Chapter 2
Project Description

The Proposed Project is the electrification of the Caltrain line from its current northern terminus at 4th and King Streets in the City of San Francisco to 2 miles south of the Tamien Station in San Jose, a total distance of approximately 51 miles. The project location is shown in Figure 2-1; a project vicinity map showing each of the stations on the line is provided in Figure 2-2.

2.1 Location and Limits

The Peninsula Corridor Joint Powers Board (JPB) owns and operates approximately 51 miles of primarily two-track mainline railroad right-of-way (ROW) between the 4th and King Street Station in San Francisco and south of the Tamien Station in San Jose, Santa Clara County. The JPB purchased this ROW from the Southern Pacific Transportation Company in 1991. Between Tamien Station and Gilroy, the mainly single-track ROW is owned by the Union Pacific Rail Road (UPRR). Caltrain has trackage rights with UPRR to provide commuter service in this approximately 25-mile segment between Tamien Station and Gilroy. This project area consists of the Caltrain ROW, immediately adjacent areas where certain project facilities or project actions are proposed, several areas separate from the ROW proposed for project traction power substations, and other nearby areas that may be used for construction staging or access.

2.2 Background

Caltrain trains presently consist of diesel locomotive-hauled, bi-level passenger cars. As of mid-2013, Caltrain operates 46 northbound and 46 southbound (for a total of 92) trains per day between San Jose and San Francisco during the week. Three of these trains start in Gilroy during the morning commute period, and three terminate in Gilroy during the evening commute period. Eleven trains in each direction are “Baby Bullet” express service trains that make the trip between San Francisco and San Jose in less than 1 hour. Service is frequent during the peak periods (five trains per peak hour per direction [pphpd]) and is provided every hour in both directions during the midday. Caltrain provides hourly service in both directions on Saturdays and Sundays (36 trains on Saturdays and 32 trains on Sundays) between San Jose Diridon and San Francisco 4th and King Stations only. Weekend service includes two “Baby Bullet” express service trains per day in each direction. Caltrain also provides extra service for special events such as San Jose Sharks and San Francisco Giants games.

In addition to Caltrain commuter rail service, UPRR operates approximately six daily freight trains (three round-trips) between Santa Clara and San Francisco under a Trackage Rights Agreement with Caltrain. From Santa Clara to San Jose, on a joint use corridor, UPRR operates approximately nine daily freight trains. Three passenger train services also operate on the Santa Clara to San Jose segment: the Capitol Corridor (14 daily trains), the Altamont Commuter Express (ACE, eight daily trains during weekdays only), and the Amtrak Coast Starlight (two daily trains).

The Proposed Project is part of a program to modernize operation of the Caltrain rail corridor between San Jose and San Francisco.[1] There is a lengthy history of planning for modernization of the Caltrain Peninsula Corridor. Modernization projects include the installation of an advanced signal system and the electrification of the rail line. The advanced signal project (Caltrain Communications Based Overlay Signal System (CBOSS) Positive Train Control (PTC) commonly referred to as CBOSS PTC or CBOSS), and corridor electrification are discussed below. The JPB previously evaluated corridor electrification in a prior EIR, for which a draft was completed in 2004 and a final was completed in 2009. The JPB did not certify the Final EIR due to the need for resolution of issues regarding joint planning for shared use of the Caltrain corridor for Caltrain service and for future high-speed rail (HSR) service. The Federal Transit Administration (FTA) completed the final EA and adopted a Finding of No Significant Impact in 2009.

Since 2009, the JPB, the California High-Speed Rail Authority (CHSRA), the California Legislature, the Metropolitan Transportation Commission (MTC) and other parties have worked together to develop a vision of a "blended system" whereby both Caltrain and HSR would utilize the existing Caltrain Peninsula Corridor. This vision for implementing Blended Service was included in the *Revised 2012 Business Plan* that the CHSRA Board adopted in April 2012 for the California High-Speed Rail System (CHSRA 2012a).

The JPB and CHSRA are committed to advancing a blended system concept. In 2013, the JPB and CHSRA signed a Memorandum of Understanding (MOU) to this effect. This local vision was developed with stakeholders interested in the corridor. The blended system would remain substantially within the existing Caltrain ROW and accommodate future high-speed rail and modernized Caltrain service by primarily utilizing the existing track configuration.

Based on the blended system vision, the Caltrain Peninsula Corridor has been designated to receive an initial investment of Proposition 1A bond funds that would benefit Caltrain's modernization program and HSR. The JPB, CHSRA and seven other San Francisco Bay Area agencies (City and County of San Francisco, San Francisco County Transportation Authority, Transbay Joint Powers Authority, San Mateo County Transportation Authority, Santa Clara Valley Transportation Authority, City of San Jose, and MTC) have approved an MOU (*High Speed Rail Early Investment Strategy for a Blended System in the San Francisco to San Jose Segment known as the Peninsula Corridor of the Statewide High-Speed Rail System*) to pursue shared use of the corridor between San Jose and San Francisco to provide Blended Service of both Caltrain commuter rail service and HSR intercity service (JPB 2012). The MOU includes agency and funding commitments toward making an initial investment of approximately $1.5 billion in the corridor for purchasing and installing an advanced signal system, electrifying the rail line from San Francisco to San Jose, and purchasing electrified rolling stock for Caltrain. The MOU also conceptually outlines potential additional improvements (i.e., "Core Capacity" projects[2]) needed beyond the first incremental investment to accommodate Blended Service in the corridor.

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[1] JPB is currently updating its Strategic Plan to account for recent policy commitments (Caltrain Modernization [CalMod], Blended Service, and High-Speed Rail).

[2] Core Capacity projects (as described in the nine-party MOU) consist of needed upgrades to stations, tunnels, bridges, potential passing tracks, other track modifications, and rail crossing improvements, including selected grade separations, and will be required to accommodate the mixed traffic capacity requirements of high-speed rail service and commuter services on the Caltrain corridor. The specific Core Capacity projects have not been identified or defined at this time. These projects will be identified in future discussions and evaluations between CHSRA and the JPB. Core Capacity projects would be subject to separate, project-level environmental evaluation by the implementing agency.

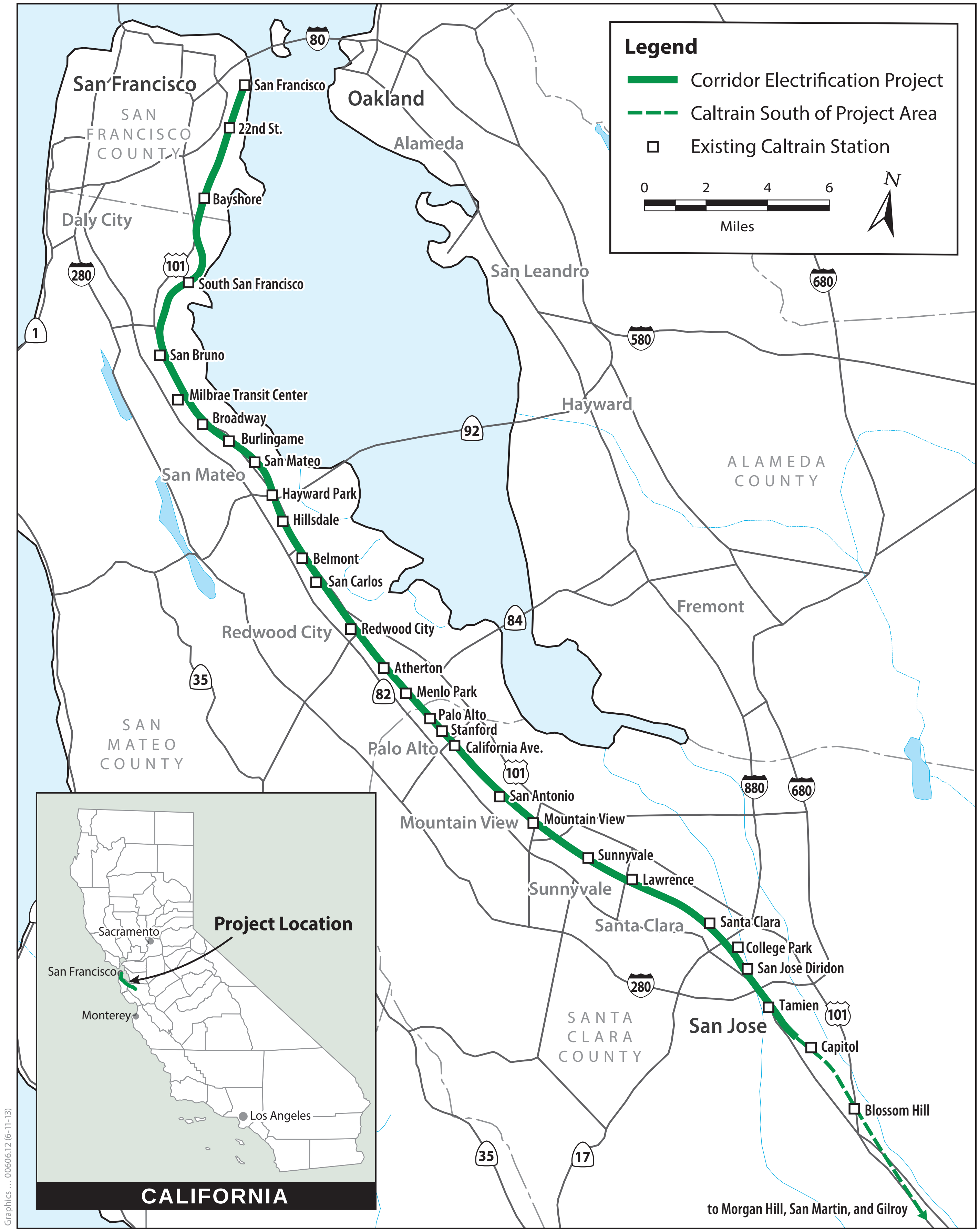

Figure 2-1
Project Location
Peninsula Corridor Electrification Project

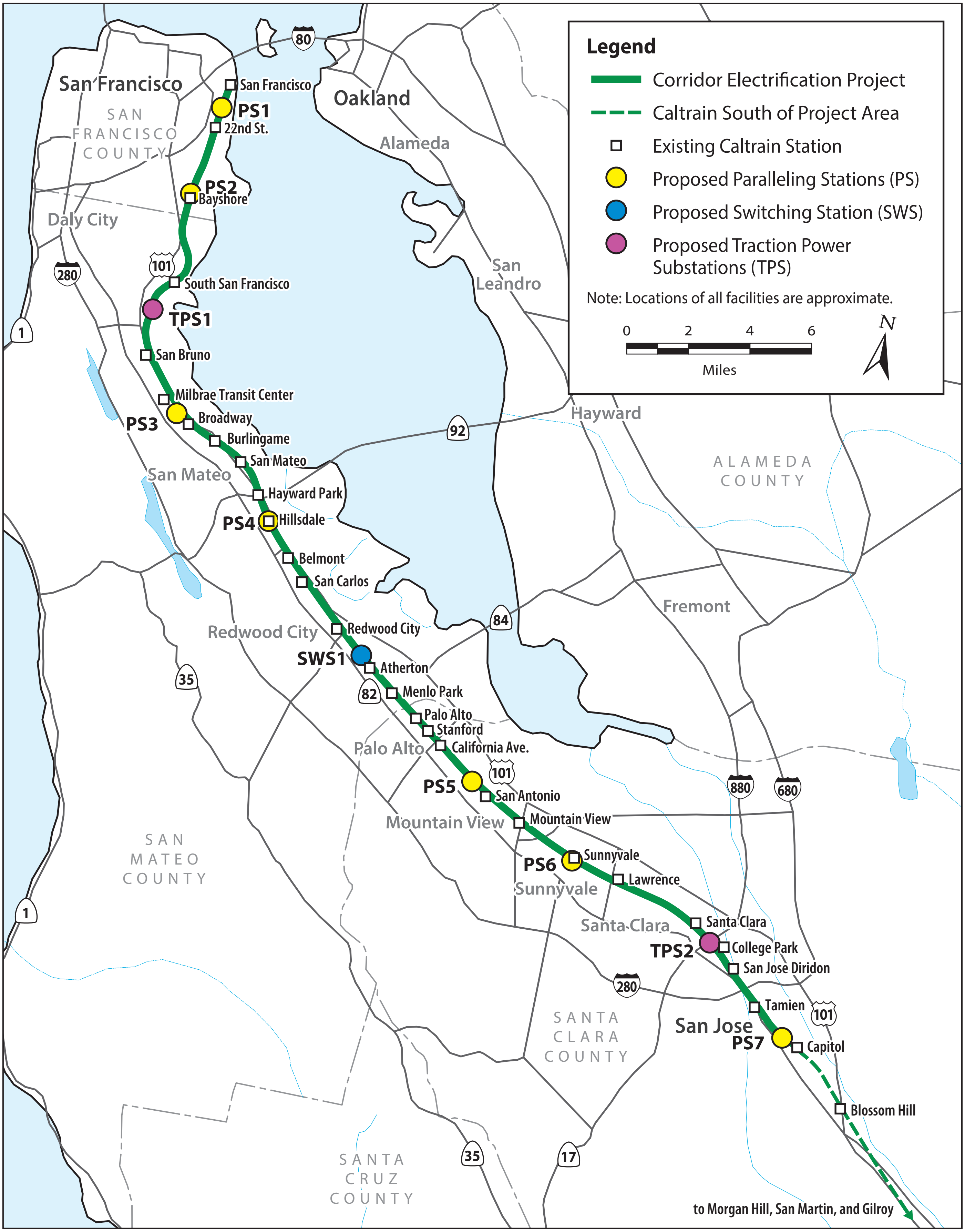

Figure 2-2
Project Vicinity
Peninsula Corridor Electrification Project

Corridor improvements identified in the MOU include the following:

