Freight Rail Operations

As discussed in Chapter 2, Caltrain now considers that temporal separation will not be required for the mixed operation of alternative compliant EMUs with freight equipment on the Caltrain Corridor because alternative compliant equipment can provide an equivalent level of safety to the Tier 1 passenger vehicle safety requirements particularly in light of the new FRA rule-making underway. Similarly, alternative compliant DMUs should also be able to share operations with freight equipment without the need for temporal separation. In fact, the Denton County Transportation Authority received authorization to operate alternative compliant DMUs on the same tracks as freight operations from the FRA without temporal separation. Thus, like the Proposed Project, the DMU Alternative would not require substantial change in the freight operational window.

~~Use of light-weight DMUs may require the same temporal separation requirements for freight as the Proposed Project's EMUs and, thus, may have the same effect on freight operations. Use of heavier FRA-compliant DMUs would allow for freight trains to operate between the current 8 p.m. and 5 a.m. period, compared with midnight to 5 a.m. under the Proposed Project (presuming the project must comply with the temporal separation requirements in the FRA waiver and the waiver requirements are not altered in the future).~~

The DMU Alternative would not require an OCS, and, thus, there would be no concerns about potential height restrictions for freight. The Proposed Project would provide adequate height clearance for existing freight service. As discussed in Section 4.1, *Cumulative Impacts*, future freight trains could be slightly constrained to the existing freight train equipment heights. But even with limited freight diversion to other modes (such as trucks), this constraint is not likely ~~expected~~ to result in significant secondary physical impacts on the environment but is disclosed as potentially resulting in localized noise or traffic impacts in the event that some diversion to freight traffic would occur due to the change in OCS heights. The DMU Alternative would avoid any such impacts because it would not restrict overhead heights along the Caltrain ROW.

Overall, this alternative would have the same impacts as the No Project Alternative. ~~if FRA-compliant DMUs were used, but would have worse impacts than the No Project Alternative if light-weight DMUs were used.~~

5.2.3 Dual-Mode Multiple Unit (Dual-Mode MU) Alternative

As explained in Section 5.4, *Alternative Screening Process*, below, the Dual-Mode MU Alternative is considered feasible, would avoid or substantially reduce one or more significant impacts of the Proposed Project, and would meet some, but not all, of the project's purpose and need.

The Dual-Mode MU Alternative would not meet the project's purpose to provide electrical infrastructure compatible with high-speed rail. ~~This purpose is fundamental to the project, especially given that the primary source of funding for the project's construction would be Proposition 1A high-speed rail bond funds. Because this alternative fails to meet this fundamental purpose, the JPB could decide not to analyze it in this EIR.~~

In addition, while the increased train service under this alternative would increase revenue, this alternative would also increase diesel fuel consumption compared with existing conditions,[5] which would increase operating fuel costs. This alternative also would have lower ridership than the

[5] As explained above, the eight-car DMU Alternative would have higher fuel consumption compared with today's diesel locomotive five-car consists. Fuel consumption for a dual-mode MU has not been determined. Assuming a 10-car train and assuming dual-mode MUs would likely be heavier than corresponding DMUs due to the need for dual-mode equipment fuel consumption is likely to be more for the Dual-Mode MU Alternative than for the DMU Alternative when running in diesel mode (which would be the dominant operating mode for the Dual-Mode MU Alternative except in the DTX and TTC).

Proposed Project would have due to a slower acceleration profile. Therefore, this alternative would only partially meet the project's objective ~~purpose and need~~ to increase operating revenue and would not meet the objective to reduce operating fuel costs. ~~However, there has been community interest, expressed most recently in scoping comments, in the analysis of a Dual-Mode MU Alternative and, thus, the JPB decided to provide this alternative analysis for informational purposes.~~

A dual-mode multiple unit is a self-propelled vehicle that can operate in both a diesel mode and in an electrified mode. While there are dual-mode locomotives in operation on the East Coast, there are no known dual-mode MUs in operation in the United States at present. However, there are dual-mode MUs in operation and in construction in Europe that can operate in both a diesel mode and using an overhead 25 kVA OCS.

