4.19 CONSTRUCTION

4.19.1 INTRODUCTION

This section describes the types and location of construction activities and the techniques and equipment that would be used for construction of the Baseline and BART alternatives (as described in Chapter 3, *Alternatives*). Pre-construction activities are described, and estimated durations of construction activities are provided. The construction activities, techniques, and equipment, as well as the pre-construction activities for the BART Alternative, also pertain to the MOS scenarios with the exception of the deferred construction of the Berryessa Station. The MOS scenarios also stagger construction of the BART Maintenance Facility and certain station parking structures.

Following the description of the construction scenario (see Section 4.19.2), the associated construction impacts and mitigation measures are evaluated for transportation and traffic; air quality; biological resources and wetlands; community facilities, schools, and religious institutions; cultural and historic resources; electromagnetic fields; geology, soils, and seismicity; hazardous materials; noise and vibration; safety and security; utilities; visual quality and aesthetics; and water resources, water quality, and floodplains.

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

For purposes of analysis, no construction activities would occur under the No-Action Alternative; therefore, this alternative is not addressed in this section.

4.19.2 CONSTRUCTION SCENARIO

Construction scenarios are provided for the various types of transit guideways, stations, transit centers, parking structures, and other related structures and facilities included in the Baseline and BART alternatives. Construction activities related to railroad relocation are discussed. Anticipated temporary street and lane closures are provided, as well as anticipated construction staging sites. Construction scheduling is summarized, and preliminary mitigation measures for project construction are provided. Pre-construction activities are described.

The design and construction of the BART Alternative is anticipated to support an average of 15,000 jobs annually[1], including professional jobs related to design, engineering, and management of the project; construction jobs; and jobs created by the manufacture and fabrication of construction materials. Forty-five percent, or approximately 6,830, of the projected jobs would be locally based.[2]

4.19.2.1 Pre-construction Activities

Baseline and BART Alternatives

The following major pre-construction activities are anticipated before construction of the Baseline or BART alternative. The magnitude of this effort would be substantially greater with the BART Alternative than with the Baseline Alternative.

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[1] The American Public Transportation Association (APTA) estimates that every $1 billion invested in public transportation infrastructure supports approximately 47,500 jobs.

[2] VTA's experience on other major transit infrastructure projects supports the conclusion that approximately 45% of jobs created by such projects are local jobs.

- Undertake detailed geotechnical investigation.
- Prepare Final Design documents and construction contracts.
- Prepare traffic control and detour plans.
- Prepare Construction Impact Mitigation Plan (BART only).
- Conduct a pre-construction building data survey, biological surveys, and other surveys as appropriate.
- Establish a construction-related community information/outreach program.
- Acquire necessary property and easements, including temporary construction and long-term underground easements.
- Acquire necessary environmental permits and approvals.
- Develop interagency cooperative agreements related to construction.
- Advance utility relocations.
- Schedule Coordination.

Detailed Geotechnical Investigation. During Preliminary Engineering and Final Design for the BART Alternative, additional sampling (drilling and core samples) and analyses of subsurface soil conditions and groundwater would be used to detail and finalize the excavation and its support system to be used in the bridge and structure foundations and the retained cut, cut-and-cover, and tunnel portions of the alignment. Current data, including subsurface sampling conducted for conceptual design, have been used to identify proposed construction techniques.

Final Design and Development of Construction Contracts. During Final Design, detailed design elements of the alternatives will be developed, reflecting, among other subjects, final geotechnical investigations. As part of Final Design, VTA will work with property owners planning to build new structures adjacent to the proposed alignments to integrate construction of the alternatives with construction of private structures to reduce project construction impacts. Final Design will in turn lead to refinements to construction contract packaging, stage plans, sequencing, and durations.

Traffic Control Plans. Construction of either alternative would temporarily interfere with the normal flow of traffic, causing some lanes and streets to be closed to vehicles for various durations. Some streets would be subject to lane and temporary closures as described in the following sections. During Final Design, traffic control plans will be developed in cooperation with local jurisdictions (i.e., Fremont and Milpitas for the Baseline Alternative; and Fremont, Milpitas, San Jose, and Santa Clara for the BART Alternative); transportation, police, and fire departments; and Caltrans. To the extent practical, traffic lanes and capacity will be maintained in the appropriate directions, particularly during peak traffic hours.

Construction Impact Mitigation Plan. A Construction Impact Mitigation Plan will be developed prior to construction. This plan will incorporate mitigation measures included as part of the Final EIS/EIR and adopted by VTA in the project's Mitigation Monitoring and Reporting Plan. Other measures, such as public outreach (described below), that go beyond more traditional actions to mitigate direct physical environmental impacts will also be implemented. Therefore, the Construction Impact Mitigation Plan supplements the requirements of NEPA and CEQA that mitigation measures be implemented.

Critical components of the Construction Impact Mitigation Plan may include such public outreach measures as:

- Performance of outreach efforts to inform residents, businesses, and property owners of the proposed construction program.

- Establishment of a community construction coordination program to encourage communication with the affected community.
- Contacting and interviewing businesses and property owners potentially affected by construction activities. Interviews with commercial establishments would provide knowledge and understanding of how these businesses carry out their work, and identify business usage, delivery and shipping patterns and critical times of the day and year for business activities. Data gathered from these interviews would assist in the development of worksite traffic control plans. Among other elements, these plans would identify alternate access routes to maintain critical business activities.
- Tailoring the mitigation program to best meet community needs.
- During construction, establishing an information field office located along the alignment. The information office will be open various days of the workweek for the duration of the construction period. The field office staff in conjunction with other staff will serve multiple purposes:
  - Providing the community and businesses with a physical location where information pertaining to construction can be exchanged;
  - Enabling VTA to better understand community/business needs during the construction period;
  - Allowing VTA to participate in local events in an effort to promote public awareness of the project;
  - Managing construction-related matters pertaining to the public;
  - Notifying property owners, residences, and businesses of major construction activities (e.g., utility relocation/disruption and milestones, re-routing of delivery trucks);
  - Providing literature to the public and press;
  - Promoting and providing presentations on the project via a Speakers Bureau;
  - Responding to phone inquires on an established information phone line;
  - Coordinating business outreach programs;
  - Scheduling promotional displays; and
  - Participating in community committees.
- Establishing a telephone information line to provide community members and businesses the opportunity to express their views regarding construction. Calls received will be reviewed by VTA staff and will, as appropriate, be forwarded to the necessary party for action (e.g., utility company, fire department, the Resident Engineer in charge of construction operations). Information available from the telephone line will include current project schedule, dates for upcoming community meetings, notice of construction impacts, individual problem solving, construction complaints, and general information. During construction of the project, phone service will be provided in multiple languages and will be operated on a 24-hour basis.
- Working with establishments affected by construction activities. Develop appropriate signage and displays to direct both pedestrian and vehicular traffic to businesses via alternate routes.

To ensure enforcement of the mitigation measures provided in the following construction section, VTA may:

- Include mitigation requirements in contract specifications, drawings, and provisions, as well as public affairs programs, as appropriate.
- Monitor contractors to assure that mitigation measures contained in the EIS/EIR are met.

- Inform the public of the progress in implementing the measures selected through a quarterly program of auditing, monitoring, and reporting. Make quarterly status reports available to local jurisdictions and the public.

Construction time limits may be included as part of the Construction Impact Mitigation Plan. In lieu of time limits included in this plan, the cities of Fremont, Milpitas, San Jose, and Santa Clara place limits on the time of day that construction activity is allowed to occur. Strict adherence to allowable construction times may be waived through mutual consent of the local jurisdiction and VTA to reduce overall impacts. However, if new environmental impacts were to occur as a result of extended construction hours, subsequent environmental analysis would be required.

Building Data Survey. A pre-construction structural photo, video, and inventory survey will be completed to determine the integrity of existing buildings adjacent to and above (for the BART Alternative subway portion) the proposed construction areas. This survey will be used to finalize detailed construction techniques along the alignments and as the baseline for monitoring construction impacts during and following construction. During construction of the BART Alternative, VTA will monitor adjacent buildings for movement and, if movement is detected, take immediate action to control the movement.

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

Establishment of Community Construction Information/Outreach Program. For either alternative, a community construction coordination program would be established to provide on-going dialogue between VTA and the affected community regarding construction impacts and possible mitigation/solutions. The program would include dedicated personnel, including outreach offices in the construction areas, to deal with construction coordination. An important element of this program would be the dissemination of information in a timely manner regarding anticipated construction activities.

Land and Easement Acquisition. Properties would need to be acquired before construction of either alternative. In addition, property easements would need to be obtained for those properties above the tunnel portion of the BART Alternative. Temporary construction easements and public service easements also would be needed.

Acquire Environmental Permits and Approvals. VTA will acquire all required environmental permits and approvals as identified in Chapter 9, *Agency and Community Participation*, Table 9.3-1. Coordination with permitting agencies will be an important aspect of VTA's construction management. In addition, Cooperative Agreements related to construction activities may be developed with affected agencies and jurisdictions.

Advance Utility Relocations. Utilities that would need to be relocated out of a construction zone prior to construction of the BART Alternative would be relocated in advance of BART construction.

Schedule Coordination. VTA will establish and oversee a schedule for the construction of the project. As necessary, action will be taken to minimize any impacts due to schedule delay.

4.19.2.2 Types of Guideways

Baseline and BART Alternatives

There are six basic guideway construction configurations that would apply to the Baseline Alternative and all the alternatives and design options associated with the BART Alternative. Detailed locations and a discussion of the types of equipment and activities associated with each of these guideway configurations are provided in the sections that follow.

At-Grade Guideway. The at-grade guideway (either pavement for buses or tracks for BART) would be located at or slightly above existing ground.

Retained Fill Guideway. The retained fill guideway would be elevated above the existing ground by up to approximately 30 feet (e.g., Baseline Alternative busway, UPRR tracks). Concrete retaining walls or mechanically stabilized earth (MSE) walls would be constructed on the sides of the guideway. Fill material would be placed between the retaining walls to provide a surface for the guideway.

Retained Cut Guideway. The retained cut guideway would be located below existing ground, as deep as 30 feet, depending on the design option. Concrete retaining walls would be located on the sides of the guideway to support the adjacent ground. Existing material between the retaining walls would be excavated, and the guideway 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, the configuration is sometimes referred to as a "U-wall" section.

Aerial Structure Guideway. Aerial structures would typically be constructed of concrete, but steel girders might be used for long spans or in special circumstances. The busway would run on a concrete surface, either the top slab of a cast-in-place concrete bridge, or a separately placed slab on a steel beam bridge. BART guideway tracks would be fastened directly to the concrete slabs.

Tunnel Guideway. The tunnel guideway configuration for the BART Alternative is entirely underground. The tunnel would be constructed using a specialized tunnel-boring machine (TBM) as described below. Tunneling construction is designed so as not to disturb the surface above. Where the tunnel passes under structures, the top of the tunnel would generally be 40 feet bgs. Refer to Figure 4.19-10. However, localized areas with a reduced depth of cover will occur as the alignment transitions from bored tunnels into cut-and-cover and at-grade structures, where the tunnel passes beneath localized topographic features, and where soil conditions allow a shallower depth.

Cut-and-Cover Subway Guideway. The cut-and-cover subway guideway for the BART Alternative is underground when it is finished and looks like a tunnel. The guideway is constructed by excavating a trench similar to a retained cut and then constructing a concrete structure with a roof. After the roof is complete, the trench is backfilled over the roof and the surface is restored.

4.19.2.3 Location and Construction of Guideway Types, Stations, and Other Facilities

Baseline Alternative

The Baseline Alternative would involve construction of three types of guideways: aerial, retained fill, and at-grade guideways for express buses. Figures 3.3-3 and 3.3-4 in Chapter 3, *Alternatives*, and Figures D-1 through D-3 in Appendix D, show the locations for these guideway types for the three busways.

At-Grade Guideway. At-grade construction for the Baseline Alternative would occur at the following locations:

- In the center median of I-680 for approximately 150 feet (Figure D-1, STA 5+00 to 6+50).
- In the center median of I-880 for approximately 200 feet (Figure D-2, STA 104+00 to 106+00).
- In the center median of I-880 for approximately 150 feet (Figure D-3, STA 6+00 to 7+50).
- In the center median of Montague Expressway for approximately 100 feet (Figure D-3, STA 36+50 to 37+50).

Construction of these sections would involve grading the surface material and constructing the roadway using standard roadway construction methods.

Retained Fill Guideway. Retained fill guideway for the Baseline Alternative would occur at the following locations:

- On the busway between I-680 and Warm Springs Boulevard for 600 feet joining the at-grade segment to the aerial guideway (Figure D-1, STA 6+50 to 12+50).
- On the busway between Warm Springs Boulevard and the aerial guideway section connecting to I-880 (Figures D1 and D-2, STA 27+50 to STA 87+80, and Figure D-2, STA 97+20 to 104+00).
- On the busway connecting Montague Expressway to I-880 (Figure D-3, STA 7+50 to 13+50 and STA 32+00 to 37+00).

Construction of the retained fill guideway sections would include methods similar to those described below for the BART Alternative.

Aerial Guideway. Aerial guideway for the Baseline Alternative would occur at the following locations:

- On the busway between I-680 and Warm Springs Boulevard (Figure D-1, STA 12+50 to STA 27+50).
- On the busway between Warm Springs Boulevard and I-880 (Figure D-2, STA 87+80 to 97+20).
- On the busway between Montague Expressway and I-880 (Figure D-3, STA 13+50 to 32+00).

Construction of the aerial guideway sections would include methods similar to those described below for the BART Alternative.

<u>BART Alternative</u>

The BART Alternative would involve construction of six types of guideways: at-grade, retained fill, retained cut, aerial structure, tunnel, and cut-and-cover. Locations of these guideway types are described below and shown in Chapter 3, *Alternatives*, for each of the five BART Alternative segments as follows: (1) Figures 3.4-3 and 3.4-4, Segment 1, (2) Figure 3.4-5, Segment 2, (3) Figure 3.4-6, Segment 3, (4) Figure 3.4-7, Segment 4, and (5) Figure 3.4-8, Segment 5. The guideway types are also shown on the Plan and Profile drawings in Appendix A, Figures A-1 to A-47.

The following sections provide the locations, construction equipment, and construction activities associated with each of the guideway types.

At-Grade Guideway. At-grade construction for the BART Alternative would occur at the following locations:

- North of Mission Boulevard (Figure A-5 and A-7, STA[3] 45+00) in Fremont to north of Montague Expressway (Figure A-19, STA 337+00) in Milpitas, with underpass options (depressed roadways) at East Warren Avenue and Dixon Landing Road.
- Either side of East Warren Avenue for the BART At-Grade Option (Figure A-7, STA 74 + 00).
- South of Trade Zone Boulevard (Figure A-22, STA 412+00) to north of Hostetter Road (Figure A-23, STA 448+00).
- South of the Sierra Road/Lundy Avenue intersection (Figure A-24, STA 500+00) to north of Berryessa Road (Figure A-24, STA 512+00).
- US 101 (Figure A-30, STA 572+00) to just south of Silver Creek (Figure A-30, STA 584+00) with the Railroad/28th Street Option (US 101 overcrossing).
- North of I-880 in Santa Clara (Figure A-42, STA 828+00) to south of De La Cruz Boulevard/UPRR (Figure A-43, STA 878+00).
- North of De La Cruz Boulevard/UPRR (Figure A-43, STA 898+00 to Figure A-44, STA 901+00).

At-grade construction for associated railroad improvements would occur at the following locations.

- Relocated rail truck transfer facility (Sno-boy) north of South Grimmer Boulevard in Fremont (Figures A-3, and A-4, STA +00).
- Locomotive wye turn-around track either south of East Warren Avenue (Figure A-9, STA 117+00) or north of Montague Expressway (Figure A-20, STA 355+00).

Figure 4.19-1 shows a conceptual cross section for an at-grade BART guideway on the existing rail ROW. At-grade construction for the BART Alternative in the rail ROW would begin with the removal of the railroad tracks, ballast gravel, and sub-ballast gravel. Earth removal equipment would be used to scarify and remove two to three feet of surface material. This equipment would generally consist of rubber-tired excavators and small bulldozers.

The excavated material would be loaded onto trucks or railroad hopper cars and removed from the site. Surface material that is contaminated would be carefully excavated and loaded onto trucks or railroad hopper cars and removed to an appropriate disposal site.

Soils such as clays or other materials unsuitable for supporting the guideway loading would need to be excavated and either recompacted or replaced with imported soils. The subgrade would be prepared with machines that compact the soil. These are steel wheeled or rubber-tired compactors, graders, and small bulldozers.

For the BART Alternative, track structural section construction could consist of one layer of compacted material similar to that used for roadways, plus ballast. Ballast is hard rock that would be imported by truck or rail and compacted with special equipment. Rails and ties would be imported by truck or rail and placed with specialized rail-mounted equipment. Construction adjacent to an active railroad must conform to Federal Railroad Administration Roadway Worker Protection rules.

BART electrification includes the construction of 34.5kV ducts (plastic pipes encased in concrete) buried below the ground adjacent to the tracks. The ducts are laid in a trench and then covered. The power cables are installed later. BART construction also includes train control cables in a duct bank or cable tray adjacent to the tracks. The duct bank or cable tray is generally a concrete trough with a cover.

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[3] STA = Station location on plan and profile drawings, Appendix A, Figure A-1 through A-47.

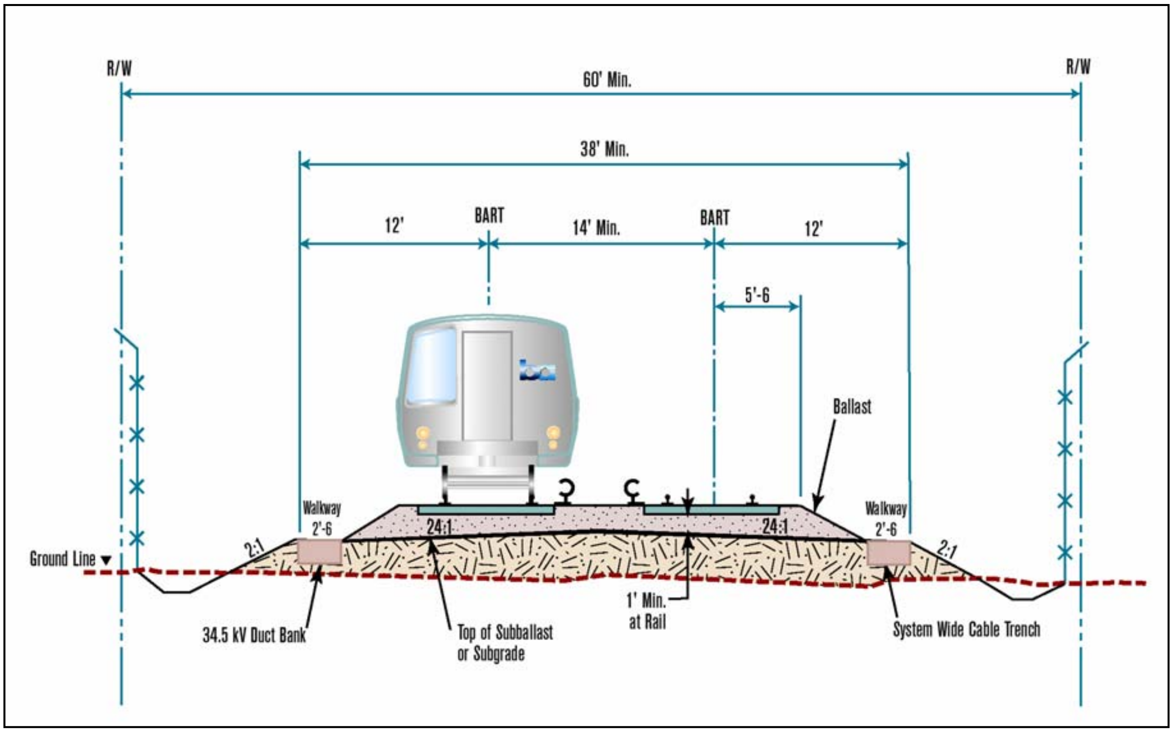


Figure 4.19-1: Conceptual At-Grade Cross Section for the BART Alternative

Retained Fill Guideway. Retained fill construction would occur at the following locations for the BART Alternative:

- Mission Boulevard (Figure A-8, STA 69+00) to south of East Warren Avenue (Figure A-8, STA 85+00) with the East Warren Avenue At-Grade Option.
- In the vicinity of Dixon Landing Road (Figure A-13, STA 182+00 to STA 201+00) with the BART Aerial Option at Dixon Landing Road (BART elevated over the road).
- North of Berryessa Road (Figure A-24, STA 512+00) to south of Mabury Road (Figures A-26 and A-30, STA 560+00).

Figure 4.19.2 shows a conceptual cross section for the BART retained fill guideway. Concrete retaining wall construction would commence with excavation for wall footings. This excavation would normally be performed with small backhoes or bulldozers. Due to seismic design requirements, retaining wall foundations may require pile foundations. These piles are generally long steel or concrete poles that are placed into the ground with special equipment. Given that pile driving creates substantial noise and vibration, vibratory pile driving equipment is proposed for residential areas, creating less noise and lower vibration levels as compared with conventional pile drivers. Cast-in-drill-hole (CIDH) piles may be suitable for wall foundations, as these would generally create very little noise and minimal vibration.

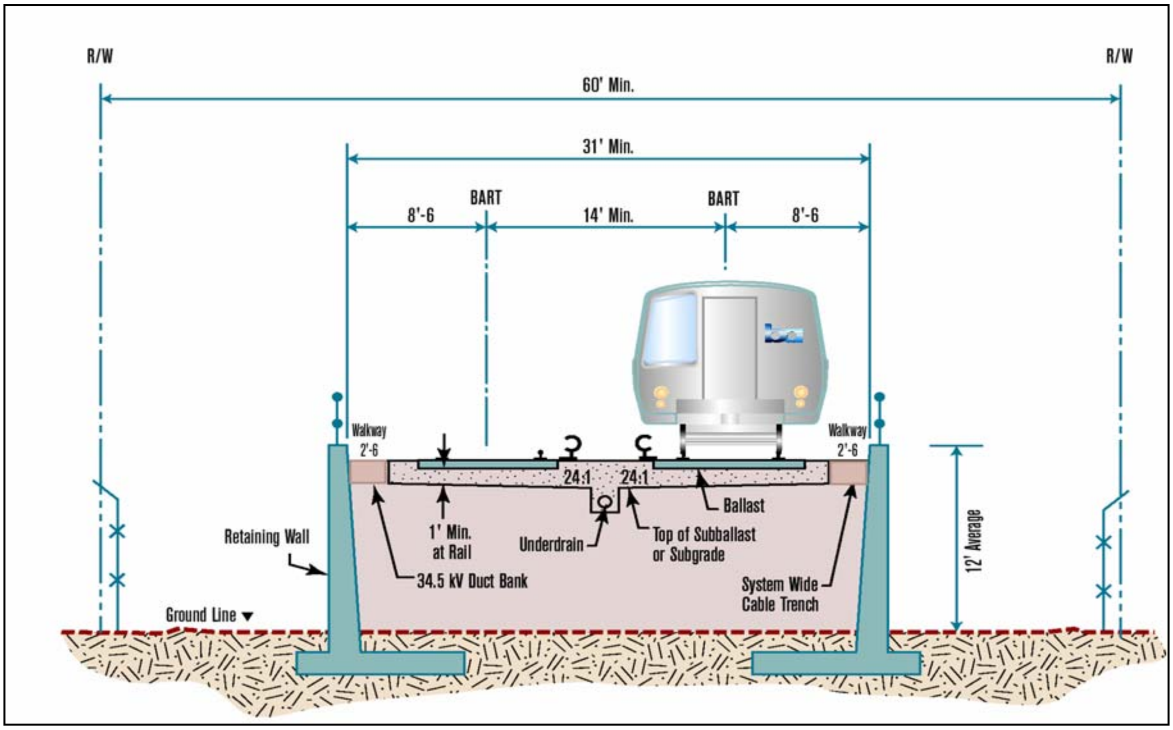


Figure 4.19-2: Conceptual Retained Fill Cross Section for the BART Alternative

The walls would be constructed by placing reinforcing steel, erecting forms, and filling them with concrete. Prefabricated forms would be set in place with cranes. Wood forms would be constructed on-site and would generate noise from carpenters' hammers. Reinforcing steel is generally pre-bent and fabricated and delivered to sites where it is installed by cranes. Concrete is delivered in truck mixers and usually pumped into the forms. The mixers and pumps generate noise. After the walls are completed, the space in between is filled with embankment material delivered by truck or other earth-moving equipment. The material is compacted with sheep's-foot and rubber-tired rollers.

Figure 4.19-3: Example of Mechanically Stabilized Wall

Alternative types of retaining walls such as MSE would not require forms, reinforcing steel, or concrete. With these walls, the earth embankment forms a part of the structure and is constructed in conjunction with the walls (Figure 4.19-3).

Retained Cut Guideway. Retained cut construction for roadway underpasses passing beneath the BART Alternative would occur at the following two locations:

- Kato Road underpass (Figures A-11 and A-12, STA 166+80 to STA 167+80).
- Dixon Landing Road underpass with BART At-Grade Option (Figures A-15 and A-16, STA 191+00 to STA 192+20).

Retained cut construction for the BART Alternative may occur at the following seven locations:

- North and south of Dixon Landing Road with the BART Retained Cut Option (BART undercrossing from Figure A-14, STA 182+40 to STA 201+00).
- North of Montague Expressway to south of Trade Zone Boulevard (Figures A-19, A-20, and A-22, STA 337+20 to STA 412+00).
- North of Hostetter Road to south of the Sierra Road/Lundy Avenue intersection (Figures A-23 and A-24, STA 448+40 to STA 500+00).
- South of Mabury Road to north of Las Plumas Avenue (Figure A-26, STA 559+00 to STA 567+60) - east portal of subway for US 101/Diagonal Option.
- South of Lower Silver Creek to north of East Julian Street (Figure A-30, STA 584+10 to STA 590+00) - east portal of subway for Railroad/28th Street Option.
- North of I-880 to north of Newhall Street (Figure A-42, STA 822+40 to STA 829+50) - west portal of subway.
- North of the Santa Clara Station to north of De La Cruz Boulevard (Figure A-43, STA 881+40 to STA 895+00 - UPRR underpass).

Figure 4.19-4 shows a conceptual cross section for the retained cut portion of the BART Alternative. Due to the close proximity of adjacent buildings along much of the corridor, the nature of soft soils, and the presence of high groundwater, temporary shoring walls will be needed to support the sides of the excavation while construction of the retained cut permanent concrete U-wall structure takes place. Despite the presence of temporary shoring walls, there will be a considerable amount of water that needs to be controlled during the excavation process. Well points, or sumps and pumping, or other dewatering techniques can be used for this purpose.

There are several methods that can be used for temporary shoring walls. One method is to use steel sheet piles, which can be driven into the ground by either a percussion or vibratory hammer. The sheet piles are coupled to each other so as to be interlocked and provide additional reinforcement. During excavation between the two sheet pile walls, horizontal steel beams are placed along the walls at designated spacing in order to transmit the soil and groundwater forces to lateral-bracing members. The lateral-bracing members can be either struts composed of steel H-beams or steel pipes that span across the width of the excavation, 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. The latter method provides an open, unrestricted trench area that does not interfere with the construction activities for the retained cut guideway. The use of the tieback method will 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. Percussion hammers generate noise and vibration, while vibratory hammers emit only vibrations. The drilling of holes generates limited noise and vibration.

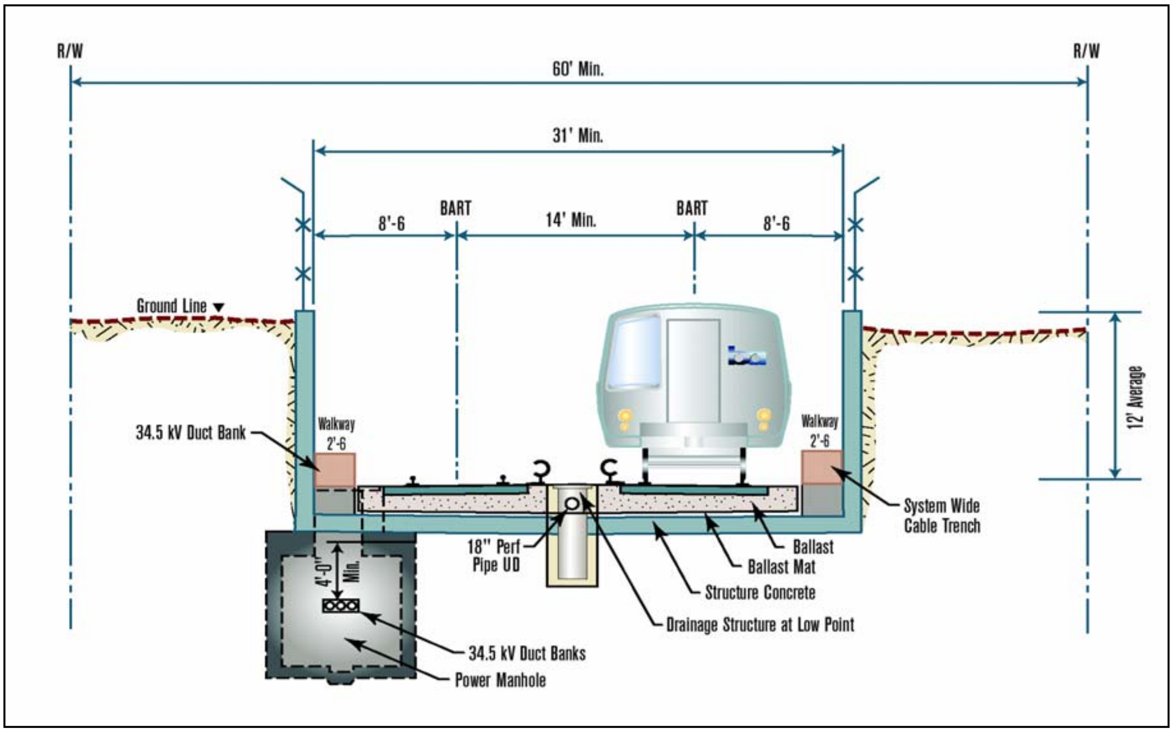


Figure 4.19-4: Conceptual Retained Cut Cross Section for the BART Alternative

Another temporary shoring wall method is called "soldier piles and lagging." Soldier piles are steel H-beam column sections. These can be placed either in drilled holes, then concreted, or driven into the ground using either a percussion or vibratory hammer at a regular spacing of approximately four to six feet. When construction starts, timber planks are placed between the flanges of the 'H' column sections as excavation proceeds downward. The end result is a wall of steel 'H' column sections with timber planks placed horizontally between them. This system also needs lateral bracing similar to the sheet pile walls described above.

A system called "soil nailing" can also be used for temporary shoring walls. This method uses a pattern of steel bars that are either placed in the face of the wall in drilled holes and grouted along their total length, or are driven into the wall. The anchors or nails are generally steel bars. The nails are placed in a grid approximately 2-1/2 feet square on the vertical faces of the excavation, or one grouted nail per every 6-10 square feet. The nails are placed progressively as the excavation work gets deeper. The length of the nails must extend beyond the failure plane for the ground potential sliding mass. Slope stability analysis of the cut slope needs to be performed. The exposed earth face can be covered using a method called shotcrete, which is formed by pneumatically blowing a concrete mixture under pressure onto a mesh of reinforcement connected to the soil nails. Precast or steel panels may also be used. The result is a self-supporting shoring wall. This system does have drawbacks, and normally is not used in areas where there is a high water table and permeable soil. Dewatering would be necessary during the excavation.

Other methods are available but are likely to be more expensive. For example, the use of groundwater cut-off walls such as the Deep Mixing Method (DMM) can be used. This produces a wall commonly referred to as a “soil-cement wall.” This method involves the mixing of cement slurry with in-situ soil to construct a continuous and practically waterproof wall made up of individual columns overlapping with each other, with every third column structurally reinforced with vertical steel H-beams that are inserted into the soil-cement mixture while the mix is still fluid (i.e., before it sets and hardens).

Soil cement walls are typically constructed deep enough to penetrate into an impermeable layer below the base of the planned excavation so that seepage of groundwater into the bottom of the excavation can be minimized. These walls would require lateral support, as described for sheet pile walls above. Dewatering would still be necessary but not to same extent as other temporary shoring alternatives.

Equipment used for installation of soil-cement walls typically includes a tall soil-mix wall boom rig for the in-situ soil mixing, a soil-mix wall batch plant for grout preparation, a crane for installation of the long ‘H’ piles, a back hoe, rubber tired loaders, and dump trucks.

Another alternative, a “slurry wall,” combines both shoring and permanent wall construction. This method involves excavating short sections of trenches in the ground where the wall is to be located, placing steel reinforcement cages into the trenches, and then filling them with concrete. In order to prevent the trenches from caving in before the concrete is poured, bentonite is placed in the trench. This heavy mud material has the ability to support the walls of the trench until the trench can be fully excavated and the concrete poured and cured. The bentonite mud is displaced by concrete during the concrete placing activity and can be reused. This method produces a concrete wall that can be used as the permanent wall. The drawbacks of this technique are high cost, slow production, and the potential for the wall to leak. Dewatering would be required during the excavation process.

Equipment used for the slurry wall method includes a crane with a specialized clamshell-type excavation bucket, a crane to lift reinforcing cages, a backhoe, dump trucks, bentonite mixers, storage tanks, and pipe network.

