained Cut Option, Dixon Landing Road would remain at grade, but be supported over the BART retained cut on a new roadway bridge structure. The existing at-grade freight train crossing would remain in place. Gates would continue to be used to protect the public from the train movements, including bells, flashing lights, and honking train horns. Traffic would continue to be impeded by train movements, as it is today. Construction of the Retained Cut Option would require a minimal closure of lanes during various construction stages. Construction activities would accommodate the traffic volumes, and diversions onto nearby streets would not be required. For this reason, an intersection level of service analysis for diversion routes is not required. Mitigation is not required.

Under the At Grade Option, Dixon Landing Road would be reconstructed as a roadway underpass with BART passing over the roadway on a new at grade bridge structure. Under this option, all three transportation modes – Dixon Landing Road, BART and freight operations – would be grade separated. Traffic along Dixon Landing Road would not be impeded by freight train activity. Also, an adjacent cross street to the west of the BART alignment, Milmont Drive, would be lowered due to the slope of Dixon Landing Road. There are two options under consideration for construction of the At Grade Option: full closure or partial closure of Dixon Landing Road during construction.

Under the At Grade Option, the entire duration of construction-related closures on Dixon Landing Road for the full closure option would take 18 months. There would be 6 months of temporary (weekend and evening) lane closures, then Dixon Landing Road would be fully closed for 6 months. The last 6 months of construction would consist of partial, temporary (evening and weekend) lane closures. Full closure of Dixon Landing Road would adversely affect traffic at the following three intersections: 1) Dixon Landing Road/Milmont Drive, 2) Kato Road/Milmont Drive, and 3) Kato Road-Scott Creek Road/Warm Springs Boulevard. Increased traffic congestion would result from the diversion of east-west traffic from Dixon Landing Road onto Kato Road. The 6-month closure of the Dixon Landing Road would be scheduled to avoid the 6-month closure of Kato Road during construction.

- **Dixon Landing Road/Milmont Drive.** Roadway excavation at this intersection would allow for only one northbound and one southbound lane on Milmont Drive to remain open. Adequate intersection levels of service would not be provided given the traffic levels and roadway constraints. To provide acceptable levels of service, road widening would be required, which would not be feasible since this would require additional ROW that would affect private property and add substantial project cost.

- **Kato Road/Milmont Drive.** Northbound Milmont Drive approaching Kato Road is currently striped for one left turn lane and one shared through-right lane. The right-turn volume increases considerably in both the morning and evening peaks. During construction, the northbound approach would be modified to one shared through-left lane and one right turn lane, and the PM peak hour would deteriorate from LOS C to LOS E. Traffic signal phasing would be modified to allow the right-turn movement from Milmont Drive to Kato Road to overlap with the westbound left turn movement from Kato Road to Milmont Drive. Southbound Milmont Drive approaching Kato Road is also currently striped for one left turn lane and one shared through-right lane. During construction, the southbound approach would be modified to one shared left-through-right lane. This modification would be implemented within existing street ROW.

- **Kato Road–Scott Creek Road/Warm Springs Boulevard.** Eastbound on Kato Road approaching Warm Springs Boulevard is currently striped for one left-turn lane, two through lanes, and one shared through right-turn lane. The right-turn volume increases considerably in both the morning and evening peaks. During construction, the eastbound approach would be modified to one left turn lane, one through lane, one shared through right-turn lane, and one right turn lane. This would result in LOS E and LOS D operation during the AM and PM peak hours, respectively. This modification would be implemented within existing street ROW.

The full closure of Dixon Landing Road in the area near the BART alignment for 6 months, in addition to the traffic effects at Dixon Landing Road/Milmont Drive, would result in an unavoidable adverse effect. Mitigation measures to reduce adverse effects from the full closure of Dixon Landing Road are not feasible due to ROW constraints. However, the following mitigation measure would help reduce the severity of this adverse effect:

> Mitigation Measure CNST-TR-3: VTA will work with the City of Milpitas to develop a Traffic Management Plan for construction of the Dixon Landing Road Crossing.

Partial closure of Dixon Landing Road under the At Grade Option, where at least one lane on Dixon Landing Road would remain open in each direction for 30 months, would affect traffic at Dixon Landing Road/Milmont Drive.

- **Dixon Landing Road/Milmont Drive.** The partial closure option would cause queues on Dixon Landing Road west of the railroad crossing that would back up onto the I-880 mainline during the PM peak hour causing deterioration from LOS E to LOS F. To provide acceptable levels of service, road widening would be required, which would not be feasible since this would require additional ROW that would affect private property and add substantial project cost.

The partial closure of Dixon Landing Road At Grade Option in the area near the BART alignment for 30 months would affect traffic at Dixon Landing Road/Milmont Drive and would result in an unavoidable adverse effect. Mitigation measures to reduce the effect of the partial closure of Dixon Landing Road are not feasible due to ROW constraints. The same mitigation used for the full closure, as would be used for the partial closure of Dixon Landing Road. This mitigation measure is:

> Mitigation Measure CNST-TR-3: VTA will work with the City of Milpitas to develop a Traffic Management Plan for construction of the Dixon Landing Road Crossing.

Montague Expressway Crossing. Under both the Retained Cut Long and the Retained Cut Intermediate Option, Montague Expressway would be supported above BART on a new roadway bridge structure. Construction on Montague Expressway would extend from Falcon Drive to Piper Drive and would require a minimal closure of lanes during various construction stages. Construction activities would accommodate the traffic volumes, and diversions onto nearby streets would not be required. For this reason, an intersection level of service analysis for diversion routes is not required. Mitigation is not required.

Capitol Avenue Crossing. Under both the Retained Cut Long and the Retained Cut Intermediate Option, Capitol Avenue would be supported above BART on a new roadway bridge structure. Construction on Capitol Avenue would extend from the Milpitas Station to East Trimble Road and would require a minimal closure of lanes during various construction stages. Construction activities would accommodate the traffic volumes, and diversions onto nearby streets would not be required. For this reason, an intersection level of service analysis for diversion routes is not required. Mitigation is not required.

Trade Zone Boulevard Crossing. Under both the Retained Cut Long and the Retained Cut Intermediate Option, Trade Zone Boulevard would be supported above BART on a new roadway bridge structure. Construction on Trade Zone Boulevard would extend from Capitol Avenue to Lundy Place and would cause the reduction in travel lanes and capacity at the crossing. However, the level of service for six of the eight study intersections remains acceptable during construction. Two intersections, Montague Expressway/Capitol Avenue and Montague Expressway/Trade Zone Boulevard, would operate at LOS F in the PM under 2015 no project conditions, and construction of the crossing would not cause the level of service to degrade from these conditions. Mitigation is not required.

Hostetter Road Crossing. BART would pass under Hostetter Road in a retained cut. Hostetter Road would be supported above BART on a new roadway bridge structure. Construction on Hostetter Road would extend from Automation Parkway to Rue Avati and would result in a reduction in travel lanes and capacity at the crossing. Construction activities would accommodate the traffic volumes, and diversions onto nearby streets would not be required. For this reason, an intersection level of service analysis for diversion routes is not required. Mitigation is not required.

Sierra Road/Lundy Avenue Crossing. BART would pass under Sierra Road/Lundy Avenue in a retained cut. This intersection would be supported above BART on a new roadway bridge structure. During construction, all of the study intersections would operate at acceptable levels of service. Mitigation is not required.

Berryessa Road Crossing. BART would pass over Berryessa Road on an aerial structure. Due to the span of the aerial structure over the roadway, a column support would be constructed in the center of Berryessa Road. Construction on Berryessa Road would extend from Cornish Lane (just west of the crossing) to Lundy Avenue/King Road and would result in the reduction of travel lanes from three to two in each direction during most of the construction period. Temporary closures of half the roadway would occur for the erection and removal of falsework, placement and removal of k-rail, and removal of the existing railroad panels (sections of railroad tracks including ties). These closures would typically occur on weekend days and last for 8 hours or less. When half the roadway is closed, traffic would be directed to the open half, which would have one travel lane in each direction.

Construction activities would accommodate the traffic volumes, and diversions onto nearby streets would not be required. For this reason, an intersection level of service analysis for diversion routes is not required. Under 2015 no project conditions, traffic volumes would not exceed the two lane capacities for long-term lane closures or the one-lane capacities for short term, half street closures during the hours indicated. For this reason, an intersection level of service analysis for diversion routes is not required. Mitigation is not required.

Mabury Road Crossing. BART would pass over Mabury Road on an aerial structure. Construction on Mabury Road would extend from Taylor Street to King Road and would result in a reduction in travel lanes and capacity. Temporary full closures of the roadway would occur for the erection and removal of falsework, placement and removal of k-rail, and removal of the existing railroad panels.

Construction activities would accommodate the traffic volumes, and diversions onto nearby streets would not be required except during the temporary full closures. Projected volumes would not exceed the proposed one lane capacity, and detours for full closures would only occur during off-peak periods. For this reason, peak hour intersection level of service analyses for full closure diversion routes is not required. Mitigation is not required.

SVRTP Alternative Only

Downtown San Jose Station. The Downtown San Jose Station would be constructed along East Santa Clara Street between 4th Street and San Pedro Street. Construction of this station involves certain basic activities, as outlined in Table 6-3.

Table 6-3: Downtown Station Construction – Adverse Affects

Activity	Duration	Adverse Affects to Roadways
Advanced Utility Relocations	16-18 months	Temporary lane closures and some street closures along Santa Clara Street – one block, or one block and one intersection, or two blocks and one intersection at a time – for periods of up to 2 months at a time.
Support of Excavation Wall Installation	12-14 months	Temporary street closures along Santa Clara Street – one block or one block and one intersection, or two blocks and one intersection at a time – for periods of up to 3 months at a time. Light Rail Transit will require bus bridges at 1st and 2nd Street intersections for up to 2 months each intersection.
Decking Installation	1-3 months	Temporary street closures along Santa Clara Street – one block or one block and one intersection, or two blocks and one intersection at a time – for approx. 2 weeks at a time
Station Box Excavation	10-12 months	Intermittent lane closures along Santa Clara Street
Tunnel Boring Machine Removal	2-4 weeks	Intermittent lane closures on each end of the station – up to 1 week four times
Station Structure Construction	18-24 months	Intermittent lane closures along Santa Clara and 1-month street closure of Market Street.
Decking Remove, Backfill and Street Restoration (includes Street Resurfacing, Landscape, Sidewalk, Signals, Lighting)	18 months	Temporary one-block street closures of 1 to 2 months, with intermittent lane closures 3 to 4 days at a time.

Source: Hexagon Transportation Consultants, Inc., 2008.

These activities overlap with each other and are scheduled to occur over a period of up to 7 years. Long-term lane and/or street closures along four blocks of Santa Clara Street would be required to accommodate the various construction activities for the Downtown San Jose Station. Construction of the Downtown San Jose Station would cause unavoidable adverse effects due to the long-term street closures and degradation of three Santa Clara Street intersections to below LOS D.

> Mitigation Measure CNST-TR-4: VTA will work with the City of San Jose, the downtown Business Association, business owners and key stake holders to develop a Traffic Management Plan to minimize adverse effects of construction for the Downtown San Jose Station. As part of the Plan, traffic and pedestrian detours, alternate access, signage, and public outreach will be implemented along with special scheduling to offset the adverse effects from street or lane closure.

Diridon/Arena Station. The construction of the Diridon/Arena Station would require partial and full street closures of Autumn, Montgomery and Cahill streets. Autumn and Montgomery streets are currently within Caltrans Right-of-Way. Full closure of Autumn, Montgomery and Cahill streets south of West Santa Clara Street near the station would occur for less than 1 month each. No more than one street would be closed at any given time. Construction activities up to and including temporary street decking at Diridon/Arena Station would cause the degradation of the West Santa Clara Street and Autumn Street intersection to below LOS D during construction. To achieve higher LOS, road widening would be required, which would not be feasible since this would require additional ROW that would affect private property and add substantial project cost. Therefore, the street closures and degradation of the intersections to below LOS D during construction of the Diridon/Arena Station would cause an unavoidable adverse effect.

> Mitigation Measure CNST-TR-5: VTA will work with Caltrans, the City of San Jose, the downtown Business Association, business owners and key stake holders to develop a Traffic Management Plan to minimize adverse effects from construction for the Diridon/Arena Station. As part of the Plan, traffic and pedestrian detours, alternate access, signage, and public outreach will be implemented along with special scheduling to offset the adverse effects of street or lane closure.

Truck Haul Routes

The proposed truck haul routes and projected volumes of material for the BEP and SVRTP alternatives are given in Section 6.2.12 of this chapter. Adverse effects from the low volume of peak hour trucks on traffic level of service would not be substantial, except for momentary delays where trucks would be entering or leaving streets from the construction areas. No mitigation is required.

6.3.2 AIR QUALITY

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine construction effects to air quality and to determine appropriate mitigation measures, if necessary. Construction projects would include the implementation of effective and comprehensive control measures to reduce air pollutant emissions from construction activities to acceptable levels. The control measures typically implemented are those of the Bay Area Air Quality Management District, as described below for the SVTRP Alternative.

BEP and SVRTP Alternatives

Construction associated with the BEP and SVRTP alternatives would generate pollutant emissions from the following construction activities: (1) site preparation/excavation, (2) demolition of existing roadways, (3) construction workers traveling to and from construction sites, (4) delivery of construction supplies to construction sites and hauling of debris from construction sites, and (5) fuel combustion by onsite construction equipment. These construction activities would create emissions of dust (particulate matter), fumes, equipment exhaust, and other air contaminants. Emissions in pounds per day were calculated for particulate matter 2.5 microns or less in diameter ($PM_{2.5}$), particulate matter 10 microns or less in diameter (PM_{10}), carbon monoxide (CO), reactive organic compounds (ROC), nitrogen oxides (NO_X), and sulfur oxides (SO_X).

Table 6-4 presents the annual regional construction emissions for the BEP and SVRTP alternatives. For the BEP Alternative, it was assumed that construction would begin in 2011, fifteen pieces of heavy-duty equipment would operate for 16 hours per day, and there would be an average of 6,328 truck trips per year. It was also assumed that the BEP Alternative would include the handling of approximately 126,550 cubic yards of soil per year based on a haul truck capacity of 20 cubic yards. For the SVRTP Alternative, construction of the tunnel portion would result in additional construction emissions. It was assumed that construction would begin in 2011, twenty pieces of heavy-duty equipment would operate for 16 hours per day, and there would be an average of 28,323 truck trips per year. It was also assumed that the SVRTP Alternative would include the handling of approximately 566,457 cubic yards of soil per year based on a haul truck capacity of 20 cubic yards.

Table 6-4: Construction Criteria Pollutant Emissions for the BEP Alternative

	CO (Tons Per Year)	ROG (Tons Per Year)	NO_X (Tons Per Year)	SO_X (Tons Per Year)	$PM_{2.5}$ (Tons Per Year)	PM_{10} (Tons Per Year)
BEP Alternative	17	4	36	<1	11	4
SVRTP Alternative	25	6	53	<1	46	11

Source: Terry A Hayes Associates LLC, 2008.

Construction-related $PM_{2.5}$ or PM_{10} emissions are not required to be included in a transportation conformity hotspot analysis if such emissions are considered temporary, as defined in 40 CFR 93.123(c)(5) (i.e., emissions which occur only during the construction phase and last five years or less at any individual site).[1] While construction activity for either the BEP or SVRTP alternative would last more than five years, construction activity would not occur for a period of more than five years at any single construction site. As such, consideration of a construction-related $PM_{2.5}$ or PM_{10} hotspot is not required as part of the federal conformity analysis, and construction activity would comply with federal conformity guidelines.

The Bay Area Air Quality Management District (BAAQMD) approach to analysis of construction effects is to emphasize the implementation of effective and comprehensive

[1] United States Environmental Protection Agency, *Transportation Conformity Guidance for Qualitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*, March 2006.

control measures. If the appropriate construction control measures are implemented, then air pollutant emissions for construction activities would be reduced to acceptable levels. The BAAQMD construction control measures that will be implemented for the BEP and SVRTP alternatives are:

- All active construction areas will be watered at least twice daily.
- Trucks hauling soil, sand, and other loose materials will be covered or required to maintain at least two feet of freeboard.
- All unpaved access roads, parking areas, and staging areas at construction sites will be paved, watered three times daily, or covered with (non-toxic) soil stabilizers.
- Paved access roads, parking areas, and staging areas at construction sites will be swept daily (with water sweepers).
- Streets will be swept with water sweepers if visible soil material is carried onto adjacent public streets.
- Inactive construction areas (previously graded areas inactive for ten days or more) will be planted with hydroseed or covered with (non-toxic) soil stabilizers.
- Exposed stockpiles (dirt, sand, etc.) will be enclosed, covered, watered twice daily, or covered with (non-toxic) soil binders.
- Traffic speeds will be limited to 15 miles per hour on unpaved roads.
- Sandbags or other erosion control measures will be installed to prevent silt runoff to public roadways.
- Disturbed areas will be replanted with vegetation as quickly as possible.
- Wheel washers will be installed for all exiting trucks or the tires of all trucks and equipment leaving the site will be washed.
- Excavation and grading activity will be suspended in areas located near sensitive receptors when winds (instantaneous gusts) exceed 25 miles per hour.