Dual-mode MUs have been in operation for approximately the last 10 years in Europe. ~~are a relatively recent technology and thus do not have a long track record by which to evaluate reliability and maintenance requirements.~~ Operational experience with some dual-mode locomotives ~~and trolleybuses~~ in the U.S. has shown reliability concerns. Based on 2010 data, the Long Island Railroad's (LIRR) dual-mode locomotives are the most unreliable pieces of equipment in their revenue vehicle fleet. For the same period, the LIRR single-level EMUs were the highest performers or most reliable equipment and have a Mean Distance Between Failures of about 300,000 miles versus only about 18,000 miles for the dual-mode locomotives. No data on the reliability of European Dual-Mode MUs was located. ~~A reliability concern with dual mode transit equipment was also found in Seattle's recently retired dual-mode diesel/electric trolleybus suburban express fleet. King County Metro later removed the diesel engines and relegated these units to exclusive trolleybus use on electrified trunk routes in the city. The dual-mode buses were ultimately replaced on the suburban express bus routes by more conventional articulated hybrid buses (Tumola, Pers. Comm).~~ However, for the purposes of this analysis, Dual-Mode MUs are considered sufficiently reliable to support project purposes.

Similar to the DMU Alternative, the diesel engines in dual-mode MUs can burn low sulfur diesel fuel and would meet state and federal air quality standards. Depending on operational modes, dual-mode MUs have been reported to have 10 to 20 percent lower emissions (Alstom 2013a) and to use approximately 15 to 30 percent less energy than diesel locomotives (Alstom 2012; Railway Gazzette 2013b). Dual-Mode MUs would also meet the USEPA Tier 4 emission standards.

The key characteristics for this alternative related to desired service improvements is the reduction of running times due to faster acceleration than traditional push-pull service. Limited data on dual-mode MUs was located on acceleration rates. One source (Railway Gazzette 2007) cites initial acceleration for a Bombardier four-car, 240-foot dual-mode multiple unit with up to 220 passenger capacity as 1.1 mph per second for diesel mode and 1.5 mph per second for 25 kVA electric mode (compared with approximately 0.5 mph per second for conventional push-pull service, 1.4 mph per second for DMUs and 2.1 mph per second for EMUs). However, the specifications for the new Super Express Class 800s being developed for use in the U.K., indicate that dual-mode MU consists up to 10 vehicles can have initial acceleration rates of 1.7 mph per second (Agility 2009). The acceleration rates for the 10-car dual-mode MU presumed in this analysis (see discussion below) is unknown but for the sake of this analysis is presumed to be 1.7 mph per second which is substantially better than current diesel locomotives.[6]

[6] If this assumption is incorrect, then this alternative could still increase ridership, but the gains would be limited given the inability to add stops without slower overall travel times.

For the purposes of this alternative analysis, existing European train designs[7] were used to derive alternative assumptions:

- A 10-car single-level dual-mode MU train, consisting of two coupled five-car train sets, with a capacity of 600 passengers per train was analyzed in order to analyze an alternative that would roughly match the passengers per train capacity of the Proposed Project.
- The 10-car single-level dual-mode MU train length would be 600 feet which would ~~fit at existing Caltrain station platforms.~~ require lengthening at some of the Caltrain platforms including the platforms at 22nd Street, Broadway, California St., Sunnyvale, and Santa Clara.
- It was assumed that the Caltrain service schedule for the Dual-Mode MU Alternative would be the same as the Proposed Project but with lower ridership. Dual-mode MUs do not accelerate ~~or decelerate~~ as fast as EMUs and thus the number of station stops ~~steps~~ would likely have to be reduced to maintain the same trip time as the Proposed Project EMUs or travel times would be ~~less~~ greater.
- This alternative does not include electrification between San Jose and San Francisco. However, the DTX project has been planned assuming that the Caltrain electrification project would provide the traction power facilities to provide electrical power to the electrical train lines in the DTX ~~tunnel~~ and the TTC. Thus, this alternative would need to include traction power facilities to link the electrified lines in DTX to power from PG&E. This would involve connecting overhead or underground transmission wires from PG&E to a new traction power substation, and connecting transmission lines from the new traction power substation to the OCS for the DTX. Given the DTX and TTC location, the traction power substation would be in San Francisco, but the location is unknown. The traction power substation and transmission lines would be similar to those described for the Proposed Project.
- This Alternative is assumed to operate in a diesel mode from Tamien Station in San Jose to San Francisco and then either terminate at the San Francisco 4th and King Station or proceed in an electric mode to the TTC. In 2020, this alternative, like the Proposed Project would terminate at the 4th and King Station. In 2040, this alternative is presumed to operate with split service with four trains terminating at the 4th and King Station and two trains proceeding to TTC.

~~No specific cost estimate was prepared for this alternative.~~ This alternative would have much lower construction costs associated with the TPFs and OCS compared with the Proposed Project because this alternative would only require traction power facilities in San Francisco to connect to the DTX facilities and not the entire 51-mile corridor. ~~Maintenance and~~ Fuel costs ~~over this alternative's lifetime~~ would be ~~similar to or~~ higher than under the Proposed Project.