The earth excavated from the retained cut segments can either be used for embankment on-site (if found to be suitable for engineered fill material) or hauled to disposal sites. The equipment used to move the material can vary, but normally includes backhoes, bulldozers, front-end loaders, trucks, and possibly scrapers if an embankment is in near proximity, such as at Berryessa and Mabury roads. The water from the dewatering of the excavation area could require treatment, if contaminated. Prior to the disposal of the pumped water it may be necessary to have this water placed in either settling ponds, “Baker Tanks,” or some other equivalent water containment to allow suspended solids in the pumped water to settle out.

The configuration of the concrete permanent structure of the retained cut can vary. Generally a concrete ‘U’-wall structure would be constructed. This includes concrete retaining walls on both sides of the trench connected to a thick concrete base slab between them. There is a limitation in height for this type of structure, as the cantilever stresses increase as the height of the wall increases. For deep retained cuts requiring high cantilever walls, horizontal concrete struts across the top of the retained cut may be required for cost-effective design.

For deep retained cuts requiring high walls in areas of high groundwater, the ‘U’-wall structure will likely require special provisions to resist uplift caused by the buoyant forces of the groundwater (hydrostatic pressure). The base slab may need to be thickened to provide extra weight, or an outside toe on the cantilever walls may be required to engage the weight of soil above this toe, or piles may be needed 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.

Aerial Guideway Structure. Aerial structure construction would occur at the following locations for the BART Alternative:

- Mission Boulevard (Figure A-8, STA 66+00 to STA 68+50).
- East Warren Avenue (Figure A-8, STA 73+50 to STA 75+00).
- Kato Road (Figure A-11, STA 167+00 to STA 168+00).
- Dixon Landing Road for the BART Aerial and BART At-Grade options (Figures A-13 and A-15, STA 189+00 to STA 194+00).
- Berryessa Road and Upper Penitencia Creek (Figure A-25, STA 519+00 to STA 525+00).
- Mabury Road (Figures A-15 and A-29, STA 548+00 to STA 549+50).
- US 101 (Figure A-30, STA 568+00 to STA 572+00) with Railroad/28th Street Option.

Figure 4.19-5 and Figure 4.19-6 shows conceptual cross sections for BART aerial construction. Aerial structures are generally constructed in four stages. The first stage involves the installation of piles that will support the weight of the structure, called "dead load," and the weight of the trains or buses, called "live load." Piles would need to be driven by pile driving equipment, unless CIDH piles are possible. The pile cap, which joins all of the piles, is constructed of reinforced concrete and is approximately four to five feet thick.

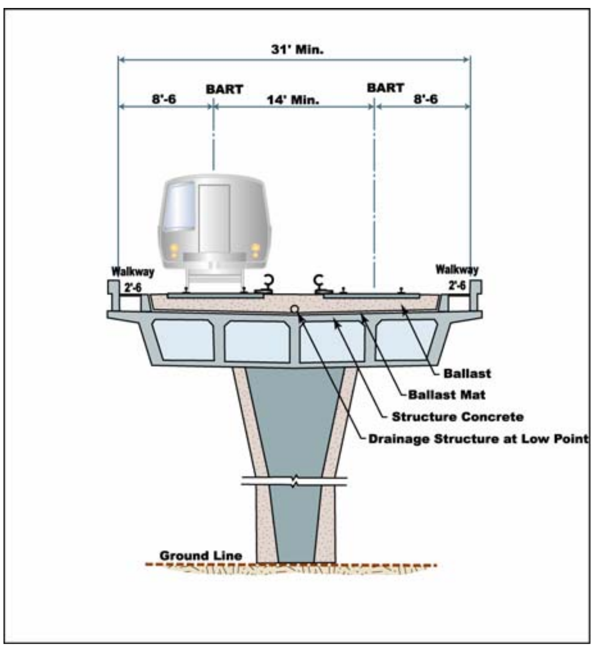


Figure 4.19-5: Conceptual Double Track

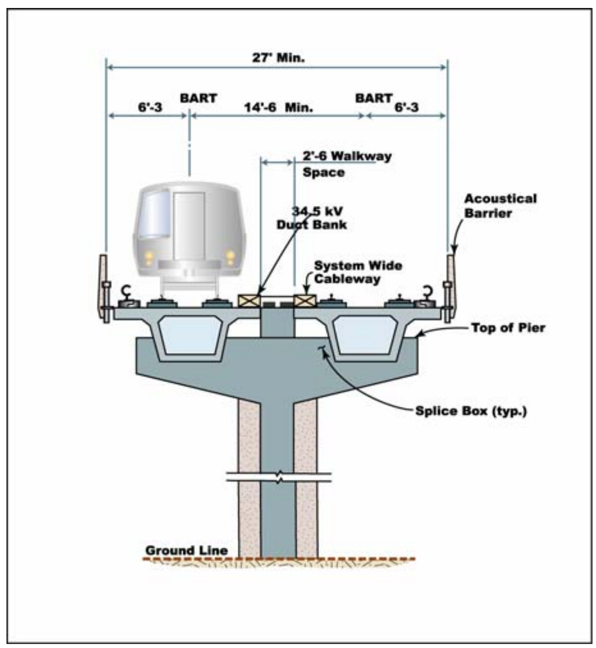


Figure 4.19-6: Conceptual Aerial Section

The third stage involves construction of the columns. Columns are constructed of reinforced concrete, which typically is poured inside a reusable steel form. The shape of the column can vary; however, a circular column approximately five feet in diameter is generally used. The fourth and final stage of construction involves the placement of the aerial girders. The placement of the aerial girders can begin after the column concrete has cured for a sufficient time, approximately 14 days.

Cast-in-place concrete bridges require erection of falsework to support the forms. Depending on the lengths of spans, falsework can be several feet deep. If the bridge is spanning a roadway, then the bridge must be designed with sufficient clearance, usually 16½ feet, or clearance might be temporarily reduced during construction. In the latter case, trucks and other vehicles may need to be detoured.

Alternative methods involve the use of steel or pre-cast concrete beams with a slab on top. The aerial girders generally consist of pre-cast concrete segments that are fabricated off-site and brought to the construction site by truck or train. The aerial girders are lifted into place by large cranes and secured to the columns. Erection of these girders over active roads generally needs to be done at night. Heavy cranes, generally rubber-tired, are used for erection of girders. Due to their size, special staging areas close to the site are usually needed to set up the cranes and temporarily store the girders.

Tunnel Guideway. The length of the subway section for the BART Alternative, with the Alum Rock Alignment Railroad/28th Street Option and the Diridon/Arena Station North Option, is 4.54 miles, of which 1.17 miles would be cut-and-cover construction and 3.37 miles would be bored tunnel. The twin-bore tunnel would begin south of the Alum Rock Station near 28th and Saint John streets, proceed westwards through downtown San Jose under East Santa Clara Street, and re-emerge near I-880 and Newhall Street near the Caltrain tracks. The US 101/Diagonal Option (including the Diridon/Arena Station North Option), is 4.83 miles of which 1.18 miles would be cut-and-cover construction and 3.65 miles would be bored tunnel. Including the Diridon/Arena Station South Option in either alignment option would lengthen the bored tunnel by 0.07 miles (354 feet).

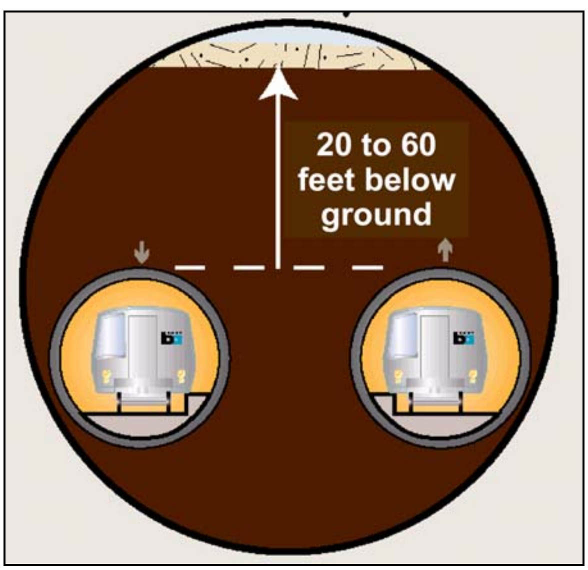


Figure 4.19-7: Conceptual Cross Section for the BART Alternative Tunnel

Two circular tunnels would be located approximately 20 to 60 feet bgs to the top of the tunnel (Figure 4.19-7). Under structures, the top of tunnel would generally be 40 feet bgs. However, localized areas with a reduced depth of cover will occur as the alignment transitions from bored tunnels into cut-and-cover and at-grade structures, where the tunnel passes beneath localized topographic features, and where soil conditions allow a shallower depth.

The twin tunnels would have a finished internal diameter of about 17.5 feet, or an excavated diameter of about 19 feet, with cross passages between the two tunnels every 650 to 800 feet. Center-to-center tunnel spacing typically would be 40 feet, providing a pillar width between tunnels of about one tunnel diameter, which is generally sufficient for 28- to 32-foot-wide island-platform stations. To allow for driving tolerances, provision for ground treatment, and final adjustments of the alignment, an easement width of at least 80 feet is assumed.

In an effort to minimize construction impacts on business and residential communities, VTA decided that tunnels in the downtown area should be constructed by tunneling rather than cut-and-cover techniques. Another important reason for use of tunneling are the wide-looped 90-degree turns south of the Alum Rock Station and west of the Diridon/Arena Station. These turns depart from street ROW and proceed beneath industrial and residential developments, and use of cut-and-cover construction in these areas would be extremely disruptive.

Ground conditions in this area consist of soft interbedded alluvial soils with a shallow groundwater table. Tunnels driven with pressurized-face TBMs are believed to be the most appropriate and cost-effective method for constructing the single-track twin tunnels under these geologic conditions. Bored tunneling in the anticipated ground conditions would require a fully shielded, pressurized-face TBM that keeps out the groundwater and stabilizes the tunnel face. The Earth Pressure Balance (EPB) machine is considered to be the most appropriate tunneling machine and method given the significant amount of unstable sand and groundwater expected to be encountered within the tunneling envelope.

EPB machines have a full-face rotating excavator (cutter head) and a pressurized muck chamber to support the tunnel face (Figures 4.19-8 and 4.19-9). The chamber is filled with soils excavated from the tunnel face, which, ideally, are mixed into a toothpaste-like plasticized muck. The muck is pressurized by forward-jacking the TBM, while a screw conveyor removes the excess material from the chamber for further transport by conveyor belts and/or muck cars.

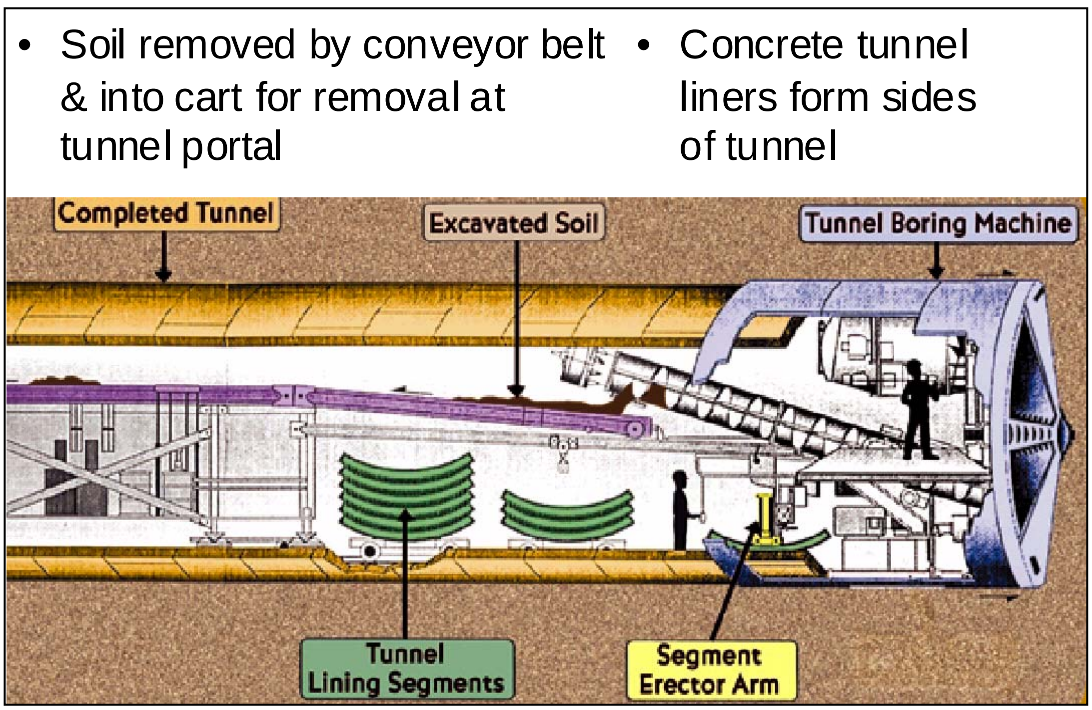


Figure 4.19-8: Earth Pressure Balance Tunnel-Boring Machine

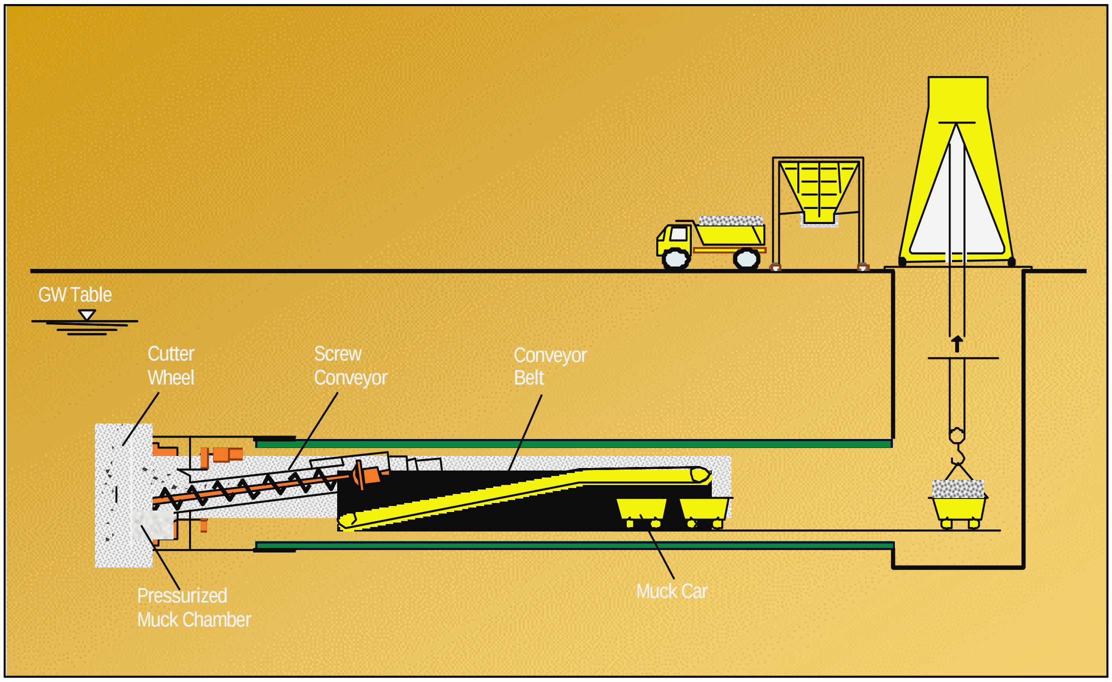


Figure 4.19-9: Muck Removal

During the Preliminary Engineering phase of the project, VTA will perform extensive geological investigations to confirm that the proposed TBM operation will be the most cost-effective technique with the lowest construction impact. It is anticipated that VTA will take soil borings at approximately 50- to 100-foot intervals along the tunnel centerline. Based on the results of this investigation, VTA will either confirm that the EBP machine is the preferred method of tunneling or select an alternative method. If an alternative method is selected, a supplemental environmental document may need to be prepared.

Newly developed state-of-the-art polymer foams are able to plasticize even coarse sands and gravels. Given the sand and gravel lenses expected to be encountered in some sections of the central San Jose BART tunnel alignment, foam addition would be an important requirement. By maintaining the chamber pressure close to the 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.

During the design phase of the BART Alternative, the surface structures near the tunnel alignment (roadways, buildings, underground utilities, etc.) will be surveyed to establish baseline data. This information will be included in the Building Data Survey (see Section 4.19.2.1). Allowable settlements above the tunnel will also be determined. A settlement-monitoring program will be employed and the settlement above the tunnel will be monitored continuously. If the actual settlement approaches the safe allowable settlement threshold, the tunnel operation will be stopped and corrective action will be taken, such as injection of grout in front of the cutting head or increasing the pressure at the tunnel face.

During tunneling, watertight segmental-lining rings are erected in the tail shield of the EPB machine, and the ring between the lining and ground is grouted as the shield is jacked forward. The lining consists of pre-cast concrete segments, manufactured to tight tolerances and fitted with synthetic rubber gaskets, which are bolted together during tunnel erection. Modern gaskets are usually hydrophilic rubber that swells up to ten times its initial volume as it absorbs water. Such a lining is a one-pass system, requiring no additional permanent lining. This minimizes the excavated tunnel diameter and saves construction time that would otherwise be needed for a separate lining operation.

Muck is transported into the main tunnel chamber by a screw conveyor as the cutter wheel rotates and channels the cuttings into the screw conveyors receiving hopper. The muck is then transferred onto a belt conveyor, which in turns discharges the muck into muck hoppers resting on small rail cars, which are part of the muck train.

Muck trains typically are made up of six cars pushed by a diesel locomotive. The last four cars hold the muck skips and the two cars nearest the face are used to carry pre-cast concrete tunnel liners to the tunnel face. These are off-loaded by a small crane and then placed into position as the TBM is jacked forward.

After filling the muck cars, the train proceeds to a muck removal shaft. Cranes lift the skips from the train and empty them into a hopper. Empty skips are then placed on the last four cars. A new supply of pre-cast concrete tunnel liner segments, enough for one circumferential ring, are placed on two train cars nearest the tunnel face. The train then proceeds back to the tunnel face and the cycle repeats itself (Figure 4.19-9).

Ventilation structures will be needed at locations along the tunnel, generally at each end of a station and extending to the surface (see cut-and-cover stations section below).

Cut-and-Cover Subway. This type of construction is required for the shallow subway at the ends of the tunnel sections in San Jose and at other locations where the alignment is in retained cut and passes under existing streets. These locations are:

- In the vicinity of Marburg Way and Las Plumas Avenue with the US 101/Diagonal Option (Figure A-26, STA 568+00 to STA 574+00).
- Both sides of East Julian Street with the Railroad/28th Street Option (Figure A-30, STA 590+00 to STA 596+00).
- Both sides of the I-880 freeway (Figure A-41, STA 811+50 to STA 823+00).

Cut-and-cover subway construction would also be required for the four underground stations in central San Jose and for the section just west of the Civic Plaza Station, or alternatively, west of the Market Street Station, where track crossovers are required. The following section discusses these stations and the crossover.

Cut-and-Cover Stations. The cut-and-cover method would be used for underground station and portal construction.

It is assumed that the following stations would be constructed as cut-and-cover stations (Figure 4.19-10):

- Alum Rock Station (Figures A-26 and 27, STA 598+00 to 607+00 for the US 101/Diagonal Option or Figures A-30 and 31, STA 597+00 to 605+00 for the Railroad/28th Street Option).
- Civic Plaza/SJSU Station (Figure A-33, STA 677+00 to 687+00).
- Market Street Station (Figures A-34, A-35, and A38, STA 699+00 to STA 709+00).
- Diridon/Arena Station (Figure A-36, STA 743+00 to 741+00 for the North Option or Figure A-39, STA 732+00 to 741+00 for the South Option).

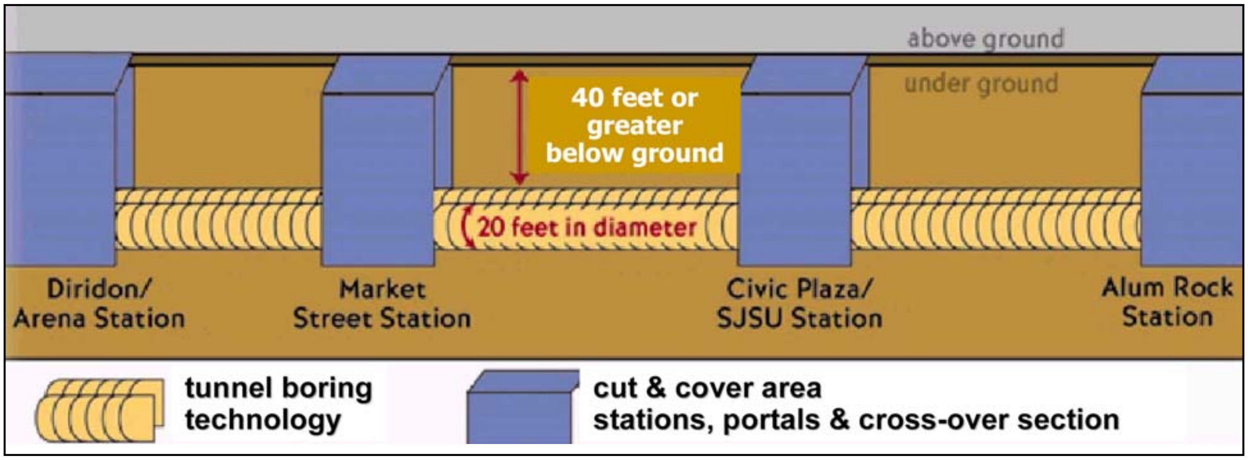


Figure 4.19-10: Cut-and-Cover Stations

Under MOS-1E, the cut-and-cover construction of the Civic Plaza/SJSU Station would still take place. Only the station finishings would be deferred to MOS-2E.[4]

Cut-and-cover construction involves construction from the street or ground level down with the subsequent covering of the opening to allow activity to resume on the street level. The first step involves the relocation of some utilities so that they will not interfere with station construction (see Section 4.19.2.6).

Holes are then bored on the boundaries of the construction, i.e., edges of the station or crossover box structures (Figure 4.19.11). Each hole is filled with concrete along with large steel beams in completed wall panels to create outside protective watertight walls for construction and to support the cover or deck. Two lanes of traffic on Santa Clara Street would remain open – one in each direction – and two lanes would be closed on the side of the construction.

When a sufficient number of deck beams have been installed, a shallow excavation approximately 8 to 12 feet deep between the deck beams is made. The excavation is designed to uncover buried utilities and to provide room for continuing the excavation after the temporary decking is erected (see Figure 4.19-12 and Section 4.19.2.6).

As roadway deck beams are installed, utilities that can remain in the trench area (e.g., telephone, electric, water, and sewers) would be cradled, picked up, and hung from the deck beams. Sewer lines may exist at this shallow depth and likewise would be hung from the deck beams during this initial excavation stage. Utilities located deeper would be uncovered fully after additional depth of excavation had been accomplished.

[4] Finishings include such items as escalators, elevators, fare collection equipment, public address systems, telephones, signage, kiosks, station agent booths, benches, etc.

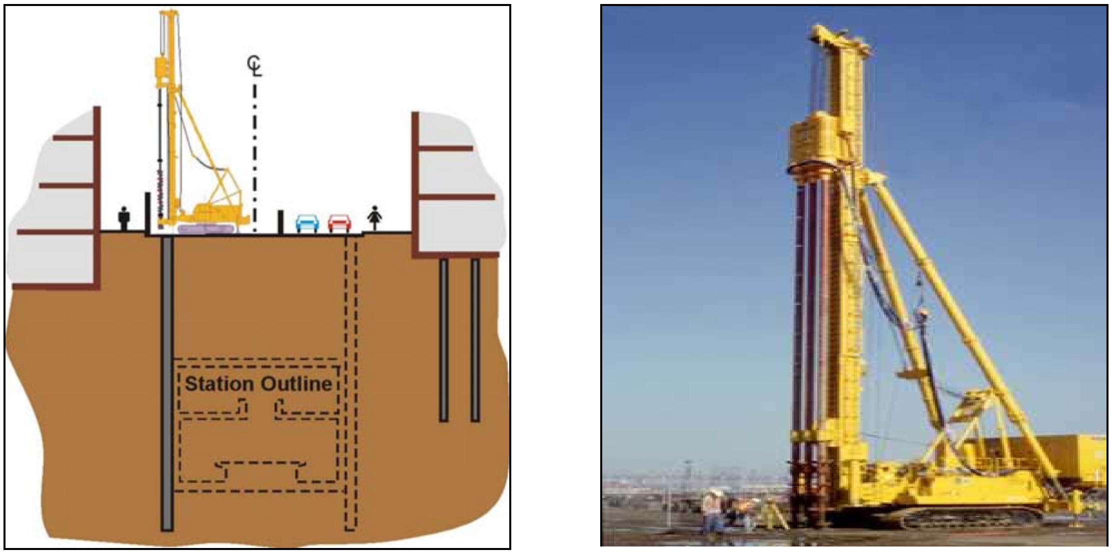


Figure 4.19-11: Construction of Outside Protective Walls

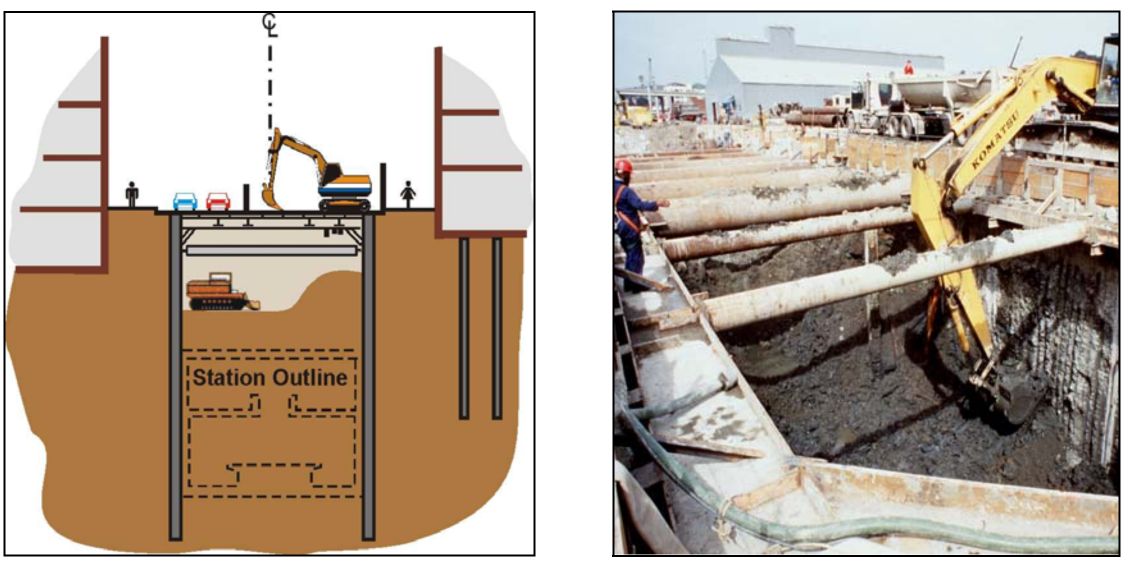


Figure 4.19-12: Shallow Excavation

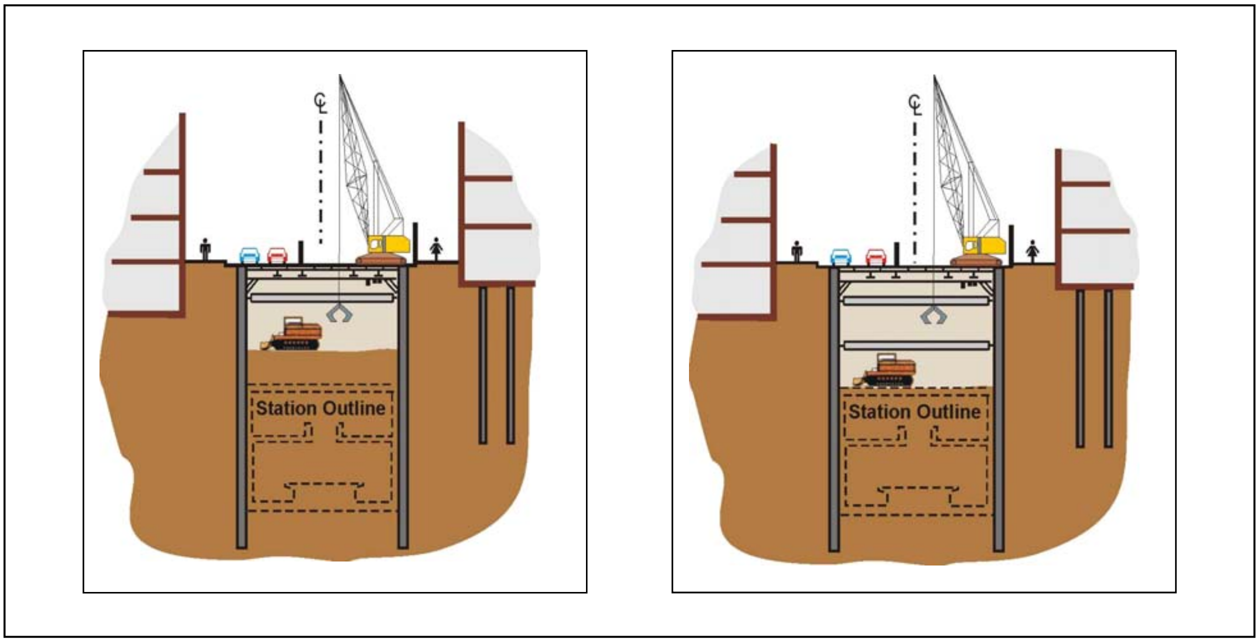


Figure 4.19-13: Station Construction Below Deck

Sometimes heavy utilities such as large sewer pipes must be supported by an auxiliary set of beams spanning between the sidewalls rather than hanging them from the deck beams. When utilities cannot be relocated outside the excavation or when they are being moved, there is a small chance of damage during excavation, causing a utility outage that can last for a few minutes to a few days. Most of the risk of hitting utilities is caused by actual utility locations being different from those shown on the construction drawings. Utility service will be restored as quickly as possible after an outage.

Station construction would then continue from on top of and under the support deck (see Figure 4.19-13). The most economical and least time-consuming condition for cut-and-cover construction is one that permits the contractor to use equipment operating at street level. Auger drills and bucket excavators are employed for the installation of excavation support systems. Clamshell buckets are used for excavation, and high capacity trucks carry the material away for disposal. Flat bed carriers transport reinforcing steel to the work site. Truck mounted cranes would lower rebar down into the open trench. Ready-mix trucks would bring concrete to the job and dump either by chutes or concrete pumps to the concreting locations. Cranes are required for the lowering and lifting of other construction materials into the station excavation. Excavation from above would require that two lanes of traffic be closed on Santa Clara Street during this period. Two travel lanes would remain open – one in each direction – past the construction site.

Walls of the excavation would be supported with internal steep pipe struts as excavation proceeds. Decking at cross-streets would be installed in stages to allow at least half of the existing traffic lanes to be maintained. After deck installation, full cross-street traffic would be maintained for the duration of construction. Equipment typically used for decking, excavation, and bracing includes: crawler dozer/loader, rubber-tired loader/bob cat, pavement breaker, excavator/backhoe, conveyer system, truck, crane, generator/compressor, water pump, and forklift.

Excavation and installation of the support system would continue, until the station is deep enough for the installation of the base slab for the box structure (Figure 4.19-14).

Permanent sidewalls are then installed for the ultimate installation of the station roof (Figure 4.19-15). After the station structure has been completed and the roof slab is allowed to cure for a specified period, backfilling can begin. During backfilling operations, utilities are restored to their permanent locations (e.g., gas mains and water mains are brought back from their temporary locations). New sewer man holes and cable/duct vaults are usually built to replace the old ones, either because the old ones are in poor condition or the locations of these structures within the station area have been changed for the restoration layout of the utilities.

After the backfill has been completed on one side of the street, the permanent street is installed to accommodate the two lanes of traffic and traffic then shifts to the paved side of the street so the contractor can complete the remaining backfilling and utility restoration work and can restore the remainder of the street pavement.

With the restoration of utilities, roadway pavement, and vehicular traffic, the surface work on the structure is completed and continuing activity involving station finishes and equipment installations can continue beneath the surface with little, if any, disruption to street use by vehicles and pedestrians.

There are two possibilities for the tunnel interface with station boxes. First is to tunnel through the station area and then dismantle the tunnel segment liners located within the station area during excavation of the station. These liners could not be re-used and would have to be thrown away at considerable costs. For this approach, the station end walls would need to be built first in order to maintain a watertight seal between the tunnel and the station box, and then the TBM would bore through these walls before station excavation takes place.