In addition to the BAAQMD construction control measures, the following measures will be implemented to further reduce construction emissions:

- An activity schedule will be created to minimize traffic congestion around the construction site.

- USEPA-registered particulate traps and other appropriate controls will be utilized to reduce emissions of diesel particulate matter and other pollutants at the construction site.
- Construction equipment and staging zones will be located as far from sensitive receptors as possible, as well as away from fresh air intakes to buildings and air conditioners.
- Low sulfur fuel will be utilized (diesel with 15 parts per million or less).
- The construction contractor will reduce use, trips, and unnecessary idling from heavy equipment.
- The construction contractor will lease equipment from year 1996 or newer.
- The project applicant will periodically inspect construction sites to ensure construction equipment is properly maintained at all times.

With implementation of these construction control measures, the BEP and SVRTP alternatives would not result in an adverse affect to air quality during construction. As such, mitigation measures are not required.

6.3.3 BIOLOGICAL RESOURCES AND WETLANDS

Construction activities have the potential to disturb biological resources that are outside the area of direct, permanent effect, including vegetative communities that provide habitat for special status species and wetlands or other waters of the U.S. This section focuses on short-term effects from construction activities and mitigation measures to avoid or minimize these adverse effects.

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine adverse affects to biological resources and wetlands during construction. However, for the projects near sensitive resources, the adverse affects to biological and wetland resources and corresponding mitigation measures would be expected to be similar to the BEP and SVRTP alternatives as discussed below.

BEP and SVRTP Alternatives

Adverse effects to native grasslands could occur in areas to the south of Calaveras Boulevard resulting from the Calaveras Boulevard construction staging areas. These grasslands provide habitat for Western burrowing owls. Construction activities and noise could disturb owl burrows, affect nesting behavior, or displace juvenile owls before they are self-sufficient. Such temporary effects could occur within areas immediately adjacent to construction of the alternatives, or – as in the case of noise – extend to the entire 13-acre grassland area identified in the vicinity of the facility.

Mitigation measure CNST-BIO-1 through CNST-BIO-4 will be implemented as appropriate to avoid or minimize any temporary affects to burrowing owls. Mitigation measure CNST-BIO-5 will be implemented to avoid or minimize any temporary affects to Congdon's tarplant.

Mitigation Measure CNST-BIO-1: A preconstruction survey of suitable habitat within 250 feet of construction areas (access permitting) will be conducted per California Department of Fish and Game (CDFG) guidelines by a qualified biologist within 30 days prior to construction to determine the presence of burrowing owls. If construction is delayed or suspended for more than 30 days after the preconstruction survey, the site will be resurveyed. If no burrowing owls are found, then no further mitigation is warranted.

Mitigation Measure CNST-BIO-2: If burrowing owls are determined to be present, avoidance of occupied burrows is the preferred method of addressing potential adverse effects. Avoidance measures include establishment of a "no disturbance" (construction-free) buffer zone within 50 meters (approximately 165 feet) of occupied burrows during the nonbreeding season (September 1 through January 31) or within 75 meters (approximately 250 feet) during the breeding season (February 1 through August 31).

Mitigation Measure CNST-BIO-3: If avoidance is not feasible, a qualified biologist, in consultation with CDFG, will use passive relocation techniques (e.g., installing one-way doors at burrow entrances) to displace burrowing owls from the construction area to avoid the loss of any individuals due to construction. At least one week is required to accomplish passive relocation and allow owls to acclimate to alternate burrows. Passive relocation is only authorized during the nonbreeding season.

Mitigation Measure CNST-BIO-4: If destruction of occupied burrows is unavoidable, the loss of foraging, nesting, and roosting habitat will be mitigated through habitat preservation at a ratio of 6.5 acres of foraging habitat permanently preserved for each pair or unpaired resident bird displaced due to the BEP Alternative. Such mitigation will be provided via preservation of the appropriate acreage of occupied burrowing owl habitat with a conservation easement or the purchase of credits in a CDFG-approved conservation bank.

Mitigation Measure CNST-BIO-5: VTA will design all facilities to avoid temporary and permanent affects to Congdon's tarplant to the maximum extent practicable. If avoidance is not feasible, a focused botanical survey will be conducted by a qualified plant biologist to ascertain the presence or absence of the species in the vicinity of selected alternative during the initial blooming period (August) that occurs prior to the construction. VTA will mitigate the permanent loss of Congdon's tarplants at a minimum ratio of 1:1 (replacement plants: lost plants), or at a ratio determined in consultation with resource agency personnel. VTA will also mitigate in accordance with the California Native Plant Society's recommended measures for mitigating adverse affects to Congdon's tarplant, as follows:

- To replace plants, seeds from plants within the affected area will be collected and stored during the month of August or September prior to construction beginning. As the blooming period lasts until November, the affect of pruning flowering heads to obtain seed will allow the plant to repeat flower and seed production before the end of the blooming period and thereby avoid or lessen a temporal loss before project work and reseeding occurs.

- The seed will be applied as a component of the revegetation mix within the affected area for any temporary effects and within a proposed replacement area for permanent effects. The replacement area will be determined in consultation with resource agency personnel. Revegetation should be accomplished by hydro seeding prior to the start of the rainy season in areas.

- The success of the reseeding will be monitored during the blooming period in the year following revegetation. The criteria for reseeding success will be that the species is found to be occurring throughout the reseeded areas. If unsuccessful, seed will be collected and sown in the unsuccessful areas prior to the rainy season that year.

- The success of the reseeding will also be monitored during the blooming period in the second year following revegetation. If seeding of previously unoccupied habitat is successful, mitigation will be deemed successful and no additional monitoring will be required. If unsuccessful, the area will be deemed as unsuitable habitat due to an apparent subtle difference in soil characteristics. In this case, revegetation of additional areas, determined in consultation with resource agency personnel, and an additional two years of monitoring will be conducted.

- If mowing of any revegetation area is proposed, it should be conducted prior to May 15 in order to allow sufficient time for flowering and seed set. Mowing should not be lower than six inches in order to minimize removal of tarplant foliage prior to flowering.

There is also potential for effects on loggerhead shrike foraging or use of nesting sites from loss of non-native grassland in the SVRTC, but this effect is not considered to be substantial, given that loggerhead shrikes are adapted to urban environments and appear to have ample foraging and nesting opportunities throughout the SVRTC.

Adverse affects to nesting or foraging habitat for loggerhead shrikes during the construction phase are also possible, but this effect is not considered to require specific mitigation, given that loggerhead shrikes are adapted to urban environments and have ample foraging and nesting opportunities throughout the SVRTC.

Special status raptors such as white-tailed kites and Cooper's hawks as well as non-special status raptors such as red-tailed hawks, red-shouldered hawks, and great-horned owls, and other raptors have the potential to nest in areas located within undeveloped lots proposed for park-and-ride lots or staging areas. The nests of these raptors are protected by California Department of Fish and Game Code and the Migratory Bird Treaty Act. Construction-related activities near active nests during the nesting season, generally from February through August, could cause nest abandonment resulting in egg failure or hatchling death. No mitigation is required if construction activities occur during the non-breeding season (generally September through January). However, if construction activities occur during the breeding season, then adverse effects could occur. Breeding season disturbance of nesting raptors would be avoided or minimized through implementation of Mitigation Measure CNST-BIO-6 through CNST-BIO-8, as appropriate.

> Mitigation Measure CNST-BIO-6: To the extent feasible, construction activities, including tree and shrub removal, will be scheduled between September and December to avoid the nesting season for most raptors, as well as other bird species.

> Mitigation Measure CNST-BIO-7: Preconstruction surveys for nesting raptors will be conducted by a qualified ornithologist during the nesting season (January through August) to ensure that no raptor nests will be disturbed during construction. The surveys will be conducted no more than 14 days prior to the initiation of construction activities during the early part of the breeding season (January through April) and no more than 30 days prior to the initiation of these activities during the late part of the breeding season (May through August). During this survey, the ornithologist will inspect all trees and electrical towers in, and immediately adjacent to, the affected area for raptor nests. If no nesting raptors are found, then no further mitigation is warranted.

> Mitigation Measure CNST-BIO-8: If an active raptor nest is found close enough to the construction area to be disturbed by these activities, the ornithologist, in consultation with CDFG, will determine the extent of a construction-free buffer zone, typically 250 feet, to be established around the nest until the chicks have fledged.

Structures present near undeveloped parcels and within existing developed parcels proposed for construction and staging under the BEP and SVRTP alternatives could provide nesting habitat for swallows and roosting habitat for bats. Construction-related activities near bridge crossings could cause nesting swallows to abandon their nests, resulting in egg failure or hatchling death, or cause roosting bats to leave prematurely. These potential effects would be avoided or minimized through implementation of Mitigation Measure CNST-BIO-9 through CNST-BIO-12, as appropriate.

> Mitigation Measure CNST-BIO-9: If construction activities are scheduled to occur during the nesting season of swallows and other migratory birds (generally March through August), a pre-construction survey for nesting activity will be

conducted prior to commencement of construction. If no nesting swallows are found, then no further mitigation is warranted.

Mitigation Measure CNST-BIO-10: If active nests are identified close to construction work, a biological monitor will monitor the nests when work begins. If the biological monitor, in consultation with the California Department of Fish and Game (CDFG), determines that construction activities are disturbing adults incubating eggs or young in the nest, then a no work zone buffer will be established by the biological monitor around the nest until the young have fledged and the nest is no longer active. If a biological monitor, in consultation with CDFG, determines that construction activities occurring in proximity to active cliff swallow nests are not disturbing adults or chicks in the nest, then construction activities can continue. Nests that have been determined to be inactive (with no eggs or young) can be removed with CDFG approval.

Mitigation Measure CNST-BIO-11: A qualified biologist will conduct pre-construction surveys in suitable habitat determine the presence of roosting bats. If no nesting swallows are found, then no further mitigation is warranted.

Mitigation Measure CNST-BIO-12: If it is determined that bats are roosting beneath a bridge, in a building, or in adjacent riparian habitat, then appropriate modifications to construction time and method will be implemented in accordance with CDFG approval. Modifications may include timing construction activities to avoid breeding periods, establishment of buffers, or biological monitoring. In some cases bats may be actively encouraged to avoid roosting in the area affected prior to the onset of construction activities.

As described in Section 4.2, Biological Resources and Wetlands, Chinook salmon may be present in Upper Penitencia Creek, Lower Silver Creek, Coyote Creek, Guadalupe River, and Los Gatos Creek. Steelhead may be present in Upper Penitencia Creek, Coyote Creek, the Guadalupe River, and Los Gatos Creek. Critical habitat for steelhead includes Upper Penitencia, Coyote Creek, and the Guadalupe River. Tunneling under Coyote Creek (at East Santa Clara Street), the Guadalupe River, and Los Gatos Creek would avoid affects to aquatic/riparian habitat and fisheries. The Berryessa station area includes either a 150-foot setback from the near banks of these creeks or a 100-foot setback from the riparian tree dripline (outer edges of the tree canopy), whichever is greater. This conforms to the San Jose Riparian Corridor Policy Study guidelines (1999), which require “a minimum of 100 feet from the edge of the riparian corridor (or top of bank, whichever is greater).” The two exceptions to this setback occur at the following locations: 1) where a new street on the east side of the railroad ROW, Berryessa Station Way, crosses over Upper Penitencia Creek to/from Berryessa Road and 2) where Berryessa Station Way intersects with Mabury Road to approximately 200 feet north. Encroachment into the riparian setback near Mabury Road has been approved by the city. Documentation of this approval is provided in Appendix H. The Las Plumas Yard also includes a 150-foot setback from Lower Silver Creek. In addition to the setbacks, potential indirect affects to these species would be avoided or minimized through implementation of mitigation measures CNST-BIO-13 and CNST-BIO-14.

Mitigation Measure CNST-BIO-13: To the maximum extent practicable throughout the project site, construction activities and facilities, including pilings and bridge footings, will be placed outside of aquatic/riparian habitat to avoid effects to riparian habitat and steelhead and Chinook salmon fisheries.

Mitigation Measure CNST-BIO-14: Installation of falsework and stream diversions required in the course of bridge construction will be consistent with VTA's Fish-Friendly Channel Design Guidelines to minimize affects to migrating anadromous fish and other in-stream species. These guidelines address concerns related to a number of issues including high water velocities, jumps to channelized inlets or outlets, water depths, and resting pools.

Upper Penitencia Creek and Lower Silver Creek provide potential aquatic habitat for the federally threatened California red-legged frog. Construction activities could also potentially affect upland aestivation habitat. Disturbance of this habitat may affect individual California red-legged frogs that may inhabit or could inhabit the area. Implementation of mitigation measure BIO-1 (please refer to Section 5.2, Biological Resources and Wetlands) would minimize effects to California red-legged frogs and their habitat. CNST-BIO-15 and CNST-BIO-16 will also be implemented to address adverse affects to red-legged frogs during construction.

Mitigation Measure CNST-BIO-15: The following recommendations by CDFG will be followed to address water quality affects to California red-legged frogs:

- Construction within the channels that cross the alignment of the selected alternative, including installation of temporary stream diversion structures, will be restricted to the dry season, which generally extends from June 1 to October 15 depending on the species present. In some cases, construction may begin earlier than June 15 or continue past October 15, as specified in regulatory agency permits and agreements or any authorized extensions.
- No equipment will be operated in the live stream channel.
- When work in a flowing stream is unavoidable, any stream flow will be diverted around the work area by a barrier, temporary culvert, or a new channel capable of permitting upstream and downstream fish movement.
- Construction of the barrier or the new channel normally will begin in the downstream area and continue upstream, and the flow will be diverted only when construction of the diversion is completed.
- Appropriate erosion control measures will be installed to prevent debris, soil, silt, sand, bark, slash, sawdust, cement, concrete, washings, petroleum products, or other organic or earthen material from being washed into waterways by rainfall or runoff.

Mitigation Measure CNST-BIO-16: The following mitigation measures will be followed to avoid or minimize take of California red-legged frogs:

- A qualified biologist will conduct pre-construction surveys for California red-legged frog within the vicinity of the project site no earlier than 2 days before ground-disturbing activities. The survey area will include 300 feet upstream and downstream from the project site.
- No activities will occur in suitable California red-legged frog habitat after October 15 or the onset of the rainy season, whichever occurs first, until May 1 except for during periods greater than 72 hours without precipitation. Activities can only resume after the 72-hour period or after May 1 following a site inspection by a qualified biologist, in consultation with USFWS. The rainy season is defined as: a frontal system that results in depositing 0.25 inches or more of precipitation in one event.
- Vehicles to and from the project site will be confined to existing roadways and defined access routes to minimize disturbance of California red-legged frog habitat.
- If a California red-legged frog is encountered during excavations, or any project activities, activities will cease until the frog is removed and relocated by a USFWS-permitted biologist. Any incidental take will be reported to the USFWS immediately by telephone.
- If suitable California red-legged frog habitat is disturbed or removed, VTA will restore the suitable habitat back to its original value by covering bare areas with mulch and re-vegetating all cleared areas with plant species that are currently found in the project site or as negotiated with USFWS.
- Any permanent loss of aquatic habitat in Upper Penitencia Creek or Lower Silver Creek will be compensated through protection or enhancement of degraded aquatic and riparian habitat at either an onsite or an offsite location. The location and total amount of the compensation habitat will be determined in consultation with USFWS.

The western pond turtle is a state species of special concern that could occur in the aquatic and riparian habitats of Upper Penitencia Creek and Lower Silver Creek. Construction activities in or near the waterways would result in temporary disturbance to western pond turtles. The following mitigation measure will be implemented to reduce affects to western pond turtles:

Mitigation Measure CNST-BIO-17: A qualified biologist will conduct a pre-construction survey for western pond turtles in all suitable aquatic habitats. The survey area will include 300 feet upstream and downstream from the project site. This survey will be conducted no more than 24 hours prior to the onset of in-water construction activities. If individual pond turtles are located, they will be captured by a qualified biologist and relocated to the nearest suitable habitat upstream or downstream of the project site. If individuals are relocated, then the contractor will install barrier fencing along each side of the work area to prevent individual turtles from re-entering the work area. In the event barrier fencing is installed, the qualified biologist will conduct relocation surveys for three consecutive days to ensure that all animals are removed from the disturbance area.

6.3.4 COMMUNITY SERVICES AND FACILITIES

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine adverse construction-related affects to community services and facilities and to determine appropriate mitigation measures. The types of projects listed under the No Build Alternative are of a much smaller magnitude and typically do not result in substantial community services and facilities construction-related effects.