~~The assumptions above are based on FRA Alternative Compliant light-weight vehicles and thus the dual-mode MUs would not operate south of Tamien station and diesel locomotives would be used for service to Gilroy (as with the Proposed Project).~~

Relative to ridership, this alternative is assumed to result in less ridership than the Proposed Project due to the inferior acceleration~~/decelerations~~ performance of dual-mode MUs compared to EMUs. While service would increase to six trains pphpd, either the travel time would be longer or there

[7] This alternative is based on the Alstom Coradia Polyvalent platform, which is a dual-mode MU that is presently described as available in 3-car, 4-car and 6-car trainsets. To provide a comparable alternative to the Proposed Project, it was assumed that 5-car trainsets (300 feet, 300 passengers) would be built that would be intermediary between the 4-car trainsets (236 feet, 228 passengers) and the 6-car trainsets (360 feet, 366 passengers) (Alstom 2013a, 2013b). It is also assumed that a 5-car trainset could be coupled to provide a 10-car train (600 feet, 600 passengers) like the coupling of 3-car, 4-car, and 6-car trainsets that is feasible with current designs (Alstom 2013a and 2013b). Alstom has been building dual-mode MUs for SNCF and some entered service in 2013 with more planned. Bombardier has also been building dual-mode MUs for a number of years.

would be fewer stations served with this alternative compared with the Proposed Project. Both reduced station stops and longer travel times would affect ridership. While ridership was not modelled for this alternative, ridership is presumed to be somewhat less than under the Proposed Project but more than under the No Project Alternative due to the increased service. Nevertheless, the analysis of air quality and GHG emissions below, have assumed that the ridership would be the same as the Proposed Project, to provide a favorable comparison for the potential of this alternative.

The Dual-Mode MUs could also be used for service to Gilroy since they can be run in diesel mode. In a scenario in which Dual-Mode MUs were used in combination with full electrification (see discussion below), they could be used for one-seat transit from Gilroy to TTC. Dual-Mode MUs can also be converted to EMU only through removal of the diesel power packs during scheduled maintenance events. This alternative is also resilient through power outages as it could always operate in diesel mode. At terminals, all of the power packs onboard could be shut down and the train put on idle power from the terminal.

For this EIR, this alternative is envisioned as an alternative to avoid the Proposed Project impacts of the OCS such as aesthetics and tree removal, while still allowing service to reach TTC in the long run and thus does not include electrification between San Jose and San Francisco. However, there are other variations on this alternative in concept:

- Electrification in phases over a longer period of time if necessary to incrementally electrify instead of electrify the entire corridor at once. This is a feasible scenario in which Dual-Mode MUs could be used to provide end to end service while the corridor is electrifies over a longer period of time than proposed under the PCEP. However, at the end of the day, once the full OCS system is constructed, the impacts of this variant would have the same OCS impacts as the Proposed Project.
- Electrification of only a portion of the San Jose to San Francisco route to reduce OCS impacts: Given that the heaviest impacts of tree removals start at Atherton and head south (there would still be substantial tree removal impacts in cities like Burlingame and other north of Atherton) , one conceptual arrangement could have electrified territory from Redwood City to San Francisco (~27 miles) and non-electrified territory from Tamien to Redwood City (~24 miles). With this configuration, there would only be one changeover of power modes in the middle of the route and there could be a contiguous OCS system from Redwood City north. There would likely be a need for a full substation in Redwood City, but the rest of the configuration northward would be similar to the proposed project.
- Electrification of only a short segment near each station to provide for electrified acceleration while operating in diesel mode outside of near the stations to reduce OCS impacts:
    - To the JPB's knowledge, Dual-Mode MUs have never been used in this "start-stop" fashion anywhere in the world. Instead, Dual-Mode MUs are used to cover routes that have contiguous areas of electrified and non-electrified territory. For example, dual-mode locomotives are used to access several train stations in New York City using electrical power and then operate in diesel mode for areas outside the stations tunnels.
    - In concept, if one wanted to provide electric power for acceleration out of every station on the entire route, this could require 26 separate OCS segments on either side of each station between Tamien and SF 4th and King (not counting the Stanford station which is only used infrequently).
    - There are a number of critical issues with the design of such an alternative:
        - Length of the OCS segments is not likely to be short. Many Caltrain stations are relatively close together. From South San Francisco to Tamien, none of the stations are more than 3 miles apart and many are much closer, such as the Menlo Park and Atherton stations

which are only 1.1 miles apart. Even under electric power, trains do not reach their top speed immediately. Based on the EMU acceleration performance, it will likely take 50 to 60 seconds to reach top speed, during which time the EMU could cover perhaps 0.3 miles. In order to preserve the ability to operate service on either line (if one is out for maintenance or due to a train issue), each station would need a minimum of 0.6 miles of OCS on both tracks (perhaps 0.3 miles in each direction). Thus, between Menlo Park and Atherton, for example, the OCS associated with both stations would take up 0.6 miles between the two, leaving perhaps 0.5 miles without an OCS.

