

CHAPTER 2

PROJECT DESCRIPTION

A. INTRODUCTION

This chapter describes the proposed BART to Livermore Extension Project that is evaluated in this Draft EIR. The Proposed Project, which is also referred to as the Conventional BART Project, involves extending the BART system, using conventional BART technology, from the existing terminus of the Daly City-Dublin/Pleasanton Line at the Dublin/Pleasanton Station to a new station located east of Isabel Avenue (State Route 84) in the city of Livermore. The Proposed Project is described in detail in this chapter.

In addition to the Proposed Project, three Build Alternatives, as well as the No Project Alternative (or No Build Alternative), are evaluated in this EIR. The three Build Alternatives were identified in initial screening as alternatives with the potential to meet most of the project objectives and be completed within a reasonable timeframe; therefore, they merited full evaluation in this EIR. The BART Board of Directors will adopt a project for implementation based on their review of the Proposed Project and Alternatives.

The three Build Alternatives are as follows:

- Diesel Multiple Unit (DMU) Alternative, which includes a variant referred to as the Electrical Multiple Unit (EMU) Option
- Express Bus/Bus Rapid Transit (BRT) Alternative
- Enhanced Bus Alternative

This Draft EIR is a second-tier project-level Draft EIR that continues the BART to Livermore planning process of the Final Program EIR for the BART to Livermore Extension Program (PEIR). The Proposed Project in this Draft EIR corresponds to Alternative 4 (Isabel Avenue/Interstate [I-] 580) in the PEIR. In addition, the same alignment, in the I-580 median from the existing Dublin/Pleasanton Station as far as the Isabel Avenue/I-580 interchange, was also included as part of Alternative 2B (Downtown/Vasco) in the Final PEIR, although Alternative 2B extended to Downtown Livermore and provided stations in Downtown Livermore and at Vasco Road without a station at Isabel Avenue/I-580. The BART Board of Directors certified the PEIR in July 2010 and selected Alternative 2B, Portola-Vasco, as the preferred alignment. See Chapter 1, Introduction, for further discussion of the project background.

This chapter presents the following topics:

- **(A) Introduction** – This section includes the project objectives and a summary of the Proposed Project and Alternatives.
- **(B through F) Detailed description of the Proposed Project and Alternatives** – The No Project Alternative is presented first (B), followed by the Proposed Project (C), the DMU Alternative with EMU Option (D), the Express Bus/BRT Alternative (E), and then the Enhanced Bus Alternative (F).

Details presented for the Proposed Project and Alternatives are as follows: (1) BART system and related rail improvements, including technology used, route/alignment, and facilities (i.e., new or modified stations and non-station facilities); (2) I-580 and roadway relocation and reconfiguration required to accommodate the BART infrastructure improvements; (3) new or modified bus routes and bus-related infrastructure improvements; and (4) operations, including hours of operation, frequency of service, fleet size, anticipated travel times and fares, and fare collection.

- **(G) Construction** – This section describes the major construction activities, the types of equipment anticipated to be used, and the expected duration of construction.
- **(H) Sustainability** – This section discusses the design features of the Proposed Project and Build Alternatives.
- **(I) Projected Ridership** – This section covers the number of passenger boardings and exits.
- **(J) Costs and Funding Sources** – This section addresses the costs and possible funding sources associated with the Proposed Project as well as all of the Alternatives.
- **(K) Alternatives Considered but Withdrawn** – This section describes the alternatives considered but withdrawn from detailed consideration in the EIR, for reasons that include (1) failure to meet most of the basic project objectives; (2) infeasibility; and (3) inability to avoid or reduce significant environmental impacts.

This Draft EIR provides a project-level analysis of the rail and associated BART facilities, as well as the roadway relocation proposed under the Proposed Project, DMU Alternative, and EMU Option. For the Express Bus/BRT Alternative, the project level analysis covers bus infrastructure improvements at Dublin/Pleasanton Station as well as roadway relocation. With regard to the bus routes and bus infrastructure improvements for the Enhanced Bus Alternative, as well as for the feeder bus routes for the Proposed Project and other Build

Alternatives, this EIR presents a programmatic-level analysis.¹ Following adoption of the project, specific routes would be developed by the bus operators based on detailed service planning. At that time, the bus routes and bus infrastructure improvements could be subject to subsequent environmental review, if necessary due to new or greater environmental impacts.

1. Project Objectives

The objectives of the BART to Livermore Extension Project are as follows:

- Provide a cost-effective intermodal link of the existing BART system to the inter-regional rail network and a series of Priority Development Areas (PDAs) identified by the City of Livermore, the Metropolitan Transportation Commission, and the Association of Bay Area Governments. These PDAs include the Livermore Isabel Avenue BART Station PDA, the Livermore Downtown PDA, and the Livermore East Side PDA.
- Support the regional goals of integrating transit and land use policies to create opportunities for transit-oriented development (TOD) in the Livermore area PDAs.
- Provide an effective alternative to traffic congestion on I-580.
- Improve air quality and reduce greenhouse gas and other emissions associated with automobile use.

2. Summary of Proposed Project and Alternatives

The Proposed Project and Build Alternatives differ in their configurations of rapid transit and passenger bus technologies, as summarized below (see Table 2-1 for a list of key characteristics). The design of the Proposed Project and Build Alternatives does not preclude a future rail alignment extension to the east, either in the I-580 median or to Downtown Livermore.

- **No Project Alternative.** The No Project Alternative describes the consequences if the BART Board decides not to proceed with either the Proposed Project or any of the Build Alternatives. For this EIR, the No Project Alternative represents the region's existing transportation network consisting of highways, arterial roads, public transit, and bicycle and pedestrian facilities, inclusive of planned improvements through 2040. In addition, the No Project Alternative accounts for population and employment growth in the nine-county San Francisco Bay Area (Bay Area) region through 2040. This alternative does not include the extension of rail or transit services beyond the improvements currently planned for implementation, described below.

¹ For this purpose of this analysis, feeder bus routes are defined as bus routes that would connect key activity nodes in the city of Livermore to the BART system (either Dublin/Pleasanton Station or Isabel Station), and thereby improve service for existing BART patrons and support additional BART patronage.

TABLE 2-1 KEY COMPONENTS OF THE PROPOSED PROJECT AND BUILD ALTERNATIVES

	Conventional BART Project	DMU Alternative (With EMU Option)	Express Bus/BRT Alternative	Enhanced Bus Alternative
Components of Proposed Project and Build Alternatives				
BART/Rail Facilities				
Rail Service Extension	<ul style="list-style-type: none"> Extend service 5.5 miles east to Isabel Avenue in I-580 median. Beyond Dublin/Pleasanton Station, convert 0.7 mile of existing tail tracks to mainline tracks, and extend track 4.8 miles to new station. Remove existing BART car storage in I-580 median and relocate to new storage and maintenance facility. 	<ul style="list-style-type: none"> Extend service 5.5 miles east to Isabel Avenue in I-580 median. Beyond Dublin/Pleasanton Station, existing BART tail tracks remain. Install DMU track 5.5 miles from Dublin/Pleasanton Station to new Isabel Station in I-580 median. 	--	--
Dublin/Pleasanton Station	<ul style="list-style-type: none"> No change. 	<ul style="list-style-type: none"> New DMU transfer platform on north side of the Dublin/Pleasanton Station. New 0.3-mile tail track for BART car storage west of station (storage for approximately 20 additional BART cars). 	<ul style="list-style-type: none"> New bus transfer platforms north and south of BART station platform. New direct bus-only ramps from I-580 express lanes to Dublin/Pleasanton Station. Extend tail track 0.1 mile east of station (storage for approximately 10 additional BART cars). 	<ul style="list-style-type: none"> No change.
Isabel Station	<ul style="list-style-type: none"> BART platform in I-580 median, with pedestrian overcrossings to bus facility at Isabel North and station parking at Isabel South. New two-story end-of-line operations building (houses train supervisory booth and associated staff facilities). 	<ul style="list-style-type: none"> Similar to Proposed Project. 	--	--
Parking	<ul style="list-style-type: none"> At Isabel Station, total of 3,412 parking spaces: 2,835 in a seven-level parking structure and 577 parking spaces in two surface parking lots. 	<ul style="list-style-type: none"> At Isabel Station, total of 2,428 parking spaces in a six-level parking structure. 	<ul style="list-style-type: none"> At Dublin/Pleasanton Station, relocate approximately 210 existing parking spaces to either (1) a surface lot adjacent to 	--

TABLE 2-1 KEY COMPONENTS OF THE PROPOSED PROJECT AND BUILD ALTERNATIVES

	Conventional BART Project	DMU Alternative (With EMU Option)	Express Bus/BRT Alternative	Enhanced Bus Alternative
			existing lot south of I-580; or (2) a three-level parking structure on the existing BART lot south of I-580. <ul style="list-style-type: none"> At Laughlin Road, new surface parking lot with approximately 230 parking spaces. 	
Storage and Maintenance Facility (for rail vehicles)	<ul style="list-style-type: none"> Extend tail tracks 1.9 miles from Isabel Station to 68-acre storage and maintenance facility north of I-580. Capacity for storage of approximately 172 BART vehicles. Westbound I-580 underpass for tail tracks (from median to north of I-580). Bridges over Arroyo las Positas and Cayetano creeks and hillside tunnel for tail tracks. 	<ul style="list-style-type: none"> Extend tail tracks 1.8 miles from Isabel Station to 32-acre storage and maintenance facility north of I-580. Capacity for approximately 12 DMU vehicles (six married pairs). Westbound I-580 underpass for tail tracks (from median to north of I-580). Bridges over Arroyo las Positas and Cayetano creeks and hillside tunnel for tail tracks. 	--	--
Wayside Facilities (power and communications support, such as power substations and switching stations)	<ul style="list-style-type: none"> Wayside facilities along the project corridor at Croak Road and at Kitty Hawk Road/Isabel Avenue. 	<ul style="list-style-type: none"> Wayside facilities along the project corridor at Croak Road and at Kitty Hawk Road/Isabel Avenue. 	--	--
Additional BART Cars to Accommodate Increased Ridership	<ul style="list-style-type: none"> 36 BART cars. 	<ul style="list-style-type: none"> 24 BART cars. 	<ul style="list-style-type: none"> 12 BART cars. 	--
Caltrans Facilities and Surface Frontage Roads				
I-580 Relocation	<ul style="list-style-type: none"> Modifications extend for 5.6 miles along I-580. Typical relocation by approximately 46 feet, from just east of Hacienda Drive interchange to west of 	<ul style="list-style-type: none"> Modifications extend for 7.1 miles along I-580. Typical relocation by approximately 46 feet, from west of Dougherty Road/Hopyard 	<ul style="list-style-type: none"> Modifications extend for 2.2 miles along I-580. Typical relocation by 88 feet from west of Dougherty Road to the 	--

TABLE 2-1 KEY COMPONENTS OF THE PROPOSED PROJECT AND BUILD ALTERNATIVES

	Conventional BART Project	DMU Alternative (With EMU Option)	Express Bus/BRT Alternative	Enhanced Bus Alternative
	<p>Portola Avenue overcrossing. At the proposed Isabel Station, relocation by approximately 67 feet.</p> <ul style="list-style-type: none"> ▪ Modifications at four interchanges: Tassajara Road/Santa Rita Road, Fallon Road/El Charro Road, Airway Boulevard, and Isabel Avenue. ▪ Modifications to surface frontage roads. 	<p>Road interchange to west of Portola Avenue overcrossing. West of Hacienda Drive interchange, on-ramp relocation up to approximately 140 feet. At the proposed Isabel Station, relocation by approximately 67 feet.</p> <ul style="list-style-type: none"> ▪ Modifications at six interchanges: Dougherty Road/Hopyard Road, Hacienda Drive, Tassajara Road/Santa Rita Road, Fallon Road/El Charro Road, Airway Boulevard, and Isabel Avenue. ▪ Modifications to surface frontage roads. 	<p>Tassajara Road/Santa Rita Road overcrossing. At the Dublin/Pleasanton Station, relocation up to 100 feet.</p> <ul style="list-style-type: none"> ▪ Modifications at three interchanges: Dougherty Road/Hopyard Road, Hacienda Drive, and Tassajara Road. ▪ Modifications to surface frontage roads in Dublin. 	
Bus Services				
Bus Routes ^{a, b}	<ul style="list-style-type: none"> ▪ New/modified bus routes to Isabel Station instead of the Dublin/Pleasanton Station: LAVTA X-B, R-B, 12; RTD 150; and MAX BART Express. ▪ Eliminated routes: LAVTA 12X, 20X, and Rapid. 	<ul style="list-style-type: none"> ▪ Same as Proposed Project. 	<ul style="list-style-type: none"> ▪ Buses use direct ramps from I-580 express lanes to Dublin/Pleasanton Station. New/modified routes: LAVTA X-B, R-B, and 12. ▪ Eliminated routes: LAVTA 20X, and Rapid. 	<ul style="list-style-type: none"> ▪ Connections at Dublin/Pleasanton Station same as existing conditions with new/modified routes: LAVTA X-A, R-B, and 12. Eliminated routes: LAVTA 20X, and Rapid.
Bus Infrastructure				
Transit Signal Priority	<ul style="list-style-type: none"> ▪ Installation of equipment at approximately two locations. 	<ul style="list-style-type: none"> ▪ Same as Proposed Project. 	<ul style="list-style-type: none"> ▪ Installation of equipment at approximately four locations. 	<ul style="list-style-type: none"> ▪ Installation of equipment at approximately six locations.
Improved Bus Shelters and Seating, Digital Messaging Boards, Pre-paid Ticketing.	<ul style="list-style-type: none"> ▪ Installation at approximately 29 locations. 	<ul style="list-style-type: none"> ▪ Same as Proposed Project. 	<ul style="list-style-type: none"> ▪ Similar to Proposed Project. 	<ul style="list-style-type: none"> ▪ Similar to Proposed Project.

TABLE 2-1 KEY COMPONENTS OF THE PROPOSED PROJECT AND BUILD ALTERNATIVES

	Conventional BART Project	DMU Alternative (With EMU Option)	Express Bus/BRT Alternative	Enhanced Bus Alternative
Bus Bulbs	▪ Installation of bus bulbs at approximately six locations.	▪ Same as Proposed Project.	▪ Installation of bus bulbs at approximately 10 locations.	▪ Similar to Express Bus/BRT Alternative.
Footprint ^a				
Permanent				
Portion of Footprint Occupied by Existing Transportation Uses (Acres)	229	268	55	-- ^a
Portion of Footprint within Parcels not Owned by BART (Acres) [Number of Parcels]	147 [117 parcels]	102 [137 parcels]	10 [34 parcels]	-- ^a
Portion of Footprint within BART-owned Parcels (Acres) [Number of Parcels]	35 [5 parcels]	35 [7 parcels]	12 [7 parcels]	-- ^a
Total Footprint - including I-580 (Acres)	411	405	77	-- ^a
Temporary				
Construction Staging Areas (Acres)	29	32	6	-- ^a

Notes:

-- = Not applicable; LAVTA = Livermore-Amador Valley Transit Authority; MAX = Modesto Area Express; RTD = San Joaquin Regional Transit District; R-B = Rapid service; X-B = Express service (peak period); Caltrans = California Department of Transportation.

All units of measure are approximate, and distances are rounded to the nearest 0.1 mile.

A married pair is a set of two vehicles that are permanently coupled and treated as if they were a single unit.

^a This EIR describes and analyzes the Enhanced Bus Alternative, as well as the feeder bus routes and bus infrastructure improvements associated with the feeder bus routes for the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative, at a programmatic level. The bus routes are conceptual and were developed for the purpose of estimating BART ridership and operating costs. Candidate locations for bus infrastructure improvements, anticipated to be constructed within existing street rights-of-way, are described to document the availability of such locations. Following implementation of the adopted project, specific routes would be developed by the bus operators based on detailed service planning. At that time, the routes and bus infrastructure improvements could be subject to subsequent environmental review, if required.

^b Several components of the proposed bus routes are similar to Wheels Forward, a program of changes to the LAVTA transit system implemented in August 2016 to provide more frequent buses and new routes in Livermore, Dublin, and Pleasanton. The new, modified, or eliminated routes under the Proposed Project and Build Alternatives are described in relation to the previous bus route network. Elements shared by the Proposed Project and Build Alternatives and the Wheels Forward program include improved bus service from Downtown Livermore to BART, improved bus service to Las Positas College, and improved bus shelters to serve the new Express and

TABLE 2-1 KEY COMPONENTS OF THE PROPOSED PROJECT AND BUILD ALTERNATIVES

Conventional BART Project	DMU Alternative (With EMU Option)	Express Bus/BRT Alternative	Enhanced Bus Alternative
<p>Rapid routes. Other capital improvements, such as real-time arrival message boards at bus stations, expansion of transit signal priority to additional intersections, and installation of bus bulbs, are not included in the Wheels Forward program. Additionally, the Proposed Project and Build Alternatives would include improved bus service to Lawrence Livermore National Laboratory and the east side of Livermore. Although LAVTA eliminated Route 12 and 12X service in August 2016, a restructured Rapid route serves most of the existing Route 12 stops on Dublin Boulevard, as well as North Canyons Parkway and Las Positas College, and a restructured Route 14 serves areas of Livermore previously served by Route 12. Therefore, these restructured routes would generally serve the areas previously served by the 12 and 12X, and the existing routes analyzed in this EIR remain as previously operated by LAVTA. Sources: Arup and Anil Verma Associates, Inc., 2017a; Arup, 2017a.</p>			

- **Conventional BART Project.** The Proposed Project involves extending the Daly City-Dublin/Pleasanton Line from its existing terminus at the Dublin/Pleasanton BART Station (Dublin/Pleasanton Station) approximately 5.5 miles to the east, to a new station located at the Isabel Avenue/I-580 (State Route 84) interchange in the city of Livermore. The new alignment and the new Isabel BART Station (Isabel Station) would be constructed in the I-580 median. New parking facilities—a parking structure and surface lot containing a total of approximately 3,412 spaces—would be constructed immediately south of I-580 along East Airway Boulevard. In addition, a new, approximately 68-acre BART storage and maintenance facility would be constructed north of I-580, beyond the Isabel Station.

To accommodate the widening of the I-580 median for the new BART alignment and Isabel Station, the California Department of Transportation (Caltrans) right-of-way (ROW) would be widened along approximately 5.6 miles. The I-580 lanes would be relocated by a total of approximately 46 feet, from just east of the Hacienda Drive interchange to west of the Portola Avenue/I-580 overcrossing. At the proposed Isabel Station, I-580 would be relocated by approximately 67 feet to accommodate the new station within the median. The relocation of I-580 would require modification of some interchanges and surface frontage roads.

The Proposed Project includes new and modified feeder bus routes that would connect the new Isabel Station to PDAs in Downtown Livermore; to the East Side PDA, including Lawrence Livermore National Laboratory (LLNL); and to other areas east of the BART system, as well as the Altamont Corridor Express (ACE) Stations in Downtown Livermore and Vasco Road. The overall performance of these bus routes would be improved via the implementation of transit priority infrastructure enhancements, such as signal timing priority, bus shelters, and bus bulbs.

- **DMU Alternative.** The DMU Alternative differs from the Proposed Project in terms of vehicle technology. DMUs are self-propelled rail cars that use a diesel engine to generate their own power and run on a standard-gauge rail track, whereas BART trains use electricity and run on wide-gauge rail track.

The DMU Alternative would have a similar median alignment and station configuration as the Proposed Project, but would have a longer alignment and includes a new transfer platform at the Dublin/Pleasanton Station. A new parking structure for the Isabel Station, with approximately 2,428 parking spaces, would be constructed immediately south of I-580 along East Airway Boulevard. In addition, a new, approximately 32-acre storage and maintenance facility would be constructed north of I-580, beyond the terminus of the alignment.

To accommodate the median widening, approximately 7.1 miles of I-580 would be relocated by a total of approximately 46 feet, from west of the Dougherty Road/Hopyard Road interchange to the Portola Avenue/I-580 overcrossing. Around the Dublin/Pleasanton Station, the north side of I-580 would be relocated to accommodate

the new DMU transfer platform. At the proposed Isabel Station, I-580 would be relocated approximately 67 feet to accommodate the station within the median. The relocation of I-580 would require modification of some interchanges and surface frontage roads.

The DMU Alternative includes the same feeder bus component as the Proposed Project, including new and modified bus routes connecting the new station to areas east of the BART system.

A variant of the DMU Alternative—the EMU Option—is also being considered. The EMU Option is generally the same as the DMU Alternative, except that it is electrically powered rather than diesel-powered. A more detailed description of the EMU Option is provided below.

- **Express Bus/BRT Alternative.** The Express Bus/BRT Alternative seeks to achieve the project goals using bus technology only. This alternative does not include an extension of BART rail service or development of a new rail station. Under this alternative, new bus transfer platforms would be constructed at the existing Dublin/Pleasanton Station. Buses would enter these bus-only transfer areas via direct bus-only ramps from the I-580 express lanes, allowing passengers to transfer from bus to BART within the station.

To accommodate the new bus transfer platforms and facilities under this alternative, approximately 2.2 miles of I-580, from west of the Dougherty Road/Hopyard Road interchange to the Tassajara Road/Santa Rita Road interchange, would be relocated by approximately 88 feet. The relocation of I-580 would require modification of some interchanges and surface frontage roads.

A new parking lot or garage with approximately 210 parking spaces would be constructed at the Dublin/Pleasanton Station to replace the 210 parking spaces removed for the relocation of I-580 to accommodate the bus platforms. In addition, a remote, approximately 230-space park-and-ride lot would be constructed at Laughlin Road; regular bus service would be provided during peak hours from the Laughlin parking lot to the Dublin/Pleasanton Station.

This alternative includes a feeder bus operations plan similar to that of the Proposed Project and DMU Alternative. The plan would be designed to enhance direct connections between the Dublin/Pleasanton Station and Downtown Livermore, the downtown and Vasco Road ACE stations, and the Livermore-area PDAs, as well as to maximize the use of the I-580 express lanes. Bus service improvements include but are not limited to two new Express/Rapid bus routes.

- **Enhanced Bus Alternative.** Like the Express Bus/BRT Alternative, the Enhanced Bus Alternative uses bus-related technology only and does not include an extension of BART rail service or the development of a new rail station. Unlike the Express Bus/BRT

Alternative, however, this alternative does not include any major capital improvements and would not involve the development of bus transfer platforms or direct bus ramps.

The Enhanced Bus Alternative includes a bus operations plan that is similar to the plan for the feeder bus services for the Proposed Project and other Build Alternatives, designed to enhance direct connections to the Dublin/Pleasanton Station from Las Positas College, Downtown Livermore, the downtown and Vasco Road ACE stations, and the East Side PDA. This alternative provides lower-cost bus service improvements to improve access to the Dublin/Pleasanton Station.

As shown in Table 2-1, the majority of the area within the footprints of the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative consists of existing transportation-related uses, including I-580 and roadways. However, a portion of the footprints would be located within parcels that are not currently used for transportation-related activities and are not owned by BART; BART would acquire a portion or the entirety of these parcels. A detailed representation of the footprints of the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative is shown in Appendix B. In addition, the parcels that would be required to be acquired in part or in full are listed in Appendix C and further discussed in Section 3.D, Population and Housing.

B. NO PROJECT ALTERNATIVE

The No Project Alternative describes the consequences if the BART Board decides not to proceed with either the Proposed Project or any of the Build Alternatives. The purpose of describing and analyzing a No Project Alternative is to allow decision-makers to compare the impacts of approving the proposed project with the impacts of not approving the proposed project.

1. Transportation Network

For the purpose of this EIR, the No Project Alternative represents the region's existing transportation network—consisting of highways, arterial roads, public transit, and bicycle and pedestrian facilities—as well as planned improvements to the transportation network through 2040, which are summarized below and described in detail in Section 3.B, Transportation. This alternative represents the network as it exists in 2016, plus the programs and plans currently identified in regional transportation plans that would be implemented through 2040 and for which funding has been identified. Planned improvements to the transportation network include the following: (1) segments of I-580; (2) local roadways and intersections in the cities of Dublin, Pleasanton, and Livermore; and (3) improvements to core transit service planned by BART, ACE, and the Livermore-Amador Valley Transit Authority (LAVTA). A more detailed description of the transportation improvements in the project area is provided in Section 3.B, Transportation.

BART system improvements include several near-term and long-term major investments to increase capacity, as follows:

- Fleet of the Future – Expansion of BART's current fleet from 669 cars to as many as 1,116 cars
- Train Control Modernization Project – An updated train control system that will allow BART to run trains more frequently and reliably
- Hayward Maintenance Complex – To ensure that BART has sufficient capacity to repair and maintain the fleet of its expanded system
- Traction Power Improvements – Upgrade or install five traction power substations to serve the congested corridor to adequately power additional BART service

Together, these projects will allow BART to run up to 30 trains per hour per direction through the Transbay Tube to alleviate the existing pinch point, and increase capacity from the current 24,000 to 35,000 passengers per hour per direction.

In addition, BART and its project partners are in the process of advancing several system extension projects, including the BART to Silicon Valley Berryessa Extension Project (extension from Fremont to Berryessa in north San Jose) and the Eastern Contra Costa County Extension Project, known as eBART (extension from Pittsburg/Bay Point to Antioch). BART is also implementing improvements at several stations.

2. Population and Employment Growth

Section 3.A, Introduction to Environmental Analysis, and Section 3.D, Population and Housing, presents information about population and employment projections through 2040.

3. BART Operations

Current BART service to the Dublin/Pleasanton Station is provided by the Daly City-Dublin/Pleasanton Line, which operates between the Daly City BART Station and the Dublin/Pleasanton Station. BART service to the Dublin/Pleasanton Station is provided as follows:

- Weekdays: 4:00 a.m. to 12:00 a.m., with trains every 15 minutes
- Saturdays: 6:00 a.m. to 12:00 a.m., with trains every 20 minutes
- Sundays/Holidays: 8:00 a.m. to 12:00 a.m., with trains every 20 minutes

Under the No Project Alternative, the BART operating plan in 2025 would be consistent with the current operating plan. However, BART intends to have 12-minute headways

(instead of 15-minute headways) at some time after 2025; these headways are reflected in the No Project Alternative in 2040.²

The No Project Alternative would require an additional 465 BART cars to accommodate the increased ridership anticipated in 2040.

C. PROPOSED PROJECT – CONVENTIONAL BART PROJECT

The Proposed Project is the approximately 5.5-mile extension of BART service on the Dublin/Pleasanton-Daly City Line from the existing Dublin/Pleasanton Station (current terminus) to a new BART station at the Isabel Avenue/I-580 interchange in the city of Livermore using conventional BART technology.^{3, 4}

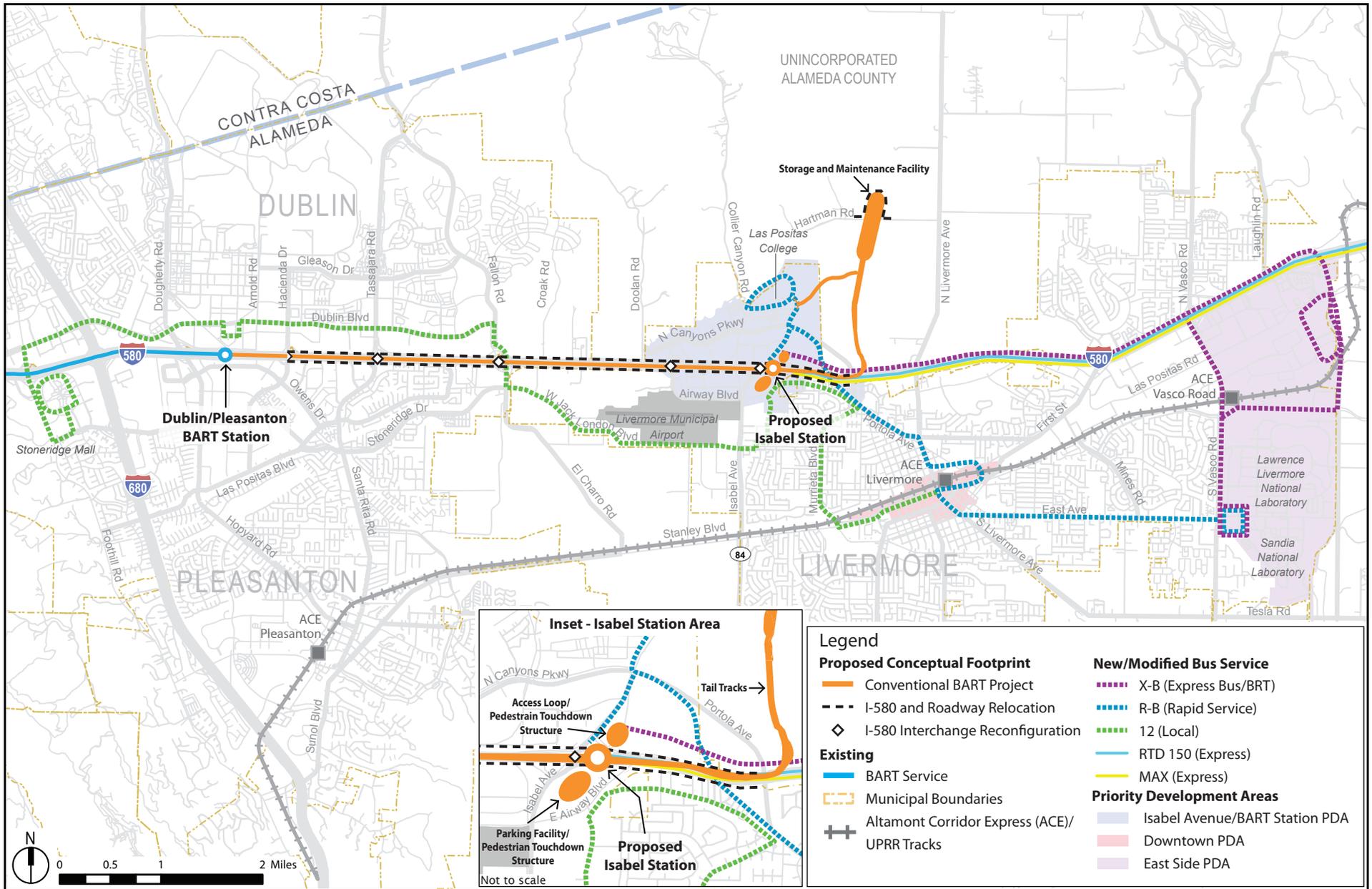
Key components of the project include the BART extension and related BART infrastructure, relocation of I-580 lanes and associated surface frontage roadway reconfigurations to accommodate the proposed BART alignment within the I-580 median, and new and modified bus services and facilities to improve transit east of the BART extension. These components are listed below, and the conceptual plan is shown in Figure 2-1. A more detailed representation of the footprint of the Proposed Project is shown in Appendix B.

- **BART System Improvements.** The extension of BART to Livermore would primarily entail the construction of new tracks, a new BART station, and a new storage and maintenance facility, as listed below. No changes to the Dublin/Pleasanton Station are proposed.
 - **BART Track Extension.** The BART mainline tracks would be extended approximately 5.5 miles within the I-580 median, which would require widening of the median. Immediately east of the Dublin/Pleasanton Station, the existing tail tracks would be converted to mainline tracks. New mainline tracks would be constructed from the end of the converted track to the proposed Isabel Station. As described above, the design of the Proposed Project does not preclude a future extension of the rail alignment to the east, either in the I-580 median or to Downtown Livermore.

² Headway is the time between successive transit vehicles operating on the same route.

³ Arup and Anil Verma Associates, Inc., 2017a. BART to Livermore Extension Contract Drawings, 10 Percent Preliminary Engineering (Draft). July.

⁴ Arup and Anil Verma Associates, Inc., 2017b. 10 Percent Preliminary Engineering Design Basis Memoranda (Draft), Alternative 1: Conventional BART, Alternative 2: DMU/EMU to Isabel Station and Maintenance Facility, Alternative 3: Express Bus/BRT.



Source: Arup, 2017a,b.

Figure 2 - 1
 Conventional BART Project
 Overview

- **New Isabel Station.** The proposed Isabel Station would be constructed just east of the Isabel Avenue/I-580 interchange. The station would be constructed in the I-580 median and would connect to parking and multi-modal transit facilities by pedestrian bridges crossing I-580 to the north and south. The main parking facility, with approximately 3,412 parking spaces, would be south of I-580, accessible from East Airway Boulevard. The main bus transfer facility would be north of I-580 and accessible from Isabel Avenue. A new BART end-of-line operations building would be constructed at the Isabel Station.
- **New BART Storage and Maintenance Facility.** BART evaluated several locations for a new BART storage yard that would provide storage space for approximately 172 BART cars. A location north of I-580 and parallel to Cayetano Creek was selected as the preferred location (see the Alternatives Considered but Withdrawn subsection [Section 2.K], below for a discussion of the other locations). Subsequently, a maintenance facility was included with the storage yard to meet the maintenance needs of a BART extension to the proposed Isabel Station as well as the Daly City-Dublin/Pleasanton Line.

The new 68-acre combined BART storage and maintenance facility would be constructed north of I-580, providing storage space for approximately 172 BART cars. Tail tracks would extend east from the Isabel Station in the median of I-580, cross under westbound I-580 in an underpass structure, cross under Portola Avenue bridge, and extend north and parallel to Cayetano Creek. The distance from the station to the yard would be approximately 1.9 miles.

- **I-580 and Frontage Road Relocation.** To accommodate the widening of the I-580 median, approximately 5.6 miles of I-580 would be relocated by approximately 46 feet, from just east of the Hacienda Drive interchange to west of the Portola Avenue overcrossing. At the proposed Isabel Station, I-580 would be relocated by approximately 67 feet to accommodate the new station. The existing lane configuration would be relocated to Caltrans standards and would have the same number of travel lanes, including express lanes, as currently exist. Freeway interchanges and on- and off-ramps along the corridor would be reconfigured to accommodate the freeway relocation, and some surface frontage roads and adjacent features would be modified or relocated. The following four interchanges would be reconfigured, either partially or completely: Tassajara Road/Santa Rita Road; Fallon Road/El Charro; Airway Boulevard; and Isabel Avenue.
- **New/Modified Bus Routes and Improvements.** New and modified LAVTA feeder bus routes would connect the new Isabel Station to Downtown Livermore, LLNL, the Vasco

Road ACE station, and other areas east of the BART system.⁵ Transit infrastructure enhancements would also be implemented to increase the performance of the bus connections. New and modified routes include Rapid service (R-B), peak-period Express service (X-B), 12, San Joaquin Regional Transit District (RTD) 150, and Modesto Area Express (MAX). Routes that would be eliminated are LAVTA 12X, 20X, and R-B.⁶ The overall performance of these routes would be improved via the implementation of bus-related transit priority infrastructure enhancements.