- **Advanced Signal System (commonly referred to as CBOSS PTC or CBOSS):** CBOSS stands for Communications Based Overlay Signal System and PTC stands for Positive Train Control. This project (currently being installed, including a new fiber optic backbone) will increase the operating performance of the current signal system, improve the efficiency of at-grade crossing warning functions, and automatically stop a train when there is violation of safe operating parameters. This project, which includes implementation of safety improvements mandated by federal law, is scheduled to be operational by 2015 as mandated by the Federal Railroad Administration (FRA).
- **Corridor Electrification:** The JPB decided to prepare this new EIR for the corridor electrification due to the changes in existing conditions[3] that have occurred along the corridor since the prior EIR analyses was conducted, to update the environmental analysis, and to update the cumulative analysis of Blended Service and other cumulative developments along the corridor. Completion of a new EIR will also allow public agencies, stakeholders, the public and decision-makers the opportunity to review and comment on the Proposed Project's environmental effects in light of current information and analyses. This Proposed Project would provide for operation of up to six Caltrain trains per peak hour per direction (an increase from five trains per peak hour per direction at present). Electrification can be analyzed as a separate project under the California Environmental Quality Act (CEQA) because it has independent utility (providing Caltrain electrified service) and logical termini (station end points). Electrification of the rail line is scheduled to be operational by 2019. The Proposed Project includes 114 trains per day between San Jose and San Francisco and six trains per day between Gilroy and San Jose. Future proposed actions to expand service beyond 114 trains per day may require additional environmental review.
- **Blended Service:** The JPB, CHSRA, and the MOU partners have agreed on shared use of the Caltrain corridor for use of up to six Caltrain trains per peak hour per direction and up to four HSR trains per peak hour per direction.[4] The operational feasibility of Blended Service has been studied, but this project is presently only at the conceptual planning phase. The potential addition of HSR service to this corridor will be the subject of a separate environmental review process that will be undertaken by CHSRA as the lead agency subsequent to the environmental process for the Peninsula Corridor Electrification Project (PCEP or Proposed Project). Based on the current CHSRA *Revised 2012 Business Plan* (and the Draft 2014 Business Plan) Blended Service along the corridor is scheduled to commence sometime between 2026 and 2029.

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[3] For example, there have been changes in existing development adjacent to the Caltrain ROW and stations, in levels of traffic, and in adopted land use plans around stations.

[4] The CHSRA 2012 Revised Business Plan *Ridership and Revenue Forecasting* (CHSRA 2012b) and the Draft *2014 Business Plan* (CHSRA 2014a) presumes Phase 1 Blended Service would have up to four trains per peak hour and up to four trains per off-peak hour. As explained in Section 4.1 *Cumulative Impacts,* this EIR presumes up to 40 HST daily round-trip trains in 2040 based on the CHSRA 2012 Business Plan, *Estimating High-Speed Train Operating and Maintenance Cost for the CHSRA 2012 Business Plan* (CHSRA 2012c). The Draft 2014 Business Plan *Service Planning Methodology* document (CHSRA 2014b) includes an assumption of 53 daily round trip trains starting in 2029 and continuing beyond 2040. Caltrain's Blended Service planning to date has not studied the *2014 Business Plan* estimates because the plan was released on February 7, 2014 and conceptual Blended Service studies were completed in 2013. Thus, this EIR is based on a service level of 40 daily round-trip trains that has been studied by Caltrain to date. The subsequent CHSRA project-level environmental evaluation will address proposed HST service levels along the San Francisco Peninsula.

2.3 Project Description

The Proposed Project consists of converting Caltrain from diesel-hauled to Electric Multiple Unit (EMU) trains for service between the 4th and King Street Station in San Francisco and the Tamien Station in San Jose. Operating speed would be up to 79 miles per hour (mph), which is what it is today.

In 2019, service between San Jose and San Francisco would use a mixed fleet of EMUs and diesel locomotives, with approximately 75% of the service being electric and 25% being diesel in 2019.[5] After 2019, diesel locomotives would be replaced with EMUs over time as they reach the end of their service life. Caltrain's diesel-powered locomotive service would continue to be used to provide service between the San Jose Diridon Station and Gilroy.[6] Fleet requirements under the Proposed Project are presented in Table 2-1.

Table 2-1. Fleet Requirements of the Electrification Program

Year	Diesel Locomotives	Diesel-Hauled Coaches/Cabs	Electric Multiple Units	Total Passenger Vehicles
2019[a] (six trains per peak hour/direction)	9	45	96	150
2040[b] (six trains per peak hour/direction)	6	31	138 to 150	175 to 187

Source: Callen pers. comm.

[a] The majority of vehicles would be replaced in 2019 as they reach the end of their design life. Additional vehicles would be replaced after 2019 as they reach the end of their design life.

[b] Diesel operation limited to San Jose – Gilroy shuttle service in 2040. 2040 operations assume fully electrified operations between San Jose and San Francisco and that the San Francisco Downtown Extension (DTX) has been completed. However, the Proposed Project only includes funding for 75 percent of the rolling stock for this service at this time. The fleet estimates for 2040 are only conceptual at this time.

The level of Caltrain operations and, therefore, fleet requirements under the Proposed Project are based on six trains per peak hour per direction (pphpd) from Tamien Station in San Jose to San Francisco, with a mixed EMU and diesel locomotive fleet. Caltrain service would also include six diesel-powered trains per day in the San Jose to Gilroy segment in 2019.

The Proposed Project would require the installation of 130 to 140 single-track miles of overhead contact system (OCS) for the distribution of electrical power to the electric rolling stock. The OCS would be powered from a 25 kilovolt (kV), 60 Hertz (Hz), single-phase, alternating current (AC) supply system consisting of traction power substations (TPSs), one switching station (SWS), and

[5] This project only includes funding for EMUs representing approximately 75 percent of the operational fleet between San Jose and San Francisco. In 2019, some peak period service (e.g., bullet/Gilroy-SF trains) would be diesel on weekdays. All other service, including off-peak, would be EMU-based in 2019. Funding for replacement of the remainder of the diesel fleet between San Jose and San Francisco would have to come from future funding sources. It is expected that 100 percent of the San Jose to San Francisco fleet would be EMUs by 2026 to 2029, because the fleet would need to be fully electrified to operate in a Blended Service environment with HSR. Fully electrified service between San Jose and San Francisco is included in the cumulative impact analysis contained in Chapter 4, *Other CEQA-Required Analysis*, but is not part of the Proposed Project.

[6] The Proposed Project only includes electrification to a point approximately 2 miles south of Tamien Station (the JPB-owned ROW). The Union Pacific Corridor south of this point would not be electrified by this Project.

paralleling stations (PSs). These traction power facilities (TPFs) are described in more detail in the following pages. Figure 2-2 shows the general location of TPF sites.

2.3.1 Overhead Contact System

To permit electric vehicles to run along a railroad track, two types of electrical power distribution system are in general use. The first type is a low-voltage direct current (DC) third rail system, as employed in the 1,000-volt DC BART system. The second type is an overhead contact wire system, used for both light and heavy rail transit. Light rail applications typically use low-voltage OCS, such as the Muni in San Francisco at 600 volts, or the Santa Clara Valley Transportation Authority light rail service at 750 volts. For high-speed, intercity passenger or commuter rail lines, the OCS is usually a high-voltage AC system, as used by Amtrak, Maryland Regional Commute trains (MARC), Southeastern Pennsylvania Transportation Authority (SEPTA), New Jersey Transit (NJT), and Metro-North Railroad (MNRR) at 11.5 to 12.5 kV, and at 25 kV on Amtrak's Northeast Corridor and portions of the NJT. This project would have an AC OCS. The typical voltage used for regional and intercity rail throughout Europe and the rest of the world is 25 kV at commercial frequencies (50 to 60 Hz). As noted above, this project would have a 25 kV AC OCS at 60 Hz.

This power supply and distribution system and voltage would be compatible with the requirements of HSR and would accommodate future development of HSR in the Caltrain Peninsula Corridor. The OCS conductors and traction power equipment would be sized and located based on a computerized analysis of traction power load flow requirements using the probable maximum capacity of the Peninsula corridor alignment of Caltrain.

A mainline OCS typically consists of two conductors above each track in what is known as a catenary configuration: a messenger wire (much like a utility transmission line) sags between support points, below which a near-level contact wire is suspended. Both main wires are energized and are part of the same circuit. The pantograph, mounted on top of the electric vehicles, slides along the underside of the contact wire and collects the traction current from it.

The messenger wire is typically supported by means of cantilevered, hinged bracket arms that extend horizontally over the track from vertical steel poles mounted clear of the dynamic envelope (i.e., the range of motion of the train on the track) of the vehicles. The OCS also includes negative feeder and static wires. The autotransformer system is described further below. These are also supported on the OCS poles. These poles are placed approximately 10 to 12 feet of the centerline of the tracks they serve. Multi-track support structures, such as multi-wire headspans attached to taller steel poles, are also employed where necessary. The poles themselves are supported by cast-in-place concrete foundations or driven pile footings, which are typically set back approximately 10 to 12 feet from the track centerline. Depending upon the clearance requirements of particular sections of the route, the contact wire height would vary from approximately 16.0 feet to 23.0 feet. Pole heights range from 30 to 50 feet. Also, depending on along-track span length and other requirements, the messenger wire would typically be positioned between 2 feet and 5 feet directly above the contact wire.

Clearances for maintenance and operation of the OCS would be designed to allow for existing freight railroad and tenant passenger rail clearances and operations. Normal design clearances up to 23 feet would be provided in all open, unconstrained areas. Special designs could be employed in close clearance tunnels or under bridges in order to provide sufficient clearances to existing freight and diesel passenger trains.

On tangent, or straight, sections of track, the OCS supports can be spaced up to 230 feet apart, though they would typically be about 180 to 200 feet apart. On curved track sections, the span lengths between supports must be reduced. The Caltrain ROW has two small radius curves, one just south of the San Francisco terminus and one north of the San Jose Diridon Station, where the support spacing would be reduced to approximately 75 feet. For the larger radius curves along the route, pole spacing would range from 120 to 150 feet.

The particular type of OCS support on a given segment is dependent upon the track segment's exact configuration (e.g., number of tracks) and other site-specific requirements and constraints. Figure 2-3 shows typical side cantilever bracket arms and poles for two-track sections. Figure 2-4 shows a portal arrangement, where the central wires are supported over multiple tracks by means of a solid steel beam and cantilever brackets. Figure 2-5 shows typical center cantilever bracket arms and poles for two track sections. Figure 2-6 shows typical multi-track arrangement with headspan construction. Figure 2-7 shows a typical two track cantilever and bracket arms. Visual impacts of the proposed OCS facilities and treatments in different corridor locations are evaluated in Section 3.1, *Aesthetics*.