- While an electric motor can be ramped up to power nearly instantaneously, a large diesel engine cannot. Thus, in order to provide seamless power after the initial acceleration, the diesel would need to be running in a standby mode before it is called on to take the load. Further, by running both electricity and standby diesel, the efficiency is worsened. This would increase fuel consumption, air pollutant emissions and GHG emissions compared to EMU operations.
- Discontinuous OCS segments would either require substations for each short electrified segment with separate power drops from PG&E (requiring more transmission lines through adjacent communities or would require undergrounding of the live wires between the OCS segments in buried power conduit along the ROW with the current configuration of TPFs.

- For the reasons above, the "start-stop" configuration with short distances of electric mode and short distances of diesel mode would be highly inefficient and would not be cost effective as one would still need a "full" OCS if the electrified segments were distributed from San Jose to San Francisco.

While there are a myriad of permutations of this alternative, using the conceptual alternative defined above with about half of the route electrified, the partial electrification variation of the alternative would have impacts that would be somewhere in between that of the Proposed Project and the Dual-Mode Multiple Unit Alternative described in the DEIR. Compared to the Dual-Mode Multiple Unit Alternative described in this EIR, the partial electrification variant would have higher aesthetic and tree removal impacts (due to an OCS system from Redwood City to San Francisco), lower criteria pollutant and GHG emission impacts (due to more use of electricity and less of diesel), possibly higher ridership (due to better acceleration from Redwood City to San Francisco), and lower noise impacts (due to electric operations from Redwood City to San Francisco). Compared to the Proposed Project, the partial electrification alternative would have lower aesthetic and tree removal impacts (due to no OCS system from San Jose to Redwood City, higher criteria pollutant and GHG emission impacts (due to less use of electricity and more use of diesel) and higher local pollution impacts from San Jose to Redwood City (due to diesel use instead of electric power use), lower performance and ridership (due to lower acceleration in both diesel and electrical modes compared to EMUs), and higher noise impacts (due to diesel operations from Redwood City to San Francisco).

As a result, the partial electrification variant of alternative is not an independent alternative, but an intermediary alternative between the Dual-Mode Multiple Unit Alternative analyzed in this EIR and the Proposed Project, with environmental impacts at somewhat of a mid-point between the two. As such, the partial electrification variant of this alternative does not actually widen the range of alternatives in the EIR, because the reader can already see clearly the differences between the "full" Dual-Mode Multiple Unit Alternative and the Proposed Project which shows the range and types of impacts that occur when switching from diesel to electric modes. As such, the partial electrification variant of this alternative is not analyzed further below.

Construction Impacts

The Dual-Mode MU Alternative's construction impacts would be limited to new traction power facilities to connect PG&E power to the DTX OCS and extension of platforms at five stations. It is presumed that transition to the DTX ~~tunnel~~ for trains shifting from diesel mode to electrified mode to reach the 4th and Townsend Station would occur at roughly the same location as the currently planned transition to separate tracks in the current DTX design north of 16th Street.

The DMU Alternative would have greater construction impacts at five Caltrain stations but would require no construction at other locations. Overall, the areas of disturbance would be far less with the DMU Alternative, but the intensity of construction at the five Caltrain stations for this alternative would be far higher. The following 5 stations have platforms that are less than 600 feet in length: 22nd Street, Broadway, California Avenue, Sunnyvale, and Santa Clara. Platform extension at Caltrain stations would require grading, excavation, pouring of concrete, and potential utility relocates. Because some of the stations are historic stations, care would need to be taken to avoid impacts on the historic features, similar to that required in placing the OCS facilities with the Proposed Project. There would also be temporary air emissions and noise at the construction locations. In addition, there could be temporary utility disruption if utilities are present in platform extension areas.

Overall, although the Dual-Mode MU Alternative would have greater impacts at five Caltrain stations than the Proposed Project, given the smaller overall area of effect, this alternative would have less construction-related impacts than the Proposed Project in all subject areas with the exception of historic resources. Because this project would require platform changes at the historic Santa Clara station, the Dual-Mode MU Alternative could have similar or potentially higher impacts on cultural resources than the Proposed Project at the Santa Clara station.

Overall, ~~even if limited areas of additional construction were necessary to facilitate an appropriate transition area~~, construction impacts would be far less than under the Proposed Project or the DMU Alternative but would be greater than under the No Project Alternative.