1. BART System Improvements

The proposed improvements to the BART system—including train technology, track alignment, station facilities, and non-station facilities—are described below and shown in Figure 2-2.

a. Conventional BART Project Technology

The BART train technology that would be used for the Proposed Project would be the same as that used in the majority of the BART system. It is referred to as conventional BART technology.

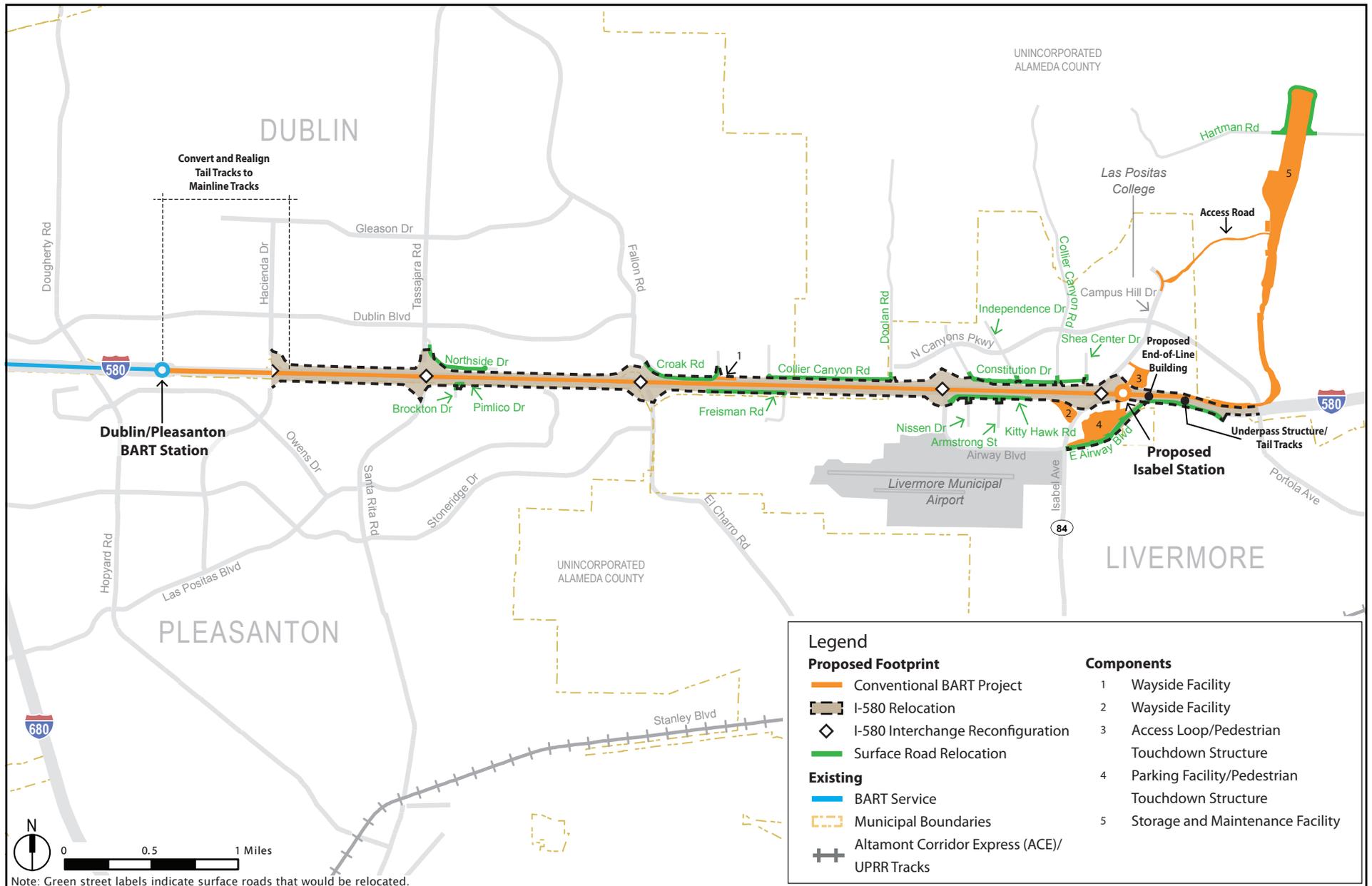
(1) Description

The conventional BART technology is an electric railway designed to carry large passenger loads using heavy rail.⁷ BART trains run within an exclusive ROW, on a track system that is 5 feet, 6 inches wide; it is wider than the standard gauge (4 feet, 8.5 inches) used for most railroads in the United States.

⁵This EIR describes and analyzes the bus routes at a programmatic level. The routes are conceptual and were developed for the purpose of estimating BART ridership and operating costs. At the time that specific routes are developed by the bus operators, those routes would be subject to a separate environmental review if required.

⁶ Although LAVTA eliminated Route 12 and 12X service in August 2016, a restructured Rapid would serve most of the existing Route 12 stops on Dublin Boulevard as well as North Canyons Parkway and Las Positas College, and a restructured Route 14 would serve the areas of Livermore currently served by Route 12. Therefore, these restructured routes would generally serve the areas currently served by the 12 and 12X, and the existing routes analyzed in this EIR remain as previously operated by LAVTA.

⁷ Heavy rail is a mode of transit service operating on an electric railway with the capacity for a heavy volume of traffic. Heavy rail is characterized by high-speed, rapid-acceleration passenger rail cars operating singly or in multi-car trains on fixed rails (on ROWs separate from all other vehicular and foot traffic) and includes sophisticated signaling.



Source: Arup, 2017b; Arup and Anil Verma Associates, Inc., 2017a.

Figure 2 - 2
Conventional BART Project
Detail

(2) Propulsion

BART trains are driven by 150-horsepower electric traction motors that are mounted on the axles of each car. Each car has four axles, for a total of four motors per train. These motors are powered by a 1,000-volt (V) direct current (DC) that is delivered to each of the motors via an electrified third rail.

(3) Vehicles

The vehicles under the Proposed Project are the same as those that will be in use throughout the BART system at the time the project opens. These new BART cars are expected to begin service by 2017. As shown in Figure 2-3, these cars, built by Bombardier Transit Corporation, will feature a series of improvements over the existing BART vehicles, which have been in use since BART began service in 1972. Approximately 36 BART cars would be purchased as part of this project to provide the additional service needed for the new station and additional ridership.

b. Conventional BART Project Alignment

The Proposed Project would extend BART service east of the existing Dublin/Pleasanton Station to a new BART station near the Isabel Avenue/I-580 interchange. The alignment and station would be constructed in the I-580 median. Approximately 5.5 miles of mainline track would extend to the new Isabel Station as follows:

- Within the existing median, approximately 0.7 mile of the existing tail tracks east of the Dublin/Pleasanton Station would be replaced with mainline tracks.
- Within the new median, approximately 4.8 miles of mainline tracks would be installed.

East of the proposed Isabel Station, approximately 1.9 miles of tail track would extend to the new storage and maintenance facility. Table 2-2 lists the proposed BART alignment, structures, and facilities for each segment of I-580 from west to east.

(1) Horizontal Alignment

The BART ROW would be extended approximately 5.6 miles within the I-580 median, requiring the existing median to be widened both north and south of I-580 by up to 46 feet (similar to the standard BART ROW) along the majority of the extension. At the proposed Isabel Station, the BART ROW would be approximately 67 feet wide to accommodate the station platform. The BART ROW would be exclusively for BART use. A typical view of I-580 and the BART alignment within the I-580 median is shown in Figure 2-4.

Typical New BART Train Cars



Typical BRT Vehicles



Source: BART, 2016; Anthony Nachor, 2017.

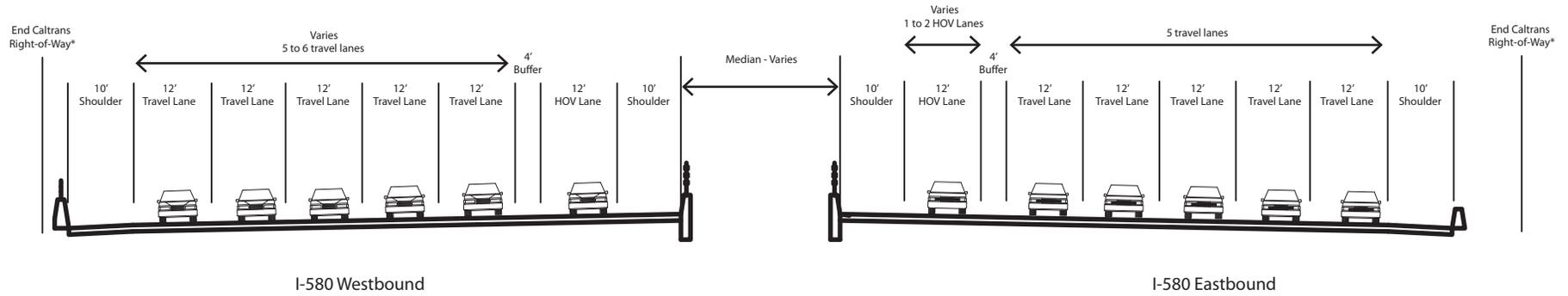
TABLE 2-2 CONVENTIONAL BART PROJECT – ALIGNMENT, FACILITIES, AND STRUCTURES

From	To	BART Alignment/Structures	BART Facilities
Dougherty Road/ Hopyard Road	Hacienda Drive	<ul style="list-style-type: none"> ▪ Convert tail tracks to mainline tracks 	--
Hacienda Drive	Tassajara Road/ Santa Rita Road	<ul style="list-style-type: none"> ▪ New BART ROW in I-580 median ▪ New mainline tracks 	--
Tassajara Road/ Santa Rita Road	Fallon Road/ El Charro Road	<ul style="list-style-type: none"> ▪ New BART ROW in I-580 median ▪ New mainline tracks 	--
Fallon Road/ El Charro Road	Airway Boulevard	<ul style="list-style-type: none"> ▪ New BART ROW in I-580 median ▪ New mainline tracks 	<ul style="list-style-type: none"> ▪ Wayside facility north of I-580 near Croak Road
Airway Boulevard	Isabel Avenue	<ul style="list-style-type: none"> ▪ New BART ROW in I-580 median ▪ New mainline tracks 	<ul style="list-style-type: none"> ▪ Wayside facility south of I-580 near Kitty Hawk Road/Isabel Avenue
Isabel Avenue	Portola Avenue	<ul style="list-style-type: none"> ▪ New BART ROW in I-580 median ▪ New mainline tracks to Isabel Station ▪ Tail tracks to storage and maintenance facility via westbound I-580 underpass 	<ul style="list-style-type: none"> ▪ Isabel Station in I-580 median and pedestrian overcrossings and touchdown structures (north and south of I-580) ▪ Two-story end-of-line BART operations building ▪ Isabel Station parking facilities – south of I-580 ▪ Bus transfer facility – north of I-580
Portola Avenue	North Livermore Avenue	<ul style="list-style-type: none"> ▪ Tail tracks to storage and maintenance facility ▪ Portola Avenue undercrossing ▪ Tail track bridges over Arroyo las Positas and Cayetano creeks ▪ Hillside tunnel for tail tracks 	<ul style="list-style-type: none"> ▪ Storage and maintenance facility and new access road from Campus Hill Drive (with crossing over Isabel Creek)

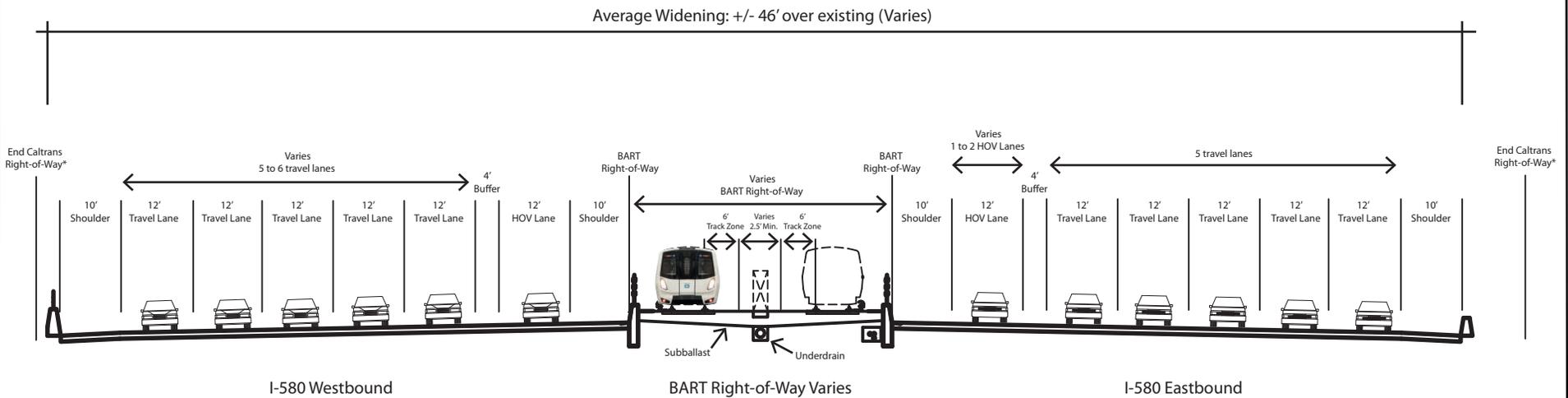
Note: -- = No change proposed.

Source: Arup and Anil Verma Associates, Inc., 2017b.

Existing



Proposed



Not to Scale

Source: Arup and Anil Verma Associates, Inc., 2017a.

The existing tail track east of the Dublin/Pleasanton Station, which is currently used to store BART trains at the end of the line, would be converted/realigned to mainline track. Along this segment of the alignment, which is approximately 0.7 mile long, the existing median would not require widening.

Double-track mainline, with one track in each direction, would be installed along the new BART ROW. The existing crossover east of the Dublin/Pleasanton Station would be retained to allow BART trains to switch tracks. In addition, three new crossovers would be constructed as follows: (1) along the BART mainline extension in the I-580 median, east of the interchange of I-580 with Fallon Road/El Charro Road; (2) along the BART mainline extension in the I-580 median, west of the Isabel Avenue/I-580 interchange; and (3) at the storage and maintenance facility.

(2) Vertical Alignment

Similar to the existing I-580 roadway, the BART alignment would cross below existing freeway overpasses and above natural features. The BART tracks would be constructed consistent with the existing grade of I-580 from the Dublin/Pleasanton Station to the Isabel Station, where the tracks would cross under westbound I-580 in an underpass, resurface north of I-580, cross under the Portola Avenue overcrossing, and then extend to the storage and maintenance facility west of Cayetano Creek.

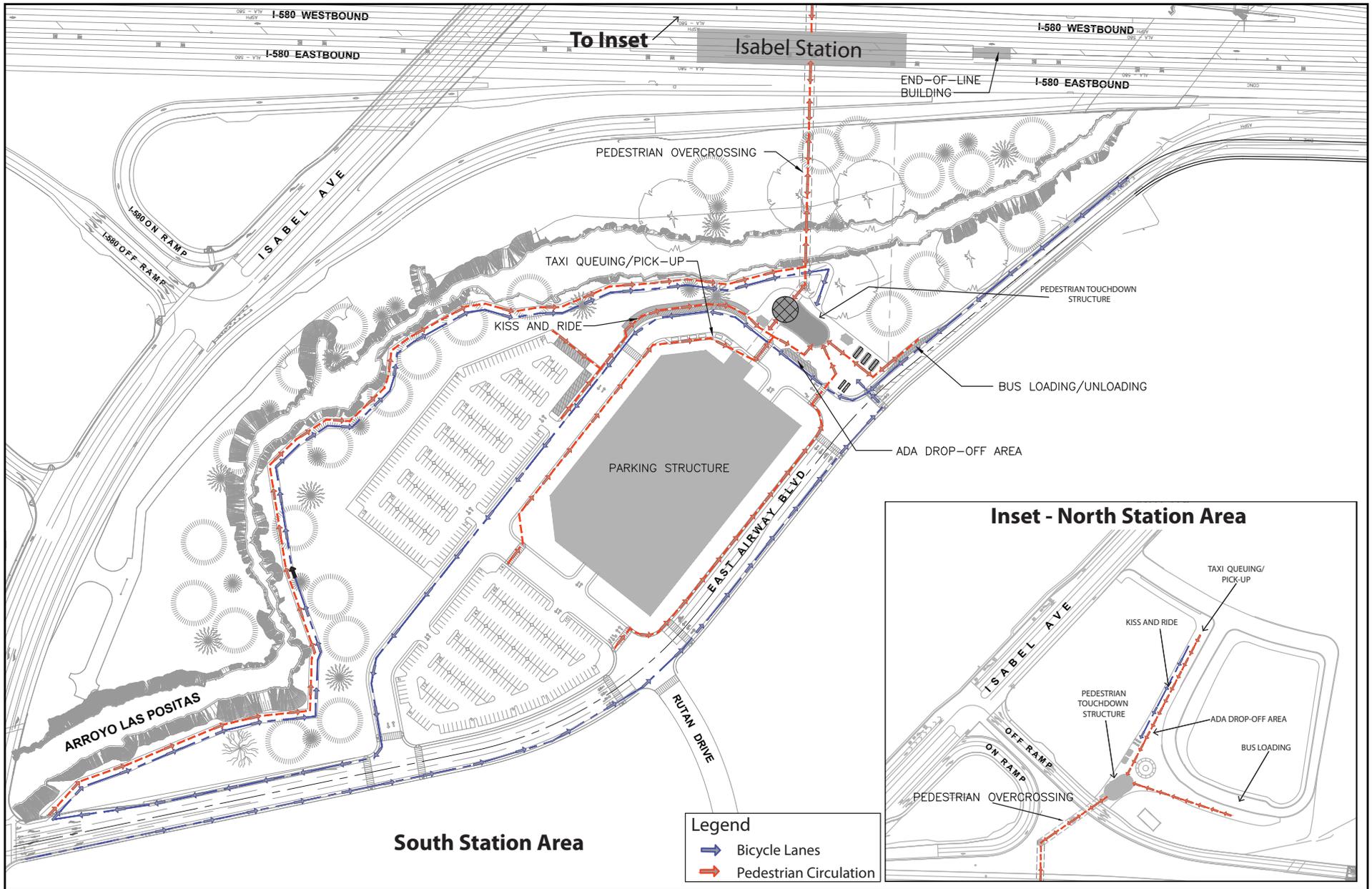
As shown in Table 2-2, new bridges and structures would be constructed along the following creeks for the tail tracks from Isabel Station to the storage and maintenance facility and the access road to the storage and maintenance facility:

- Arroyo las Positas (east of Portola Avenue)
- Cayetano Creek
- Isabel Creek

c. New Isabel Station

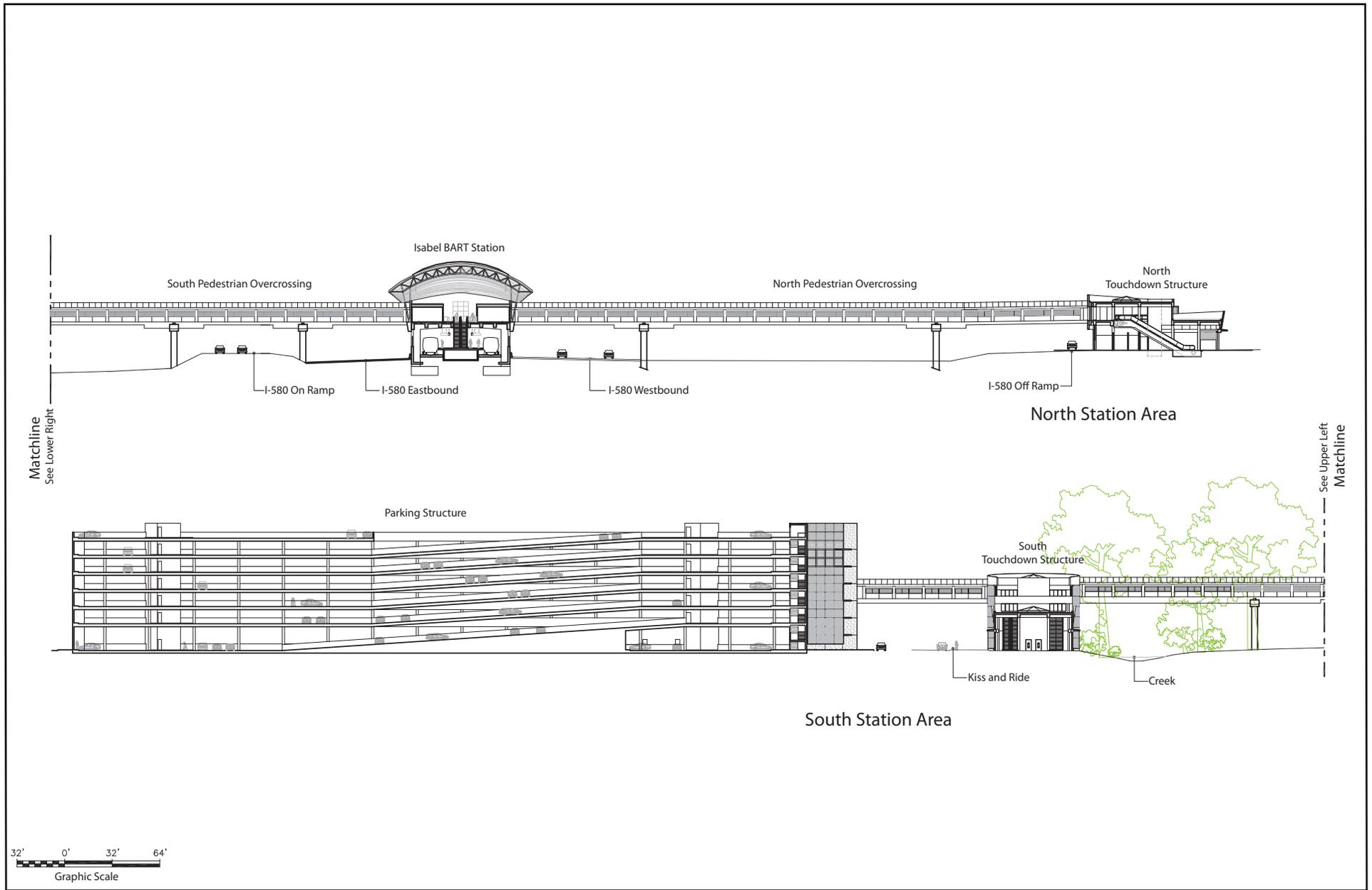
The Proposed Project includes the construction of a new terminus station for the Dublin-Pleasanton Line, which would be located in the I-580 median just east of the Isabel Avenue/I-580 interchange in the city of Livermore. A plan view of the new Isabel Station and surrounding facilities is shown in Figure 2-5. A section view of the new station and BART facilities north and south of I-580 is presented in Figure 2-6.

No modifications to the Dublin/Pleasanton Station are proposed under the Proposed Project. The existing BART end-of-line operations building would be vacated and a new end-of-line operations building would be constructed at the proposed Isabel Station, as described below. This would not require any change to the existing Dublin/Pleasanton Station.



Source: Arup and Anil Verma Associates, Inc., 2017a.

Figure 2 - 5
Conventional BART Project
Isabel Station and Parking – Site Plan



Source: Arup and Anil Verma Associates, Inc., 2017a.

Figure 2 - 6
Conventional BART Project
Isabel Station and Parking – Site Section

(1) Design and Facilities

The proposed Isabel Station would be a partially enclosed station with an elevated concourse level above the BART platform, as shown in Figure 2-7. The station would be approximately 67 feet wide and approximately 700 feet long. It would have a canopy-type roof at a height approximately 62 feet above grade. Figure 2-8 shows a longitudinal section of the station and south elevation.

The station would include the following three types of areas: (1) free area, where the public congregates and that contains ticket vending machines; (2) paid area, which starts just beyond the fare gates and that includes the passenger boarding platform; and (3) ancillary areas, which are non-public areas required for station operation. Typical station amenities, including public restrooms and drinking fountains, would be provided for passengers in the paid area.

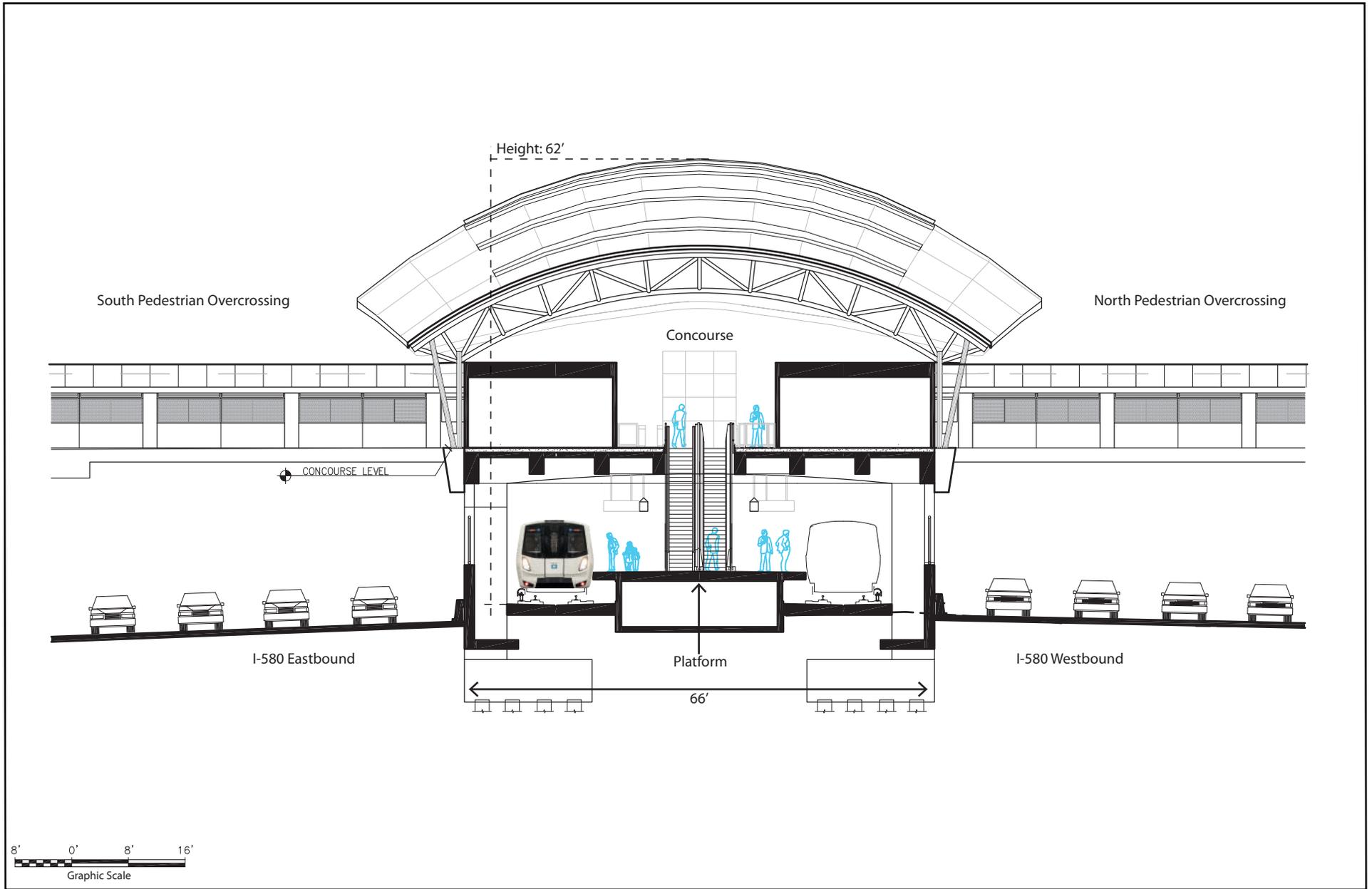
The concourse level (upper level) would be approximately 66 feet wide by approximately 424 feet long. The pedestrian overcrossings would connect at this level. The ticket booth, station agent gate, fare gates, train control room, electrical and mechanical rooms, police, staff break room, and other related uses would be located on this level. Escalators, elevators, and stairs would connect the concourse to the BART platform on the lower level. The BART platform would be approximately 30 feet wide by approximately 700 feet long, and would accommodate a standard 10-car BART train.

As shown in Figures 2-5 and 2-6 above, pedestrian overcrossings would extend north and south of the station, crossing I-580 and connecting the station concourse to the bus transfer facilities on the north and parking facilities on the south, via touchdown structures housing escalators and elevators. The pedestrian overcrossings would be approximately 20 feet wide. The overcrossing to the north would extend approximately 382 feet from the station to the touchdown structure, and the overcrossing to the south would extend approximately 485 feet to the touchdown structure.

The parking and transit facilities are described below in the Access and Connections subsection.

BART operations facilities within the Isabel Station would include the train control room, traction power substation, a 34.5-kilovolt (kV) switching station, and a 115/34.5-kV high-voltage substation. A permanent emergency generator would be located at the Isabel Station north pedestrian touchdown structure.

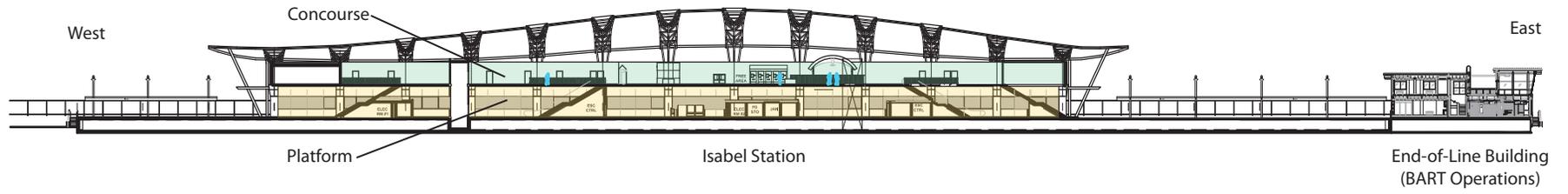
Landscaping would be installed at the north and south station areas, which are described below.



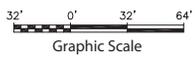
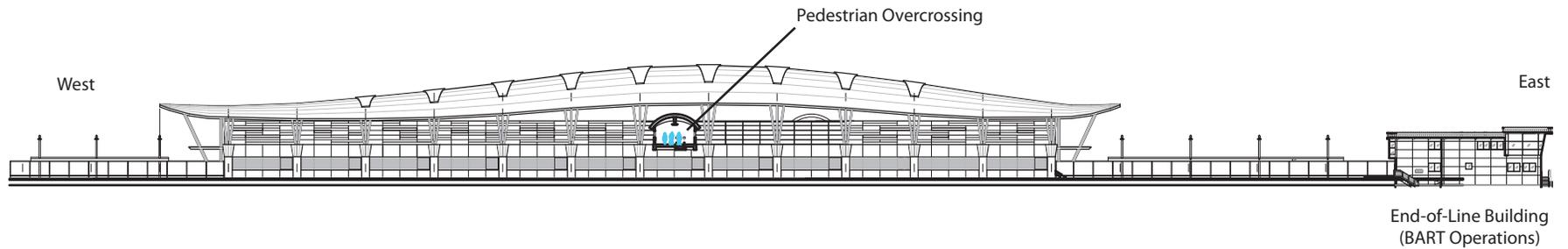
Source: Arup and Anil Verma Associates, Inc., 2017a.

Figure 2 - 7
Conventional BART Project
Isabel Station Cross Section

Longitudinal Section



South Elevation



Source: Arup and Anil Verma Associates, Inc., 2017a.

(2) Access and Connections

BART's Station Access Policy, adopted June 9, 2016, provides guidance on prioritizing access modes to BART stations, depending on station type.⁸ The policy identifies six station types: urban; urban with parking; balanced intermodal; intermodal/automobile reliant; and automobile-dependent. When the Isabel Station would first be open for service, riders would rely primarily on automobiles for access to the station, making it an automobile-dependent station. Over time, development guided by the City of Livermore's proposed Isabel Neighborhood Plan (INP) is expected to increase the density of housing and jobs around Isabel Station, and to promote active transportation with a network of bicycle and pedestrian trails and pedestrian-scale streets with traffic calming devices. With these improvements, it is anticipated that the proposed Isabel Station would be considered a balanced intermodal station. For additional description of the INP, see Chapter 1, Introduction, and Section 3.A, Introduction to the Environmental Analysis.

For automobile-dependent stations, investments to provide access by walking, bicycle, transit, drop-off and pick-up, and automobile parking are all accommodated, with priority given to walking. For balanced intermodal stations, investments to provide access are limited to walking, bicycle, transit, and drop-off and pick-up, and not automobile parking.

The Isabel Station would be accessible from both the north and south, on either side of I-580. A bus transfer facility would be located at the north station area, providing bus and passenger access to the station, while the south station area would be primarily for passenger vehicle parking. Site circulation in the vicinity of the proposed station is shown in Figure 2-5.

(a) North Station Area – Bus Transfer Facility

A bus transfer facility at the north station area on the north side of I-580 would provide the primary transit connections to the station. A new loop road from Isabel Avenue would be constructed to provide access to the north station area. Passenger drop-off and pick-up, a taxi stand, and bus connections would be provided at the transfer facility. In addition, a combination of bicycle lockers and bicycle racks would be provided at the north station area. Approximately 300 bicycle lockers and racks would be provided at the Isabel Station, divided between the north and south sides of the station. The proportion of bicycle facilities allocated to the north and south sides of the station would be determined by demand as the patronage develops. Buses traveling westbound on I-580 would take the off-ramp at Isabel Avenue, turn right onto Isabel Avenue, and turn right to enter the north

⁸ San Francisco Bay Area Rapid Transit District (BART), 2016. BART Station Access Policy. Available at: <http://www.bart.gov/about/planning/access>, accessed June 2017.

station area. The route for non-freeway buses would be similar to the route of freeway buses, except that non-freeway buses would approach the bus drop-off/pick-up facility from local roads rather than from the I-580 off-ramp. Buses would use the access loop road to drop off passengers at the transfer facility as close to the north pedestrian overcrossing as feasible.

BART would construct the access loop road from Isabel Avenue, as well as the bus transfer facility and the pedestrian overcrossing from the station in the I-580 median. The area around those elements of the project would be available for TOD consistent with Livermore's INP and would be integrated into the INP as it is developed. For additional description of the INP, see Chapter 1, Introduction, and Section 3.A, Introduction to the Environmental Analysis.