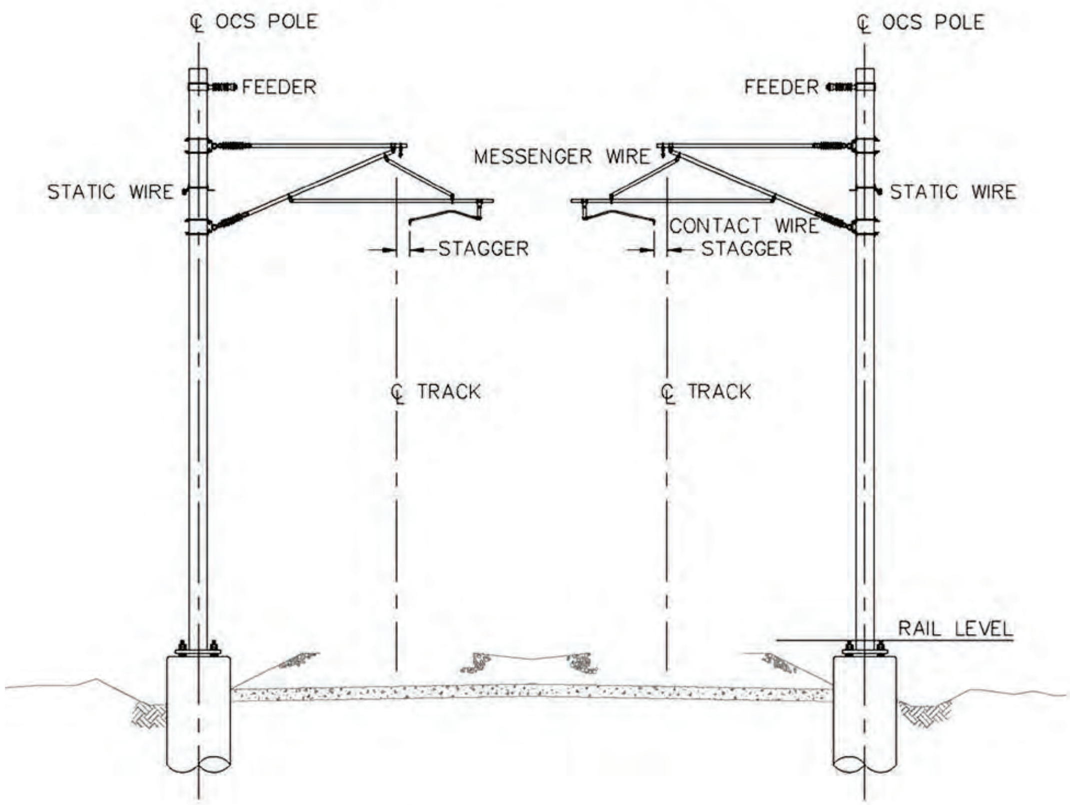
Power would be supplied to the OCS at each of the TPFs, either by means of non-insulated aerial connections or by insulated underground connections. Power would generally be delivered to the OCS through a pole-mounted disconnect switch, which permits energization or de-energization of a particular section of the OCS conductors. The overhead electrical system would include an integrated bonding and grounding system to protect the public during all system operations.

As noted above, the OCS poles nominally need to be approximately 10 to 12 feet from the centerline of the railway tracks. In addition, there needs to be clearance of vegetation within approximately 10 feet of the OCS poles and catenary system for electrical safety. Pruning or removal of trees would be required along the tracks and electrical facilities where they would otherwise pose a maintenance or safety concern. The distance from the railway outside track centerlines to the outer edge of the vegetation clearance zone (called the electrical safety zone or ESZ) would be up to 24 feet (up to 12 feet to the OCS pole alignment + 2 feet for the width of the pole + 10 feet for the vegetation clearance). In addition, structures cannot be closer than 6 feet to the OCS pole alignment (the 6 feet is within the 10-foot ESZ). Figure 2-8 shows the structural and vegetation clearance zones relative to the track and OCS pole alignment.

At three tunnel locations, all within San Francisco, the Proposed Project includes potential tunnel and track modifications necessary to provide adequate vertical clearances for the OCS for both passenger and existing freight operations. The amount of additional clearance, depending on location, varies from 0.25 to 1.75 feet. These improvements could include potential "notching" (i.e., minor excavation of the tunnel wall) of the tunnel, horizontal realignment of tracks to maximize vertical clearance, and potential lowering of the track grade. If lowering of the track grade is necessary, construction would involve temporary removal of the track and track ballast, excavation, and then replacement of track ballast and tracks. At four bridge overcrossings where vertical height is constrained, the Proposed Project also would involve lowering the track by 0.25 foot to 1 foot to provide adequate vertical clearance for existing passenger and freight vehicles.

At San Franciscquito Creek Bridge, the standard OCS pole design has been modified to avoid impacts on the historic bridge and to avoid using side poles near the landmark tree El Palo Alto. The OCS cables would be suspended from the San Francisquito Creek Bridge truss in a manner that would not alter the existing structure. The power cables, fasteners and support brackets would be attached

Amtrak's North End Electrification



Source: JPB Staff.

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Figure 2-3

OCS Two Track Arrangement with Side Pole Construction

Peninsula Corridor Electrification Project

Amtrak's North End Electrification

Source: JPB Staff.

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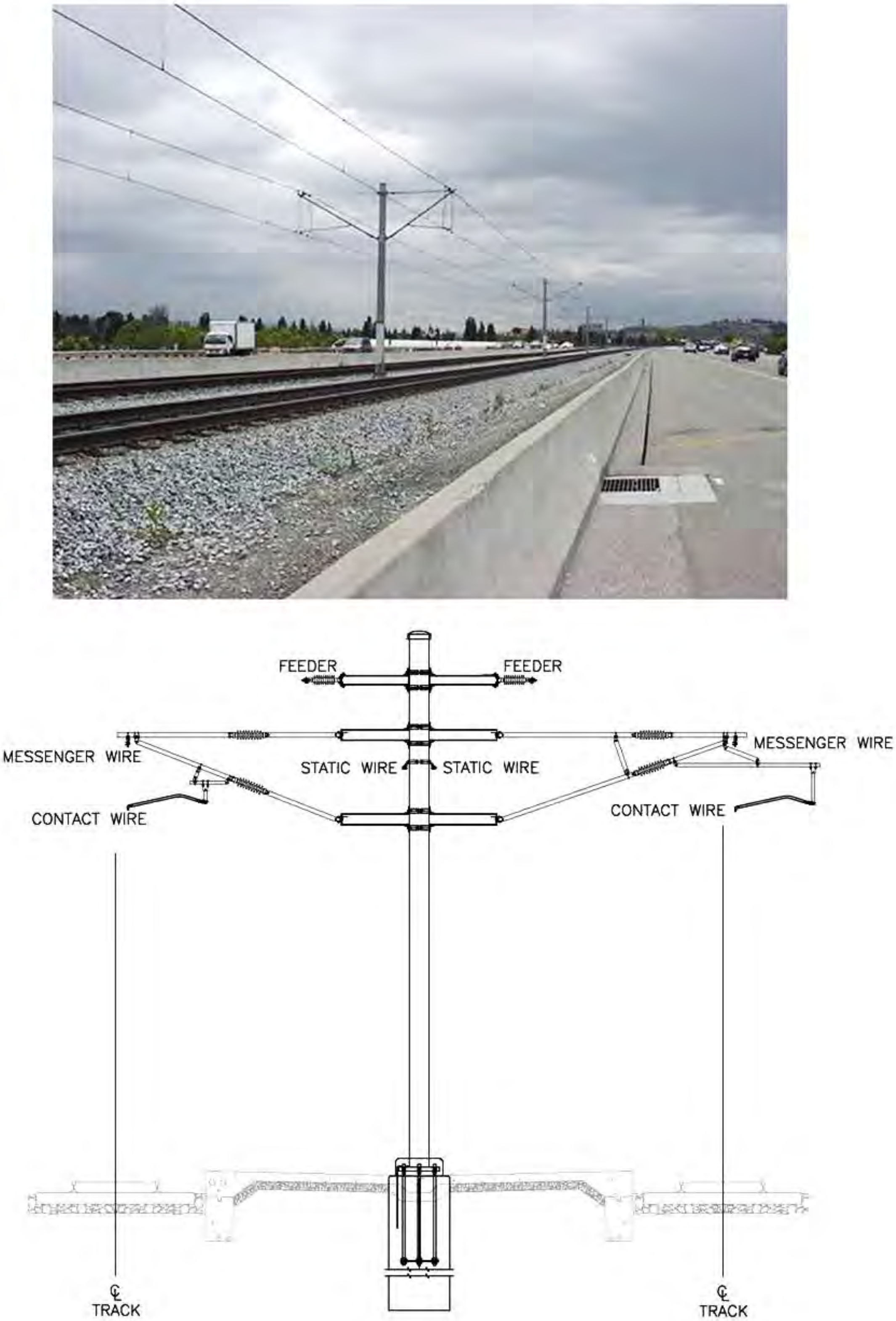
Figure 2-4
OCS Typical Portal Arrangement
Peninsula Corridor Electrification Project



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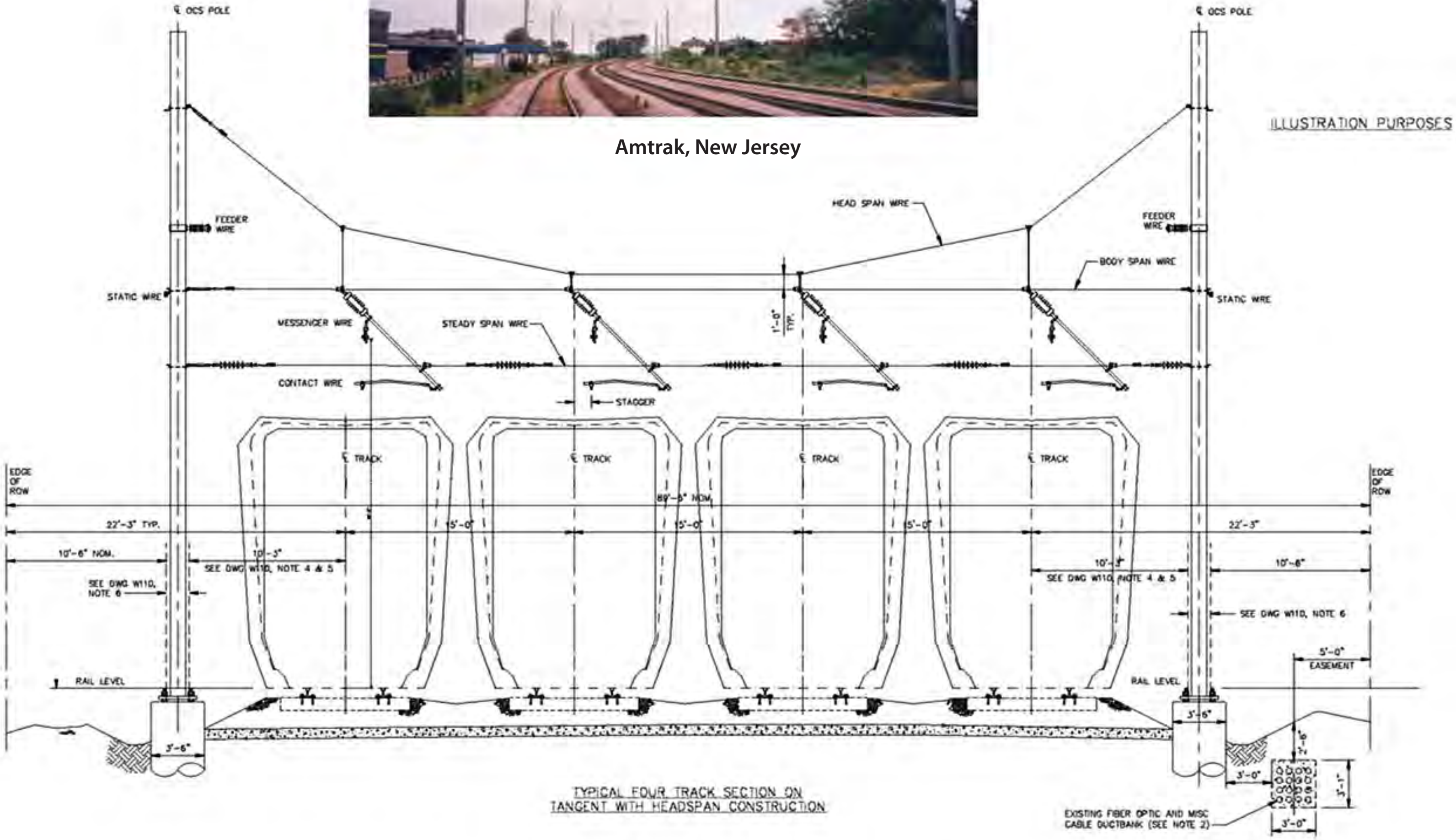
Source: JPB Staff.