Operational Impacts

When operating in diesel mode, the Dual-Mode MU Alternative would have impacts similar to those of the DMU Alternative. Thus, the analysis above for the DMU Alternative is referenced where appropriate and differences with the DMU Alternative are highlighted.

Aesthetics

This alternative would result in no changes to existing visual aesthetics, except in relation to traction power facilities and transmission lines in San Francisco, and possibly resulting from limited track work along the Caltrain ROW on the approach to the 4th and King Street Station, around 16th Street in San Francisco as well as platform extensions at five stations.

Minor track and OCS work at the transition point would not have significant impacts on existing visual aesthetics at this location under I-280 along the existing Caltrain ROW. The visual impacts of a new traction power substation and transmission lines would depend on their location, which is unknown.

This alternative would require extension of platforms at five Caltrain stations, which would change the visual appearance of the affected stations with additional concrete platform areas. But with extended platforms, the change in visual appearance would likely be less than significant given it would be at-grade and can be designed to be consistent with the aesthetics of existing platforms. The Dual-Mode MU Alternative would result in fewer permanent impacts than the Proposed Project on aesthetics along the Caltrain ROW because there would be no need for tree removal and an OCS.

This alternative would have less aesthetic impacts than the DMU Alternative as it would not require platform extension but would have aesthetic impacts greater than the No Project Alternative.

Air Quality

Emissions resulting from this alternative are presumed to be similar to the DMU Alternative for 2020 since this alternative presumes diesel operations between San Jose and San Francisco 4th and King Station. The diesel engines on the Dual-Mode MUs should have similar performance as the diesel engines on the DMUs. Given the likely train length and the somewhat heavier weight of dual-mode MUs compared to DMUs, it is ~~probably~~ possible that train-related emissions of this alternative would be higher than the DMU Alternative. For 2040, this alternative ~~may~~ will likely have lower emissions than the DMU Alternative due to the higher ridership with access to TTC and the resultant VMT-related emissions reductions.

Based on the DMU Alternative, the Dual-Mode MU Alternative would have lower emissions than the No Project Alternative in 2020 for criteria pollutants other than NOx but would likely have lower emissions compared with the No Project Alternative when taking into account VMT reductions in 2040 with the service to TTC.

Similar to the DMU Alternative, in 2020, health risks resulting from the Dual-Mode MU Alternative would be similar to, but possibly slightly higher ~~less~~ than under the No Project Alternative due to slightly higher ~~lowered~~ PM emissions along the Caltrain ROW ~~but~~ and risks may be slightly higher in 2040 depending on the No Project Alternative replacement of locomotives over time.

As discussed above for the DMU Alternative, the effect of tree removal avoidance compared to the Proposed Project on particulate emissions and health risks and other emissions (such as pantograph wear emissions) is likely minimal and would not change the conclusions noted above. Therefore, in 2020 this alternative would have a greater impact on air quality than the Proposed Project and the DMU Alternative but less impact than No Project Alternative relative to certain pollutants and more impact relative to other pollutants. In 2040, this alternative would have a greater impact on air quality than the Proposed Project, less impact than the No Project Alternative, and likely less impact than the DMU Alternative.

Biological Resources

Similar to the DMU and No Project Alternatives, this alternative would avoid the need for expanded tree removal and pruning. There would likely be limited to no biological resource impacts due to new traction power facilities and transmission lines in San Francisco.

With the Dual-Mode MU Alternative, diesel and nitrogen emissions regionally would be less than the No Project Alternative and result in fewer related effects on biological resources than the No Project Alternative. However, diesel fuel consumption would likely be higher than the DMU Alternative and would be substantially higher than the Proposed Project.

Cultural Resources

Operation of this alternative would not impact archeological, cultural, or historical resources. Dual Mode MUs would operate within the existing Caltrain ROW and on the existing tracks, and would not require modifications or removal of existing historical structures. Therefore, operational impacts on cultural resources would be the same as the Proposed Project, the DMU Alternative and the No Project Alternative.

Electromagnetic Fields/Electromagnetic Interference

Operation of this alternative would not require an overhead OCS except at the DTX ~~tunnel~~ and at TTC and new transmission lines from PG&E to the DTX. The operation of this alternative would not increase the level of electromagnetic fields along the Caltrain corridor and project vicinity, or increase electromagnetic interference in this same area. Impacts along the DTX ~~tunnel~~ and at TTC would be the same as with the Proposed Project. New transmission facilities can be designed to maintain exposure limits within health thresholds. Therefore, the potential impacts associated with EMF and EMI would be less than under the Proposed Project, but slightly greater than under the DMU Alternative and the No Project Alternative because of the Dual-Mode MU Alternative's electrified operations along the DTX ~~tunnel~~ and at TTC.