(b) South Station Area – Parking

As described above, the primary parking facility for BART would be provided south of I-580 along East Airway Boulevard, east of Isabel Avenue. Vehicular access would be from I-580 via Isabel Avenue or Portola Avenue to East Airway Boulevard.

Approximately 3,412 parking spaces would be provided as follows: a seven-level, approximately 87-foot-high parking structure would provide approximately 2,835 parking spaces, and two surface parking lots would provide 577 parking spaces. The number of spaces provided was based on the anticipated parking demand (see Section 3.B, Transportation, for additional information). An investment in parking at Isabel Station is consistent with the classification of the station as an automobile-dependent station under BART's Station Access Policy, as described above. Solar panels would be installed above the top parking level and would have a photovoltaic capacity of approximately 1,000 kilowatts (kW).

The south station area would be accessed by three driveways from East Airway Boulevard. The central driveway would be opposite Rutan Drive, with a second driveway to the east and a third to the west. The central driveway would be signalized with a protected phase provided for eastbound left-turning traffic (entering the station site from eastbound East Airway Boulevard). The other two driveways would be stop-controlled, with the westernmost driveway a right-turn-out-only driveway.

In addition to vehicle parking, a bicycle station with a combination of bicycle racks and lockers would be constructed. An area that accommodates a taxi stand, bus loading/unloading zone, and passenger drop-off/pick-up would also be provided within the south station facility. Although most buses would serve the bus transfer facility at the north station area, at least one bus line (LAVTA 12) would stop on Airway Boulevard near the parking facility and pedestrian overcrossing. Passengers would use the south pedestrian overcrossing to access the BART platform. Approximately 0.4 mile of East

Airway Boulevard would be widened from the existing two lanes to four lanes (two lanes in each direction), from Isabel Avenue to the eastern-most new access road at the south station area, and pedestrian and bicycle improvements would be constructed as described below.

While the quantity of station parking has been designed to accommodate the anticipated demand, unanticipated demand for parking could exceed supply. This could result in BART patrons parking on local streets. In the event that a local jurisdiction requests BART assistance with management of overflow parking by BART patrons, BART would work with the jurisdiction to implement BART's Parking Management Toolkit, which provides recommended strategies for addressing BART parking overflow onto city streets (a copy of the Parking Management Toolkit is provided in Appendix D). In addition, the station parking garage would be designed to accommodate the potential future construction of two additional levels of parking.

(c) Pedestrian and Bicycle Access

Improvements for pedestrian and bicycle access to the proposed Isabel Station are described below.

- Standard-width sidewalks and crosswalks would be provided along the north station access loop road and bus transfer facility. Additionally, a 5-foot-wide sidewalk would be constructed along the north side of East Airway Boulevard along the Isabel parking facility (within the BART property).
- A high-visibility crosswalk, including striping and traffic signal modifications, would be installed at the intersection of Rutan Drive and East Airway Boulevard to provide safe pedestrian and bicycle crossing.
- A crosswalk, including striping and traffic signal modifications, would also be installed across the north leg of the Isabel Avenue and East Airway Boulevard intersection.
- Bicycle lanes (6 feet wide) would be constructed on East Airway Boulevard. These lanes would connect to the existing bicycle lanes on Isabel Avenue and Airway Boulevard to the west, to the existing trail along Sutter Street, and to the planned trail along Airway Boulevard east of the site.
- A service road would be constructed along the south side of Arroyo las Positas Creek, north of the parking facility. This road would also serve as a pedestrian pathway and bicycle trail. A connection to the service road would be installed from East Airway Boulevard. Separately, the City of Livermore may construct a pedestrian way/bicycle trail connection under I-580, along the Arroyo las Positas Creek undercrossing of I-580 that could connect the pedestrian and bicycle access at the Isabel Station with other pedestrian paths and bicycle trail planned for north of I-580 by the City of Livermore.

d. Non-Station Facilities

Non-station facilities associated with the Proposed Project include the tail tracks and end-of-line operations building, storage and maintenance facility, and wayside system facilities. The wayside facilities provide power to the tracks and switches and communications to the trains.

(1) End-of-line Operations Building and Tail Tracks

The tail tracks east of the Dublin/Pleasanton Station would be converted to mainline tracks. Tail tracks differ primarily from mainline tracks in that they are used for train storage and logistics and not for revenue passenger transport. The new end-of-line building for BART operations at the Isabel Station (shown in Figure 2-8 above) would be a two-story structure east of the BART platform. The end-of-line building would house the train supervisory booth and associated staff facilities.

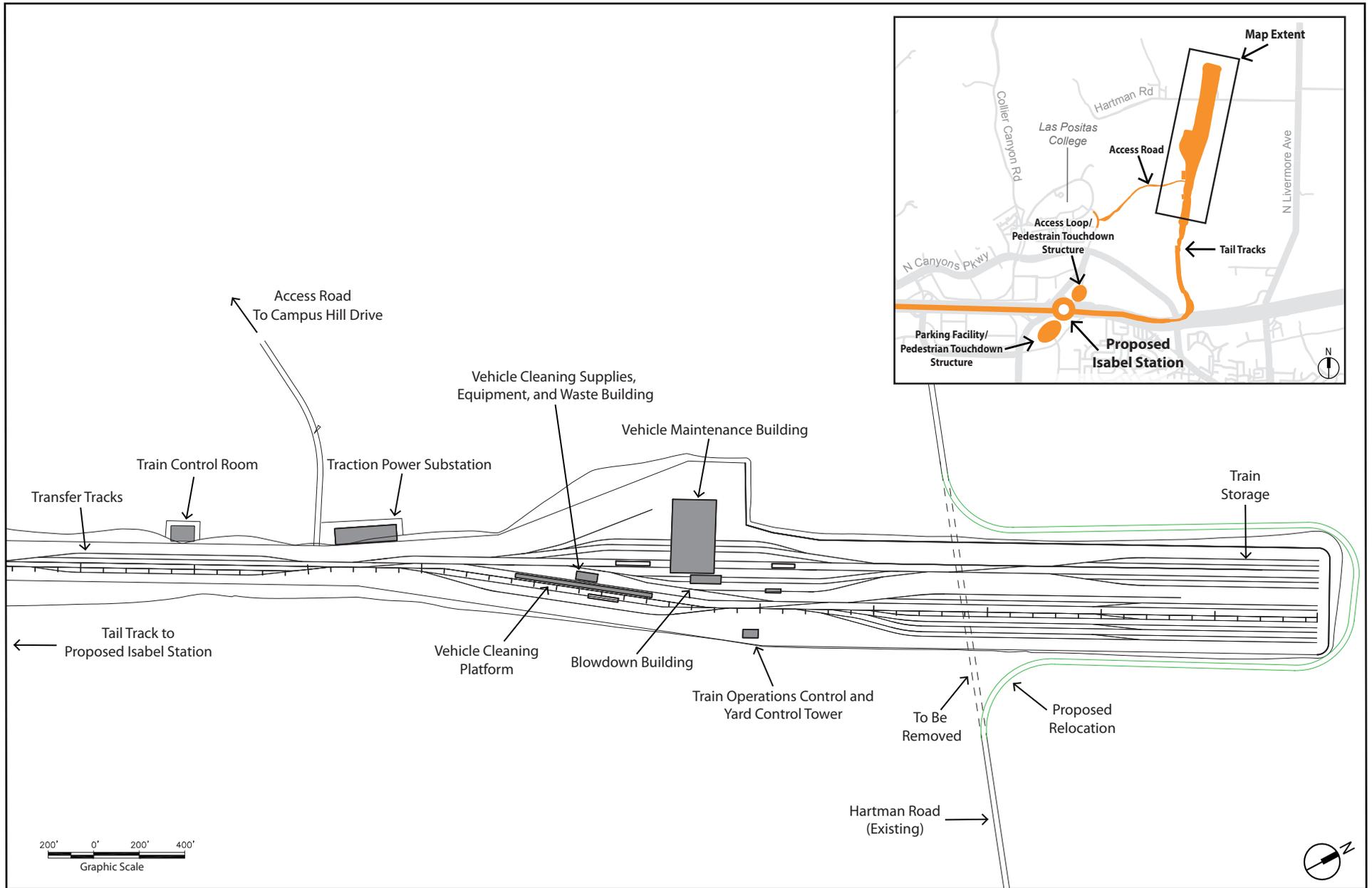
The tail tracks would extend approximately 1.9 miles from the Isabel Station to the storage and maintenance facility. The tail tracks would extend from the Isabel Station in the I-580 median, through an underpass to the north side of I-580, crossing Arroyo las Positas and Cayetano creeks on bridges, and extending through an approximately 450-foot hillside tunnel to the storage and maintenance facility.

The tail tracks would be designed with culverts or drainage ways at regular intervals under the track to disperse stormwater runoff evenly along the trackway and maintain drainage to Cayetano Creek and vernal pools in the area.

(2) Storage and Maintenance Facility

BART conducted an operations analysis to determine BART vehicle fleet and storage needs to effectively operate the Proposed Project. The analysis considered expected BART ridership on the Proposed Project as well as BART's operating plan for the Daly City-Dublin/Pleasanton Line in 2040. Based on the analysis, a storage yard providing storage space for approximately 172 BART cars would be required. As the Proposed Project evolved, a maintenance facility was added to the storage yard to meet the maintenance needs of a BART extension to Isabel Station as well as the Daly City-Dublin/Pleasanton Line.

Thus, an approximately 68-acre storage and maintenance facility, shown in Figure 2-9, would be constructed to store approximately 172 BART cars and conduct systemwide maintenance activities for BART cars. The storage and maintenance facility would contain approximately nine tracks to store BART trains. Fueling, vehicle cleaning, washing, and routine maintenance activities would be carried out at this facility. The main building, with



Source: Arup, 2017b; Arup and Anil Verma Associates, Inc., 2017a.

Figure 2 - 9
Conventional BART Project
Storage and Maintenance Facility

a footprint of approximately 71,337 square feet and a height of approximately 44 feet, would serve as the maintenance facility. Other support buildings would include a 50-foot-high train control tower; a train control room; a traction-power substation; a vehicle cleaning supplies, equipment, and waste building; a vehicle cleaning platform; and a blowdown building.⁹ A permanent emergency generator would be installed at the facility. A surface parking lot with approximately 100 employee parking spaces would be constructed. The storage and maintenance facility would be enclosed with security fencing, and security lighting would be installed.

Vehicle access to the storage and maintenance facility would be provided by a new two-lane road that would extend approximately 0.7 mile from Campus Hill Drive.

(3) Wayside System Facilities

As listed in Table 2-2 and shown in Figure 2-2 above, wayside facilities would be constructed along the proposed BART alignment to provide power and communications support for the project. The wayside facilities provide the ability to power different sections of track and switches via electrical substations that connect to the larger power grid. They also provide communications to trains in this segment of the system. Typical wayside facilities for the BART alignment include train control houses, traction power substations, train control rooms, gap breaker stations, switching stations, high-voltage substations, auxiliary substations, and signaling bungalows.¹⁰

Several wayside facilities would be constructed at the Isabel Station and the storage and maintenance facility, as described in the respective sections for those topics above. In addition, two stand-alone wayside facilities would be constructed, as follows:

- A train control house and traction power substation north of I-580, with access from Croak Road
- A train control house, traction power substation with Pacific Gas and Electric Company power switching station, and gap breaker on the south side of I-580 at the east off-ramp at Kitty Hawk Road and Isabel Avenue

Where the stand-alone facilities would be adjacent to public areas, an approximately 9-foot-high concrete masonry wall would be constructed around the perimeter of the facility. Where the facility is not publicly visible, an approximately 8-foot-high chain-link

⁹ The waste building contains dumpsters for garbage that is removed from the trains. Within the blowdown building, high-powered fans blow down the outside and undercarriage of the BART cars prior to maintenance.

¹⁰ Gap breaker stations control power to the third rail and allow sections of the rail to be turned on and off. Signaling bungalows allow control over trains on specific segments of track.

metal fence topped with barbed wire would surround the facility. Structures within the facility would range in length from approximately 32 feet to 110 feet and would be up to 17 feet high. Vehicular access would be from nearby roadways via a new two-lane access road. Figure 2-10 shows typical site plans and Figure 2-11 shows typical elevations for the wayside facilities.

The wayside facility near Croak Road would be approximately 70 feet by 410 feet. The facility would include a traction power substation with a 34.5-kV alternating current (AC) house, a 1,000-V DC house, transformers, and a train control house.

The wayside facility at Kitty Hawk Road and Isabel Avenue would be approximately 90 feet by 400 feet. The facility would include a traction power substation and high-voltage substation with a 34.5-kV AC house and a 1,000-V DC house and Pacific Gas and Electric Company switching station.

2. I-580 and Frontage Road Relocation

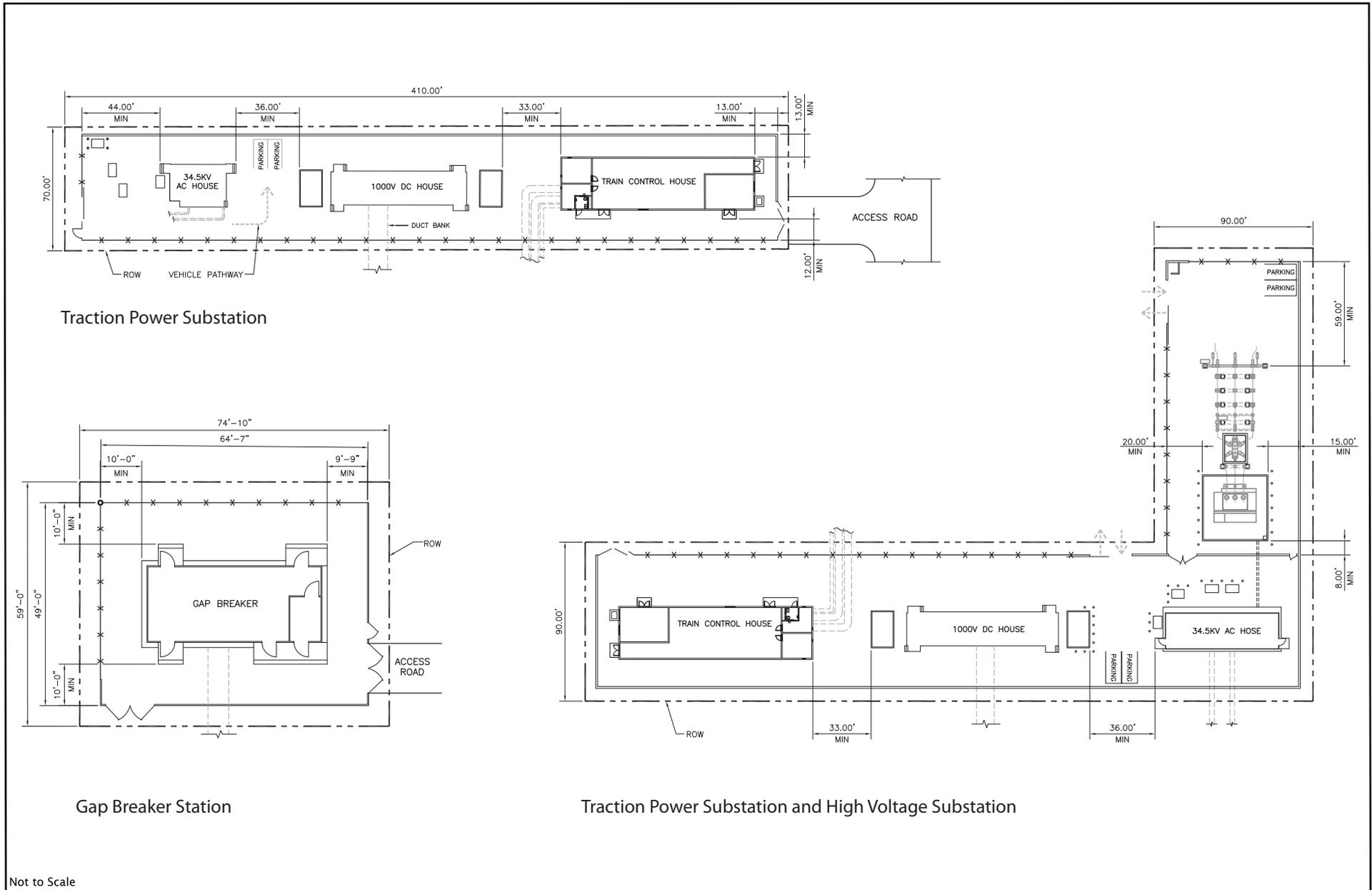
Approximately 5.6 miles of the Caltrans ROW and I-580, from east of the Hacienda Drive interchange to west of the Portola Avenue/I-580 overcrossing, would be relocated to accommodate the new BART ROW in the median. Existing freeway interchanges, on- and off-ramps, freeway structures such as overcrossings, and surface frontage roads would be reconfigured to accommodate the increased ROW width, as needed. The horizontal and vertical alignment of the I-580 relocation, as well as I-580 interchange and roadway reconfigurations, are described below and indicated in Figures 2-2 and 2-4 above. Table 2-3 shows the proposed I-580 relocation, interchange reconfiguration, roadway modifications, and structures for each segment of I-580, from west to east.

a. I-580 Horizontal Alignment

The Caltrans ROW would be widened generally by approximately 46 feet. In the vicinity of the proposed Isabel Station, east of the Isabel Avenue overcrossing, the Caltrans ROW would be widened by approximately 67 feet to accommodate the new station. The existing freeway lane configuration would be moved outward and relocated to Caltrans standards, and would have the same number of travel lanes and express lanes under the Proposed Project as currently exist.

b. I-580 Vertical Alignment

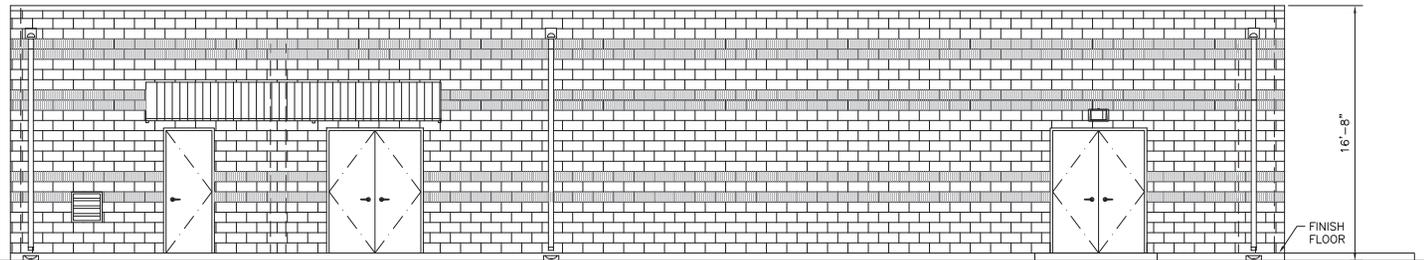
The vertical freeway alignment along I-580 would be generally similar to existing conditions. Where required by existing topography, new/realigned retaining walls would be required. Structures, including the existing I-580 bridges, would be widened to accommodate the wider ROW.



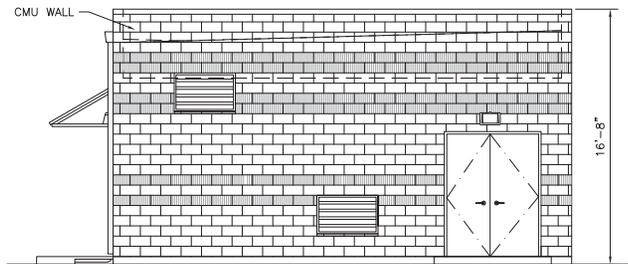
Not to Scale

Source: Arup and Anil Verma Associates, Inc., 2017a.

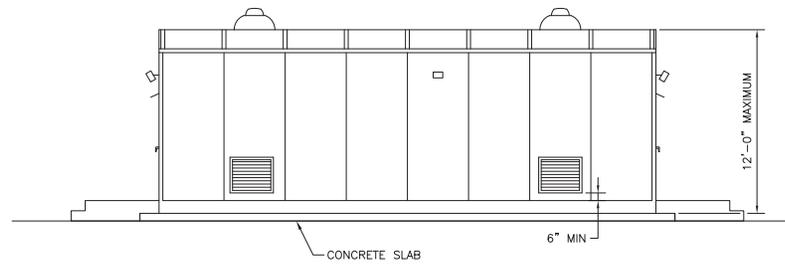
Figure 2 - 10
Conventional BART Project
Wayside Facilities - Typical Site Plans



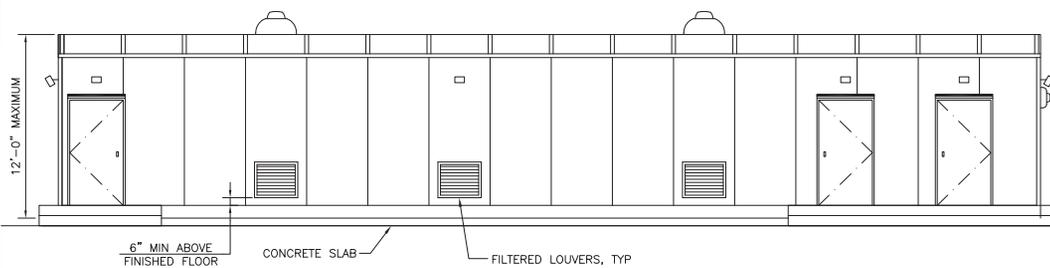
Train Control House Building Elevation



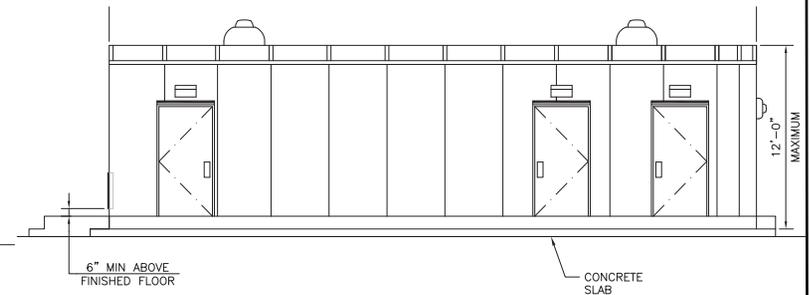
Train Control House Building Elevation



34.5 KV AC House Elevation



1000V DC House Elevation



Gap Breaker Station Elevation

Not to Scale

Source: Arup and Anil Verma Associates, Inc., 2017a.

TABLE 2-3 CONVENTIONAL BART PROJECT – I-580 AND ROADWAY MODIFICATIONS

From	To	I-580 and On-ramps/ Off-ramps/Interchanges	Surface Road Realignment	Structures
Dougherty Road/ Hopyard Road	Hacienda Drive	--	--	--
Hacienda Drive	Tassajara Road/ Santa Rita Road	<ul style="list-style-type: none"> ▪ Relocate I-580 in both directions (EB and WB) ▪ Reconfigure EB on-ramp and WB off-ramp at Hacienda Drive 	--	<ul style="list-style-type: none"> ▪ Tassajara Creek bridge (widen bridge deck; new deck piles)
Tassajara Road/ Santa Rita Road	Fallon Road/ El Charro Road	<ul style="list-style-type: none"> ▪ Relocate I-580 in both directions (EB and WB) ▪ Reconfigure all on-/off-ramps at Tassajara Road/Santa Rita Road/ 	<ul style="list-style-type: none"> ▪ Northside Drive, Brockton Drive, Pimlico Drive 	<ul style="list-style-type: none"> ▪ Reconfigure retaining walls at Tassajara Road/Santa Rita Road
Fallon Road/ El Charro Road	Airway Boulevard	<ul style="list-style-type: none"> ▪ Relocate I-580 in both directions (EB and WB) ▪ Reconfigure all on-/off-ramps at Fallon Road/El Charro Road 	<ul style="list-style-type: none"> ▪ Croak Road, Freisman Road, Collier Canyon, Road, Doolan Road 	<ul style="list-style-type: none"> ▪ Reconfigure retaining walls at Fallon Road/El Charro Road ▪ Cottonwood Creek bridge (widen bridge deck; new piles and abutments)
Airway Boulevard	Isabel Avenue	<ul style="list-style-type: none"> ▪ Relocate I-580 in both directions (EB and WB) ▪ Reconfigure all on-/off-ramps at Airway Boulevard ▪ Demolish and reconstruct one (west) of the two bridge overcrossings 	<ul style="list-style-type: none"> ▪ Constitution Drive, Independence Drive, Collier Canyon Road, Shea Center Drive, Kitty Hawk Road, Nissen Drive, Armstrong Street 	<ul style="list-style-type: none"> ▪ Rebuild one of two Airway Boulevard overcrossings ▪ Reconfigure retaining walls Airway Boulevard overcrossing ▪ Collier Canyon Creek bridge (widen bridge deck; new piles and abutments)
Isabel Avenue	Portola Avenue	<ul style="list-style-type: none"> ▪ Relocate I-580 in both directions (EB and WB) ▪ Reconfigure all on-/off-ramps at Isabel Avenue 	<ul style="list-style-type: none"> ▪ East Airway Boulevard, Hartman Road 	<ul style="list-style-type: none"> ▪ Reconfigure retaining walls at Isabel Avenue/I-580 ▪ Arroyo las Positas Creek bridge (widen bridge deck; new deck piles)

Notes:

-- = No change proposed; EB = eastbound; WB = westbound.

Collier Canyon Road refers to the portion of the road that is west of Doolan Road.

Source: Arup and Anil Verma Associates, Inc., 2017a.

As shown in Table 2-3, the following existing bridges and structures would be widened to accommodate the new BART ROW within the I-580 median:

- Tassajara Creek
- Cottonwood Creek
- Collier Canyon Creek
- Arroyo las Positas (at Isabel Station)

c. Interchange and Roadway Reconfiguration

Modifications would be required at the interchanges and on- and off-ramps along this corridor, including tightening the radius of some ramps and reconstructing others. Reconfiguration/realignment of the I-580 interchanges in both the eastbound and westbound directions would be required at Tassajara Road/Santa Rita Road, Fallon Road/El Charro Road, Airway Boulevard, and Isabel Avenue. Retaining walls would be reconfigured for realigned roadways as required based on the existing topography. The west side of the Airway Boulevard bridge over I-580 would be rebuilt.

In addition, adjacent surface frontage roads and structures would be realigned, as shown in Table 2-3. This includes portions of the following roads: Northside Drive; Brockton Drive; Pimlico Drive; Croak Road; Freisman Road; Collier Canyon Road; Doolan Road; Constitution Drive; Independence Drive; Shea Center Drive; Kitty Hawk Road; Nissen Drive; Armstrong Street; East Airway Boulevard; and Hartman Road.¹¹

As part of a separate project, the City of Livermore plans to widen the Isabel Avenue overcrossing. To accommodate this future widening, BART would build the foundations and columns for the overcrossing concurrent with the Proposed Project to avoid potential future conflicts with the BART system operations. As part of this work, concrete columns approximately 6 feet in diameter and 18 feet high would be constructed within the I-580 median for the future Isabel Avenue widening.

3. Bus Routes and Improvements

As shown in Figure 2-1, new and modified feeder bus routes would be developed for the project, and new bus infrastructure would be installed to provide improved service.¹² These bus routes and infrastructure improvements are referred to in this EIR as feeder buses since they would carry riders to the Proposed Project. The bus technology, proposed route modifications, and bus infrastructure improvements for the project are described below.

¹¹ The portion of Collier Canyon Road west of Doolan Road.

¹² Arup, 2017a. BART to Livermore Extension Bus Operations Technical Memorandum. July.

As described above, this EIR describes and analyzes the bus routes and bus infrastructure improvements at a programmatic level. The routes are conceptual and were developed for the purpose of estimating the BART ridership and operating costs. Candidate locations for bus infrastructure improvements within existing street ROWs are described below to document the availability of such locations. Following implementation of the adopted project, specific routes would be developed by the bus operators based on detailed service planning. At that time, the routes and bus infrastructure improvements could be subject to subsequent environmental review, if required.

a. Bus Technology

LAVTA would provide the majority of the bus service to the Isabel Station using existing passenger buses. The LAVTA fleet currently consists of a mixed fleet of 40-foot and 29-foot diesel and hybrid fixed-route buses; buses contain passenger amenities such as restrooms and on-board information systems. There are currently 66 fixed-route standard buses. Forty of LAVTA's 40-foot diesel buses will be retired by 2017 and replaced with a mix of 35-foot and 40-foot hybrid electric and/or electric coaches. LAVTA is pursuing all-electric vehicles for much of the 2017 fleet replacement.¹³

BRT service characteristics would be used for some routes as described below. BRT refers to bus routes with one or more of the following elements, which provide reduced travel times: limited-stop service; transit priority elements, such as transit signal priority, queue-jump lanes and bus bulb-outs; and freeway-travel and use of express lanes, where possible. Figure 2-3 shows a typical BRT bus.

b. New/Modified Bus Routes

For the Proposed Project, bus routes currently serving the Dublin/Pleasanton Station and areas to the east would be shortened, and routes that duplicate service provided by the Proposed Project would be removed.¹⁴ Eastward bus connections at the Dublin/Pleasanton Station would be limited to two local routes: LAVTA's Route 10 to LLNL and Stoneridge Mall, and LAVTA's Route 12 to the Livermore Transit Center.

New/modified LAVTA routes (including local, Express, and Rapid routes) would serve the proposed Isabel Station, connecting the station with destinations in Livermore, including

¹³ Livermore-Amador Valley Transportation Authority (LAVTA), 2016. LAVTA Short Range Transit Plan, Fiscal Year 2016 to 2025. April. Available at: <http://www.wheelsbus.com/wp-content/uploads/2015/08/FINAL-SRTP.pdf>.

¹⁴ Six bus operators currently provide service connecting areas east of the BART system to the Dublin/Pleasanton Station: LAVTA Wheels bus service; Central Contra Costa Transit Authority; RTD; MAX; Amtrak California; and Stanislaus Regional Transit.

LLNL, the Downtown Livermore ACE station, the Vasco Road ACE Station, and Las Positas College.¹⁵ The new/modified bus routes are listed in Table 2-4.

The bus routes for the connecting bus services for the Proposed Project (as well as those for the DMU Alternative), were developed to provide effective connections from key nodes of activity in Livermore to the BART system (Isabel Station), and thereby improve service for existing BART patrons and generate as many additional BART patrons as possible. Consistent with the objectives of the BART to Livermore Extension Project, this includes providing effective connections to inter-regional rail (i.e., ACE Downtown Livermore and Vasco Road stations) and PDAs in Livermore (i.e., Livermore Isabel Avenue BART Station PDA, Livermore Downtown PDA, and Livermore East Side PDA). Other key activity nodes connected by proposed bus services include LLNL, Sandia National Laboratories, Las Positas College, and the San Francisco Premium Outlets.

Bus services were developed to provide as fast and as direct a route as practical from these activity nodes to the Isabel station. To reduce travel time, routes were developed to make optimal use of the I-580 express lanes. In addition, transit priority elements such as transit signal priority, bus bulbs, and real-time information were deployed to improve travel times along bus route segments experiencing traffic congestion, intersection delay, interference from general traffic, and long dwell times due to high passenger boarding and alighting volumes at specific bus stops.

To provide a seamless connection with the BART system, the frequency of many of the bus routes was chosen to match the frequency of BART trains arriving at the Isabel Station during peak periods. Coordinated bus arrival and departure times with each BART train significantly improves a passenger's perception of reliability and experience of using bus service to connect to BART.

c. Bus-Related Infrastructure Improvements

A series of transit priority infrastructure enhancements would also be implemented to increase the performance of the bus connections described above. Typical bus improvements are shown in Figure 2-12. These enhancements would be implemented on local bus corridors and arterials, and are discussed below.

¹⁵ Rapid routes are routes that run with high frequency and provide service connecting key destinations. Express routes run during peak periods only, make limited stops, and serve major destinations. Both of these route types may feature transit priority elements along their respective route alignments, such as transit signal priority, bus bulbs, queue-jump lanes, and freeway-travel and use of express lanes.

TABLE 2-4 CONVENTIONAL BART PROJECT – NEW/MODIFIED BUS SERVICE

New/ Modified Route	Operator	Route	Existing Peak Headway	Existing Service Span	Proposed Peak Headway	Proposed Service Span	Proposed Route Overview (Existing Route to be Eliminated)	Summary of Changes
New	LAVTA	X-B	--	--	▪ 12 min. (peak)	▪ Weekday: 6:15 a.m. – 9:15 a.m. & 3:30 p.m. – 6:00 p.m. ▪ Weekend: No service	Isabel Station, LLNL, SNL	New service
New	LAVTA	R-B	--	--	▪ 12 min. (peak) ▪ 20 min. (off-peak)	▪ Weekday: 5:30 a.m. – 7:30 p.m. ▪ Weekend: No service	Isabel Station, Las Positas College, ACE Livermore, SNL	New service
Modified	LAVTA	12	30 min.	▪ Weekday: 6:00 a.m. – 10:40 p.m. ▪ Weekend: Sunday only, 6:00 a.m. – 10:40 p.m.	▪ Weekday: 12 min. ▪ Weekend: 30 min. 9:00 a.m. – 9:00 p.m. & 40 min. 5:00 a.m. – 9:00 a.m. & 9:00 p.m. – 1:00 a.m.		Livermore Transit Center to Stoneridge Mall via Isabel Station	Service times: Service span will be extended to 4:30/5:00 a.m. in the mornings and 1:00 a.m. in the evenings. Peak headways will be shortened. Route: Similar to current route, with new stop at Isabel Station.
Modified	RTD	150	60 min.	▪ Weekday: 4:10 a.m. – 10:20 p.m. ▪ Weekend: No service	▪ 45 min.	▪ Weekday: 5:00 a.m. – 7:00 p.m. ▪ Weekend: No service	Stockton Downtown Transit Center, Stockton-Michigan Park & Ride, Lathrop: Save Mart, Tracy Transit Station, Isabel Station	Service times: Peak headways shortened from 60 to 45 min. Routes: Truncated route to stop at Isabel Station instead of Dublin/Pleasanton Station.
Modified	MAX	BART Express	60 min. (two roundtrips each in a.m. and	▪ Weekday: 4:40 a.m. – 9:00 a.m. & 3:45 p.m. – 8:00 p.m. ▪ Weekend:	60 min. (two roundtrips each in a.m. and p.m.)	▪ Weekday: 4:40 a.m. – 9:00 a.m. & 3:45 p.m. – 8:00 p.m.	Modesto Downtown Transportation Center to Isabel Station Modesto Downtown Transportation Center, Sisk	Service times: No change. Route: Truncated route to stop at Isabel Station instead of

TABLE 2-4 CONVENTIONAL BART PROJECT – NEW/MODIFIED BUS SERVICE

New/ Modified Route	Operator	Route	Existing Peak Headway (p.m.)	Existing Service Span	Proposed Peak Headway	Proposed Service Span	Proposed Route Overview (Existing Route to be Eliminated)	Summary of Changes
				No service		▪ Weekend: No service	Road Orchard Supply Hardware Parking Lot (Modesto), Isabel Station	Dublin/Pleasanton Station.
Modified	LAVTA	12X	45 min.	▪ Weekday: 6:00 a.m. – 9:15 p.m. ▪ Weekend: No service	None – Express route to be eliminated	--	(Livermore Transit Center, Valley Care Livermore Campus, Airway Park and Ride, Las Positas College, Kitty Hawk/Armstrong, Dublin Blvd/Fallon intersection, East Dublin/Pleasanton Station)	Route to be eliminated
Modified	LAVTA	20X	45 min.	▪ Weekday: 6:15 a.m. – 10:00 a.m. & 4:00 p.m. – 6:40 p.m. ▪ Weekend: No service	None – Express route to be eliminated	--	(Dublin/Pleasanton Station, Greenville Road, LLNL/SNL, Livermore Transit Center)	Route to be eliminated
Modified	LAVTA	Rapid Route	15 min.	▪ Weekday: 5:30 a.m. – 8:00 p.m.	None – Express route to be eliminated	--	Dublin/Pleasanton Station to Livermore Transit Center	Route to be eliminated

Notes:

-- = Not Applicable; SNL = Sandia National Laboratories.