Figure 2-5
OCS Two Track Arrangement with Center Pole Construction
Peninsula Corridor Electrification Project

Amtrak, New Jersey



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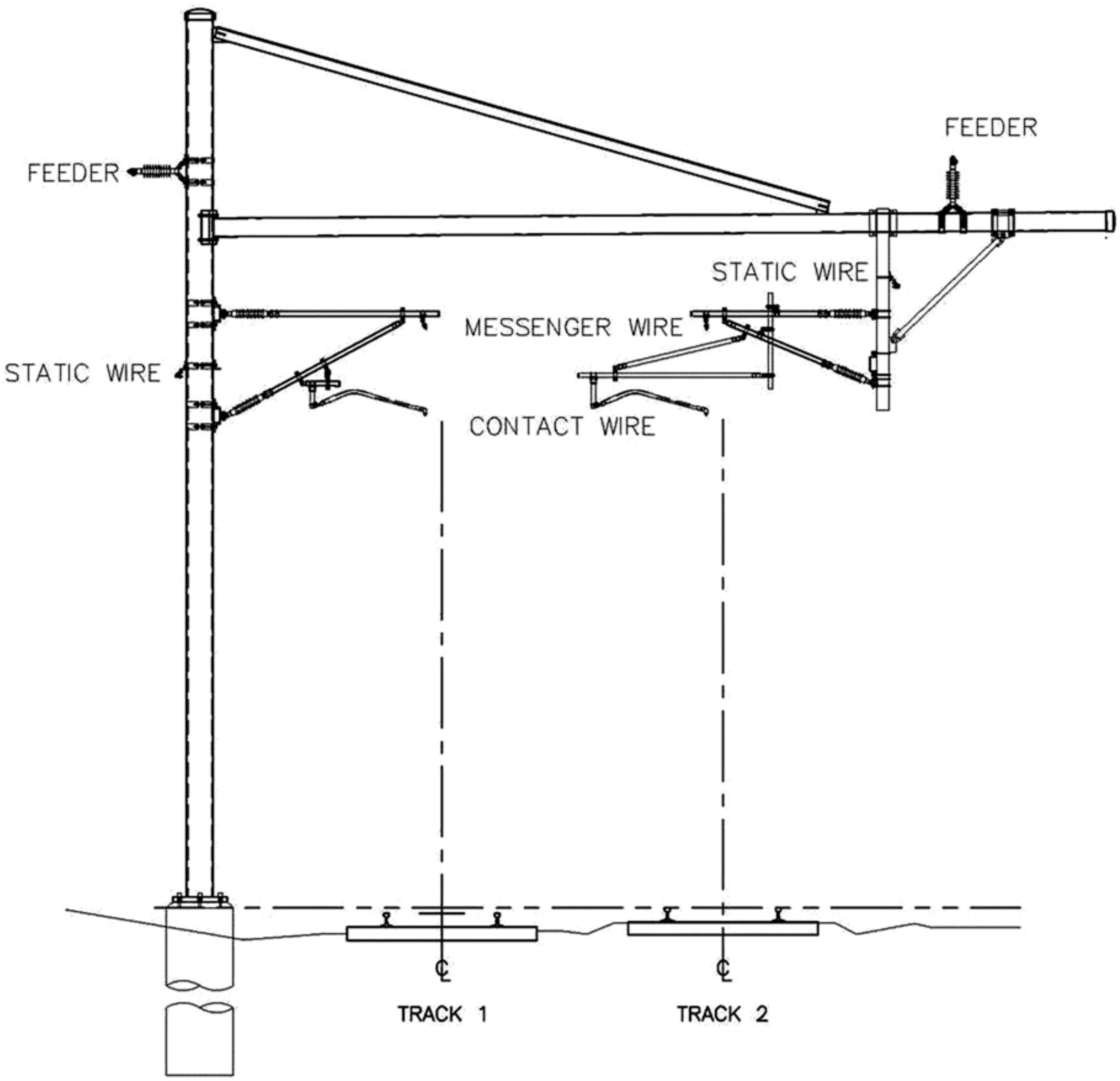
Source: JPB Staff.

Figure 2-6
OCS Multi-Track Arrangement with Headspan Construction
Peninsula Corridor Electrification Project



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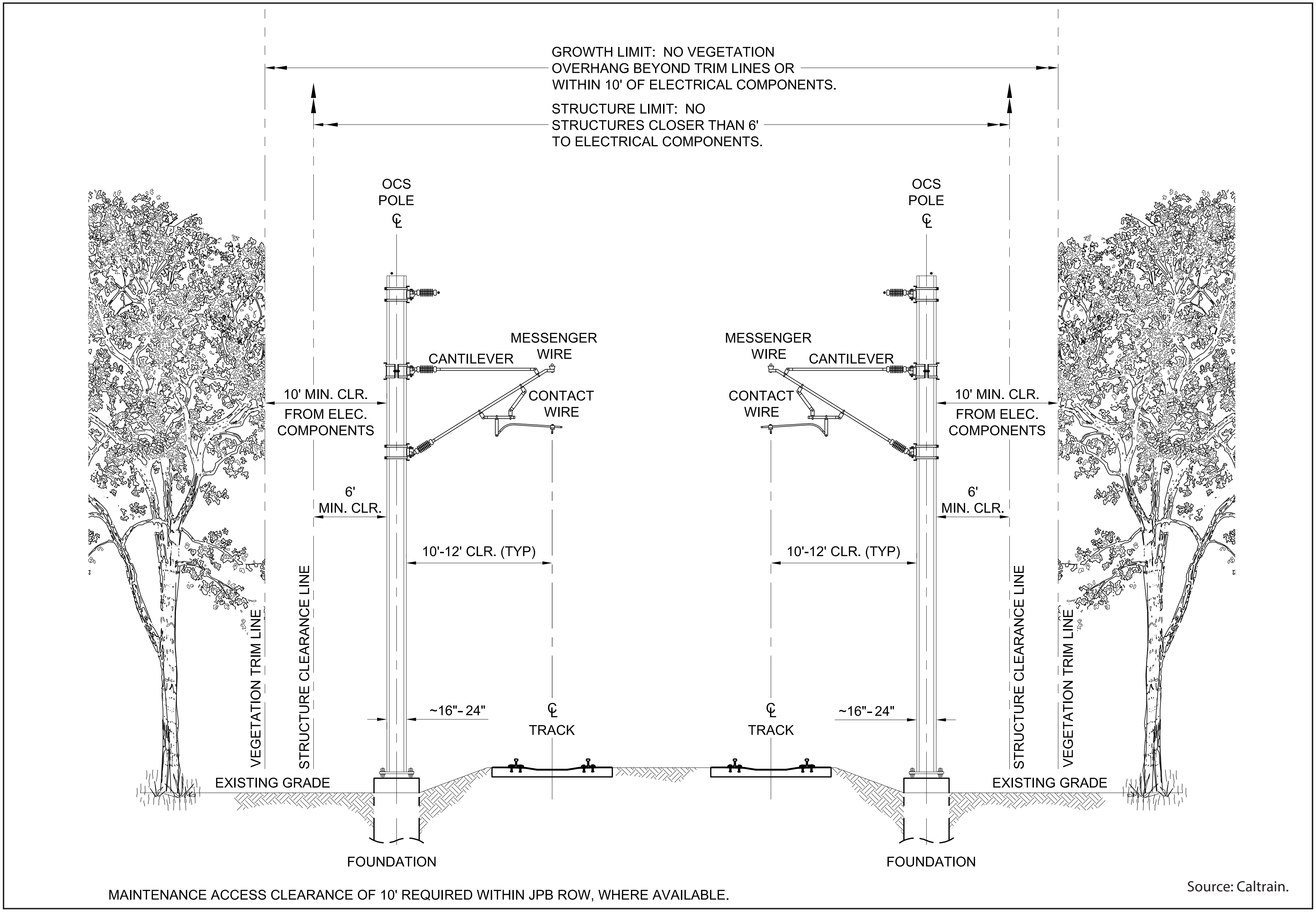
Source: JPB Staff.

Figure 2-7
OCS Two Track Cantilever
Peninsula Corridor Electrification Project



Source: Caltrain.

Figure 2-8
Vegetation Clearance
Peninsula Corridor Electrification Project

to the existing structure, but no part of the existing structure would be removed as a part of the Proposed Project. Installation of the main support brackets would require no permanent modification to the bridge structure and would be completely removable. To avoid impacts on neighboring trees, no poles would be set on the bridge itself or on the side of the bridge superstructure.

Between 1st and 3rd Avenues in San Mateo, the project design would be modified, such as using an alternative pole arrangement, to avoid affecting buildings on the west side that are very close to the Caltrain ROW.

2.3.2 Auto-Transformer Power Feed Arrangement

The auto-transformer power feed system arrangement reduces the need for substations and would require the installation of only two TPSs spaced 36 miles apart. There are three options for the site of each of the TPSs. In addition, there would be one switching station (SWS1) and seven paralleling stations (PS1 through PS7) at a spacing of approximately 5 miles. Two options have been identified for the PS4, PS5, and PS6 sites.

The paralleling stations provide additional power support to the power distribution system and permit increased spacing of the primary substations. In addition to reducing the number of substations—and thereby minimizing the introduction of new, large equipment installations into the corridor—the auto-transformer feed arrangement for implementation along the Caltrain corridor would help reduce electromagnetic fields (EMF) and electromagnetic interference (EMI) because the arrangement includes two parallel aerial feeders, one on each side of the alignment. The currents in the parallel feeders flow in the opposite direction to that in the main catenary conductors, reducing the EMF/EMI effects created by current flow in the OCS.

The Proposed Project would protect the existing railroad signal system, the at-grade crossing system, and the PTC system from EMI created by the 25kv AC system the following ways.

- Designing the catenary system using proven solutions that minimize the effect of EMI.
- Providing sufficient shielding for electronic equipment.
- Installing specialized components, such as filters, capacitors, and inductors.
- Ensuring that the electric vehicles are designed with a frequency that does not interfere with the frequency of the at-grade crossing warning system.

See Chapter 3, Section 3.5, *Electromagnetic Field and Electromagnetic Interference*, for the evaluation of the EMF/EMI effects of this power feed arrangement.

Figure 2-2 shows the proposed general locations for potential TPFs and Figures 2-9 to 2-18 show their specific location, including different options for certain facilities.

2.3.3 Traction Power Substations, Switching Stations, and Paralleling Stations

The two traction power substations would each include two 60MVA (million Volt-amperes) oil-filled transformers that would step down the power utility supplied voltage of 115 kV to the 2 by 25 kV distribution voltage needed for the OCS. The source power utility would be requested to provide two incoming feeds, which would tap two phases of each three-phase transmission line. The traction power substation compound would include circuit breakers and switching equipment that would feed power from the high-voltage lines to each line section of track. The line-side equipment would be designed to provide alternate switching arrangements in the event of a traction power substation equipment outage. A traction power substation compound would typically be approximately 150 feet by 200 feet in size.

Figure 2-19 shows an example TPS compound installation. Figure 2-20 shows a typical 115-kV to 50-kV primary transformer. Figure 2-21 shows a typical 10-MVA auto-transformer.

At approximately the midpoint between traction power substations, a switching station would be installed. At the switching station, a phase break would be required to ensure the power supplies from each traction power substation are isolated from each other in order to avoid a fault condition. In addition, switching would be installed to provide operating flexibility during equipment outages. Between the traction power substations and the switching station, paralleling stations would be installed to maintain the autotransformer system and system operating voltages. The switching station would be equipped with two 10-MVA oil-filled auto-transformer units and the paralleling stations with either one or two 10-MVA oil-filled auto-transformer units. These facilities would contain a variety of circuit breakers and switching equipment but would be typically as shown in the proposed location drawings above. Switching station compound dimensions are typically 80 feet wide by 160 feet long; paralleling station compound dimensions are typically 40 feet wide by 80 feet long. A typical switching station is shown in Figure 2-22.

2.3.4 Overbridge Protection Structures

Electrification of the corridor would require the construction or enhancement of overbridge protection barriers on 47 roadway or pedestrian bridges across the Caltrain alignment. These barriers are necessary to prohibit access to the rail corridor and prevent objects from being thrown off the bridges in a manner that would damage or interfere with the electrical facilities. As shown in Table 2-2, 15 of the existing bridges already have such barriers on both the north and south bridge face, six bridges have a barrier on only one bridge face, and 26 have no overbridge protection barriers. Overbridge protection barriers would be 6.5 feet high above sidewalk or pavement level, and placed along the parapet of the bridge at least 10 feet from the closest energized conductors crossing underneath. The existing barriers would be enhanced to meet these requirements. The overbridge protection barriers would have black, red, and white signage that says, “Danger, Live Wire.”

For two-track segments, the length of the overbridge protection barrier would be about 35 to 40 feet long. For three- and four-track segments, the overbridge protection barrier would be from 65 to 80 feet long. Overbridge protection barriers may be constructed from a variety of materials, including timber, sheet metal, small mesh wire fabric, plastic, concrete, or other solid material.