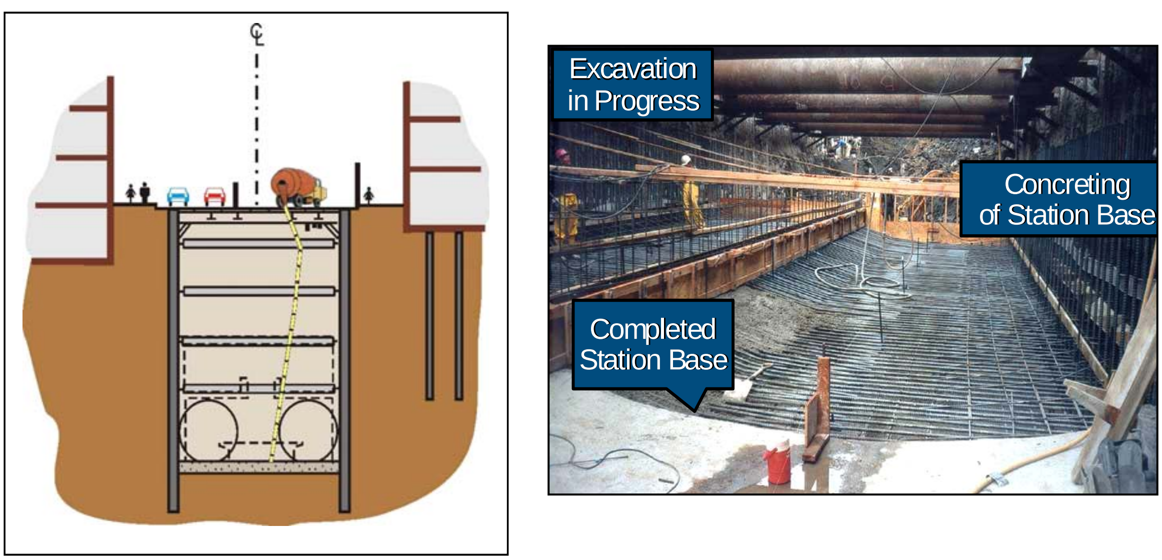


Figure 4.19-14: Installation of Base Slab

Figure 4.19-15: Installation of Station Roof

The second approach is to first build the station box and then excavate to below the level of the bottom slab. A ground layer of concrete would then be poured to seal off the bottom of the station box from water, and the TBM would bore through the end walls. Once the TBM emerges through the station end wall, it would be dragged through the station to the other end, and tunneling would start again, proceeding to the next station. This approach could save costs but would require that the station be constructed ahead of time. The decision on which technique should be used will depend on a number of factors, including schedule and cost implications. For both scenarios, special care is needed to minimize groundwater leakage around the TBM as it emerges through the end of the station. Jet grouting would be used for several feet approaching the box, with the TBM moving through the jet-grouted soil.

Even after the TBM is bored or dragged through a station box, station structural concrete work cannot proceed until the tunneling operation in that station is finished, i.e., as long as tunnel muck and supply trains are still moving through the station box, station concrete work is restricted. Once tunneling operations are moved to another location and muck and supply trains are no longer passing through the station, station structural work can proceed.

For the central San Jose subway, construction would be visible only where cut-and-cover construction is used. Because cut-and-cover construction has a major street level element, VTA would focus on minimizing impacts such as mud and noise, interruption of traffic, and maintenance of auto and pedestrian access at key locations. Construction work would be staged so that inconvenience to traffic, delivery trucks, emergency vehicles, pedestrians, and businesses is minimized to the extent possible.

Tunnel Vent Fan Plants/Shafts. These proposed locations are provided in Section 3.4.6.1, *Alternatives/BART Alternative Ancillary Facilities*. The at-grade portions of the vent structures consist of buildings that house the fans. Aboveground construction would be similar to an industrial building, while the shafts would be constructed using cut-and-cover construction techniques described above.

Depressed Station. The Montague/Capitol Station (Figure A-20, STA 373+00 to 380+00) would be a depressed station and would be constructed in a manner similar to the retained cut BART guideway. A mezzanine and other ancillary facilities (e.g., elevated pedestrian walkway to the elevated light rail platform near the station) would then be constructed.

Aerial and At-Grade Stations. Construction of the proposed aerial station at Berryessa (Figure A-25, STA 525+00 to STA 533+00) would involve construction techniques similar to those for aerial guideways. Columns and foundations would be constructed to support the platform. The station platform would typically be constructed of cast-in-place concrete with falsework. Essentially, forms would be erected, reinforcing steel would be put in place, and concrete would be poured into the forms to construct the columns and the platform slab. Ancillary facilities would be added (escalators, stairs, elevators, fare equipment, etc.) to form the station.

Construction of the at-grade South Calaveras Future Station (Figure A-18, STA 289+00 to 296+00) and the Santa Clara Station (Figure A-44, STA 878) would involve pouring the concrete footings and slabs to form the surface station. The elevated mezzanine would be constructed in a manner similar to that described above for the aerial Berryessa Station.

Facility Footprints. The maximum acreage that would be disturbed for construction of each proposed station and the proposed Maintenance Facility is shown in Table 4.19-1. As shown, building demolition would be required for most station options. The property required for the stations and Maintenance Facility will still be purchased during the first phase of the MOS scenarios (MOS-1E or MOS-1F). However, building demolition could be deferred at the Berryessa Station under MOS-1E.

Table 4.19-1: Maximum Acreage Required for Station And Maintenance Facility Construction

Station	Option	Permanent Project Facilities	Potential Future Transit Facilities	Buildings Demolished
		(approximate acreage)		
Future South Calaveras	• Parking Structure North	13	9	Yes
	• Parking Structure North with Parallel Bus Transit Center	12	9	
	• Parking Structure South	17	5	
Montague/Capitol	• All options	15	6	Yes
Berryessa	• Southwest Parking Structure[1]	17	19	No
	• Northeast Parking Structure[1]	19	15	Yes
Alum Rock	• US 101/Diagonal	8	9	Yes
	• Railroad/28th Street	9	9	Yes
Civic Plaza/SJSU	• Station + all entrances	0	2	Yes
Market	• Station + all entrances	1	1	Yes
Diridon/Arena	• North station + all entrances	7	4	No
	• South station + all entrances	7	4	Yes
Santa Clara Station	• North Option	7	15	Yes
	• South Option	6	16	Yes
BART Maintenance Facility		50	9	Yes
Estimated Total Acreage (Maximum)		**125**	**66**	

[1] Nine acres of riparian setback would also be acquired.

Source: Earth Tech, Inc., 2002.

Building Demolition. The BART Alternative alignment and stations have been selected to minimize, to the extent possible, impacts on adjoining buildings and on the communities within which BART would be constructed and operated. Still, for some stations, parking lots and structures, and the Maintenance Facility properties would be acquired with existing buildings and these structures would need to be demolished. Building demolitions would not be required in areas over the subsurface tunnels. Equipment typically involved in building demolition includes: crawler cranes, crawler dozer/loaders, pavement breakers, rubber-tired loader/bob cats, trucks, excavator/backhoes, generator/compressors, and water trucks for dust control. As mentioned previously, building demolition could be deferred at the Berryessa Station under MOS-1E.

Other Structures/Facilities. In addition to the transit guideways and stations, other types of structures and facilities would be constructed for the BART Alternative including:

- **BART Maintenance Facility** (as described in Section 3.4.6.1, *Alternatives/BART Alternative Ancillary Facilities*). (VTA and other bus operators are expected to have sufficient bus maintenance facilities for the Baseline Alternative.) Construction of this facility would involve: (1) track and ballast removal and building demolition (using dozers and end-loaders, cranes and wrecking balls, forklifts, and heavy trucks to haul the materials away, (2) utility relocation using back hoes and dozers, jack hammers, forklifts, and trucks (see Section 4.19.2.6), (3) site preparation using graders and compactors, (4) BART track construction (see section on BART at-grade guideway), and (5) building construction, using equipment common to construction of heavy industrial and office buildings.

  The MOS scenarios reduce the capacity of the BART Maintenance Facility compared with the full-build BART Alternative. This would involve deferring up to approximately 5,900 feet of storage track, as well as some building areas and shop equipment. Phase one of the MOS scenarios construction would involve grading of the entire Maintenance Facility, placing ballast to accommodate future storage track, and designating future building footprints to enable expansion of the facilities in the second phase of construction.

- **Electrical and train control equipment for the BART system, including substations and bulk substation/switching stations** (as described in Section 3.4.6.1, *Alternatives/BART Alternative Ancillary Facilities*). Construction of the substations and bulk substation/switching station would include placement of large electrical and electronic equipment on a concrete pad within an enclosed building or within a constructed subsurface station box. Graders, bobcats, forklifts, cranes, concrete and materials/equipment trucks would be used for the at-grade and subsurface installations. Construction of electrical feeder lines to the substations/switching stations would require augers, cranes, back hoes, and concrete and materials trucks.

4.19.2.4 Haul Routes

Baseline Alternative

The Baseline Alternative's three new busway connectors would involve the use of a substantial number of trucks and other equipment for site preparation, the hauling of materials, and the construction of the retaining walls and aerial structures. However, all three busway connectors are near existing freeways that provide direct access to the regional transportation system. Access routes to the I-680 to BART Warm Springs Station Aerial Busway Connector and BART Warm Springs Station to I-880 Aerial Busway Connector construction sites would be either be from: 1) South Grimmer Boulevard to Osgood Road to Durham to I-680 if heading east or 2) South Grimmer Boulevard to Fremont Boulevard to I-880 if heading north, south, or west. The haul route for the I-880 to Montague Expressway Aerial Busway Connector would be at the adjacent Montague Expressway and I-880 interchange.

BART Alternative

The BART Alternative would require removal of approximately two million cubic yards of material excavated for subgrade preparation, retained cuts, cut-and-cover subway, and tunnel construction. Some of this material may be used in the retained fills and over the cut and cover structures depending on its suitability. However, there would still be a large excess of excavated material that would need to be hauled away from the project area. Excavated material would be loaded into trucks and transported along major streets to the nearest freeway. Actual volumes of material and specific routes would depend on a number of factors, including the construction contract limits and individual contractors' choices. Restrictions on haul routes can be incorporated into construction specifications.

The contractor will employ best management practices when removing excess soil from the project site such as drying out the soil prior to loading the trucks, covering the soil with tarps in loaded trucks, etc. Some of the soil will be stockpiled within the project limits so that it is available to use in retained fill structures or backfill cut and cover structures. Excess soil will be hauled to an offsite location where it may be available for other projects requiring fill material.

An estimate has been made of the total amount of material to be hauled from the project site. In addition, the locations of the excavations have been analyzed with respect to major streets leading to freeway interchanges. Based on this analysis, a preliminary estimate of the number of trucks by haul road has been made. The following paragraphs describe the basis of the estimate, which is shown in Table 4.19-2.

Material excavated for subgrade preparation in the at-grade and retained fill segments and for the retained cuts would normally be hauled along the ROW until the nearest major cross street and then proceed to the nearest freeway, as indicated in Table 4.19-2.

Table 4.19-2: Estimated Haul Road Volumes and Numbers of Trucks [1]

Haul Road	Haul Volume, Cubic Yards [2]	Estimated Number of Trucks [3]
East Warren Avenue using I-880 or I-680 via Mission Boulevard	60,200	3,010
Kato Road using I-880 or I-680	9,400	470
Dixon Landing Road using I-880	118,300	5,915
Montague Expressway using I-880 or I-680	160,700	8,035
Hostetter Road using I-880 or I-680	136,900	6,845
Berryessa Road using US 101	20,700	1,035
East Julian Street/McKee Road to US 101	455,236	22,341
3rd and 4th streets	258,513	12,925
3rd/4th streets/Notre Dame Street/St. James Street	135,019	6,751
Autumn Street/Montgomery Street to I-280	152,203	7,610
Hedding Street/Coleman Avenue to I-880	404,521	20,226
Totals	**1,911,692**	**95,163**

Notes:

[1] Assumes tunneling from both tunnel portals for tunnel portion of alignment.

[2] Includes swell factors of 30 percent for tunnel and 15 percent for all other excavation. Volumes shown are calculated for the Railroad/28th Street Option. Volumes shown for the US 101/Diagonal Option (tunnel under US 101) would be 10 to 15 percent higher (tunnel only).

[3] Based on 20 cubic yards per truck.

Source: Earth Tech, Inc., 2003.

The soil excavated by TBMs would be brought to the surface at construction access points and loaded into trucks to be hauled away. Excavated material that is wet would be stored at the construction site to dry out for several days in advance of transport. Construction access and soil excavation locations would be at the tunnel portals and at stations where cut-and-cover construction is being performed (see Section 4.19.2.9).

Several scenarios are under consideration for use of the tunneling equipment. One scenario would involve two TBMs running parallel to each other from the east portal to the west portal (Figure 4.19-16). Excavated material would be hauled from the east portal site. A second scenario would involve three TBMs (Figure 4.19-17). For this scenario, tunneling would proceed from each portal in opposite directions toward the Diridon/Arena Station. TBMs would be removed from the open cut at the station. Material would be hauled from both the east and the west portal areas.

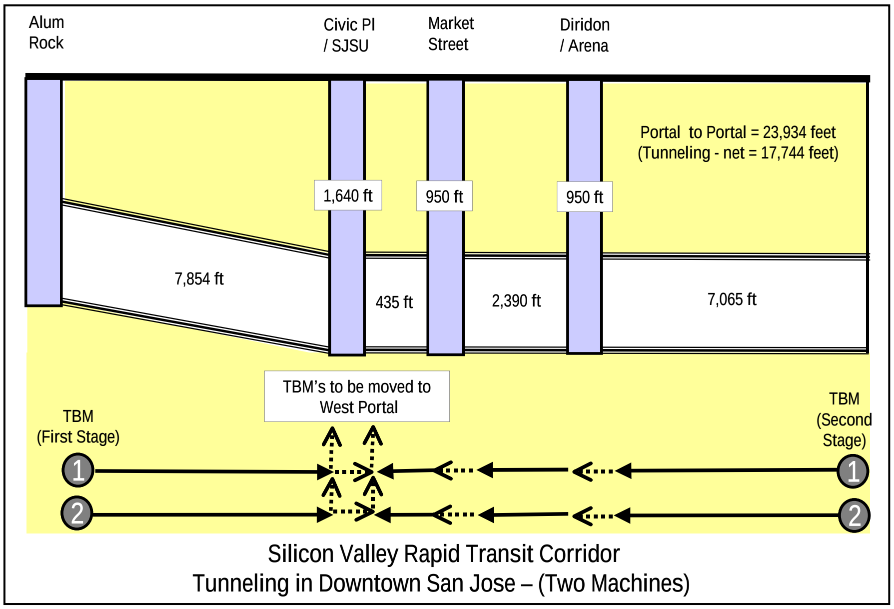


Figure 4.19-16: Tunneling Two Directions (Two TBMs)

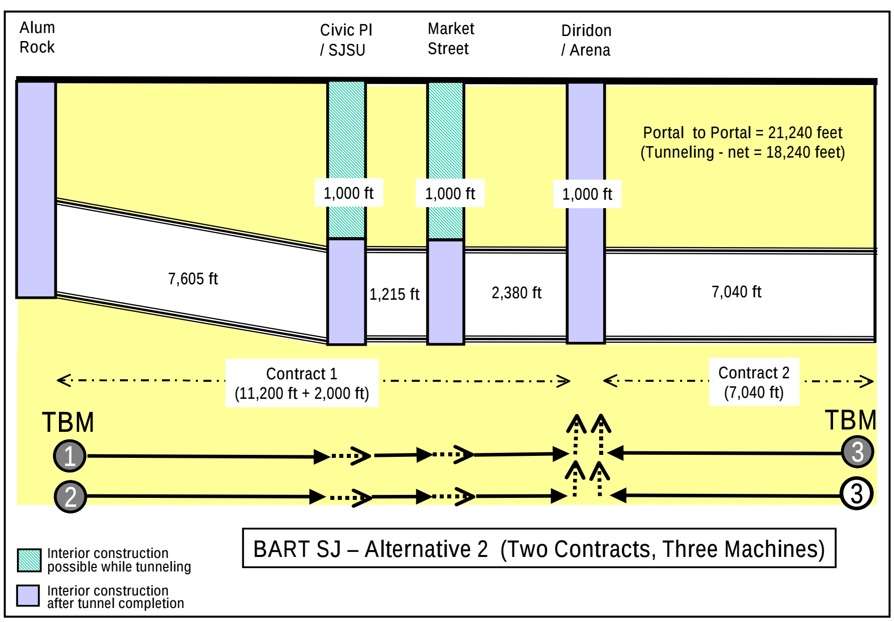


Figure 4.19-17: Tunneling Two Directions (Three TBMs)

A likely scenario would involve two TBMs starting at the east portal and tunneling westward to the Civic Plaza/SJSU Station. The TBMs would then be removed, restaged to the I-880 west portal, and then tunnel south and east to the Market Street Station and crossover. Additional analysis of the most cost-effective tunneling approach will occur during Final Design.

All excavated material would be hauled away from the construction sites and cut-and-cover station areas along the most direct routes to the nearest freeways. Haul trucks from the east portal would use the East Julian Street/McKee Road entrance on US 101. Trucks from the west portal would use the Coleman Avenue entrance to I-880. Estimated tunnel excavation volumes shown in Table 4.19-2 are calculated for the Railroad/28th Street Option. Volumes for the US 101/Diagonal Option (tunnel under US 101) would be 10 to 15 percent more.

Trucks hauling excavated materials (muck) from the three cut-and-cover stations in downtown San Jose would most likely use the following designated truck haul routes:

- Civic/Plaza/SJSU Station – Truck traffic could use two truck haul routes, the 10th/11th Street and the 3rd/4th Street couplets to/from I-280 a few blocks to the south. See Figures 4.19-36 and 4.19-37.
- Market Street Station – Truck traffic could use two haul truck routes, the 3rd/4th Street couplet to/from I-280 a few blocks to the south, and West Santa Clara, Notre Dame, and St. James streets to/from SR 87 a few blocks to the west and north. See Figure 4.19-37 and Figure 4.19-38.
- Diridon/Arena Station – Truck traffic could use two truck haul routes, the Autumn/Montgomery Street couplet to/from I-280 a few blocks to the south, and West Santa Clara, Notre Dame, and St. James streets to/from SR 87 a few blocks to the east and north. See Figure 4.19-38.

Trucks hauling excavated material from the Alum Rock Station site would use 28th Street and East Julian Street/McKee Road to/from US 101.

4.19.2.5 Utility Relocations

<u>Baseline Alternative</u>

The only major construction activities for the Baseline Alternative are the busway connectors, which are located primarily in the medians of I-680 and I-880 or on retained fill. While no major utility relocations have been identified to date, short segments of South Grimmer and Fremont boulevards may include utilities that connect to adjacent properties. If utilities are present in these locations, they may need to be relocated.

<u>BART Alternative</u>

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

As discussed in the cut-and-cover station construction section, utilities within the subsurface construction area that do not need to be relocated, either permanently or temporarily, would be uncovered during the early stages of excavation. These buried utilities, with the possible exception of sewers, are generally found within ten 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. Section 4.16, *Utilities*, Table 4.16-1 shows the utilities that are known to exist within the BART Alternative alignment.

4.19.2.6 Railroad Relocation/Locomotive Wye

BART Alternative

Railroad relocation consists either of shifting existing tracks or constructing new tracks to replace existing tracks that need to be removed for the BART guideway construction. This work would normally be performed by the UPRR before construction of the BART Alternative. In some cases, however, the work would need to be done concurrently.

Track construction would begin by preparing subgrade and drainage ditches. This work would be performed by earth moving equipment such as bulldozers, graders, loaders, and compacting equipment. The top layer of soil would be loaded into trucks and hauled off-site. Track construction would be performed by a combination of earth moving and specialized track equipment. Subballast would be laid down and compacted with standard railroad construction equipment. Ballast would be delivered via rail cars or truck, dumped in place, and compacted with rail-mounted tampers. Ties would similarly be delivered by rail and placed with special equipment. Rails would be shop-welded into long strings of about one-quarter mile and delivered by railcars. The strings would be field-welded together by special truck-mounted welding machines.

The existing locomotive wye is in a location near Montague Expressway that is incompatible with the BART Alternative. A new wye would be constructed in one of two alternative locations. Section 3.4.6.3, *Alternatives/Associated Railroad Improvements*, describes the relocated railroad wye options.

- Most of the railroad track relocation would occur in UPRR ROW, generally adjacent to the proposed BART Alternative corridor. A few locations would require construction on new ROW or adjacent to existing streets. These locations are:
  - The replacement locomotive wye, either in Fremont or Milpitas.
  - South of Abel Street.
  - On the east edge of the Great Mall Drive.
  - Along Piper Drive, just north of Montague Expressway.

Temporary traffic barriers may be needed at appropriate locations where construction is close to traffic lanes. Temporary track relocations, known as “shoo-flys,” would be needed for the construction of UPRR grade separation structures. These locations are:

- Kato Road.
- Dixon Landing Road with BART At-Grade Option (road underpass).
- Industry lead track to properties east of Piper Drive. This shoo-fly would be needed to maintain freight service across the BART alignment in retained cut. This work would need to be staged in conjunction with the BART guideway construction.
- Underpass carrying BART tracks under UPRR tracks in Santa Clara in the vicinity of De La Cruz Boulevard. Temporary construction and easements from adjacent property may be required for this shoo-fly.

Temporary shoo-fly track construction would be essentially the same as new track. Bolted rail may be used instead of continuously welded rail.

4.19.2.7 Grade Separation and Station Construction Street and Lane Closures

Baseline Alternative

For the Baseline Alternative, construction of the aerial busway connector from I-680 west to the proposed BART Warm Springs Station would involve the widening of I-680 north of South Grimmer Road with short-term (night-time) closure of one or two I-680 lanes in this area during construction.

Construction of the aerial busway from the proposed BART Warm Springs Station west and south to I-880 would cross an active UPRR railroad. It is assumed that construction of the aerial busway would result in minimal or no loss of freight rail movements. This guideway would also pass over Old Warm Springs Boulevard, and South Grimmer and Kato roads. It is assumed that the guideway and roadways would be jointly designed with possible minor relocations of Grimmer and Kato roads to minimize disruption to the traffic-carrying capacity of these roads and to minimize the length and costs of the aerial guideway. Construction of this guideway would involve the widening of I-880 south of Fremont Boulevard with short-term (night-time) closure of one or two I-880 lanes in this area during construction.

BART Alternative

Roadway Crossings

The BART system would be grade separated (pass either over or under) at all roadway crossings. Grade separations would occur at the locations described below.

Mission Boulevard (SR 262). An aerial structure carrying BART over Mission Boulevard is proposed. The road currently has two lanes in each direction with a median and shoulders. Widening of this roadway is currently under design. The new road, which is expected to be in place before construction of the BART Alternative, would have six lanes plus outside shoulders and a 22-foot median. At the location of the BART overcrossing, there are ramps merging and diverging on either side of the roadway. The UPRR bridge immediately west of the proposed BART alignment would be a two-span structure with a center pier. The BART structure would have spans of approximately 100 and 110 feet. During construction of the BART overcrossing structure center pier and abutments, it is assumed that three lanes of traffic in each direction could be maintained by shifting the roadways, as appropriate. If the Mission Boulevard widening and the BART project were constructed at the same time, three lanes of traffic could still be maintained if the UPRR bridge is constructed first. If not, only two lanes of traffic could be maintained in each direction.

East Warren Avenue. This road currently crosses the existing freight railroad tracks at grade. For the Warren Avenue Underpass (BART At-Grade) Option, the BART tracks would cross over East Warren Avenue at grade. The option assumes that the City of Fremont would depress East Warren Avenue under both BART and the railroad track. For the Warren Avenue At-grade (BART Aerial) Option, the BART tracks would be elevated above East Warren Avenue, which would remain at grade.

East Warren Avenue currently has two lanes of traffic in each direction (approximately 35 feet wide from curb to curb) with a 20-foot wide median at the proposed BART crossing. For either option, BART would cross East Warren Avenue on a two-span structure either at grade or on an aerial structure. It is assumed that two lanes of traffic could be maintained in each direction on East Warren Avenue during construction of a center pier and two abutments, one on each side of the roadway. If the roadway were depressed by the City of Fremont before construction of the BART Alternative, the roadway width planned is essentially the same as the current width. Thus, it should still be possible to maintain two lanes of traffic in each direction during construction of the BART structure, whether the roadway remains at grade or is depressed.

Kato Road. An underpass (road passing under BART and the UPRR tracks to the west) is planned at this location. The road is proposed to be closed during construction of the roadway underpass under the proposed BART at-grade alignment and UPRR tracks. Closure is estimated to be between 1½ to 2 years. Dixon Landing Road would be used as the detour route.

Dixon Landing Road. Three optional configurations for grade separation are being considered at Dixon Landing Road. In addition, there are plans to expand the road to six lanes. The BART Aerial Option would leave the road at grade. BART would cross over the road on an elevated aerial structure. The BART Retained Cut Option would also leave the road at grade. BART would pass under the road in a cut-and-cover subway. If Dixon Landing Road was depressed as an underpass in a retained cut (similar to the design proposed for Kato Road), the BART At-grade Option could be implemented.

The road currently is four lanes wide, plus a median east of the railroad, and has been widened on the south side west of the railroad. For the BART Aerial Option, two lanes of traffic could be maintained in each direction for construction of the center pier and abutments. For the BART Retained Cut Option under Dixon Landing Road, two lanes of traffic in each direction could be maintained during construction of the BART trench, assuming that the roadway has been widened to three lanes in each direction east of the corridor. For this option, construction would need to occur in three stages.

For the BART At-Grade Option, a maximum of three lanes of traffic for both directions (one lane in one direction, two lanes in the other) could be maintained by constructing one-half of the roadway and the BART and UPRR bridges at the same time. Construction of the railroad bridge would first require development of a shoo-fly. Existing adjacent tracks may be used as a shoo-fly until the bridge is built.

The new railway bridge would have to be constructed before the roadway is lowered, using "top-down" techniques. With a center pier, the railroad bridge would be constructed in two stages. A maximum of three lanes for both directions of traffic would be maintained for construction of this railroad bridge. However, depending on the size and configuration of the center pier foundation and shoring requirements, it may only be possible to maintain one lane of traffic in each direction during some of the construction.

As an alternative, the road could be closed to traffic during construction of the underpass. There wouldn't be any need to construct temporary grade crossing warning devices, and no shoring would be needed the length of the roadway to build the road in two halves. Traffic could be detoured to Kato Road via Millmont Drive and Milpitas Boulevard for an estimated period of 1½ to 2 years.

Montague Expressway. The BART Alternative would pass under Montague Expressway in a retained cut. The roadway structure would be constructed as a short bridge spanning the BART trench. The road currently has three lanes in each direction plus a wide median east of the railroad. The road is being widened to eight lanes. By making use of the median area, three lanes of traffic could be maintained in each direction by constructing the BART trench in three stages. This assumes that the roadway will have been widened east of the railroad when BART construction occurs.

Capitol Avenue. The BART Alternative would pass under Capitol Avenue in a retained cut. The road recently experienced lane closures due to construction of the Tasman East aerial guideway LRT system. At times during off-peak traffic period, one lane of traffic was maintained in each direction during the LRT construction.

Overhead utility poles exist in the sidewalk about one foot from face of southwestern curb. Two lanes of traffic in each direction could be maintained for construction of the BART trench under Capitol Avenue in stages. Eastbound traffic could be shifted toward the LRT structure columns. For westbound traffic, it would be necessary to provide two single lanes for one stage of construction. One of the lanes would pass between the two rows of columns supporting the LRT structure; the other lane would be adjacent to the north columns.

Trade Zone Boulevard. The BART Alternative would pass under Trade Zone Boulevard in a retained cut. The road has two lanes in each direction with a planted median about 14 feet wide. One lane of traffic could be maintained in each direction during construction of the BART Alternative underpass in stages.

Hostetter Road. The BART Alternative would pass under Hostetter Road in a retained cut. The road has three lanes in each direction with a median. Two lanes of traffic could be maintained in each direction during construction of the BART underpass, assuming a three-stage construction approach.

Sierra Road and Lundy Avenue. Two lanes exist in each direction at the intersection of Sierra Road and Lundy Avenue, with dedicated left turn lanes in all quadrants. The BART Alternative would pass under the skewed intersection of these two roadways. Construction could be accomplished in three phases while maintaining two lanes of traffic in each direction, but without dedicated left turns. Sheet piles would need to be installed with temporary cover for the central 40 linear feet in Phase 1. Phase 2 would construct the southern portion conventionally and mine out the 40-foot central portion. Phase 3 would construct the northern portion conventionally for the completion.

Berryessa Road. Berryessa Road has three lanes eastbound, two lanes westbound and a wide median at its intersection with the BART Alternative alignment. The BART Alternative would pass over the road on an aerial structure. Two lanes of traffic could be maintained in each direction while constructing center and end piers of the proposed BART overcrossing. Sufficient room appears to exist for a pier on the south side between the roadway and Upper Penitencia Creek. If not, a long-span steel box girder could span from the center of the roadway to the south side of the creek; however, the depth of such a long span could raise the BART Alternative profile in this area.

Mabury Road. Mabury Road currently has two lanes of traffic in each direction, with a ten-foot median. The BART Alternative overcrossing structure with a center pier could be constructed while maintaining two lanes of traffic in each direction. Falsework would be utilized for the bridge construction.

US 101/Diagonal Option. This option would require tunneling under US 101. Construction techniques would need to be approved by Caltrans and FHWA before construction of the tunnel section.

Railroad/28th Street Option. This option would require a new BART bridge over US 101. Currently there is an existing single-track UPRR railroad bridge at this location crossing over US 101. This bridge was constructed in 1990 and could be utilized for the BART Alternative as the southbound track if it is determined that the bridge meets BART standards. A new BART single-track bridge would be constructed adjacent to and east of the existing bridge. The bridge would have an overall length of approximately 300 feet and would have two spans with a center pier. US 101 has four lanes in each direction with a 25-foot median and 10-foot outside shoulders. Initially the abutments would be constructed requiring the temporary elimination of the outside shoulders. Then the center pier would be constructed requiring the temporary elimination of the outside shoulders and the re-striping of the eight travel lanes around the center pier location leaving 49 feet for construction. The freeway would need to be closed two nights to erect the falsework over the lanes. The bridge deck would then be constructed while maintaining four lanes of traffic in each direction. Finally, a one-night freeway closure would be required to remove the falsework. Again, approvals would be required between VTA, Caltrans, and FHWA for temporary lane closures on US 101 during construction of this new bridge.

East Julian Street. For the Railroad/28th Street Option, the BART Alternative would be in a subway box under East Julian Street. The existing East Julian Street has a total width of 65 feet with two lanes of traffic in each direction and a 10-foot median. This median could be utilized during the cut-and-cover tunnel construction. The subway box could initially be constructed to the northern limit of East Julian Street. The four lanes could be temporarily shifted north into the 40-foot median and the remainder of the subway box would then be constructed. Finally, traffic would be reinstated to its original position.

De La Cruz Boulevard. The BART Alternative would pass under the existing De La Cruz Boulevard overcrossing structure and in a new structure under the UPRR tracks located just east of the boulevard. The existing boulevard structure consists of pre-cast concrete girders supported on piers generally oriented perpendicular to traffic lanes. The piers are supported by CIDH concrete pile foundations.

BART would be in a retained cut under the De La Cruz Boulevard overcrossing structure as it emerges from a cut-and-cover subway under the UPRR tracks. The BART alignment would pass under boulevard at a skew relative to the orientation of the piers. The BART tracks would be aligned so that the retained cut structure passes in the space between two piers. The construction may require some underpinning or reinforcement of the foundations at two end locations where BART is close to the piers. This work is not expected to impact traffic using De La Cruz Boulevard.

Station Construction

The following streets would be affected by construction of BART Alternative stations:

- 28th Street would need to be closed to traffic between East Julian Street and Five Wounds Lane during construction of the Alum Rock Station for both the US 101/Diagonal and the Railroad/28th Street Design options for the BART Alternative.
- Specific travel lanes of East Santa Clara Street and associated cross streets (1st, 5th, 6th, 7th, Market, San Pedro, and Almaden) would be closed to traffic for portions of the construction period of the Civic Plaza/SJSU and Market Street stations and the BART track crossover box east or west of the Market Street Station.
- Montgomery, Autumn, and Cahill streets between West Santa Clara and San Fernando streets would be closed during construction of the Diridon/Arena Station.

Individual station-area tracks used by freight trains, Caltrain, Amtrak, ACE, and Capitol Corridor trains would need to be closed to train traffic and rerouted to alternative tracks during construction of the Diridon/Arena Station for the South Option.

4.19.2.8 Construction Staging Sites

Baseline Alternative

For the Baseline Alternative, contractor work staging sites could include VTA's railroad ROW and/or a six-acre site south of East Warren Avenue east of the railroad corridor (Figure 4.19-18).

BART Alternative

Contractor work areas (or construction staging areas) would be needed for the aerial, surface, retained-cut, cut-and-cover, and tunnel construction segments. Given the level of construction activities anticipated, station areas would be, by definition, construction staging sites. Following are the proposed contractor work areas:

- Six acres south of East Warren Avenue east of the rail corridor (Figure 4.19-18).
- Two acres between Railroad Court and the rail corridor south of the Abel Street overcrossing (Figure 4.19-19).
- Four acres adjoining the rail corridor south of Calaveras Boulevard overcrossing – portion of site for South Calaveras Future Station site (Figure 4.19-19).
- Eighteen acres on either side of rail corridor south of Montague Expressway – portion of Montague/Capitol Station site (Figure 4.19-20).
- Seventeen acres on either side of rail corridor at Mabury Road – portion of Berryessa Station optional parking area (Figure 4.19-21).
- Nineteen acres to the west of US 101 and south of East Julian Street – Alum Rock Station area (Figure 4.19-22).
- Two plus acres on northeast quadrant of 4th and East Santa Clara streets – includes area for optional entrance locations for Civic Center/SJSU Station (Figure 4.19-23).
- 0.72 acres in the southwest and northeast quadrants of the East Santa Clara and Market Street intersection – optional entrance locations for Market Street Station (Figure 4.19-24).
- Five acres south of West Santa Clara Street on either side of Montgomery Street – includes optional entrance locations for Diridon/Arena Station (Figure 4.19-25).
- Thirteen acres on either side of I-880 east of the rail corridor – includes portion of BART rail alignment and tunnel portal (Figure 4.19-26).
- Nine acres on east side of rail corridor north of Brokaw Road (Figure 4.19-27).