BEP and SVRTP Alternatives

The BEP and SVRTP alternatives would be constructed primarily within the railroad corridor ROW, and in tunnels beneath existing transit corridors. Thus temporary effects on existing community facilities and services are anticipated to be minor. The construction of the BEP and SVRTP alternatives could involve temporary detours or street closures in the vicinity. The primary effect would be the need for emergency vehicles to observe any short-term closures and temporary construction detours. Construction detours and road closures are described in Section 6.3.1 of this chapter.

To minimize disruption to emergency services response during construction of the BEP and SVRTP alternatives, VTA will:

- Coordinate with local emergency service providers in developing construction phase detour plans.
- Provide emergency service providers advance notice of any road closures and detour routes.

Mitigation is not required.

6.3.5 CULTURAL AND HISTORIC RESOURCES

Archaeological Impacts

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine construction-related affects to archaeological properties and to determine appropriate mitigation measures. Construction effects of the No Build Alternative projects would likely result in adverse affects to archaeological resources typically associated with transit vehicles and facilities and highway facilities. Where historic archaeological properties are adversely affected by the construction of a No Build Alternative project, mitigation measures could include but not be limited to avoidance, protection, data recovery, and public education. The mitigation measures may be developed through a Memorandum of Agreement depending on the type of project. Inadvertent or unexpected discoveries of cultural resources during construction would be addressed in accordance with Federal and State laws related to the protection of cultural resources.

BEP and SVRTP Alternatives

Construction of the BEP and SVRTP alternatives along the line segment may disturb cultural resources, particularly in areas of high sensitivity or where cultural deposits are expected to exist, as described in Section 5.4, Cultural and Historic Resources/Archaeological Resources**.**

For the tunnel segment, both the State Office of Historic Preservation (SCPO) and representatives of the local Ohlone community expressed concerns about potential effects to buried prehistoric archaeological deposits resulting from boring under downtown San Jose. The tunnel would be constructed at a minimum of approximately 20 feet below the existing ground surface, including through the downtown area, except near the portals where the tunnel slopes gradually to the surface.

Due to the vertical offset in geological strata along the tunnel alignment, there remains some possibility that buried early Holocene to late Pleistocene cultural deposits exist between about 30 and 40 feet below surface near the center of the tunnel alignment (near the intersection of Santa Clara and Market streets). On the western and eastern ends of the alignment, there is little to no possibility of encountering buried archaeological materials during tunnel boring, except at exit points where the tunnel emerges at the surface.

A Memorandum of Agreement and supporting Cultural Resources Treatment Plan will be developed and implemented for the BEP or SVRTP alternative, as appropriate. Mitigation measures are provided in Section 5.4, Cultural and Historical Resources/Disturbance of Archaeological Materials.

Historic Architecture Impacts

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine construction-period affects to historic architectural properties and to determine appropriate mitigation measures. Construction of the No Build Alternative projects would likely result in adverse architectural effects typically associated with transit vehicles and facilities and highway facilities. Where historic architectural properties are adversely affected by the construction of a No Build Alternative project, mitigation measures could include but not be limited to avoidance, protection, adherence to *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstruction Historic Buildings* (U.S. Department of the Interior, National Park Service, 1995), recordation, and development of an interpretive display. The mitigation measures may be developed through a Memorandum of Agreement.

BEP and SVRTP Alternatives

There are no historic properties identified within or near the BEP Alternative APE. There would therefore be no construction affects to historic properties from implementing this alternative and no mitigation measures.

For the SVRTP Alternative, several sites in Downtown San Jose are being considered for use as construction staging areas. However, no construction phase adverse affects to historic resources identified within the project APE are anticipated. Construction activities would not cause noise or vibration levels that would threaten the structural integrity of historic properties. Temporary adverse visual effects would not affect the attributes contributing to the historic eligibility of these resources. Nonetheless, contractors and construction workers would be informed in advance of the significance of historic resources within or along the SVRTP Alternative alignment.

Long-term effects from the BEP or SVRTP alternative on historic architectural resources within the project APE and mitigation measures are described in Section 5.4, Cultural and Historical Resources/Degradation of Historic Architecture.

6.3.6 ELECTROMAGNETIC FIELDS

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine EMF or electromagnetic interference (EMI) effects related to construction and to determine appropriate mitigation measures. The types of projects listed under the No Build Alternative would not be expected to result in adverse effects related electromagnetic fields during construction.

BEP and SVRTP Alternatives

There would be no EMF-related effects associated with the BEP and SVRTP alternatives during construction. Construction activities typically would not involve the use of major electrical systems in the vicinity of EMF or EMI sensitive land uses. Since effects to human health from the use of EMF equipment would not occur during construction, mitigation is not required.

6.3.7 ENERGY

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine adverse energy effects related to construction and to determine appropriate mitigation measures. The types of projects listed under the No Build Alternative could result in adverse construction related energy effects if nonrenewable energy resources are consumed in a wasteful, inefficient, or unnecessary manner.

BEP and SVRTP Alternatives

Energy (diesel fuel and electricity) would be used during construction of the BEP and SVRTP alternatives. Energy usage during construction, while short-term, would encompass a period of approximately eight years. There would be substantial use of energy though the use of fossil fuels by machinery and workers traveling to and from the sites. Increased use of energy and electricity also would occur due to operation of facilities during construction. However, VTA's adopted Sustainability Program requires projects to "incorporate sustainability and green building principles and practices in the planning, design, construction, and operation of new VTA facilities". Energy demands during construction activities would be short-term and temporary, and they are not anticipated to result in the substantial waste or inefficient use of energy. Therefore, there would be no substantial adverse effects related to energy.

6.3.8 GEOLOGY AND SEISMICITY

No Build Alternative

The No Build Alternative projects would likely result in geologic and seismic effects typically associated with construction of transit facilities and roadway projects including slope stability and settlement potential. Structures associated with the projects would be designed in accordance with current seismic design standards as found in the California Uniform Building Code (CUBC). Additionally, it could be anticipated that engineering studies would be performed to identify the appropriate design measures needed for the geologic and seismic conditions of project sites. Projects planned under the No Build Alternative would undergo separate environmental review to determine adverse construction related geologic effects.

BEP and SVRTP Line Segment

The line segment includes rigid shoring designed to control settlement due to the retained cuts to the order of 1 inch or less. The only location where retained cut work is close enough to an existing structure to be of concern is near the light rail aerial guideway in Milpitas. Construction of the retained cut in this area will include rigid shoring to address any settlement. Otherwise, construction of the line segment is not near enough to adjacent buildings to cause settlement concerns. Construction of the aboveground stations and Las Plumas Yard is not anticipated to result in any settlement to surrounding properties.

A settlement monitoring program will be implemented to monitor the progress of ground settlement along the line segment. The recorded settlement data will be submitted to a geotechnical engineer for review and to verify that the majority of the settlement has occurred prior to pile driving and track construction.

Due to limitations inherent to geotechnical investigations conducted to date for the line segment, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional geotechnical investigation and engineering services. These services will be available during construction as needed to address field variations.

SVRTP Alternative Tunnel and Cut and Cover Stations

During Preliminary Engineering, additional analyses were conducted regarding potential surface settlements and lateral ground movements during construction of the tunnel and cut and cover stations for the SVRTP Alternative. The purposes of these analyses were to assess the magnitude and likelihood of settlement and ground movement, physical damage to structures or utilities caused by potential settlement or ground movement, and functional adverse effects related to any physical damage on performance of structures or utilities that may be caused by tunnel boring and cut and cover construction, and to recommend appropriate mitigation measures.

Along the tunnel alignment, the maximum surface settlement induced during tunnel boring is predicted to be less than 1 inch, or in a range categorized as between negligible and slight. Minor cracking that can easily be patched, and sticking windows or doors would characterize slight damage. Any settlement would be distributed in a "trough" running parallel to and centered over the twin tunnel bores, with the maximum settlement occurring at the centerline of the trough between the two bores.

For cut and cover construction, surface settlement varies with distance from the excavation, with a maximum being at the face of the excavation wall to zero at the "limit of influence," a horizontal distance around the excavation equal to twice the depth of excavation. The maximum surface settlement adjacent to the open cut excavations during construction is predicted to be approximately 1.4 inches. However, the potential for ground settlement during construction is greatly reduced through the use of soil-cement mix walls (See Section 6.3.11, of this chapter).

Utilities most sensitive to ground movement are water and gas mains constructed of cast iron. A review of the utility drawings shows water mains in San Jose dating to the late 1800s and early 1900s, which are assumed to be cast iron. Also identified is an abandoned brick-lined sewer crossing East Santa Clara Street, near City Hall.

Surface settlements and ground movements may cause damage to structures, facilities, and utilities. However, the occurrence of settlement does not necessarily result in damage. Depending on the predicted degree of adverse effect, probability of exceedance, structural sensitivity to movement, the SVRTP Alternative would include ground treatment measures, strengthening of structures, and underpinning of structures on a case-by-case basis prior to tunnel boring or cut and cover construction. The SVRTP Alternative also would employ TBMs to minimize the risk of surface settlements and lateral ground movements (Section 5.7, Geology and Seismicity). In addition to these design requirements, mitigation can be implemented to reduce the magnitude and likelihood of surface settlements and ground movements, physical damage, or adverse functional effects.

Mitigation Measure CNST-GEO-1. Pre-construction condition surveys of the interiors and exteriors of select structures within the settlement trough along the tunnel alignment and within the limit of influence around the cut and cover excavations will be conducted by independent surveyors to assess the condition of each property. These surveys will include written and photographic (video and still) records. The results of these surveys will be compared with post-construction condition surveys so that any effects of tunneling and cut and cover construction on structures can be assessed. For the tunnel activity, surveys will occur as close to the planned dates of tunneling as possible so that the results are as current as possible. Therefore, surveys will be performed prior to passage of the tunnel boring machines with some surveys conducted once tunneling has commenced.

Mitigation Measure CNST-GEO-2. For the tunneling activity, ground surface monitoring will be performed prior to and during construction. Instrumentation will be installed to monitor ground movements and effects of tunnel boring on structures and utilities. Monitoring can be used to direct real-time modifications, as appropriate, to tunneling practices and procedures to assist in minimizing adverse effects along the tunnel alignment.

Mitigation Measure CNST-GEO-3. Monitoring points will be mounted on select structures within the settlement trough along the tunnel alignment and within the limit of influence around the cut and cover excavations to monitor any effects of settlement.

Mitigation Measure CNST-GEO-4. A pre-construction condition survey will be conducted of utilities deemed to be potentially at risk due to surface settlement or ground movement. Major utilities deemed to be at risk will be monitored during construction. Coordination with utility providers will be conducted prior to installation of utility monitoring points.

Mitigation Measure CNST-GEO-5. The option of post construction repair is based on the probability of damage, predicted degree of damage, sensitivity of the structure or facility, and cost and ease of repair. If repair is not feasible, compensation may be necessary.

With implementation of design requirements and mitigation measures, the likelihood of damage due to surface settlements and ground movements is considered low. However, additional studies of potential settlements and ground movements will be conducted during subsequent engineering phases.

6.3.9 HAZARDOUS MATERIALS

The primary issues related to hazardous materials during construction are the health and safety of construction workers, the public, and the environment, and the proper management of hazardous materials. Adverse effects from hazardous materials during construction of each alternative can be divided into effects caused by existing soil contamination, existing groundwater contamination, structure demolition, and potential surface water contamination.

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine adverse construction effects related to hazardous materials. Depending on the project location and past and present land uses, hazardous materials may be encountered during construction. Regulatory requirements to protect human health and the environment would be implemented and any hazardous materials encountered in soil, groundwater, or structure demolition would require proper management and disposal. Project-specific mitigation measures, if necessary, would be determined during environmental review.

BEP and SVRTP Alternatives

A database research revealed numerous known and potential hazardous materials sources within near the alternatives. These sites are discussed in Section 4.8, Hazardous Materials. Where contaminated sites are known or are discovered during construction, there is potential for exposure of construction workers and the public to hazardous materials, emissions of hazardous dusts, releases of contaminated water, and offsite transport of hazardous materials.

During the Preliminary Engineering phase, hazardous materials characterization included the collection and chemical analysis of 179 soil or railroad ballast samples from 44 locations for the first 9.3 miles of the alignment. The results are included in Section 4.8, Hazardous Materials. While more is known about contamination along this portion of the alignment, the soil and ballast may be further characterized during construction. Reasons for additional characterization could include waste management or the discovery of a previously unknown effect or “hot spot” (samples with unexpectedly high contaminant concentrations). Any field characterization work will be performed in accordance with appropriate health and safety standards, including Title 29 Code of Federal Regulations (CFR) 1910.120, Hazardous Waste Operations and Emergency Response. Transport and disposal of contaminated material to an appropriate facility will be in accordance with federal, state and local regulations, including the Uniform Hazardous Waste Manifest standards.

Contaminant Management Plan

A Contaminant Management Plan has been prepared to address the management of contaminated materials encountered during construction, including soil, existing railroad ballast, groundwater from construction dewatering, and debris from building demolition. The plan covers the line segment, stations, yard and shops, and portions of the tunnel segment. Under the SVRTP Alternative, the construction of the tunnel bores is excluded because: 1) the subsurface materials encountered while tunneling are expected to be uncontaminated due to their depth (approximately 25 to 50 feet below the groundwater table), and 2) the soil handling procedures will be dramatically different when removing the thoroughly mixed soil and groundwater (muck) generated while advancing the TBMs to construct the bores. The Contaminant Management Plan was approval by the Regional Water Quality Control Board on August 7, 2008.

The Contaminant Management is incorporated into this EIS by reference and is included in Appendix I. The plan is technical in nature and includes mitigation measures in Section 4 for soil and railroad ballast; Section 5 for groundwater as part of dewatering activities; and Section 6 for building materials. Mitigation measures applicable to soil and railroad ballast include characterization of the material, constraints on material transportation and stockpiling, restriction of reuse of the material to defined specific reuse scenarios (also see Section 5.8, Hazardous Materials in this EIS), and air monitoring requirements. Mitigation measures applicable to groundwater as part of dewatering activities include characterization, treatment, and disposal of groundwater. Mitigation measures applicable to building materials (demolition) include characterization, abatement, and disposal. While this section includes information from the Plan, the reader should refer to the Plan for the complete analysis of adverse effects and the mitigation measures to be implemented during construction of the BEP and SVRTP alternatives.

> Mitigation Measure CNST-HAZ-1: The project-wide Contaminant Management Plan dated and approved by the RWQCB on October 21, 2008 and mitigation measures included in the Plan will be implemented during construction of the Build Alternatives. The mitigation measures detail requirements for the management for soil and railroad ballast, groundwater as part of dewatering activities, and building materials. The Plan is included in Appendix I in the EIS.

Soil and Ballast. A wide variety of protective measures will be employed for both soil and railroad ballast encountered during construction of the BEP and SVRTP alternatives. These will include environmental characterization of the material, restriction of reuse of the material to defined specific reuse scenarios, constraints on material transportation and stockpiling, and air monitoring requirements. Soil and ballast that will be excavated or disturbed during construction will be characterized through sampling, chemical analysis, and statistical analysis of the resulting data. The characterization process is detailed in the Contaminant Management Plan and includes the sampling strategy, chemical analysis methods, and data analysis methods.

After the soil and ballast is adequately characterized for design purposes, the soil will be classified for potential reuse during construction. The Contaminant Management Plan includes the five reuse scenarios for soil and ballast listed in anticipated order of lowest to highest acceptable chemical concentrations. These are listed in Section 5.8, Hazardous Materials. Details of the criteria used to develop the reuse scenarios and further explanation of the reuse scenarios are included in the Plan.

Transportation procedures included in the Contaminant Management Plan are designed to minimize potential health, safety, and environmental risks resulting from the transportation of soil and ballast. Transportation of soil and ballast may occur both onsite (within VTA ROW including construction staging areas and TCEs) and offsite (along a public or private ROW) using either trucks or railcars. Much of the soil and ballast material excavated during construction will be transported onsite to a stockpile or reuse area. Offsite transportation occurs when a material is being properly shipped for disposal or under a variance approved by DTSC for consolidation or reuse. Soil and ballast that contains chemical constituents at levels greater than the acceptable reuse concentrations for any of these five reuse scenarios will be characterized in accordance

with applicable regulations and disposed of offsite at an appropriate disposal facility. Some soil acceptable for reuse may also be disposed offsite after characterization, depending on volume constraints to onsite reuse. Offsite disposal will be in accordance with all appropriate federal, state, and local regulations.

Due to physical space limitations, the sequencing of work, the proximity of sensitive receptors, and/or the net balance of fill/cut, soil or ballast may be removed from and transported to a stockpile location within the project site while awaiting either reuse or offsite disposal. Large stockpile sites would be within the construction staging areas and fenced to discourage public access. Smaller sites adjacent to reuse locations may be used temporarily to store the material prior to reuse. Material from separate project areas will not be mixed unless the material has been fully characterized and shown to be equivalent for the purposes of reuse or disposal. Records will be kept for all stockpiled material. For stockpiled material intended for offsite disposal, the records will also include the sampling and analytical results for samples used to profile the material for disposal. Onsite storage of non-hazardous material will meet the following requirements:

- Best management practices for erosion control will be implemented to prevent migration of sediment into the storm drain system or surface waters.
- The soil will be stockpiled in a manner that facilitates the segregation of 1,000 cubic yard subsections.
- A silt fence will be constructed around the perimeter of the stockpile area to mitigate migration of sediment into the storm drains or surface waters.
- Saturated soils, if any, will be placed on 10 millimeter plastic sheeting.