Peak periods are assumed to be 6:00 a.m. to 10:00 a.m. (AM peak) and 3:00 p.m. to 7:00 p.m. (PM peak).

Several components of the proposed bus routes are similar to Wheels Forward, a program of changes to the LAVTA transit system implemented in August 2016 to provide more frequent buses and new routes in Livermore, Dublin, and Pleasanton. The new, modified, or eliminated routes under the Proposed Project and Build Alternatives are described in relation to the previous bus route network. Elements shared by the Proposed Project and Build Alternatives and the Wheels Forward program include improved bus service from Downtown Livermore to BART, improved bus service to Las Positas College, and improved bus shelters to serve the new Express and Rapid routes. Other capital improvements, such as real-time arrival message boards at bus stations, expansion of transit signal priority to additional intersections, and installation of bus bulbs, are not included in the Wheels Forward program. In addition, the Proposed Project and Build Alternatives would include improved bus service to LLNL and the east side of Livermore.

Although LAVTA eliminated Route 12 and 12X service in August 2016, a restructured Rapid route serves most of the existing Route 12 stops on Dublin Boulevard as well as North Canyons Parkway and Las Positas College, and a restructured Route 14 serves the areas of Livermore previously served by Route 12. Therefore, these restructured routes would generally serve the areas previously served by the 12 and 12X, and the existing routes analyzed in this EIR remain as previously operated by LAVTA.

Source: Arup, 2017a.

Typical Bus Shelters



Typical Bus Bulbs



Source: thefnerucodesign.wordpress.com, 2014; [Streetsblog](http://Streetsblog.com), 2007.

- **Transit Signal Priority.** Transit signal priority allows for signal timings to be adjusted, reducing the wait times for buses at intersections. Typically, this is done with technology on transit vehicles that works with traffic signals to lengthen green time for buses approaching intersections and reduces red time for buses waiting at intersections. Under the Proposed Project, buses would be given priority at key intersections along two roadways on the R-B Route: Portola Avenue and Livermore Avenue.
- **Rapid/Express Route Amenities.** The following amenities/improvements would be implemented to serve new X-B and R-B routes at approximately 29 locations at existing bus stops, within existing street and sidewalk ROWs:
 - Bus shelters
 - Real-time information via digital messaging boards
 - Improved seating and surroundings near bus stops
 - Pre-paid ticketing with Clipper® within the LAVTA service area
- **Bus Bulbs.** Bus bulbs are curb extensions that serve a transit stop. Bus bulbs can improve transit performance by eliminating the need for transit vehicles to exit and re-enter the flow of traffic at each stop. They also facilitate accessible boarding, as the bus can align directly with the curb. Bus bulbs improve pedestrian conditions by providing extra space for waiting and passing pedestrians and to locate transit shelters out of the way of pedestrian flow. For the Proposed Project, bus bulbs would be installed at approximately six locations along the R-B route—at stops on Portola Avenue and North Livermore Avenue south of I-580 and north of East Avenue.

4. Operations

Operations—including the operating plan, fleet size, travel times, and fares and fare collection—are described below for the Proposed Project.

a. Operating Plan

Current BART service to the Dublin/Pleasanton Station is provided by the Daly City-Dublin/Pleasanton Line, which operates between the Daly City BART Station and the Dublin/Pleasanton Station. BART service to the Dublin/Pleasanton Station is provided as follows:

- Weekdays: 4:00 a.m. to 12:00 a.m., with trains every 15 minutes
- Saturdays: 6:00 a.m. to 12:00 a.m., with trains every 20 minutes
- Sundays/Holidays: 8:00 a.m. to 12:00 a.m., with trains every 20 minutes

The operating plan for the Proposed Project would consist of a new end-of-line station (terminus) for the Daly City-Dublin/Pleasanton Line at the new Isabel Station, with the same hours of operation and train headways as the current BART service at the

Dublin/Pleasanton Station. The proposed operating plan is based on anticipated opening day ridership, which could be adjusted based on changes to subsequent demand. BART intends to have 12-minute headways (instead of 15-minute headways) at some time after 2025.

Hours of operation and bus headways are shown in Table 2-4 for the new/modified bus routes under the Proposed Project.

b. Employees

By 2040, the Proposed Project would result in a total of approximately 119 additional full-time-equivalent staff systemwide, as follows: (1) 101 BART personnel to provide administration, operation, and maintenance of the BART system; and (2) 18 non-BART personnel for the additional bus service anticipated under the Proposed Project.

c. Fleet Size

The Proposed Project would add riders to an already crowded BART core system during peak periods (as described in Section 3.B, Transportation). To assess the capacity needed to accommodate the additional riders within the core system as well as on the extension to Livermore, BART conducted an operations analysis to determine BART vehicle needs to effectively operate the Proposed Project. The analysis considered expected BART ridership on the Proposed Project as well as BART's operating plan for the Daly City-Dublin/Pleasanton Line in 2040. Based on the analysis, the Proposed Project would require an additional 36 BART cars to accommodate the anticipated increase in ridership and the longer route while maintaining a level of crowding similar to the BART systemwide average. No additional buses would be needed to serve the Proposed Project.

d. Travel Times

The BART train running time would be 5.5 minutes from the Dublin/Pleasanton Station to the Isabel Station.

e. Fares and Fare Collection

Fares for the Proposed Project would be consistent with BART's current distance-based fare policy. Fares would be collected from patrons at the Isabel Station using both paper tickets and the pre-paid Clipper® card system, which allows patrons to touch a card to tag in or tag out as they enter or leave the BART system. In addition, BART-specific or regional stored-value fare cards could be purchased in advance or from ticket machines within the Isabel Station.

Fares and collection for the LAVTA bus system would be consistent with LAVTA's current fares and collection. LAVTA currently accepts cash, Wheels tickets, Wheels passes, and the Clipper® card system for fare payment. Wheels tickets and passes can be purchased directly from LAVTA, a number of local retailers, or public facilities.¹⁶ These forms of payment are presented as patrons enter the bus.

Transfers from buses to BART, and vice versa, would be done via the Clipper® card system. Transfers from BART to Wheels currently costs \$1.

D. DMU ALTERNATIVE/EMU OPTION

Similar to the Proposed Project, the DMU Alternative would extend transit service approximately 5.5 miles to the east, from the existing Dublin/Pleasanton Station to a new station at the Isabel Avenue/I-580 interchange in the city of Livermore. The DMU Alternative would have a similar alignment within the I-580 median as the Proposed Project and terminus at a new Isabel Station.^{17, 18} However, the type of rail technology used under this alternative would differ from that of the Proposed Project. DMUs are self-propelled rail cars that use a diesel engine to generate their own power and run on a standard-gauge rail track—unlike BART trains, which use electricity and run on wide-gauge rail track. As part of this alternative, a BART-to-DMU transfer platform would be incorporated into the existing Dublin/Pleasanton Station, requiring widening of the BART ROW at the station, with corresponding relocation of I-580 and reconfiguration of adjacent roadways beyond that required for the Proposed Project. EMU rail vehicle technology also under consideration (hereinafter referred to as the EMU Option) is analyzed as a variant of the DMU Alternative. The EMU Option would generally be the same as the DMU Alternative, except that it is electricity-powered rather than diesel-powered, with an electric motor receiving power from an overhead wire or a third rail. Features of the EMU Option that differ from the DMU Alternative are described under EMU Option Facilities below.

Key components of the DMU Alternative include construction of the new rail alignment and related infrastructure, relocation of I-580 and associated frontage roadway reconfigurations to accommodate the proposed DMU alignment within the I-580 median,

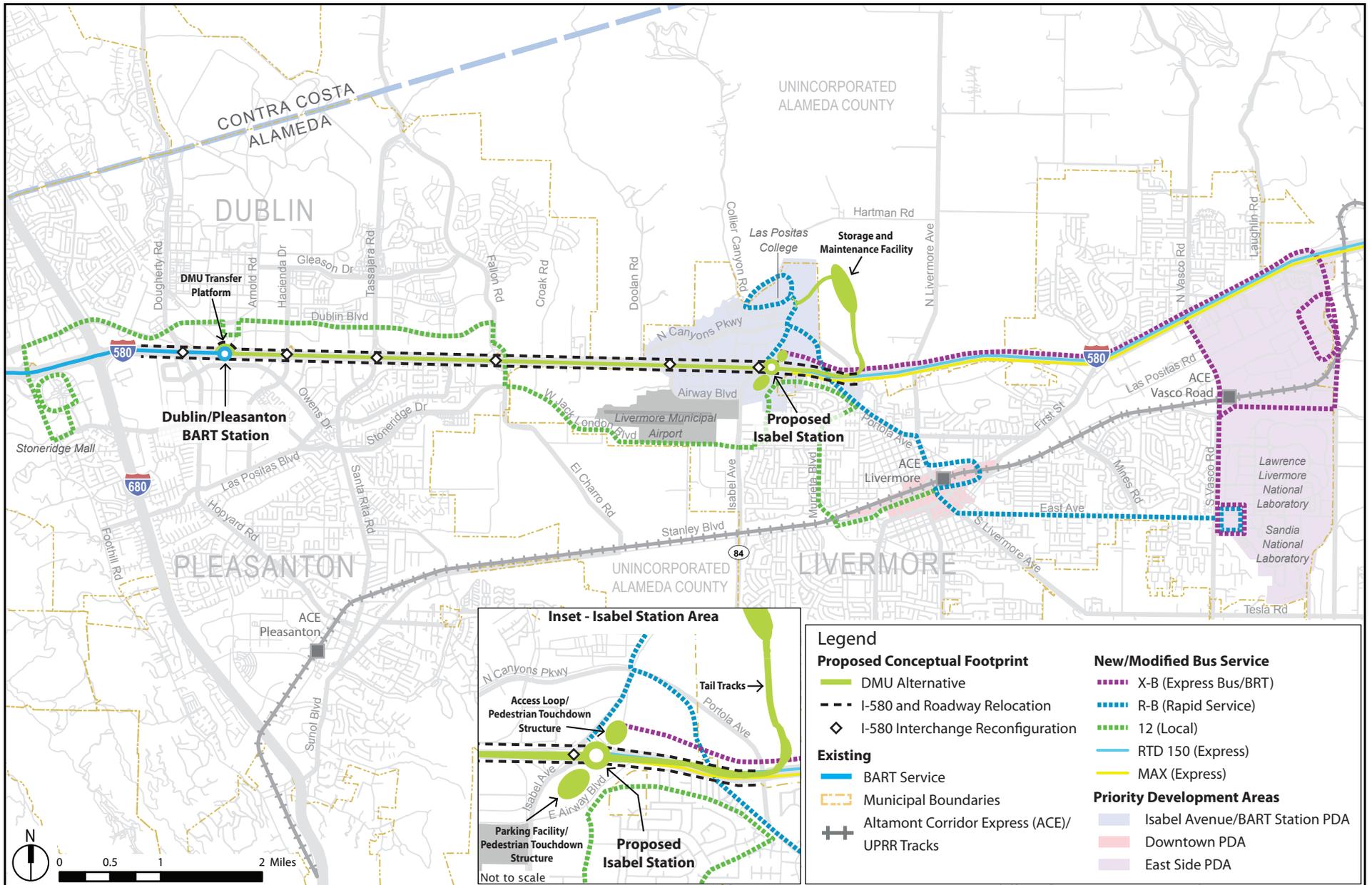
¹⁶ Wheels is a public transportation system operated by LAVTA and serves Dublin, Pleasanton, Livermore, and the surrounding incorporated areas of Alameda County.

¹⁷ Arup and Anil Verma Associates, Inc., 2017a. BART to Livermore Extension Contract Drawings, 10 Percent Preliminary Engineering (Draft). July.

¹⁸ Arup and Anil Verma Associates, Inc., 2017b. 10 Percent Preliminary Engineering Design Basis Memoranda (Draft), Alternative 1: Conventional BART, Alternative 2: DMU/EMU to Isabel Station and Maintenance Facility, Alternative 3: Express Bus/BRT.

and new and modified bus services and facilities to improve transit access to the new Isabel Station. These components are listed below and the conceptual plan is shown in Figure 2-13. Features that would be similar to or the same as the Proposed Project are noted. A more detailed representation of the footprint of the DMU Alternative is shown in Appendix B.

- **BART System Improvements.** The DMU Alternative would entail the construction of new standard-gauge tracks, a new DMU transfer platform at the Dublin/Pleasanton Station, a new DMU station at Isabel Avenue, and a new storage and maintenance facility north of I-580. The alignment, facilities, and new station under the DMU Alternative would be similar to that for the Proposed Project, except that it would have a transfer platform at the Dublin/Pleasanton Station. In addition, the storage and maintenance facility would be for DMU vehicles only (instead of BART cars under the Proposed Project) and the existing BART car storage track at the Dublin/Pleasanton Station would be extended for storage of additional BART cars to accommodate the increased ridership under this alternative.
 - **DMU Track Extension.** Similar to the Proposed Project, the BART ROW would be extended approximately 5.5 miles within the I-580 median, requiring widening of the median. New standard-gauge tracks would be constructed from the Dublin/Pleasanton Station to the proposed Isabel Station. The design of the DMU Alternative does not preclude or prevent a future extension of the rail alignment to the east, either in the I-580 median or to Downtown Livermore, although it does preclude the use of technology other than DMU (such as conventional BART technology).
 - **New DMU Transfer Platform at the Dublin/Pleasanton Station.** A DMU transfer platform would be constructed on the north side of the Dublin/Pleasanton Station to allow passengers to connect from the BART trains to the DMU trains. The existing concourse (lower level) would be widened and the new transfer platform would be constructed above the widened concourse. This alternative would require I-580 to be relocated to the north to accommodate the platform and the new DMU single track at the station.
 - **BART Car Storage at the Dublin/Pleasanton Station.** The DMU Alternative would require an additional 24 BART cars for the anticipated increase in ridership. In addition to the relocation of I-580 for the DMU transfer platform described above, I-580 would also be relocated to the south to accommodate a new 0.3-mile tail track for storage of approximately 20 BART cars to the west of the station. The remaining additional four BART cars required under this alternative would be stored elsewhere in the BART system.



Source: Arup, 2017a,b.

Figure 2 - 13
DMU Alternative
Overview

- **New DMU Isabel Station.** The proposed Isabel Station would be constructed just east of Isabel Avenue, in the same location and with a similar site plan to the Proposed Project; the station platform would be approximately half the length of the platform required for the Proposed Project (approximately 355 feet rather than 700 feet). The station would be constructed in the I-580 median and would connect to parking and multi-modal transit facilities by pedestrian overcrossings that would cross I-580 to the north and south. The main parking facility, with approximately 2,428 parking spaces, would be located south of I-580 and accessible from East Airway Boulevard. The main bus transfer facility would be north of I-580, accessible from Isabel Avenue. A new end-of-line building for BART Operations would be constructed at the east end of the Isabel Station platform.
- **New DMU Storage and Maintenance Facility.** BART evaluated four locations for a DMU storage and maintenance facility. A location north of I-580 and parallel to Cayetano Creek was selected as the preferred location (see the Alternatives Considered but Withdrawn subsection [Section 2.K], below for a discussion of the other locations). The new 32-acre DMU storage and maintenance facility would be provide storage space and maintenance for approximately 12 DMU vehicles (six married pairs of two vehicles each). Similar to the Proposed Project, tail tracks would extend east from the Isabel Station, cross under westbound I-580 in an underpass structure, cross under Portola Avenue, and then extend north parallel to and west of Cayetano Creek, approximately 1.8 miles from the station to the facility.
- **I-580 and Frontage Road Relocation.** To accommodate the median widening, approximately 7.1 miles of I-580 would be relocated on both the north and south, typically by up to 46 feet, from just west of Dougherty Road/Hopyard Road to the Portola Avenue/I-580 overcrossing. At the Hacienda Drive interchange, the westbound I-580 on-ramps would be relocated up to 140 feet, and I-580 would be relocated by approximately 67 feet at the proposed Isabel Station.

Compared to the Proposed Project, this alternative would require the relocation of an additional 1.5 miles of I-580 in the vicinity of the Dublin/Pleasanton Station. Similar to the Proposed Project, the existing lane configuration would be relocated and constructed to Caltrans standards and would have the same number of travel lanes, including express lanes, as currently exist. Freeway interchanges and on- and off-ramps along the corridor would be reconfigured to accommodate the freeway relocation and some surface frontage roads, and adjacent features would be widened or relocated. Similar to the Proposed Project, the following four interchanges would be reconfigured: Tassajara Road/Santa Rita Road; Fallon Road/El Charro; Airway Boulevard; and Isabel Avenue. In addition, portions of the Dougherty Road/Hopyard Road and Hacienda Drive interchanges would also be reconfigured under this alternative.

- **New/Modified Bus Routes and Improvements.** New and modified bus routes and infrastructure enhancements would be the same as those described above for the Proposed Project in the Conventional BART subsection.

1. Rail System Improvements

The improvements for the BART system are described below for the DMU Alternative; these improvements include train technology, track alignment, station facilities, and non-station facilities, as shown in Figure 2-14.

a. DMU Technology

The DMU train technology is similar to the rail technology currently being used by BART in constructing the new rail service between the Pittsburg/Bay Point BART station and a new station in Antioch; this new rail service is referred to as eBART.

(1) Description

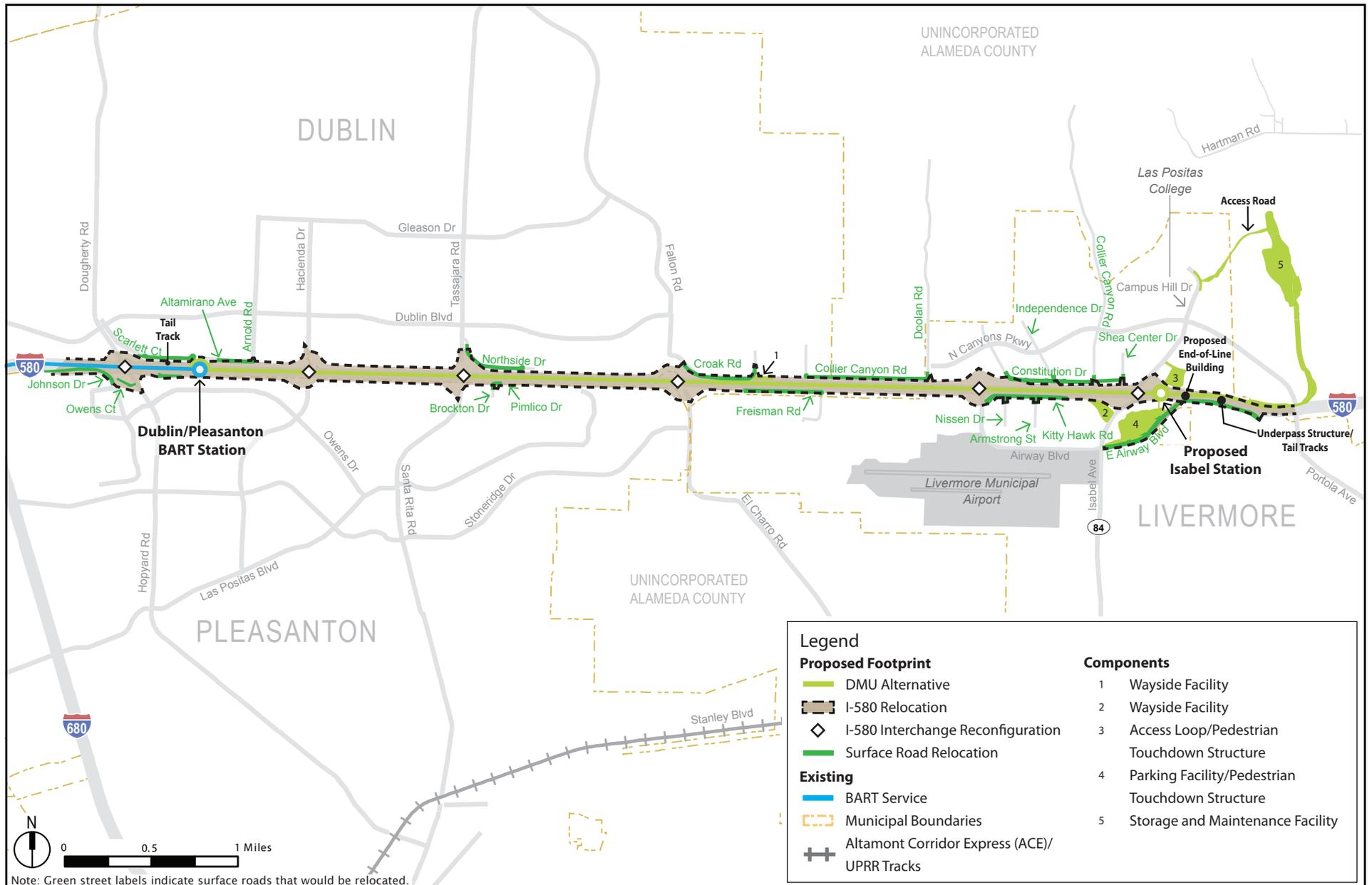
The amenities and operating characteristics of the DMU and EMU rail cars resemble those of existing BART vehicles; however, they differ in that they generate their own power and run on standard-gauge (4-foot, 8.5-inch) rail track. Both DMUs and EMUs are self-propelled rail cars that can be coupled to form trains. Both DMU and EMU technology are used widely in public transportation systems. See EMU Option Facilities below, for additional information on the components specific to the EMU Option.

(2) Propulsion

Some DMUs are powered by diesel engines, which drive an axle through a hydraulic torque converter, and some DMUs use direct mechanical or electrical transmissions. DMUs configured to use diesel engines to generate electricity, which in turn power electric propulsion motors, are also common. The DMU diesel engines would burn low-sulfur diesel fuel and meet both State of California (State) and federal air quality standards.

(3) Vehicles

An example of a DMU train is shown in Figure 2-15. DMU vehicles are operated in married pairs (i.e., each married pair consists of two permanently coupled vehicles). Married pairs are connected to form a train, and the propulsion systems are controlled from the single operator's station or cab. Under the DMU Alternative, there would be a control cab at each end of the train, removing the need to turn the trains at terminal stations. Distribution of the propulsion among the married pairs results in a system that is less vulnerable to single-point-of-failure outages. For the DMU Alternative, four-vehicle trains (two married



Source: Arup, 2017b; Arup and Anil Verma Associates, Inc., 2017a.

Figure 2 - 14
DMU Alternative
Detail

Typical DMU Train



Typical EMU Train



Source: Mark Duferene, 2016; Wikimedia Commons, 2017.

pairs) would be operated during peak period operations. Two-vehicle trains (one married pair) would be provided on weekends or during periods of lighter passenger demand. DMU infrastructure would be designed and built to allow expansion to six-vehicle trains (three married pairs), should future demand warrant. A specific supplier and precise vehicle specifications have not been identified at this time for the DMU Alternative. BART would need to procure the vehicles for this alternative. BART would equip DMU (or EMU) vehicles with BART-style transit horns.

In addition, approximately 24 BART cars would be purchased to accommodate the additional ridership under this alternative.

b. DMU Alignment

Similar to the Proposed Project, the DMU Alternative would extend rail service approximately 5.5 miles east of the existing Dublin/Pleasanton Station to a new station near the Isabel Avenue/I-580 interchange. The standard-gauge tracks would be constructed in the I-580 median. East of the Isabel Station, approximately 1.8 miles of tail track would extend to a new storage and maintenance facility, described in the DMU Storage and Maintenance Facility subsection below. Table 2-5 lists the proposed DMU alignment, structures, and facilities for each segment of I-580 from west to east.

(1) Horizontal Alignment

Single track (standard gauge) would be installed in the I-580 median north of the Dublin/Pleasanton Station, from the station to approximately 0.8 mile east of the station, past the existing BART tail tracks. A DMU passing loop would be constructed east of the station to allow trains to pass each other along this single-track segment, as shown in Figure 2-16. East of the BART tail tracks, standard-gauge double track would be extended to the proposed Isabel Station. This segment would be similar to the Proposed Project, as described below.

The ROW for the DMU Alternative would be extended approximately 5.5 miles within the I-580 median, requiring widening of the existing median along both the north and south sides by up to a total of 46 feet along the majority of the extension. Therefore, the DMU ROW would be the same as the standard BART ROW. At the new Isabel Station, the BART ROW would be approximately 67 feet wide, to accommodate the station platform. The BART ROW would be exclusively for BART use. See Figure 2-4 above for a typical view of the cross-section along the alignment.

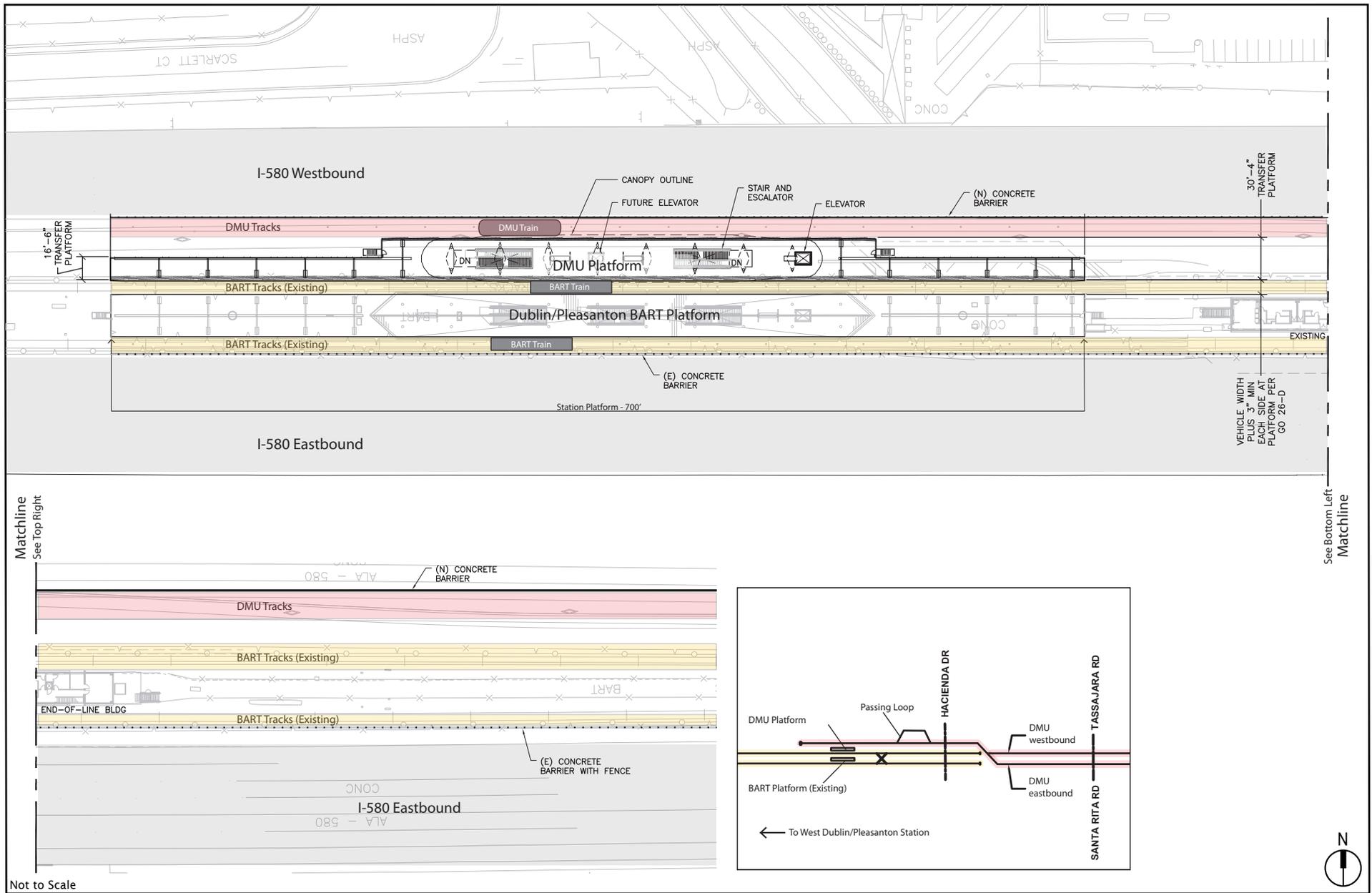
Similar to the Proposed Project, a tail track would be extended approximately 1.8 miles from the Isabel Station to a storage and maintenance facility north of I-580.

TABLE 2-5 DMU ALTERNATIVE – ALIGNMENT, FACILITIES, AND STRUCTURES

From	To	DMU Alignment/Structures	DMU Facilities
West of Dougherty Road	Dougherty Road/ Hopyard Road	<ul style="list-style-type: none"> ▪ New ROW in I-580 median ▪ New tail track for additional BART car storage 	--
Dougherty Road/ Hopyard Road	Hacienda Drive	<ul style="list-style-type: none"> ▪ New ROW in I-580 median ▪ New tail track for additional BART car storage west of the Dublin/Pleasanton Station ▪ New DMU tracks along north side of the Dublin/Pleasanton Station 	<ul style="list-style-type: none"> ▪ DMU transfer platform at the Dublin/Pleasanton Station
Hacienda Drive	Tassajara Road/Santa Rita Road	<ul style="list-style-type: none"> ▪ New ROW in I-580 median ▪ New DMU tracks 	--
Tassajara Road/ Santa Rita Road	Fallon Road/El Charro Road	<ul style="list-style-type: none"> ▪ New ROW in I-580 median ▪ New DMU tracks 	--
Fallon Road/ El Charro Road	Airway Boulevard	<ul style="list-style-type: none"> ▪ New ROW in I-580 median ▪ New DMU tracks 	<ul style="list-style-type: none"> ▪ Wayside facility north of I-580 near Croak Road
Airway Boulevard	Isabel Avenue	<ul style="list-style-type: none"> ▪ New ROW in I-580 median ▪ New DMU tracks 	<ul style="list-style-type: none"> ▪ Wayside facility south of I-580 near Kitty Hawk Road/Isabel Avenue
Isabel Avenue	Portola Avenue	<ul style="list-style-type: none"> ▪ New ROW in I-580 median ▪ New DMU tracks to Isabel Station ▪ Tail track to storage and maintenance facility via westbound I-580 underpass 	<ul style="list-style-type: none"> ▪ Isabel Station in I-580 median and pedestrian overcrossings and touchdown structures (north and south of I-580) ▪ Two-story end-of-line DMU operations building ▪ Isabel parking facility-south of I-580 ▪ Bus transfer facility-north of I-580
Portola Avenue	North Livermore Avenue	<ul style="list-style-type: none"> ▪ Tail tracks to storage and maintenance facility ▪ Portola Avenue underpass ▪ Tail track bridges over Arroyo las Positas and Cayetano creeks ▪ Hillside tunnel for tail tracks 	<ul style="list-style-type: none"> ▪ Storage and maintenance facility and new access road from Campus Hill Drive (with crossing over Isabel Creek)

Note: -- = No change proposed.

Source: Arup and Anil Verma Associates, Inc., 2017b.



Source: Arup and Anil Verma Associates, Inc., 2017a.

Figure 2 - 16
DMU Alternative
DMU Transfer Platform at Dublin/Pleasanton Station

The existing BART crossover east of the Dublin/Pleasanton Station would be maintained to allow BART trains to switch tracks. In addition, six new crossovers would be constructed as follows: (1) along the DMU extension in the I-580 median, west of the Hacienda Drive/I-580 overcrossing; (2) along the DMU extension in the I-580 median, east of the Hacienda Drive/I-580 overcrossing; (3) along the DMU extension in the I-580 median, east of the interchange of I-580 with Fallon Road/El Charro Road; (4) along the DMU extension in the I-580 median, west of the Isabel Avenue/I-580 interchange; (5) along the DMU extension in the I-580 median, east of the Isabel Avenue/I-580 interchange; and (6) at the storage and maintenance facility.

(2) Vertical Alignment

Similar to the Proposed Project, the DMU alignment would be consistent with the existing grade of I-580 from the Dublin/Pleasanton Station to the Isabel Station, at which point the tracks would cross under westbound I-580 in an underpass, resurface north of I-580, cross under Portola Avenue, and then extend to the storage and maintenance facility west of Cayetano Creek.