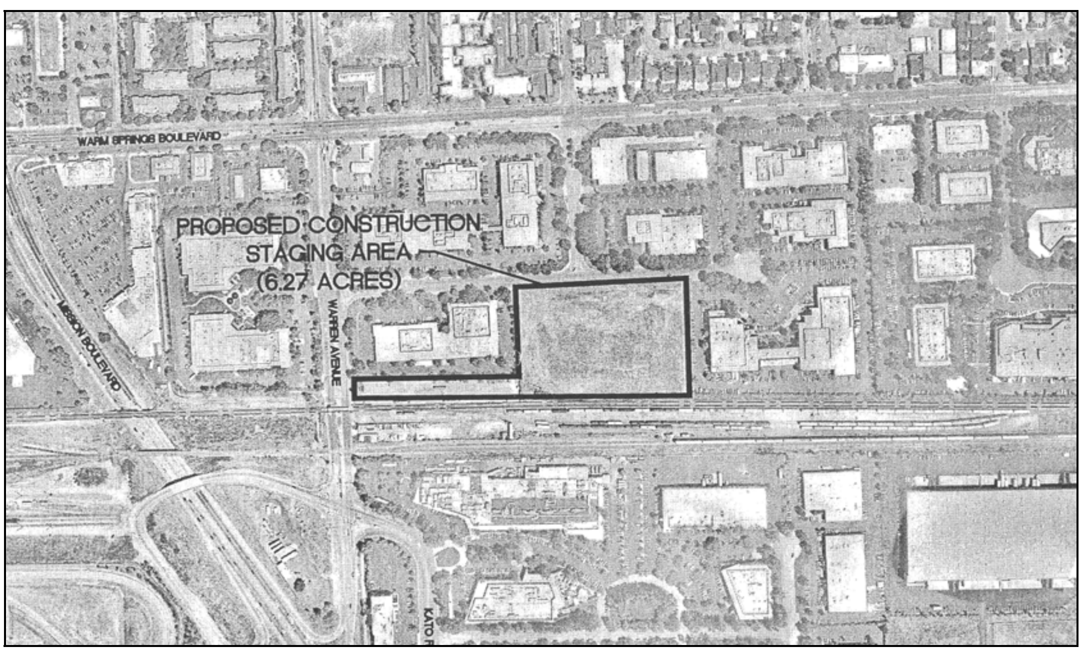


Figure 4.19-18: Construction Staging Site South of East Warren Avenue East of the Rail Corridor

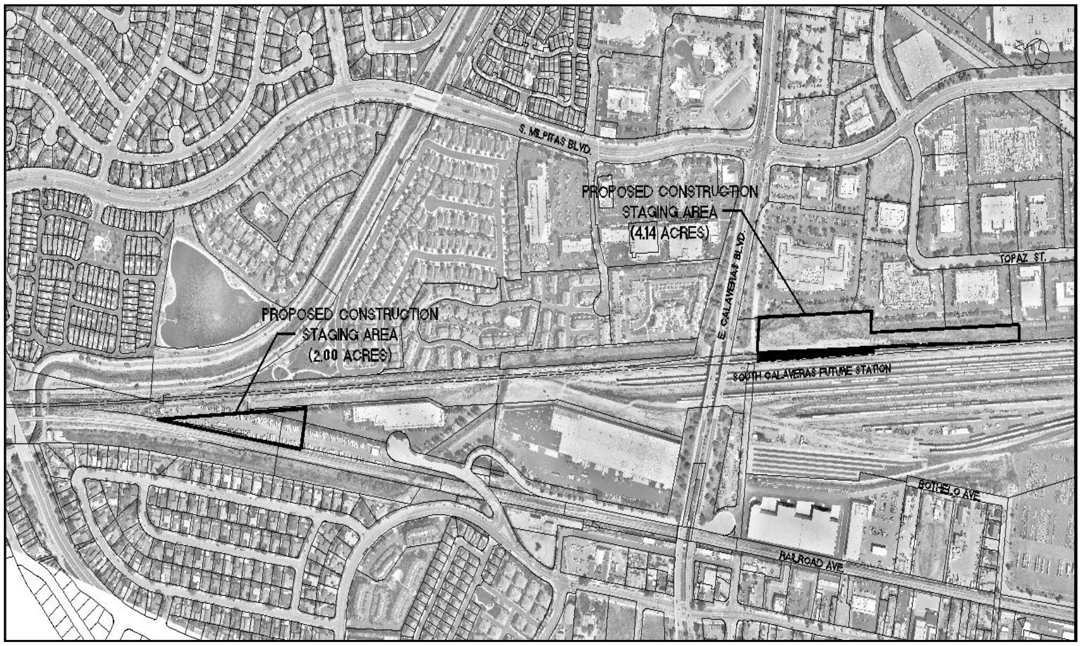


Figure 4.19-19: (a) Construction Staging Site between Railroad Court and Rail Corridor and (b) Construction Staging Site Adjoining Rail Corridor South of the Abel Street Overcrossing

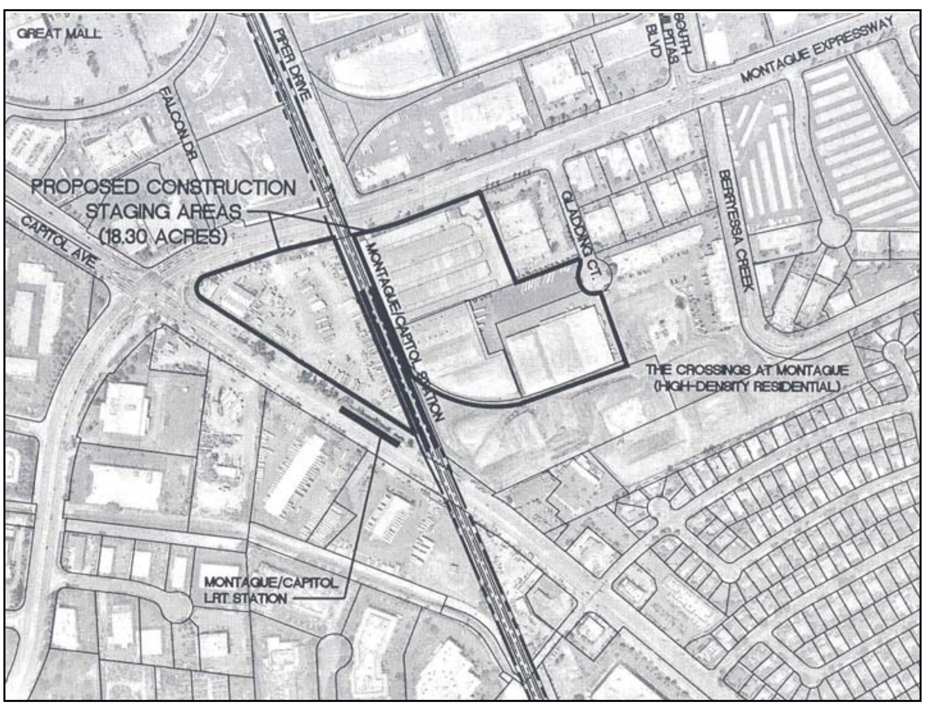


Figure 4.19-20: Construction Staging Site on Either Side of the Rail Corridor South of Montague Expressway

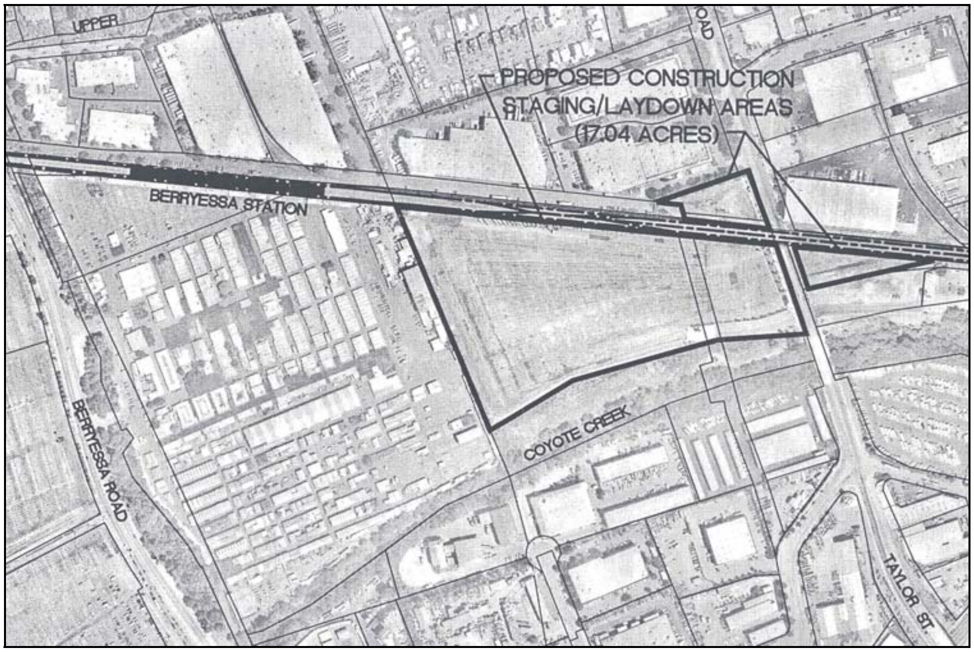


Figure 4.19-21: Construction Staging Site on Either Side of the Rail Corridor North of Mabury Road

Figure 4.19-22: Construction Staging Site West of US 101 South of East Julian Street

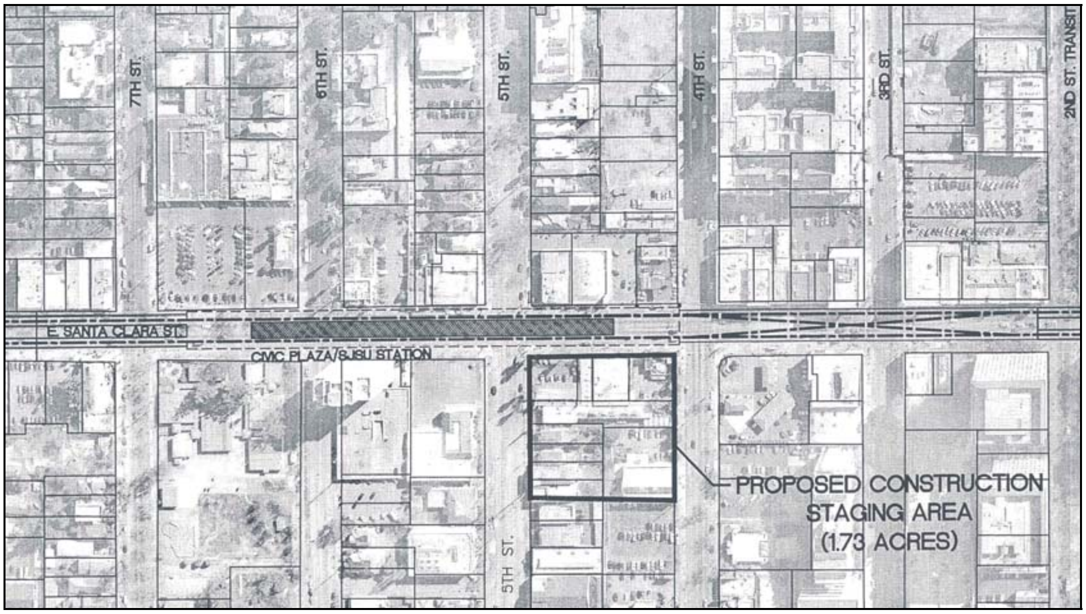


Figure 4.19-23: Construction Staging Site on Northwest Quadrant of Fifth and East Santa Clara Streets

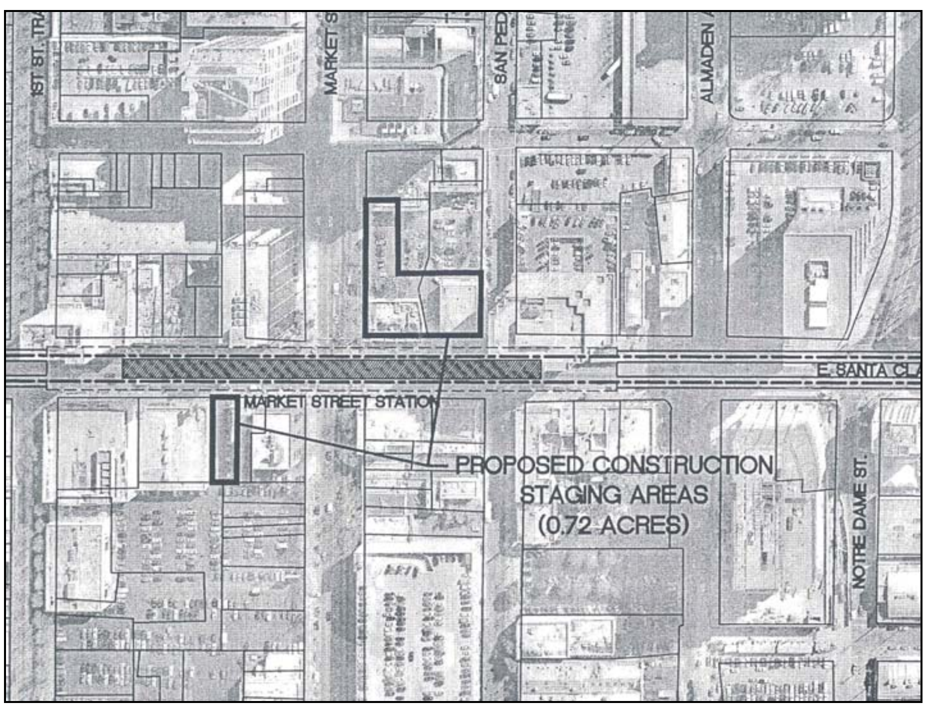


Figure 4.19-24: Construction Staging Sites in Southwest and Northeast Quadrants of the East Santa Clara Street and Market Street Intersection

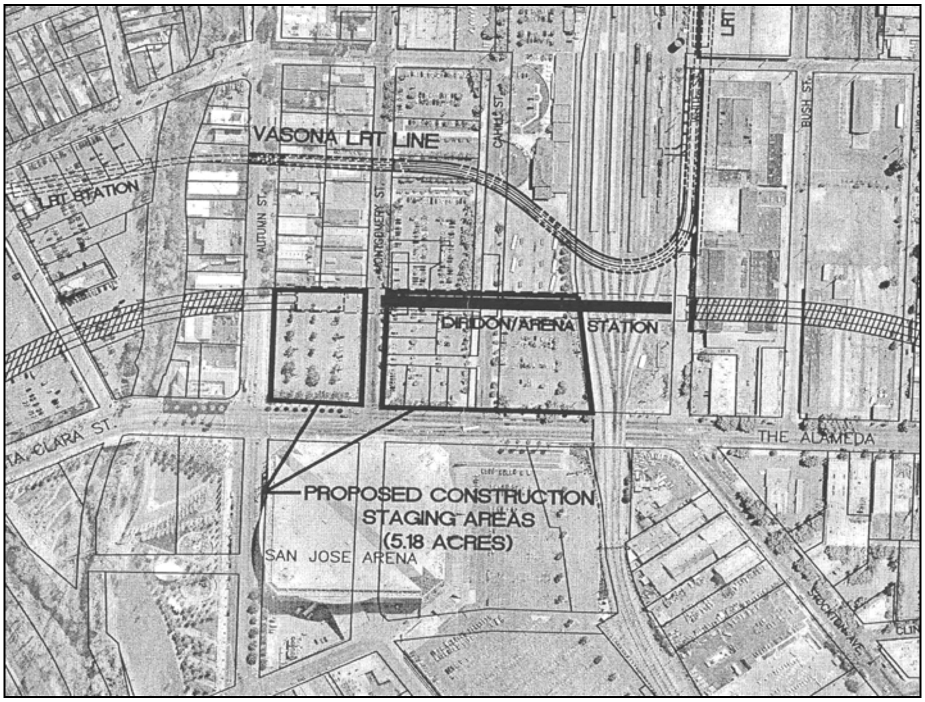


Figure 4.19-25: Construction Staging Site South of West Santa Clara Street on Either Side of Montgomery Street

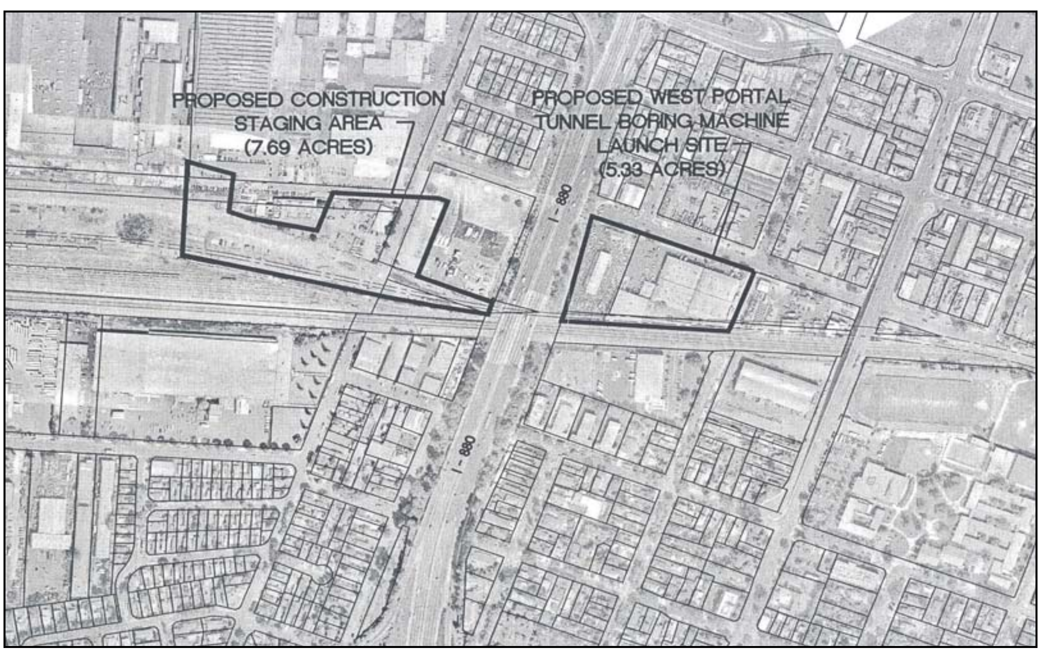


Figure 4.19-26: Construction Staging Site on Either Side of I-880 East of the Rail Corridor

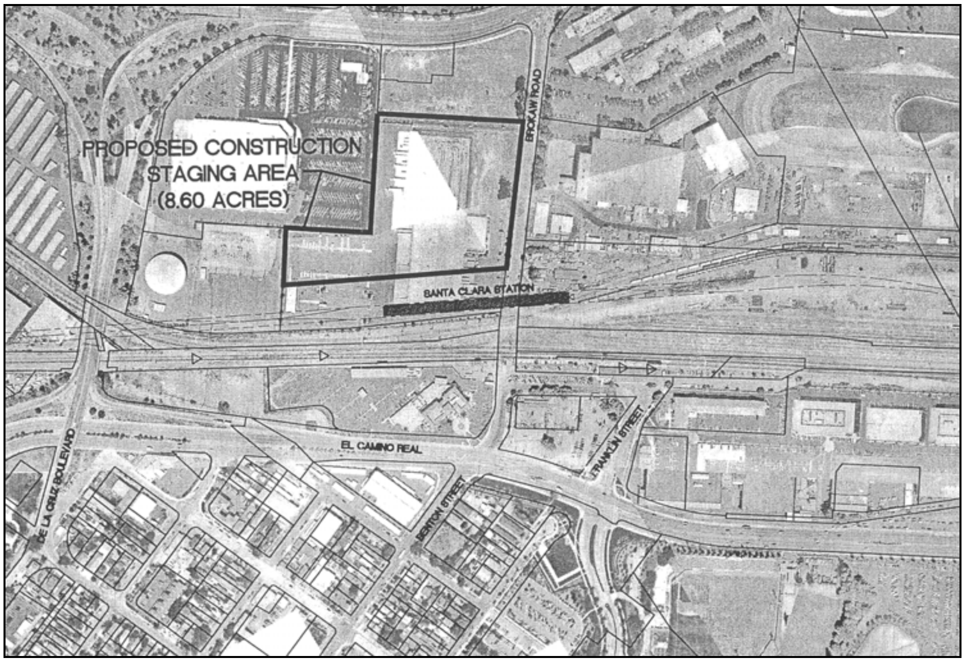


Figure 4.19-27: Construction Staging Site on East Side of the Rail Corridor North of Brokaw Road

It is anticipated that the majority of the construction for the aerial, surface, retained cut, cut and cover, and tunnel segments would be an early work effort and completed prior to the beginning of station construction. Therefore, station areas would also serve as staging sites. It is also anticipated that part of the thirteen acres on either side of I-880 would be used as a staging area for the tunnel and a fabrication area for the tunnel liners. In addition, portions of the land acquired for the BART Maintenance Facility can be used on an interim basis for construction staging. All of the construction staging areas would be required for the MOS scenarios. Long-term environmental impacts from the construction staging sites are addressed in each topical section.

4.19.2.9 Noise and Visual Screening Devices

Noise and visual screening devices can be installed if necessary for construction sites located near sensitive land uses. Examples of screened construction sites are shown in Figures 4.19-28 and 4.19-29. Construction staging sites for the BART Alternative have been located, to the extent possible, away from sensitive areas (residences, schools, hospitals). Such screening may be appropriate for: (1) the southern portion of the Montague/Capitol staging area near the adjoining residences, (2) the southern boundary of the Alum Rock construction site for the US 101/Diagonal Option, and (3) the southern and western edges of the Alum Rock Station for the Railroad/28th Street Option.

4.19.2.10 Construction Schedule

Baseline Alternative

The Baseline Alternative aerial busway is expected to take from 18 to 36 months to construct. It is anticipated that the aerial busway would be completed in advance of the BART Warm Springs extension proposed opening in 2008.

Figure 4.19-28: Construction Site Screening Example #1

BART Alternative

The anticipated BART Alternative construction schedule is shown in Figure 4.19-30. The BART Alternative would take seven to nine years to construct and perform start-up trains and testing activities. If Preliminary Engineering is funded in 2003, the BART Alternative could be completed by 2013.

The MOS scenarios would require a two-phased construction approach. MOS-1E or MOS-1F would involve the first phase of construction and vehicle procurement on the same timeline as the full-build BART Alternative shown in Figure 4.19-30. This would result in the first phase being completed and operational by the year 2013. Phase two would entail additional construction and vehicle procurement, which would be delayed by three years. As a result, two distinct construction phases would take place at the Berryessa Station, the Maintenance Facility, and parking facilities. The Civic Plaza/SJSU Station would also involve construction in two phases focusing on construction of the trackway, platform, and entrances in the first phase and construction of finishings to prepare the station for revenue service in the second phase. Under the MOS scenarios, the full project would be completed by the year 2016.

Figure 4.19-29: Construction Site Screening Example #2

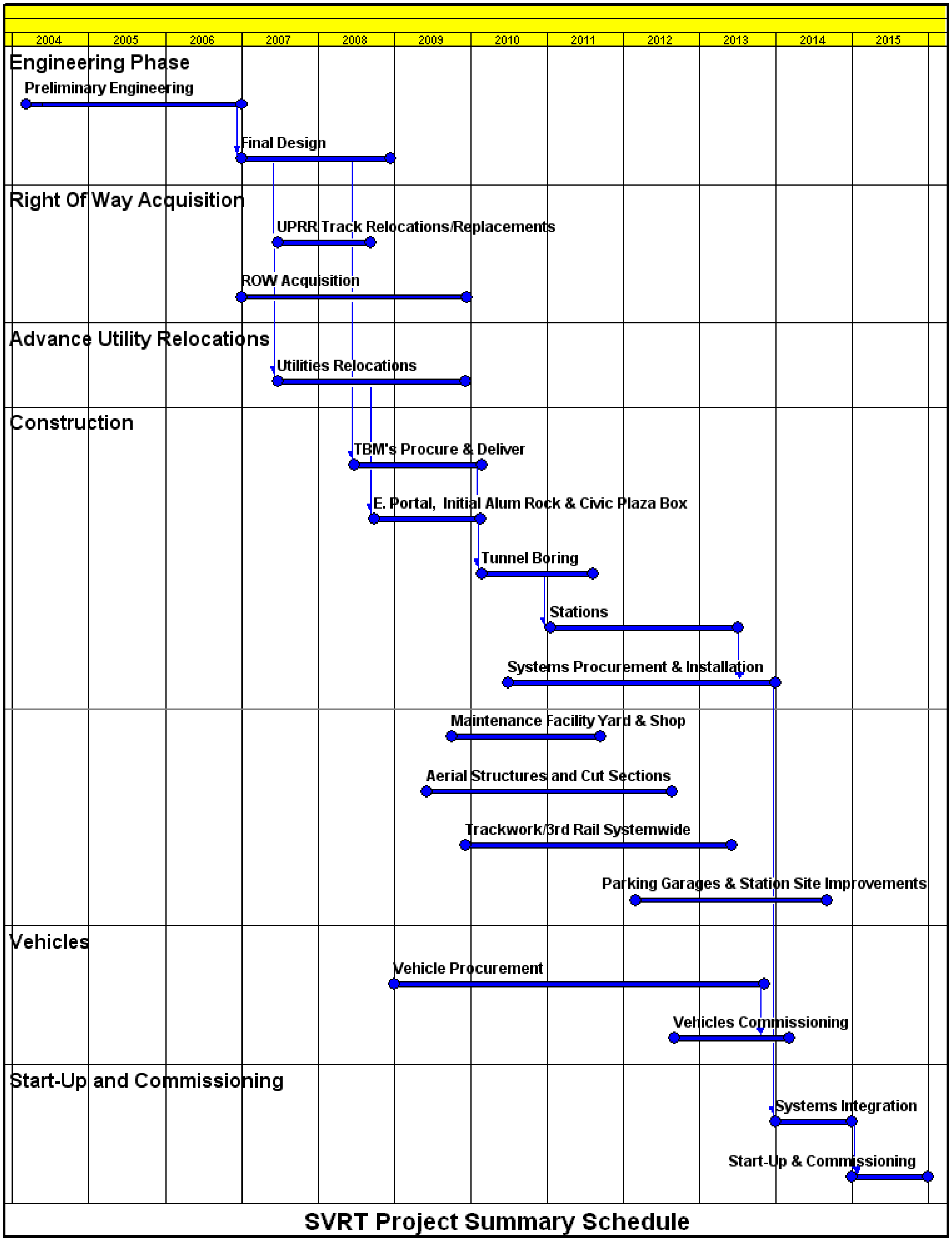


Figure 4.19-30: Project Schedule for the BART Alternative

4.19.3 TRANSPORTATION AND TRANSIT

This subsection discusses impacts to vehicular traffic, rail and bus service, parking, and pedestrians and bicyclists during construction. The No-Action Alternative would not result in any impacts. Thus, the discussion focuses on the Baseline and the BART alternatives, as well as the MOS scenarios.

4.19.3.1 Vehicular Traffic Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to vehicular traffic. (See Section 3.2.1.2 for a list of future projects under the No-Action Alternative.)

Baseline Alternative

The construction of major facilities for the Baseline Alternative would potentially affect vehicular traffic on adjacent streets. Under the Baseline Alternative, traffic in the vicinity of the proposed bus connector ramps at the BART Warm Springs Station and at the I-680/Montague Expressway connection could be disrupted by construction equipment and traffic.

BART Alternative

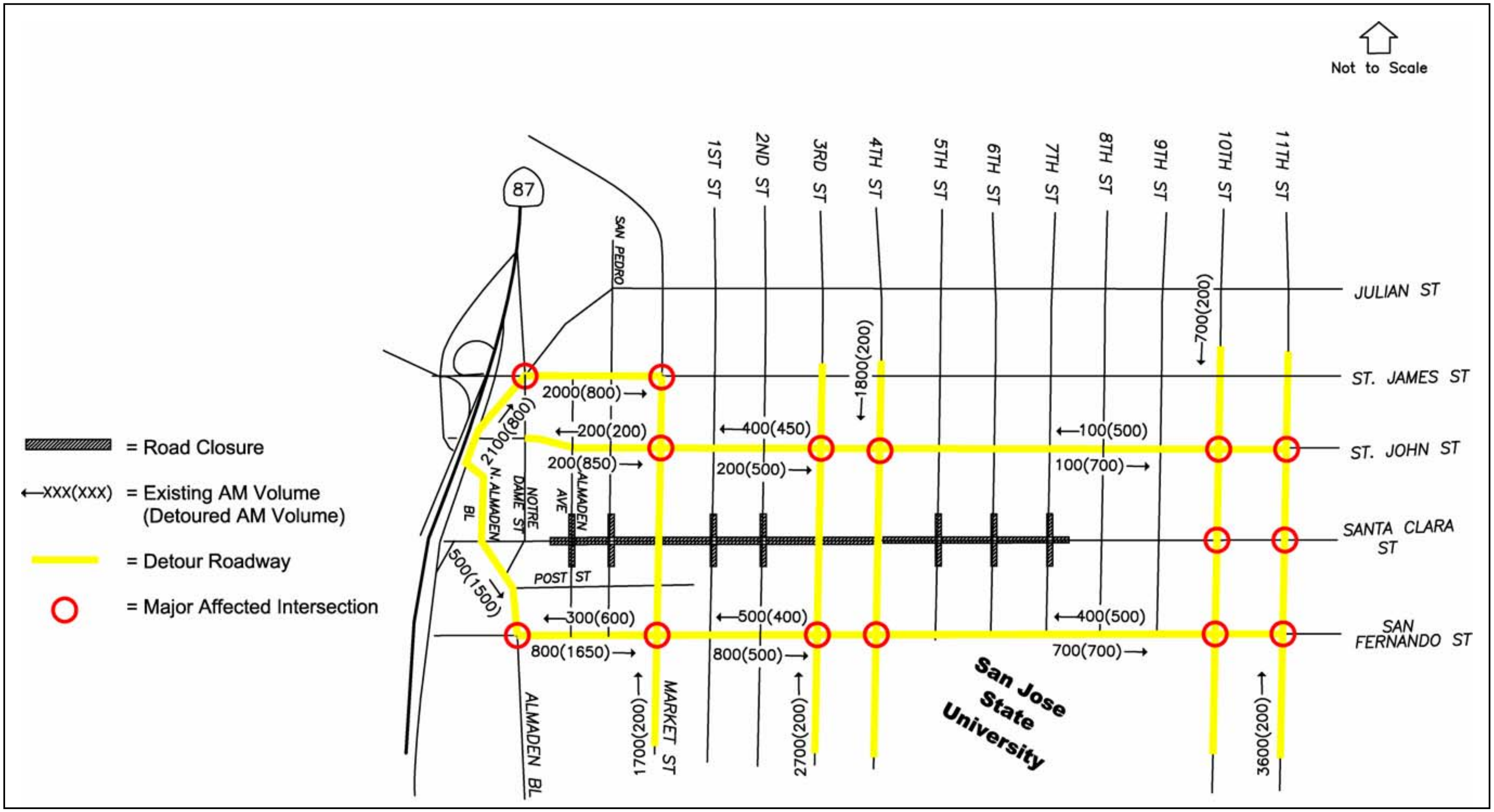
Under the BART Alternative, traffic in the vicinity of the proposed BART facilities, such as stations, park-and-ride structures, tunnel portals, and cut-and-cover stations, would be disrupted by construction equipment and traffic. With proper traffic handling procedures and the scheduling of major traffic generating activities in non-peak periods, some impacts would be minimized. Construction of BART improvements would, however, require partial and full street closures for cut-and-cover construction and grade separations. Therefore, there would be potential unavoidable adverse traffic impacts during construction, as discussed below. Similar traffic impacts apply to the MOS scenarios.

Station and Cut-and-Cover Impacts within Downtown San Jose

This subsection presents the BART Alternative construction effects on traffic in the area of downtown San Jose. The construction areas would be located along and around East/West Santa Clara Street at each of the proposed cut-and-cover station locations.