- A commercial, non-petroleum-based dust palliative or hydroseeding will be applied to stockpiles within 30 days of placement to minimize the migration of airborne dust.
- Soils classified for the "Reuse in Right-of-Way or "Reuse in Encapsulation" (see Section 4.8, Hazardous Materials) or classified as waste for disposal will be covered with 10 millimeter plastic sheeting. Sheeting will be anchored to prevent removal by the wind.
- After receipt of sample results, separate stockpiles may be consolidated into larger piles consistent with potential reuse criteria and space constraints.
- The dimensions of any single soil stockpile will be not greater than 1,000 feet long by 50 feet wide and 15 feet high.

Construction activities such as excavation, backfilling, grading operations, stockpiling soil, construction vehicle traffic, and wind blowing over disturbed soil may expose site workers and the public within the surrounding area to chemicals of concern via airborne contamination. Exposures are possible either by the volatilization of contaminants into ambient air or the movement of airborne particulate matter containing contaminants. An air quality monitoring program will be implemented during construction, particularly in the areas where potential elevated concentrations of chemicals of concern have been detected, to ensure that construction activities do not create an unacceptable health risk to site workers or the public.

The air quality program will be included in the Contractor's Health and Safety Plan for the selected Build Alternative and will include procedures to be followed, action levels for total particulates that require respiratory or other protection, types of equipment needed for monitoring, and frequency of monitoring. For particulate matter, the air monitoring program will consist of real-time particulate monitoring and will include personal monitoring, site perimeter monitoring, and meteorological monitoring. Real-time particulate monitoring will be performed to protect construction workers and the public from nuisance particulate dust.

The Bay Area Air Quality Management District's approach to analysis of construction effects is to emphasize the implementation of effective and comprehensive control measures. If the appropriate construction control measures are implemented, then air pollutant emissions for construction activities would be reduced to acceptable levels. With implementation of design requirements and best management practices for construction activity, the SVRTP Alternative would not result in adverse effects. The BAAQMD construction control measures will be implemented for the BEP and SVRTP alternatives to reduce air pollutant emissions due to construction activities (see Section 6.3.2 of this chapter). If site-specific dust action levels, as set forth in the Health and Safety Plan, are exceeded, immediate corrective actions will be taken to minimize dust generation and/or the work will be temporarily ceased until more favorable conditions exist.

Groundwater. Dewatering of the shallow groundwater zone (approximately 20 and 30 feet below ground surface) will be required during excavation activities. Dewatering activities will be conducted within the excavation limits either by utilizing a well-based dewatering system and/or by pumping from the excavation using trash pumps in low spots. Prior to construction, a preliminary estimate of the volume of groundwater that needs to be extracted for a specific construction activity will be calculated to determine the appropriate dewatering method.

It is anticipated that groundwater encountered during excavation will contain contaminants that require remediation prior to discharge. Based on available analytical data for the Build Alternatives, groundwater containing metals (arsenic, lead, selenium, and chromium), chlorinated solvents (including PCE and TCE), and/or total petroleum hydrocarbons may be present in the excavation areas.

The variation of groundwater contamination will not allow the dewatering methods to adequately segregate clean groundwater from contaminated groundwater. Therefore, all extracted groundwater will be considered as potentially contaminated and will require characterization to determine the appropriate treatment requirements for discharge/disposal. Groundwater characterization will be performed in accordance with the discharge permit requirements or offsite facility acceptance requirements, as appropriate. Aboveground treatment of extracted groundwater, such as by gravity sedimentation followed with activated carbon adsorption using granular activated carbon (GAC) vessels, will be performed prior to discharge. Removal of metals may be required based on permit requirements, dewatering rates, and concentrations of metals encountered during the dewatering.

Discharge of treated dewatering groundwater to the storm drain system is regulated by the RWQCB, under a National Pollutant Discharge Elimination System (NPDES) general permit. VTA anticipates discharge under Order No. R2-2004-0055, for the discharge of extracted and treated groundwater. The contractor will apply for the NPDES permit from the RWQCB. The contractor will also meet the substantive requirements for discharge of storm water runoff associated with construction activity (see Section 6.3.16 of this chapter). Regular system sampling and reporting is required under any NPDES permit. Solids and spent carbon generated from the dewatering system must be handled and disposed of in accordance with appropriate and relevant state and federal regulations. The contractor will be responsible for system operation, maintenance, sampling, and reporting as required by the NPDES permit.

Discharge of treated dewatering groundwater to the local sanitary sewer system will be in compliance with the regulatory requirements of the Union Sanitary District for the City of Fremont or the San Jose/Santa Clara Water Pollution Control Plant for the Cities of Milpitas, San Jose, and Santa Clara.

Building Demolition. Several buildings and structures will need to be demolished at the locations of the station areas, yard and shop sites, and northernmost area of the line segment where the tracks are planned to be shifted from the existing ROW to the east. Since there have been no previous hazardous materials surveys for these buildings or structures performed, appropriate building materials characterization will be conducted by qualified personnel prior to demolition. During demolition of buildings, potential hazardous and contaminated building materials encountered may include asbestos-containing materials, lead-based paints, light ballasts containing polychlorinated-biphenyls (PCBs), mercury vapor lamps, and/or wood, concrete, or sheetrock contaminated from previous chemical use, storage, and/or handling. Additionally, chemicals from prior use, such as pesticides, may be present during demolition of buildings. If hazardous building materials (including remaining chemicals that will be removed during demolition) are identified during the hazardous building materials survey, a site-specific Hazardous Materials Management Plan (or equivalent such as hazardous building materials abatement work plan) will be prepared and will include: 1) the overall scope and schedule of hazardous materials management; 2) the contact information for the demolition contractor(s)'s designated Hazardous Materials Supervisor; and 3) the identification of the appropriate landfill where materials will be disposed. If at least 100 square feet of hazardous materials are found to have asbestos content of more than 0.1 percent, abatement must be performed by a certified California Asbestos Contractor (Title 8 CCR Section 1529). Asbestos abatement includes proper personal protective equipment for workers and negative pressure to prevent the emission of fibers. Also, asbestos levels in worker breathing zones must be maintained below permissible exposure limits defined by Occupational Safety and Health Administration. Abatement of other hazardous building materials is usually performed at the same time as asbestos abatement.

Great Mall Property

In addition to the requirements included in the Contaminant Management Plan, the "Site Management Plan – Former Ford Automobile Assembly Plant Formerly 1100 South Main Street, Milpitas, California" (March 1997) addresses soil and groundwater conditions specifically on the Great Mall property. The Plan includes measures that must be followed for redevelopment activities at this property including measures for notification and disclosure, construction safety, soil management, and use of shallow groundwater. Redevelopment includes construction of either the BEP or SVRTP alternative at this location. In a letter dated April 16, 2001, the RWQCB specified several additional actions required for redevelopment activities on the property. These actions include: notification to the RWQCB prior to initiating construction activity; review of historic environmental data and further investigation, if necessary; performance of a human health risk assessment; and development of a project-specific site management plan and health and safety plan. The measures in both these documents will be implemented during construction of either the BEP or SVRTP alternative.

> <u>Mitigation Measure CNST-HAZ-2:</u> In addition to implementation of the project-wide Contaminant Management Plan, the measures included in the "Site Management Plan – Former Ford Automobile Assembly Plant Formerly 1100 South Main Street, Milpitas, California" (March 1997) and the RWQCB's letter dated April 16, 2001 for this property will be implemented during construction of the selected Build Alternative at the Great Mall. These documents include measures for: review of historic environmental data and further investigation, if

necessary; performance of a human health risk assessment; development of a project-specific site management plan and health and safety plan; and requirements for notification and disclosure, construction safety, soil management, and use of shallow groundwater. These documents are included in Appendix I in the EIS.

Remedial Action Plans

Remedial action plans will be prepared during subsequent engineering phases and submitted to the Regional Water Quality Control Board for approval following a 30-day public review period. The plans will be site-specific for locations where known contaminated soil is present and remediation is required prior to construction of either alternative. The ultimate objective of the remediation is to safely remove soil with contamination levels greater than the reuse screening criteria included in the Contaminant Management Plan (see Section 4.8, Hazardous Materials) so that the site conditions meet the requirements of the planned future use, and the soil contaminants that may pose substantial levels of risk to human health or the environment are removed from the site.

Each remedial action plan will include the purpose and objectives of the remedial action, site information, a summary of the site investigations completed to date, a detailed technical approach for the remedial activities, a discussion of health and safety and decontamination, the identification of permits and notifications needed, a description of the report to be prepared upon completion of the remedial action, and an estimated schedule for implementation. Each plan will include the requirements as described in the Contaminant Management Plan, with additional site-specific requirements as necessary.

Contractor Health and Safety Plan

In addition to the requirements discussed above, a Health and Safety Plan will be prepared prior to construction in contaminated areas, including areas where excavation and grading will occur.

> Mitigation Measure CNST-HAZ-3: To protect the health and safety of construction workers, the public, and the environment, and to ensure the proper management of hazardous materials, a Health and Safety Plan for the selected Build Alternative that meets Occupational Safety and Health Administration requirements will be prepared, CERCLA certified, and implemented during construction.

6.3.10 LAND USE

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine adverse effects during construction regarding land use and to determine appropriate mitigation measures. The types of projects listed under the No Build Alternative are of a much smaller magnitude and typically do not result in substantial adverse land use construction effects.

BEP and SVRTP Alternatives

Construction of the BEP and SVRTP alternatives would involve the temporary use of several construction staging areas, which would result in the displacement of several businesses. Refer to Section 6.3.12 of this chapter for a discussion of these displacements. Additionally, refer to Sections 6.3.1 and 6.3.10 of this chapter for discussions on adverse construction effects that may cause transportation and noise - related disruptions to local businesses.

6.3.11 NOISE AND VIBRATION

Construction of either the BEP or SVRTP alternative has the potential to generate high levels of noise and vibration that may adversely affect nearby residential, commercial, and institutional land uses. In addition, some construction activities may generate vibration levels that could damage nearby structures. In order to determine the potential noise and vibration effects during construction, an analysis of construction period effects from noise and vibration was performed. Construction noise and vibration projections are based on typical construction equipment that contractors may use at the site. The analysis included below is supported by a number of technical documents found in Chapter 14, References (ATS Consulting, 2006b and 2006c, HMM/Bechtel and Shor Acoustical Consultants, 2005, and HNTB Companies et al, 2006).

Noise Impacts

FTA has no official criteria for assessing adverse effects from construction noise. However, FTA does have noise guidelines for assessment of construction. These guidelines are summarized in Table 6-5. The guidelines are based on land use and time of day and are given in terms of Leq for an eight-hour work-shift. Leq represents the level of a steady noise level containing the same total noise energy as the fluctuating noise over a given time period. For this analysis, the residential daytime noise guidelines are also applied to schools.

Table 6-5: FTA Construction Noise Guidelines

Land Use	Noise Limit: 8-Hour Leq (dBA) Daytime	Noise Limit: 8-Hour Leq (dBA) Nighttime
Residential	80	70
Commercial	85	85
Industrial	90	90

Source: FTA, 2006.

Although no identified limits on maximum construction equipment noise levels are in force in any of the local jurisdictions along the alternative alignments, construction activities are generally restricted to certain time periods, as presented in Table 6-6. However, certain construction activities, such as emergency work (e.g., water main break) or utilities work may be exempted from these constraints.

Table 6-6: Construction Hours by Jurisdiction

Location	Allowable Construction Noise Periods
City of Fremont	7:00 am to 7:00 pm - weekdays 9:00 am to 6:00 pm - weekends and holidays
City of Milpitas	7:00 am to 7:00 pm - all days of the week
City of San Jose	7:00 am to 7:00 pm - weekdays
City of Santa Clara	7:00 am to 6:00 pm – weekdays 9:00 am to 6:00 pm - Saturday

Source: BART Extension to Milpitas, San Jose, and Santa Clara Draft Supplemental Environmental Impact Report, 2007.

BEP and SVRTP Alternatives – Line Segment

A construction noise analysis was prepared for the line segment to identify noise effects to nearby sensitive noise receptors. The analysis considered the proposed locations of both the eastern and western BART tracks and up to five basic phases of construction depending on type of guideway:

- At grade: Phase I – site clearing, Phase II – preparation of subgrade, Phase III – retaining wall construction, Phase IV – layout of sub-ballast, Phase V – track installation.
- Retained cut: Phase I – construction of soil mix wall, Phase II – excavation of retained cut, Phase III – retained cut structure concrete base slab and walls, Phase IV – track installation.
- Retained fill: Phase I – site clearing, Phase II – preparation of subgrade, Phase III – retaining wall construction, Phase IV – layout of sub-ballast, Phase V – track installation.
- Aerial guideway: Phase I – site clearing, Phase II – foundation construction, Phase III – pier formation, Phase IV – pre-cast guideway members layout.
- At grade utilities modifications: Phase I – sheet piling at eleven street crossings (during daytime hours only), Phase II – modification of utilities at eleven street crossings (approximately 1/3 of work is performed during nighttime hours from 9 p.m. to 5 a.m.).

- Bridges at grade separation locations: Phase I – construction of soil mix wall, Phase II - excavation, Phase III – structure concrete wall. Approximately 80 percent of work during all three phases is performed during nighttime hours from 9 p.m. to 5 a.m.

Areas along the line segment where construction activities are expected to exceed the FTA noise limit during certain construction phases are included in Table 6-7. The recommended noise mitigation measures are also included in the table. A discussion of noise analysis along the entire alignment, whether there is an adverse effect or not, follows and is presented by alignment segment. Noise effects from different alignment options are discussed within the respective segment.

Table 6-7: Summary of BEP Alternative and Portion of SVRTP Alternative Construction Noise Effects and Mitigation

Receptors[a b]	Projected Hourly Leq and 8-Hour Leq Noise Levels (dBA) by construction phase[c]	Applicable Noise Limit (dBA)	Projected Noise Level Above Noise Limit (dBA)	Recommended Noise Mitigation
At-Grade—Station 176+00 to 191+50: Eastern track: 3 apartment buildings at 40 ft	Ph I: 85 Ph II: 82 Ph IV: 81	FTA: 80	1-5	Temporary noise barrier or noise control curtain.
At-Grade—Station 191+50 to 208+00: Eastern track: 20 mobile homes at 50 ft	Ph I: 84 Ph II: 82 Ph IV: 80	FTA: 80	2-4	Temporary noise barrier or noise control curtain.
At-Grade—Station 416+00 to 423+00: Eastern track: 5 apartment buildings at 50 ft	Ph I: 83 Ph II: 81 Ph IV: 79	FTA: 80	1-3	Temporary noise barrier or noise control curtain.
At-Grade— Station 423+00 to 452+00: Eastern track: 48 residences at 50 ft	Ph I: 85 Ph II: 83 Ph IV: 81	FTA: 80	1-5	Temporary noise barrier or noise control curtain.
Retained Cut—Station 454+00 to 456+00: Eastern track: 2 residences at 50 ft	Ph I: 82 Ph II: 85	FTA: 80	2-5	Temporary noise barrier or noise control curtain.
Retained Cut—Station 458+50 to 461+00: Western track: 5 residences at 50 ft	Ph I: 82 Ph II: 85 Ph III: 78 Ph IV: 66 Cut has no adverse affect on Phases I and II activities	FTA: 80	2-5 Cut has no adverse affect on Phases I and II activities	Temporary noise barrier or noise control curtain.

Receptors[a b]	Projected Hourly Leq and 8-Hour Leq Noise Levels (dBA) by construction phase [c]	Applicable Noise Limit (dBA)	Projected Noise Level Above Noise Limit (dBA)	Recommended Noise Mitigation
Retained Cut—Station 461+00 to 485+00: Western track: 48 residences at 40 to 90 ft	Ph I: 78-84 Ph II: 81-87 Ph III: 75-81 Ph IV: 72-78 Cut has no adverse affect on Phases I and II activities	FTA: 80	1-7 Cut has no adverse affect on Phases I and II activities	Temporary noise barrier or noise control curtain.
Retained Cut—Station 485+00 to 490+00: Western track: 2 residences at 40 ft	Ph I: 84 Ph II: 87 Ph III: 80 Ph IV: 71 Cut has no adverse affect on Phases I and II activities	FTA: 80	4-7 Cut has no adverse affect on Phases I and II activities	Temporary noise barrier or noise control curtain.
Retained Cut—Station 461+00 to 485+00: Eastern track: 32 residences at 50 ft	Ph I: 82 Ph II: 85 Ph III: 79 Ph IV: 76 Cut has no adverse affect on Phases I and II activities	FTA: 80	2-5 Cut has no adverse affect on Phases I and II activities	Temporary noise barrier or noise control curtain.
Retained Cut—Station 485+00 to 490+00: Eastern track: 5 residences at 50 ft	Ph I: 82 Ph II: 85 Ph III: 78 Ph IV: 69 Cut has no adverse affect on Phases I and II activities	FTA: 80	2-5 Cut has no adverse affect on Phases I and II activities	Temporary noise barrier or noise control curtain.
Retained Cut—Station 491+00 to 494+00: Western track: 5 residences at 40 ft	Ph I: 84 Ph II: 87 Ph III: 80 Ph IV: 71 Cut has no adverse affect on Phases I and II activities	FTA: 80	4-7 Cut has no adverse affect on Phases I and II activities	Temporary noise barrier or noise control curtain.