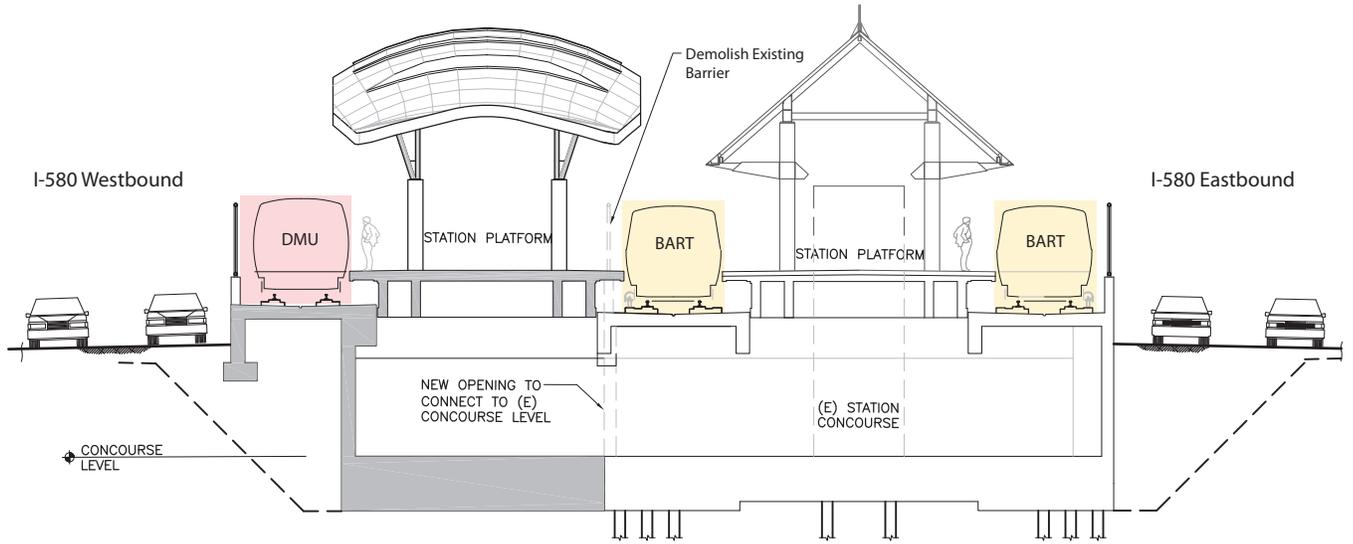
As shown in Table 2-5, new bridges and structures would be constructed along the following creeks for the tail tracks from Isabel Station to the storage and maintenance facility and the access road to the storage and maintenance facility:

- Arroyo las Positas Creek (east of Portola Avenue)
- Cayetano Creek
- Isabel Creek

c. DMU Transfer Platform at the Dublin/Pleasanton Station

A DMU transfer platform would be constructed on the north side of the Dublin/Pleasanton Station to allow passengers to connect from the BART trains to the DMU trains, as shown in Figures 2-16 and 2-17. The concourse level (lower level), which houses the passenger entry area and ticket area, would be widened by approximately 29 feet for a length of approximately 300 feet. This would require excavation along the north wall of the existing concourse level. Portions of the northern wall of the existing station concourse would be removed to allow connections between the existing and proposed station area. As shown in Figure 2-17, a new DMU platform would be constructed above the concourse north of the existing platform. The new platform would range in width from 16 to 30 feet and would extend for the length of the existing BART platform (700 feet). A canopy would cover a portion of the platform; the canopy would be approximately 27 feet high, similar to the existing canopy on the BART platform.

**Cross Section - BART Platform and Proposed DMU Platform
View East**



**Conceptual Cross Section
View West**



BART

DMU

Not to Scale

Source: Arup and Anil Verma Associates, Inc., 2017a; BART, 2008.

Access to the station would not change from existing conditions (passenger entrance from the sidewalk and access road under I-580). Elevators and escalators connect the lower concourse to the upper platform level.

d. BART Car Storage at the Dublin/Pleasanton Station

To accommodate the storage of approximately 20 of the 24 additional BART cars needed to meet projected service requirements at the Dublin/Pleasanton Station, approximately 0.3 mile of new tail tracks would be constructed between the existing BART tracks, to the west of the station. I-580 would be relocated to the south to accommodate the additional storage track. The remaining four BART cars would be stored elsewhere in the BART system.

e. New Isabel Station

The DMU Alternative would include construction of the proposed Isabel Station located in the I-580 median, just east of the Isabel Avenue/I-580 interchange in the city of Livermore, similar to the Proposed Project. The site plan for the station and surrounding facilities and section view are shown in Figure 2-5.

(1) Design and Facilities

Overall, the design and facilities of the proposed Isabel Station under the DMU Alternative would be similar to those for the Proposed Project, as shown in Figures 2-6, 2-7, and 2-8. The concourse and platform would be the same width as the station for the Proposed Project, but it would be shorter.

The station would be approximately 67 feet wide and approximately 355 feet long. The concourse level (upper level) would be approximately 66 feet wide by approximately 315 feet long, and the platform (lower level) would be approximately 30 feet wide by approximately 355 feet long, which would accommodate DMU trains of up to three married pairs (six vehicles).

Under the DMU Alternative, facilities within the Isabel Station would include the train control room. A permanent emergency generator would be located at the Isabel Station north pedestrian touchdown structure.

(2) Access and Connections

The Isabel Station would be accessible from both the north and south, on either side of I-580, similar to the Proposed Project. A bus transfer facility would be constructed at the north station area, providing transit and vehicular access to the station, while the south station area would be primarily for passenger vehicle parking. Site circulation in the

vicinity, including for pedestrian and bicycles, vehicles, and buses, would be the same as for the Proposed Project, as shown in Figure 2-5.

At the south station area, the parking facilities would be similar to the Proposed Project, except that the parking structure would consist of six levels rather than seven and would have fewer parking spaces (approximately 2,428 spaces). Fewer parking spaces are required for the DMU Alternative because ridership demand would be less than under the Proposed Project, as described in Section 3.B, Transportation. As with the Proposed Project, an investment in parking at Isabel Station is consistent with its identification as an automobile dependent station under BART's Station Access Policy. Similar to the Proposed Project, solar panels with a photovoltaic capacity of approximately 1,000 kW would be installed above the top parking level.

Unlike the Proposed Project, the DMU Alternative would not include surface parking lots; parking would be concentrated in a structure, potentially allowing the remainder of the site to be developed in the future.

While the quantity of station parking has been designed to accommodate the anticipated demand (see Section 3.B, Transportation, for additional information), unanticipated demand for parking could exceed supply in the future. This could result in BART patrons parking on local streets. In the event that a local jurisdiction requests BART assistance with management of overflow parking by BART patrons, BART would work with the jurisdiction to implement BART's Parking Management Toolkit, which addresses BART parking overflow onto city streets (a copy of the Parking Management Toolkit is provided in Appendix D). In addition, the parking garage would be designed to accommodate the potential future construction of two additional levels of parking.

f. Non-Station Facilities

Non-station facilities associated with the DMU Alternative include the tail tracks and end-of-line facility, storage and maintenance facility, and wayside system facilities.

(1) DMU End-of-line Operations Building and Tail Tracks

Tail tracks and a new end-of-line operations building for DMU operations would be constructed east of the Isabel Station, similar to the Proposed Project, as shown on Figure 2-8, above. The proposed end-of-line building for DMU operations would be a two-story building east of the Isabel Station. The end-of-line operations building would house the train supervisory booth and associated staff facilities.

The DMU tail track would extend approximately 1.8 miles from the Isabel Station to the storage and maintenance facility. Similar to the Proposed Project, the tail tracks would extend from the Isabel Station in the I-580 median, through an underpass to the north

side of I-580, then cross Arroyo las Positas and Cayetano creeks on bridges, and extend through an approximately 450-foot hillside tunnel to the storage and maintenance facility.

Similar to the Proposed Project, the tail tracks would be designed with culverts or drainage ways at regular intervals under the track to disperse stormwater runoff evenly along the trackway and maintain drainage to Cayetano Creek and vernal pools in the area.

(2) DMU Storage and Maintenance Facility

An approximately 32-acre storage and maintenance facility would be designed to accommodate the servicing and periodic maintenance of the DMU vehicles. Fueling, vehicle cleaning, washing, and routine light vehicle maintenance activities would be carried out at this facility. An approximately 51,255-square-foot maintenance building, approximately 44 feet high, would be constructed, as well as a surface parking lot with approximately 67 employee parking spaces, as shown in Figure 2-18.

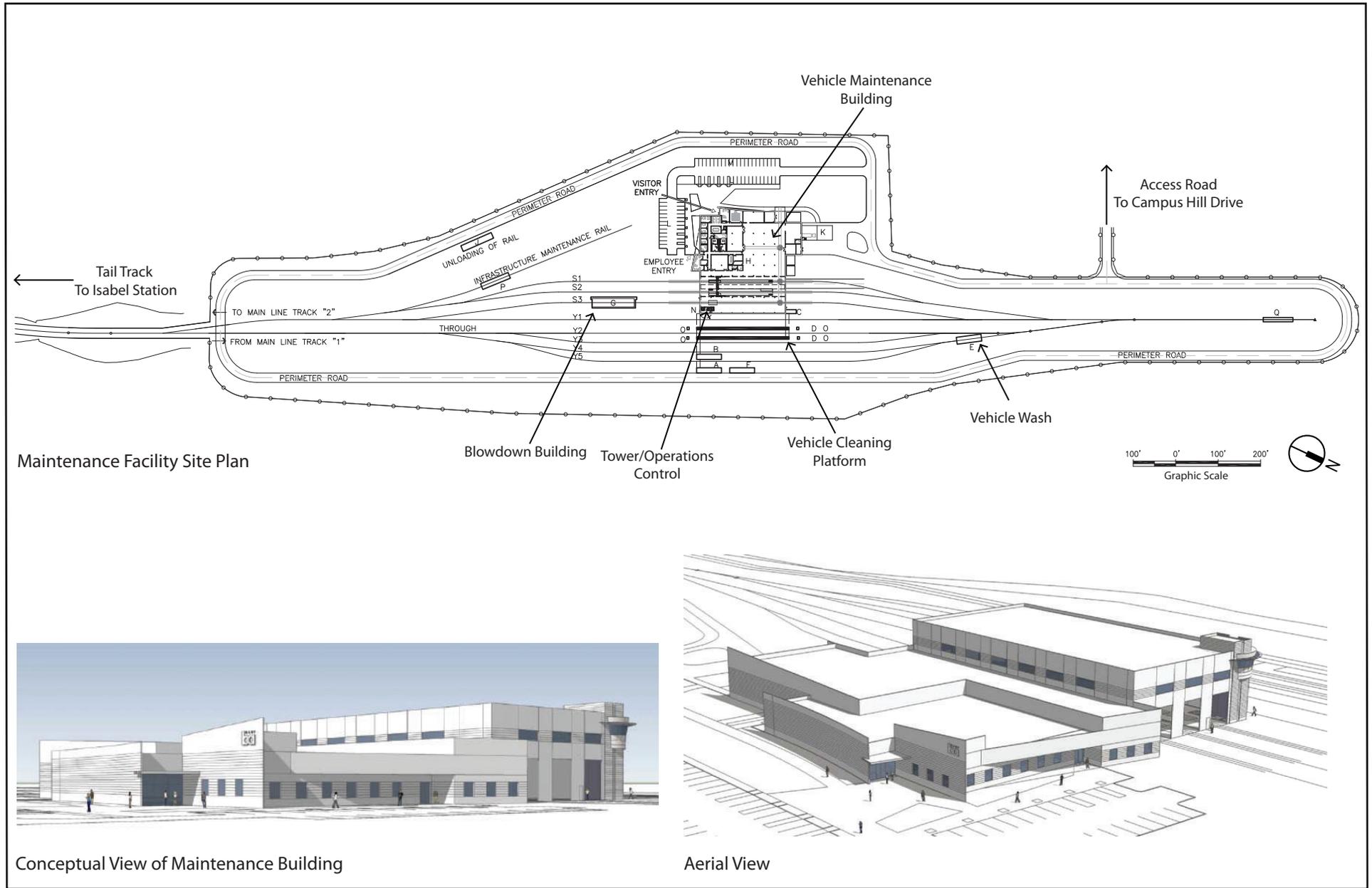
In addition, storage tracks at the facility would accommodate the storage of approximately 12 DMU vehicles (six married pairs). Other support buildings would include a 44-foot-high train control tower; a vehicle cleaning platform; and a blowdown building. A permanent emergency generator and an auxiliary power substation would be installed at the facility. The storage and maintenance facility and connecting tail tracks would be enclosed with security fencing and security lighting would be installed.

Vehicular access to the storage and maintenance facility would be provided by a new two-lane road from Campus Hill Drive to the facility, similar to the Proposed Project.

(3) DMU Wayside System Facilities

As listed in Table 2-5 and shown in Figure 2-14 above, wayside facilities would be constructed along the proposed DMU alignment to provide power and communications support for the alternative. Similar to the Proposed Project, several wayside facilities would be constructed at the Isabel Station and the storage and maintenance facility, as described in the respective sections for those topics above. In addition, two standalone signaling bungalows would be required along the alignment: one near Croak Road and one near the eastbound off-ramp at Kitty Hawk Road and Isabel Avenue.

The wayside facilities for the DMU would not require the traction power system used by the Proposed Project, and the facilities would be smaller. The signaling bungalows would be approximately 35 feet long by 25 feet wide, and the facility enclosure would be approximately 77 feet long by 45 feet wide. These structures would be modular type. See the description of the signaling bungalows for the Proposed Project above.



Source: Arup and Anil Verma Associates, Inc., 2017a.

Figure 2 - 18
DMU Alternative
Storage and Maintenance Facility

g. EMU Option Facilities

This section describes the key differences between the DMU Alternative and the EMU Option. Except as described below, the EMU Option would be similar to the DMU Alternative.

(1) EMU Technology – Propulsion

The key difference between DMUs and EMUs is the source of power. EMUs are powered by electricity drawn from an electrified infrastructure, usually a third rail or overhead (catenary) system, whereas DMUs are powered by an on-board diesel engine. EMUs are driven by electric motors (typically 750 V). The current then passes to an inverter where it is converted to AC, which then drives traction motors mounted on the trains. The torque generated by these motors is transmitted via gear wheels to the driving wheels. Electric traction motors are incorporated within one or more of the train carriages.

Emissions associated with the operation of EMUs occur only where the power is generated, not along the alignment, which is where emissions occur for DMUs. EMUs are generally quieter than DMUs because little noise is associated with their motors.

(2) EMU Wayside Facilities

To support the EMU technology, the EMU Option would require wayside facilities similar to the Proposed Project. These facilities are described below, ordered from west to east along the alignment.

- A train control house and traction power substation would be constructed north of I-580 near Croak Road, and a train control house, traction power substation, and gap breaker would be constructed at Kitty Hawk Road and Isabel Avenue, similar to the Proposed Project.
- EMU operations facilities within the Isabel Station area would include a train control room, a traction power substation, a 34.5-kV switching station, and a high-voltage substation, similar to the Proposed Project. A permanent emergency generator would be installed at the Isabel Station north pedestrian touchdown structure.
- At the storage and maintenance facility, the EMU Option would require a traction power substation, in addition to the facilities required for the DMU Alternative.

2. I-580 and Frontage Road Relocation

Under the DMU Alternative, approximately 7.1 miles of the Caltrans ROW and I-580, from west of the Dougherty Road/Hopyard Road interchange to west of Portola Avenue, would be widened to accommodate the new BART ROW in the median. This alternative would

require an additional approximately 1.5 miles of median widening, in the vicinity of Dougherty Road/Hopyard Road and Hacienda Drive, compared to the Proposed Project. Existing freeway interchanges, on- and off-ramps, freeway structures such as overcrossings, and some surface frontage roads would be reconfigured to accommodate the increased ROW. The horizontal and vertical alignment of the I-580 relocation, as well as I-580 interchange and roadway reconfigurations, are described below and shown in Figure 2-14, above. Table 2-6 shows the proposed I-580 relocation, interchange reconfiguration, roadway modifications, and structures for each segment of I-580, ordered from west to east.

a. I-580 Horizontal Alignment

Under the DMU Alternative, the Caltrans ROW would be generally widened by approximately 46 feet. The freeway would be relocated to the north along the westbound direction to accommodate the new DMU transfer platform at the north side of the Dublin/Pleasanton Station, as well as the related facilities. The freeway relocation also would take place west of the Dublin/Pleasanton station to provide space in the median for an additional storage track for BART car storage.

In the vicinity of the proposed Isabel Station, east of the Isabel Avenue overcrossing, the Caltrans ROW would be widened by approximately 67 feet to accommodate the new station. At the end of the existing BART tail tracks beyond the Dublin/Pleasanton Station, the DMU tracks would be constructed in the center of the median and the I-580 relocation would then be similar to that for the Proposed Project. The existing freeway lane configuration would be relocated to Caltrans standards and would have the same number of travel lanes and express lanes as currently exist.

a. I-580 Vertical Alignment

Under the DMU Alternative and similar to the Proposed Project, the vertical alignment for I-580 would be generally similar to existing conditions. Where required by existing topography, some new or realigned retaining walls would be required. Structures, including the existing I-580 bridges, would have to be widened to accommodate the wider ROW.

As shown in Table 2-6, existing bridges and structures over the following creeks would be widened to accommodate the new DMU alignment within the I-580 median:

- Line G-1-1
- Chabot Canal and Hewlett Canal/Line G-2
- Tassajara Creek
- Cottonwood Creek
- Collier Canyon Creek
- Arroyo las Positas Creek (at Isabel Station)

TABLE 2-6 DMU ALTERNATIVE – I-580 AND ROADWAY MODIFICATIONS

From	To	I-580 and On-ramps/Off-ramps/ Interchanges	Surface Road Realignment	Structures
West of Dougherty Road	Dougherty Road/ Hopyard Road	<ul style="list-style-type: none"> Relocate I-580 in WB direction 	<ul style="list-style-type: none"> Johnson Drive 	<ul style="list-style-type: none"> Extension of the existing concrete culvert for Line G-1-1
Dougherty Road/ Hopyard Road	Hacienda Drive	<ul style="list-style-type: none"> Relocate I-580 in both directions (EB and WB) Reconfigure EB and WB off-ramps at Dougherty Road/Hopyard Road 	<ul style="list-style-type: none"> Scarlett Drive, Altamirano Avenue, Owens Court 	<ul style="list-style-type: none"> Extension of existing concrete culvert for Chabot Canal/Line G-2 Iron Horse Regional Trail underpass
Hacienda Drive	Tassajara Road/Santa Rita Road	<ul style="list-style-type: none"> Relocate I-580 in both directions (EB and WB) Reconfigure WB off-ramp at Hacienda Drive 	--	<ul style="list-style-type: none"> Hacienda Drive westbound on-ramp underpass Tassajara Creek bridge (widen bridge deck; new deck piles)
Tassajara Road/Santa Rita Road	Fallon Road/El Charro Road	<ul style="list-style-type: none"> Relocate I-580 in both directions (EB and WB) Reconfigure all on-/off-ramps at Tassajara Road/Santa Rita Road 	<ul style="list-style-type: none"> Northside Drive, Brockton Drive, Pimlico Drive 	<ul style="list-style-type: none"> Reconfigure retaining walls at Tassajara Road/Santa Rita Road
Fallon Road/El Charro Road	Airway Boulevard	<ul style="list-style-type: none"> Relocate I-580 in both directions (EB and WB) Reconfigure all on-/off-ramps at Fallon Road/El Charro Road 	<ul style="list-style-type: none"> Croak Road, Freisman Road, Collier Canyon Road, Doolan Road 	<ul style="list-style-type: none"> Reconfigure retaining walls at Fallon Road/El Charro Road Cottonwood Creek bridge (widen bridge deck; new piles and abutments)
Airway Boulevard	Isabel Avenue	<ul style="list-style-type: none"> Relocate I-580 in both directions (EB and WB) Reconfigure all on-/off-ramps at Airway Boulevard Demolish and rebuild one (west) of the two Airway Boulevard bridges 	<ul style="list-style-type: none"> Constitution Drive, Independence Drive, Shea Center Drive, Kitty Hawk Road, Nissen Drive, Armstrong Street 	<ul style="list-style-type: none"> Rebuild one of two Airway Boulevard overcrossings Reconfigure retaining walls Airway Boulevard overcrossing Collier Canyon Creek bridge (widen bridge deck; new piles and abutments)
Isabel Avenue	Portola Avenue	<ul style="list-style-type: none"> Relocate I-580 in both directions (EB and WB) Reconfigure all on-/off-ramps at Isabel Avenue 	<ul style="list-style-type: none"> East Airway Boulevard 	<ul style="list-style-type: none"> Reconfigure Isabel Avenue/I-580 separation retaining wall Arroyo las Positas Creek bridge (widen bridge deck; new deck piles)

Notes: --= No change proposed; EB = eastbound; WB = westbound.
Collier Canyon Road refers to the portion of the road that is west of Doolan Road.
Source: Arup and Anil Verma Associates, Inc., 2017b.

b. Interchange and Roadway Reconfiguration

Under the DMU Alternative and similar to the Proposed Project, modifications would be required at the interchanges and on- and off-ramps along this corridor, including the tightening of the radius of some ramps and reconstruction of others. Relocation of the I-580 interchanges in both the eastbound and westbound directions would be required at the same interchanges as that for the Proposed Project (Tassajara Road/Santa Rita Road, Fallon Road/El Charro Road, Airway Boulevard, and Isabel Avenue). At Hacienda Drive, the westbound on-ramps to I-580 from both northbound and southbound Hacienda Drive would be rebuilt north of their existing locations. The on-ramp from northbound Hacienda Drive currently passes under Hacienda Drive just in front of (i.e., south of) the Hacienda Drive overcrossing abutment. This on-ramp would be rebuilt so it passes under Hacienda Drive just behind (i.e., north of) the abutment. Relocation of the northbound on-ramp would require the relocation of the southbound on-ramp. To provide room to reconfigure both on-ramps, the Caltrans I-580 ROW would need to be widened, up to a maximum of approximately 140 feet west of Hacienda Drive. In addition, the west side of the Airway Boulevard bridge over I-580 would be rebuilt.

Some adjacent surface frontage roads and structures would be realigned, as shown in Table 2-6. Similar to the Proposed Project, segments of the following surface frontage roads would be realigned: Northside Drive; Brockton Drive; Pimlico Drive; Croak Road; Freisman Road; Collier Canyon Road¹⁹; Doolan Road; Constitution Drive; Independence Drive; Shea Center Drive; Kitty Hawk Road; Nissen Drive; Armstrong Street; and East Airway Boulevard. In addition, portions of Scarlett Drive and Altamirano Avenue would be relocated. Reconfigured retaining walls would be constructed for realigned roadways, principally at interchange ramps, where needed based on the existing topography.

As described above for the Proposed Project, BART would build the foundations and columns for the anticipated future widening of the Isabel Avenue overcrossing.

3. Bus Routes and Improvements

Under the DMU Alternative, bus routes, shown in Figure 2-13, and bus improvement would be the same as for the Proposed Project, described above in the Conventional BART subsection.

¹⁹ The portion of Collier Canyon Road west of Doolan Road.

4. Operations

Operations—including the operating plan, fleet size, travel times, and fares and fare collection—are described below for the DMU Alternative.

a. Operating Plan

As described above, current BART service to the Dublin/Pleasanton Station is provided by the Daly City-Dublin/Pleasanton Line, which operates between the Daly City BART Station and the Dublin/Pleasanton Station. BART service to the Dublin/Pleasanton Station is provided as follows:

- Weekdays: 4:00 a.m. to 12:00 a.m., with trains every 15 minutes
- Saturdays: 6:00 a.m. to 12:00 a.m., with trains every 20 minutes
- Sundays/Holidays: 8:00 a.m. to 12:00 a.m., with trains every 20 minutes

The operating plan for the DMU Alternative would consist of a new transfer platform at the existing Dublin/Pleasanton Station and a new end-of-line station (terminus) at the proposed Isabel Station, with the same hours of operation and train headways as current BART service at the Dublin/Pleasanton Station. The proposed operating plan is based on anticipated opening day ridership, which could be adjusted based on changes to subsequent demand. BART intends to have 12-minute headways (instead of 15-minute headways) at some time after 2025.

Hours of operation and bus headways for the new/modified bus routes would be the same as under the Proposed Project (see Table 2-4).

b. Employees

By 2040, the DMU Alternative would result in a total of approximately 135 additional full-time-equivalent staff systemwide, as follows: (1) 15 BART personnel to provide administration, operation, and maintenance of the BART system; (2) 102 BART personnel to provide operation and maintenance of the DMU service; and (3) 18 non-BART personnel for the additional bus service anticipated under the DMU Alternative.

c. Fleet Size

On weekdays during peak periods, a total of 2 four-vehicle DMU trains (two married pairs) would be required for service. Peak periods typically are early morning and evening service. During off-peak periods, including Saturday and Sunday all-day service, 2 two-vehicle DMU trains (one married pair) would be required. Therefore, the total DMU fleet size needed for operation of the alternative is approximately 12 DMU vehicles (six

married pairs), which would allow for 2 spare two-vehicle DMU trains in addition to the 2 four-vehicle peak period trains.

The DMU Alternative would add riders to an already crowded BART core system during peak periods (see Section 3.B, Transportation). To assess the capacity needed to accommodate the additional riders within the core system, BART conducted an operations analysis to determine BART vehicle fleet needs to effectively operate the DMU Alternative. The analysis considered expected BART ridership under the DMU Alternative as well as BART's operating plan for the Daly City-Dublin/Pleasanton Line in 2040. Based on the analysis, the DMU Alternative would require an additional 24 BART cars to accommodate the anticipated increase in ridership while maintaining a level of crowding similar to the BART systemwide average. No additional buses would be needed to serve the DMU Alternative.

d. Travel Times

The DMU running time would be 6 minutes from the Dublin/Pleasanton Station DMU transfer platform to the proposed Isabel Station.

e. Fares and Fare Collection

Fares for the DMU Alternative are assumed to be consistent with BART's current fare policy and fare collection, as described above for the Proposed Project.

E. EXPRESS BUS/BRT ALTERNATIVE

This alternative would implement Express bus service to the Dublin/Pleasanton Station with improvements that would provide for more seamless bus-to-BART transfers. Unlike the Proposed Project and the DMU Alternative, the Express Bus/BRT Alternative would not extend rail service from the Dublin/Pleasanton Station. While this alternative would not include an extension of BART rail service or the development of a new BART rail station, it does not preclude or prevent implementation of an extension of BART rail service from Dublin/Pleasanton Station to the east.

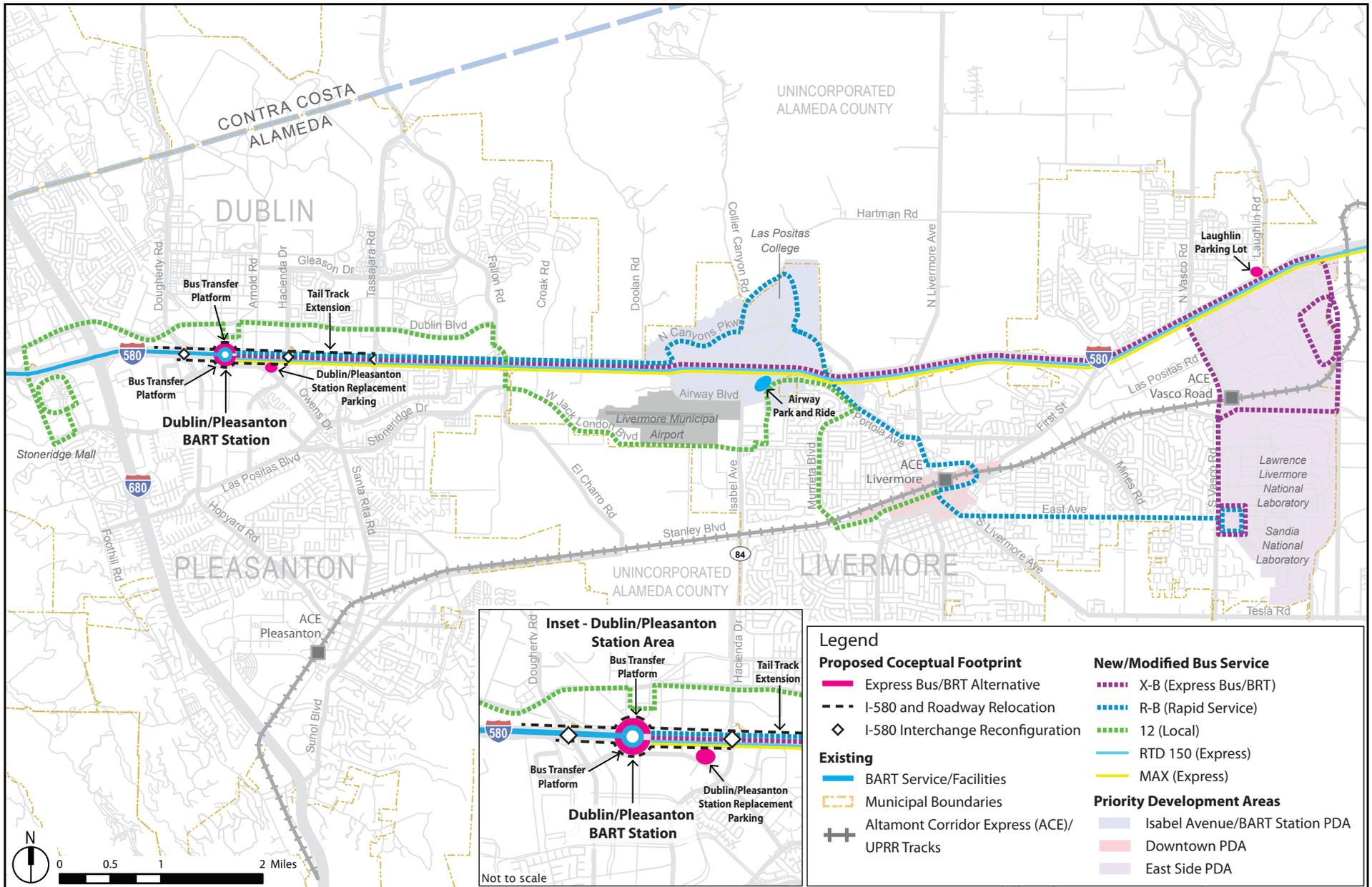
Instead, this alternative is intended to achieve the project objectives using BRT only. This alternative would include new bus transfer platforms at the Dublin/Pleasanton Station; the bus platforms would be located to the outside of the existing BART station platforms. New bus ramps from the I-580 express lanes would be constructed for buses to enter and connect directly to the bus transfer platforms, allowing passengers to transfer from bus to BART without leaving the station.

Key components of the Express Bus/BRT Alternative include construction of the new bus ramps, bus transfer platforms at the Dublin/Pleasanton Station, relocation of I-580 and associated surface frontage road reconfigurations to accommodate new bus platforms within the I-580 median, and new and modified bus services and facilities to improve transit service.^{20, 21} A replacement parking lot or garage would be constructed at the Dublin/Pleasanton Station south of I-580, and a new remote parking lot would be constructed at Laughlin Road. These components are listed below and the conceptual plan is shown in Figure 2-19. Features that would be similar to or the same as the Proposed Project are noted. A more detailed representation of the footprint of the Express Bus/BRT Alternative is shown in Appendix B.

- **BART System Improvements.** The Express Bus/BRT Alternative would entail the construction of bus transfer platforms at the Dublin/Pleasanton Station, replacement parking at the Dublin/Pleasanton Station, and a new parking lot at Laughlin Road.
 - **Bus Transfer Platforms at the Dublin/Pleasanton Station.** The new bus transfer platforms at the existing Dublin/Pleasanton Station would be integrated into the station to support BART-to-bus and bus-to-BART connections. New bus-only on- and off-ramps from the I-580 express lanes would be constructed for buses from both the westbound and eastbound directions to connect directly to the bus transfer platforms, allowing passengers to transfer within the station.
 - **Dublin/Pleasanton Station Additional BART Car Storage.** The Express Bus/BRT Alternative would require an additional 12 BART cars for the anticipated increase in ridership. Approximately 0.10 mile of tail track would be constructed to the east of the Dublin/Pleasanton Station to accommodate the storage of approximately 10 additional BART cars needed for the station. The remaining two BART cars required under this alternative would be stored elsewhere in the BART system.
 - **Dublin/Pleasanton Station Replacement Parking.** Widening for the proposed bus transfer platforms and I-580 relocation would result in the loss of approximately 210 parking spaces at the Dublin/Pleasanton Station. To replace these spaces, a new surface lot or garage would be constructed south of I-580. If adjacent land can be acquired by BART, a new surface parking lot with approximately 210 parking spaces would be constructed. If the land is not available, BART would construct a three-level parking garage on a portion of the existing BART parking lot south of I-580.

²⁰ Arup and Anil Verma Associates, Inc., 2017a. BART to Livermore Extension Contract Drawings, 10 Percent Preliminary Engineering (Draft). July.

²¹ Arup and Anil Verma Associates, Inc., 2017b. 10 Percent Preliminary Engineering Design Basis Memoranda (Draft), Alternative 1: Conventional BART, Alternative 2: DMU/EMU to Isabel Station and Maintenance Facility, Alternative 3: Express Bus/BRT.



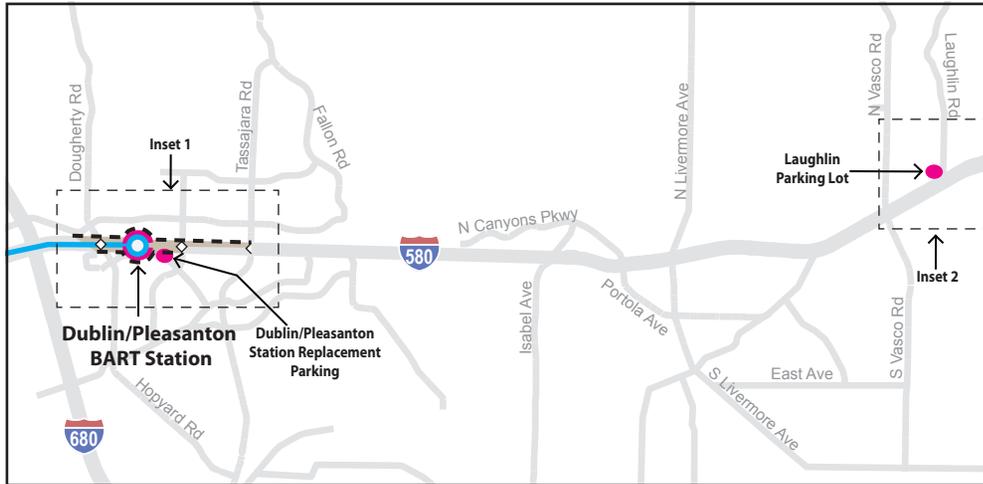
Source: Arup, 2017a,b.