Source:Imagery, ESRI 2013

Figure 2-9
Proposed Paralleling Station 1 (PS1), San Francisco
Peninsula Corridor Electrification Project

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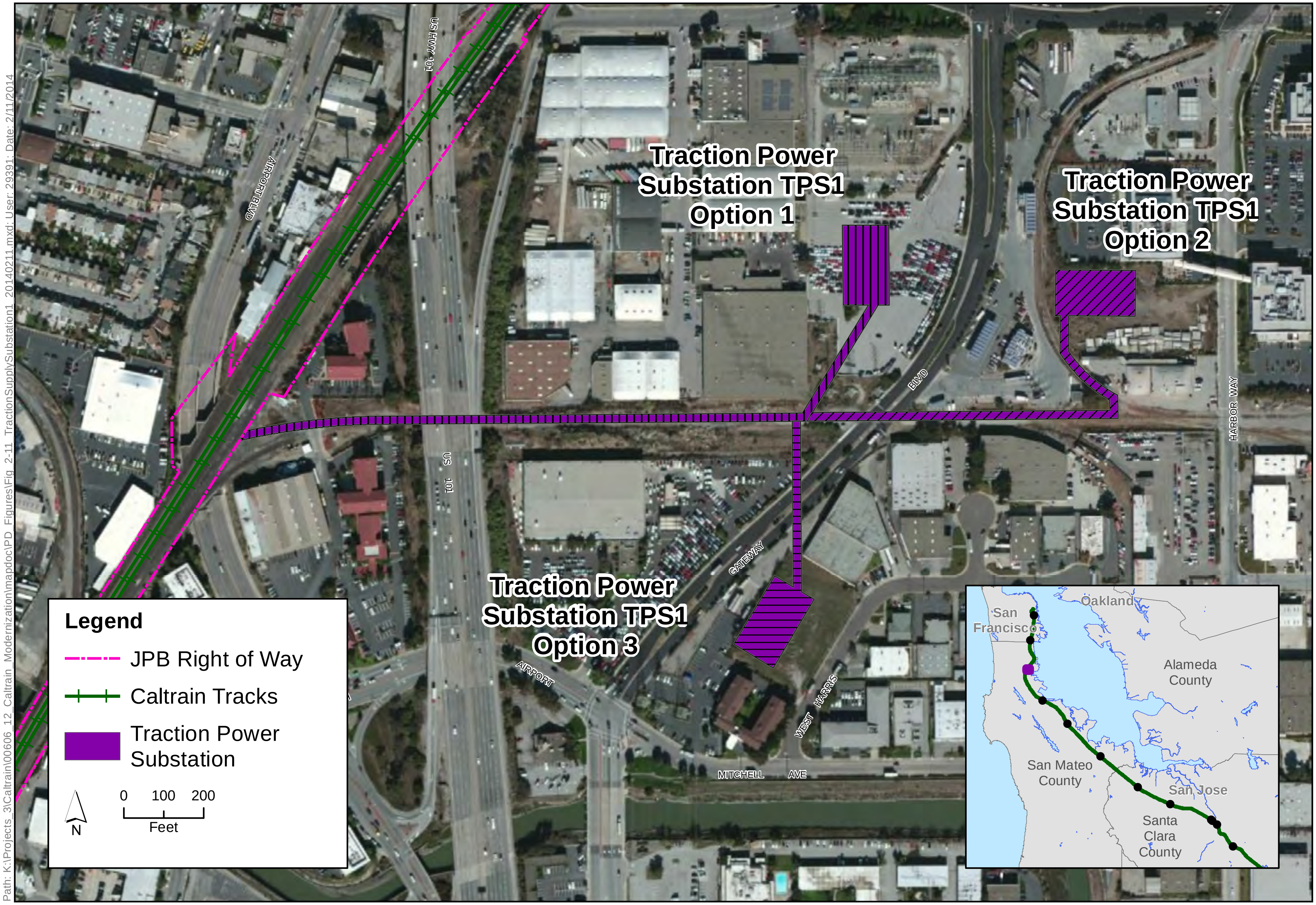
Source: Imagery, ESRI 2013

Figure 2-10
Proposed Paralleling Station 2 (PS2), San Francisco
Peninsula Corridor Electrification Project



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Source: Imagery, ESRI 2013

Figure 2-11
Traction Power Substation 1 (TPS1), South San Francisco
Peninsula Corridor Electrification Project

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Source: Imagery, ESRI 2013

Figure 2-12
Proposed Paralleling Station 3 (PS3), Burlingame
Peninsula Corridor Electrification Project

Source: Imagery, ESRI 2013

Figure 2-13a
Proposed Paralleling Station 4, Option 1 (PS4, Option 1), San Mateo
Peninsula Corridor Electrification Project

Source: Imagery, ESRI 2013

Figure 2-13b
Proposed Paralleling Station 4, Option 2 (PS4, Option 2), San Mateo
Peninsula Corridor Electrification Project

Source: Imagery, ESRI 2013

Figure 2-14
Proposed Switching Station 1 (SWS1), Redwood City
Peninsula Corridor Electrification Project

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Source: Imagery, ESRI 2013

Figure 2-15a
Proposed Paralleling Station 5, Option 1 (PS5, Option 1), Palo Alto
Peninsula Corridor Electrification Project

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Source: Imagery, ESRI 2013

Figure 2-15b
Proposed Paralleling Station 5, Option 2 (PS5, Option 2), Palo Alto
Peninsula Corridor Electrification Project

Path: K:\Projects_3\Caltrain\00606_12_Caltrain_Modernization\mapdoc\PD_Figures\Fig_2-16_ParallelingStation6_20130626.mxd; User: 29391; Date: 1/9/2014

Source: Imagery, ESRI 2013

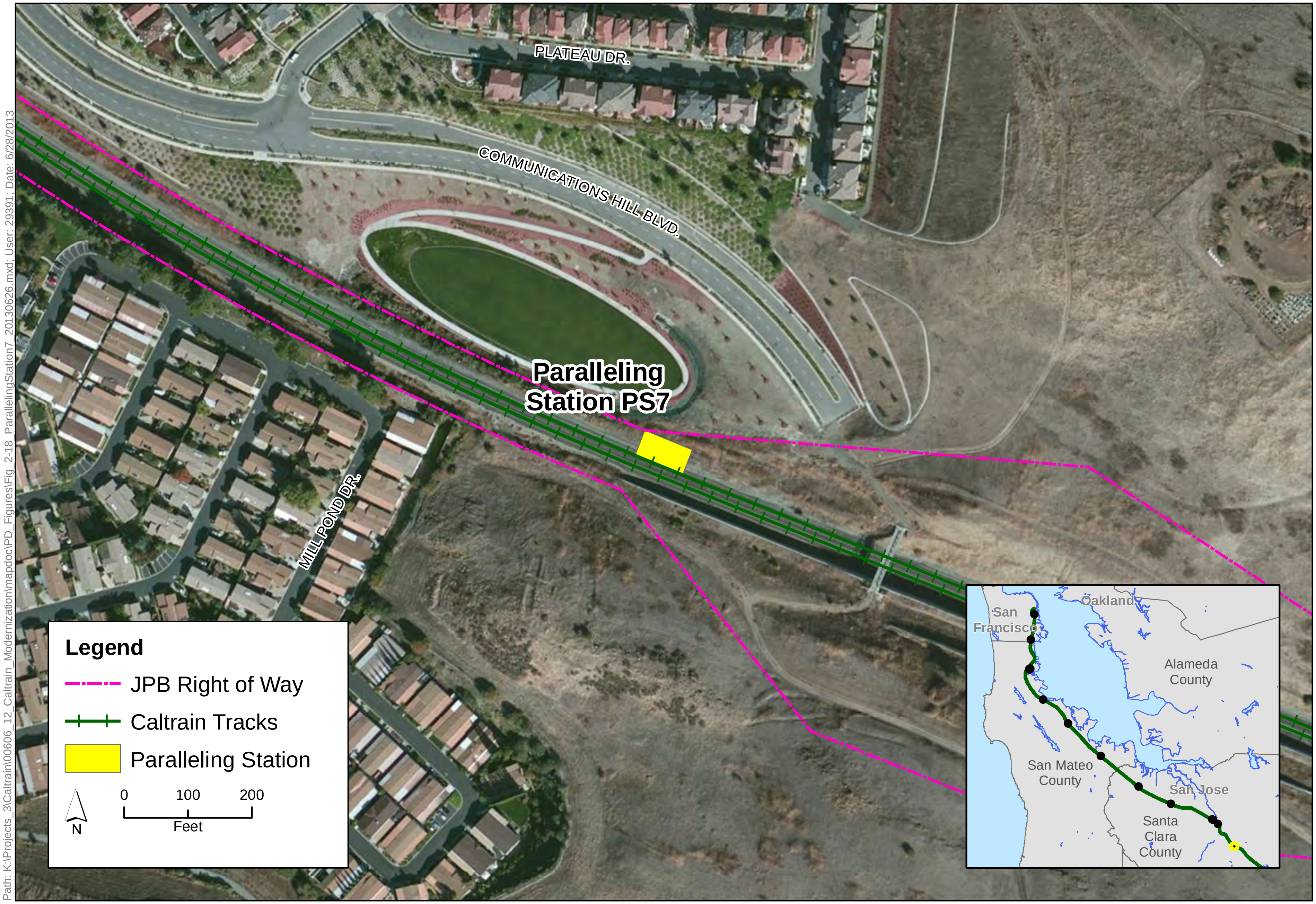
Figure 2-16
Proposed Paralleling Station 6, Option 1 & 2 (PS6, Option 1 & 2), Sunnyvale
Peninsula Corridor Electrification Project

Source: Imagery, ESRI 2013

Figure 2-17a
Traction Power Substation 2, Option 1 & 2 (TPS2, Option 1 & 2), San Jose
Peninsula Corridor Electrification Project

Source: Imagery, ESRI 2013

Figure 2-17b
Traction Power Substation 2, Option 3 (TPS2, Option 3), San Jose
Peninsula Corridor Electrification Project



Source: Imagery, ESRI 2013

Figure 2-18
Proposed Paralleling Station 7 (PS 7), San Jose
Peninsula Corridor Electrification Project

Amtrak's North End Electrification

Source: JPB Staff.

Graphics … 00606.12 (12-10-13)

Figure 2-19
Typical Substation Compound
Peninsula Corridor Electrification Project

Amtrak's North End Electrification

Source: JPB Staff.

Figure 2-20
Typical 115–50 kV (2x25 kV) Primary Transformer (40 MVA)
Peninsula Corridor Electrification Project

Amtrak's North End Electrification

Source: JPB Staff.

Graphics ... 00606.12 (12-10-13)

Figure 2-21
Typical Autotransformer (10 MVA) at Paralleling or Switching Station
Peninsula Corridor Electrification Project

Amtrak's North End Electrification

Auto-Transformers with Fire Walls

Control Building and Auto-Transformer

Source: JPB Staff.

Graphics ... 00606.12 (12-10-13)

Figure 2-22
Typical Switching Station
Peninsula Corridor Electrification Project

Table 2-2. Overhead Bridge Protection Barriers

Number	Mile Post	Bridge Location
Bridges with Barriers on Both Sides – Barriers may be Enhanced		
1	1.90	23rd Street, San Francisco
2	3.14	Oakdale Avenue, San Francisco
3	8.67	Oyster Point Boulevard, South San Francisco
4	9.22	Grand Avenue Westbound, South San Francisco
5	9.23	Grand Avenue Eastbound, South San Francisco
6	13.63	Pedestrian Crossing (Millbrae Station), Millbrae
7	13.70	Millbrae Avenue, Millbrae
8	35.60	Shoreline Boulevard, Mountain View
9	36.49	Stevens Creek Pedestrian Crossing, Mountain View
10	39.32	Pedestrian Crossing, Sunnyvale
11	39.71	Wolfe Road, Sunnyvale
12	40.70	Pedestrian Crossing, Sunnyvale
13	40.75	Lawrence Expressway, Sunnyvale
14	43.65	Lafayette Pedestrian Crossing, Santa Clara
15	45.60	Hedding Avenue, San Jose
Bridges with One Barrier – Construct One New Barrier; Existing Barrier May be Enhanced		
1	1.72	22nd Street, San Francisco[a]
2	19.16	Highway 92 Eastbound, San Mateo[b]
3	26.15	Woodside Road / Highway 84, Redwood City[a]
4	36.80	Whisman Road, Mountain View[a]
5	38.60	Mathilda Avenue, Sunnyvale[b]
6	42.90	Scott Boulevard, Santa Clara[b]
Bridges with No Barriers – Construct Two New Barriers		
1	0.48	6th Street Off-Ramp, San Francisco
2	0.85	Interstate 280, San Francisco
3	1.27	Mariposa Street, San Francisco
4	2.10	Interstate 280 Southbound, San Francisco
5	2.16	Interstate 280 Northbound, San Francisco
6	2.70	Cesar Chavez Street Off-Ramp, San Francisco
7	3.66	Williams Avenue, San Francisco
8	4.15	Paul Avenue, San Francisco
9	6.64	Tunnel Avenue, Brisbane
10	7.69	U.S. Highway 101, Brisbane
11	7.80	Sierra Point Parkway, Brisbane
12	9.40	U.S. Highway 101 Northbound, South San Francisco
13	9.41	U.S. Highway 101 Southbound, South San Francisco
14	10.82	Interstate 380, San Bruno
15	19.12	State Route 92 Westbound, San Mateo
16	34.00	San Antonio Avenue, Palo Alto
17	36.50	State Route 85, Mountain View
18	37.10	State Route 237 Westbound, Mountain View
19	37.11	State Route 237 Eastbound, Mountain View
20	39.31	Fair Oaks Avenue, Sunnyvale

Number	Mile Post	Bridge Location	
21	42.50	San Tomas Expressway, Santa Clara	
22	43.99	De La Cruz Boulevard, Santa Clara	
23	45.30	Interstate 880, San Jose	
24	47.29	San Carlos Street, San Jose	
25	50.10	Almaden Expressway, San Jose	
26	50.49	Curtner Avenue, San Jose	
TOTALS			
Bridges with Two Existing Barriers: Barriers May Be Enhanced			15
Bridges with One Existing Barrier: Construct One/May Enhance One			6
Total Bridges with No Existing Barriers: Construct Two New Barriers			26
TOTAL NUMBER OF BRIDGES			47

Source: FTA and JPB 2009.
[a] For bridges with one barrier, the existing barrier is on the north face.
[b] For bridges with one barrier, the existing barrier is on the south face

Figure 2-23 shows a typical overbridge protection barrier treatment as installed on the Northeast Corridor. A fine mesh wire fabric would be used for the Proposed Project. This fabric would provide safety protection and maintainability while affording a measure of transparency for both pedestrians and motorists. See Chapter 3, Section 3.1, *Aesthetics*, for a visual simulation of the overbridge protection barrier type that would be used for the Proposed Project and an evaluation of visual impacts.