Receptors[a b]	**Projected Hourly Leq and 8-Hour Leq Noise Levels (dBA) by construction phase [c]**	**Applicable Noise Limit (dBA)**	**Projected Noise Level Above Noise Limit (dBA)**	**Recommended Noise Mitigation**
Retained Cut—Station 494+00 to 499+00: Western track: 4 residences at 40 ft	Ph I: 84 Ph II: 87 Ph III: 82 Ph IV: 79	FTA: 80	2-7	Temporary noise barrier or noise control curtain.
Retained Cut—Station 494+00 to 499+00: Eastern track: 11 residences at 40 ft	Ph I: 84 Ph II: 87 Ph III: 82 Ph IV: 79	FTA: 80	2-7	Temporary noise barrier or noise control curtain.
At-Grade—Station 499+00 to 507+50: Western track: 16 residences at 40 ft	Ph I: 87 Ph II: 84 Ph III: 80 Ph IV: 83 Ph IV: 79	FTA: 80	3-7	Temporary noise barrier or noise control curtain.
At-Grade—Station 499+00 to 507+50: Eastern track: 20 residences at 40 to 50 ft	Ph I: 85-87 Ph II: 83-84 Ph III: 78-80 Ph IV: 81-83 Ph IV: 77-79	FTA: 80	1-7	Temporary noise barrier or noise control curtain.
At-Grade—Station 507+50 to 512+00: Eastern track: 6 residences at 40 to 50 ft	Ph I: 85-87 Ph II: 83-84 Ph IV: 81-83	FTA: 80	1-7	Temporary noise barrier or noise control curtain.
Retained Fill—Station 512+00 to 519+40: Eastern track: 9 residences at 30 to 50 ft	Ph I: 85-89 Ph II: 83-84 Ph III: 78-82 Ph IV: 81-85 Ph IV: 77-81	FTA: 80	1-9	Temporary noise barrier or noise control curtain.

Receptors[a b]	Projected Hourly Leq and 8-Hour Leq Noise Levels (dBA) by construction phase[c]	Applicable Noise Limit (dBA)	Projected Noise Level Above Noise Limit (dBA)	Recommended Noise Mitigation
At-Grade Utilities Modifications—Crossing at Dixon Landing Road: Nearest residence at 50 ft (eastern track)	Ph I: 89 Ph II: 82	FTA: *Day* - 80 *Night* - 70	 2-9 12 2-9 12	Temporary noise barrier or noise control curtain. Restrict nighttime work hours to further minimize adverse noise effect.
At-Grade Utilities Modifications—Crossing at Capitol Avenue: Nearest residence at 150 ft (eastern track)	Ph II: 74 (Daytime & nighttime)	FTA: *Day* - 80 *Night* - 70	0 4	Temporary noise barrier or noise control curtain. Restrict nighttime work hours to further minimize adverse noise effect.
At-Grade Utilities Modifications—Crossing at Hostetter Road: Nearest residence at 60 ft (western track) to 80 ft (eastern track)	Ph I: 85-87 (Piling, daytime) Ph II: 80-82 (Daytime & nighttime)	FTA: *Day* - 80 *Night* - 70	 2-7 10-12 2-7 10-12	Temporary noise barrier or noise control curtain. Restrict nighttime work hours to further minimize adverse noise effect.
At-Grade Utilities Modifications—Crossing at Sierra Road/Lundy Avenue: Nearest residence at 100 ft (eastern and western tracks)	Ph I: 83 (Piling, daytime) Ph II: 78 (Daytime & nighttime)	FTA: *Day* - 80 *Night* - 70	 3 8 3-8 13	Temporary noise barrier or noise control curtain. Restrict nighttime work hours to further minimize adverse noise effect.
At-Grade Utilities Modifications—Crossing at Berryessa Road: Nearest residence at 80 ft (eastern track)	Ph I: 85 (Piling, daytime) Ph II: 80 (Daytime & nighttime)	FTA: *Day* - 80 *Night* - 70	5 10 5 10	Temporary noise barrier or noise control curtain. Restrict nighttime work hours to further minimize adverse noise effect.

Receptors[a b]	Projected Hourly Leq and 8-Hour Leq Noise Levels (dBA) by construction phase [c]	Applicable Noise Limit (dBA)	Projected Noise Level Above Noise Limit (dBA)	Recommended Noise Mitigation
At-Grade Utilities Modifications—Crossing at Mabury Road: Nearest commercial at 60 ft	Ph I: 87 (Piling, daytime)	FTA: *Day* - 85 *Night* - 85	2 0 2	Mitigation not required since no windows face the alignment.
Bridges At-Grade Separation Locations—Bridge at Dixon Landing Road: Nearest residence at 60 ft	Ph I: 82 PH II: 83 Ph III: 78 Existing barrier has no adverse affect on Phases I and II activities	FTA: *Day* - 80 *Night* - 70	 2-3 8-13 2-3 8-13	Temporary noise barrier or noise control curtain. Restrict nighttime work hours to further minimize adverse noise effect.

Notes:

[a] **Distances shown are from the representative nearest receptors to the centerline of near track.**

[b] **Western Track:** Stations 458+00 to 507+50

Eastern Track: Stations 176+00 to 208+00
Stations 416+00 to 456+00
Stations 457+50 to 519+00

[c] **At-Grade**: Phase I – Site Clearing, Phase II – Preparation of Subgrade, Phase III – Retaining Wall Construction, Phase IV – Layout of Sub-ballast, Phase V – Track Installation

Retained Cut: Phase I – Construction of Soil Mix Wall, Phase II – Excavation of Retained Cut, Phase III – Retained Cut Structure Concrete Base Slab and Walls, Phase IV – Track Installation

Retained Fill: Assumed equipment and construction phases similar to At-Grade construction.

Aerial Guideway: Phase I - Site Clearing, Phase II – Foundation Construction, Phase III – Pier Formation, Phase IV – Pre-cast Guideway Members Layout

At-Grade Utilities Modifications: Phase I – Sheet Piling at Eleven Street Crossings (only during daytime), Phase II – Modification of Utilities at Eleven Street Crossings (35% of work for Phase II is performed during nighttime shift from 9 pm to 5 am)

Bridges At-Grade Separation Locations: Phase I – Construction of Soil Mix Wall, Phase II – Excavation, Phase III – Structure Concrete Walls (80% of work for all Phases is performed during nighttime shift from 9 pm to 5 am)

Source: HNTB Companies, 2006.

At Grade, Retained Cut, Retained Fill, and Aerial Guideway Locations

At-Grade: Stations 176+00 to 191+50. Along the eastern track, there are 3 apartment buildings located within about 40 feet from the track. The projected noise levels exceed the FTA daytime noise limit of 80 dBA by 1 to 5 dBA during various phases of construction. The projected noise levels have allowed for about 2-dBA noise reduction for the existing sound wall along the property line. Adverse noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains. Noise levels at the commercial locations along the western track would be in compliance with the noise limit.

At-Grade: Stations 191+50 to 208+00. There are 20 mobile homes along the eastern track located 50 feet from the eastern track. The daytime noise limit of 80 dBA is exceeded by 2 to 4 dB during the first two phases of construction. Noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains. Noise levels at the commercial locations and apartments along the western track would be in compliance with the noise limit.

At-Grade: Stations 208+00 to 244+00. There are residences along the western track located at distances of 160 to 310 feet from the alignment. Noise projections at these residences are 75 dBA or lower, complying with the daytime noise limit of 80 dBA. Noise levels at the commercial and industrial locations along the eastern track would be in compliance with the noise limit.

At-Grade: Stations 244+00 to 287+00. Along the western track, there are residences at 230 to 550 feet and commercial uses at 80 to 140 feet. The projected noise levels are within the noise limit of 80 dBA for the residences and 85 dBA for the commercial locations. There are nine residences along the eastern track between Stations 262+00 to 274+00 located 70 to 90 feet from the alignment. The projected noise levels are 81 to 82 dBA during Phase I, which exceed the daytime noise limit of 80 dBA. With the expected 2 dB shielding from the existing sound wall along the property line, noise levels would be in compliance with the noise limit. Along the eastern track, there are more residences and apartments located 100 to 160 feet from the nearest track. The projected noise level of 80 dBA or lower is in compliance with the daytime noise limit.

At-Grade: Stations 287+00 to 345+00. Along the western track, there are apartments between Stations 333+00 and 336+00 that are located 120 feet from the alignment. The projected noise level is 78 dBA or lower, complying with the daytime noise limit. Noise levels at the commercial locations along both sides of the alignment would be in compliance with the noise limit.

Long Retained Cut Option: Stations 345+00 to 414+40. Along the western track, the 2 hotels between Stations 361+00 and 369+00 are located 150 feet from the alignment. The hotels are expected to experience noise levels of 77 dBA or lower, resulting in compliance with the daytime noise limit of 80 dBA for residential land uses. Along the eastern track, there are apartments (Stations 379+00 to 384+00) and residences (Stations 407+00 to 414+40) located at distances of 100 to 210 feet from the alignment.

The projected maximum noise level of 80 dBA is in compliance with the daytime noise limit. Noise levels at the commercial locations along both sides of the alignment would be in compliance with the noise limits.

Intermediate Retained Cut Option: Stations 351+00 to 414+40. This option differs from the Long Retained Cut Option by a retained cut that starts 600 feet further south. In the area where the track structure is different (Stations 345+00 to 351+00) there are commercial buildings, which are not noise sensitive. Furthermore, the difference in noise generated by at-grade construction will be somewhat less than for retained cut construction. Consequently, the adverse noise effects will be less than for the Long Retained Cut Option in the area of alignment difference.

At-Grade: Stations 414+40 to 452+00. Between Stations 416+00 and 423+00, there are 5 apartment buildings along the eastern track located within 50 feet of the alignment. The projected noise levels are up to 83 dBA during the first two phases of construction, assuming a 2 dB shielding allowance for the existing barrier. Adverse noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains. There are 48 residences along the eastern track between Stations 423+00 and 452+00 located within 50 feet of the alignment. The projected noise levels exceed the daytime noise limit of 80 dBA during various phases of construction. Adverse noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains. Noise levels at all the commercial locations along the western track would be in compliance with the noise limit.

Retained Cut: Stations 452+00 to 461+00. There are 2 residences (Stations 454+00 to 456+00) along the eastern track located at about 50 feet from the alignment. The projected noise levels are between 82 and 85 dBA during the first two phases of construction, exceeding the daytime noise limit of 80 dBA. Noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains.

Construction activities during Phases I and II of Retained Cut do not provide any shielding since construction equipment will be located entirely aboveground (Phase I) or at least start aboveground and then gradually working below ground level during excavation (Phase II).

Along the western track, there are 5 residences (Stations 458+50 to 461+00) located within 50 feet of the alignment. The projected noise levels for the first four phases of construction exceed the FTA daytime noise limit of 80 dBA without considering the noise attenuation provided by the retained cut once the trench is excavated. Since the Retained Cut does not provide any shielding during Phases I and II, and only provides about 2 dBA shielding during Phase III [With the 2 dBA reduction in Phase III, the noise limits are met. The projected noise levels are still expected to exceed the applicable noise limits during the first two phases of construction. Noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains. There are 5 residences along the eastern track located at 100 feet from the alignment. The projected noise levels of 77 to 80 dBA during Phases I and II do not exceed the FTA daytime intermittent noise limit of 80 dBA.

Retained Cut: Stations 461+00 to 499+00. There are residences on both sides of the alignment with the majority of the residences located within 40 to 50 feet of the alignment, and some residences about 90 feet from the nearest track. Between Stations 461+00 and 485+00, the alignment is about 7 feet below existing ground level, and reaches a minimum depth of about 12 feet deep as the alignment passes under the Sierra Road/Lundy Avenue street crossing and is almost at-grade between Stations 494+00 and 499+00. There are 59 residences along the western track and 48 residences along the eastern track, where the projected noise levels during various Phases of construction activities exceed the FTA daytime noise limits of 80 dBA. For the majority of the residences located at 40 to 50 feet from the alignment, the projected noise levels are 82 to 84 dBA during Phase I, 85 to 87 dBA during Phase II, 78 to 82 dBA during Phase III and 69 to 79 dBA during Phase IV. This takes into consideration about 1 to 2 dB shielding for Phases III and IV for a 7 ft deep cut, and a minimum of 8 dB shielding during Phase IV for a 12 feet deep cut. The projected noise levels are about 6 dB lower for residences at 90 feet from the alignment relative to the highest levels indicated above for each Phase of construction activity. Adverse noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains.

At-Grade: Stations 499+00 to 512+00. There are 16 residences along the western track between Stations 499+00 and 507+50 located 40 feet from the nearest track and 20 residences along the eastern track, located 40 to 50 feet from the alignment. The projected noise levels are 85 to 87 dBA during Phase I, 83 to 84 dBA during Phase II, 78 to 80 dBA during Phase III, 81 to 83 dBA during Phase IV and 77 to 79 dBA during Phase IV. These levels exceed the FTA daytime noise limits of 80 dBA during one or more phases of construction activities. Noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains. Between Stations 507+50 and 512+00, there are six residences along the eastern track, located at 40 to 50 feet from the alignment. The projected noise levels are similar to the ones presented above. Since these residences are located directly opposite the Trucking Company facility, an existing noise source, it is appropriate to use higher FTA noise limit of 80 dBA during the daytime periods. The projected noise levels exceed the noise limit during Phases I, II and IV by 1 to 7 dB. Adverse noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains.

Las Plumas Yard Option Retained Fill: Stations 512+00 to 519+40. Along the eastern track, there are nine residences located 30 to 50 feet from the nearest track. The projected noise levels exceed the daytime noise limit of 80 dBA for one or more Phases of construction. The projected noise level is 77 to 89 dBA, exceeding the noise limit by as much as 9 dBA during Phase I (Site Clearing) for residences at 30 feet from the alignment. Noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains. Careful attention will be needed to shield those residences opposite the higher portion of the retained fill.

No New Yard Option Retained Fill: Stations 507+50 to 519+40. This alignment option starts the at the retained fill structure 450 feet north of that for the Las Plumas Yard Option. Between Stations 507+50 and 512+00, there are six residences along the eastern track, located at 40 to 50 feet from the alignment. Constructing the retained fill portion in this option will expose these residences to somewhat more noise than for the Las Plumas Yard Option since the work will be elevated compared to at-grade construction. However, the projected noise levels are similar to the ones presented above. Since these residences are located directly opposite the Trucking Company facility, an existing noise source, it is appropriate to use higher FTA noise limit of 80 dBA during the daytime periods. The projected noise levels exceed the noise limit during Phases I, II and IV by 1 to 7 dB. Adverse noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains. As with the Las Plumas Yard Option, careful attention will be needed to shield those residences opposite the higher portion of the retained fill.

Aerial Guideway: Stations 519+40 to 535+20. Along the eastern track, the projected noise levels at residences 450 feet from the alignment are expected to be in compliance with the daytime noise limit of 80 dBA. Noise levels at all the commercial locations along both sides of the alignment would be in compliance with the noise limit.

Retained Fill: Stations 535+20 to 559+40. The projected noise levels at residential and commercial locations along the eastern track are expected to be in compliance with the noise limits.

Retained Cut: Stations 559+00 to 562+00. Along the eastern track, there is a commercial building 40 feet from the alignment. The projected noise level of 87 dBA during Phase II (Excavation of Retained Cut) exceeds the noise limit of 85 dBA. Since the commercial building does not have any windows directly facing the alignment, there would be a substantial exterior to interior noise reduction and exceeding the exterior noise limit by 2 dB would be acceptable.

At-Grade Utilities Modifications at Eleven Street Crossings. In addition to the adverse noise effects associated with constructing the track structure, there are also potential effects associated with utility modifications at street crossings. At-grade utilities modifications at eleven street crossings require driving of sheet piles during the daytime, which are generally driven with an impact or sonic piling-rig. In order to minimize adverse noise effects at some of the nearby noise-sensitive residential receptors during Phase I (Sheet Piling at Eleven Street Crossings), it is anticipated that sheet piling operations at these locations will use vibratory type pile driver. Vibratory pile drivers typically generate at least 5 dBA lower noise levels relative to impact pile drivers.