Figure 2 - 19
Express Bus/BRT Alternative
Overview

- **Laughlin Parking Lot.** A new remote surface parking lot would be constructed at Laughlin Road to provide parking for transit users. This lot would have approximately 230 parking spaces and would include regular bus service to the Dublin/Pleasanton Station during peak hours.
- **I-580 and Frontage Road Relocation.** The widening of the I-580 median for the bus transfer platforms would require the relocation of approximately 2.2 miles of I-580, from just west of Dougherty Road/Hopyard Road to Tassajara Road/Santa Rita Road. Similar to the Proposed Project, the existing lane configuration would be relocated to Caltrans standards and would have the same number of travel lanes, including express lanes, as currently exist. New direct bus ramps would connect the freeway to the Dublin/Pleasanton Station. The Dougherty Road/Hopyard Road interchange and the Hacienda Drive on- and off-ramps would be reconfigured to accommodate the freeway relocation, and some surface frontage roads and adjacent features would be widened or relocated.
- **New/Modified Bus Routes and Improvements.** New and modified bus routes and infrastructure enhancements would be similar to those described for the Proposed Project, except that the modified routes would serve the Dublin/Pleasanton Station rather than the Isabel Station. The bus connections for the Express Bus/BRT Alternative would be designed to maximize usage of the I-580 express lanes, increase the speed of transit journeys via direct bus-to-BART transfers, provide parking for San Joaquin County commuters at the Laughlin Road parking lot, provide Express service in areas with the greatest ridership potential, and serve PDAs and transit-supportive areas. Bus infrastructure improvements would also be constructed along the new bus routes. The feeder bus routes and infrastructure are described and analyzed at a programmatic level. However, the Express Bus/BRT Alternative improvements discussed above are analyzed at the project level.

1. BART System Improvements

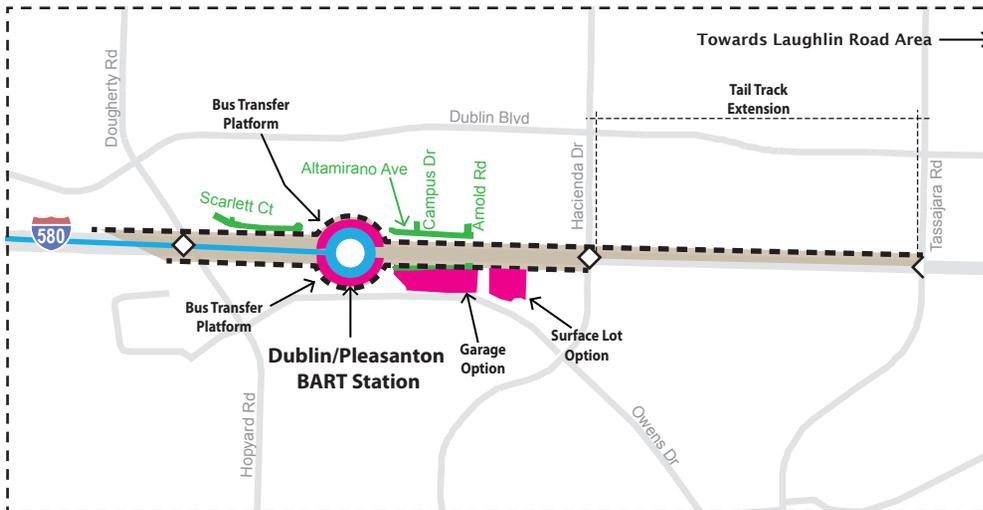
The BART system improvements under the Express Bus/BRT Alternative are described below. The improvements include bus transfer platforms at the Dublin/Pleasanton Station, extension of tail track at the Dublin/Pleasanton Station for additional BART car storage, replacement parking at the Dublin/Pleasanton Station, and a parking lot at Laughlin Road, as shown in Figure 2-20 and listed in Table 2-7.



Overview



Inset 2



Inset 1

Not to Scale
 Note: Green street labels indicate surface roads that would be relocated.

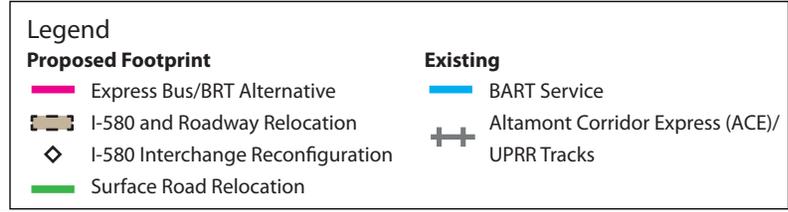


Figure 2 - 20
 Express Bus/BRT Alternative
 Detail

TABLE 2-7 EXPRESS BUS/BRT ALTERNATIVE – ALIGNMENT, FACILITIES, AND STRUCTURES

From	To	Alignment/Structures	Facilities
Dougherty Road/ Hopyard Road	Hacienda Drive	<ul style="list-style-type: none"> ▪ New ROW in I-580 median 	<ul style="list-style-type: none"> ▪ Bus transfer platforms at Dublin/Pleasanton Station ▪ Replacement parking lot or garage at Dublin/Pleasanton Station
Hacienda Drive	Tassajara Road/ Santa Rita Road	<ul style="list-style-type: none"> ▪ New ROW in I-580 median ▪ New 0.1-mile tail track for additional BART car storage east of Dublin/Pleasanton Station 	--
North Vasco Road	Greenville Road	--	<ul style="list-style-type: none"> ▪ Laughlin surface parking lot

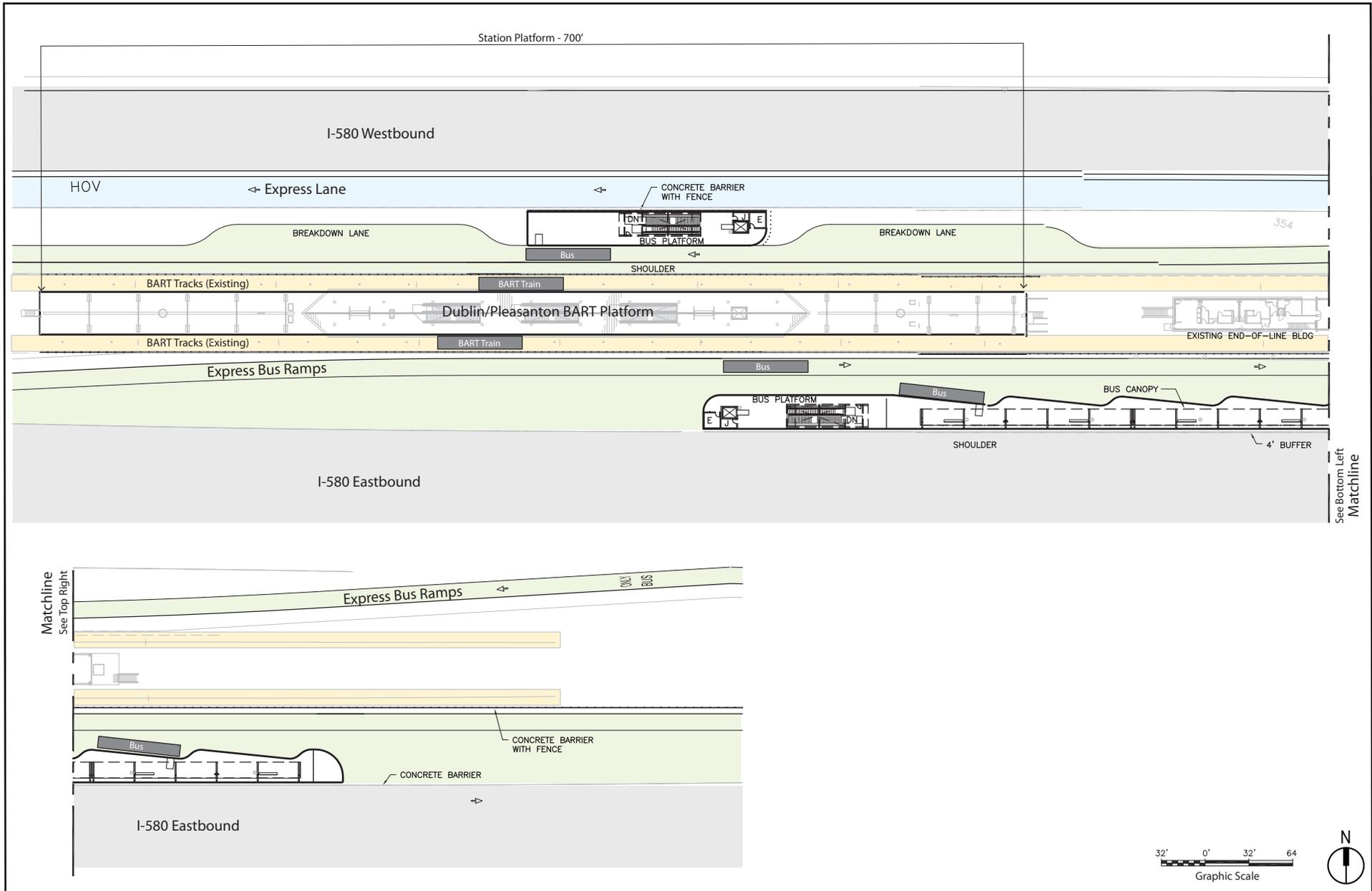
Note: -- = No change proposed.
 Source: Arup and Anil Verma Associates, Inc., 2017b.

a. Bus Transfer Platforms at the Dublin/Pleasanton Station

As shown in Figures 2-21 and 2-22, the new bus transfer platforms at the existing Dublin/Pleasanton Station would be integrated into the station to support direct BART-to-bus connections. New bus ramps from the I-580 express lanes would be constructed for both westbound and eastbound buses to connect directly to the bus transfer platforms, allowing passengers to transfer to BART within the station.

The concourse level (lower level), which houses the passenger entry area and ticket area, would be widened by approximately 44 feet to the north and by approximately 50 feet to the south. This would require excavation along both the north and south side of the existing concourse to provide the necessary room for expansion. Portions of the existing concourse wall would be removed to allow connections between the existing and proposed station areas. New bus transfer platforms would be constructed above the concourse, both north and south of the existing BART platform, beyond the BART train ROW. The new platforms would be at grade with the bus lanes, and would be approximately 24 feet wide by 180 feet long on the north of the station and 24 feet wide by 640 feet long on the south. The bus platforms would be protected from the freeway by concrete safety barriers, and a windscreen would be constructed over the platforms.

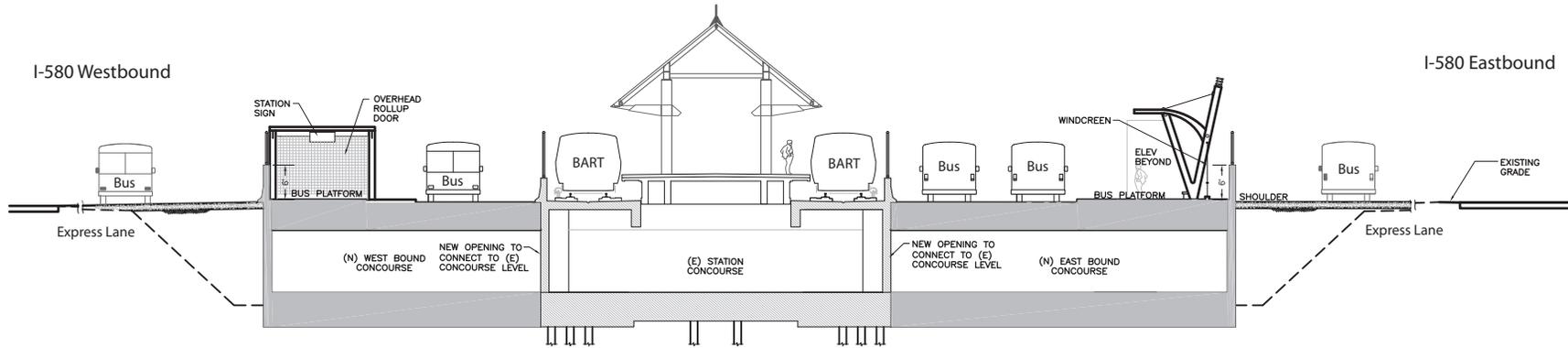
Passenger access to the station would not change from existing conditions; passengers currently enter the station concourse from the sidewalk and access road under I-580. Elevators and escalators connect the concourse level to the bus and BART platforms.



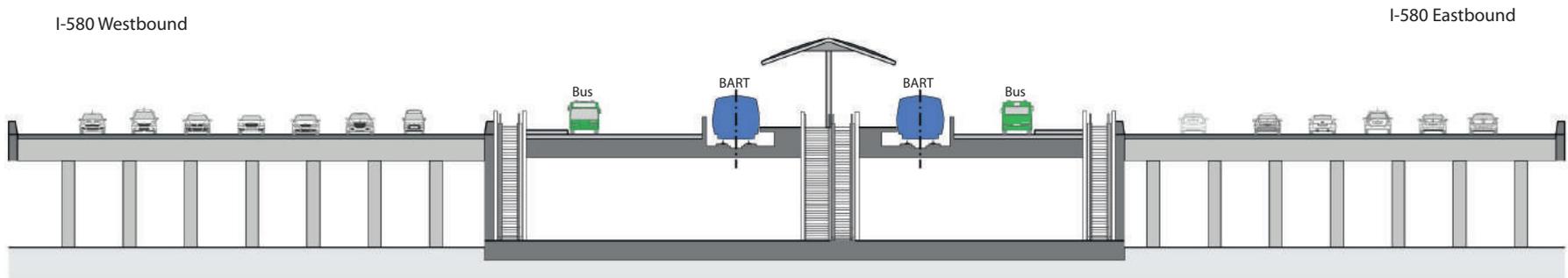
Source: Arup and Anil Verma Associates, Inc., 2017a.

Figure 2 - 21
Express Bus/BRT Alternative
Bus Ramps and Bus Transfer Platforms at Dublin/Pleasanton Station

Cross Section - BART Platform and Proposed Bus Transfer Platforms
View East



Conceptual Cross Section
View East



Not to Scale

Source: Arup and Anil Verma Associates, Inc., 2017a.

No bus bays would be located at the bus transfer facility in the westbound direction because the Dublin/Pleasanton Station would be the terminal stop for all westbound buses using the facility (i.e., no passenger boarding in the westbound direction). If a future bus route were to continue along to stops west of the Dublin/Pleasanton Station (e.g., Hacienda Business Park), the bus would have a designated stop at the western-most end of the platform. A pull-out shoulder area would be located both before and after the bus platform for emergencies and vehicle breakdowns.

In the eastbound direction, a passing lane for buses is required because each route using the facility would have a designated bay for passenger boarding. Six sawtooth bays would be provided. Buses using the direct Express Bus ramps would likely lay over in the eastbound bus bays.

At the existing bus stop outside the BART station, approximately 14 of the existing 17 bus bays would have to be retained to accommodate existing routes that would continue to travel to the station via local roads.

The relocation of the I-580 median to accommodate the bus transfer platform would require the relocation of approximately 1,400 feet of the existing Line G-2 canal that extends along the southern edge of I-580 in the vicinity of the Dublin/Pleasanton Station. The canal would be relocated approximately 50 to 70 feet to the south to accommodate the relocation of the freeway lanes.

b. Dublin/Pleasanton Station BART Car Storage

Approximately 12 BART cars would be purchased to accommodate the additional ridership projected under this alternative. To accommodate the storage of approximately 10 additional BART cars at the Dublin/Pleasanton Station, the tail tracks would be extended to the east of the station by approximately 0.1 mile. The remaining two BART cars required under this alternative would be stored elsewhere in the BART system.

c. Dublin/Pleasanton Station Replacement Parking

The relocation of the I-580 median to accommodate the bus transfer platform would result in the loss of approximately 210 parking spaces on the south side of the station. To replace these spaces, a new surface lot or garage would be constructed south of I-580. A new surface parking lot with approximately 210 parking spaces would be constructed adjacent to and east of the existing BART parking lot if BART could acquire the adjacent land. However, if the land is not available, BART would construct a three-level parking garage up to approximately 35 feet high, with approximately 210 parking spaces on a portion of the existing BART parking lot south of I-580. See Figure 2-23 for the proposed locations for replacement parking.



Dublin/Pleasanton Station Parking (Surface Lot Option)



Dublin/Pleasanton Station Parking (Garage Option)



Laughlin Parking Lot

Source: Arup and Anil Verma Associates, Inc., 2017a.

d. Laughlin Parking Lot

A new surface parking lot would be constructed at Laughlin Road to provide additional parking for transit users, as shown in Figure 2-23; the lot would contain approximately 230 parking spaces. Regular bus service to the Dublin/Pleasanton Station would be provided by a new X-B bus route, which would run on 12- to 15-minute headways during the peak periods (6:15 to 9:15 a.m. and 3:30 to 6:00 p.m., as shown in Table 2-9).

2. I-580 and Frontage Road Relocation

Under the Express Bus/BRT Alternative, approximately 2.2 miles of I-580, from west of Dougherty Road/Hopyard Road to Tassajara Road/Santa Rita Road, would be relocated to accommodate the bus ramps and bus platforms in the median. This alternative would require approximately 3.4 fewer miles of widening than the Proposed Project. Existing freeway interchanges, on- and off-ramps, freeway structures such as overcrossings, and some surface frontage roads would be reconfigured to accommodate the increased ROW. The horizontal and vertical alignment of the I-580 relocation, as well as the I-580 interchange and roadway reconfigurations, are described below and shown in Figure 2-20, above.

Table 2-8 shows the proposed I-580 relocation, interchange reconfiguration, roadway modifications, and structures for each segment of I-580, from west to east.

a. I-580 Horizontal Alignment

Under the Express Bus/BRT Alternative, I-580 would be relocated to accommodate the bus platforms at the Dublin-Pleasanton Station (in the I-580 median). The freeway relocation would be greatest at the Dublin/Pleasanton Station, with total relocation up to approximately 100 feet, and would decrease toward the west and east of the station—to the west of Dougherty Road and east of Tassajara Road/Santa Rita Road—where the freeway would return to its existing configuration. The typical freeway widening would be approximately 88 feet along the alignment. The existing freeway lane configuration would be relocated to Caltrans standards and would have the same number of travel lanes and express lanes as currently exist.

TABLE 2-8 EXPRESS BUS/BRT ALTERNATIVE – I-580 AND ROADWAY MODIFICATIONS

From	To	I-580 and On-ramps/ Off-ramps/Interchanges	Surface Road Realignment	Structures
West of Dougherty Road	Dougherty Road/ Hopyard Road	<ul style="list-style-type: none"> ▪ Relocate I-580 in WB direction 	--	<ul style="list-style-type: none"> ▪ At Line G-1-1, modify existing I-580 bridge (widen bridge deck)
Dougherty Road/ Hopyard Road	Hacienda Drive	<ul style="list-style-type: none"> ▪ Relocate I-580 both directions (EB and WB) ▪ Reconfigure WB off-ramp at Hacienda Drive ▪ Reconfigure WB off-ramp at Dougherty Road ▪ Reconfigure EB on-ramp at Hopyard Road 	<ul style="list-style-type: none"> ▪ Scarlett Court, Scarlett Drive, Altamirano Avenue, Campus Drive, Arnold Road 	<ul style="list-style-type: none"> ▪ Iron Horse Regional Trail underpass ▪ Cantilever over Chabot Canal/Line G-2 (west of Iron Horse Trail) ▪ Relocate approximately 1,400 feet of Line G-2 (east of Iron Horse Trail)
Hacienda Drive	Tassajara Road/ Santa Rita Road	<ul style="list-style-type: none"> ▪ Relocate I-580 in WB direction 	--	<ul style="list-style-type: none"> ▪ Tassajara Creek bridge (widen bridge deck; new deck piles)

Notes: -- = No change proposed; EB = eastbound; WB = westbound.
 Source: Arup and Anil Verma Associates, Inc., 2017b.

West of the Iron Horse Regional Trail, a cantilever structure along the south side of I-580 would support the freeway above the Chabot canal/Line G-2. The cantilever would be approximately 800 feet long and would extend over the canal by 5 to 15 feet. The existing access road along the north side of the canal would be removed; however, vehicle access along the south side of the canal would be maintained and would be widened to a minimum of 12 feet to accommodate maintenance vehicles. In addition, east of the Iron Horse Regional Trail, where Line G-2 extends adjacent to the BART parking lot, approximately 1,400 feet of the canal would be relocated to the south by approximately 50 to 70 feet.

b. I-580 Vertical Alignment

Under the Express Bus/BRT Alternative, the vertical alignment for I-580 would be the same as existing conditions. The bridge over the Iron Horse Regional Trail would be widened on the north and south to accommodate the relocated I-580 and widened BART ROW at the Dublin/Pleasanton Station.

In addition to the relocation of a portion of Line G-2 described above, existing bridges and structures over the following creeks would be widened to accommodate the new bus

transfer platforms and extended tail tracks for BART car storage within the I-580 median, as shown in Table 2-8:

- Line G-1-1
- Tassajara Creek

c. Interchange and Roadway Reconfiguration

Under the Express Bus/BRT Alternative, modifications would be required at the interchanges and on- and off-ramps, including the tightening of the radius of some ramps and reconstruction of others. The on- and off-ramps at Dougherty Road/Hopyard Road and Hacienda Drive would be realigned. In addition, the adjacent surface roads and structures would be realigned, including Scarlett Court, Scarlett Drive, Altamirano Avenue, Campus Drive, and Arnold Road.

3. Bus Routes and Improvements

Under the Express Bus/BRT Alternative, new or modified LAVTA routes—including local, Express, and Rapid routes—would serve the Dublin/Pleasanton Station, connecting the station with destinations in Livermore (including LLNL, the Downtown Livermore ACE station, the Vasco Road ACE Station, and Las Positas College).²² The bus technology, proposed route modifications, and bus infrastructure improvements for this alternative are described below.²³

This EIR describes and analyzes the bus routes and bus infrastructure improvements at a programmatic level. The routes are conceptual and were developed for the purpose of estimating BART ridership and operational cost. Candidate locations for bus infrastructure improvements, anticipated to be constructed within existing street ROWs, are described to document the availability of such locations. Following implementation of the adopted project, specific routes would be developed by the bus operators based on detailed service planning. At that time, the routes and bus infrastructure improvements could be subject to subsequent environmental review, if required.

²² Rapid routes are routes that run with high frequency and provide service that connects key destinations. Express routes are routes that run during peak periods only, make limited stops, and serve major destinations. Both of these route types may feature transit priority elements along their respective route alignments—such as transit signal priority, bus bulbs, queue-jump lanes, and freeway-travel—and the use of express lanes.

²³ Arup, 2017a. BART to Livermore Extension Bus Operations Technical Memorandum. July.

a. Bus Technology

The bus technology for the Express Bus/BRT Alternative would be the same as for the Proposed Project, described above in the Conventional BART subsection. The existing LAVTA passenger buses would be used. The fleet consists of standard 29-foot to 40-foot passenger buses and paratransit vehicles.

BRT service characteristics would be used for some routes as described below. For purposes of this EIR, BRT refers to bus routes with one or more of the following elements, which provide reduced travel times: limited-stop service; transit priority elements, such as transit signal priority, queue-jump lanes and bus bulb-outs; and freeway-travel and use of express lanes, where possible.

While many BRT systems and projects include the use of special BRT buses, the BART to Livermore Extension Project would not use special BRT buses. The bus infrastructure included in the Express Bus/BRT Alternative such as the transfer platforms at Dublin/Pleasanton Station and the bus ramps from the I-580 express lanes are designed to be maximally flexible so any bus can use them (i.e., they are not designed to be useable only by special BRT buses). This flexible design allows existing bus operators such as LAVTA, RTD, MAX, Stanislaus Regional Transit, and County Connection to use the facility without purchasing special buses.

b. New/Modified Bus Routes

The bus routes for the Express Bus/BRT Alternative would include new/modified routes, as shown in Table 2-9. The bus routes for the Enhanced Bus Alternative were developed to provide effective connections from key nodes of activity in the city of Livermore to the BART system (Dublin/Pleasanton Station), and thereby improve service for existing BART patrons and generate as many additional BART patrons as possible. Consistent with the objectives of the BART to Livermore Extension Project, this includes providing effective connections to inter-regional rail (i.e., ACE Downtown Livermore and Vasco Road stations) and PDAs in Livermore (i.e., Livermore Isabel Avenue BART Station PDA, Livermore Downtown PDA, and Livermore East Side PDA). Other key activity nodes connected by proposed bus services include LLNL, Sandia National Laboratories, Las Positas College, and the San Francisco Premium Outlets. In addition, the Express Bus/BRT Alternative includes express bus service from a remote parking lot at Laughlin Road to the Dublin/Pleasanton Station to enable a direct connection from the park and ride facility to the BART station.

TABLE 2-9 EXPRESS BUS/BRT ALTERNATIVE – NEW/MODIFIED BUS SERVICE

New/ Modified Route	Operator	Route	Existing Peak Headway	Existing Service Span	Proposed Peak Headway	Proposed Service Span	Proposed Route Overview (Existing Route to be Eliminated)	Summary of Changes
New	LAVTA	X-B	--	--	<ul style="list-style-type: none"> ▪ 12-15 min. (peak) 	<ul style="list-style-type: none"> ▪ Weekday: 6:15 a.m. – 9:15 a.m. & 3:30 p.m. – 6:00 p.m. ▪ Weekend: No service 	Livermore East Side PDA, Laughlin Parking Lot, Dublin/Pleasanton Station, ACE, LLNL, SNL	New service
New	LAVTA	R-B	--	--	<ul style="list-style-type: none"> ▪ 12-15 min. (peak) ▪ 20 min. (off-peak) 	<ul style="list-style-type: none"> ▪ Weekday: 5:30 a.m. – 7:30 p.m. ▪ Weekend: No service 	Dublin/Pleasanton Station, Las Positas College, ACE Livermore, SNL	New service
Modified	LAVTA	12	30 min.	<ul style="list-style-type: none"> ▪ Weekday: 6:00 a.m. – 10:40 a.m. ▪ Weekend: Sunday only, 6:00 a.m. – 10:40 a.m. 	<ul style="list-style-type: none"> ▪ Weekday: 12-15 min. ▪ Weekend: 20 min. 	<ul style="list-style-type: none"> ▪ Weekday: 6:30 a.m. – 10:30 p.m. ▪ Weekend: 9:00 a.m. – 10:00 p.m. 	Livermore Transit Center to Stoneridge Mall via Isabel Station	Peak headways shortened; minor changes to service span.
Modified	LAVTA	20X	45 min.	<ul style="list-style-type: none"> ▪ Weekday: 6:15 a.m. – 10:00 a.m. & 4:00 p.m. – 6:40 p.m. ▪ Weekend: No service 	<ul style="list-style-type: none"> ▪ None – Express route to be eliminated 	--	Dublin/Pleasanton Station, Greenville Road, LLNL/SNL, Livermore Transit Center	Route to be eliminated

TABLE 2-9 EXPRESS BUS/BRT ALTERNATIVE – NEW/MODIFIED BUS SERVICE

New/ Modified Route	Operator	Route	Existing		Proposed Peak Headway	Proposed Service Span	Proposed Route Overview (Existing Route to be Eliminated)	Summary of Changes
			Peak Headway	Existing Service Span				
Modified	LAVTA	Rapid Route	15 min.	▪ Weekday: 5:30 a.m. – 8:00 p.m.	▪ None – Express route to be eliminated	--	Dublin/Pleasanton Station to Livermore Transit Center	Route to be eliminated

Notes:

-- = Not applicable; R-B = Rapid service; X-B = Express service (peak period); SNL = Sandia National Laboratories.

Peak periods are assumed to be 6:00 a.m. to 10:00 a.m. (AM peak) and 3:00 p.m. to 7:00 p.m. (PM peak).

Several components of the proposed bus routes are similar to Wheels Forward, a program of changes to the LAVTA transit system implemented in August 2016 to provide more frequent buses and new routes in Livermore, Dublin, and Pleasanton. The new, modified, or eliminated routes under the Proposed Project and Build Alternatives are described in relation to the previous bus route network. Elements shared by the Proposed Project and Build Alternatives and the Wheels Forward program include improved bus service from Downtown Livermore to BART, improved bus service to Las Positas College, and improved bus shelters to serve the new Express and Rapid routes. Other capital improvements, such as real-time arrival message boards at bus stations, expansion of transit signal priority to additional intersections, and installation of bus bulbs, are not included in the Wheels Forward program. In addition, the Proposed Project and Build Alternatives would include improved bus service to LLNL and the east side of Livermore.

Although LAVTA eliminated Route 12 and 12X service in August 2016, a restructured Rapid route serves most of the existing Route 12 stops on Dublin Boulevard as well as North Canyons Parkway and Las Positas College, and a restructured Route 14 serves areas of Livermore previously served by Route 12. Therefore, these restructured routes would generally serve the areas previously served by the 12 and 12X, and the existing routes analyzed in this EIR remain as previously operated by LAVTA.

Source: Arup, 2017a.

Bus services were developed to provide as fast and as direct a route as practical from these activity nodes to the Dublin/Pleasanton Station. To reduce travel time, routes were developed to make optimal use of the I-580 express lanes. In addition, transit priority elements such as transit signal priority, bus bulbs, and real-time information were deployed to improve travel times along bus route segments experiencing traffic congestion, intersection delay, interference from general traffic, and long dwell times due to high passenger boarding and alighting volumes at specific bus stops.

To provide a seamless connection with the BART system, the frequency of many of the bus routes was chosen to match the frequency of BART trains arriving at Dublin/Pleasanton Station during peak periods. Coordinated bus arrival and departure times with each BART train significantly improves a passenger's perception of reliability and experience of using bus service to connect to BART.

c. Bus-Related Infrastructure Improvements

Similar to the other alternatives, a series of transit priority infrastructure enhancements would also be implemented under this alternative to increase the performance of the above bus connections. Typical bus improvements are shown in Figure 2-12. These enhancements would be implemented on local bus corridors and arterials, and include the following:

- **Transit Signal Priority.** Under the Express Bus/BRT Alternative, buses would be given priority at approximately four locations, as follows:
 - For the 12 and 12X routes, on East Jack London Boulevard at Isabel Avenue and Murrieta Boulevard
 - For the R-B Route, at key intersections along Portola Avenue and Livermore Avenue that would be on the route
- **Rapid/ Express Route Amenities.** Bus shelters, real-time information via digital messaging boards, improved seating and surroundings near bus stops, and pre-paid ticketing with Clipper® would be implemented for the R-B, X-B, 12, and 12X routes at approximately 29 locations at existing bus stops, within existing street and sidewalk ROWs.
- **Bus Bulbs.** Under the Express Bus/BRT Alternative, bus bulbs would be installed at approximately 10 locations, as follows:
 - For the R-B Route, at stops on Portola Avenue and North Livermore Avenue, between I-580 and East Avenue, and at stops on North Canyons Parkway
 - For the 12 and 12X routes, along Railroad Avenue between Murrieta Boulevard and Livermore Avenue

4. Operations

Operations—including the operating plan, fleet size, travel times, and fares and fare collection—are described below for the Express Bus/BRT Alternative.

a. Operating Plan

Hours of operation and bus headways are shown in Table 2-9 for the new/modified bus routes under the Express Bus/BRT Alternative.

The BART operating plan for the Express Bus/BRT Alternative would remain as current BART operations. The hours of operation and train headways would be the same as the current BART service at the Dublin/Pleasanton Station. The proposed operating plan is based on anticipated opening day ridership, which could be adjusted based on changes to subsequent demand. BART intends to have 12-minute headways (instead of 15-minute headways) at some time after 2025. As described above, current BART service to the Dublin/Pleasanton Station is provided by the Daly City-Dublin/Pleasanton Line, which operates between the Daly City BART Station and the Dublin/Pleasanton Station. BART service to the Dublin/Pleasanton Station is provided as follows:

- Weekdays: 4:00 a.m. to 12:00 a.m., with trains every 15 minutes
- Saturdays: 6:00 a.m. to 12:00 a.m., with trains every 20 minutes
- Sundays/Holidays: 8:00 a.m. to 12:00 a.m., with trains every 20 minutes

b. Employees

By 2040, the Express Bus/BRT Alternative would result in a total of approximately 23 additional full-time-equivalent staff systemwide, as follows: (1) 6 BART personnel to provide administration, operation, and maintenance of the BART system; and (2) 17 non-BART personnel for the additional bus service anticipated under the Express Bus/BRT Alternative.

c. Fleet Size

Approximately 7 to 13 additional buses would be needed to serve the Express Bus/BRT Alternative.

The Express Bus/BRT Alternative would add riders to an already crowded BART core system during peak periods (see Section 3.B, Transportation). To assess the capacity needed to accommodate the additional riders within the core system, BART conducted an operations analysis to determine BART vehicle fleet needs to effectively operate the Express Bus/BRT Alternative. The analysis considered expected BART ridership under the Express Bus/BRT Alternative as well as BART's operating plan for the Daly

City-Dublin/Pleasanton Line in 2040. Based on the analysis, the Express Bus/BRT Alternative would require an additional 12 BART cars to accommodate the increased ridership anticipated while maintaining a level of crowding similar to the BART systemwide average.

d. Fares and Fare Collection

Fares and fare collection for the buses would be consistent with LAVTA's current fare policy and fare collection, also described above for the Proposed Project.

BART fares and fare collection would remain as currently exists at the Dublin/Pleasanton Station (described under Proposed Project above) with new fare gates for passengers transferring from the proposed bus transfer platforms to the BART system.