2.3.5 At-Grade Crossing Warning Devices

The Proposed Project would also require a change in the warning devices for at-grade crossings. At present, at-grade crossings are operating with Harmon Crossing Predictors and Grade Crossing Predictors as warning devices. As part of the Proposed Project, those warning devices would be removed because they operate on a DC circuit and the proposed EMUs would operate on an AC circuit.

Caltrain trains equipped with onboard CBOSS PTC equipment will communicate with the at-grade crossings wirelessly, allowing the at-grade crossing gates to function safely. CBOSS PTC will be in place by 2015.

For non-Caltrain trains (which will not have onboard CBOSS PTC equipment), Audio Frequency Overlays (AFOs), also known as track circuits, will be installed at fixed locations along the Caltrain ROW, allowing the at-grade crossing gates to function safely. An AFO is a sensor that activates the at-grade crossings when the train is approaching. New cables and wires are required for the AFOs. Cable and wire installation will be within the Caltrain ROW and construction will involve these specified activities:

- Trenching and excavating
- Installation of conduits
- Installation of cables and wires
- Installation of AFO equipment

Existing Caltrain Pedestrian Walkway with Overbridge Protection Barrier

Barrier Material

Source: JPB Staff.

Graphics ... 00606.12 (12-10-13)

Figure 2-23
Typical Overbridge Protection Barrier
Peninsula Corridor Electrification Project

- Connections at at-grade crossings

In the next phase of design, additional engineering will be conducted on the performance of AFOs and alternative design options.

2.3.6 Rolling Stock

New EMUs are the preferred rolling stock option for the Proposed Project. New EMUs would replace the portion of Caltrain's existing diesel locomotives and passenger cars that will reach the end of its useful life by 2019. In 2019, Caltrain would operate a mixed fleet that would have approximately 75 percent electric service between San Francisco and San Jose with EMUs, and diesel service for the remaining 25 percent. With EMUs, each car, or set of cars (unit), can have its own pantograph mounted on the roof and separate electric motor drives to each axle. EMUs can be operated in a variety of train consists, dependent upon the requirements of the rail system operator. Options include single motor cars (where each car is fitted with a driving cab at both ends) and paired cars (where there is a driving cab at only one end of each car). A pair can comprise two motor-cab cars, or a motor-cab plus a non-motored trailer-cab car. Another option would be two motorized cab cars with multiple non-motored trailer cab-cars in between.

EMUs currently in use include the 1,500-volt DC gallery cars now being operated by Metra in Chicago. These cars closely resemble the Caltrain double-level gallery cars. Northern Indiana Commuter Transportation District also operates the new 1,500-volt DC multi-level Nippon Sharyo cars in northern Indiana and Illinois. Twenty-five kV AC single-level EMUs are in service on the Deux Montagnes Commuter Railroad in Montreal. Typical modern European EMU vehicles are shown in Figure 2-24. In addition, Metro-North Railroad, NJT, and SEPTA operate single-level EMUs powered from an 11.5- to 12.5-kV and 25-kV AC OCS. There is currently no United States-based prototype for the EMU proposed for the Proposed Project. The EMU vehicle for the Proposed Project would be a multi-level car of comparable dimensions to the existing Caltrain gallery car. Caltrain has received a waiver from the FRA that would allow modern European EMU equipment to operate on the Caltrain Peninsula Corridor provided that temporal separation is provided between the light-weight EMUs and heavy freight trains (this is referred to as the FRA waiver).[7]

Power for the electric vehicles would be drawn from the OCS through a roof-mounted pantograph on the power car(s) or locomotive. The pantograph is a hinged, mechanical device that can extend vertically to follow variations in the OCS contact wire height, with a typical extension from as low as 14 feet up to 24 or 25 feet. A typical pantograph is depicted in Figure 2-25.

2.3.7 Operations and Maintenance

2.3.7.1 Caltrain Operating Scenario(s) Under Electrification

Caltrain's existing service includes five trains per peak hour during the a.m. and p.m. peaks, as well as mid-day service, for a total of 92 trains per day. In addition to local service (stopping at every station), existing weekday Caltrain service consists of six baby bullet trains and ten limited-stop trains in the a.m. northbound and p.m. southbound and five baby bullet trains and 11 limited-stop

[7] It should be noted that the FRA is currently in a rulemaking process for "Alternative Compliant Vehicles" that is relevant to the EMUs in the Proposed Project. It is Caltrain's understanding that when the rule is in place, the FRA waiver and the temporal separation requirement may no longer be necessary. For the purposes of this EIR, it is assumed that the current FRA waiver requirement would be in force.

trains in the a.m. southbound and p.m. northbound. There is approximately one train per hour per direction from 10 a.m. until 2 p.m. and after 7 p.m.

The proposed level of Caltrain operations includes six trains per peak hour during the a.m. and p.m. peaks, as well as mid-day service, for a total of 114 trains per day. Based on a prototypical schedule, with project implementation, there would be approximately six a.m. and p.m. baby bullet trains per direction. There would be approximately two trains per hour per direction from 9 a.m. until 4 p.m. and after 7 p.m. An example prototypical schedule of proposed Caltrain service is provided in Appendix I, *Ridership Technical Memorandum*. This prototypical schedule was developed to derive ridership estimates and for use in the analysis in this EIR. The actual schedule may vary.

2.3.7.2 Ridership

Implementation of the Proposed Project is anticipated to result in increased ridership by 2020 and by 2040. Table 2-3 shows the existing Caltrain ridership and the projected Caltrain ridership from 2020 and 2040, with and without the Proposed Project.

Table 2-3. Estimated Caltrain System Ridership with the Proposed Project

	2013	2020[a]	2040
Existing/No Project[b]	47,000	57,000	84,000
With Project[c, d]	N/A	69,000	111,000

Source: Appendix I, *Ridership Technical Memorandum*

[a] 2020 was used for ridership analysis to ensure full operation of the new electrified service.

[b] No Project analysis assumes the same schedule as at present (5 trains per peak hour; 1 train per off-peak hour per direction; total of 92 trains per day) for both 2020 and 2040

[c] For 2020, analysis assumed 75% electrified and 25% diesel service from San Jose to San Francisco.

[d] For 2040, analysis presumes fully electrified service between San Jose and San Francisco. As described above, the Proposed Project only has sufficient funding at present to provide 75% electrified service between San Jose and San Francisco. It is presumed that additional funding will be obtained to allow full electrified service between San Jose and San Francisco to occur by 2040.

2.3.7.3 Energy Consumption

The Proposed Project's primary energy source would be electricity. Through conversion of trains from diesel motor propulsion to EMUs, the Proposed Project would substantially decrease diesel fuel use and substantially increase annual electricity use.

Existing fuel consumption is approximately 4.5 million gallons per year (mid-2012 to mid-2013). With the Proposed Project, in 2019 diesel trains would provide approximately 25 percent of service from San Francisco to San Jose and all of the service from San Jose to Gilroy. These diesel trains would require 1.1 million gallons of fuel per year, a reduction of approximately 3.4 million gallons per year from current conditions.

Proposed Project operation would require approximately 83 million kWh of electricity in 2019. This includes energy expended during both train travel and idling.

2.3.7.4 Maintenance

Pruning or removal of trees would be required along the tracks and electrical facilities where trees would otherwise pose a maintenance or safety concern. These impacts are addressed within this

Siemens EMU

TER-2N EMU

Source: JPB Staff.

Graphics … 00606.12 (12-10-13)

Figure 2-24
Typical EMU Vehicles
Peninsula Corridor Electrification Project

Source: JPB Staff.

Graphics … 00606.12 (12-10-13)

Figure 2-25
Typical Pantograph
Peninsula Corridor Electrification Project

document; refer to Chapter 3, Section 3.1, *Aesthetics*, and Section 3.3, *Biological Resources* for analysis of the impacts of tree pruning and removal on aesthetics and biological resources.

One maintenance item that is unique to electric vehicles is the need to inspect the pantograph carbon collector strips for wear and damage. Carbon is a relatively soft material, even when mixed with copper particles to create "metalized" strips. However, carbon, rather than the contact wire, is designed to be the sacrificial element in the sliding current collection interface. As a result, the pantograph would need to be frequently inspected to ensure that there is sufficient carbon interface.

2.3.8 Construction

Construction activities for PECP would consist of the installation of OCS poles and wires; the construction of TPFs; the installation of pantograph inspection platforms; and the erection of overbridge protection barriers on roadway bridges that cross the Caltrain alignment. Installation of wiring and storage tracks within the Central Equipment Maintenance Operations Facility (CEMOF) and at the Lenzen Yard in San Jose are also included. Construction of the electrification infrastructure from San Francisco to San Jose would take approximately 3 to 4 years, including commissioning and testing.

2.3.8.1 Construction Methods

Overhead Contact System Installation

Under normal conditions, pole foundations would be excavated by means of 3-foot-diameter augers, and the soil would be removed to a depth of approximately 15 feet. In areas that are close to drainages paralleling the rail corridor or in areas where there is potential for encountering contaminated soils or groundwater, an alternate process would be used. In order to reduce impacts to the drainage banks and vegetation, a steel casing would be vibrated into place by ultrasonic vibrators. The casing would be sunk to the full 15-foot depth, and soil would be excavated to a depth of only 5 to 7 feet to place the pole foundation.

Spoils resulting from the excavations for OCS pole foundations would be relatively small in quantity. These spoils would be disposed of by spreading them along the railroad ROW in the vicinity of the excavation. Any spoils found to be contaminated with hazardous waste would not be spread within the ROW; the disposal of such material is addressed in Section 3.8, *Hazards and Hazardous Materials*.

Construction would typically occur along 1- to 2-mile sections of the corridor and would involve several "passes" per track. One pass would install the foundations, a second would place the poles, and another would install the feeder wires and support arms; these would then be followed by additional passes for installation of the messenger and contact wires. The final pass would involve a system check to ensure proper installation. This sequence is consecutive; however, construction could occur in several segments simultaneously, with different activities occurring at any or all of those locations.

The construction equipment required for these operations may include flatbed trucks, on which various items of construction equipment would be mounted. These may include auger drill rigs, directional bore machines, cranes, and telescoping boom bucket trucks. There would be other support vehicles, many of which would be fitted with hi-rail equipment, because the primary access to the construction sites for the catenary system would be from the tracks.

The track windows required for the installation of the OCS poles and foundations would be different from those required for other tasks, depending upon whether there is access for the contractor to perform the construction adjacent to the tracks, or whether there are constraints to access due to natural resources or the potential for archaeological resources in the immediate vicinity. Work adjacent to the tracks is best for minimizing impacts on train operations, but work on the tracks may be preferable where feasible to avoid impacts on sensitive resources.

Based upon the current and planned track alignment, there would be approximately 3,200 poles and 3,800 foundations. Approximately 20 to 30 percent of the poles and foundations could be installed with off-track equipment and with minimal impact on train operations. Nominal timeframes for installing OCS pole foundations and poles with off-track access would be between 10:00 a.m. and 3:00 p.m., but installations may be outside these hours if needed to meet the overall construction schedule. The remaining 70 to 80 percent of the poles and foundations would be installed with on-track equipment, requiring single-track access work windows. This work would need to be performed during off-peak operations, with single-tracking, such as:

- 8:00 p.m. to 6:00 a.m., Monday through Thursday
- 8:00 p.m. Friday to 6:00 a.m. Monday

The windows for the installation of the OCS conductors, such as static wires, parallel feeders, and messenger and contact wires, would use on-track equipment and require nighttime and weekend track occupancies, including weekend outages that would require total suspension of passenger revenue service. These track windows would primarily use single-tracking but would require some multiple track shutdowns to install the OCS conductors at the complex interlockings. The majority of such OCS wirework would need to be accomplished during the nighttime using single-track windows, but some portions of the work could only be installed by using complete weekend outages, requiring suspension of passenger service to increase working efficiency and reduce public safety risks. Typical work windows for on-track equipment would be:

- 8:00 p.m. to 6:00 a.m., Monday through Friday (night and multiple tracking)
- 8:00 p.m. Friday to 6:00 a.m. Monday (with single-tracking)

Overbridge Protection Barriers

Bridge barrier installation would consist generally of installing prefabricated components onto the existing parapets of the overhead bridges that traverse the project corridor. Work crews would install anchor bolts into the existing bridge structure and then mount the bridge barrier. Equipment used would typically be pneumatic drills, flatbed trucks, utility trucks, boom trucks, generators, and light towers. The JPB would coordinate with Caltrans or city departments of public works to obtain the required permit approvals for barriers on state or city roadways, respectively.