The projected Leq noise levels from vibratory pile drivers at the eleven street crossings are 83 to 89 dBA at the nearest receptors. At the five construction sites in residential areas (Dixon Landing Road, Capitol Avenue, Hostetter Road, Sierra Road/Lundy Avenue and Berryessa Road), residences are located at distances of 50 to 150 feet from the closest construction point. The projected Leq noise levels are 83 to 89 dBA, exceeding the FTA daytime noise limit of 80 dBA. Noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains. The temporary barrier or noise control curtain will be fully effective when the top of the vibratory rig is actually below the top of the barrier/curtain height.

During Phase II (Modification of Utilities at Eleven Street Crossings), about 35 percent of construction work will occur during the nighttime period. The projected noise levels at the five construction sites in residential areas are 78 to 82 dBA, exceeding the applicable daytime and nighttime noise limits of 80 dBA and 70 dBA, respectively, and resulting in a substantial adverse effect during the nighttime period. The noise projections have allowed for about 2 dB shielding by the existing barriers at the residential property lines on both sides of Dixon Landing Road. Noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains.

Noise levels at all other commercial locations near the at-grade crossing construction sites would be in compliance with the noise limits.

Bridges At Grade Separation: Dixon Landing Road

The Bridges At Grade Separation: Dixon Landing Road. The new bridge at Dixon Landing Road is located near a residential area. The closest residences are located at about 60 feet from the nearest point of construction activity, and about 80 percent of the work will occur during the nighttime period. The projected noise levels are 78 to 82 dBA during the various construction phases, exceeding the applicable FTA nighttime noise limit of 70 dBA. Noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains. Restriction on nighttime construction work beyond 9 or 10 p.m. in residential areas also would reduce adverse noise effects.

SVRTP Alternative Tunnel Segment

A construction noise analysis was also prepared for the tunnel segment for the SVRTP Alternative. Hourly Leq noise levels were estimated for each phase of construction at the nearest noise-sensitive receptors. Leq levels for an 8-hour period are similar to the hourly Leq levels. Because the TBMs would be working underground, they would not be a source of airborne noise, except near the portal areas. Table 6-8 provides Leq noise levels for the four basic phases of construction at each construction site:

- Portals: All the equipment is assumed to be working concurrently with the tunnel operations near the Portals.
- Stations: Phase I – Construction of Temporary Shoring Walls, Phase II – Deck Installation, Phase III – Excavation of Stations and Mid-Tunnel Vent Structures, Phase IV – Vent Structure Construction. At the stations, the construction site is assumed to span about 200 feet in length in front of any building.

Table 6-8: SVRTP Alternative Tunnel Segment Noise Levels at Sensitive Receptors

Receptors	Construction Site	Hourly Leq and 8-Hour Leq (dBA)
Apartments on 2nd floor, or higher, of buildings between 3rd and 4th Streets, Aconda Hotel at 131 Santa Clara Street, and all commercial buildings are assumed to be about 40 ft from centerline of nearest construction activities (even during temporary shoring wall construction, center of crane will be at about 40 ft from buildings)	Downtown San Jose Station	Phase I: 86 Phase II: 88 Phase III: 85
Five Wounds School	Alum Rock Station	Phase I: 70 Phase II: 72 Phase III: 68
Two single-family homes on N 27th Street at about 400 ft	Alum Rock Station	Phase I: 70 Phase II: 72 Phase III: 68
Two single-family homes on N 27th Street at about 750 ft	Alum Rock Station	Phase I: 65 Phase II: 66 Phase III: 63
Church building on Montgomery Street at 145 ft	Diridon/Arena Station	Phase I: 77 Phase II: 78 Phase III: 75
Multi-family building at 92 Montgomery Street at 560 ft	Diridon/Arena Station	Phase I: 67 Phase II: 69 Phase III: 66
Foundry on Montgomery Street at 35 ft	Diridon/Arena Station	Phase I: 87 Phase II: 89 Phase III: 86
Offices at corner of Santa Clara and Autumn Street at 155 ft	Diridon/Arena Station	Phase I: 77 Phase II: 79 Phase III: 75
East Portal: Cal Wine Cellars on Las Plumas Avenue	East Portal	77
West Portal: Four single-family homes along Stockton Avenue	West Portal	70

Source: HMM/Bechtel and Shor Acoustical Consultants, 2005.

Based on review of the noise limits and the projected Leq noise levels provided in Table 6-8, there is potential for noise effects near some of the construction sites. An assessment of the projected noise levels is presented below for each construction site.

Tunnel Portals. The land uses near the east and west portals are both primarily industrial. The closest receptor to the east portal is the Cal Wine Cellars on Las Plumas Avenue. Leq noise levels at this location are projected to be 77 dBA, which is in compliance with the applicable noise limit of 90 dBA. The west portal is in a rail yard and near I-880. There are no adverse noise effects expected at any of the nearby industrial facilities.

Alum Rock Station. There are four single-family (one-story) residences on N 27th Street, located 400 to 750 feet from the station, and Five Wounds School on Five Wounds Lane, approximately 400 feet from the station. The projected Leq noise levels are between 63 and 72 dBA, exceeding the nighttime noise limit of 70 dBA by 2 dB for the residences. Exceeding the noise limit by 2 dB may not be substantial since shielding allowance for existing sound walls and privacy fences is not included in the analysis, because they are not continuous or are in poor condition. Adverse noise effects at these receptors can be minimized by use of temporary noise barriers or noise control curtains, if required. Noise levels at the Five Wounds School and other buildings are expected to be in compliance with the noise limit.

Downtown San Jose Station. There are several apartments on the upper floors (2nd through 5th floors) of buildings between 3rd and 4th Streets, located on both sides of the street, and Aconda Hotel at 131 Santa Clara Avenue. The 1st floor of these buildings is commercial. All other buildings are typically commercial at ground floor and offices at higher floors. These buildings are typically located at a distance of approximately 40 feet from the centerline of closest construction activities. Even during temporary shoring wall construction, the center of crane can range up to 40 feet from the façade of the nearest building.

Based on the assumption that the construction site spans about 200 feet in front of a building during any construction phase, Table 6-8 shows that the Leq noise levels at the nearest receptors (apartments, hotel, or commercial) will range between 85 and 88 dBA. This exceeds the daytime noise limit of 80 dBA for the apartments and hotel, and 85 dBA daytime and nighttime noise limit for the commercial buildings. The nighttime noise limit for the apartments and hotels are 70 dBA. The noise analysis indicates that there will be adverse noise effects during the temporary support and excavation of the Downtown San Jose Station and crossover. The site layout, selection of equipment and the condition of the equipment would influence the actual noise levels.

Table 6-8 indicates that the noise levels during Phase I: Construction of Temporary Shoring Wall and Phase III: Excavation of Stations exceeds noise limit by 1 to 2 dB, which could be considered essentially in compliance with the noise limit of 85 dBA for commercial buildings. Noise levels for the commercial locations are projected to exceed the criteria by approximately 3 dB during Phase II: Deck Installation. Since the deck is installed in 200 feet sections between 10:00 pm Friday and 4:00 am Monday, exceeding the noise limit at the commercial buildings that conduct business typically on weekdays would not be adverse.

The nighttime noise limit of 70 dBA for the apartments (between 3rd and 4th Streets) and hotel (at 131 Santa Clara Avenue) is projected to be exceeded by approximately 15 to 18 dBA, resulting in an adverse noise effect. Noise mitigation measures for these affected properties may include one or more of the following: new sound rated dual-glazed windows, installation of heavy storm windows on the interior of existing windows, temporary sound walls or noise control curtains (only practical and feasible for one to two story buildings), restrictions on the work hours or temporary relocation of affected residents.

On the south side of the intersection of 2nd Street and Santa Clara Avenue, a building is currently vacant at the 2nd floor. If the vacant space is turned into apartments, this building may also require noise mitigation to minimize any future adverse noise effects.

Diridon/Arena Station and Alignment. The nearest noise-sensitive receptor is a church building on Montgomery Street, located at a distance of approximately 150 feet from the station. The projected Leq noise levels at the church are between 75 and 78 dBA, complying with the recommended daytime noise limit of 80 dBA for the church. The nearest apartment building at 92 Montgomery Street is located 560 feet from the alignment. The projected noise level is 69 dBA or lower, complying with the nighttime noise limit of 70 dBA. The projected noise levels at the adjacent Foundry are 89 dBA or lower, complying with the noise limit of 90 dBA. Noise levels at all other nearby commercial uses are expected to comply with the noise limit.

Tunnel Alignment near Hedding Street. There are four single-family homes (single-story) on Stockton Avenue near the West Portal, located at a distance of over 500 feet from the construction site. These homes are located near Interstate 880. At these four homes, Leq noise levels are projected at 70 dBA, which is in compliance with the nighttime criteria of 70 dBA. The construction noise projections have allowed for about 2 dB noise reduction for the existing sound wall. If the selected construction equipment and layout at the site results in noise levels higher than projected, it is possible to minimize adverse noise effects by making the two chain link gates to the PG&E's facility solid and by increasing the height of the existing sound wall, or installing a new sound wall, to shield construction operations.

Newhall Yard and Shops Facility

Construction activities in the yard and shops area would be a substantial distance from noise sensitive land uses. The closest noise-sensitive land uses are residential use to the west and across the existing railroad tracks. Existing ambient noise levels are high with the railroad activities and the nearby Norman Y, Mineta San Jose International Airport. Construction work would be in compliance with FTA noise limits and with the local noise ordinances to the extent feasible.

Construction Staging Areas

A variety of construction activities would take place in the construction staging areas, such as many of the major activities described in Section 6.2.11, of this chapter. Because many of these staging areas are adjacent to noise-sensitive land uses, noise levels may exceed the noise limit. Mitigation measures such as temporary sound walls, noise control curtains, or other measures will be implemented to comply with the FTA noise guidelines.

Vibration Impacts

FTA construction vibration criteria area based on the FTA transit ground-borne vibration annoyance criteria. For this assessment, the Frequent Event criteria are used because of the extended duration of the expected construction activity. FTA has set a damage criterion of 0.2 inch/second for fragile buildings and 0.12 inch/second for extremely fragile historic buildings. At these levels (0.2 inch/second or 0.12 inch/second for fragile historic buildings), a building may suffer architectural cosmetic damage, characterized by fine plaster cracking and the re-opening of old cracks (FTA, 2006). None of the local jurisdictions have vibration criteria that are applicable.

Construction vibration projections were made based on the construction scenarios described above. Actual vibration effects would be dependent on the methods and procedures used by the selected contractor. In particular, the location of equipment inside a construction zone has a large effect on the vibration exposure to nearby sensitive receptors. This information is typically not available at this stage of a project.

Construction activities can result in varying degrees of ground vibration, depending on the equipment, construction operation being performed and the location of equipment inside a construction zone. The major construction vibration effects for this type of project are generally from impact and vibratory pile driving, blasting and possibly large tracked dozers and compactors. The use of blasting is not anticipated at this time for the Build Alternatives.

Construction vibration projections are based on assumptions on the type of construction equipment the contractor would use at the site. Information on construction vibration is based on the FTA Guidance Manual (FTA, 2006) and that reported in the available literature. It is important to note that information on construction vibration is very limited, probably due to the fact that there are rarely any vibration related complaints during typical construction operations except during blasting and impact or vibratory pile driving. Table 6-9 shows screening distance of sensitive receptors from adverse vibration effects.

Table 6-9: Vibration Effects on Sensitive Receptors

Type of Construction Activity	Vibration Annoyance[b] Distance to Vibration Effect (feet)[a]	Vibration Damage[c] Distance to Vibration Effect (feet)[a]
At-Grade Guideway	225	15
Retained Fill Guideway	315	25
Retained Cut Guideway	140	10
Aerial Structure Guideway	140	10
Tunnel Guideway	125	10
Cut-and-Cover Subway Guideway	281	20
Construction Staging Areas	120	10

[a] Adverse vibration effect is based on FTA "Frequent Event" vibration guidelines.
[b] An adverse effect from vibration annoyance occurs when vibration levels reach 72 VdB.
[c] Vibration damage is assumed to occur when vibration levels reach 95 VdB.
Source: Noise and Vibration Technical Report, HMMH, 2003.

The use of large tracked dozers and compactors generate vibration levels that may be perceptible within 30 to 35 feet and possibly cause cosmetic building damage within about 10 feet from construction activities. An augering drill-rig may generate vibration levels that are perceptible within about 20 feet, but would probably not cause any building damage.

If vibratory pile driver (i.e., sonic pile driver) is used to drive steel "sheet piles" at the eleven street crossings during at-grade utilities modifications, it will be perceptible at some of the nearby locations and may exceed the FTA damage criterion of 0.2 inch/second PPV for fragile buildings.

If non-impact pile driving methods are used, the maximum distance to vibration effects would be 315 feet, and the distance to potential cosmetic damage to nearby buildings would be 25 feet. The potential for serious foundation or structural damage, even when impact pile driving is used, occurs only at distances of 20 feet or less from the activity. The TBM may generate perceptible vibration at buildings located within 20 feet of the tunnel, but the TBM is not projected to produce vibration levels high enough to cause even cosmetic damage.

BEP Alternative and Portion of SVRTP Alternative Aboveground

Table 6-10 presents the projected PPV (peak particle velocity) vibration levels, from a traditional vibratory pile driver, on the common alignment common to the BEP and SVRTP alternatives. The projected PPV (peak particle velocity) vibration levels range from 0.01 to 0.26 inch/second at the closest residence or commercial structure due to vibratory piling operations at the eleven street crossings. Construction of the Dixon

Landing Road Alignment and the Crossing at Hostetter Road and the Crossing at Berryessa Road sites, result in projected vibration levels of 0.20 to 0.26 inch/second. These levels are above the FTA damage criterion of 0.2 inch/second for fragile buildings and could cause some building damage to fragile buildings.

Table 6.10: Estimates of BEP Alternative and Portion of SVRTP Alternative Aboveground Vibration Levels due to Vibratory Pile Driver

Receptor	Peak Particle Velocity (PPV) Vibration Levels (in/sec)
Crossing at Mission Avenue: Nearest commercial at 200 ft	0.013
Crossing at Warren Avenue: Nearest commercial at 170 ft	0.015
Crossing at Kato Road: Nearest commercial at 130 ft	0.017
Crossing at Dixon Landing Road: Nearest residential at 50 ft (Eastern track)	0.260
Crossing at Montague Expressway: Nearest commercial at 100 ft	0.100
Crossing at Capitol Avenue: Nearest residential at 150 ft (Eastern track)	0.017
Crossing at Trade Zone Boulevard: Nearest commercial at 90 ft	0.120
Crossing at Hostetter Road: Nearest residential at 60 ft (Western track) Nearest residential at 80 ft (Eastern track)	0.220
Crossing at Sierra Road/Lundy Avenue: Nearest residential at 100 ft (Tracks S1 and S2)	0.100
Crossing at Berryessa Road: Nearest residential at 80 ft (Eastern track)	0.140
Crossing at Mabury Road: Nearest commercial at 60 ft	0.220

Source: HNTB Companies and Wilson Ihrig & Associates, 2006.

It is important to note that a traditional vibratory pile driver generates the maximum vibration level during the start-up and shutdown phase of operation, due to various resonances that occur during vibratory pile driving. In order to avoid the resonance effect and to minimize adverse vibration effects during sustained “sheet piling” operations, a resonant-free vibratory pile driver could be used for any “sheet piling” operations and a crane be used for extraction of piles. Alternatively, the use of soil-mix-wall construction in lieu of “sheet piling” would minimize adverse vibration effects at the nearest buildings.

SVRTP Alternative Tunnel Segment

Tunnel construction ground vibration effects can vary greatly depending on the equipment, construction operation being performed, the location of equipment inside a construction zone, and distance to sensitive receptors. The major tunnel construction vibration effects are generally from impact pile driving, blasting, and possibly large tracked dozers and compactors. For the SVRTP Alternative, the use of blasting and impact or sonic pile driving is not anticipated.

Construction vibration projections are based on the typical construction equipment the contractor would use at the site. Information on construction vibration is based on the FTA Guidance Manual and that reported in the available literature.

The use of large tracked dozers and compactors generate vibration levels that may be perceptible within about 30 to 35 feet and possibly cause cosmetic building damage within about 10 feet from construction activities. The augering drill-rig may generate vibration levels that are perceptible within about 20 feet and is not anticipated to cause any building damage.

With a TBM, operated at about 50 feet or deeper, the TBM would cut the full tunnel diameter in a rotary fashion at speeds in the range of 3 to 5 revolutions per minute. At this depth, vibration levels are not likely to be perceptible.