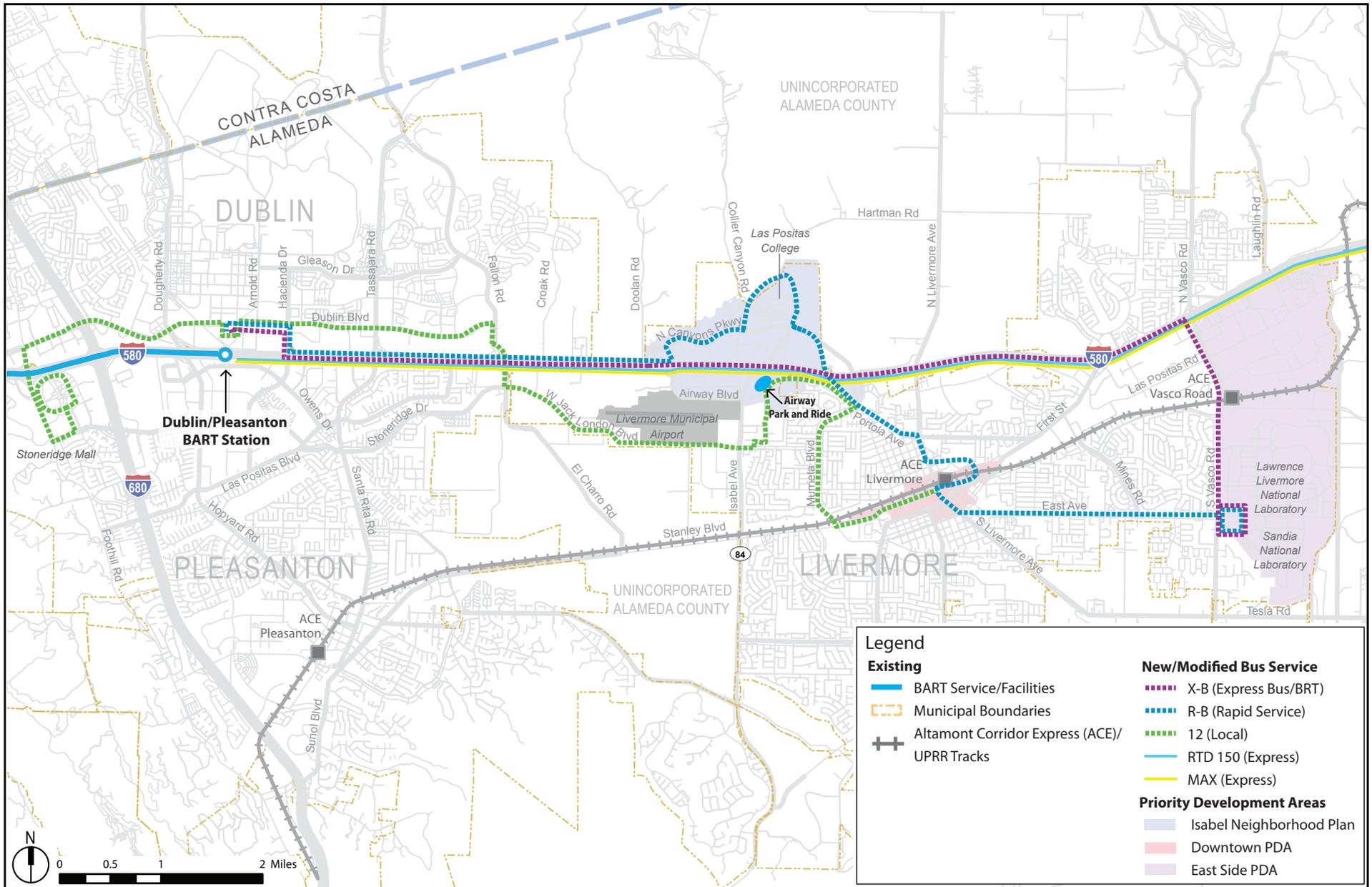
F. ENHANCED BUS ALTERNATIVE

The Enhanced Bus Alternative seeks to achieve project objectives via bus-related technology only. Similar to the Express Bus/BRT Alternative, the Enhanced Bus Alternative would not include an extension of BART rail service or the development of a new BART station. However, unlike the Express Bus/BRT Alternative, this alternative would not include any major capital improvements, such as the development of new bus transfer platforms. This alternative entails lower-cost bus service improvements to improve transit access to the Dublin/Pleasanton Station. Similar to the Proposed Project and the other alternatives, this alternative includes a bus operations plan designed to enhance direct connections to the Dublin/Pleasanton Station from Las Positas College, Downtown Livermore, and the ACE stations, as well as to serve existing and future PDAs.

While this alternative would not include an extension of BART rail service or the development of a new rail station, it does not preclude or prevent the future extension of rail service from Dublin/Pleasanton Station to the east.

Key components of the Enhanced Bus Alternative include new and modified bus services and facilities to improve transit to the Dublin/Pleasanton Station. These components are listed below and shown in Figure 2-24. Features that would be similar to or the same as the Proposed Project are noted.

The bus routes for the Enhanced Bus Alternative were developed to provide effective connections from key nodes of activity in the city of Livermore to the BART system (Dublin/Pleasanton Station), and thereby improve service for existing BART patrons and generate as many additional BART patrons as possible. Consistent with the objectives of the BART to Livermore Extension Project, this includes providing effective connections to inter-regional rail (i.e., ACE Downtown Livermore and Vasco Road stations) and PDAs in



Source: Arup, 2017a,b.

Figure 2 - 24
Enhanced Bus Alternative
Overview

Livermore (i.e., Livermore Isabel Avenue BART Station PDA, Livermore Downtown PDA, and Livermore East Side PDA). Other key activity nodes connected by proposed bus services include LLNL, Sandia National Laboratories, Las Positas College, and the San Francisco Premium Outlets.

Bus services were developed to provide as fast and as direct a route as practical from these activity nodes to the Dublin/Pleasanton Station. To reduce travel time, routes were developed to make optimal use of the I-580 express lanes. In addition, transit priority elements such as transit signal priority, bus bulbs, and real-time information were deployed to improve travel times along bus route segments experiencing traffic congestion, intersection delay, interference from general traffic, and long dwell times due to high passenger boarding and alighting volumes at specific bus stops.

To provide a seamless connection with the BART system, the frequency of many of the bus routes was chosen to match the frequency of BART trains arriving at Dublin/Pleasanton Station during peak periods. Coordinated bus arrival and departure times with each BART train significantly improves a passenger's perception of reliability and experience of using bus service to connect to BART.

- **New/Modified Bus Routes and Improvements.** The proposed bus operations plan for this alternative would include an additional Rapid route (R-B) and one Express route (X-A). The existing local Route 12 would be modified and the existing Rapid route and 20X route would be eliminated to avoid redundancy and ensure an efficient spread of transit service to all key areas. This bus operations plan assumes that the service provided by RTD and MAX Express routes would remain identical to today's service. Bus infrastructure improvements such as bus bulbs, bus shelters, and signage would also be constructed along the new bus routes. The bus routes and infrastructure are described and analyzed at a programmatic level.

1. Bus Routes and Improvements

The bus technology, proposed route modifications, and bus infrastructure improvements for the Enhanced Bus Alternative are listed below.

As described above, this EIR describes and analyzes the bus routes and bus infrastructure improvements at a programmatic level. The routes are conceptual and were developed for the purpose of estimating BART ridership and operating costs. Candidate locations for bus infrastructure improvements, anticipated to be constructed within existing street ROWs, are described to document the availability of such locations. Following implementation of the adopted project, specific routes would be developed by the bus operators based on detailed service planning. At that time, the routes and bus infrastructure improvements could be subject to subsequent environmental review, if required.

a. Bus Technology

The bus technology for the Enhanced Bus Alternative would be the same as for the Proposed Project and Express Bus/BRT Alternative, described above.

b. New/Modified Bus Routes

Under the Enhanced Bus Alternative, new/modified bus routes—including local, Express, and Rapid routes—would serve the Dublin/Pleasanton Station, connecting the station with destinations in Livermore (including LLNL, the Downtown Livermore ACE station, and Las Positas College).^{24, 25} The new/modified bus routes are listed in Table 2-10.

c. Bus-Related Infrastructure Improvements

A series of transit priority infrastructure enhancements would also be implemented under this alternative, to increase the performance of the bus connections. Typical bus improvements are shown in Figure 2-12. These enhancements would be implemented on local bus corridors and arterials, and include the following:

- **Transit Signal Priority.** Under the Enhanced Bus Alternative, buses would be given priority at approximately six locations as follows:
 - For the X-A Route, at the I-580 westbound ramps at Vasco Road and at key intersections along Hacienda Drive and Owens Drive that would be on the route
 - For the 12 and 12X routes, on East Jack London Boulevard at Isabel Avenue
 - For the R-B, Portola Avenue and Livermore Avenue
- **Rapid/Express Route Amenities.** Bus shelters, real-time information via digital messaging boards, improved seating and surroundings near bus stops, and pre-paid ticketing with Clipper® would be implemented for the R-B, X-A, and 12X routes at approximately 29 locations at existing bus stops within existing street and sidewalk ROWs.

²⁴ Rapid routes are routes that run with high frequency and provide service connecting key destinations. Express routes are routes that run during peak periods only, make limited stops, and serve major destinations. Both of these route types may feature transit priority elements along their respective route alignments—such as transit signal priority, bus bulbs, queue-jump lanes, and freeway-travel—and use of express lanes.

²⁵ Arup, 2017a. BART to Livermore Extension Bus Operations Technical Memorandum. July.

TABLE 2-10 ENHANCED BUS ALTERNATIVE – NEW/MODIFIED BUS SERVICE

New/ Modified Route	Operator	Route	Existing Peak Headway	Existing Service Span	Proposed Peak Headway	Proposed Service Span	Proposed Route Overview (Existing Route to be Eliminated)	Summary of Changes
New	LAVTA	X-A	--	--	▪ 15 min. (peak)	▪ Weekday: 6:15 a.m. – 9:15 a.m. & 3:30 p.m. – 6:00 p.m. ▪ Weekend: No service	Dublin/Pleasanton Station to SNL	New service
New	LAVTA	R-B	--	--	▪ 12–15 min. (peak) ▪ 30 min. (off-peak)	▪ Weekday: 5:30 a.m. – 7:30 p.m. ▪ Weekend: No service	Dublin/Pleasanton Station, Las Positas College, ACE Livermore, SNL	New service
Modified	LAVTA	12	30 min	▪ Weekday: 6:00 a.m. – 10:40 p.m. ▪ Weekend: Sunday only, 6:00 a.m. – 10:40 p.m.	▪ Weekday: 12–15 min. ▪ Weekend: 20 min.	▪ Weekday: 6:30 a.m. – 10:30 p.m. ▪ Weekend: 9:00 a.m. –10:00 p.m.	Livermore Transit Center to Stoneridge Mall via Isabel Station	Peak headways shortened; minor changes to service span.
Modified	LAVTA	Rapid Route	15 min	▪ Weekday: 5:30 a.m. – 8:00 p.m.	None – Express route to be eliminated	--	Dublin/Pleasanton Station to Livermore Transit Center	Route to be eliminated
Modified	LAVTA	20X	45 min	▪ Weekday: 6:15 a.m. – 10:00 a.m. & 4:00 p.m. – 6:40 p.m.	None – Express route to be eliminated	--	Dublin/Pleasanton Station, Greenville Road, LLNL/SNL, Livermore Transit Center	Route to be eliminated

Notes:

-- = Not applicable; R-B = Rapid service; X-B, X-A = Express service (peak period); MAX = Modesto Area Express; SNL = Sandia National Laboratories.

Peak periods are assumed to be 6:00 a.m. to 10:00 a.m. (AM peak) and 3:00 p.m. to 7:00 p.m. (PM peak).

Several components of the proposed bus routes are similar to Wheels Forward, a program of changes to the LAVTA transit system implemented in August 2016 to provide more frequent buses and new routes in Livermore, Dublin, and Pleasanton. The new, modified, or eliminated routes under the Proposed Project and Build Alternatives are described in relation to the previous bus route network. Elements shared by the Proposed Project and Build Alternatives and the Wheels Forward program include improved bus service from Downtown Livermore to BART, improved bus service to Las Positas College, and improved bus shelters to serve the new Express and Rapid routes. Other capital improvements, such as real-time arrival message boards at bus stations, expansion of transit signal priority to additional intersections, and installation of bus bulbs, are not included in the Wheels Forward program. In addition, the Proposed Project and Build Alternatives would include improved bus service to LLNL and the east side of Livermore.

Although LAVTA eliminated Route 12 and 12X service in August 2016, a restructured Rapid route serves most of the existing Route 12 stops on Dublin Boulevard as well as

TABLE 2-10 ENHANCED BUS ALTERNATIVE – NEW/MODIFIED BUS SERVICE

New/ Modified Route	Operator	Route	Existing Peak Headway	Existing Service Span	Proposed Peak Headway	Proposed Service Span	Proposed Route Overview (Existing Route to be Eliminated)	Summary of Changes
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North Canyons Parkway, and Las Positas College and a restructured Route 14 serves areas of Livermore previously served by Route 12. Therefore, these restructured routes would generally serve the areas previously served by the 12 and 12X, and the existing routes analyzed in this EIR remain as previously operated by LAVTA.
 Source: Arup, 2017a.

- **Bus Bulbs.** Under the Enhanced Bus Alternative, bus bulbs would be installed at approximately 10 locations as follows:
 - For the R-B Route, at stops on Portola Avenue and North Livermore Avenue between I-580 and East Avenue, and at stops on North Canyons Parkway
 - For the 12 and 12X routes, along Railroad Avenue between Murrieta Boulevard and Livermore Avenue

2. Operations

Operations—including the operating plan, fleet size, travel times, and fares and fare collection—are described below for the Enhanced Bus Alternative.

a. Operating Plan

The operating plan for the Enhanced Bus Alternative would consist of adding/modifying bus routes. Hours of operation and bus headways are shown in Table 2-10 for the new/modified bus routes under the Express Bus/BRT Alternative.

The current hours of operation and headways for BART service along the Daly City-Dublin/Pleasanton Line would not change. As described above, current BART service to the Dublin/Pleasanton Station is provided by the Daly City-Dublin/Pleasanton Line, which operates between the Daly City BART Station and the Dublin/Pleasanton Station. BART service to the Dublin/Pleasanton Station is provided as follows:

- Weekdays: 4:00 a.m. to 12:00 a.m., with trains every 15 minutes
- Saturdays: 6:00 a.m. to 12:00 a.m., with trains every 20 minutes
- Sundays/Holidays: 8:00 a.m. to 12:00 a.m., with trains every 20 minutes

As described above, BART intends to have 12-minute headways (instead of 15-minute headways) at some time after 2025.

b. Employees

By 2040, the Enhanced Bus Alternative would result in a total of approximately 20 additional full-time-equivalent staff associated with the provision of bus services. No additional staff would be required for the BART service.

c. Fleet Size

Approximately 6 to 10 additional buses would be needed to serve the Enhanced Bus Alternative. No additional BART vehicles would be required for the Daly City-Dublin/Pleasanton Line as a result of the Express Bus/BRT Alternative.

d. Fares and Fare Collection

Fares and fare collection for the buses would be consistent with LAVTA's current fare policy and fare collection, as described above for the Proposed Project.

G. CONSTRUCTION

This section describes the construction schedule and activities for the Proposed Project and Build Alternatives, as follows:

- Construction schedule
- Construction phases and activities
- Construction staging areas and haul routes
- Excavation, equipment, materials, and haul trips
- Project workforce
- Utilities relocation
- Coordination with Caltrans

Information specific to an alternative is provided for topics where the alternative differs from the Proposed Project.

1. Construction Schedule

Construction of the Proposed Project is anticipated to begin in 2021 and last approximately 5 years through 2026. Construction activities would occur in phases at various locations along the project corridor. During peak construction periods, work could be underway at several locations, resulting in overlapping construction of various project elements.²⁶ The construction phases and the approximate duration of construction associated with the phases are shown in Table 2-11, presented generally west to east. Construction durations are shown for each construction phase that is applicable to the Proposed Project or Build Alternatives. The anticipated order of construction activities is described below under Construction Phases and Activities.

²⁶ While the entire construction duration would occur over approximately 5 years and include start-up and testing, the majority of the construction activities resulting in emissions would occur over approximately 4 years (48 months) for the Proposed Project and DMU Alternative and over approximately 4.25 years (52 months) for the Express Bus/BRT Alternative. Construction of the Enhanced Bus Alternative, as well as bus infrastructure improvements under the Proposed Project and other Build Alternatives, is anticipated to occur over approximately 2 months.

TABLE 2-11 CONSTRUCTION SEGMENTS AND DURATION

	Conventional BART Project	DMU Alternative	Express Bus/BRT Alternative	Enhanced Bus Alternative
Dublin/Pleasanton Station Area				
Relocate I-580 and surface roads		18 months	18 months	
Construct DMU transfer platform (north of I-580)		30 months		
Construct BART car storage (west of station)		18 months		
Install replacement parking lot (south of I-580)			9 months	
Relocate bus drop-off facility and Line G-2 canal (south of I-580)			12 months	
Install bus transfer platforms (north and south of I-580)			21 months	
Construct BART car storage (east of station)			12 months	
Between Dublin/Pleasanton Station and Isabel Station				
Relocate I-580 and surface roads	24 months	24 months		
Isabel Station Area to Storage and Maintenance Facility				
Relocate I-580 and surface roads	18 months	18 months		
Construct Isabel Station	30 months	30 months		
Construct Isabel Station - north station area improvements, and south station area improvements and parking facility	18 months	18 months		
Install westbound I-580 BART underpass for tail tracks	21 months	21 months		
Install tail tracks and construct storage and maintenance facility	30 months	30 months		
Other Areas or Project-wide				
Construct Laughlin parking lot			6 months	
Install bus improvements	2 months	2 months	2 months	2 months
Install track and system equipment	21 months	21 months		
Test and service start-up	6 months	6 months		
Total				
	5 years	5 years	5 years	2 months

Notes:

Segments are listed from west to east along the project corridor and are not shown in chronological order. Several segments of construction would occur concurrently; therefore, durations for each segment are not sequential.

The anticipated order of construction activities is described in the text.

Working hours would vary depending on the activities being performed. In general, construction activities would occur primarily during weekdays, typically between 7:00 a.m. and 7:00 p.m. However, many activities associated with relocation of I-580—including lane relocation, surface frontage road relocation, and the westbound I-580 BART underpass for the tail tracks—would occur at night (10:00 p.m. to 7:00 a.m.) to reduce impacts on traffic. Once the freeway lanes are relocated, work would be conducted during the day for the BART extension and station facilities. Weekend work could be required, although the extent of such work is not currently known.

2. Construction Phases and Activities

a. Overview

Construction of the Proposed Project and Build Alternatives would entail various types of activities, as described below, and would occur in several overlapping or concurrent phases in segments along the project corridor. The construction segments are shown in Table 2-11.

For the Proposed Project, the first phase of construction would be the relocation of I-580 in the vicinity of Isabel Station to create adequate space in the median for the station and tail tracks. The remainder of the I-580 relocation from Isabel Avenue west toward Dublin/Pleasanton Station would then occur. Once the I-580 median is widened at the Isabel Station area, construction of the BART system facilities would commence, including the following: Isabel Station; the north station area improvements; the south station area improvements and parking facility; construction of the westbound I-580 underpass for the tail tracks; and construction of the tail tracks and storage and maintenance facility. The remainder of the BART system improvements along I-580, including the installation of the new mainline track connecting the Dublin/Pleasanton Station to the Isabel Station would be constructed. Along the entire project corridor, BART track and system equipment would be installed and tested.

Construction activities for the alternatives would be as follows:

- **DMU Alternative.** In addition to activities similar to those described above for the Proposed Project, activities would include construction of the DMU transfer platform at the Dublin/Pleasanton Station. Construction at the Dublin/Pleasanton Station area would likely begin simultaneously with construction at the Isabel Station area. To construct the transfer platform, I-580 and surface frontage roads would be relocated in the vicinity of the station. This would be followed by construction of the DMU transfer platform on the north side of I-580. Overall, construction would occur along the I-580 corridor from west of Dougherty Road to North Livermore Avenue, with I-580 modifications occurring from west of Dougherty Road to the Portola Avenue overcrossing.

- **Express Bus/BRT Alternative.** Unlike the Proposed Project, the relocation of I-580 would occur at the Dublin/Pleasanton Station area and would include construction of the bus transfer platforms at the station and ramps from I-580 express lanes to the bus platforms. West of the Iron Horse Regional Trail, a cantilever structure along the south side of I-580 would support the freeway above the Chabot canal/Line G-2, and a portion of Line G-2 canal would also be relocated, and a replacement parking lot or garage at the Dublin/Pleasanton Station and a new parking lot at Laughlin Road would also be constructed. Overall, construction would occur along the I-580 corridor from Dougherty Road/Hopyard Road to Tassajara Road/Santa Rita Road, and at Laughlin Road and Northfront Road.
- **Enhanced Bus Alternative.** Construction activities would consist only of bus infrastructure improvements in the public ROW, which would be similar to the bus improvements for the Proposed Project.

b. Construction Activities

This subsection describes specific construction activities for the Proposed Project and Build Alternatives. Project initiation would be followed by several phases of construction and then testing and service start-up. Construction activities are described below for the Proposed Project, followed by a description of activities specific to the alternatives.

During project initiation, BART would undertake ROW acquisition and preconstruction activities such as developing a construction and staging plan; confirming staging and casting/precasting concrete preparation areas; creating temporary spoils storage; conducting workshops; and providing temporary storage for delivered construction materials. Contractors would mobilize equipment and materials at various locations along the alignment before construction begins, and would then proceed with site preparation, demolition, clearing, grubbing, and grading, and relocating and/or protecting utilities.

(1) Relocate I-580 and Surface Frontage Roads

To accommodate the new, approximately 46-foot-wide BART ROW in the I-580 median, the westbound and eastbound freeway lanes would be shifted to the north and south. As shown in Table 2-11, the construction activities described below are anticipated to take place over approximately 24 months from Hacienda Drive to the Isabel Interchange, and over an 18-month period from the Isabel Interchange to Portola Avenue.

To relocate the Caltrans ROW, some frontage roads (listed in Table 2-3 above) would be realigned and property access would be reconfigured. The relocated lanes would be constructed at the same grade as the existing freeway. Where the freeway is at grade, construction would possibly entail excavation to approximately 2 feet below grade. The area would then be backfilled with aggregate and paved. In cases where the freeway

crosses a bridge, the bridge would be extended north and south to accommodate the widening. Interchanges would be reconfigured, including on- and off-ramp modifications and installation of retaining walls where necessary.

In the area of the Isabel Station along the project corridor from Isabel Avenue to Portola Avenue, both westbound and eastbound freeway lanes, including on- and off-ramps, would be relocated outward to the north and south, respectively. In addition, East Airway Boulevard would be widened slightly to the south to accommodate the additional lanes needed for the south station area parking facility. The freeway bridge over Arroyo las Positas Creek would be widened.

For the relocation of I-580 along the remainder of the project corridor, from Isabel Avenue to Hacienda Drive, retaining walls and on- and off-ramps would be modified in both the eastbound and westbound directions of I-580 at Tassajara Road/Santa Rita Road, Fallon Road/El Charro Road, Airway Boulevard, and Isabel Avenue. The existing bridges over Tassajara Creek, Cottonwood Creek, and Collier Creek would be extended for the relocated I-580 lanes. Frontage roads would be relocated.

As described above for the Proposed Project and DMU Alternative, BART would build the foundations and columns for the anticipated future widening of the Isabel Avenue overcrossing, which is a separate project by the City of Livermore. As part of this work, two concrete columns, approximately 6 feet in diameter and 18 feet high, would be constructed within the I-580 median for the future Isabel Avenue widening. Driven or continuous flight auger piles would be extended to a depth of approximately 70 feet and a steel case foundation would be constructed.

(2) Construct Isabel Station, North Station Area Improvements, and South Station Area Improvements and Parking Facility

Construction of the Isabel Station and parking facility would include installation of foundations and structural framing for the new station and parking structure, construction of new platforms, and connection of the structure to utilities on the site, followed by finishes and interior improvements. Construction of the Isabel Station is anticipated to require approximately 30 months and construction of the south station area parking facility is anticipated to require approximately 18 months.

As part of this work, improvements at the north station area would be constructed; these include the pedestrian touchdown structure, roadway access loop from Isabel Avenue, bus loading/unloading, taxi, kiss-and-ride, bicycle facilities, and Americans with Disabilities Act-compliant drop-off. South station area improvements would include the construction of the parking garage, surface parking lots and roadways, the pedestrian touchdown structure, bicycle facilities, and bus loading/unloading.

Construction of the Isabel Station and parking facility would involve the use of cast-in-place concrete and steel.²⁷ The platform and building would be constructed of standard building materials such as concrete, steel, aluminum, and heavy plastic.

The pedestrian overcrossings from the station to the touchdown structures north and south of I-580 would be constructed during this phase. Bridge construction for the pedestrian overcrossings would entail the installation of piles,²⁸ generally long steel or concrete poles that are driven into the ground. Cast-in-drilled-hole²⁹ piles, which do not require driving, could also be used. Bridges spanning roadways would have to be designed with sufficient clearance.

(3) Install Westbound I-580 BART Underpass For Tail Tracks

The BART underpass structure would connect the tail track east of the station to the storage and maintenance facility north of I-580. Construction of the underpass is anticipated to occur over approximately 21 months. The underpass is anticipated to be constructed in segments and could entail cut-and-cover construction techniques.

(4) Install Tail Tracks and Construct Storage and Maintenance Facility

Construction activities for the installation of the tail track from east of the Isabel Station to the storage and maintenance facility would include installation of the tail tracks, construction of bridges over Arroyo las Positas and Cayetano creeks, grading of the hillside for tail tracks, and installation of a hillside tunnel via cut and cover construction.

Construction of the storage and maintenance facility would include installation of storage tracks, and construction of the building itself; these activities are anticipated to occur over approximately 30 months.

A City of Livermore trail is planned along Arroyo las Positas Creek just west of the Portola Avenue overcrossing and would be constructed by the time of project implementation. The trail would need to be relocated to accommodate the proposed tail track alignment. The Proposed Project would relocate approximately 750 feet of the trail from the south side to the north side of Arroyo las Positas Creek, and relocate the bridge to the east of the Portola Avenue overcrossing.

²⁷ Cast-in-place concrete is transported in an unhardened state, commonly referred to as ready-mix cement. The concrete is then poured in wooden forms and allowed to cure on site.

²⁸ Piles are deep foundations typically used to support large structures.

²⁹ Involves digging a deep hole (shaft), placing the pile into the hole, and then filling the remainder with concrete.

(5) Install Track and System Equipment

Along the project corridor, track and system equipment would be installed. The existing tail tracks east of the Dublin/Pleasanton Station would be removed; the old ballast and ties would be replaced; new mainline track would be installed; and the subgrade, drainage, duct banks, traffic barriers, and fence would be retained. For areas east of the existing tail tracks, where soil improvement would be required, the existing soil would be excavated to approximately 5 feet below grade. A subterranean drainage system and buried ductbank for electrical, communication, and train controls would be installed. Sub-ballast and ballast would be placed first, followed by precast concrete ties and rails.³⁰ Freeway barriers would be constructed using cast-in-place concrete to build 3-foot-high traffic barriers and top-mounted security fencing. Installation of track and system equipment is anticipated to occur over an approximately 21-month period.

(6) Test and Service Start-up

The last phase of construction would entail testing and start-up of the BART extension; this phase would last approximately 6 months.

(7) Install Bus Improvements

Bus infrastructure improvements would include installation of transit signal priority timing, bus shelters, improved seating at bus stops, digital messaging boards, and bus bulb-outs. Construction activities would primarily entail installation of the bus shelters, installation of new signal poles, and conversion of existing roadway to bus bulb-outs. Construction of foundations for bus shelters, signal poles, and curb and sidewalk modifications could require excavation up to approximately 2 feet below grade. Construction of bus bulbs would entail removal of existing asphalt, installation of new curbs and drainage, and replacement of the sidewalk. Construction of a bus bulb-out would typically occur over one week, and the bus system improvements would be installed over approximately 2 months.

(8) Specific Construction Activities for Alternatives

Construction activities for the alternatives are described below and shown in Table 2-11.

³⁰Ballast and sub-ballast refer to the crushed angular rocks that are packed below, between, and around rail ties. The use of ballast facilitates drainage and bearing the weight of the trains.

(a) DMU Alternative

Construction activities would be similar to those described above for the Proposed Project; the differences from the Proposed Project are outlined below.

Relocate I-580 and Surface Frontage Roads

This phase of construction would be similar to that for the Proposed Project as described above. To accommodate the new BART storage tracks west of the Dublin/Pleasanton Station, the eastbound freeway lanes would be shifted to the south and Owens Court and Johnson Drive would be relocated to the south. To accommodate the new DMU transfer platform, the westbound freeway lanes would be shifted to the north at the Dublin/Pleasanton Station. The existing bridges over Line G-1-1 and Chabot Canal would be extended. Scarlett Court and Arnold Road, which are frontage roads, would be relocated to the north; then, the westbound lanes of I-580 would be relocated outward to the north. As shown in Table 2-11, the relocation of I-580 and surface frontage roads in the vicinity of the station from Dougherty Road/Hopyard Road to Hacienda Drive would take place over approximately 18 months.

Construct DMU Transfer Platform at the Dublin/Pleasanton Station

The DMU transfer platform would be constructed on the north side of the existing westbound BART platform. During construction of the transfer platform, the existing BART service at the station would operate with limited interruption. Cast-in-place concrete and steel would be used to construct the DMU transfer platform. The platform would be constructed of standard building materials such as concrete, steel, aluminum, and heavy plastic. As shown in Table 2-11, construction of the transfer platform is anticipated to take place over approximately 30 months.

Construct Dublin/Pleasanton Station BART Car Storage

This phase would construct 0.3 mile of BART car storage track west of the Dublin/Pleasanton Station. The tail track would be constructed at grade between the BART mainline tracks. Construction materials would include ballast, ties, and rails. Construction is expected to occur over approximately 18 months.

Install Tail Track and Construct Storage and Maintenance Facility

This phase of construction would be similar to the Proposed Project as described above. The construction of the facility would entail placing the structure foundation, framing, and finishing of the building, anticipated to require approximately 30 months. As noted above for the Proposed Project, ballast and sub-ballast would be installed prior to installation of

ties and rails. Ballast would be utilized instead of a concrete guideway, to facilitate drainage and reduce noise.

EMU Option Facilities

This section describes the key construction differences between the DMU Alternative and the EMU Option (a variation of the DMU Alternative). Except as described below, construction of the EMU Option would be similar to the DMU Alternative.

Under the EMU Option, a third rail or overhead (catenary) system would be installed along the EMU alignment, from Dublin/Pleasanton Station to the proposed Isabel Station, and along the tail track to the storage and maintenance facility. In addition, wayside facilities, as described above, would be similar to those described for the Proposed Project's wayside facilities—near Croak Road, at Kitty Hawk Road and Isabel Avenue, at the proposed Isabel Station, and at the storage and maintenance facility.

(b) Express Bus/BRT Alternative

Construction activities would entail the construction of the bus transfer platforms and replacement parking lot as described below. In addition, the existing tail tracks would be extended by approximately 0.1 mile, to the east of the station. This alternative would include construction of the Laughlin Parking Lot, as described below. Construction activities would be similar to the bus improvements described above for the Proposed Project.

Relocate I-580 and Surface Frontage Roads

To expand the BART ROW in the center of the freeway for the construction of the bus transfer platforms, I-580 would be relocated to both the north and the south.

To relocate westbound I-580 on the north, Scarlett Court, Scarlett Drive, Altamirano Avenue, Campus Drive, and Arnold Road would be relocated and property access would have to be reconfigured. To relocate eastbound I-580 on the south, construction of a cantilever structure would be required to support the highway where it extends adjacent to Chabot Canal/Line G-2 and a portion of Line G-2 that extends adjacent to the Dublin/Pleasanton Station BART parking lot would be relocated to the south. The relocated freeway lanes would be constructed at the same grade as the existing freeway. The Hacienda interchange would be reconfigured, including on- and off-ramp modifications and installation of retaining walls. To accommodate the new BART tail tracks east of the Dublin/Pleasanton Station, the westbound freeway lanes would be shifted to the north. The existing bridges over Line G-1-1 and Tassajara Creek would be extended for the relocated I-580 lanes. As shown in Table 2-11, the construction activities

described below are anticipated to take place over approximately 18 months for the work from west of Dougherty Road/Hopyard Road to Tassajara Road/Santa Rita Road.

Construct Bus Transfer Platforms and Other Improvements at the Dublin/Pleasanton Station

Construction of the bus transfer platforms on the north and south sides of the existing Dublin/Pleasanton Station would involve cast-in-place concrete to construct slightly elevated platforms, as well as bus ramps leading from the express lanes to the platforms. The platforms would be constructed of standard building materials such as concrete, steel, aluminum, and heavy plastic. In addition, portions of the existing concourse wall (lower level) at the Dublin/Pleasanton Station would be removed and the concourse would be expanded. As shown in Table 2-11, construction of the platforms is anticipated to require approximately 21 months. During construction, the existing BART service at the station would operate with limited interruption.

The replacement parking lot or garage would be constructed south of I-580. The area would be graded and leveled to prepare the subbase for paving of the parking areas. The existing parking lot on the south side of the Dublin/Pleasanton Station would also be restriped to reflect a different parking layout. As shown in Table 2-11, the construction of a replacement parking lot would occur over approximately 9 months. In addition, the existing bus drop-off facility and Line G-2 canal at the Dublin/Pleasanton Station, south of I-580 and east of the Iron Horse Regional Trail, would be relocated to the south to accommodate the relocated I-580. As shown in Table 2-11, this would occur over approximately 12 months.

Construct Dublin/Pleasanton Station BART Car Storage

The existing tail track at the Dublin/Pleasanton Station would be extended approximately 0.1 mile to the east for BART car storage. Construction materials would include ballast, ties, and rails. Construction is estimated to occur over 12 months.

Construct Laughlin Parking Lot

The Laughlin parking lot area would be graded and leveled to prepare the subbase for the paving of the parking areas. Once paved, the parking stalls would be striped and the bus shelter and lighting would be installed. As shown in Table 2-11, the construction of the parking lot would occur over approximately 6 months.

(c) Enhanced Bus Alternative

Construction activities would be similar to those described above for the Proposed Project under Install Bus Improvements.