The installation of overbridge protection barriers would occur almost entirely with the use of off-track equipment. Installation of overbridge protection barriers would occur from 7:00 a.m. to 7:00 p.m. Monday through Sunday. Any work requiring the use of on-track equipment would be minimal and would be coordinated with the on-track window requirements for OCS wire installation.

Traction Power Substation, Switching, and Paralleling Stations and Lay-Down Area

The sites proposed for the location of the traction power substations, switching stations, and paralleling stations are mostly in industrial areas or transportation rights of way, or are proximate to existing high-voltage facilities; see Chapter 3, Section 3.10, *Land Use and Planning*, for evaluation of the use of these sites. Site preparation would include clearing, grubbing, and grading with bulldozers and dump trucks. Site access would be prepared concurrently with the site operations.

A ground grid composed of copper wire and driven ground rods, which is necessary for the protection of personnel and equipment during operation of the electrical systems, would be placed below each TPF at a depth of approximately 3 feet and then covered by fill.

Interconnections between electrical equipment would be accomplished in part by raceways contained in concrete encased conduits (duct banks). These duct banks would be installed as explained below.

- Dig a 4-foot-deep trench with backhoe.
- Construct forms as necessary (plywood and 2x4s).
- Arrange conduits per design plans.
- Place encasement concrete.
- Remove forms and backfill with soil.

Concrete foundations would be required for the mounting of freestanding electrical transformers, circuit breakers, and disconnect switches, as well as for the prefabricated control and medium voltage switchgear building. Foundations would generally be constructed as explained below.

- With bulldozer and backhoe, dig to bottom grade per design plan.
- Construct forms as necessary (plywood and 2x4s).
- Arrange reinforcing steel, anchor bolts, grounding connections, and conduits (extensions of duct banks) as required per design plans.
- Place concrete.
- Strip forms and backfill.

Electrical equipment to be installed would include outdoor high-voltage switches, transformers, and cables, as well as the prefabricated control and switchgear room. Some of the equipment would be mounted on small steel structures. Equipment weights range from several hundred pounds to 100,000 pounds; therefore, the installation rigs would range from small truck-mounted cranes to larger track-mounted units. The equipment would be electrically connected together by cable or by buss (open air copper or aluminum tubes). Small truck-mounted cranes would be used to move and arrange the reels of cable and to support buss work during installation.

The primary service from the local utility network would be via either underground or overhead transmission lines. The installation would be either through duct banks or via direct connections to the transmission lines. Station sites would typically be finished with fencing along the entire periphery. Ground surfaces would be covered with clean crushed rock.

The electrical system would be tested prior to initiation of electrified train operations. Testing would be in two main phases. The first phase would involve testing with no power to verify that the installation complies with the design. In the second phase, the system would be energized to verify performance and to adjust system protective devices.

The traction power substations, switching station, and paralleling stations would be installed with off-track equipment. The work window requirements for constructing the interface facilities to the OCS conductors would be coordinated with the installation of the OCS wires.

2.3.8.2 Potential Construction Staging and Access Areas

The JPB has preliminarily identified potential construction track access and staging locations within the Caltrain ROW, on other property owned by the JPB or the San Mateo County Transit District (SamTrans), and at the TPF sites. There could be staging locations outside the Caltrain ROW or additional staging and access areas within the ROW that are not listed below that may be used for construction. This information is provided for the purposes of analysis in the EIR to give an idea of where staging may occur.

The following primary track access points have been identified along the corridor.

- San Francisco, CP Common set out tracks (MP 0.9).
- Brisbane, Visitation lead (MP 6.0).
- South San Francisco, Drill track (MP 9.5).
- Burlingame, Set out track (MP 16.0).
- San Mateo, Former Bay Meadows set out track (MP 19.9).
- San Carlos, Set out track (MP 23.4).
- Redwood City, Redwood Junction (MP 26.5).
- Menlo Park, Alma set out track (MP 29.6).
- Palo Alto, Set out track (MP 32.2).
- Mountain View, Set out track (MP 35.3).
- Santa Clara, Calstone lead (MP 40.8).
- Santa Clara/San Jose, Santa Clara Drill track (MP 45.5).
- San Jose, Tamien siding (MP 49.2).
- San Jose, Lick set out track (MP 51.6).

The following potential staging areas within the Caltrain ROW or on JPB or SamTrans property have been identified.

- San Francisco, East side of San Francisco 4th and King Yard, (MP 0.4).
- San Francisco, Northeast corner of 16th street (MP 1.1).
- Brisbane, Under Tunnel Avenue West and East side of ROW (MP 6.7).
- San Bruno, Caltrain ROW Scott Street (MP 10.6).
- San Bruno, East of San Bruno Grade Separation (MP 11.6).
- Millbrae, Caltrain ROW Center Street (MP 12.7).
- Burlingame, Caltrain ROW South of Oxford Road (MP 14.8).
- Burlingame, Caltrain ROW, East of MT-1 (MP 15.5).

- Burlingame, Southeast of Oak Grove Avenue (MP 16.0).
- Burlingame, Northeast corner of Peninsula Avenue (MP 16.8).
- San Mateo, East side of ROW at Villa Terrace (MP 17.0).
- San Mateo, West side of ROW between 9th and 16th Avenues (MP 18.3).
- San Mateo, West side of ROW past 25th Avenue (MP 19.8).
- Belmont, Belmont Station Parking Lot North (MP 22.0).
- Redwood City, East of Redwood Sidings (MP 26.5).
- Atherton, South of Atherton Station (MP 27.8).
- Atherton, Northwest of Encinal and Glenwood Avenues (MP 28.3).
- Palo Alto, Southside of Alma Crossing (MP 29.8).
- Palo Alto, South of California Avenue Station (MP 32.1).
- Palo Alto, Along ROW from Meadow to Charleston (MP 33.0).
- Mountain View, East side of ROW (MP 35.2).
- Sunnyvale, South of Sunnyvale Avenue (MP 38.9).
- Sunnyvale, West side of ROW (MP 42.9).
- Sunnyvale, West side of ROW (MP 44.0).
- Sunnyvale, South of De la Cruz Boulevard, West of ROW (MP 44.6).
- Santa Clara, Santa Clara Station parking lot (MP 45.0).
- San Jose, College Park Station (MP 46.3).
- San Jose, CEMOF (MP 46.6).
- San Jose, North of Diridon Station, corner of Alameda Street (MP 47.4).
- San Jose, Southwest corner of Virginia Street (MP 48.2).

In addition to the potential staging areas noted above, the TPF sites could also be used for staging.

- TPS1 Options 1 and 2: Off Gateway Boulevard, South San Francisco.
- TPS Option 3: Off Harbor Way, South San Francisco.
- TPS2 Option 1: Off Newhall Street, San Jose.
- TPS Option2: Off Stockton Avenue, San Jose.
- TPS Option 3: At CEMOF[8], San Jose.
- PS1: Pennsylvania Avenue and Mariposa Street, San Francisco (MP 1.3).

[8] TPS2 Option 3 would affect the Caltrain parking lot at the Central Control Facility. A high level assessment shows that if TPS2 is located at the Option 3 site, it would require relocation of approximately 75 Caltrain parking spaces (an approximately 150-foot-by-200-foot area) and two Caltrain storage containers (approximately 40 feet by 20 feet). If Option 3 site is selected, the parking spaces and containers would be relocated within Caltrain's ROW in non-sensitive environmental areas.

- PS2: Blanken and Tunnel Avenues, San Francisco (MP 5.0).
- PS3: California & Lincoln Avenues, Burlingame (MP 15.0)
- PS4: Option 1: Hillsdale, San Mateo (MP 20.1).
- PS4 Option 2: Hillsdale, San Mateo (MP 20.3).
- SWS1: Redwood Junction, Redwood City (MP 26.7).
- PS5 Option 1: Alma Boulevard and Green Meadow Way, Palo Alto (MP 33.6).
- PS5 Option 2: Near Page Mill Road at Caltrain ROW (MP 32.0).
- PS6 Option 1: West Hendy and North Murphy Avenues, Sunnyvale (MP 38.9).
- PS6 Option 2: Sunnyvale Train Station parking lot (MP 38.7).
- PS-7: End of Communication Hill Boulevard, San Jose (MP 51.0).

2.3.8.3 Construction Schedule/Durations

The preliminary project schedule (subject to change) is provided below.

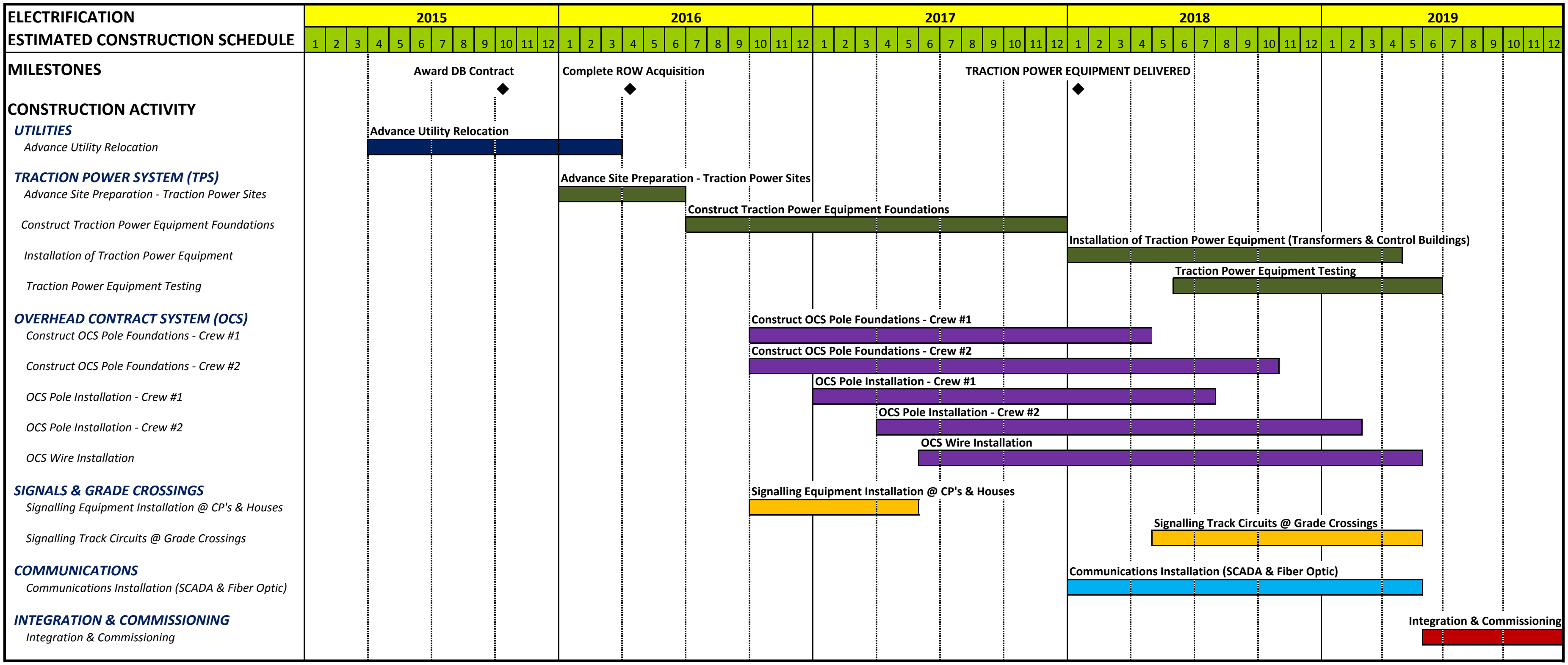
- Environmental review/design/permitting: 1–2 years.
- Construction: 3–4 years.
- Testing: 1–2 years.

The goal is to commence electric revenue service in 2019.

The construction activities described above are not sequential; construction could occur simultaneously at several locations. Figure 2-26 shows estimated durations for construction of the Proposed Project.

2.3.8.4 Potential Construction Strategies to Accelerate Construction Completion

Although the preliminary schedule shown in Figure 2-26 shows completion of construction to allow revenue service to commence in 2019, achieving this goal will be challenging given the scale and complexity of construction. The JPB has identified a number of construction strategies (see Table 2-4) that could be used to accelerate completion of construction. These strategies may be employed on different elements of construction, different segments of construction, or construction as a whole. Construction strategies need to balance construction efficiency with minimizing construction impacts.