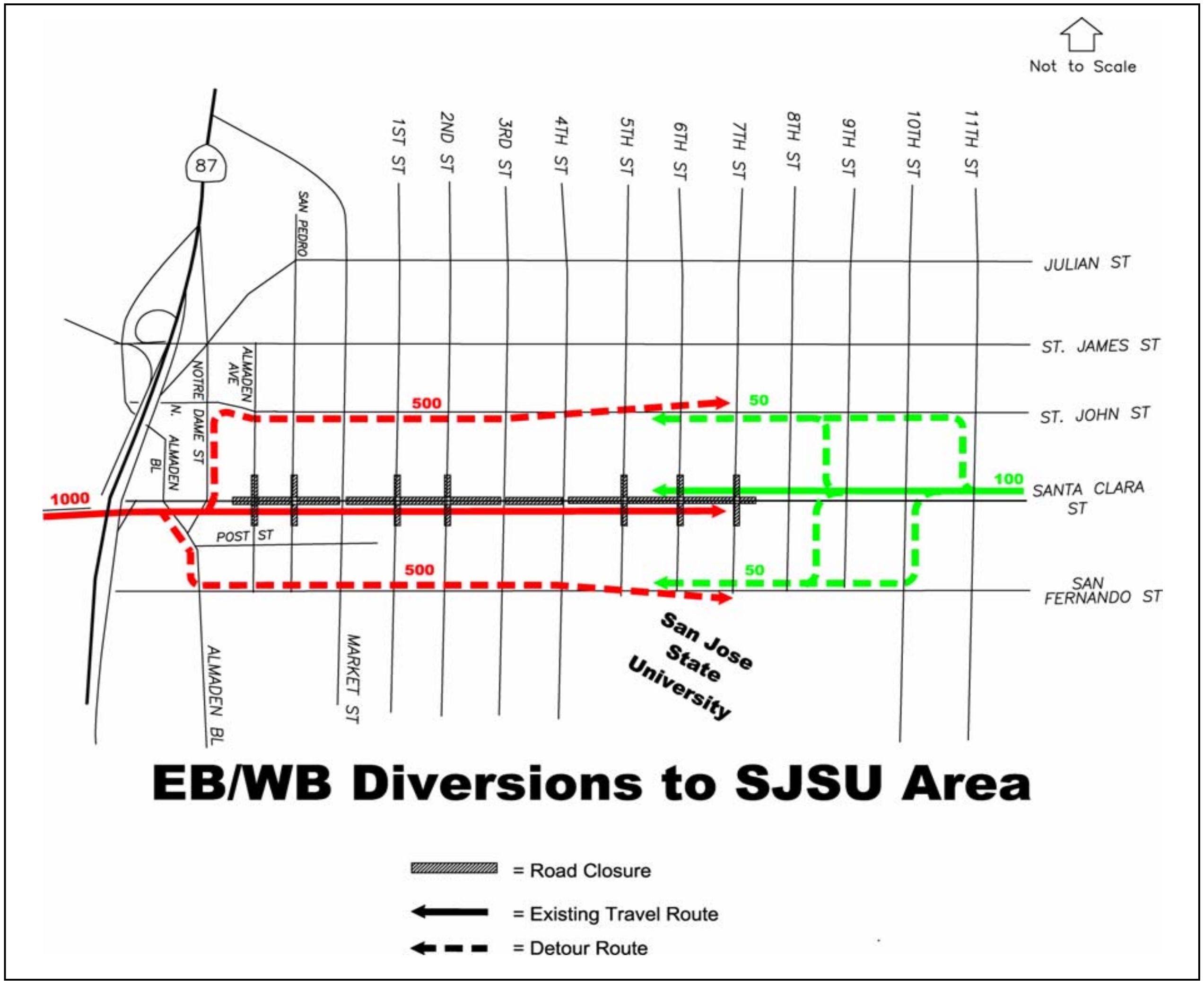
Construction methods for the cut-and-cover stations and crossover section would require that one lane in each direction on East/West Santa Clara Street be closed for up to three-and-a-half years. As part of the construction phasing, East/West Santa Clara Street would have to be completely closed for an additional one to three months at both the start and finish of construction to put on a temporary deck and to restore the street surface. Cross streets would also require closure to through traffic at staggered periods of one to three months. The evaluation is based on the assumption that all street and lane closures would occur during the same period. The evaluation also uses future morning peak hour traffic estimations based on planned and potential future development within downtown San Jose as identified by the Downtown Strategy Plan.

Detour routes during construction are identified on Figures 4.19-31 through 4.19-35. Truck haul routes are identified on Figures 4.19-36 through 4.19-38. Excavation of the three downtown subway stations and the crossover track box are expected to be staggered and to take approximately 10 months in total (with the heaviest truck traffic occurring during the middle 6 months). The truck haul volumes from each subway station excavation site would range from about 63 to 135 trucks per day, or a maximum of 17



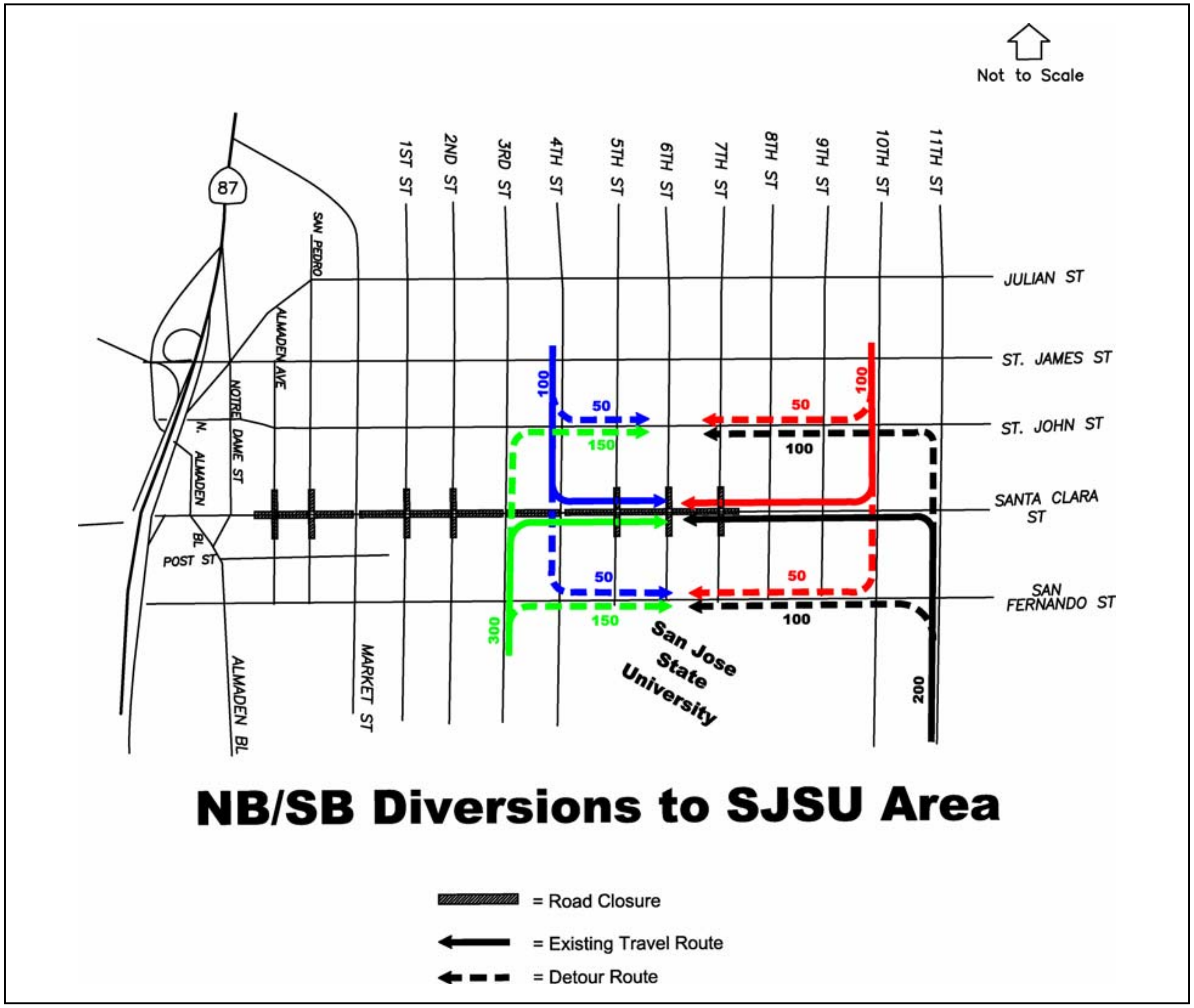
* Existing and detoured traffic volumes are from existing counts (1998 to 2002) plus projected traffic from approved development in downtown San Jose.

Figure 4.19-31: Morning Inbound Traffic Detour Routes



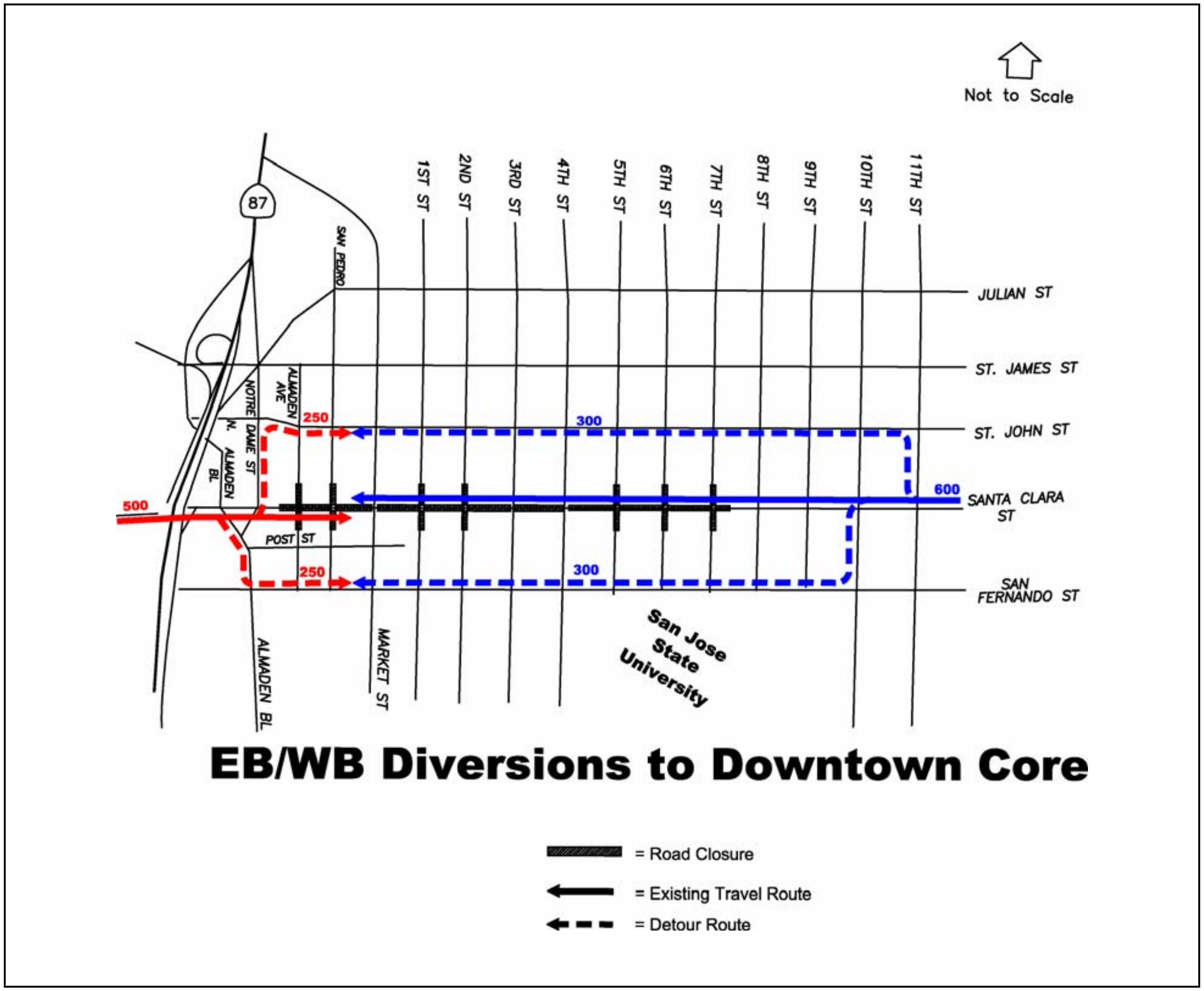
* Existing and detoured traffic volumes are from existing counts (1998 to 2002) plus projected traffic from approved development in downtown San Jose.

Figure 4.19-32: Eastbound / Westbound Traffic Diversions to SJSU Area



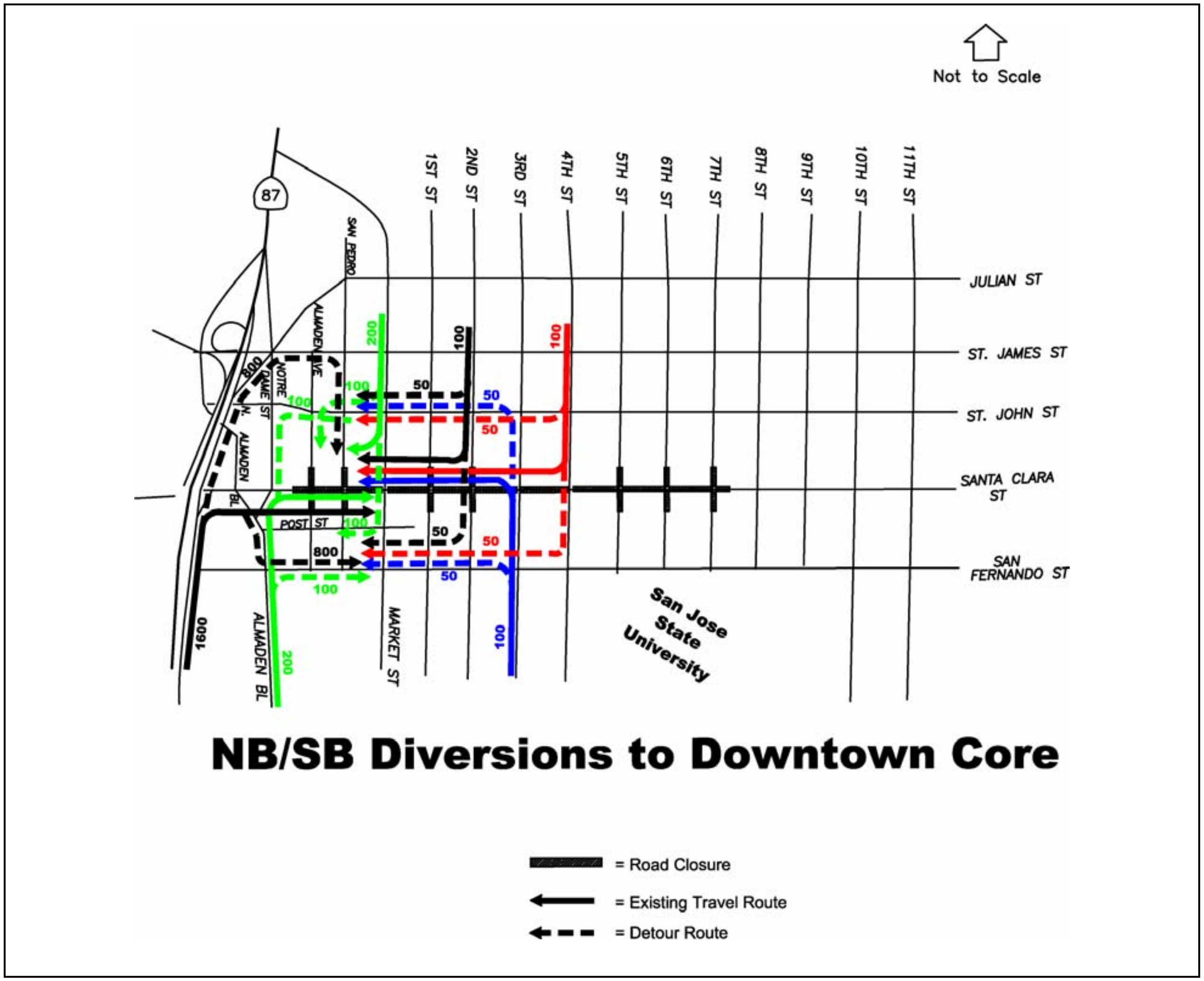
* Existing and detoured traffic volumes are from existing counts (1998 to 2002) plus projected traffic from approved development in downtown San Jose.

Figure 4.19-33: Northbound/Southbound Traffic Diversions to SJSU Area



*Existing and detoured traffic volumes are from existing counts (1998 to 2002) plus projected traffic from approved development in downtown San Jose.

Figure 4.19-34: Eastbound / Westbound Traffic Diversions to Downtown Core Area



* Existing and detoured traffic volumes are from existing counts (1998 to 2002) plus projected traffic from approved development in downtown San Jose.

Figure 4.19-35: Northbound / Southbound Traffic Diversions in Downtown Core Area

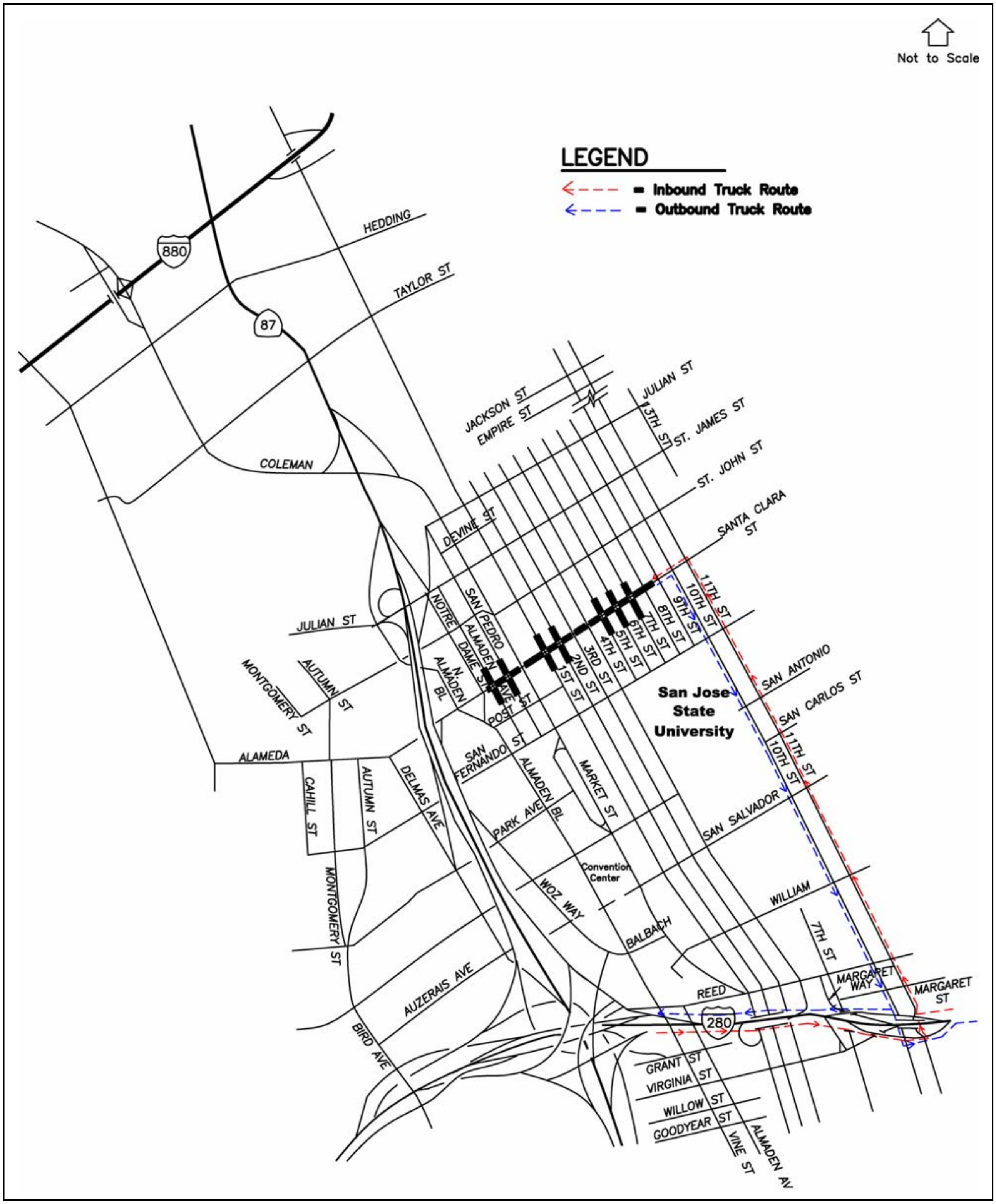


Figure 4.19-36: SJSU Area Truck Routes

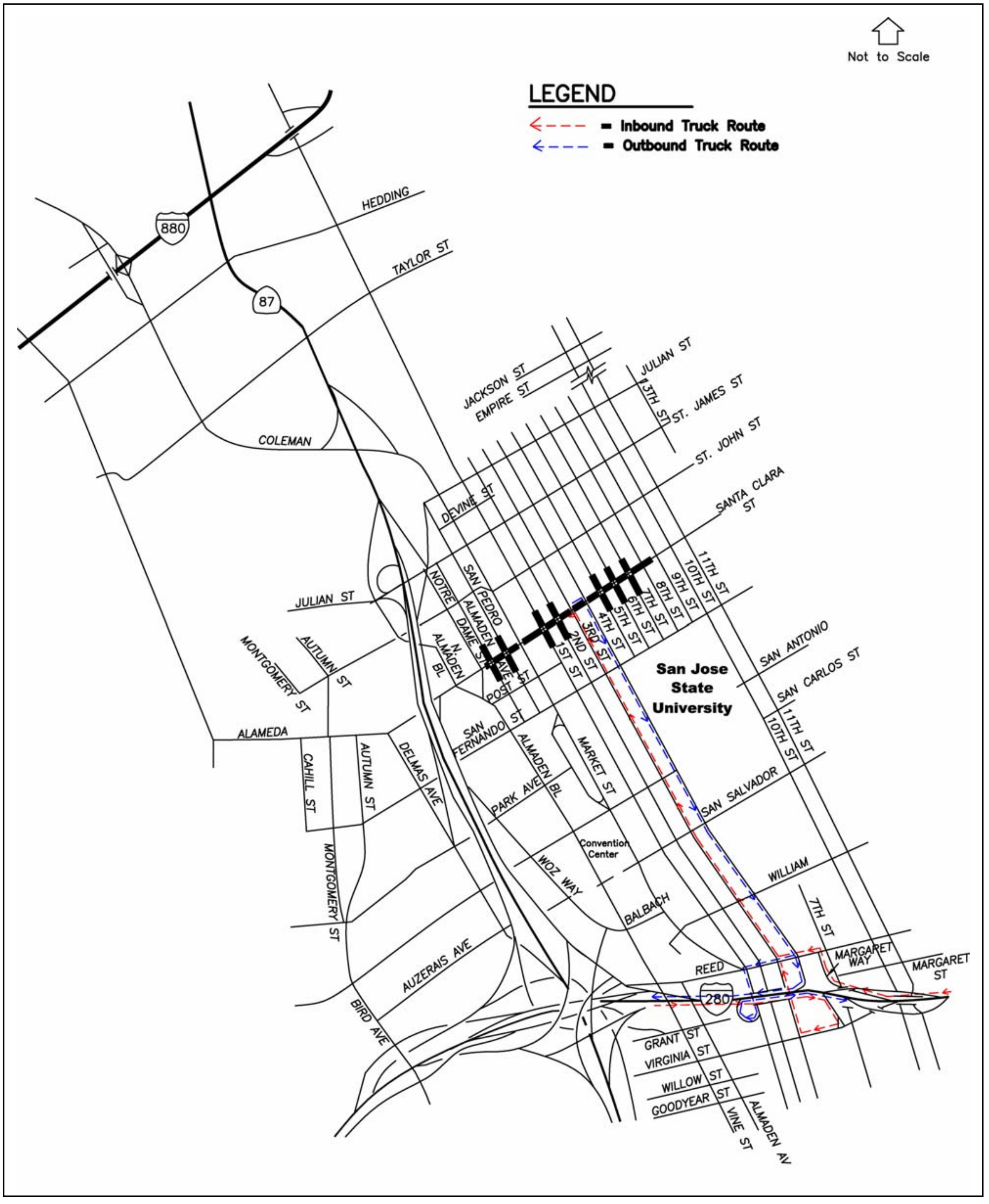


Figure 4.19-37: 3rd / 4th Street Area Truck Routes

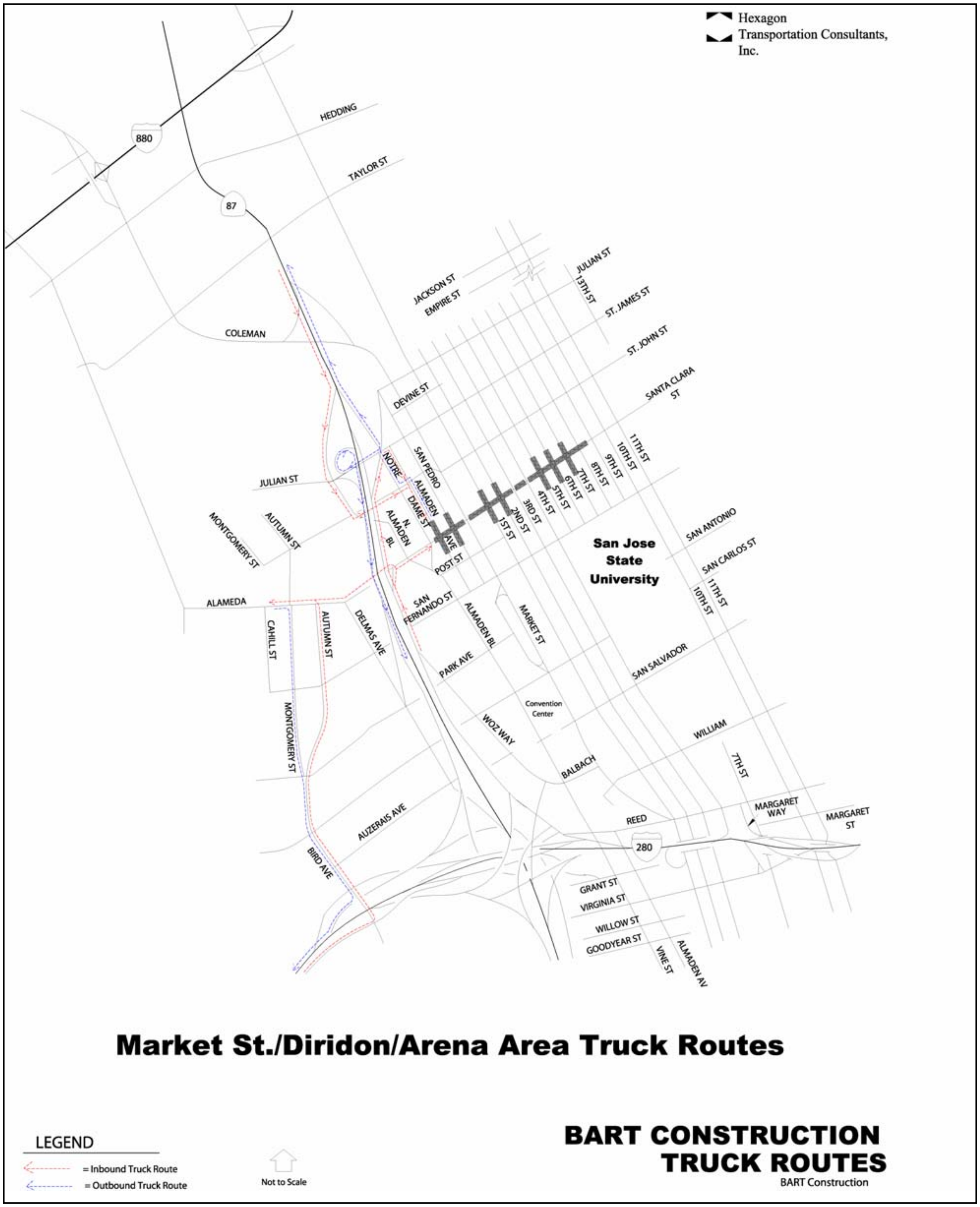


Figure 4.19-38: Market Street / Diridon / Arena Truck Routes

trucks per hour in each direction for the largest station, Civic Plaza/SJSU with its adjoining cross over track box, if all hauling of excavated materials were concentrated in one eight-hour shift. The Market Street Station and Diridon/Arena Station excavations would produce a maximum of 8 trucks per hour in each direction for one eight-hour shift. This would not change under MOS-1E. If the time window for truck hauling permits a double shift of sixteen hours, then the above hourly truck volumes could be reduced by one-half – i.e., to 8.5 trucks per hour for the Civic Plaza/SJSU Station excavation and 4 trucks per hour for both the Market Street Station and Diridon/Arena Station excavations. If only one truck haul route is used for each station excavation, or if two stations share all or parts of a haul route, then the maximum truck volumes on any one street would be 17 trucks per hour per direction. If two truck haul routes are used for each station, then the maximum truck haul volumes on any one street would be 8.5 trucks per hour per direction. Impacts on traffic level of service would be negligible from this volume of trucks, except for momentary delays where trucks would be entering or leaving a street from the construction area. Restrictions of truck traffic during peak commute hours would further minimize the impact of construction activities on detoured traffic.

Civic Plaza/SJSU Station Area. The Civic Plaza/SJSU Station would be located beneath East Santa Clara Street between 7th/8th streets and 4th Street. In addition to the closure of one lane in each direction on East Santa Clara Street, which would last for three-and-a-half years to four years, 5th, 6th, and 7th streets would also be closed to through traffic for periods of one to three months during decking or street reconstruction. Figure 4.19-31 shows the closed streets, the morning inbound detour routes, and existing and detoured traffic volumes for the entire downtown area, while Figures 4.19-32 and 4.19-33 show the localized traffic diversions to the SJSU area. Existing and detoured traffic volumes include current traffic counts, which can be any year from 1998 through 2002, plus projected traffic from development that has been approved but not yet built. Figures 4.19-36 and 4.19-37 illustrate the truck haul routes next to SJSU.

With the East Santa Clara Street lane closures, traffic would be detoured to East San Fernando Street and East St. John Street. The majority of the detoured traffic would be traffic moving through the Civic Plaza/SJSU area. The detour routes would use 3rd, 4th, 10th, and 11th streets to access and return from East San Fernando Street and East St. John Street. It is estimated that the morning peak hour volumes along East St. John Street would increase from approximately 200 vehicles per hour (vph) to as much as 1,400 vph. Along East San Fernando Street, volumes would increase from approximately 1,100 vph to 2,300 vph. Cross street closures of 5th, 6th, and 7th streets would detour traffic to 4th and 10th streets. The detour would result in an increase of approximately 200 vph to both the 1,800 vph on 4th Street and 700 vph on 10th Street. In the event that the West of Civic Plaza/SJSU Station Crossover Option is chosen, which would close 3rd and 4th streets at East Santa Clara Street, there would be a phased detour in which 5th and 6th streets would be used for the north-south connection for the one to three months while the intersections of 3rd and 4th streets with East Santa Clara Street are being decked or paved.

Some of the construction traffic and equipment in this area would be from the construction of three vent structures that would be located between 19th and 4th streets: one at the northwest corner of East Santa Clara and 13th streets, and one at each end of the Civic Plaza/SJSU Station. These structures would be off the street and while this would not result in long-term lane closures, there could be intermittent closure of lanes.

Although the Civic Plaza/SJSU Station would not be operational until MOS-2E, cut and cover construction of the station box during MOS-1E would generate the same traffic impacts described for the full-build BART Alternative.

Market Street Station Area. The Market Street Station would be located between 1st/2nd streets and Almaden Avenue. In addition to the closure of one lane in each direction on East/West Santa Clara Street, which would last for three-and-a-half years to four years, Almaden Avenue, San Pedro Street, Market Street, 1st Street, and 2nd Street would also be closed to through traffic for periods of one to three months during decking or street reconstruction. LRT service would be maintained on 1st and 2nd streets. In the event that the West of Market Street Station Crossover Option is chosen, Notre Dame Street would also be closed to through traffic at West Santa Clara Street. Figures 4.19-34 and 4.19-35 show the localized traffic diversions to this area, while Figure 4.19-38 illustrates the truck haul routes.

Some of the construction traffic and equipment in this area would be from the construction of two vent structures at the Market Street Station. Two vent structures – one at each end – are proposed: one at the northeast corner of East Santa Clara and 1st streets and one at the southeast corner of West Santa Clara Street and Almaden Avenue. These structures would be off the street and while this would not result in long-term lane closures, there could be intermittent closure of lanes.

Eastbound and westbound traffic along East/West Santa Clara Street would be detoured to East/West St. James Street, East/West San Fernando Street, and East/West St. John Street. With the proposed station and construction closures being located in the downtown core, affected traffic would use the extensive downtown roadway system to reach their destinations. But it can be expected that Almaden Boulevard and Market Street would serve the majority of detoured traffic to reach the primary eastbound/westbound detour streets of East/West St. James, East/West San Fernando, and East/West St. John streets. It is estimated that the morning peak hour volumes along East/West St. James Street would increase from approximately 2,000 vph to 2,800 vph. East/West St. John Street traffic volumes would increase from approximately 500 vph to 1,500 vph. Along East/West San Fernando Street, volumes would increase from approximately 1,200 vph to 2,800 vph. Cross street closures would detour traffic to Market Street and Almaden Boulevard. The detour would result in an increase of approximately 500 vph to the 1,500 vph on Almaden Boulevard and 200 vph to the 1,700 vph on Market Street.