An assessment of adverse vibration effects from the tunnel construction supply trains operating in each tunnel, using one to two diesel locomotives (25 to 35 ton), was based on typical vibration levels from freight trains reported in the FTA Guidance Manual. The projected vibration velocity levels are approximately 86 VdB at 15 mph (the anticipated maximum speed allowed in the tunnels). This exceeds the groundborne annoyance vibration limit of 80 VdB for the residential uses by 6 dB. However, to account for variations in track construction techniques, the vibration projections have assumed 5 dB higher vibration levels for a jointed rail track and 7 dB higher vibration levels for a rail track directly bolted into the tunnel invert. The projected groundborne noise levels are approximately 52 dBA at 15 mph, exceeding the groundborne noise annoyance criteria of 43 dBA for the residential uses by 9 dBA.

If complaints occur after the supply train is operational, vibration mitigation measures such as reducing train speeds in the vicinity of noise-sensitive receptors or installing ballast mats could be implemented. The evaluation assumed that a continuous conveyor belt system would be used to transport the muck. If muck trains are used in lieu of a conveyor system, groundborne vibration and noise levels will be similar to the material supply train.

Noise and Vibration Mitigation Measures

Construction activities will be carried out in compliance with FTA noise and vibration criteria and guidelines, and applicable local regulations to the extent feasible. In addition, specific property line noise and vibration limits will be developed during final design and included in the construction noise and vibration specifications for the selected Build Alternative. Regular noise and vibration monitoring will be performed during construction to verify compliance with these limits. This approach provides for site specific analysis and allows the contractor flexibility to meet the noise and vibration limits in the most efficient and cost-effective manner. Noise and vibration control mitigation measures that will be applied as needed to meet the noise and vibration criteria include:

Mitigation Measure CNST-NV-1. A comprehensive construction noise and vibration specification will be incorporated into all construction bid documents. The existence and importance of noise and vibration control specifications will be emphasized at pre-bid and pre-construction conferences.

Mitigation Measure CNST-NV-2. Stationary equipment, such as generators and compressors, will be located as far as feasible from noise and vibration sensitive sites, and be acoustically treated. Grout batch plants, and grout silos, mixers, and pumps, and diesel pumping equipment will also be located as far as feasible from noise sensitive sites, and be acoustically treated if necessary.

Mitigation Measure CNST-NV-3. Temporary noise barriers, as shown in Figures 6-47 and 6-48, or noise control curtains will be constructed in areas between noisy activities and noise-sensitive receptors, where practical and effective. Temporary noise barriers can reduce construction noise by 5 to 15 dB, depending on the height of the barrier and the placement of the barrier. To be most effective, the barrier will be placed as close as possible to the noise source or the sensitive receptor. Temporary barriers tend to be particularly effective because they can be easily moved as work progresses to optimize performance. If temporary noise barriers and site layout do not result in compliance with the noise limit, retrofitting existing windows and doors with new acoustically rated units may be considered for the residential structures.

Mitigation Measure CNST-NV-4. Use electric instead of diesel-powered equipment, hydraulic tools instead of pneumatic impact tools and electric instead of air- or gasoline driven saws, where feasible.

Mitigation Measure CNST-NV-5. Use resonant-free vibratory pile driver or augering drill-rig for setting piles in lieu of impact pile drivers where feasible.

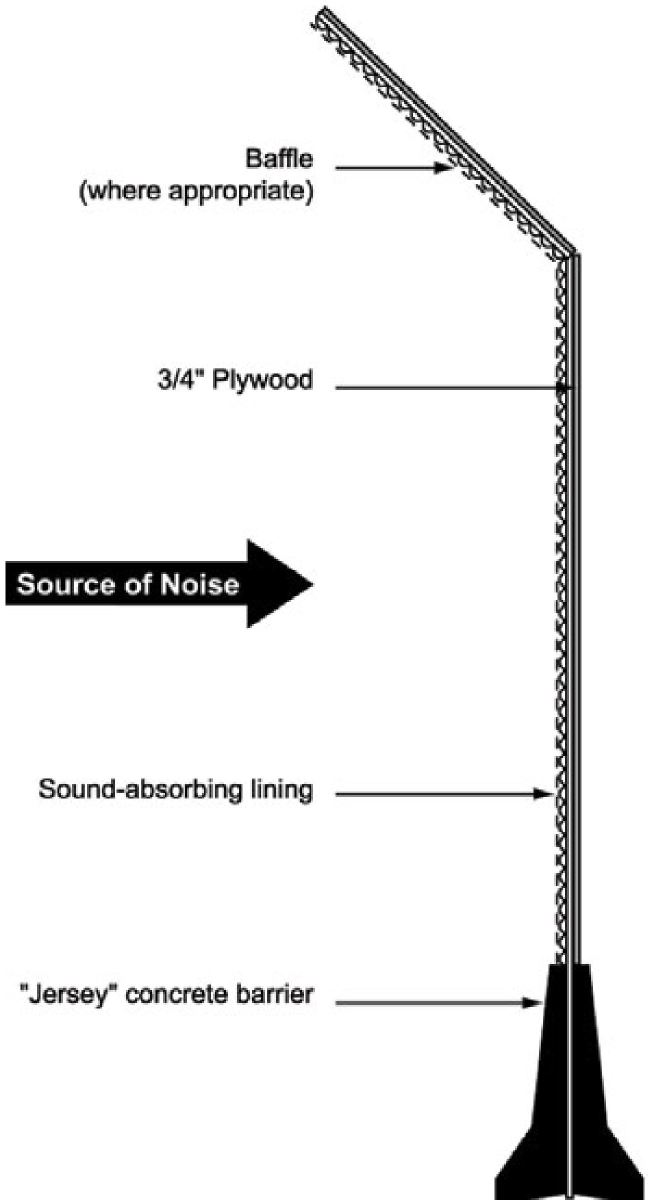
Mitigation Measure CNST-NV-6. Turn off idling equipment, whenever possible.

Mitigation Measure CNST-NV-7. Line or cover hoppers, conveyor transfer points, storage bins, and chutes with sound-deadening material.

Mitigation Measure CNST-NV-8. Construction-related truck traffic will be routed along roadways that would cause the least disturbance to residents. Loading and unloading zones will be laid out to minimize truck idling near sensitive receptors and to minimize truck reversing so back-up alarms do not affect residences.

Mitigation Measure CNST-NV-9. Use back-up alarms that are less intrusive in noise-sensitive areas.

Mitigation Measure CNST-NV-10. At nighttime and weekends, use strobe warning lights and/or back-up observers during any back-up operations, where permitted by the local jurisdiction.



Source: VTA, 2004.

Figure 6-47: Example of a Temporary Noise Barrier

Source: VTA, 2007.

Figure 6-48: Example of a Temporary Noise Barrier

Mitigation Measure CNST-NV-11. Line haul truck beds with rubber or sand to reduce noise, if needed and requested by the Resident Engineer.

Mitigation Measure CNST-NV-12. Steel and/or concrete plates over excavated holes and trenches will be secured to reduce rattling when vehicles pass over. Use of thicker plates, stiffer beams beneath the plates, and rubber gaskets between the beams and plates will also reduce rattling noise.

Mitigation Measure CNST-NV-13. Contractor will be required to use the best available practices to reduce the potential for excessive noise and vibration from construction activities. This may require the use of equipment with special exhaust silencers, construction of temporary enclosures or noise barriers around activities, and tracks for the tracked vehicles to be in good condition.

Mitigation Measure CNST-NV-14. Local jurisdiction construction time periods will be adhered to, to the extent feasible, recognizing that nighttime and weekend construction may be necessary and/or preferred by VTA and local jurisdictions to reduce other related environmental effects such as traffic. Note that local jurisdictions typically prohibit construction operations between the hours of 7:00 pm and 7:00 am. VTA will work with the local jurisdictions and the affected property owners to determine if the daytime working hours may be extended until 9:00 or 10:00 pm without severely affecting the nearby residents.

Mitigation Measure CNST-NV-15. Require the contractor to perform pre-construction ambient noise measurements at or near representative aboveground noise-sensitive locations. This will serve to document the noise environment just prior to start of construction at representative locations along the alignment. These measurements will be performed continuously over a minimum of 10 days at the representative above locations.

Mitigation Measure CNST-NV-16. Require the contractor to perform a 30-minute Leq noise sampling at representative noise sensitive locations within 250 feet of the construction at least once each week and after a change in construction activity or construction location. The measurements will be performed on both sides of the alignment. If required, additional noise monitoring site(s) may be added by the Resident Engineer to address any specific situation and concern. Additional noise measurements will be performed during daytime and nighttime construction activities at the eleven street crossings during at-grade utilities modifications and at the three new bridge locations.

Mitigation Measure CNST-NV-17. Construction noise measurements will coincide with periods of maximum noise-generating activity, and be taken during the construction phase or activity that has the greatest potential to create annoyance or to exceed applicable noise limits. The noise data will be submitted to the Resident Engineer on a weekly basis, including details and location of construction activity, and details and sketch of noise monitoring location.

Mitigation Measure CNST-NV-18. Require the contractor to perform pre-construction ambient noise measurements at the East and West Portal construction staging areas, at the station and vent shaft areas, and at the gap breaker areas. This will serve to document the noise environment just prior to start of construction. These measurements will be performed over a minimum of ten days at the staging areas, and at the station and vent shaft areas. At the gap breaker sites, four days of noise measurements will be conducted.

Mitigation Measure CNST-NV-19. Require the contractor to submit to the Resident Engineer a Noise Control Plan and a Noise Monitoring Plan, prepared by a qualified Acoustical Engineer. The qualifications and activities of the Acoustical Engineer will be subject to approval of the Resident Engineer. The Noise Control Plan will be updated every three months and include all the pertinent information about the equipment and the construction site layout, the projected noise levels and the noise mitigation measures that may be required to comply with the noise limits for each sensitive receptor. The Noise Monitoring Plan will outline the equipment and procedures used by the contractor to perform noise measurements, and to identify noise sensitive structures in the immediate vicinity of construction operations, including details regarding the noise measurement locations. The results of noise monitoring will be documented and reported. In the event that levels exceed allowable limits, the Resident Engineer will ensure that contractually required corrective measures are implemented.

Mitigation Measure CNST-NV-20. The minimum qualifications for the Acoustical Engineer will be a Bachelor of Science or Engineering degree, from a qualified program in engineering or physics offered by an accredited university or college, and five years in noise control engineering and construction noise analysis.

Mitigation Measure CNST-NV-21. Require that the contractor not operate noise-generating equipment at the construction site prior to acceptance of the Noise Monitoring Plan and the Noise Control Plan.

Mitigation Measure CNST-NV-22. Require the contractor to install permanent noise monitors at the Downtown San Jose Station and Diridon/Arena Station during all the construction phases, sampling continuously at one monitoring location at each Station. The monitoring location may be moved as the construction site progresses. At the Alum Rock Station and the West Portal staging area, permanent noise monitors will also be initially installed, which may be removed if the noise levels are in compliance with the noise limits when the construction activities are closest to the sensitive receptors.

Mitigation Measure CNST-NV-23. In addition to these permanent noise monitors, 30-minute noise sampling will also be required weekly at the station sites and at other construction sites, including the vent shafts and gap breaker sites. If required, additional noise monitoring site(s) may be added by the Resident Engineer to address any specific situation and concern. Noise data will be submitted to the Resident Engineer on a weekly basis, including details and location of construction activity, and details and sketch of noise monitoring location.

Mitigation Measure CNST-NV-24. For major equipment to be used at the surface of the construction site for a total duration greater than five days, ensure that the equipment is pre-certified by the Acoustical Engineer during field measurements at a test site or guaranteed by the equipment vendor to meet the noise limits developed for construction equipment as shown in Table 6-11.

Table 6-11: Noise Emission Limits for Construction Equipment

Equipment Type	Typical L_{max} Sound Level at 50 ft dBA
Excavators	82
Dump trucks	81
Front end loaders	82
Dozers	82
Concrete trucks	77
Graders	81
Cranes	79
Backhoes	75
Compactors	77
Compactor roller	81
Concrete pumping trucks	77
Tamper/Aligner	81
Water trucks	77
Large and small diameter auger drill-rigs	81
Diesel generators	69[a]
Flat-bed semi-trucks	81
Compressed-air construction tools	81
Air compressors	70[a]
Welding equipment	73

[a] Assumed acoustically treated

Source: HNTB Companies, 2006.

The final limits to be applied will be re-examined and developed during final design. Construction equipment will be retested at six-month intervals while in use onsite. Any equipment used during construction may be subject to confirmatory noise level testing by the contractor at the request of the Resident Engineer.

Mitigation Measure CNST-NV-25. Require the contractor to initially perform vibration monitoring at the nearest residence or commercial structure within 100 feet of pile driving operation. If the measured vibration data during the first two days is in compliance with the vibration limits, vibration monitoring may be discontinued at the site, assuming that piling operation occurs close to the nearest receptor. Vibration measurements will be measured in the vertical direction on ground surface or building floor and measured during a pile driving operation.

Mitigation Measure CNST-NV-26. Require contractor to initially conduct vibration monitoring daily at the nearest representative affected buildings during Phase I: Construction of Temporary Shoring Walls and Phase II: Deck Installation at the San Jose Downtown Station. Vibration measurements will be measured in the vertical direction on ground surface or building floor and measured during peak vibration generating construction activities. If the measured vibration data is in compliance with the vibration limits, either in terms of velocity levels in dB re 10-6 in/sec or peak particle velocity, vibration monitoring may be performed weekly instead of the daily monitoring.

Mitigation Measure CNST-NV-27. Require the contractor to perform vertical direction vibration (rms) monitoring on the ground at the nearest representative residential structure during supply train operations in the tunnels. These measurements will be repeated at approximately one-mile intervals along the tunnel construction.

Construction of either of the BEP or SVRTP alternative would result in substantial adverse effects due to construction noise which would occur during site clearing, preparation of subgrade, retaining wall and aerial construction, layout of sub-ballast, and track installation for the line portion and during tunnel portal, station vent shaft and auxiliary facility construction. Mitigation measures such as temporary sound walls, noise control curtains, restrictions on work hours, or temporary relocation of affected residents have been identified to minimize adverse effects but do not reduce noise levels to acceptable levels. Therefore, substantial adverse noise effects are anticipated during construction.

Adverse construction vibration effects would occur from the use of vibratory pile drivers, large tracked dozers, compactors and other heavy equipment. Mitigation measures such as the use of “resonant-free pile drivers” would be required if vibration levels exceed the criteria. Vibration monitoring during construction is proposed to ensure compliance. With mitigation, construction period vibration effects would not be adverse.

6.3.12 SECURITY AND SYSTEM SAFETY

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine adverse construction affects to security and system safety and to determine appropriate mitigation measures. The types of projects listed under the No Build Alternative are of a much smaller magnitude and typically do not result in substantial security and system safety construction effects.

BEP and SVRTP Alternatives

The safety of construction workers and/or others in the vicinity of construction activities could be affected by accidents or unsafe practices during construction. Emergency response personnel within the cities of Fremont, Milpitas, San Jose, and Santa Clara will be notified of construction activities and any incidents that need emergency response. Emergency response personnel will also be notified of any transportation network disruptions or temporary detours to ensure that they will be available for immediate response on an as-needed basis. Mitigation is not required.

6.3.13 SOCIOECONOMICS & ENVIRONMENTAL JUSTICE

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine socioeconomic effects related to construction and to determine appropriate mitigation measures if necessary. The types of projects listed under the No Build Alternative are of a much smaller magnitude and typically do not result in substantial socioeconomic and environmental justice effects during construction.

BEP and SVRTP Alternatives

The construction staging areas outside of and in addition to the permanent footprint of the project (see Section 6.2.11 of this chapter) would result in the following displacements of businesses and/or residences for the BEP and SVRTP alternatives.

BEP and SVRTP Alternatives

- **Mission Falls Court.** There would be no displacements of businesses or residences.
- **Calaveras Boulevard.** There would be no displacements of businesses or residences.
- **Capitol Avenue.** Two industrial businesses would be displaced. No residences would be displaced.

- **Trade Zone Boulevard.** This construction staging area would result in the displacement of 110 parking spaces from a business for two to three years; however, the business could continue the use onsite. Therefore, there would be no displacements of businesses or residences.

- **Berryessa Road.** Up to 6 industrial businesses would be displaced. No residences would be displaced.

SVRTP Alternative Only

- **Mabury Road and US 101.** Up to 3 industrial businesses and 1 advertising sign would be displaced. No residences would be displaced.

- **Alum Rock.** There would be no displacements of businesses or residences.

- **17th Street.** There would be no displacements of businesses or residences.

- **Downtown San Jose.** The downtown construction staging area would include three separate sites. The first site would be located north of West Santa Clara Street between Market and 1st street and would cause the displacement of four businesses, approximately 430 parking spaces, and 2 advertising signs. The second site would be located north of Santa Clara Street between 2nd and 3rd streets and would cause no displacements.

  There are three alternate locations for the third site. The first alternative site is located north of East Santa Clara Street between 3rd and 4th and would cause the displacement of 1 business. The second alternative site is located south of East Santa Clara Street between 1st and 2nd streets and would cause the displacement of 4 businesses and approximately 170 parking spaces. The third alternative site is located south of East Santa Clara Street between 3rd and 4th streets. This site would cause the displacement of approximately 50 parking spaces; however, no businesses would be displaced.