Source: JPB Staff 2014

Graphics … 00606.12 (01-06-2014) SS

Figure 2-26
Estimated Construction Schedule
Peninsula Corridor Electrification Project

Table 2-4. Potential Construction Strategies to Accelerate Project Completion

Potential Strategies (Not Exhaustive)	Past Caltrain Projects
Flexibility for construction work permitted during the day on weekdays	San Bruno, Jerrold
Single tracking during the midday (10 a.m.–3 p.m.) on weekdays	None
Revise Caltrain schedule	San Bruno, Jerrold
Reduce the span of Caltrain service day	None
Reduce number of trains (including special trains)	None
Shut down service through specific track segments for specific weekends	South Terminal, Jerrold
Shut down service through specific track segments for extended periods	None
Close a station temporarily during construction	South Terminal, San Bruno

Some of these strategies have been used on other rail projects, including those listed below.

- The Gladstone Line OCS Pole Replacement Project for New Jersey Transit used full weekend outages throughout the summer.
- The Track Testing Program for the Long Island Railroad removed early morning train service during construction.
- The Tie Installation and Track Resurfacing Project for the Long Island Railroad eliminated midday service for 1 month during construction.
- The Catenary System Replacement Project for the North Indiana Commuter Transportation District used single tracking throughout construction.

The JPB has not selected specific strategies for project delivery at this time, especially in advance of selection of contractors for design and construction of the Proposed Project. The JPB will work with its staff and future contractors to best minimize impacts on Caltrain customers and follow all applicable federal policies such as Title VI and the Americans with Disabilities Act (ADA).

2.3.9 Right-of-Way and Easement Needs

Based on the current system design, and assuming a worst-case-pole-placement scenario, there would be a need for acquisition of new ROW for one TPS (and possibly a second TPS, depending on location) as well as for some areas where OCS poles and wires would need to be placed outside the current ROW.

For the two TPSs, the JPB is considering several different sites for each substation. Sites for intermediate paralleling and switching station facilities have also been identified, but all of the locations are within the Caltrain ROW. The nominal size of the traction power substations would be 150 feet by 200 feet, which is approximately 0.7 acre. Thus, the total estimated area needed for the two traction power substations is up to 1.4 acres.

In most cases, the OCS poles would be placed within the Caltrain ROW. However, in certain locations, there may be insufficient clearance from the railway track centerlines and the JPB may need to acquire ROW for placement of poles and wires. At this time, based on 35 percent design and worst-case pole placement (i.e., side poles) in terms of ROW need, it is estimated that approximately 9,000 linear feet of the OCS alignment would be slightly outside the existing ROW, of which 7,000 linear feet would in adjacent public road and rail ROWs (requiring easement acquisition) and 2,000 feet would be on private commercial or industrial property (requiring ROW acquisition in fee). Assuming an average encroachment of 4 feet, new easements on adjacent public roads and on rail ROW is estimated as 0.6 acres and ROW acquisition on private property is estimated as 0.2 acres, for a total of 0.9 acres.[9] These calculations presume placement of OCS poles on the outside of the outermost track. If alternative pole alignments are used in some locations, these estimates may change.

In addition, in some locations there is insufficient ROW width to provide for the necessary 10 feet of electrical safety clearance to adjacent vegetation and structures. Where electrical clearance is necessary outside the Caltrain ROW, the JPB would need to obtain an electrical safety easement from property owners to permit the pruning and removal of vegetation and to maintain structures outside a 6-foot safety zone from the OCS alignment. At this time, it is estimated that approximately 8 acres of new easement would be required on adjacent public road and rail ROW, 10 acres on private residential, commercial, or industrial property, and 0.3 acres on parklands for a total of approximately 18 acres. These calculations presume placement of OCS poles on the outside of the outermost track. If alternative pole alignments are used in some locations, these estimates may change.

The JPB is presently examining the design for project facilities and the amount of needed ROW may be more or less than that discussed above.

2.3.10 Relation to the High-Speed Rail Project

The electrification system envisioned for the corridor would be configured in such a way that it would support the future operation of California HSR. Twenty-five-kV, 60-Hz single-phase AC electrification would be the power supply system of choice for a steel-wheel-on-steel-rail high-speed train operation. The Caltrain corridor is currently only rated for a maximum of 79 mph and, thus, there may be a need for track and other system upgrades in order to support higher speeds than at present. The Proposed Project includes electrification infrastructure that would first be used by Caltrain and can later be used for high-speed trains. However, the Proposed Project does not include other improvements necessary for high-speed trains such as platform improvements, high-speed rail maintenance facilities, passing tracks or other Core Capacity projects. The Proposed Project does not include improvements to support speeds greater than 79 mph or high-speed rail operations on the Caltrain corridor at speeds up to 110 mph.[10] High-speed rail construction and operations would be the subject of a later, separate environmental analysis to be conducted by CHSRA and FRA. The

[9] Total does not add due to rounding.

10 As described in Section 4.1, *Cumulative Impacts*, the cumulative analysis in this EIR presumes speeds for Blended Service up to 110 mph because the blended system has been simulated by Caltrain at speeds of up to 110 mph and shown to be viable. In addition, CHSRA has confirmed that with speeds up to 110 mph, a 30-minute express travel time can be achieved between San Jose and San Francisco as required by Prop 1A (CHSRA 2013). If it is determined to be necessary to analyze speeds greater than 110 mph in the future, additional simulations will be performed to understand the viability and implications of the 100 to 125 mph speed range identified by CHSRA in the 2012 Partially Revised Program EIR (CHSRA 2012d). If speeds beyond 110 mph are ultimately proposed by CHSRA for the Caltrain corridor, they will be evaluated in the separate environmental document for HST service on the San Francisco Peninsula.

cumulative impact analysis in this document does address cumulative impacts of Blended Service (see Chapter 4, Section 4.1, *Cumulative Impacts*) but only provides a conceptual analysis of those impacts given that HSR design for Blended Service has not been completed.

2.4 Costs and Funding

2.4.1 Capital Costs

An estimate of the capital costs associated with the Proposed Project including rolling stock and the fixed facilities was completed for the 2009 Environmental Assessment (EA)/EIR (FTA and JPB 2009). The cost of the fixed facilities (e.g., OCS, traction power facilities) was estimated at approximately $785 million and the cost of rolling stock was estimated to be $440 million for a total of $1,225 million (FTA and JPB 2009). The JPB is presently developing updated capital costs that will be presented in the Final EIR.

2.4.2 Capital Funding Sources and Programming

The Proposed Project's capital costs are proposed to be funded from the sources shown in Table 2-5.

Table 2-5. Funding Sources for Corridor Electrification Project (Millions of Dollars)

Source	Amount (YOE$)
State Proposition 1A[a], Proposition 1B[b]	$620
JPB	$121
Regional (Bay Area Air Quality Management District, Tolls)	$31
Federal (Federal Transit Administration)	$453
TOTAL	**$1,225**

[a] Safe, Reliable High-Speed Passenger Train Bond Act for the 21st Century of 2008.
[b] The Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006.
YOE = year of expenditure.

2.4.3 Operating and Maintenance Costs and Revenues

The prior 2009 EA/EIR (FTA and JPB 2009) presented estimates of operating and maintenances costs and revenues for the electrification project. The JPB is presently developing new estimates that reflect current assumptions and the recent ridership estimates. The updated operations and maintenance costs will be presented in the Final EIR.

2.5 Required Permits and Approvals

Pursuant to SamTrans' enabling legislation (Public Utilities Code Section 103200 et seq.) which is applicable to the JPB under the terms of its formation document and federal law governing the operations of rail carriers (which is applicable to the JPB as a result of the 1991 Interstate

Commerce Commission approval of the JPB acquisition of the Caltrain line), JPB activities within the Caltrain ROW are exempt from local building and zoning codes and other land use ordinances. Nonetheless, the JPB will cooperate with local government agencies in performing improvements within its ROW and will comply with local regulations, as appropriate, affecting any of its activities within other jurisdictions.

Table 2-6 lists anticipated permits and approvals that would be required for this project; the JPB will continue to coordinate with all local, regional and state agencies to ensure that all permits and approvals are received to support the project schedule.

Table 2-6. Permits, Funding, and Other Approvals Anticipated to be Required

Agency	Funding, Approval, or Permit
Federal Agencies	
Federal Transit Administration	NEPA review and approval (completed). Federal funding.
U.S. Army Corps of Engineers	Approval of nationwide permit for effects to wetlands and other waters of the United States under Section 404 of the Clean Water Act (CWA).
State Agencies	
California High Speed Rail Authority	Approval of funding and other agreements/documents.
California Department of Fish and Wildlife (CDFW)	Review and approval of 1602 Streambed Alteration Agreement for placement of power pole foundations affecting waterways.
California Department of Toxic Substances Control (DTSC)	Review of Worker Health and Safety Plan. Review and approval of revised JPB Soil Management Plan.
California Department of Transportation (Caltrans)	Encroachment Permit and Traffic Control Plan for overbridge barriers on State roadways.
California Public Utilities Commission (CPUC)	Approvals required for public safety considerations of Caltrain electrification facilities.
San Francisco Bay Regional Water Quality Control Board (RWQCB)	CWA Section 401 Water quality certification/waste discharge requirements for placement of power pole foundations affecting waterways.
State Water Resources Control Board	General Construction Activity Stormwater Permit or Section 402 National Pollutant Discharge Elimination System (NPDES) permit.
Regional Agencies and Transportation Agencies	
Peninsula Corridor Joint Powers Board (JPB)	Certification of CEQA environmental document; project proponent; project funding.
Bay Area Air Quality Management District	Funding approvals.
Metropolitan Transportation Commission	Funding coordination and approvals.
San Francisco Bay Area Rapid Transit District (BART)	Encroachment Permit.
San Francisco Bay Conservation and Development Commission (BCDC)	Permit for construction of facilities within 100-foot shoreline band (at Brisbane Lagoon).
San Francisco Municipal Transportation Agency (SFMTA)	Coordination regarding Muni service during Proposed Project construction and coordination regarding the 22-Fillmore rerouting project.
San Mateo County Transportation Authority (SMCTA)	Funding approvals.
Santa Clara Valley Transportation Authority (VTA)	Access permit for work adjacent to VTA light rail operations in Mountain View.

Agency	Funding, Approval, or Permit
Santa Clara Valley Water District (SCVWD)	NPDES general permit for construction-related activities. Includes developing and implementing a Storm Water Pollution Prevention Plan (SWPPP). SCVWD encroachment permit if need to access any district lands or if any construction comes within 50 feet of the top of bank of any Santa Clara County stream.
Transbay Joint Powers Authority (TJPA)	Coordination regarding the Downtown Extension Project and the Transbay Terminal Center Project.
Local Agencies (in geographic order from North to South)[a]	
San Francisco Bureau of Environmental Health	Permit for drilling or other subsurface exploration.
San Francisco Department of Public Works	Approval required for construction in public rights-of-way. Batch Industrial Wastewater Discharge Permit for de-watering effluent discharge to the combined sewer system providing the quality of the effluent meets the NPDES General Permit discharge standards. Article 20 of San Francisco Municipal Code requires preparation of a Site Mitigation Plan if soil sampling and analysis indicate presence of hazardous waste in soil subject to construction disturbance.
San Francisco Planning Department/ Commission	Certificate of Appropriateness for modification of historic resources (if necessary).
San Mateo County	Encroachment Permit.
City of Brisbane	Encroachment Permit, Haul Permit for transport of spoils in excess of 6 cubic yards and Traffic Control Permit for detours or traffic control measures.
City of South San Francisco	Encroachment Permit.
City of San Bruno	Department of Public Works may issue a permit in order to monitor impacts to city sewer lines and storm drains.
City of Millbrae	Encroachment Permit for overbridge barrier. A Haul Permit if spoils are hauled off-site in Millbrae.
City of Burlingame	Encroachment Permit.
City of San Mateo	Encroachment Permit.
City of Belmont	Encroachment Permit. A Haul Permit if more than 50 cubic yards of spoils are removed via Belmont streets.
City of Redwood City	Encroachment Permit for traction power substation and overbridge protection barrier.
Town of Atherton	Encroachment Permit.
City of Menlo Park	Encroachment Permit for construction in the city ROW.
Santa Clara County	Encroachment permit for construction affecting Lawrence Expressway.
City of Palo Alto	Encroachment Permit for construction in the city ROW.
City of Mountain View	Encroachment Permit for construction in the city ROW.
City of Sunnyvale	General Encroachment Permit for construction in the city ROW.
City of Santa Clara	Street Opening Permit for construction in the city ROW.
City of San Jose	Encroachment Permit for construction in city ROW.

Agency	Funding, Approval, or Permit
Other Parties	
Pacific Gas & Electric Company (PG&E)	Power supply and equipment installation for traction power; Fee or Easement Title for use of PG&E Property for traction power equipment and facilities.
Union Pacific Railroad (UPRR)	Encroachment Permit for work conducted with UPRR right-of-way; design and installation permits for electrification equipment and facilities.
[a] Activities within the Caltrain ROW are not subject to the land use jurisdiction of local governments.	