The detour in street traffic would also result in adverse effects on intersection operations at virtually every major intersection in the downtown area. The detours would last three-and-a-half to four years and would add vehicular traffic to already congested movements and/or create new demand for movements that conflict with other high demand movements. Affected intersections include:

- West San Fernando Street and Almaden Boulevard
- East/West San Fernando Street and Market Street
- East San Fernando Street and 3rd Street
- East San Fernando Street and 4th Street
- East San Fernando Street and 10th Street
- East San Fernando Street and 11th Street
- East Santa Clara Street and 10th Street
- East Santa Clara Street and 11th Street
- East St. John Street and 10th Street
- East St. John Street and 11th Street
- East St. John Street and 3rd Street
- East St. John Street and 4th Street
- East/West St. John Street and Market Street
- West Julian Street and SR 87
- St. James Street and Market Street

Lane Closures Due to BART Grade Separations

This subsection presents the results of the traffic analysis conducted for the proposed BART grade-separation construction projects. Some grade-separations may require partial or full closure of roadways. Full closures of roadways, which allow for faster construction, would last for one year. Partial closures would last for 18 to 24 months. In general, only partial closures are proposed. The purpose of the analysis is to determine the effects of lane closures due to construction of the grade-separations. The effects of construction on traffic conditions, is evaluated based on volume-to-capacity (V/C) ratios on the effected roadways prior to and during construction. Each of the proposed grade-separations is discussed separately below. Tables 4.19-3 and 4.19.4 present the resulting V/C ratios and levels of service for the morning and evening peak hours, respectively. Construction conditions assume 2025 conditions for a worse case analysis, since construction would occur in an earlier year with lower traffic volumes. Existing (2000) conditions are shown for comparison.

Mission Boulevard (SR 262). The existing roadway has two lanes in both the eastbound and westbound directions. The planned widening of the roadway to three lanes in each direction is assumed completed at the time of construction. The proposed BART grade-separation would consist of an aerial structure. Construction methods would allow for the maintenance of three-lanes in each direction only if the planned UPRR bridge is constructed prior to the start of the grade-separation project. If the UPRR bridge is not in place at the initiation of construction, only two lanes of traffic in each direction would be maintained.

Since the preferred construction conditions at Mission Boulevard would allow for the maintenance of three lanes in each direction, there would be minimal effects of construction on traffic conditions. The roadway is projected to operate at LOS E in the eastbound direction during the evening peak hour.

East Warren Avenue. Currently, East Warren Avenue is a four-lane roadway with two lanes in each direction. There are plans to depress the roadway. Should East Warren Avenue be depressed prior to construction of the over-crossing, two lanes of traffic in each direction could be maintained. Without the completion of the depressed roadway, the over-crossing construction would require the closure of one lane in each direction.

With the closure of one lane in each direction during construction of the BART aerial structure, the roadway would experience minimal effects. Based on projected volumes, one lane in each direction would be adequate to serve traffic volumes with little effect on surrounding roadways. With or without the lane closure, the roadway is projected to operate at LOS A during both peak periods and directions.

Kato Road. Kato Road is a four-lane roadway. The proposed construction method for the BART underpass would require that the roadway be closed. Should the roadway need to remain open during construction, one lane in each direction could be maintained.

With the complete closure of Kato Road, traffic served by Kato Road would shift to Dixon Landing Road. This shift in traffic would have a minor effect on traffic conditions on the roadway, but with less than 800-peak hour trips being redistributed, the effects would be manageable.

The maintenance of one-lane in each direction during construction would result in the lane closures having little effect on Kato Road or its surrounding roadways. Kato Road is projected to operate at LOS A with the closure of one lane in each direction during both peak hours.

Dixon Landing Road. Dixon Landing Road currently has two lanes in each direction with plans of widening it to three lanes in each direction. There currently are three options for the crossing of BART at Dixon Landing Road: the Aerial Option, the At-grade Option, and the Retained Cut Option (trench). The

Table 4.19-3: Grade Separation Road Closure Volume-to-Capacity Ratios (Morning Peak Hour)

Roadway	City	Segment	Direction	2000 Existing				2025 No-Action Alternative				BART Alternative			
				# of Lanes	Peak hr. Volume	V/C	LOS	# of Lanes [2]	Peak hr. Volume [1]	V/C	LOS	# of Lanes [2]	Peak hr. Volume [1]	V/C	LOS
Mission Boulevard	Fremont	Between Warm Springs Boulevard and I-880	WB	2	2,628	1.095	F	3	2,794	0.776	C	3	2,794	0.776	C
			EB	2	1,556	0.648	B	3	2,060	0.572	A	3	2,060	0.572	A
East Warren Avenue	Fremont	Between Warm Springs Boulevard and I-880	WB	2	491	0.205	A	2	266	0.111	A	1	266	0.222	A
			EB	2	36	0.015	A	2	47	0.020	A	1	47	0.039	A
Kato Road	Fremont	West of Warm Springs Boulevard	WB	2	259	0.108	A	2	167	0.070	A	1	167	0.139	A
			EB	2	304	0.127	A	2	388	0.162	A	1	388	0.323	A
Dixon Landing Road	Milpitas	Between North Milpitas Boulevard and I-880	WB	2	1,083	0.451	A	3	1,913	0.531	A	2	1,913	0.797	C
			EB	2	316	0.132	A	3	612	0.170	A	2	612	0.255	A
Montague Express-way	Milpitas	Between Capitol Avenue and Milpitas Boulevard	WB	3	3,765	1.046	F	4	4,985	1.039	F	3	4,985	1.385	F
			EB	3	1,418	0.394	A	4	2,109	0.439	A	3	2,109	0.586	A
Capitol Avenue	San Jose	Between Montague Expressway and Trade Zone Boulevard	NB	2	1,472	0.613	B	2	1,715	0.715	C	2	1,715	0.715	C
			SB	2	161	0.067	A	2	547	0.228	A	2	547	0.228	A
Trade Zone Blvd	San Jose	Between Lundy Avenue and Capitol Avenue	WB	2	1,569	0.654	B	2	1,453	0.605	B	1	1,453	1.211	F
			EB	2	706	0.294	A	2	775	0.323	A	1	775	0.646	B
Hostetter Road	San Jose	Between Lundy Avenue and I-680	WB	3	2,633	0.731	C	3	2,841	0.789	C	2	2,841	1.184	F
			EB	3	658	0.183	A	3	1,232	0.342	A	2	1,232	0.513	A
Berryessa Road	San Jose	Between Lundy Avenue and Old Oakland Road/Commercial Street	WB	2	1,394	0.581	A	2	2,320	0.967	E	2	2,320	0.967	E
			EB	3	410	0.114	A	3	916	0.254	A	2	916	0.382	A

continued

Table 4.19-3: Grade Separation Road Closure Volume-to-Capacity Ratios (Morning Peak Hour)

Roadway	City	Segment	Direction	2000 Existing				2025 No-Action Alternative				BART Alternative			
				# of Lanes	Peak hr. Volume	V/C	LOS	# of Lanes [2]	Peak hr. Volume [1]	V/C	LOS	# of Lanes [2]	Peak hr. Volume [1]	V/C	LOS
De La Cruz Blvd	Santa Clara	Between El Camino Real and Reed Street	WB	2	900	0.375	A	2	1,066	0.444	A	2	1,066	0.444	A
			EB	3	1,862	0.517	A	3	1,384	0.384	A	3	1,384	0.384	A
Lundy Avenue	San Jose	At its intersection with Sierra Road	NB	2	1,384	0.577	A	2	1,701	0.709	C	2	1,701	0.709	C
			SB	2	152	0.063	A	2	204	0.085	A	2	204	0.085	A
Sierra Road	San Jose	At its intersection with Lundy Avenue	WB	2	241	0.100	A	2	368	0.153	A	2	368	0.153	A
			EB	2	43	0.018	A	2	54	0.023	A	2	54	0.023	A
Mabury Road	San Jose	Between King Road and US 101	WB	2	1,472	0.613	B	2	1,692	0.705	C	2	1,692	0.705	C
			EB	2	217	0.090	A	2	1,051	0.438	A	2	1,051	0.438	A
East Julian Street	San Jose	West of US 101	WB	2	1,619	0.675	B	2	2,315	0.965	E	2	2,315	0.965	E
			EB	2	499	0.208	A	2	1,026	0.428	A	2	1,026	0.428	A
US 101	San Jose	Between Mabury Road and East Julian Street	NB-Mixed	4	6,038	1.258	F	4	6,743	1.405	F	4	6,743	1.405	F
			SB-Mixed	4	4,063	0.846	D	4	4,757	0.991	E	4	4,757	0.991	E
			NB-HOV	1	1,848	1.540	F	1	2,060	1.717	F	1	2,060	1.717	F
			SB-HOV	1	649	0.541	A	1	678	0.565	A	1	678	0.565	A

Notes:

[1] Volumes obtained from traffic model. 2025 traffic is analyzed as a worse case condition, since construction would be in earlier years.

[2] Number of lanes under construction includes planned widenings.

Source: Hexagon Transportation Consultants, Inc., March 2003.

Table 4.19-4: Grade Separation Road Closures Volume-to-Capacity Ratios (Evening Peak Hour)

Roadway	City	Segment	Direction	2000 Existing				2025 No-Action Alternative				BART Alternative			
				# of Lanes	Peak hr. Volume	V/C	LOS	# of Lanes [2]	Peak hr. Volume [1]	V/C	LOS	# of Lanes [2]	Peak hr. Volume [1]	V/C	LOS
Mission Boulevard	Fremont	Between Warm Springs Boulevard and I-880	WB	2	2,374	0.989	E	3	2,505	0.696	B	3	2,505	0.696	B
			EB	2	2,214	0.923	E	3	3,300	0.917	E	3	3,300	0.917	E
East Warren Avenue	Fremont	Between Warm Springs Boulevard and I-880	WB	2	170	0.071	A	2	147	0.061	A	1	147	0.123	A
			EB	2	633	0.264	A	2	490	0.204	A	1	490	0.408	A
Kato Road	Fremont	West of Warm Springs Boulevard	WB	2	394	0.164	A	2	635	0.265	A	1	635	0.529	A
			EB	2	304	0.127	A	2	261	0.109	A	1	261	0.218	A
Dixon Landing Rd	Milpitas	Between North Milpitas Boulevard and I-880	WB	2	607	0.253	A	3	849	0.236	A	2	849	0.354	A
			EB	2	1,128	0.470	A	3	1,660	0.461	A	2	1,660	0.692	B
Montague Expressway	Milpitas	Between Capitol Avenue and Milpitas Boulevard	WB	3	2,277	0.633	B	4	2,703	0.563	A	3	2,703	0.751	C
			EB	3	3,483	0.968	E	4	4,852	1.011	F	3	4,852	1.348	F
Capitol Avenue	San Jose	Between Montague Expressway and Trade Zone Boulevard	NB	2	462	0.193	A	2	943	0.393	A	2	943	0.393	A
			SB	2	1,270	0.529	A	2	1,392	0.580	A	2	1,392	0.580	A
Trade Zone Boulevard	San Jose	Between Lundy Avenue and Capitol Avenue	WB	2	938	0.391	A	2	997	0.415	A	1	997	0.831	D
			EB	2	1,677	0.699	B	2	1,400	0.583	A	1	1,400	1.167	F
Hostetter Road	San Jose	Between Lundy Avenue and I-680	WB	3	1,052	0.292	A	3	1,655	0.460	A	2	1,655	0.690	B
			EB	3	2,627	0.730	C	3	2,774	0.771	C	2	2,774	1.156	F
Berryessa Road	San Jose	Between Lundy Avenue and Old Oakland Road/Commercial Street	WB	2	742	0.309	A	2	1,812	0.755	C	2	1,812	0.755	C
			EB	3	1,209	0.336	A	3	2,124	0.590	A	2	2,124	0.885	D

continued

Table 4.19-4: Grade Separation Road Closures Volume-to-Capacity Ratios (Evening Peak Hour)

Roadway	City	Segment	Direction	2000 Existing				2025 No-Action Alternative				BART Alternative			
				# of Lanes	Peak hr. Volume	V/C	LOS	# of Lanes [2]	Peak hr. Volume [1]	V/C	LOS	# of Lanes [2]	Peak hr. Volume [1]	V/C	LOS
De La Cruz Boulevard	Santa Clara	Between El Camino Real and Reed Street	WB	2	1,888	0.787	C	2	1,428	0.595	A	2	1,428	0.595	A
			EB	3	957	0.266	A	3	1,073	0.298	A	3	1,073	0.298	A
Lundy Avenue	San Jose	At its intersection with Sierra Road	NB	2	420	0.175	A	2	498	0.208	A	2	498	0.208	A
			SB	2	1,095	0.456	A	2	1,646	0.686	B	2	1,646	0.686	B
Sierra Road	San Jose	At its intersection with Lundy Avenue	WB	2	77	0.032	A	2	81	0.034	A	2	81	0.034	A
			EB	2	155	0.065	A	2	252	0.105	A	2	252	0.105	A
Mabury Road	San Jose	Between King Road and US 101	WB	2	729	0.304	A	2	1,664	0.693	B	2	1,664	0.693	B
			EB	2	1,362	0.568	A	2	1,610	0.671	B	2	1,610	0.671	B
East Julian Street	San Jose	West of US 101	WB	2	855	0.356	A	2	1,487	0.620	B	2	1,487	0.620	B
			EB	2	1,248	0.520	A	2	1,863	0.776	C	2	1,863	0.776	C
US 101	San Jose	Between Mabury Road and East Julian Street	NB-Mixed	4	4,730	0.985	E	4	4,748	0.989	E	4	4,748	0.989	E
			SB-Mixed	4	6,211	1.294	F	4	6,734	1.403	F	4	6,734	1.403	F
			NB-HOV	1	908	0.757	C	1	1,084	0.903	E	1	1,084	0.903	E
			SB-HOV	1	1,665	1.388	F	1	1,253	1.044	F	1	1,253	1.044	F

Notes:

[1] Volumes obtained from model. 2025 traffic is analyzed as a worse case condition, since construction would be in earlier years.

[2] Number of lanes under construction includes planned widenings.

Source: Hexagon Transportation Consultants, Inc., March 2003.

Aerial and Retained Cut options would enable two lanes in each direction to remain open. The At-grade Option would maintain only three lanes of traffic in total.

Two lanes in each direction could adequately serve the projected traffic volumes along Dixon Landing Road during the construction of the Aerial or Retained Cut options. Based on the projected traffic volumes, the roadway would operate at LOS A during both peak hours under this scenario.

Traffic conditions for the At-grade Option could be maintained at acceptable levels with the use of reversible lanes on Dixon Landing Road. With the Retained Cut Option, only three lanes of traffic would be available. Two lanes are necessary to serve projected peak direction volumes. With two eastbound lanes and one westbound lane provided during the morning peak hour, and the reversal of the middle lane to provide one eastbound and two westbound lanes during the evening peak hour, acceptable levels can be maintained during construction. However, depending on the size and configuration of the center pier foundation and shoring requirements, it may only be possible to maintain one lane of traffic in each direction during some of the construction.

As an alternative, the road could be closed to traffic during construction of the underpass. Construction of temporary grade crossing warning devices would not be needed. In addition, no shoring would be needed the length of the roadway to build the road in two halves. Traffic could be detoured to Kato Road via Millmont Drive and Milpitas Boulevard for an estimated period of 1½ to 2 years. This would result in a substantial adverse traffic impact because of the volume of traffic that would be detoured for this length of time.

Montague Expressway. The existing roadway has three lanes in both the eastbound and westbound directions with planned widening of the roadway to four lanes in each direction. The proposed BART retained cut construction methods would allow for the maintenance of three lanes in each direction with the planned widening.

Montague Expressway currently operates at an unacceptable LOS F in the peak directions (westbound morning/eastbound evening). During the construction of the BART retained cut section, it would continue to operate poorly. With Montague Expressway being the primary east-west facility in the area, commuters would bear the delays due to construction or utilize longer routes on minor streets.

Capitol Avenue. One lane of traffic in each direction was recently closed on Capitol Avenue due to VTA's LRT construction. When the LRT is complete, the roadway will return to two lanes in each direction. With construction of the BART retained cut, it would be possible to maintain these two lanes of traffic in each direction. The diversion of traffic to surrounding streets due to construction would be minimal since Capitol Avenue serves as the only direct north-south route in the area, and the level of service would be LOS C or better during both peak hours.

Trade Zone Boulevard. The existing roadway provides two lanes in each direction. The construction of the BART retained cut would require that one lane of traffic be closed in each direction. The partial closure of Trade Zone Boulevard during construction would have an adverse impact on traffic conditions. Trade Zone Boulevard serves as a connection between Montague Expressway and Capitol Avenue. One lane of traffic in each direction during construction would not be adequate to serve projected traffic volumes and would deteriorate operating levels from acceptable levels to LOS F in the peak directions. To avoid delays, drivers would be forced to use circuitous alternative routes.

Hostetter Road. Hostetter Road provides three lanes of traffic in each direction. With the construction of the BART retained cut, one lane in each direction would be closed. The lane closures would result in increased delays along Hostetter Road. Traffic projections indicate that two lanes of traffic would not be adequate and would cause the roadway operating levels to deteriorate from LOS C to LOS F in the peak directions. Large traffic volumes exist and are projected on Hostetter Road because it provides access to

I-680. With lane closures at Trade Zone Boulevard and Berryessa Road, which also serve I-680, drivers would be forced to accept the increased traffic congestion.

Lundy Avenue and Sierra Road. Both Lundy Avenue and Sierra Road provide two lanes in each direction in the vicinity of their intersection. Exclusive left-turn lanes are provided on all approaches to the intersection. Though two-lanes of traffic can be maintained on both roads during BART construction, the exclusive left-turn lanes would not be maintained.

Though there would be noticeable increased delays at the intersection, the roadways would continue to operate at acceptable levels, LOS C or better. Alternative routes are available in the area, but with the intersection being centrally located within a densely populated residential area, some commuters would have no alternative routes.

Berryessa Road. Berryessa Road provides three lanes in the eastbound and two lanes westbound direction. With the construction of the BART aerial structure, two lanes in each direction can be maintained. The lane closure in the eastbound direction would result in increased delays since it is the peak commute direction during the evening peak hour. The increased delay would not be adverse and the roadway would still operate at an acceptable LOS D.

Although construction of the Berryessa Station would be deferred to MOS-2E, the aerial guideway in this area would still be constructed during MOS-1E. Similar to the BART Alternative, the second phase of station construction under MOS-2E would not adversely affect traffic conditions, which would remain at an acceptable LOS D.

Mabury Road. Mabury Road provides two-lanes in each direction in the immediate vicinity of the proposed BART construction area. All lanes of traffic would be maintained, as well as LOS C or better conditions, during BART construction causing no adverse effect on traffic conditions.

East Julian Street. East Julian Street provides two-lanes of traffic in the eastbound and westbound directions in the immediate area of the proposed BART construction area. During construction, it would be necessary to shift traffic lanes around construction points but all lanes would be maintained. The shift in lanes would minimally affect traffic conditions, but would not deteriorate the projected LOS E operating levels. The lane reconfiguration would depend on whether the US 101/Diagonal Option or the Railroad/28th Street Option is chosen.

US 101. US 101 provides four lanes in each direction between Mabury Road and East Julian Street. During BART construction under the Railroad/28th Street Option, it may be necessary to close a lane in each direction and the entire freeway during off-peak hours for overhead aerial structure construction. The closure of lanes would cause already congested conditions to worsen. Though it can be expected that commuters may seek alternative routes via parallel arterials, the congested conditions would for the most part be unavoidable.

Although implementation of design requirements and best management practices, including the Construction Impact Mitigation Plan, will substantially reduce traffic impacts, unavoidable adverse traffic impacts will remain. The following intersections will have unavoidable adverse traffic impacts resulting from cut-and-cover station construction:

- West San Fernando Street and Almaden Boulevard
- East/West San Fernando Street and Market Street
- East San Fernando Street and 3rd Street
- East San Fernando Street and 4th Street

- East San Fernando Street and 10th Street
- East San Fernando Street and 11th Street
- East Santa Clara Street and 10th Street
- East Santa Clara Street and 11th Street
- East St. John Street and 10th Street
- East St. John Street and 11th Street
- East St. John Street and 3rd Street
- East St. John Street and 4th Street
- East/West St. John Street and Market Street
- West Julian Street and SR 87
- East/West St. James Street and Market Street

The following streets will have unavoidable adverse traffic impacts resulting from lane closures for grade separation construction:

- Montague Expressway
- Trade Zone Boulevard
- Hostetter Road

4.19.3.2 Design Requirements and Best Management Practices for Vehicular Traffic Impacts

Baseline and BART Alternatives

The following design requirements and best management practices will be applied during the construction phase for either Baseline or BART alternatives, as well as the MOS scenarios:

- During Final Design, traffic control plans will be developed in cooperation with local jurisdictions (i.e., Fremont and Milpitas for the Baseline Alternative; and Fremont, Milpitas, San Jose, and Santa Clara for the BART Alternative) transportation, police, and fire departments and Caltrans. The Plans will identify detour routes, signing and barricade locations, turnarounds at street closures and other traffic control elements.
- To the extent practical, traffic lanes and capacity will be maintained in the appropriate directions, particularly during peak traffic hours.
- During construction of grade separations, VTA will coordinate construction with other major public or private construction projects within a one-mile radius of its project and schedule its construction contracts to avoid overlapping major activities.
- VTA will notify local residents and businesses in advance of proposed construction activity (see Section 4.19.2.1).
- VTA will coordinate with the affected cities to provide the public advance notice of proposed traffic detours and their duration.

4.19.3.3 Mitigation Measures For Vehicular Traffic Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to vehicular traffic and to determine appropriate mitigation measures.

Baseline Alternative

With the implementation of the design requirements and best management practices listed above, no substantial adverse impacts would result and mitigation measures are not required.

BART Alternative

With the implementation of the design requirements and best management practices listed above, most traffic impacts due to construction of the BART Alternative and MOS scenarios would be substantially reduced. However, adverse impacts at some of the intersections and street segments listed in Section 4.19.3.1 above will still remain that cannot be mitigated.

4.19.3.4 Rail and Bus Service Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to rail and bus service.

Baseline Alternative

The Baseline Alternative includes new transit facilities. The three busway connectors to be constructed under the Baseline Alternative would not affect existing bus and rail service.

BART Alternative

Rail Service Impacts

The BART Alternative and MOS scenarios would involve connecting existing BART tracks with new tracks south of the planned Warm Springs Station. Construction of these new connections has the potential to affect on-going revenue service. To avoid adverse disruption of current BART operations, construction of the connection to the existing track will be scheduled during non-revenue hours. BART construction in the vicinity of 1st and 2nd streets will be staged to avoid disruption to LRT service along 1st and 2nd streets. Likewise, construction will be timed to avoid impacts to other LRT service downtown and at the Montague/Capitol Station or to the Caltrain service in the vicinity of the Diridon and Santa Clara Caltrain stations.

Bus Service Impacts

Bus service could be delayed when operating on streets with lane closures or increased congestion, as described under Section 4.19.3.1 above. Construction of the BART Alternative and MOS scenarios would also disrupt bus services operating on streets closed for construction. If Kato Road were closed during construction, AC Transit lines 22 and 253 would have to be rerouted for one year. The one- to three-month closures of East/West Santa Clara Street would also require temporary rerouting of VTA bus lines 22, 63, 64 65, 81, 300, and Highway 17. Buses using the intersections of East Santa Clara Street with 1st and 2nd streets would also have to be detoured around those intersections while they are being decked or rebuilt, for periods of one to three months. VTA bus lines that would be affected include lines 23, 66, 68, 72, 73, 82, 85, 180, 304, and 305.

4.19.3.5 Design Requirements and Best Management Practices for Rail and Bus Service Impacts

Baseline Alternative

There are no potential adverse impacts to transit service associated with the Baseline Alternative, as traffic flows would be maintained during the construction of the busway connectors. No route, stop, or service changes are anticipated during construction.

BART Alternative

The following design requirements and best management practices will be applied for the BART Alternative, as well as the MOS scenarios:

- To reduce bus transit impacts, in addition to the vehicular traffic mitigation measures proposed above, VTA will provide the public and transit users advance notice of proposed transit route, stop, and services changes and any other changes in stops and service. Bus route detours will minimize the number of bus stop changes.
- VTA will coordinate with Caltrain and UPRR during the Preliminary Engineering, Final Design, and construction phases of the BART Diridon/Arena and Santa Clara stations to minimize construction impacts at these locations.

4.19.3.6 Mitigation Measures For Rail and Bus Service Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to rail and bus service and to determine appropriate mitigation measures.

Baseline and BART Alternatives

With implementation of design requirements and best management practices, no mitigation is required for the Baseline and BART alternatives, nor the MOS scenarios.

4.19.3.7 Parking Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to parking.

Baseline Alternative

Construction activities for the Baseline Alternative are not expected to have adverse impacts on the availability of parking, as construction of the busway connectors may only temporarily eliminate a few on-street parking spaces along South Grimmer Boulevard and Fremont Boulevard.

BART Alternative

The cut-and-cover construction of the Civic Plaza/SJSU Station, Market Street Station, and either one of the proposed downtown crossover options has the potential to temporarily displace up to 76 to 98 metered and un-metered on-street parking spaces, 25 to 26 commercial loading spaces, 2 to 10 pedestrian loading spaces, and 16 to 19 parking space equivalents in bus loading zones. The commercial, pedestrian, and bus loading zones would most likely be relocated to adjacent blocks or side streets, potentially displacing an equal number of on-street parking spaces. Therefore, a maximum of 129 to 144 on-street parking spaces would be displaced under the BART Alternative, as well as the MOS scenarios. This assumes that all station and crossover construction would occur at the same time with East/West Santa Clara Street closed from 7th Street to Almaden Avenue. However, construction of these facilities will be staggered, making it unlikely that all of the spaces would be displaced at the same time. The impact at any particular time would be less than these maximum numbers.

Currently in the downtown area there are over 6,140 parking spaces in parking lots accessible to the public within one block of the proposed stations and crossover locations. In addition, over 3,250 new public or publicly accessible parking spaces are proposed by the City of San Jose, the San Jose Redevelopment Agency, and private developers to be constructed within one block of the BART Alternative. The temporarily displacement of up to 129 to 144 parking and loading spaces would be accommodated by the existing and planned publicly accessible parking lots totaling approximately 6,000 to 9,000 spaces. In addition, the Construction Impact Mitigation Plan would also include actions to minimize impacts to both parking loss and commercial loading spaces.

Construction workers would be expected to park on-site or in construction areas. Where the construction site would not accommodate worker parking, there would be some minor temporary inconvenience to local residents and businesses from the additional parking demand in their neighborhoods. Streets that provide parking would have local disruptions of parking during cut-and-cover construction, such as along East/West Santa Clara Street and the nearby portions of the cross streets shown on Figure 4.19-31. BART construction activities would also lead to disruption of Caltrain and HP Pavilion parking while the Diridon/Arena Station and replacement parking garages are being constructed over a period of four-and-a-half to five years.

4.19.3.8 Design Requirements and Best Management Practices for Parking Impacts

No design requirements or best management practices have been identified for parking impacts under the Baseline or BART alternatives, nor the MOS scenarios.

4.19.3.9 Mitigation Measures for Parking Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to parking and to determine appropriate mitigation measures.

Baseline and BART Alternatives

VTA and the City of San Jose will develop specific plans for the temporary relocation of displaced parking and loading zones along East/West Santa Clara Street. These plans will be included in the Construction Impact Mitigation Plan.

Provisions will be incorporated into the construction contracts to avoid construction worker parking impacts to residential areas or businesses under the Baseline or BART alternatives, as well as the MOS scenarios. Interim replacement parking will be provided for the Diridon/Arena Station parking disrupted by construction.

4.19.3.10 Pedestrians and Bicyclists Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to pedestrians and bicyclists.

Baseline Alternative

Construction activities for the Baseline Alternative are not expected to have adverse impacts on pedestrians and bicyclists. For example, construction of the busway connectors in Fremont would only displace pedestrian traffic to the opposite side of the road.

BART Alternative

Construction areas could affect access by pedestrians and bicyclists to business and residences adjacent to the construction areas under the BART Alternative and MOS scenarios.

4.19.3.11 Design Requirements and Best Management Practices for Pedestrians and Bicyclists Impacts

Under the Baseline and BART alternatives, VTA will contact and interview businesses and property owners potentially affected by construction activities. As noted in Section 4.19.2.1 above, interviews with commercial establishments would provide knowledge and understanding of how these businesses carry out their work, and identify business usage, delivery and shipping patterns and critical times of the day and year for business activities. Data gathered from these interviews will be used to develop worksite traffic control and pedestrians and bicyclists access plans. Among other elements, these plans will identify alternate access routes to maintain critical business activities.

The worksite traffic control and pedestrians and bicyclists access plans will also identify safety precautions for non-motorized traffic such as the separation of pedestrian movements from both motor vehicle traffic and construction activity, advance signage directing pedestrian traffic to alternate access routes, and safe and convenient pathways for pedestrians that reflect existing sidewalks or pathways.

Contractors will be required to maintain adequate pedestrians and bicyclists access in construction areas to minimize impacts to non-motorized traffic. This will include maintaining access and providing signs to indicate routes of access to businesses and other activities where normal access is obscured or impaired.

4.19.3.12 Mitigation Measures for Pedestrians and Bicyclists Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to pedestrians and bicyclists and to determine appropriate mitigation measures.

Baseline and BART Alternatives

With implementation of design requirements and best management practices, no mitigation is required for either the Baseline or BART Alternative.

4.19.4 AIR QUALITY

4.19.4.1 Air Quality Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to air quality.

Baseline and BART Alternatives

Construction for the Baseline and BART alternatives, as well as the MOS scenarios, would generate pollutant emissions from the following construction activities: (1) site preparation, (2) demolition of existing roadway, (3) construction workers traveling to and from construction sites, (4) delivery and hauling of construction supplies and debris to and from construction sites, and (5) fuel combustion by on-site construction equipment. These construction activities would create emissions of dust (particulate matter), fumes, equipment exhaust, and other air contaminants. Particulate matter less than 10 microns in diameter (PM_{10}) is the most adverse source of air pollution from construction, particularly during grading and excavation activities.

Table 4.19-5 quantifies construction emissions for the Baseline and BART alternatives. As can be seen from the table, PM_{10} pollutant emissions can be reduced substantially by mitigation.

Table 4.19-5: Construction Emissions

Project Alternative	Criteria Pollutant Emissions (pounds per day)					
	CO	ROG	NO_X	SO_X	PM_{10} (without mitigation)	PM_{10} (with mitigation)
Baseline	26	5	55	5	15	8
BART Alternative	134	25	282	23	385	193

Source: Terry A. Hayes Associates LLC, 2004.

Pollutant concentrations at various distances from the construction sites are provided in Table 4.19-6. Ambient PM_{10} concentrations currently exceed the state 24-hour and annual standards of 50 µg/m^3 and 20 µg/m^3, respectively. With implementation of design requirements and best management practices, PM_{10} concentrations during construction of the Baseline Alternative would be less than 5% over the ambient 24-hour and annual arithmetic mean concentrations. During construction of the BART Alternative, PM_{10} concentrations would be less than 5% over the ambient 24-hour concentration at a distance of approximately 1,050 feet or more from the construction sites. PM_{10} concentrations would be less than 5% over the ambient annual arithmetic mean concentration at a distance of approximately 500 feet or more from the construction sites. PM_{10} contributions from construction would last for several days at various sensitive receptor locations, as construction for the BART Alternative would occur on a linear basis. According to BAAQMD, if appropriate construction controls are implemented, PM_{10} emissions for construction activities would be considered less than significant.

Table 4.19-6: Pollutant Concentrations Near Construction Sites

Distance from Construction Sites (feet)	Pollutant Concentrations										
	CO (ppm) [1] [2]		NO_2 (ppm) [3] [4] [5]		SO_2 (ppm) [6] [7] [8]			PM_{10} without Mitigation (µg/m³) [9] [10]		PM_{10} with Mitigation (µg/m³) [10]	
	1-Hour	8-Hour	1-Hour	Annual Arithmetic Mean	1-Hour	24-Hour	Annual Arithmetic Mean	24-Hour	Annual Arithmetic Mean	24-Hour	Annual Arithmetic Mean
Baseline											
50	11.7	7.0	0.14	0.027	0.026	0.005	0.002	73	29	72	28
100	11.7	7.0	0.13	0.027	0.025	0.005	0.002	72	28	72	28
500	11.7	7.0	0.13	0.026	0.024	0.004	0.002	71	28	71	28
1,000	11.7	7.0	0.13	0.026	0.024	0.004	0.002	71	28	71	28
1,500	11.7	7.0	0.13	0.026	0.024	0.004	0.002	71	28	71	28
BART Alternative											
50	11.7	7.0	0.17	0.032	0.027	0.006	0.002	139	44	105	36
100	11.7	7.0	0.15	0.030	0.025	0.005	0.002	111	37	91	32
500	11.7	7.0	0.13	0.027	0.024	0.004	0.002	81	30	76	29
1,000	11.7	7.0	0.13	0.026	0.024	0.004	0.002	76	29	73	28
1,500	11.7	7.0	0.13	0.026	0.024	0.004	0.002	75	29	72	28

Notes:

[1] State 1-Hour Standard: 20 ppm; State 8-Hour Standard: 9.0 ppm

[2] CO concentrations include the one- and eight-hour ambient concentrations of 11.7 ppm and 7.0 ppm, respectively.

[3] State 1-Hour Standard: 0.25 ppm; Federal Annual Arithmetic Mean Standard: 0.053 ppm

[4] The California Ambient Air Quality Standards do not have NO_2 standards for the annual arithmetic mean.