Geology, Soils and Seismicity

Under this alternative, operation of the Caltrain service would be in the same project area as the Proposed Project and would expose structures and people to the same seismic, soil, and geologic hazards as the Proposed Project. Therefore, the exposure of risks associated with seismic, soil, and geologic hazards would be the same as the Proposed Project, the DMU Alternative and the No Project Alternative.

Greenhouse Gas Emissions and Climate Change

Compared with the No Project Alternative, the Dual-Mode MU Alternative would ~~likely~~ have greater Caltrain system emissions similar to the DMU Alternative. The greater emissions would result from the increase in service and from the decreased fuel efficiency of longer MU consists. However, the Dual-Mode MU Alternative would likely have lower overall emissions than the No Project Alternative overall when including lowered VMT-related emissions resulting from increased Caltrain ridership (using the assumptions noted above).

Compared with the DMU Alternative, this alternative would likely have slightly higher GHG emissions to 2020 with the likely lower efficiency of longer and heavier dual-mode MUs. However, for 2040, this alternative is likely to have lower GHG emissions overall compared to the DMU alternative when taking into account the additional ridership likely with access to TTC.

Operation of the dual-mode MUs operating primarily in a diesel mode would produce substantially more GHG emissions than would the electric engines of the Proposed Project EMUs. This conclusion takes into account both direct engine GHG emissions and indirect GHG emissions from electricity generation, and the lower ridership likely with this alternative compared with the Proposed Project because of the alternative's relatively inferior train performance.

Hazards and Hazardous Material

Similar to the DMU Alternative, compared with the No Project Alternative, this alternative would result in more Caltrain diesel fuel use due to increased train service and due to a lower fuel efficient than the diesel locomotives. However, because the Dual-Mode MU Alternative would increase ridership, the decreased regional handling of gasoline would likely offset the increased Caltrain handling of diesel in terms of risk of accidents and spillage overall resulting in similar impacts as the No Project Alternative.

Compared with the Proposed Project, the Dual-Mode MU Alternative would require much more handling and transfer of diesel fuel, which increases the potential for release of diesel. Therefore, this alternative would have greater impacts associated with the release of and exposure to hazardous materials compared than the Proposed Project.

Because this alternative would likely be less efficient than the DMU Alternative when running in diesel mode, this alternative would likely have greater diesel consumption and handling. However in 2040, this alternative would reduce regional VMT more than the DMU Alternative and thus would have lower gasoline handling.

Hydrology and Water Quality

Under this alternative, there would be limited changes in impervious space and stormwater runoff potential due to new traction power facilities. It is assumed that new facilities would likely be out of the 100-year floodplain in San Francisco. If facilities were built in the floodplain, they could be flood-proofed similar to those of the Proposed Project. This alternative would require more handling and transfer of diesel fuel than the Proposed Project, which would increase the potential for release of diesel that may affect water quality.

The areas of the Caltrain ROW and associated facilities potentially subject to flooding would remain mostly the same, as the additional platforms at five stations would all be at stations that are not in the 100-year floodplain. for tracks 1 and 2 at the San Francisco 4th and King Station, which is in the 100-year floodplain. The Proposed Project would place some new facilities into the 100-year floodplain that would be subject to flooding effects, but mitigation is available to reduce effects to a less-than-significant level. Both the Dual-Mode MU Alternative and the Proposed Project would have similar vulnerabilities to future flooding associated with sea level rise, but the Proposed Project would place slightly more facilities at risk than the Dual-Mode MU Alternative. Thus, the Dual-Mode MU Alternative would have less impact related to flooding than the Proposed Project.

The Dual-Mode MU Alternative would have slightly higher potential for diesel spills than the No Project Alternative due to greater diesel duel handling but less gasoline handling overall due to lowered regional VMT. These impact changes offset each other and, therefore, this alternative would have similar water quality impacts to the No Project Alternative related to potential fuel spills or leakage.

Relative to the DMU Alternative, this alternative would have less impervious space and likely similar potential for fuel spills (due to more diesel use but less gasoline consumption in the long run).

Land Use and Recreation

Under this alternative, the OCS alignment and its associated vegetation clearance zone would not be required. As a result, land outside the ROW would not need to be acquired in fee or easement for OCS alignment or ESZ purposes. This alternative would require a traction power substation in San Francisco, but it is probable that this facility would be placed in commercial or industrial areas and would not result in land use incompatibilities. This alternative would not increase the demand or physically impact existing recreational facilities. The additional station platform areas would be within the Caltrain ROW and thus would not displace any other land uses.