- **SR 87.** There would be no displacements of businesses or residences.

- **Diridon/Arena Station.** Two parking lot vendors and up to 635 parking spaces south of West Santa Clara Street between Autumn Street and the railroad tracks would be displaced. Not all 635 parking spaces would be displaced at once. Construction activities in the Diridon/Arena Station Area would occur over a six to eight year period, and would include the phased use of existing parking lots for construction staging, based on phase and type of construction activity.

- **Santa Clara Station.** There would be no displacements of businesses or residences.

The provisions of VTA's Relocation Program will minimize any adverse effects of the business and residential displacements associated with the construction of the BEP or SVRTP alternatives; therefore, no mitigation is required.

6.3.14 UTILITIES

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine construction period affects to utilities and to determine appropriate mitigation measures. However, affects to utilities and mitigation measures would be expected to be similar to the BEP and SVRTP alternatives as discussed below.

BEP Alternative

As discussed in Section 5.13, Utilities, the BEP Alternative has been located to avoid conflicts with existing major utilities to the extent feasible. Nonetheless, some major utilities would need to be relocated or reinforced and suspended to enable construction of the BEP Alternative alignment, stations, and ancillary facilities. These buried utilities, with the possible exception of sewers, are generally found within several feet of the street surface (e.g., telephone, traffic, electric).

Disruptions to services during construction will be avoided if possible. If necessary, the disruptions would be short-term and carefully scheduled with advance notice given to affected customers.

To avoid or minimize disruptions in service and inconvenience to customers, the following practices will be implemented:

- VTA will continue to coordinate with utility providers throughout the design and construction phases of the BEP Alternative, to identify existing utility locations and potential conflicts in the project construction area and formulate strategies to address problems and avoid unscheduled interruptions of service.

- A set of detailed plans for the BEP Alternative will be submitted to utility providers for their review and comment prior to the onset of any utility relocation work.

- Underground utilities that do not need to be relocated either temporarily or permanently will be uncovered and reinforced, if necessary, and supported in place during construction by hanging from support beams spanning across the excavation.

SVRTP Alternative

The SVTRP Alternative includes those utilities effects identified as part of the BEP Alternative and additional effects along the remaining extension of the alternative to the City of Santa Clara. Some major utilities require relocation or reinforcing and suspension to enable construction of the SVTRP Alternative alignment, stations, and other facilities. Similar to the BEP Alternative, utilities within the subsurface construction area not in need of relocation would be uncovered and protected during the early stages of excavation. Particularly within the tunnel segment and at the cut-and-cover stations, buried utilities can be found within several feet of the street surface. These buried utilities not needing relocation work, either permanently or temporarily, would be uncovered and protected during the early stages of excavation.

6.3.15 VISUAL QUALITY AND AESTHETICS

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine construction effects and mitigation measure related to visual quality and aesthetics. However, for the projects near sensitive receptors, the affects to visual quality and aesthetics and mitigation measures would be expected to be similar to the BEP and SVRTP alternatives as discussed below.

BEP and SVRTP Alternatives

Construction of the BEP and SVRTP alternatives would occur in different locations at different times. Construction activities would involve the use of heavy equipment, stockpiling of soils and materials, and other visual signs of construction.

To minimize the signs of construction, visual screening would be erected at construction sites as appropriate. Construction areas would be maintained in an orderly manner, including proper containment and disposal of litter and debris to prevent dispersal onto adjacent properties or streets. Construction crews working at night would direct any artificial lighting onto the work area to minimize the spillover of light or glare onto adjacent areas. Specifically at the Crossings at Montague, which is adjacent to the Milpitas Station, a 12-foot high community wall would be constructed as a first order of work to provide a visual screen and noise buffer of the construction area.

Short-term visual changes as a result of construction are a common and accepted feature of urban and suburban areas. Mitigation is not required.

6.3.16 WATER RESOURCES

Additional information related to potential construction affects to water resources is found in Sections 6.3.3 and 6.3.8 above for biological resources and hazardous materials, respectively.

Surface Waters

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine construction affects to surface waters, and to determine appropriate mitigation measures. However, for the projects near sensitive surface waters, effects and mitigation measures would be expected to be similar to the BEP and SVRTP alternatives as discussed below.

BEP and SVRTP Alternatives

Construction of the BEP or SVRTP alternatives would involve earth-disturbing activities including excavation of retained cuts, underground stations, and other facilities; stockpiling of excavated soil and imported fill; and other construction activities that could result in the discharge of sediment or other pollutants in site runoff that would flow directly to surface waters or enter the storm drain system. Dewatering operations for excavations could also result in discharge of sediments or pollutants. High sediment content in dewater discharges is common because of the nature of the operation in which soil and water mix in a turbulent flow of high-volume pump intakes. To the extent possible, earth-disturbing activities will be scheduled or prioritized outside the October to April rainy season to minimize the potential for erosion of construction areas. However, due to the magnitude of the BEP or SVRTP alternatives, many construction activities will occur year-round and measures will be taken to address potential affects to water quality.

The BEP or SVRTP alternatives will require an NPDES Construction General Permit and contractors must meet the substantive requirements for discharge of storm water runoff associated with construction activity. The permit will include the implementation of measures to avoid or minimize degradation of water quality during construction, and will include the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) by contractors involved with earth-disturbing activities. The SWPPP will accomplish two major objectives: (1) identify the sources of sediment and other pollutants that may affect water quality and (2) describe and ensure the implementation of site-specific erosion and sediment control measures and best management practices that reduce or eliminate sediment and other pollutants that could be discharged into surface waters or the storm drain system. In addition to the SWPPP, an erosion and sediment control plan will be developed and implemented by VTA and submitted to the RWQCB, ACFCWCD, and SCVWD for review and comment. For earth-disturbing activities that occur during the rainy season, the erosion and sediment control plan will specifically address measures to be undertaken during this season. As required by the NPDES permit, erosion and sediment control measures will include, but are not limited to, the following.

- Temporary and permanent seeding of disturbed areas and stockpiles
- Use of erosion control blankets

- Stabilization of construction area entrances and exits
- Dust suppression
- Use of straw rolls, sediment fences, straw bales, and/or sediment traps
- Use of temporary dikes to redirect or control runoff

The SWPPP will also include provisions for management of dewatering effluent. At a minimum, all dewatering effluent will be contained prior to discharge to allow the sediment to settle out, or will be filtered if necessary, to ensure that only clear water is discharged to the storm drain system or sanitary sewer, as appropriate. In areas of suspected groundwater contamination (i.e., underlain by fill or near sites where chemical releases are known or suspected to have occurred), groundwater will be sampled and analyzed by a state-certified laboratory for the suspected pollutants prior to discharge. Based on the results of the analytical testing, VTA will work with the RWQCB and/or local wastewater treatment plants to determine appropriate disposal options in compliance with applicable regulations. Additional effects due to dewatering are discussed in the Groundwater section below.

The Build Alternatives will also be consistent with the NPDES permits issued to the Alameda Countywide Clean Water Program and Santa Clara Valley Urban Runoff Pollution Prevention Program. These permits address non-point storm water pollutant runoff and include conditions that reduce storm water-borne pollutants at their source.

Construction of either the BEP or SVRTP alternative would not violate water quality standards or waste discharge requirements or provide substantial additional sources of polluted runoff. Compliance with the NPDES permits and implementation of a SWPPP and an erosion and sediment control plan would avoid or reduce affects to surface water resources during construction. Mitigation is not required.

Floodplains

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine construction affects to floodplains, and to determine appropriate mitigation measures. The types of projects listed under the No Build Alternative are of a much smaller magnitude and typically do not result in substantial floodplains construction effects.

BEP and SVRTP Alternatives

As mentioned in Chapter 2, Alternatives, several flood protection projects are planned and/or programmed (funded) to address design flow and flooding conditions in the SVRTC. The objective of these projects is to upgrade the creek channels to contain the design flows within the channel. Once completed, these projects will eliminate flooding in the areas of improvements, which include the SVRTC. In the event that one or more of these projects are not completed by the time the BEP or SVRTP alternative is under construction, or if these projects are under construction concurrently with the BEP or SVRTP alternatives, they could be subject to flooding if a 100-year flood event were to occur during construction. This is of particular concern for construction of the retained cuts, underground stations, tunnel portals, and ventilation shafts. VTA will coordinate with appropriate agencies to obtain updated information on the progress of these projects. Additional hydrologic and hydraulic studies will be prepared if necessary during subsequent engineering phases to determine how best to address flooding issues during construction.

The street drainage system in the City of San Jose has been designed for a 10-year storm event, or to a lesser standard (i.e., a 3-year storm event). This implies that there will be no flooding due to a 10-year/3-year storm event along the tunnel alignment for the SVRTP Alternative during construction. However, some construction sites along the alignment, particularly the underground station and ventilation shaft excavations, may interrupt some of the existing street storm drainage collection and conveying systems. Temporary drainage systems to be implemented during excavation of underground station boxes through completion of roadway restoration will be designed in subsequent engineering phases. Major drainage lines crossing the excavation will be supported and maintained in place. Storm drainage discharge from minor collector and lateral service pipes that get interrupted by construction will be collected and pumped directly to the nearest storm drainage manhole if the discharge does not come in contact with soils exposed by construction activities. Storm water entering excavation boxes directly or from surrounding site flows will be collected in sump pits at the bottom of the excavations and, depending on quality, will be discharged directly into existing street drainage system or treated before discharge into the existing storm drainage system. Temporary barriers such as sand bags or temporary AC curbs may be installed around excavation sites where they do not interfere with vehicular or pedestrian traffic to prevent excessive quantities of site runoff from entering the excavations.

With implementation of the flood protection projects and coordination with the appropriate agencies overseeing these projects to ensure flooding issues are addressed during construction of the BEP or SVRTP alternatives, and with implementation of other design requirements, construction of the Build Alternatives would not impede or redirect flood flows. Mitigation is not required.

Groundwater

This section focuses on potential hydrogeologic changes to groundwater. While contamination of groundwater is also included in the discussion, the reader is referred to Section 6.3.9 of this chapter for a more complete discussion of effects related to contaminated groundwater.

No Build Alternative

Projects planned under the No Build Alternative would undergo separate environmental review to determine construction affects to groundwater, and to determine appropriate mitigation measures. The types of projects listed under the No Build Alternative are of a much smaller magnitude and typically do not result in substantial adverse groundwater construction effects.

BEP and SVRTP Alternatives

Affects to groundwater are anticipated between the Great Mall parking lots and the Trade Zone Boulevard intersection, and from Trade Zone Boulevard to north of Berryessa Road, as excavation for the approximately 20-foot deep trench in this section may affect shallow groundwater quality due to percolation of contamination in the soil to groundwater, particularly during wet weather. During the dewatering of saturated soils, localized pumping of groundwater may cause diversion of groundwater flow direction toward the excavations, lower groundwater levels, or change overall groundwater flow direction. A decrease in groundwater levels from prolonged pumping may cause subsidence. The extent of hydrogeologic changes would be dependent on the amount of groundwater table drawdown, transmissivity of the water-bearing sediments, rates and duration of pumping during dewatering, and the distance to a potentially affected water supply facility. If extensive dewatering is needed, it is possible that groundwater conditions over a wide area would be affected. Changes in groundwater flow direction could affect the rate and direction of migration of existing contaminated groundwater. These changes could result in accelerated migration or interference with remediation efforts at existing contaminated sites.

Affects to groundwater are also anticipated from south of Mabury Road to west of I-880. Construction of the underground stations and tunnel may affect groundwater quality during excavation and construction. The subgrade levels for the three underground station excavations would vary in depth between 55 and 67 feet below existing ground surface, and the groundwater level at the stations varies between 6 and 26 feet below existing ground surface. Therefore, some dewatering operations would be necessary during construction of the tunnel and underground station excavations to remove seepage water from work areas.

Preliminary site investigations and aquifer pump tests have been conducted where groundwater is expected to be encountered during construction dewatering to determine the amount of water to expect, to define the effects of dewatering on groundwater supply facilities, and to characterize any groundwater contamination. Additional investigations and pump tests will be completed in subsequent engineering phases to refine the information obtained from the preliminary work effort, with the results used to develop a dewatering plan. Appropriate sampling and analysis protocols for dewatering during construction will be developed as part of the plan and incorporated into contracts for implementation during construction. Dewatering effluent will be preferentially discharged to the sanitary sewer or used as dust control on site, if appropriate. If discharge directly to surface waters or the storm drain system is unavoidable, an

NPDES permit and waste discharge requirements from the RWQCB will be obtained. Some effluent may require treatment prior to discharge. Depending on the volume and characteristics of the discharge, coverage under the NPDES General Construction Permit may be possible. This permit contains numerical and narrative limits that are sufficiently protective of water quality such that affects to surface water or groundwater as a result of dewatering effluent will be minimized.

To avoid potential complications caused by dewatering of excavations, it is intended to construct temporary shoring walls extending into the impervious clay below the pervious sand/gravel strata, creating a seepage barrier between the excavation subgrade and the water bearing aquifer. As described in the construction methodology section above, temporary shoring walls will be installed to support the sides of excavations and minimize groundwater flow into the construction area. Shoring walls include soil-cement mix walls, slurry diaphragm walls, steel sheet piles, soldier piles and lagging, and soil nailing. A soil-cement mix wall is typically constructed deep enough to penetrate into an impermeable soil layer below the base of an excavation so that groundwater seepage is minimized. A slurry diaphragm wall produces a concrete wall that can serve as the permanent wall, and can reduce the need for dewatering during the excavation process. Either of these methods is preferred for cut and cover construction where the excavations are deeper, such as the underground stations. The other methods may be used for shallower excavations such as the tunnel portals and retained cuts. One or more methods may be used at a single location depending on site-specific conditions. Depending on the method chosen for the temporary shoring walls and the depth of groundwater, varying degrees of dewatering will be required. In addition, less pumping will reduce the potential to lower groundwater levels and change groundwater flow directions outside the construction area. In addition to temporary shoring walls, sumping and/or dewatering shafts with submersible pumps will be required within the excavations to pre-drain permeable sand and gravel layers as the excavations proceed to subgrade level. Without the planned temporary shoring walls, the amount of dewatering needed to maintain safe and workable construction sites would require lowering groundwater elevation by about 40 to 50 feet. Substantial groundwater draw-down, on the order of several thousand gallons per minute, would be required to lower groundwater elevation by that much.

VTA will also implement a groundwater level monitoring program of shallow aquifers to assess long-term water level trends and will alter dewatering strategies if adverse effects are noted. If necessary, VTA will remedy adverse effects by lowering pumping rates, deepening wells, or providing other means of maintaining the historical water supply. During the Preliminary Engineering phase, aquifer testing was conducted in two locations: one adjacent to the planned underpass at Kato Road and one adjacent to the planned retained cut at Hostetter Road. One of the purposes for the testing was to obtain the hydrogeologic parameters for the aquifer located under these two locations to develop construction dewatering strategies. The first encounters of groundwater at the Kato Road and Hostetter Road sites were approximately 7 feet below ground surface and 14.5 feet below ground surface, respectively. Therefore, the assumed saturated thicknesses of the shallow aquifer at these sites are taken to be approximately 63 feet and 55.5 feet respectively. While the testing provided information on appropriate dewatering rates, it also showed that groundwater level monitoring of deep aquifers (approximately 500 ft. deep) will not be necessary because no work that deep is planned along the alignment.

VTA will identify the sources of contamination or any existing groundwater contaminants within or around the construction area and implement a water level and water quality monitoring program to prevent potential movement of contaminated water before it affects a well field. Abandoned or improperly destroyed wells screened across deep aquifers and overlying shallow aquifers could provide a conduit for vertical contaminant migration. These conduits could “short-circuit” the groundwater flow system and allow rapid transport of water vertically between aquifers. Note that no abandoned wells were identified during the Preliminary Engineering field investigations along the alignment from the BART Warm Springs Station to the east tunnel portal; however, abandoned wells were identified along the SVRTP Alternative tunnel alignment. Additional investigations will continue in subsequent engineering phases to identify abandoned wells at other facilities such as parking areas. Existing wells will be closed and abandoned in accordance with applicable regulations prior to construction to prevent cross contamination of aquifers. Any undocumented and unexpected wells encountered during construction will also be closed and abandoned appropriately.

Materials used during construction, and any accidentals spills, may affect groundwater quality. Contract documents will reference waste minimization measures and specification of non-hazardous materials, to the extent feasible, for incorporation in the project. Soil and ballast reuse will comply with the Contaminant Management Plan (see Section 6.3.9 of this chapter). VTA will remediate groundwater contamination from accidental spills related to excavation, drilling, grouting, and other construction activities in accordance with local, state, and federal requirements.

With implementation of the above design requirements and best management practices, adverse groundwater effects due to construction of the BEP or SVRTP alternatives are not anticipated. Mitigation is not required.

This page intentionally left blank.