[5] NO_2 concentrations include the one-hour and annual average ambient concentrations of 0.13 ppm and 0.03 ppm, respectively.

[6] State 1-Hour Standard: 0.25 ppm; State 24-Hour Standard: 0.04 ppm; Federal Annual Arithmetic Mean Standard: 0.030 ppm

[7] The California Ambient Air Quality Standards do not have SO_2 standards for the annual arithmetic mean.

[8] SO2 concentrations include the one-hour, 24-hour, and annual average ambient concentrations of 0.024 ppm, 0.004 ppm, and 0.002 ppm, respectively.

[9] PM10 concentrations include the 24-hour and annual average ambient concentrations of 71µg/m3 and 28 µg/m3, respectively.

[10] State 24-Hour Standard: 50 µg/m3; State Annual Arithmetic Mean Standard: 20 µg/m^3

Source: Terry A. Hayes Associates LLC, 2004.

The duration and concentrations of pollutant emissions for each phase of project construction are not available at this time, as such phasing details will not be determined until Preliminary Engineering. However, implementation of the BAAQMD construction control measures would reduce air quality impacts to acceptable levels, as stated in the BAAQMD California Environmental Quality Act Guidelines (December 1999).

The MOS scenarios would produce similar air quality related construction impacts as those for the full-build BART Alternative. However, deferred construction at Berryessa Station, Civic Plaza/SJSU Station, the Maintenance Facility, and parking facilities could generate temporary air quality impacts during MOS-2E.

4.19.4.2 Design Requirements and Best Management Practices for Air Quality Impacts

The BAAQMD approach to analysis of construction impacts 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. Below is a list of BAAQMD construction control measures that will be implemented for the Baseline or BART alternative, as well as the MOS scenarios.

- Water all active construction areas at least twice daily.
- Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard.
- Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas, and staging areas at construction sites.
- Sweep daily (with water sweepers) all paved access roads, parking areas, and staging areas at construction sites.
- Sweep streets (with water sweepers) if visible soil material is carried onto adjacent public streets.
- Hydroseed or apply (non-toxic) soil stabilizers to inactive construction areas (previously graded areas inactive for ten days or more).
- Enclose, cover, water twice daily, or apply (non-toxic) soil binders to exposed stockpiles (dirt, sand, etc.).
- Limit traffic speeds on unpaved roads to 15 mph.
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways.
- Replant vegetation in disturbed areas as quickly as possible.
- Install wheel washers for all exiting trucks or wash off the tires or tracks of all trucks and equipment leaving the site.
- Suspend excavation and grading activity in areas located near sensitive receptors when winds (instantaneous gusts) exceed 25 mph.

In addition to the BAAQMD construction control measures, to further reduce impacts associated with emissions of PM_{10} and other toxics, the following measures will be implemented.

- Establish an activity schedule designed to minimize traffic congestion around the construction site.
- Utilize EPA-registered particulate traps and other appropriate controls to reduce emissions of diesel particulate matter and other pollutants at the construction site.

- Locate construction equipment and staging zones away from sensitive receptors such as children and the elderly, as well as away from fresh air intakes to buildings and air conditioners.
- Use low sulfur fuel (diesel with 15 parts per million or less).
- Reduce use, trips, and unnecessary idling from heavy equipment.
- Lease newer and cleaner equipment (1996 or newer).
- Periodically inspect construction sites to ensure construction equipment is properly maintained at all times.

4.19.4.3 Mitigation Measures for Air Quality Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to air quality and to determine appropriate mitigation measures.

Baseline and BART Alternatives

With implementation of design requirements and best management practices (BAAQMD and other control measures), no mitigation is required for either the Baseline or BART alternative, or the MOS scenarios.

4.19.5 BIOLOGICAL RESOURCES AND WETLANDS

Construction activities for either the Baseline or BART alternative have the potential to disturb biological resources that are outside the area of direct, permanent impact, including vegetative communities that provide habitat for special status species and wetlands or other waters of the U.S. The locations of biological resources in the SVRTC project area and permanent impacts that would occur under either alternative are discussed in Section 4.4, *Biological Resources and Wetlands*. This section focuses on short-term impacts from construction activities and mitigation measures to minimize or avoid such effects.

4.19.5.1 Biological Resources and Wetlands Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to biological resources and wetlands.

Baseline Alternative

Construction activities for the I-680 to Warm Springs and Warm Springs to I-880 busway connectors could temporarily disrupt the habitat function of the non-native grassland areas that have been identified in the vicinity. 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 impacts could occur within areas immediately adjacent to project construction, or – as in the case of noise – extend to the entire 13-acre grassland area identified in the vicinity of the proposed busway connectors. Best management practices are proposed to avoid or reduce these effects.

Construction activities could also affect populations of Congdon's tarplant, if the plant is found to be present in this area. Congdon's tarplant has been documented or identified within the SVRTC, but only specifically in locations that would be affected under the BART Alternative as described below. The non-native grassland could also contain alkali milkvetch or diamond-petaled California poppy, but based on habitat factors and the documented distribution of these plants, they are not anticipated to be found in the SVRTC. Construction phase mitigation measures are proposed below.

Construction phase impacts to nesting or foraging habitat for loggerhead shrikes are also possible, but this impact 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.

Construction activities associated with the I-680 to Warm Springs and Warm Springs to I-880 busway connectors have the potential to affect nesting raptors in trees located near non-native grasslands. Construction activities and noise could cause nesting special-status and non-special-status raptors to abandon their nests causing egg failure or hatchling death. These impacts could occur within the immediate SVRTC or within the vicinity of the SVRTC. Mitigation measures are proposed to reduce these effects.

Bridge crossings located within the SVRTC 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, causing egg failure or hatchling death, or cause roosting bats to leave prematurely. Mitigation measures have been proposed for these impacts.

<u>BART Alternative</u>

Constructing the replacement rail-truck tank car transfer facility at the Sno-boy site, the South Calaveras Future Station, the Locomotive Wye Fremont Option, or the TPSS #5 site could temporarily disrupt the non-native grasslands habitat that has been identified in these areas. These grasslands provide habitat for Western burrowing owls; therefore, construction noise and other activities could disturb owl burrows, affect nesting behavior, or displace juvenile owls before they are self-sufficient. Temporary effects could occur to areas immediately adjacent to construction activities or – as in the case of noise – extend over the full 15.6 acres of grasslands identified in the vicinity of the BART Alternative alignment and facilities. Best management practices are identified to avoid or reduce such effects.

Construction activities with the replacement rail-truck tank car transfer facility at the Sno-boy site, the South Calaveras Future Station, the Locomotive Wye Fremont Option, or the TPSS #5 site have the potential to affect nesting special-status and non-special-status raptors in trees located near the non-native grasslands. Construction activities and noise could cause nesting raptors to abandon their nest causing egg failure of hatchling death. These impacts could occur within the immediate SVRTC or within the vicinity of the SVRTC. Mitigation measures are proposed to reduce these effects.

Construction in these areas could also affect populations of Congdon's tarplant, if the plant is present. Congdon's tarplant has been documented immediately west of the Sno-boy site and was identified in the vicinity of the UPRR Milpitas Yard. The non-native grassland could also contain alkali milkvetch or diamond-petaled California poppy, but based on habitat factors and the documented distribution of these plants, they are not anticipated to be found in the SVRTC. Construction phase mitigation measures are proposed below.

Construction phase impacts to nesting or foraging habitat for loggerhead shrikes are also possible, but this impact 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.

There is potential for temporary impacts to three areas of wetlands or other waters of the U.S. from construction activities for the BART Alternative, as well as the MOS scenarios, as summarized in Table 4.19-7, from north to south. Temporary impacts could also result from fill associated with temporary stream diversions, temporary access bridges, and falsework pilings. These impacts would be in addition

Table 4.19-7: Temporary Impacts of Construction Activities for the BART Alternative to Wetlands/Other Water of the U.S. *and Vegetation Communities*	
Location/Type of Impact	**Acreage Temporarily Affected**
Wetlands/Other Water of the U.S	
Widen railroad bridge across Berryessa Creek (Waters of the U.S.)	0.001 acres
Widen railroad bridge across Wrigley Creek north of Calaveras Boulevard (Waters of the U.S.)	0.074 acres
Widen railroad bridge across Lower Silver Creek north of Alum Rock subway portal (Waters of the U.S.)	0.018 acres
Total Acreage Temporarily Affected	**0.093 acres**
Vegetation Communities	
Central Coast cottonwood-sycamore riparian forest	2.6 acres
Total Acreage Temporarily Affected	**2.6 acres**
Source: Parsons Corporation, Earth Tech, Inc., 2003.	

to the permanent effects described in Section 4.4.3.2, *Biological Resources and Wetlands/Impacts to Wetlands and Other Waters of the U.S*. Construction phase mitigation measures are proposed including restoration of temporarily disturbed areas to pre-construction conditions at the conclusion of construction activities, to the maximum extent practicable.

There is also some potential for impacts to steelhead and Chinook salmon fisheries if construction materials were to enter waterways or construction activities were to temporarily impede fish passage. Therefore, installation of falsework and stream diversions (including temporary dewatering) in the course of bridge construction will minimize impacts to migrating anadromous fish and other in-stream species. Such plans will be consistent with VTA's Fish Friendly Channel Design Guidelines.

Construction-related activities at the Guadalupe River, Coyote Creek, Upper Penitencia Creek, and Lower Silver Creek have the potential to affect California red-legged frogs and their habitat. In-stream work could disturb red-legged frogs occurring in the waterways or construction activities on the banks of these waterways could disturb aestivating California red-legged. Mitigation measures proposed for these impacts are described below.

Construction-related activities at the Guadalupe River, Coyote Creek, Upper Penitencia Creek, and Lower Silver Creek have the potential to impact southwestern pond turtles. In-stream work could disturb southwestern pond turtles occurring in the waterways or construction activities on the banks of these waterways could disturb nesting habitat. Mitigation measures proposed for these impacts are described below.

Impacts to up to 2.6 acres of Central Coast cottonwood-sycamore riparian forest along Berryessa, Upper Penitencia, and Coyote creeks could occur as a result of construction of the Montague/Capitol and Berryessa stations. Protective measures will be able to avoid encroachment on the riparian corridor and effects on Central Coast cottonwood-sycamore riparian forest in constructing the BART aerial structure crossing Upper Penitencia Creek at the Berryessa Station, in constructing the Parking Structure Northeast Option at this station, and in using the proposed laydown area at Mabury Road. The existing Mabury Road Bridge over Coyote Creek may be widened as part of the City of San Jose and Caltrans US 101/Mabury Road Interchange Project. This could encroach upon the Coyote Creek riparian corridor. Encroachment on the riparian forests could affect nesting special-status and non-special-status raptors, nesting swallows, and roosting bats. However, this project is currently unfunded and environmental analysis has not begun. If the interchange project were to move forward in an overlapping construction schedule with the BART Alternative, mitigation measures have been proposed for impacts due to the BART Alternative.

Bridge crossings located within the SVRTC 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, causing egg failure or hatchling death, or cause roosting bats to leave. Mitigation measures have been proposed for these impacts.

4.19.5.2 Design Requirements and Best Management Practices for Biological Resources and Wetlands Impacts

The following design requirements and best management practices will be followed during construction of the Baseline or BART alternatives, as well as the MOS scenarios. It is anticipated that implementing these measures will avoid many construction-phase impacts.

- Design requirements and best management practices will be employed to ensure that construction materials are not allowed to enter open waterways or to impede water flow and fish passage. In addition to the requirements of the NPDES Construction General Permit, project designers will use the construction-phase requirements of the Storm Water Quality Management Plan (for Alameda County co-permittees) and the Urban Runoff Management Plan (for Santa Clara County co-permittees), respectively, to specify potential construction-phase storm water management methods.
- All natural communities and wetland areas located adjacent to the construction zone that could be affected by construction activities will be temporarily fenced off and designated as Environmentally Sensitive Areas (ESAs) to prevent accidental intrusion by workers and equipment.
- Installation of falsework and stream diversions in the course of bridge construction will minimize impacts to migrating anadromous fish and other in-stream species through incorporation of VTA's Fish Friendly Channel Design Guidelines. These guidelines address concerns related to high water velocities, jumps to channelized inlets or outlets, shallow water depths, and lack of resting pools thereby insuring that construction activities do not become barriers to fish passage. These guidelines have been used, as necessary, in all of VTA's rail and highway projects since 2001.
- Clearing and grubbing procedures will specify that only those trees and plants designated for removal will be removed.
- Excavation techniques will be used that ensure the stability of subsurface materials and the retention of excavated materials within construction areas.
- Construction within wetlands will be avoided during the rainy season to prevent excess siltation and sedimentation.
- Materials and fluids generated by construction activities will be placed away from wetland areas or drainages until they could be disposed of at a permitted site.
- Central Coast cottonwood-sycamore riparian forest areas identified along Berryessa Creek (bordering Milpitas Boulevard) in the Montague/Capitol Station area, along Upper Penitencia and Coyote creeks at the Berryessa Station, and in the vicinity of the proposed construction laydown area at Mabury Road near Coyote Creek will be identified and marked with protective orange fencing to avoid disturbance or accidental intrusion by workers or equipment.

4.19.5.3 Mitigation Measures for Biological Resources and Wetlands Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to biological resources and wetlands and to determine appropriate mitigation measures.

Baseline and BART Alternatives

Construction phase mitigation measures for the Baseline and BART alternatives, as well as the MOS scenarios, will be stipulated in a Mitigation Monitoring and Reporting Program that will be included in the project's plans and specifications. Furthermore, USFWS, NOAA Fisheries, ACOE, and CDFG will be consulted regarding potential impacts and appropriate construction-phase mitigation measures. Construction phase mitigation measures will include:

- Providing a riparian corridor buffer zone along the banks of creeks. Where riparian vegetation will be affected unavoidably, habitat quality will be assessed and confirmed with regulatory agencies. The size of the area and the quality of the resources that will be affected will determine the requirements of the compensatory mitigation to be carried out. The site-specific mitigation plan will assure replacement, or enhancement, of habitat values, such as the density of the overstory vegetation, reintroduction of native species, and development of complex vegetation structure, to the maximum extent practicable;
- Complying with ACOE nationwide permit conditions associated with pre-construction notification, such as proposed compensatory mitigation and restoration plans;
- Conducting pre-construction surveys for Congdon's tarplant during the June to November flowering periods. Any identified areas will be marked as ESAs and protected with orange fencing until after seed-set to prevent accidental intrusion by construction workers and equipment. Coordination of specific compensatory mitigation measures will be carried out with CDFG to address any unavoidable impacts;
- Avoiding areas occupied by Congdon's tarplant or other special status species plants to the maximum extent practicable;
- Where impacts to areas found to support Congdon's tarplant populations, collecting seeds to be stored and grown for plant conservation following CNPS and CDFG plant protection guidelines;
- Conducting pre-construction surveys for California red-legged frogs prior to any construction activities occurring at Guadalupe River, Coyote Creek, Upper Penitencia Creek, and Lower Silver Creek;
- Having a USFWS permitted biologist relocate California red-legged frogs encountered in the work area. Installing exclusionary fencing to prevent California red-legged frogs from re-entering the work area;
- Conducting pre-construction surveys for southwestern pond turtles prior to any construction activities occurring at Guadalupe River, Coyote Creek, Upper Penitencia Creek, and Lower Silver Creek;
- Having a qualified biologist relocate southwestern pond turtles encountered from the work area. Installing exclusionary fencing to prevent southwestern pond turtles from re-entering the work area;
- Conducting pre-construction surveys in Western burrowing owl habitat areas within established limits of the project area of disturbance no earlier than two weeks prior to the start of construction and stipulation of measures to be followed before proceeding with construction if owls are found;

- Delaying construction within specified distances from occupied burrows if it is determined that construction would disrupt nesting behavior until the owls are not nesting or juvenile owls are self-sufficient;
- Conducting pre-construction surveys for nesting special-status and non-special-status raptors within 0.25 mile of the SVRTC during the nesting season (generally February through August);
- Delaying construction activities within specified distances from active raptor nests if it is determined that construction would disrupt nesting behavior until raptors are no longer nesting or the fledglings are self-sufficient;
- Conducting pre-construction surveys for nesting swallows under bridge structures and in riparian habitat located within the SVRTC during the nesting season (generally March through August);
- Delaying construction activities within specified distances from occupied swallow nests if it is determined that construction would disrupt nesting behavior until swallows are no longer nesting or the fledglings are self-sufficient;
- Surveying vegetation and structures that could support nests or roosts of species such as migratory songbirds and non-game mammals, such as bats, prior to the onset of construction activities;
- A combination of avoidance, installation of exclusion devices, and monitoring to assure protection of migratory birds and non-game mammals;
- Educating construction workers regarding the sensitive plant and wildlife species in the project vicinity, including methods to avoid or minimize impacts to biological resources; and
- Conducting pre-construction surveys for alkali milkvetch and diamond-petaled California poppy during their bloom period (March to June and March to April). If plants are found, they will be marked as ESAs and protected by orange safety fencing, and compensatory measures will be coordinated with CDFG. These measures will prevent declines of core populations.

Other specific measures may be identified during consultations with regulatory and resources agencies. It is anticipated that project-specific special conditions will be stipulated as part of the ACOE Section 404 permit and CDFG Streambed Alteration Agreement. The Section 401 Water Quality Certification also may stipulate waste discharge requirements.

4.19.6 COMMUNITY SERVICES AND FACILITIES

4.19.6.1 Community Services and Facilities Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to community services and facilities.

Baseline Alternative

The bus transit center and three aerial busway connectors would be constructed on presently vacant land, which would avoid impacts to existing public facilities during construction. Construction phase effects on I-680, I-880, and the BART Warm Springs Station are discussed in Section 4.19.3 above.

BART Alternative

The BART Alternative and MOS scenarios 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 BART Alternative and MOS scenarios could involve temporary detours or street closures in the vicinity of the project. These are expected to have little or no effect on the ability to access public services and facilities within the SVRTC. 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 4.19.3 above.

4.19.6.2 Design Requirements and Best Management Practices for Community Services and Facilities Impacts

The following best management practices are proposed to minimize disruption to emergency services response for the Baseline and BART alternatives, as well as the MOS scenarios:

- VTA will coordinate with local emergency service providers in developing construction phase detour plans.
- Emergency service providers will be provided advance notice of any road closures and detour routes.

4.19.6.3 Mitigation Measures for Community Services and Facilities Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to community services and facilities and to determine appropriate mitigation measures.

Baseline and BART Alternatives

With implementation of design requirements and best management practices, no mitigation is required for the Baseline and BART alternatives, nor the MOS scenarios.

4.19.7 CULTURAL AND HISTORIC RESOURCES

4.19.7.1 Archaeological Resources Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to archaeological resources.

Baseline Alternative

Construction of the Baseline Alternative is not anticipated to disturb any cultural resources, based on findings of the ASSR summarized in Section 4.6, *Cultural and Historic Resources*, which identified no known cultural resources in the APE for the Baseline Alternative.

BART Alternative

Construction of the BART Alternative and MOS scenarios may disturb cultural resources, particularly in areas of high sensitivity or where cultural deposits are known to exist, as described in Section 4.6.3.2, *Cultural and Historic Resources/Archaeological Resources Impacts*.

4.19.7.2 Design Requirement and/Best Management Practices for Archaeological Resources Impacts

No design requirements or best management practices have been identified for archaeological resource impacts for the Baseline and BART alternatives, nor the MOS scenarios.

4.19.7.3 Mitigation Measures for Archaeological Resources Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to archaeological resources and to determine appropriate mitigation measures.

Baseline and BART Alternatives

An MOA and supporting CRTP will be developed and implemented for the Baseline and BART alternatives, and the MOS scenarios. Appropriate mitigation measures are provided in Section 4.6.6.1, *Cultural and Historic Resources/Archaeological Resources Mitigation*.

4.19.7.4 Historic Architectural Resources Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to historic architectural resources.

Baseline and BART Alternatives

No construction-period adverse impacts to any of the 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 visual impacts 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 SVRTC.

Long-term project effects on historic architectural resources within the project APE, along with mitigation measures proposed to reduce such effects, are described in Section 4.6.4.2, *Cultural and Historic Resources/Historic Architectural Resources Impacts*.

4.19.7.5 Design Requirements and Best Management Practices for Historic Architectural Resources Impacts

With no construction phase impacts, no design requirements or best management practices have been identified for historic architectural resource impacts.

4.19.7.6 Mitigation Measures for Historic Architectural Resources Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to historic architectural resources and to determine appropriate mitigation measures.

Baseline and BART Alternatives

An MOA will be developed and implemented for the Baseline and BART alternatives, and the MOS scenarios. Refer to Section 4.6.6.2, *Cultural and Historic Resources/Historic Architectural Resources Mitigation*, for a discussion of the MOA, which addresses construction impacts.

4.19.8 ELECTROMAGNETIC FIELDS

4.19.8.1 Electromagnetic Fields Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine EMF or EMI impacts related to construction.

Baseline and BART Alternatives

There would be no construction phase EMF or EMI impacts associated with the SVRTC project under the Baseline or BART alternatives, or the MOS scenarios. Construction activities typically would not involve the use of major electrical systems in the vicinity of EMF or EMI sensitive land uses. In the event such systems (e.g., temporary electrical generators or power transmission networks) are installed to support construction, steps will be taken to avoid potential effects on sensitive land uses. These steps will include locating major electrical systems away from sensitive receptors and shielding electrical systems.

4.19.8.2 Design Requirements and Best Management Practices for Electromagnetic Fields Impacts

Since no construction phase impacts have been identified for electromagnetic fields, no design requirements or best management practices are proposed for the Baseline and BART alternatives, or the MOS scenarios.

4.19.8.3 Mitigation Measures for Electromagnetic Fields Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine EMF or EMI impacts related to construction and to determine appropriate mitigation measures.

Baseline and BART Alternatives

Mitigation measures are not required for the Baseline and BART alternatives, or the MOS scenarios.

4.19.9 GEOLOGY, SOILS, AND SEISMICITY

4.19.9.1 Geology, Soils and Seismicity Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine geology, soils, and seismicity impacts during construction.

Baseline and BART Alternatives

Soil stability for the Baseline and BART alternatives, as well as the MOS scenarios, is associated with slope stability related to cuts and new embankments. Settlement impacts are associated with new structural loads, basement excavation or tunnel bore. The soils through which excavation will be performed are medium-stiff to stiff clays and sands that range from medium dense to dense. Maximum settlement values could range from one inch to three inches. Given the number of buildings that could be influenced by the excavations and the types of buildings involved, it is unlikely that settlements significantly higher than one inch could be tolerated. Hence, the shoring system will be designed to be very stiff to control settlement to values on the order of one inch. In addition, the use of a TBM, which installs the tunnel liners as it moves forward, is an efficient construction method to deal with settlement.

The process of tunneling relieves the in-situ stresses in the ground by allowing a certain amount of inward movement of soil ahead of the tunnel and around the perimeter. This soil movement at depth then migrates to the surface. Additional settlement may be induced by consolidation due to lowering of the groundwater table either intentionally to facilitate construction or unintentionally by leaks in the tunnel lining. A discussion of impacts due to consolidation of clays due to drawdown of the groundwater table resulting from dewatering during excavation is found in Section 4.19.15 below.

Excavation for the four underground stations, Alum Rock, Civic Plaza/SJSU, Market Street, and Diridon/Arena, will result in significant hydrostatic pressures at the subgrade level. Excavation at the Alum Rock Station is anticipated to leave a relatively thin clay cap above the sand causing the potential for uplift of the excavation bottom due to the weight of the clay cap being insufficient to resist uplift pressures.

4.19.9.2 Design Requirements and Best Management Practices for Geology, Soils, and Seismicity Impacts

An evaluation of slope stability of the earth embankments and retained fills or cuts will be conducted, and implementation of best management practices will minimize the impact of soil instability for the Baseline and BART alternatives, as well as the MOS scenarios.

The potential settlement impacts on new structures will be minimized by determining the ultimate quantity and rate of settlement and by designing compatible systems that can tolerate the estimated settlement. The shoring system will be designed to control settlement to on the order of one-inch or less. For existing structures, these impacts would be mitigated by requiring rigid construction shoring systems and underpinning existing buildings, as needed.

4.19.9.3 Mitigation Measures for Geology, Soils and Seismicity Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine geology, soils, and seismicity impacts during construction and to determine appropriate mitigation measures.

Baseline and BART Alternatives

With implementation of design requirements and best management practices, no mitigation is required.

4.19.10 HAZARDOUS MATERIALS

4.19.10.1 Hazardous Materials Impacts

Hazardous materials impacts during construction for the Baseline and BART alternatives can be divided into impacts caused by existing soil contamination, existing groundwater contamination, structure demolition, and potential surface water contamination.

Since the construction envelope of the MOS scenarios is similar to the full-build BART Alternative, hazardous materials impacts would be encountered at the same sites. Ground disturbance is expected to occur in the initial construction phase; although, building demolition to construct the Berryessa Station could be deferred to the second phase of construction.

<u>Impacts Due to Soil Contamination</u>

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts due to soil contamination.

Baseline Alternative

The construction of three busway connectors from I-680 to Warm Springs (I-680 WS), from Warm Springs to I-880 (WS I-880), and from I-880 to Montague Expressway under the Baseline Alternative would likely encounter soil contamination during operations such as shallow excavations, drilling, and grouting for construction of deep foundations. Based on the types of structures required for the busway connectors and soil conditions at the site, it is anticipated that a relatively small volume of waste soil would be generated during construction. The potential for contaminated soil exposure to workers and the surrounding population and environment is therefore limited.

Construction activities may also emit contaminants into ambient air. Dust laden with low volatility chemicals, such as metals and some petroleum products, is a common by-product of earthmoving activities in contaminated soils. The evaporation of volatile organic compounds (VOCs), such as chlorinated solvents and gasoline, upon excavation and exposure to ambient air is also a potential impact.

BART Alternative

The database research revealed numerous potential hazardous materials sources along the SVRTC where millions of cubic yards of soil must be removed during BART construction. These sources present the potential for impacts during construction in terms of exposure of construction workers to hazardous materials, emissions of hazardous dusts, releases of contaminated water, and off-site transport of hazardous materials.

Impacts would differ according to whether the BART alignment is at grade, in a retained cut, in a subway tunnel, in a cut-and-cover station in downtown San Jose, or on aerial structure above grade. Construction of aerial structures would encounter the least soil contamination, since the only soil excavated would be during foundation construction work such as pile or bent installation. Since at-grade sections of the line have typically been planned so the top of rail would be three or four feet above existing ground, only relatively small quantities of near-surface soil contamination would be encountered. Replacement track for UPRR use and foundations for structures such as stations and power substations would have similar impacts as at-grade portions of the BART Alternative.

The greatest amount of soil contamination is likely to be encountered during the construction of retained cuts, when construction crews will encounter both near-surface and deeper soil. Deeper soil may be contaminated either as a result of downward percolation of near-surface contamination or by the flow of groundwater-borne contaminant plumes. Somewhat less soil contamination is expected to be encountered in constructing the subway tunnel than in constructing retained cuts. Nonetheless, separating clean and contaminated soil during tunneling would be particularly difficult during subway tunnel construction, so a larger volume of combined soil containing relatively low contamination levels may need to be managed.

Construction may also emit contaminants into ambient air. Dust laden with low volatility chemicals, such as metals and some petroleum products, is a common by-product of earthmoving activities in contaminated soils. The evaporation of VOCs, such as chlorinated solvents and gasoline, upon excavation and exposure to ambient air is also a potential impact.

Impacts Due to Structure Demolition

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts due to structure demolition.

Baseline Alternative

For the Baseline Alternative, demolition or renovation of structures would be anticipated for construction of the I-680 WS and WS I-880 busway connectors on the south edge of Grimmer Boulevard. For the construction of the I-880 to Montague Expressway busway connector, some pavement reconstruction activities may be needed. The hazardous materials impact of these demolition or renovation activities is expected to be relatively minor.

BART Alternative

Portions of the BART Alternative and MOS scenarios would require demolition or renovation of existing buildings or other structures. The hazardous materials most likely to be encountered during renovation or demolition of these structures include asbestos in flooring tiles, mastic or pipe insulation, lead-based paint, and fluorescent lighting ballasts containing polychlorinated-biphenyls (PCBs). Demolition of structures at the Berryessa Station would be deferred until the second phase of construction.

Impacts Due to Groundwater Contamination

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts due to groundwater contamination.

Baseline Alternative

In the Baseline Alternative, construction of the three busway connectors may involve operations below the groundwater table. These activities may include excavations, drilling, grouting, and construction of deep foundations. Based on the types of structures proposed, however, limited or no dewatering operations are anticipated. Therefore, exposure to contaminated groundwater is not expected.

BART Alternative

Groundwater contamination would likely be encountered during construction of retained cuts (most of which will extend below the water table), the subway tunnel, and cut-and-cover subway stations for the BART Alternative and MOS scenarios. Adverse effects to workers from ingestion or skin contact with contaminated water are possible during construction dewatering.

Chlorinated solvent contamination would be encountered in groundwater in the cut just north of the Montague Expressway, due to the plume from the North American Transformer and Jones Chemical sites. Other types of contaminants, including heavy metals and petroleum hydrocarbons, may be encountered at this and other locations along retained cuts. Given the ubiquitous nature of dissolved petroleum and chlorinated solvents in the downtown San Jose area, encounters with at least low levels of dissolved contaminants are anticipated during tunneling. Cut-and-cover construction of BART stations, which must reach their target depths using dewatering to pass through the groundwater table, would have a very high likelihood of encountering any groundwater contamination that exists in the area. Encounters with contaminated groundwater are also anticipated during construction of the Civic Plaza/SJSU Station, due to the Deluxe Cleaners and Downtown Auto Express groundwater contaminant plumes immediately up gradient of the proposed station location.

After construction, the retained cuts or subway tunnels may affect groundwater flow directions and pathways. Without mitigation measures, the concrete U-walls used in retained cuts may divert the normal flow of contaminated groundwater, potentially causing the mounding of groundwater upgradient of these obstacles to flow. It may also cause the spreading of chemicals into previously uncontaminated groundwater at lower depths or in adjacent areas. Mitigation measures will be used to reduce these effects.

Build-up of groundwater upgradient of the subway tunnel is not expected to have an adverse impact. Since the subway tunnel will be constructed at a minimum depth of 30 feet below ground surface at the tunnel crown, well below the water table (which is approximately 15 feet below ground surface in the San Jose area), groundwater will be able to flow above and below the tunnel structure. Groundwater flow analysis, including computer modeling, will be used to verify that no adverse effects on pollutant migration pathways will occur. If required, the mitigation measures proposed below can be applied.

Impacts Due to Surface Water Contamination

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts due to surface water contamination.

Baseline and BART Alternatives

Surface water contamination during construction of either the Baseline or BART alternatives, as well as the MOS scenarios, may result from contact between surface water, such as rainwater runoff, and hazardous materials, such as contaminated soil or spilled hazardous materials used in construction. Surface water contamination may also result from spills of untreated contaminated groundwater generated during dewatering. Mitigation is proposed below.

Runoff may contain hazardous waste levels that are unacceptable for waters entering local creeks or San Francisco Bay. Contaminants in runoff may be dissolved chemicals, separate phase chemicals such as oily hydrocarbon sheens, sediments carried by flowing surface water, or the chemicals inside those sediments. Surface water contamination may also result from contact with hazardous materials used in construction of either the Baseline or BART alternative, such as equipment-related fuels, lubricants, and antifreeze.

Contaminated groundwater may be brought to the surface during dewatering and treatment. Releases of untreated groundwater at the surface may result from pipe and equipment leaks or breaks or the accidental release of groundwater that has not been properly treated. Large volume releases may find their way to the storm drain system, waterways, and eventually to San Francisco Bay. Mitigation measures are proposed below.

4.19.10.2 Design Requirements and Best Management Practices for Hazardous Materials Impacts

Impacts from hazardous materials encountered during construction can be avoided or reduced through the implementation of construction best management practices, which are commonly used during construction projects. These and other measures identified below apply to both the Baseline and BART alternatives, as well as the MOS scenarios, unless otherwise specified.

Soil Contamination

For excavations planned within the banks of streams, a sediment characterization plan will be prepared and provided to the San Francisco Bay Regional Water Quality Control Board (RWQCB). The RWQCB will review and recommend measures to ensure that the potential for disturbances to surface waterways and any adjacent wetlands caused by migration of hazardous materials disturbed during excavation will be minimized. To avoid health effects on construction workers, all personnel involved in the soil and sediment characterization program will be trained in accordance with the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) standard (29 CFR 1910.120). A site-specific health and safety plan defining potential contaminants will be developed and implemented. HAZWOPER-trained personnel will wear proper personal protective equipment, as required. Proper decontamination procedures for workers and equipment will be followed. The same health and safety standards will apply during construction in contaminated material.

Soil that has been exposed for more than 20 years in the median or on the shoulder of highways will be tested for lead prior to the beginning of construction. One key method of mitigating the effects of such contamination would be to identify and segregate soil according to types of contamination, using data from the detailed soil and sediment characterization program and in some cases (with regulatory agency approval) providing for encapsulation on-site. In other cases, proper disposal procedures will require off-site disposal in specially designed, constructed, and permitted landfills. Materials for off-site disposal will be shipped by licensed Class A hazardous materials transporters in accordance with Caltrans guidelines.

To minimize hazardous emissions that may impact construction workers and the public in nearby areas, dust control measures will be employed around contaminated soil. These include spraying water to control dust emissions or applying dust palliatives.