Therefore, this alternative would have less impact on land use and recreation than the Proposed Project. This alternative would have similar impacts as the DMU Alternative and the No Project Alternative.

Noise and Vibration

Operation of the dual-mode MUs would likely have similar noise impacts as the DMU Alternative but possibly slightly greater due to heavier vehicles. Noise impacts would be greater than under the Proposed Project.

The dual-mode MUs should be quieter than today's locomotives but train horn sounding would increase with increased service and thus noise levels may be less than or similar to the No Project Alternative~~Proposed Project~~.

Population and Housing

This alternative would not indirectly or directly induce population growth or the demand for new housing units in the project area. Similar to the Proposed Project and the DMU Alternative, operation of this alternative would not require the displacement of existing housing units or businesses. Therefore, the impact on population and housing would be the similar to the Proposed Project, the DMU Alternative and the No Project Alternative.

Public Services and Utilities

With this alternative, operations would not have appreciable changes in public services demand, similar to the Proposed Project and the DMU Alternative, and no effect on utility disruption. Thus, the Proposed Project, the DMU Alternative, the No Project Alternative, and the Dual-Mode MU Alternative would all have similar effects on public services and utilities during operations.

Transportation/Traffic

Regional Traffic

Under this alternative, there would an increase in rail service similar to the Proposed Project and the DMU Alternative, but with more trains than with the No Project Alternative. Regionally, the Dual-Mode MU Alternative would result in a lesser reduction in VMT and associated general traffic congestion compared with the Proposed Project because, like the DMU Alternative, the Dual-Mode MU Alternative would result in less ridership due to inferior performance relative to the Proposed Project's EMUs. However, the Dual-Mode MU Alternative would be beneficial compared with the No Project Alternative and would reduce regional traffic more than the DMU Alternative in 2040 with access to TTC.

Localized Traffic at Certain At-Grade Crossings and Caltrain Stations

In comparison with the Proposed Project, the ridership under this alternative would be somewhat less. Dual-mode MUs cannot accelerate ~~and decelerate~~ as fast as the proposed EMUs which will mean that either less stops can be serviced or overall travel times would be less, either of which will lessen ridership.

The Dual-Mode MU Alternative would likely result in a similar number of gate-down events during peak hours at the grade crossings as the Proposed Project. At grade crossings that are not near stations, the gate-down time should be similar to the Proposed Project. At grade crossings that are near stations, the Dual-Mode MU Alternative would result in greater gate-down time than the Proposed Project due to the slower ~~deceleration and~~ acceleration performance. Thus, at grade crossings near stations, the Dual-Mode MU Alternative, like the DMU Alternative, would have a greater impact on localized traffic than the Proposed Project.

Because the Dual-Mode MU Alternative would result in less ridership than the Proposed Project, traffic impacts near Caltrain stations may be somewhat less, like the DMU Alternative. On balance localized traffic impacts are likely to be similar to the Proposed Project.

Relative to the No Project Alternative, the Dual-Mode MU Alternative would result in better regional traffic and worse localized traffic at some at-grade crossings and near Caltrain stations.

Ridership of Other Transit Systems

The Dual-Mode MU Alternative would result in less Caltrain ridership than the Proposed Project. Similar to the Proposed Project and the DMU Alternative, this alternative would not substantially change the ridership of other transit systems compared with the No Project Alternative.

Conflict with other Transit Projects

The Dual-Mode MU Alternative would be consistent with plans for DTX and TTC. Regarding the rerouting of 22-Fillmore, there may be need for crossing design to ensure the pantograph of the dual-mode MUs would not contact the direct current trolley bus overhead line, which is a similar concern to the Proposed Project, depending on the location for transition from diesel to electrified service with this alternative relative to 16th Street. If no electrification were done at 16th Street, since this alternative can run in diesel mode, there would be no conflict with the 22-Fillmore OCS.

The Proposed Project's impacts related to the OCS for other transit projects are either less than significant or can be managed with mitigation, so this difference is not considered significant.

This alternative would be consistent with the plans for DTX and TTC which would be a lower impact than either the DMU Alternative or the No Project Alternative both of which would be in conflict.

Pedestrian/Bicycle Facilities

As discussed in Section 3.14, *Transportation and Traffic,* the Proposed Project would have a less than significant impact on pedestrian facilities with mitigation. Since ridership would increase with the Dual-Mode MU Alternative, but less than with the Proposed Project, this alternative would have a smaller less than significant impact (with mitigation) on pedestrian facilities. It would have a similar impact as the DMU Alternative.