The presence of exposed or temporarily stored hazardous materials along the SVRTC may affect the actions of emergency response teams. The construction manager will coordinate with emergency response providers to notify them when hazardous materials are present or are no longer on-site, as detailed in the site-specific health and safety plan. Emergency response personnel will be available whenever hazardous materials are found to be present.

Groundwater Contamination

Groundwater flow rates during dewatering would have to be estimated using pump tests and computer modeling. As with soil contamination, the groundwater characterization and treatment program will employ HAZWOPER-trained personnel using a site-specific health and safety plan and proper personal protective equipment.

The spreading of groundwater contamination and the rising of the water table due to groundwater flow directions and pathways affected by the retained cuts or subway tunnels after construction, will be minimized by routing water underneath the U-wall through the installation of highly permeable preferential flow pathways underneath the U-wall during construction. Channels of highly permeable gravel placed perpendicularly beneath the U-wall, crossing from one side of the U-wall to the other, will create appropriate preferential flow pathways. The frequency of placed gravel channels will be determined based on groundwater flow analysis.

Should measures be required to reduce groundwater flow impacts from the tunnel, various remedial measures can be employed. High permeability gravel channels can be placed in selected locations above the subway tunnel using trenching in areas with few access constraints, microtunnelling or a bore/jack approach in areas with more access constraints.

Surface Water Contamination

Minimizing the availability, volumes, and concentrations of hazardous materials above the ground surface will reduce the risk of surface water contamination during construction. One important measure will be to obtain and adhere to the requirements the statewide general NPDES permit for "Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity (General Permit)" (Order No. 99-08-DWQ, NPDES No. CAS000002). The conditions of the General Permit apply to all construction projects covering at least one acre. Among the conditions, the permit requires the preparation of a Storm Water Pollution Prevention Plan (SWPPP), which includes best management practices to minimize pollution and periodic inspections of the construction site to identify releases. An NOI to discharge under the General Permit must be filed with the RWQCB before discharge can commence.

In Santa Clara County, the cities of Milpitas, San Jose, and Santa Clara must comply with Board Order 01-119 (an amendment of Board Order 01-024 for NPDES Permit No. CAS029718) issued to the Santa Clara Urban Runoff Pollution Prevention Program, with which the cities are co-permitees. This permit requires that the cities control pollutant discharge from their storm drains. In Santa Clara County, this is achieved by requiring that dischargers follow the Santa Clara Urban Runoff Pollution Prevention Program's recommended best management practices for construction activities, as contained in "Blueprint for a Clean Bay" and the "California Storm Water Construction BMP Handbook." Similar requirements are expected to take effect in Fremont before construction of either the Baseline or BART alternative under the provisions of the Alameda Countywide Clean Water Program. The Clean Water Program helps participants fulfill their permit obligations and includes the preparation of detailed reports that describe what each participant is doing to prevent stormwater pollution. Through the program, activities are coordinated with other pollution prevention programs, such as wastewater treatment, hazardous waste disposal, and waste recycling.

The Clean Water Program has developed a Storm Water Quality Management Plan that describes an approach to reducing stormwater pollution. The Storm Water Quality Management Plan for Fiscal Years 2001/02 through 2007/08 is the Clean Water Program's third to date, and serves as the basis of the Clean Water Program's NPDES permit (Alameda Countywide Clean Water Program 2001). A portion of the SVRTC project is within the boundaries addressed by the plan.

BART Design Criteria require drainage ways that would collect runoff from BART facilities be designed to convey the surface flow generated by a 10-year storm event. This applies to the BART Alternative and MOS scenarios. Therefore, the design of all parking and roadway areas will be submitted to the ACFCWCD, SCVWD, MDPW, SJDPW, SCDPW, and other regulatory agencies responsible for review.

In summary, the project incorporates stormwater treatment best management practices that are consistent with SCVURPPP, ACCWP, and the NPDES General Permit will be implemented during the construction and operational phases of the project to reduce stormwater-borne pollutants at their source.

To minimize additional risks of surface water contamination caused by site contaminants, contact between water and aboveground contaminants will be minimized by characterizing contaminated soil for disposal prior to excavation and hauling it off-site.

The risk of releasing untreated dewater product to surface waters will be reduced by using appropriate water testing and treatment systems throughout the dewatering process.

4.19.10.3 Mitigation Measures for Hazardous Materials Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts related to hazardous materials and to determine appropriate mitigation measures.

Baseline and BART Alternatives

The measures identified below apply to both the Baseline and BART alternatives, as well as the MOS scenarios, unless otherwise specified.

Mitigation Measures for Soil Contamination

During Final Design, a Phase Two site assessment will be performed for areas where hazardous material contamination is anticipated. Prior to the start of excavation, a detailed characterization of soil contamination levels in all soil to be excavated will be performed. The detailed characterization will serve to identify the lateral and vertical extent of contamination, characterize contaminated material for disposal, evaluate all chemicals of concern in each area, and determine the potential for any health and safety effects. The remediation requirements identified per local, state, and federal regulations will be implemented as part of the project.

In addition, the "Site Management Plan Former Ford Automobile Assembly Plant Formerly 1100 South Main Street Milpitas, California" (SMP) addresses environmental conditions, including soil and groundwater on the Great Mall property. In a letter dated April 16, 2001, the RWQCB specified several actions required for ongoing and future development activities at the Great Mall. Activities by VTA on Great Mall property will comply with the SMP and RWQCB requirements.

Mitigation Measures for Structure Demolition

Best management practices for hazardous materials encountered during demolition or renovation operations of existing structures will focus on proper handling of hazardous building materials, such as asbestos, lead-based paint, or lighting ballasts containing PCBs. Prior to the start of demolition, properly certified personnel will perform a detailed evaluation of building materials to determine if any hazardous materials are present. The evaluation will identify suspect building materials and samples will be collected and analyzed for the presence of hazardous materials of concern.

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 OSHA. Abatement of other hazardous building materials is usually performed at the same time as asbestos abatement.

Through the adoption of these mitigation measures, the net impact of hazardous materials encountered in demolition or renovation operations can be reduced to near zero.

Mitigation Measures for Groundwater Contamination

As with soil contamination, groundwater contaminant levels in each area will be characterized and this information will be used to design groundwater treatment systems for use during project construction. Both the ACFCWCD and the SCVWD require permits for monitoring well installation.

Contaminated groundwater collected during dewatering will be treated prior to discharge under an appropriate discharge permit. A site-specific NPDES permit or a functionally equivalent permit will be required.

Measures will be taken to ensure that the volume of water discharged does not overwhelm the water drainage system, especially in storm drains or sewer pipes. Treatment necessary before discharge and other measures to mitigate impacts will be consistent with regulatory agency input and consolidation.

Mitigation Measures for Surface Water Contamination

With implementation of design requirements and best management practices, no mitigation is required.

4.19.11 NOISE AND VIBRATION

4.19.11.1 Noise Impacts

The FTA guidance manual, *Transit Noise and Vibration Impact Assessment* (FTA Report DOT-T-95-16, April 1995), provides guidelines for assessing impact from construction noise, as summarized in Table 4.19-8. These guidelines are based on land use and time of day and are given in terms of Leq for an eight-hour work shift. Local ordinances also restrict construction to certain time periods as highlighted in Table 4.19-9.

Table 4.19-8: FTA Construction Noise Guidelines

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

Source: Noise and Vibration Technical Report, HMMH, 2003.

Construction noise varies greatly depending on the construction process, type and condition of equipment used, and layout of the construction site. Many of these factors are traditionally left to the contractor's discretion, which makes it difficult to accurately estimate levels of construction noise. Overall, construction noise levels are governed primarily by the noisiest pieces of equipment. For most construction equipment, the engine, which is usually diesel, is the dominant noise source. This is particularly true of engines without sufficient muffling. For special activities such as impact pile driving and pavement breaking, noise generated by the actual process dominates.

Table 4.19-9: Construction Hours by Jurisdiction	
Location	**Allowable Construction Time 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: Noise and Vibration Technical Report, HMMH, 2003.	

Table 4.19-10 summarizes some of the available data on noise emissions of construction equipment from the FTA guidance manual. Shown are the average of the Lmax values at a distance of 50 feet. Although the noise levels in the table represent typical values, there can be wide fluctuations in the noise emissions of similar equipment. Construction noise at a given noise-sensitive location depends on the magnitude of noise during each construction phase, the duration of the noise, and the distance from the construction activities.

Construction noise projections were made based on construction scenarios described in Section 4.19.2 above. Actual noise impact would be dependent on the methods and procedures used by the selected contractor. The construction noise projections do not account for shielding from existing noise walls and privacy barriers because the construction scenarios are not detailed enough to allow for these types of calculations. In particular, the location of equipment inside a construction zone has a large effect on the noise exposure to nearby sensitive receptors. This information is typically not available at this stage.

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine noise impacts from construction.

Baseline Alternative

Potential for substantial noise impact would exist near the construction of the new bus connectors and at construction staging areas where the contractor can receive delivery of materials and equipment, perform routine maintenance of equipment, and move excavated material. Primary sources of noise impact near at-grade construction would be diesel engines on construction equipment and dump trucks along local haul routes.

The primary source of construction noise for retained fill and aerial structures would be diesel engine noise from construction equipment. If impact pile driving were avoided, the maximum distances to impact would be 300 feet for daytime noise and 1,000 feet for nighttime noise. For construction activities that do not require pile driving, such as at-grade guideway construction, the distance to noise impact would be 110 feet from the center of the construction zone.

Table 4.19-10: Construction Equipment Noise Emission Levels	
Equipment Type	**Typical Lmax Sound Level at 50 ft (dBA)**
Backhoe	80
Bulldozer	85
Compactor	82
Compressor	81
Concrete Batch Plant	83
Concrete Mixer	85
Concrete Pump	82
Crane, Derrick	88
Crane, Mobile	83
Drilled Pile Auger Machine	85
Grader/Blade	85
Jackhammer/Impact Hammer	88
Large Dump Truck	88
Loader	85
Pavement Breaker	88
Paver	89
Pile Driver, Impact	101
Pump	76
Rail Welding Machine	82
Roller	74
Scraper/Earth Mover	74
Soil-Cement Wall Construction Machine	85
Track Ballast Spreader	82
Track Ballast Tamper	83
Truck	88
Tunnel Boring Machine Transformer	60
Source: Noise and Vibration Technical Report, HMMH, 2003.	

BART Alternative

There is potential for substantial noise impact near the construction of retained fill guideway, retained cut guideway, and cut-and-cover tunnel guideway. Assuming non-impact pile driving methods were used, the maximum distances to impact would be 300 feet for daytime noise (approximately three rows of homes) and 1,000 feet for nighttime noise. For construction activities that do not require pile driving, such as at-grade guideway construction, the distance to noise impact would be 110 feet from the center of the construction zone. This suggests that noise impact would be limited to the first row of homes in areas where impact pile driving would not occur.

Construction-related noise impacts for the MOS scenarios would be similar to the full-build BART Alternative. However, the Berryessa Station, Maintenance Facility, and parking facilities would have noise impacts during the two construction phases, which are three years apart.

4.19.11.2 Design Requirements and Best Management Practices for Noise Impacts

Construction activities for both the Baseline and BART alternatives, as well as the MOS scenarios, will be carried out in compliance with FTA criteria. In addition, specific residential property line noise limits will be developed during Final Design and included in the construction specifications for the project, and noise monitoring will be performed during construction to verify compliance with these limits. This approach allows the contractor flexibility to meet the noise limits in the most efficient and cost-effective manner. Noise control measures that may be applied as needed to meet the noise limits include:

- A comprehensive construction noise specification will be incorporated into all construction bid documents.
- Stationary construction equipment will be located as far as possible from noise-sensitive sites.
- 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 that back-up alarms do not affect residences.
- 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 impacts such as traffic.
- A public notification program will be implemented to alert residents and institutions well in advance of particularly disruptive construction activities such as impact pile driving.
- A complaint resolution procedure will also be put in place to rapidly address any noise problems that may develop during construction.

4.19.11.3 Mitigation Measures for Noise Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine noise impacts from construction and to determine appropriate mitigation measures.

Baseline and BART Alternatives

The following noise mitigation measures are included for both the Baseline and BART alternatives, as well as the MOS scenarios:

- Temporary noise barriers, such as that shown in Figure 4.19-39, will be constructed as needed in areas between noisy activities and noise-sensitive receivers. Temporary barriers can reduce construction noise by 5 to 12 dB, depending on the height and placement of the barrier. To be most effective, the barriers 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 their performance.
- Impact pile driving near noise-sensitive areas will be avoided where possible. Drilled piles, or the use of a sonic or vibratory pile driver, or other "quiet piling" techniques are quieter alternatives and may be used where geological conditions permit.

4.19.11.4 Vibration Impacts

FTA construction vibration criteria are based upon the FTA transit ground-borne vibration annoyance

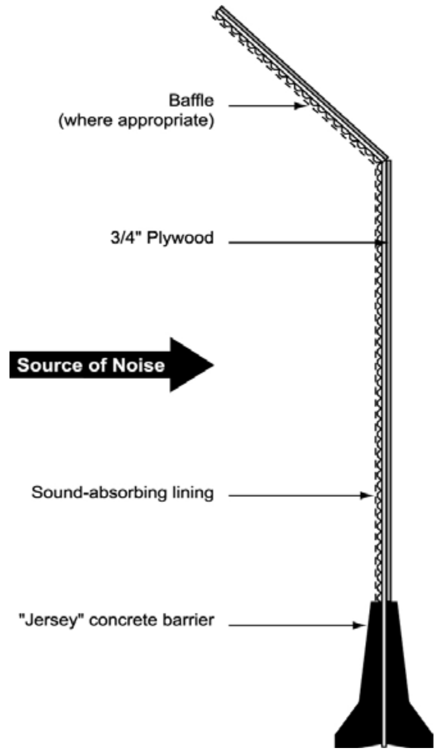


Figure 4.19-39: Example of Temporary Noise Barrier

criteria. For this assessment, the Frequent Event criteria are used because of the extended duration of the expected construction activity. FTA also set a damage criterion of 0.20 in/sec for fragile buildings, or 0.12 in/sec for extremely fragile historic buildings.

Construction vibration projections were made based on construction scenarios described in Section 4.19.2 above. The impact distances given are approximate and based on the best available data. Actual vibration impact 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 vibration exposure to nearby sensitive receptors. This information is typically not available at this stage.

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine vibration impacts from construction.

Baseline Alternative

The primary vibration source near at-grade construction would be compactors, because the compactors use a vibrating plate to compress soil. The major vibration impacts near retained fill and aerial structure construction would be caused by pile driving methods. Use of non-impact pile driving would result in vibration annoyance up to 140 feet from the construction activity.

BART Alternative

Table 4.19-11 shows screening distances to vibration impact for sensitive receptors.

Table 4.19-11: Distance to Vibration Impact for All Residential Land Use

Type of Construction Activity	Distance to Vibration Impact (feet) [1]	
	Vibration Annoyance [2]	Vibration Damage [3]
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

Notes:
[1] Vibration impact is based on FTA "Frequent Event" vibration guidelines.
[2] Vibration annoyance impact is assumed to occur when vibration levels reach 72 VdB.
[3] Vibration damage is assumed to occur when vibration levels reach 95 VdB.
Source: Noise and Vibration Technical Report, HMMH, 2003.

If non-impact pile driving methods are used, the maximum distance to vibration impact would be 315 feet, and the distance to potential cosmetic damage to nearby structures 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.

Any vibration impacts caused during construction of the MOS scenarios would be similar to the full-build BART Alternative.

4.19.11.5 Design Requirements and Best Management Practices for Vibration Impacts

Construction activities for both the Baseline and BART alternatives, as well as the MOS scenarios, will be carried out in compliance with FTA criteria. In addition, specific residential property line vibration limits will be developed during Final Design and included in the construction specifications for the project, and vibration monitoring will be performed during construction to verify compliance with the limits. This approach allows the contractor flexibility to meet the vibration limits in the most efficient and cost-effective manner. Vibration control measures that may be applied as needed to meet the vibration limits include:

- A comprehensive construction vibration specification will be incorporated into all construction bid documents.
- Stationary construction equipment will be located as far as possible from vibration-sensitive areas.
- A public notification program will be implemented to alert residents and institutions well in advance of particularly disruptive construction activities such as impact pile driving.
- A complaint resolution procedure will be put in place to rapidly address any vibration problems that may develop during construction.

4.19.11.6 Mitigation Measures for Vibration Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine vibration impacts from construction and to determine appropriate mitigation measures.

Baseline and BART Alternatives

The following vibration mitigation measure is required for the BART Alternative and MOS scenarios. No mitigation measures are needed for the Baseline Alternative.

- Impact pile driving will be avoided near vibration-sensitive areas, where possible. Drilled piles the use of a sonic or vibratory pile driver, or other "quiet piling" techniques are quieter alternatives and may be used where geological conditions permit.

4.19.12 SECURITY AND SYSTEM SAFETY

4.19.12.1 Security and System Safety Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to security and system safety.

Baseline and BART Alternatives

Evaluation of long-term project impacts on public safety and security is presented in Section 4.14, *Security and System Safety*. This section focuses only on the short-term security and system safety impacts of construction activities. Impacts could occur to workers on the job and/or others in the vicinity of construction activities because of the magnitude of construction activities.

4.19.12.2 Design Requirements and Best Management Practices for Security and System Safety Impacts

Construction best management practices will be required to be in place to ensure the safety of construction workers, employees, and local residents during construction of either the Baseline or BART alternative, as well as the MOS scenarios.

- Construction activities will need to be in accordance with local and state recognized safety practice requirements for the use of heavy equipment and the movement of construction materials. The construction manager will be responsible for job site safety and security during construction.
- Fencing and lighting of construction and staging areas will be implemented to avoid accidents.
- Emergency response personnel within the cities of Fremont, Milpitas, San Jose, and Santa Clara will be notified of construction activities and of any transportation network disruptions or temporary detours to ensure that they will be available for immediate response on an as-needed basis.

4.19.12.3 Mitigation Measures for Security and System Safety Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to security and system safety and to determine appropriate mitigation measures.

Baseline and BART Alternatives

With implementation of design requirements and best management practices, no security and system safety mitigation is required for the Baseline and BART alternatives, nor the MOS scenarios.

4.19.13 UTILITIES

The locations of existing utilities and permanent impacts are described in Section 4.16, *Utilities*. This section focuses on short-term, temporary impacts of construction activities.

4.19.13.1 Utilities Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to utilities.

Baseline Alternative

Because the busway connectors to be constructed under the Baseline Alternative would be built on retained fill between or alongside existing roadway ROW, impacts to existing underground utilities are anticipated to be very minor. Any major utilities would be expected to be within existing roadway ROW. The I-680 to Warm Springs and Warm Springs to I-880 busway connectors are generally outside the ROW but parallel to South Grimmer and Fremont boulevards. Therefore, the connectors would make a more or less perpendicular crossing of any utility lines that provide service to adjacent properties. Support columns would be designed to span utilities where possible, eliminating the need for relocation.

BART Alternative

As discussed in Section 4.16, *Utilities*, the BART Alternative and MOS scenarios have 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 BART Alternative alignment, stations, and ancillary facilities. The cut-and-cover method of construction will involve the relocation of some utilities so that they will not interfere with station construction. Utilities within the subsurface construction area that do not need to be relocated, either permanently or temporarily, would be uncovered during the early stages of excavation. These buried utilities, with the possible exception of sewers, are generally found within several feet of the street surface (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.

4.19.13.2 Design Requirements and Best Management Practices for Utilities Impacts

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 either the Baseline or BART alternative, as well as the MOS scenarios, 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 BART Alternative and MOS scenarios will be submitted to utility providers for their review and comment prior to the onset of any utility relocation work.

4.19.13.3 Mitigation Measures for Utilities Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to utilities and to determine appropriate mitigation measures.

Baseline and BART Alternatives

The following mitigation measures will be implemented for the BART Alternative and MOS scenarios. No mitigation measures are needed for the Baseline Alternative.

- 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.
- It is anticipated that the recently constructed 72-inch trunk sanitary sewer line near the center of 6th Street in San Jose will be supported in place during construction, rather than being relocated. The support could be a temporary overhead bridge with suspended cables, or a permanent beam under the pipe spanning the BART subway. Alternatively, a detour or “shoo-fly” could be constructed adjacent to the pipe while the subway is excavated, and the pipe replaced after the subway is complete. The precise method will be investigated during later design stages of the project.

4.19.14 VISUAL QUALITY AND AESTHETICS

4.19.14.1 Visual Quality and Aesthetic Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to visual quality and aesthetics.

Baseline and BART Alternatives

Project construction would be multi-phased and would occur in different locations at different times. Construction activities, whether for the proposed busway improvements under the Baseline Alternative or for the facilities included in the BART Alternative and MOS scenarios, would involve the use of heavy equipment, stockpiling of soils and materials, and other visual signs of construction. When construction occurs, construction equipment and supplies would be visible, and evidence of construction activity would be noticeable to residents, workers, motorists, and pedestrians who are in the vicinity of the construction. Such short-term visual changes as a result of construction are a common and accepted feature of urban and suburban areas, and generally, mitigation is not warranted. Nonetheless, construction operations will incorporate efforts to minimize the adverse visual effects that result from construction activities.

4.19.14.2 Design Requirements and Best Management Practices for Visual Quality and Aesthetics Impacts

The following design requirements and best management practices will be applied for either the Baseline or BART alternative, as well as the MOS scenarios.

- Construction contractors will be required to maintain the construction site(s) in an orderly manner, including proper disposal of construction and construction worker debris and proper storage and stockpiling of materials and equipment on site.
- Construction crews working at night will direct any artificial lighting onto the work site to minimize the spillover of light or glare onto adjacent areas.

4.19.14.3 Mitigation Measures for Visual Quality and Aesthetics Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to visual quality and aesthetics and to determine appropriate mitigation measures.

Baseline and BART Alternative

Visual screening will be erected at construction sites for the Baseline and BART alternatives, as well as the MOS scenarios, as appropriate.

4.19.15 WATER RESOURCES, WATER QUALITY, AND FLOODPLAINS

Long-term impacts of the SVRTC alternatives on water resources, water quality and floodplains are discussed in Section 4.18, *Water Resources, Water Quality, and Floodplains*.

4.19.15.1 Groundwater Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to groundwater.

Baseline Alternative

Excavation and construction of busway structures would disturb soil and potentially affect groundwater in the immediate area of the Baseline Alternative. Accidental spills could contaminate the soil and/or groundwater. Materials used to construct foundations may be hazardous and could contaminate groundwater by contact, or groundwater may be contaminated by contact with contaminated soil. Percolation of pollutants from the construction zones could impact groundwater quality.

The extent of such impacts is anticipated to be minor, as Baseline Alternative construction would affect only small areas. No impact to groundwater flow patterns, groundwater levels, or groundwater supply conditions is anticipated. Additionally, the shallow aquifers that could be affected by construction of this alternative are not used for drinking water, and the drinking water supply would not be affected.

BART Alternative

The BART Alternative, as well as the MOS scenarios, could have impacts on groundwater from construction of deep foundations, subway tunnels, underground stations, station support structures, and excavation of deep trenches.

Impacts 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 (Segment 2), 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 granular deposits, localized pumping of groundwater may cause diversion of groundwater flow direction toward the excavations, lower groundwater levels, or change overall groundwater flow direction. Decrease in the 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 impact 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.

Abandoned or improperly destroyed wells screened across both deep aquifers and overlying shallow aquifers within the BART corridor 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.

Impacts to groundwater are also anticipated from south of Mabury Road to west of I-880 (Segments 3 and 4). Construction of the cut-and-cover stations and deep underground subway tunnel in this area may affect groundwater quality during excavation and construction. Materials used during construction, and any accidentals spills, may affect groundwater quality. The effects of dewatering in Segments 3 and 4 include the effects of dewatering described for Segment 2. In addition, some dewatering operations would be necessary during construction of tunnels to divert seepage water.

Impacts to groundwater quality from construction activities for Segment 1 would be minor, as the BART Alternative would be within the railroad ROW and constructed at grade. No impact on groundwater quality is anticipated in Segment 5, as the BART Alternative would be aboveground in this segment. Impacts from dewatering activities are not anticipated, as only limited or no dewatering would be required in these segments.

The planned subgrade levels for the four underground station excavations, located in Segments 3 and 4, vary in depth between 55 and 67 feet below existing ground surface, and the groundwater level at the four stations varies between 6 and 26 feet below existing ground surface. Therefore, it is estimated that dewatering of the proposed excavations will typically require depressing the groundwater table 40 to 50 feet. Given the significant amount of drawdown required and relatively high permeability of the deep sand/gravel stratum, dewatering the excavations will require significant effort and could be quite expensive, especially if the groundwater requires special treatment before disposal. It is estimated that the required pumping rate could be several thousand gallons per minute.

One alternative to avoid potential complications caused by dewatering of the excavations is to construct cutoff walls extending into impervious clay below the pervious sand/gravel strata, creating a seepage barrier between the excavation subgrade and the water bearing aquifer. In addition to a cutoff wall system, sumping and/or dewatering shafts with submersible pumps will be required within the excavation to pre-drain permeable sand and gravel layers as the excavation proceeds to subgrade level.

4.19.15.2 Surface Water Resource Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to surface water.

Baseline and BART Alternatives

Construction activities for the Baseline Alternative or the BART Alternative, as well as the MOS scenarios, could affect stormwater quality by releasing sediment and/or chemicals onto the ground or directly into watercourses. Mismanagement of on-site excavated or imported construction materials could result in release of sediments directly into creeks at aboveground stream crossings or into the storm drainage system and subsequently into creeks.

Excavated soil could be contaminated, and release of contaminated sediments could pollute surface water sources. The deep retained cuts would require excavation, which would expose the soil to run off and potentially cause erosion and entrainment of sediment in the runoff. Soil stockpiles could be exposed to runoff and, if not managed properly, runoff could cause erosion and increased sedimentation directly into receiving water bodies at stream crossings, in storm sewers, or in drainage channels.

In addition to erosion, there is a potential for chemical releases at construction sites. Once released, substances such as fuels, oils, paints, and solvents could be transported to nearby drainage channels.

The Baseline and BART alternatives would involve excavations and fill construction. This earthwork would not produce substantial erosion and sedimentation problems if properly designed, constructed, and maintained. Stockpiles of excavated soil and imported fill, if properly managed, also would not be sources of sedimentation. If, however, construction-related erosion and sedimentation were to occur, it could result in impacts to surface water quality and drainage channel maintenance.

Dewatering operations for excavations could result in discharge of sediments and/or pollutants to surface water bodies, thereby degrading water quality. High sediment content in dewater discharges is common because of the nature of the operation, in which soil and water mix in the turbulent flow of high-volume pump intakes. Based on historical land uses in the project area, chemical compounds are expected in the groundwater. Direct discharge of dewatering effluent to the storm drainage system could result in water quality impacts to downstream drainages and to the Bay. Limited dewatering activities are anticipated for the Baseline Alternative, and the BART Alternative in Segments 1 and 5. There may be substantial dewatering operations for construction of the BART Alternative in Segments 2, 3 and 4.

4.19.15.3 Floodplain Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to floodplains.

<u>Baseline Alternative</u>

As noted in Section 4.18.3.3, *Water Resources, Water Quality, and Floodplains/Floodplains*, the facilities proposed under the Baseline Alternative are outside areas of 100-year floodplain. Therefore, there would be no floodplain impact under this alternative, and no mitigation is needed.

<u>BART Alternative</u>

The SCVWD is constructing or planning flood control projects within the BART Alternative (including MOS scenarios) project area. "Reach 1" of the Lower Silver Creek Flood Protection Project, which crosses the BART alignment, is currently under construction. In the planning and design phases are the Berryessa Creek Flood Protection Project, consisting of the joint SCVWD/U.S. Army Corp of Engineers Berryessa Creek Project, anticipated to be complete by 2010, and the Berryessa Creek Levees Project (aka Lower Berryessa Creek Project), anticipated to be complete by 2008. The Upper Penitencia Creek Flood Protection Project is anticipated to be complete by 2011; the Mid-Coyote Creek Flood Protection Project by 2016; and Reaches 3A and 3B of the Guadalupe River Park and Flood Protection Project, in the area of the BART Alternative, by December 2004. Construction of the BART Alternative and MOS scenarios would need to be coordinated with these flood control projects.

4.19.15.4 Design Requirements and Best Management Practices for Water Resources, Water Quality, and Floodplains Impacts

<u>Design Requirements and Best Management Practices for Groundwater Impacts</u>

Baseline and BART Alternatives

Following are the design requirements and best management practices that will be implemented for groundwater under the Baseline and BART alternatives and MOS scenarios:

- To the extent feasible, materials used in construction will be non-hazardous.
- Prior to the final design of a dewatering system, aquifer pump tests will be conducted to better define the effects of dewatering on groundwater supply facilities. The results of the pump tests will be used to develop a dewatering strategy that will minimize impacts to other groundwater users in the area. VTA will prepare a dewatering plan that will include provisions for the management of pumped water. The volume and duration of groundwater extraction necessary for deep excavations during construction of the cut-and-cover stations and/or tunnel could be reduced by construction of groundwater barriers such as slurry walls or sheet piles to minimize groundwater flow into the construction area. Less pumping will reduce the potential to lower groundwater levels and change groundwater flow directions outside the construction zone.
- VTA will implement a groundwater level monitoring program of shallow and deep aquifers to assess long-term water level trends and will alter dewatering strategies if adverse impacts are noted. If necessary, VTA will remedy adverse impacts by lowering pumping rates, deepening wells, or providing other means of maintaining the historical water supply.
- 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. VTA will properly close all identified abandoned wells on the project site that are screened across both deep aquifers and overlying geologic units, in accordance with state regulations.
- VTA will remediate groundwater or soil contamination from accidental spills related to excavation, drilling, grouting, and other construction activities in accordance with local, state, and federal requirements.

Design Requirements and Best Management Practices for Surface Water Impacts

Baseline and BART Alternatives

The following design requirements and best management practices will be implemented for the Baseline and BART alternatives, as well as the MOS scenarios, to protect surface water conditions during construction.

- To the extent possible, earthwork will be scheduled outside the October to April rainy season to minimize the potential for erosion of construction areas. If earthwork were to occur during the rainy season, the erosion and sediment control plan will specifically address measures to be undertaken during the rainy season. Exposed ground on cut or fill slopes will be planted with vegetative cover designed to reduce erosion. The erosion and sediment control plan will identify the location and design of sediment retention structures. Sediment traps will be placed at the drainage outlet of each earthwork construction area. Drainage outlets from sediment traps will be protected with energy dissipation techniques, such as riprap, to reduce erosion potential. Sediment barriers will be placed along the toe of the embankment.
- Erosion control structures will be inspected by VTA prior to the beginning of the rainy season and after major rainstorms, or as required by regulatory agencies. Problems identified by these inspections will be remediated.
- An erosion and sediment control plan for the entire project will be developed and implemented by VTA and submitted to the RWQCB, ACFCWCD, and SCVWD for review and comment.
- VTA will file a NOI with the RWQCB to obtain coverage under the NPDES Construction General Permit.
- Prior to disturbing a site, VTA will develop a SWPPP as required by the General Permit. The SWPPP will be implemented at the appropriate level to protect water quality at all times during construction of either the Baseline or BART alternative, as well as the MOS scenarios. The SWPPP will remain on the site throughout construction, commencing with the initial mobilization and ending with the termination.
- The SWPPP will accomplish two major objectives: (1) identify the sources of sediment and other pollutants that may affect the quality of stormwater discharges, and (2) describe and ensure the implementation of best management practices to reduce or eliminate sediment and other pollutants in stormwater, as well as non-storm water discharges. The SWPPP will also include best management practices that address source control and pollutant control.
- The SWPPP will include provisions for proper 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 or sanitary sewer system, 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.
- Prior to construction activities, VTA will obtain an NPDES permit for sub-drains, dewatering, and discharge activities, which result in either permanent or temporary discharge of contaminated groundwater to a receiving water. This may require groundwater treatment.

- VTA will receive written authorization from RWQCB for significant discharges of groundwater into the storm sewer system or directly into waters of the state. VTA will comply with any conditions required as part of the authorization to discharge.

Design Requirements and Best Management Practices for Floodplain Impacts

VTA will minimize floodplain impacts to the Baseline and BART alternatives, as well as the MOS scenarios, by incorporating into the final design the features of the planned ACFCWCD and SCVWD flood control projects and by coordinating construction activities with the appropriate agencies during the construction phase.

4.19.15.5 Mitigation Measures for Water Resources, Water Quality, and Floodplains Impacts

No-Action Alternative

Projects planned under the No-Action Alternative would undergo separate environmental review to determine construction impacts to water resources, water quality, and floodplains and to determine appropriate mitigation measures.

Baseline and BART Alternatives

Mitigation Measures for Groundwater Impacts

With implementation of the above design requirements and best management practices, no additional mitigation is required for construction-related groundwater impacts from the Baseline and BART alternatives, or the MOS scenarios.

Mitigation Measures for Surface Water Impacts

With implementation of the above design requirements and best management practices, no additional mitigation is required for construction-related surface water impacts from the Baseline and BART alternatives, or the MOS scenarios.

Mitigation Measures for Flooding Impacts

With implementation of the above design requirements and best management practices, no additional mitigation is required for construction-related floodplain impacts from the Baseline and BART alternatives, or the MOS scenarios.

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