As discussed in Section 3.14, *Transportation and Traffic* and Section 4.1, *Cumulative Impacts*, the Proposed Project would result in an increased demand for bike facilities, but proposed mitigation would address this increased demand. There would also be an increase in demand for bike facilities with the increased ridership expected with this alternative; however, Caltrain could address this demand by similar means as the proposed mitigation for the Proposed Project. Thus, the Dual-Mode MU Alternative would have a lesser impact than the Proposed Project relative to bicycle facilities.

Station Parking and Access

As discussed in Section 3.14, *Transportation and Traffic* and Section 4.1, *Cumulative Impacts*, the Proposed Project would result in an increased demand for parking, but this would not result in significant secondary impacts on air quality, noise, or traffic or due to the construction of other parking facilities. The Dual-Mode MU Alternative would result in a lower increase in parking demand and, therefore, would have less impact than the Proposed Project relative to parking demand.

Emergency Vehicle Access

Relative to emergency vehicle access, the Dual-Mode MU Alternative would have a similar but smaller positive effect on reducing higher regional vehicle miles traveled, a similar but worse adverse effect at at-grade crossing, and similar but smaller adverse effects at intersections near stations. This alternative would have similar but less overall beneficial impacts on emergency response times as the Proposed Project. This alternative would be beneficial relative to the No Project Alternative.

Freight Rail Operations

This alternative ~~would require the same temporal separation requirements for freight as the Proposed Project's EMUs and, thus,~~ would have the same effect on freight operations as the Proposed Project because it is presumed that alternative compliant dual-mode MUs could operate in a shared environment with freight trains, like the Proposed Project's EMUs.

This alternative would not require an OCS (outside of DTX/TTC); consequently, there would be no concerns about potential height restrictions for freight. Overall this alternative would have the same impacts as the DMU Alternative ~~(presuming light-weight DMUs),~~ less impacts than the Proposed Project (due to lack of OCS), and ~~more~~ similar impacts to ~~than~~ the No Project Alternative.

5.2.4 Tier 4 Diesel Locomotive Alternative (T4DL)

A Tier 4 Diesel Locomotive (T4DL) Alternative is feasible as new diesel locomotives are under construction in the U.S. that can meet the USEPA's Tier 4 emissions standards.

The T4DL Alternative would not meet the project's purpose to provide electrical infrastructure compatible with high-speed rail. In addition, while the increase train service under this alternative would increase revenue, this alternative would also increase diesel fuel consumption compared with existing conditions[8] which would increase operating fuel costs. Therefore, this alternative would only partially meet the project's objective to increase operating revenue and would not meet the objective to reduce operating fuel costs. In addition, as discussed below, this alternative would not lower engine noise compared to the No Project Alternative.

Although this alternative does not meet three of the project objectives, it was analyzed to respond to public interest. It should be noted that this alternative is actually an extension of the No Project Alternative. The No Project Alternative also uses Tier 4 Diesel Locomotives; the differences are that the Tier 4 Diesel Locomotive Alternative includes an increase to 114 trains per day and 6 trains per peak hour per direction, a change from the existing schedule to the Proposed Project schedule, and he T4DL-DH variant of this alternative would include two locomotives per consist. If this alternative were advanced, it would require no CEQA analysis, because CEQA exempts increases of passenger service on existing rail lines if it involves no new construction of new rail lines. As such, this alternative does not actually meaningfully expand the range of alternatives considered in the DEIR and it is not mandatory to analyze this alternative further. However, as noted above, due to public interest, this alternative is analyzed to respond to comments on the DEIR.

As indicated in Table 5-1, a new Tier 4 single diesel locomotive hauling passenger coaches would have initial acceleration rates of approximately 1.1 mphps and a train consist with two diesel locomotives would have an initial acceleration rate of approximately 2.1 mphps. The new Tier 4 diesel locomotives under construction by Siemens can reach up to 125 mph top speed and have a maximum deceleration of approximately 1.8 mphps (Siemens 2013) but the deceleration profile would be somewhat less than that of the EMUs as the passenger coaches would not have independent braking like the EMUs.

[8] 2020 No Project diesel consumption is estimated as 5.6 million gallons/year compared with 2020 T4DL Alternative diesel consumption of 6.5 to 9.2 million gallons/year (Single-head vs. double-head scenario). Nominal fuel consumption for a single T4 diesel locomotive is 3.6 gallons/mile (including non-revenue) compared to 3.1 gallons/mile (including non-revenue) for today's diesels, which are less powerful. Double-head scenario would have higher fuel consumption due to use of two locomotives per consist. As discussed in text, 2020 scenarios for the T4DL Alternative assume continued use of 1998 and 2003 remnant diesel locomotives until they reach the end of their service life to match the project's use of remnant diesel locomotives as well.