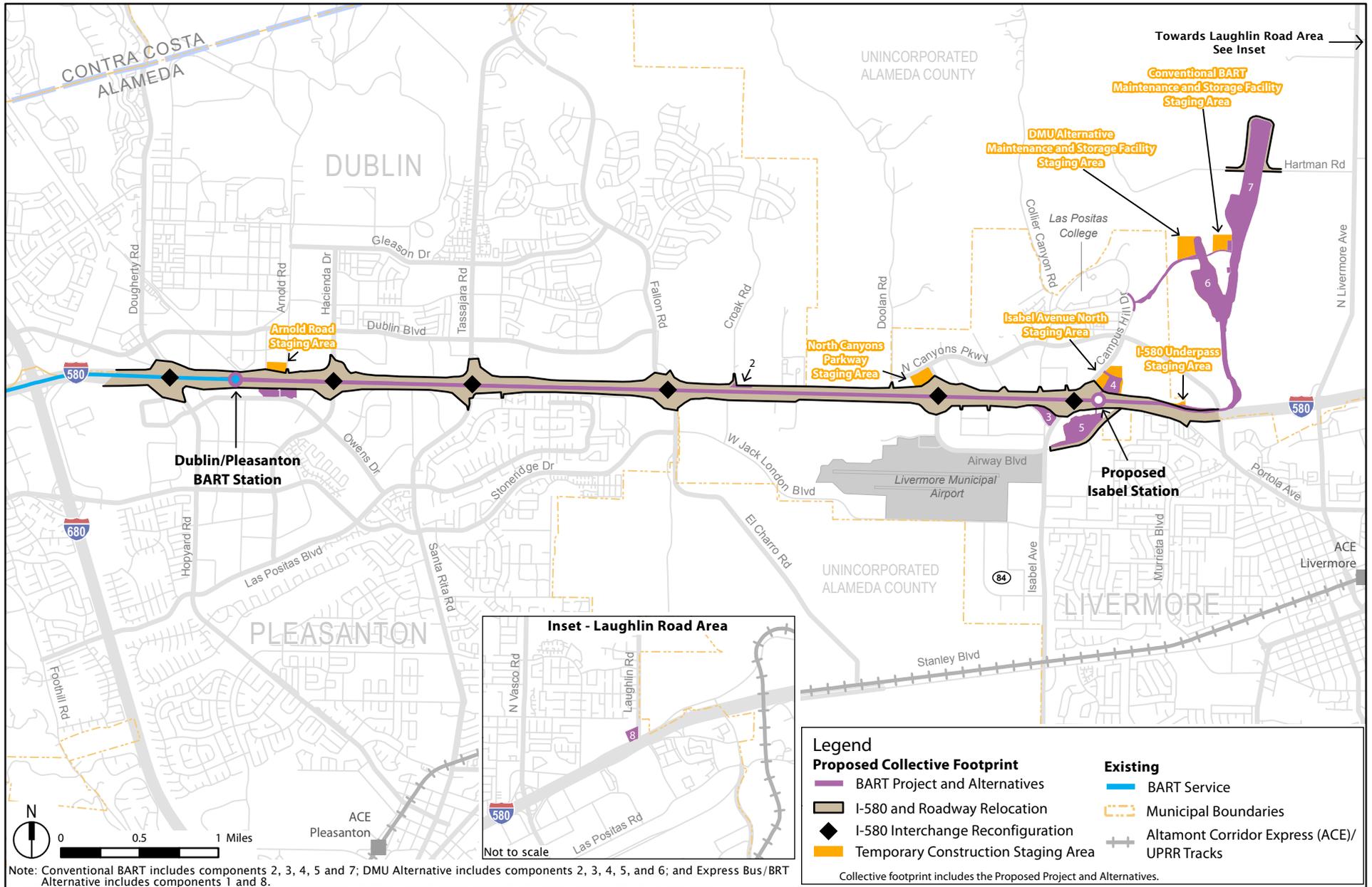
3. Staging Areas and Haul Routes

Construction staging areas would be used for material lay-down, off-site construction activities, storage of construction equipment, temporary offices, and storage of other construction-related materials such as fuel. Several temporary staging areas that might be used during project construction have been identified for the Proposed Project and Build Alternatives, as shown in Figure 2-25. These temporary staging areas are on undeveloped land in close proximity to the project corridor; they would be used in addition to the areas within the permanent project footprint where construction and staging would also occur.

Construction staging areas within the permanent project footprint include the following: (1) the area north of I-580 at Isabel Avenue (north station area); (2) the southwest quadrant of Kitty Hawk Road and Isabel Avenue; (3) the area south of I-580 at Isabel Avenue (south station area); and (4) the storage and maintenance facility area east of Campus Hill Drive. These areas would be used for staging, in addition to the temporary staging areas identified in Figure 2-25. The construction contractor would make the final determination about which staging areas to use, prior to commencement of construction activities.

Temporary staging areas from west to east along the project corridor and potential access to the routes from I-580 are listed below for the Proposed Project:

- Arnold Road Staging Area – North of I-580 and south of Martinelli Way, between Campus Drive and Arnold Road. This staging area is at the western end of the project corridor, northeast of the Dublin/Pleasanton Station. Access from I-580 to this staging area would be from the Hacienda Drive interchange. This staging area could be used under the DMU and Express Bus/BRT alternatives as well.
- North Canyons Parkway Staging Area – North of I-580 and south of North Canyons Parkway, between Airway Boulevard and Doolan Road. Access from I-580 to this staging area would be from the Airway Boulevard or Isabel Avenue interchanges. This staging area would be used under the DMU Alternative as well.
- Isabel Avenue North Staging Area – North of I-580 and east of Isabel Avenue. This staging area would be within the INP area and would serve as a staging area prior to development of the INP. Access from I-580 to this staging area would be principally from the Isabel Avenue interchange. This staging area would be used under the DMU Alternative as well.
- Westbound I-580 Underpass Staging Area – North of I-580 where the proposed BART underpass would re-emerge above ground. This staging area would be used under the DMU Alternative as well.



Source: Arup, 2017b.

Figure 2 - 25
 Proposed Project and Build Alternatives
 Construction Staging Areas

- Storage and Maintenance Facility Staging Area – North of I-580 and northeast of Campus Hill Drive. Two staging areas are identified, one for the Proposed Project and one for the DMU Alternative, to support the construction of the storage and maintenance facility. Access from I-580 would be from Isabel Avenue to Campus Hill Drive.

Construction haul routes would run along I-580 with regional access from I-880 and I-680 to the west and I-5 and I-205 to the east of the project corridor. Isabel Avenue (State Route 84) would provide access to the south of the project corridor. Construction vehicles would generally travel from I-580 on existing surface roads to and from the staging areas to access nearby portions of the project corridor. In addition, North Vasco Road provides access to the Republic Services Vasco Road Landfill.

To reduce traffic-related construction impacts along I-580 and other roadways, major material deliveries and heavy equipment use would be coordinated with Caltrans and the local jurisdictions. The contractor would develop a traffic mitigation plan to address lane closures for construction activities, deliveries, and equipment access. Vehicle and pedestrian movement could be temporarily delayed during construction at various locations along the project corridor. Lane closures would be expected along portions of the surface roads where roadway relocation would occur. Other detours/delays could be expected along segments of I-580, as well as along the cross streets where aerial structures would be constructed.

While haul routes have not been designated, roadways that reduce residential impacts would be used to the fullest extent feasible. These operations are subject to the traffic safety requirements of Caltrans, Alameda County, and the Cities of Dublin, Pleasanton, and Livermore.

4. Equipment, Materials, Excavation, and Haul Trips

Typical equipment for construction of the Proposed Project and Build Alternatives would include excavators, dozers, compactors (including vibratory compactors), loaders, dump trucks, scrapers, graders, pavers, pile drivers, forklifts, and cranes. Other equipment would include drilling rigs; concrete ready-mix trucks; lubrication/fueling service trucks; concrete pumps; specialized truck trailers to deliver precast concrete beams; trucks to deliver forms and reinforcing steel; pavement saws; precast concrete post tensioning jacks; and diesel-driven generators and compressed air units for construction power,

equipment, and tools. Specialized equipment for the BART underpass construction could include water jet excavators and large excavators.³¹

Table 2-12 shows the approximate depth of excavation anticipated for construction of the Proposed Project and Build Alternatives. Generally grading and excavation along the I-580 corridor would extend up to 4 feet below ground surface (bgs). Construction activities at the Dublin/Pleasanton Station, the proposed Isabel Station, and along the tail track (including the westbound I-580 underpass and hillside tunnel) would entail greater amounts of excavation, as shown in Table 2-12, based on types of structure and existing slope at the sites. Furthermore, where piles are needed for structural support, they could be installed up to 60 feet bgs, depending on the final engineering.

The amount of excavation, materials and soils imported and exported for construction, and related truckloads are shown in Tables 2-13 to 2-15. The amount of excavation, soil and demolition export, and on-hauling of soil and construction materials would be greatest for the DMU Alternative, as this alternative would have the greatest amount of construction activity associated with the longer project corridor along I-580. The DMU Alternative includes relocation of I-580 from west of Dougherty Road to the Portola Avenue/I-580 interchange, whereas the Proposed Project includes relocation of I-580 from Hacienda Drive to the Portola Avenue/I-580 interchange, and the Express Bus/BRT Alternative includes relocation of I-580 for a shorter stretch of I-580, from west of Dougherty Road to Tassajara Road/Santa Rita Road.

Overall, construction of the Proposed Project would require approximately 262 truck trips per work day over the construction period.³² These trips would be dispersed along the project corridor, consistent with project phasing. For the other Build Alternatives, truck trips per work day are anticipated to be as follows: 305 truck trips for the DMU Alternative; and 62 truck trips for the Express Bus/BRT Alternative. The Enhanced Bus Alternative would require a very limited number of truck trips compared to the Express Bus/BRT Alternative, as the amount of construction would be substantially less.

³¹ Water jet is a method of excavation that uses a stream of high-pressure water to remove soil rather than standard mechanical chippers.

³² Delivery of each truckload would require a return truck trip; therefore, the truck trip count is double the number of truckloads.

TABLE 2-12 APPROXIMATE DEPTHS OF EXCAVATION FOR CONSTRUCTION OF THE PROPOSED PROJECT AND BUILD ALTERNATIVES

Area/Component	Below Ground Surface (feet)			
	Conventional BART Project	DMU Alternative	Express Bus/BRT Alternative	Enhanced Bus Alternative
Dublin/Pleasanton Station Area				
Transfer platform	--	25*	25*	--
Other areas	4	4*	4*	2
I-580 Corridor Area				
Underpass under westbound I-580	25*	25*	--	--
Isabel Station	10*	10*	--	--
Other areas	4*	4*	4	2
Isabel North and Isabel South Areas				
All areas	4*	4*	--	--
Cayetano Creek Area				
Majority of tail tracks	4*	4*	--	--
Tail tracks (area of slope cut)	up to 23	up to 23	--	--
Tail tracks (hillside tunnel)	up to 70	up to 70	--	--
Storage and Maintenance Facility	up to 28	up to 30	--	--
Laughlin Road Area				
	--	--	4	--

Notes:

-- = Not applicable.

* Areas where piles may be installed for structures up to 60 feet bgs.

TABLE 2-13 CONSTRUCTION QUANTITIES AND TRUCKLOADS FOR CONVENTIONAL BART PROJECT

	I-580 Project Corridor (Hacienda Drive to Isabel Avenue/I-580 Interchange)	Isabel North and South Area (including Station and Parking)	Tail Tracks and Storage and Maintenance Facility
Total Excavation of Soil (cubic yards)	326,442	69,024	1,135,307
Export Materials			
Export Soil (cubic yards)	21,689	27,678	115,954
Export Demolished Material (cubic yards)	75,719	12,089	18,757
Import Materials			
Import Soil (cubic yards)	151,966	75,204	12,561
Import Concrete, Paving Material, Ballast (cubic yards)	274,495	52,525	110,200
Import Steel, Rail, Ties, Rebar (tons)	10,203	2,660	8,217
Truckloads			
Off-Haul	17,626	6,443	16,669
On-Haul	47,791	16,074	11,977
Total Truckloads	65,416	22,516	28,645

Notes: Assumed capacities for dump trucks are 10 cubic yards for soil and 8.5 cubic yards for construction materials. Capacities for other truck types are not noted here. Truckloads are one-way trips; delivery of each truckload would require a return truck trip. Therefore, the truck trip count is double the number of truckloads.

TABLE 2-14 CONSTRUCTION QUANTITIES AND TRUCKLOADS FOR DMU ALTERNATIVE

	Dublin/Pleasanton Station (West of Dougherty Road to Hacienda Drive)	I-580 Project Corridor (Hacienda Drive to Isabel Avenue/I-580 Interchange)	Isabel North and South Area (including Station and Parking)	Tail Tracks and Storage and Maintenance Facility
Total Excavation of Soil (cubic yards)	20,495	446,970	32,846	277,883
Export Materials				
Export Soil (cubic yards)	-	53,226	-	137,452
Export Demolished Material (cubic yards)	-	88,196	12,089	16,292
Import Materials				
Import Soil (cubic yards)	8,993	177,010	113,724	12,561
Import Concrete, Paving Material, Ballast (cubic yards)	7,541	322,913	54,092	92,647
Import Steel, Rail, Ties, Rebar (tons)	1,111	10,222	2,821	6,859
Truckloads				
Off-Haul	194	23,808	3,818	18,648
On-Haul	1,742	57,209	20,129	11,200
Total Truckloads	1,935	81,016	23,946	29,848

Notes: Assumed capacities for dump trucks are 10 cubic yards for soil and 8.5 cubic yards for construction materials. Capacities for other truck types are not noted here. Truckloads are one-way trips; delivery of each truckload would require a return truck trip. Therefore, the truck trip count is double the number of truckloads. Construction quantities and truckloads are the same for the EMU Option.

TABLE 2-15 CONSTRUCTION QUANTITIES AND TRUCKLOADS FOR EXPRESS BUS/BRT ALTERNATIVE

	Dublin/Pleasanton Station (West of Dougherty Road to Hacienda Drive)	I-580 Project Corridor (Hacienda Drive to Tassajara Road/Santa Rita Road)	Laughlin Parking Lot
Total Excavation of Soil (cubic yards)	84,056	71,939	-
Export Materials			
Export Soil (cubic yards)	-	55,897	-
Export Demolished Material (cubic yards)	6,542	12,477	1,780
Import Materials			
Import Soil (cubic yards)	53,624	6,037	-
Import Concrete, Paving Material, Ballast (cubic yards)	49,517	48,228	5,335
Import Steel, Rail, Ties, Rebar (tons)	1,853	492	-
Truckloads			
Off-Haul	2,169	8,604	315
On-Haul	11,807	6,844	734
Total Truckloads	13,975	15,448	1,049

Notes: Assumed capacities for dump trucks are 10 cubic yards for soil and 8.5 cubic yards for construction materials. Capacities for other truck types are not noted here. Truckloads are one-way trips; delivery of each truckload would require a return truck trip. Therefore, the truck trip count is double the number of truckloads.

5. Project Workforce

The construction workforce for the Proposed Project is expected to consist of several hundred workers per day, depending on the construction phase, and would vary by location along the alignment. Worker shifts would be 8 hours on average. Staff parking would be located at common staging areas for the duration of construction. Additionally, construction staff parking would be located in staging and spoils areas at the sites.

The construction workforce for the DMU Alternative would be similar to the workforce for the Proposed Project. The Express Bus/BRT Alternative and the Enhanced Bus Alternative would have fewer workers per day than the Proposed Project.

6. Utilities Relocation

Utilities located in the project footprint would be relocated prior to construction of the Proposed Project, as needed. Temporary utilities for electricity and water would be provided to the staging areas during the construction phases. New utility infrastructure—including water, power, communication, and sewer utilities—would be required for the Isabel Station and north and south station area improvements, including the pedestrian touchdown structure, south station area parking facility, wayside facilities, and storage and maintenance facility. See Section 3.P, Utilities, of this EIR for additional information.

7. Coordination with Caltrans and Local Cities

I-580 is a Caltrans facility and the ROW is owned by Caltrans. Therefore, coordination with Caltrans would be essential throughout the design and construction of the Proposed Project. Throughout construction, primary access to the median work areas and median station sites would be through interior I-580 eastbound and westbound traffic lanes. Temporary openings would be made in the existing concrete barriers to allow for vehicle and equipment access. These openings, wherever necessary, would be subject to direct authorization from Caltrans for configuration and traffic safety. In work areas that do not have existing barriers, construction areas would be separated from the vehicular traffic by (K-rail) barriers. Vehicle and pedestrian movement on overpasses (for example, Isabel Avenue) could be delayed during certain construction activities. These construction operations would be subject to the traffic safety requirements of Caltrans.

In addition, BART and its construction contractors would coordinate with the Cities of Dublin, Pleasanton, and Livermore, and with Alameda County, on activities related to construction in their jurisdictions, including for possible encroachment permits for construction within city-owned ROWs. Table 1-1 in Chapter 1, Introduction, shows a list of cities and other agencies with which BART would coordinate regarding the Proposed Project and/or Build Alternatives.

H. SUSTAINABILITY

The Proposed Project and Build Alternatives represent an opportunity to implement sustainable design innovations related to energy conservation, alternative energy systems, stormwater management, and judicious material selection that were not available when the original BART system was constructed. The facilities would incorporate a number of sustainable elements into the project design, and a variety of other sustainable practices are being considered. During the final design of the Proposed Project or an Alternative, the particular sustainable designs and practices would be determined.

The following design features would be included:

- High-efficiency lighting and lighting control methods to reduce electricity consumption.
- Reduction in light spillage (and energy) through use of appropriate fixtures and lower lumens.
- Photovoltaics to generate electricity and reduce reliance on the power grid. As described for the Proposed Project and DMU Alternative above, solar panels with a photovoltaic capacity of approximately 1,000 kW would be installed on the Isabel Station parking structure.
- Energy efficient systems such as solar hot water, more efficient HVAC (heating, ventilation, and air conditioning), and elevators/escalators, where feasible.
- Xeriscaping and other drought-tolerant landscaping.
- Use of recycled water in landscaping, as available.
- Swales to treat runoff from parking lots and other hardscape areas.
- Waste management and recycling.
- Use of recycled materials where feasible.
- Other sustainable technologies or practices that become feasible or required at the time the system is in final design.

Other sustainable features could include:

- Electric car charging ports
- Lighter color aggregate or cool pavement technologies for parking lots and other paved surfaces to reduce the heat island effect
- Signage and other educational tools about sustainable methods

- Vehicle-to-grid system charging³³

I. PROJECTED RIDERSHIP

The BLVX Travel Demand Model, a version of the Alameda County Transportation Commission travel demand model customized for the BART to Livermore Extension Project, was used to forecast station-to-station origin-destination ridership for all of the project alternatives under each analyzed scenario.³⁴

Estimated ridership for the entire BART system is presented in Table 2-16 and estimated ridership at the Tri-Valley Area BART stations—existing West Dublin/Pleasanton and Dublin/Pleasanton stations and proposed Isabel Station—is presented in Table 2-17.

TABLE 2-16 EXISTING AND FUTURE BART SYSTEMWIDE DAILY RIDERSHIP (WEEKDAY)

Year	Total Ridership (Change from No Project)				
	No Project Alternative	Conventional BART Project	DMU Alternative	Express Bus/BRT Alternative	Enhanced Bus Alternative
Existing Ridership (2013)	400,400	--	--	--	--
Projected Ridership 2025	472,200	478,800 (+6,600)	477,200 (+5,000)	473,900 (+1,700)	472,200 (0)
Projected Ridership 2040	657,300	669,200 (+11,900)	664,300 (+7,000)	669,800 (+3,500)	657,700 (+400)

Notes:

-- = Not applicable.

Ridership refers to the number of linked trips on the BART system; a theoretical passenger boarding the Dublin/Pleasanton-Daly City Line at the Dublin/Pleasanton Station and transferring at the Coliseum BART Station to the Richmond-Fremont Line would count as one trip. Net change in ridership compared to the No Project Conditions is shown in parentheses (positive values indicate an increase in ridership).

Source: Cambridge Systematics, 2017.

³³ Vehicle-to-grid system charging is a system in which plug-in electric vehicles communicate with the power grid to return electricity to the grid.

³⁴ Cambridge Systematics, 2017. BART to Livermore Ridership Projections (Draft). July.

TABLE 2-17 EXISTING AND FUTURE TRI-VALLEY AREA DAILY BOARDINGS (WEEKDAY)

Total Boardings by Station (Change from No Project)				
	West Dublin/ Pleasanton	Dublin/ Pleasanton	Proposed Isabel Station	Total Tri-Valley
Existing (2013)				
	3,000	7,300	N/A	10,300
Projected Boardings 2025				
No Project Alternative	3,100	8,300	--	11,400
Conventional BART Project	3,100	7,200	4,700	15,000 (+3,600)
DMU Alternative	3,100	7,900	3,100	14,100 (+2,700)
Express Bus/ BRT Alternative	3,100	9,300	--	12,400 (+1,000)
Enhanced Bus Alternative	3,100	8,300	--	11,400 (0)
Projected Boardings 2040				
No Project Alternative	3,400	10,800	--	14,200
Conventional BART Project	3,600	9,000	8,100	20,700 (+6,500)
DMU Alternative	3,500	9,800	4,800	18,100 (+3,900)
Express Bus/BRT Alternative	3,400	12,700	--	16,100 (+1,900)
Enhanced Bus Alternative	3,500	10,900	--	14,400 (+200)

Notes:

-- = Not applicable.

Net change in ridership compared to the No Project Conditions is shown in parentheses (positive values indicate an increase in ridership).

Sources: Cambridge Systematics, 2017.

Ridership as reported in this table represents the number of trips taken on the BART system itself. For the Proposed Project, a rider boarding at the new Isabel Station and getting off at the Embarcadero Station represents one trip. For the DMU Alternative, a rider boarding at the Isabel Station, taking the DMU to the Dublin/Pleasanton Station, boarding BART and getting off at the Embarcadero Station represents one trip. In addition, for purposes of this ridership table, a rider taking the DMU for one stop, from the Isabel Station to the Dublin/Pleasanton Station, also counts as one trip on the BART

system. For the Express Bus/BRT Alternative and Enhanced Bus Alternative, a rider taking the bus to the Dublin/Pleasanton Station, boarding BART and getting off at the Embarcadero Station represents one trip. For the DMU Alternative, Express Bus/BRT Alternative, and Enhanced Bus Alternative, BART ridership would increase from the riders connecting to BART via those alternatives.

Overall, systemwide ridership is expected to grow approximately 18 percent from 2013 to 2025, and then to accelerate to nearly 40 percent from 2025 to 2040, a trend that reflects land use growth expectations. The Proposed Project would result in the highest systemwide ridership in both 2025 and 2040. In 2040, the Proposed Project would generate 11,900 more BART trips than would occur without the project. The alternatives would add fewer net new trips in 2040 to the BART system than the Proposed Project, as follows: (1) the DMU Alternative would add 7,000 new BART trips; (2) the Express Bus/BRT Alternative would add 3,500 new trips; and (3) the Enhanced Bus Alternative would add 400 new trips. Ridership comparisons of different alternatives for 2025 yield similar trends to those for 2040.

The Proposed Project would also result in the greatest increase in the number of new boardings in the Tri-Valley BART stations in 2025 and 2040. In 2040, the Proposed Project would result in 6,500 new boardings. New boardings for the alternatives would be as follows: (1) DMU Alternative – 3,900 new boardings; (2) Express Bus/BRT Alternative – 1,900 new boardings; and (3) Enhanced Bus Alternative – 200 new boardings. A more detailed description of ridership for the Proposed Project and Build Alternatives is provided in Section 3.B, Transportation, of this Draft EIR.

J. COSTS AND FUNDING

The estimated costs for construction, operation, and maintenance of the Proposed Project and Build Alternatives are summarized below, followed by a discussion of known funds and funding sources. Cost estimates are based on the preliminary engineering completed for the Proposed Project and Build Alternatives.

1. Capital Costs

The total estimated capital costs for the Proposed Project and Build Alternatives are presented in Table 2-18. The Proposed Project's capital cost is approximately \$1,635 million (cost escalated to the mid-point of construction); the DMU Alternative's capital cost is approximately \$1,599 million; the EMU Option's capital cost is approximately \$1,665 million; the Express Bus/BRT Alternative's capital cost is approximately \$376 million; and the Enhanced Bus Alternative's capital cost is approximately \$25 million.

TABLE 2-18 ESTIMATED CAPITAL COSTS FOR THE PROPOSED PROJECT AND BUILD ALTERNATIVES

	Dollars (\$ Millions)				
	Conventional BART Project	DMU Alternative	EMU Option	Express Bus/BRT Alternative	Enhanced Bus Alternative
Guide-Way and Track Elements	\$38	\$39	\$44	\$0.7	--
Stations and Parking	\$153	\$148	\$148	\$26	\$6
Support Facilities (includes tail tracks and storage and maintenance facility)	\$112	\$107	\$108	--	--
Site Work (includes relocating I-580 and frontage roads, relocating utilities, and environmental mitigations)	\$89	\$99	\$99	\$32	\$0.5
Systems (includes communications, traction power, wayside facilities, and train control)	\$95	\$60	\$87	\$14	\$1
Subtotal - Construction Cost (2016\$)	\$487	\$454	\$485	\$72	\$8
ROW Acquisition	\$101	\$130	\$130	\$40	--
Purchase of Vehicles	\$191	\$176	\$176	\$70	\$5
Professional Services (includes design and engineering and project and construction management)	\$248	\$240	\$249	\$57	\$4
Contingency	\$181	\$181	\$190	\$38	\$3
Program Reserve	\$121	\$118	\$123	\$28	\$2
Total Cost (2016\$)	\$1,329	\$1,300	\$1,353	\$305	\$21
Total Cost (escalated to construction mid-point)	\$1,635	\$1,599	\$1,665	\$376	\$25

Notes:

Estimates are based on primary engineering. Costs are based on 2016 dollars. Numbers are rounded to the nearest million and the sum of the values may not exactly match the totals. Total project cost is escalated to the estimated mid-point of construction (2024).

Sources: Arup, 2017c; BART, 2017a.

The capital costs for the Proposed Project and Build Alternatives differ primarily based on the length of the rail alignment to be constructed and the length of the I-580 corridor that would require modifications to accommodate the Proposed Project and Build Alternatives. Specifically, the DMU Alternative would have the longest work zone along I-580, followed

by the Proposed Project, with a substantially shorter work zone under the Express Bus/BRT Alternative, and no work along I-580 under the Enhanced Bus Alternative. In addition, the size of the storage and maintenance facility affects the cost of construction; e.g., the Proposed Project has a substantially larger facility than the DMU Alternative. The EMU Option has increased costs compared to the DMU Alternative due to the additional infrastructure needed for electrification, i.e., the catenary system and wayside facilities.

The capital cost for the Proposed Project includes 25 percent of the cost to include a BART storage and maintenance facility. A BART storage and maintenance facility is needed to service the overall future needs of the Daly City-Dublin/Pleasanton Line.

2. Operating and Maintenance Costs

The total estimated annual operating costs for the Proposed Project and Build Alternatives in 2025 and 2040 are presented in Table 2-19. Operating and maintenance costs in 2025 and 2040 are as follows for the Proposed Project and Build Alternatives:

- **Conventional BART Project.** Approximately \$19.0 million in 2025 and \$22.8 million in 2040
- **DMU Alternative.** Approximately \$14.5 million in 2025 and \$16.8 million in 2040
- **EMU Option.** Approximately \$14.3 million in 2025 and \$16.6 million in 2040
- **Express Bus/BRT Alternative.** Approximately \$2.1 million in 2025 and \$3.0 million in 2040
- **Enhanced Bus Alternative.** Approximately \$1.7 million in both 2025 and 2040

Operating and maintenance costs are higher for the Proposed Project and Build Alternatives in 2040 than in 2025 due to the higher level of service to accommodate increased ridership and the higher cost of providing service.

Similar to the capital cost, the operating cost for the Proposed Project includes a 25 percent allocation of the cost to operate a BART maintenance facility.

3. Funding

As of 2016, approximately \$533 million in funding has been committed to the design and construction of the BART to Livermore Extension Project. Committed project funding is provided by a combination of revenues from local impact fees, Alameda County use tax, and State and regional funds.

These sources would provide funds for the adopted project's capital costs. The largest source of secured funding comes from the Alameda County Transportation Commission Measure BB, which provides approximately \$398 million to the Proposed Project or Alternatives, as reflected in the 2014 Alameda County Transportation Expenditure Plan.

TABLE 2-19 OPERATING AND MAINTENANCE COSTS FOR THE PROPOSED PROJECT AND BUILD ALTERNATIVES

	Dollars (\$ Millions)				
	Conventional BART Project	DMU Alternative	EMU Option	Express Bus/BRT Alternative	Enhanced Bus Alternative
2025					
Rail (BART and DMU or EMU)	17.4	12.9	12.8	0.5	0
Bus	1.6	1.6	1.6	1.6	1.7
Total Operation and Maintenance Cost (2016\$)	19.0	14.5	14.4	2.1	1.7
2040					
Rail (BART and DMU or EMU)	21.1	15.2	15.0	1.4	0
Bus	1.6	1.6	1.6	1.6	1.7
Total Operation and Maintenance Cost (2016\$)	22.8	16.8	16.6	3.0	1.7

Notes: Costs are based on 2016 dollars. Numbers are rounded to the nearest million and the sum of the values may not exactly match the totals.

Source: Arup, 2017d; BART, 2017b.

The funding sources and amounts are identified below.

- **Alameda County Transportation Commission Measure BB (\$398 million).** On November 4, 2014, Alameda County voters approved an extension of an existing 0.5 percent transactions and use tax through March 31, 2045, and an increase to the transactions and use tax by 0.5 percent, resulting in a total tax of 1 percent, and authorization for the ACTC to issue limited tax bonds. Measure BB funds the 2014 Transportation Expenditure Plan, which includes funding for a BART extension to Isabel Avenue using the most efficient transit technology.
- **Metropolitan Transportation Commission Assembly Bill 1171 (\$80 million).** Assembly Bill 1171 was adopted by the State legislature in 2001 to fund the cost of the seismic retrofit of Bay Area toll bridges and imposed an indefinite extension of the current \$1 surcharge on State-owned toll bridges in the Bay Area. Approximately \$80 million of these bridge tolls have been set aside for funding the design and construction of the Proposed Project and Build Alternatives.
- **Livermore Traffic Impact Fee Program (\$40 million).** As a result of increasing regional growth, significant residential, commercial, and industrial development within the city of Livermore, the Livermore City Council adopted a traffic impact fee for development in 1988. The impact fee is intended to help reduce adverse traffic-related

impacts associated with the increasing growth in the area. The City of Livermore has programmed \$40 million of projected program funding to the capital costs of the Proposed Project only. Without further analysis, funding from this source could not be used on any of the Build Alternatives. Funding from this program can only be expended on project elements within the city of Livermore.

- **Metropolitan Transportation Commission Regional Measure 1 (\$15 million).** In 1988, Regional Measure 1 established a uniform \$1 base toll on the Bay Area's seven State-owned toll bridges. Approximately \$15 million of these bridge tolls have been set aside for funding of the Proposed Project and Build Alternatives.

The remaining funding required for the Proposed Project and Build Alternatives has yet to be determined.

K. ALTERNATIVES CONSIDERED BUT WITHDRAWN

Alternatives that are considered but withdrawn are required to be analyzed per CEQA Guidelines Section 15126.6(c), which states that the EIR should briefly discuss the rationale for selecting the alternatives to be discussed. The EIR should also identify any alternatives that were considered by the lead agency but rejected as infeasible during the scoping process, and then briefly explain the reasons underlying the lead agency's determination. Additional information explaining the choice of alternatives may be included in the administrative record. Factors that may be used to eliminate alternatives from detailed consideration in an EIR include (1) failure to meet most of the project objectives; (2) infeasibility; and (3) inability to avoid significant environmental impacts.

This subsection does not list the alternative alignments that were considered in the PEIR, but rather focuses on the variants to the Proposed Project and two of the project-specific Build Alternatives (the DMU Alternative and Express Bus/BRT Alternative) that were considered but rejected, and describes the reasons why they were withdrawn from consideration.

1. Variants to the Conventional BART Project

As described below and listed in Table 2-20, variants to the Proposed Project include one or more of the following elements: (1) different vertical alignments for the BART tracks, such as elevated (aerial) tracks or underground tracks instead of the proposed at-grade tracks; (2) different horizontal alignments for the BART tracks, such as locations north of I-580 or south of I-580 instead of in the I-580 median; (3) different locations for the storage and maintenance yard; (4) increased parking supply at the proposed Isabel Station; (5) elevated bus connections at the proposed Isabel Station instead of via the north Isabel Station bus transfer facility; and (6) an aerial structure over I-580 instead of

an underpass for the tail track connection to the storage and maintenance yard. The cost of these variants relative to the Proposed Project is provided, where available.³⁵

TABLE 2-20 VARIANTS TO THE CONVENTIONAL BART PROJECT – CONSIDERED BUT WITHDRAWN

Variant	Location of Variant^a	Reasons for Rejection
Elevated BART Tracks	Entire alignment	<ul style="list-style-type: none"> ▪ Greater visual impacts ▪ Increased cost ▪ Reduced opportunity for TOD (north of I-580 variant) ▪ Possible conflict with Federal Aviation Administration requirements (south of I-580 variant)
Underground BART Tracks	Entire alignment	<ul style="list-style-type: none"> ▪ Increased cost ▪ Similar or increased ROW impacts (cut and cover tunnel)
At-Grade Tracks, North of I-580 from Tassajara Road to Isabel Station	North of I-580 from Tassajara Road to Isabel Station	<ul style="list-style-type: none"> ▪ ROW impacts would be disproportionately concentrated north of I-580 ▪ Station would occupy land planned for development
Storage and Maintenance Facility Locations	Various locations along the alignment	<ul style="list-style-type: none"> ▪ Operational performance deficiencies (Location 1) ▪ Conflicts with local zoning (Location 1) ▪ Increased cost (Location 3) ▪ Significant visual impacts (Location 3)
Larger Parking Facility	Isabel Station	<ul style="list-style-type: none"> ▪ Increased visual impacts ▪ Conflict with Station Access Policy ▪ Unnecessary to meet projected demand ▪ Increased cost
Elevated Bus Connections	Isabel Station	<ul style="list-style-type: none"> ▪ Increased costs ▪ Minimal increase in ridership
Aerial Tail Track Structure over I-580	West of the Portola Avenue overcrossing	<ul style="list-style-type: none"> ▪ Increased visual impacts

Note:

^a Location of Variant = along entire alignment (Dublin/Pleasanton Station to proposed Isabel Station) or portion of the alignment.

Sources: Arup, 2013; Arup, 2014; Arup, 2015b; Arup, 2017a; BART, 2016.

³⁵ The cost of the variants is compared to the unescalated capital cost of the Proposed Project (\$1.329 billion). See Chapter 2, Project Description, for further detail.

a. Elevated BART Tracks

The three variants described below include an aerial (or elevated) BART track alignment instead of the at-grade alignment of the Proposed Project.³⁶ In addition, two of the variants include different horizontal alignments for the tracks, either north of I-580 or south of I-580 instead of in the I-580 median as under the Proposed Project. These variants would extend BART service approximately 5.5 miles from the Dublin/Pleasanton Station to the proposed Isabel Station as follows:

- **Aerial Track North of I-580.** This variant would consist of an elevated BART track north of I-580. The elevated section of the track would extend from east of Hacienda Drive to the proposed Isabel Station, which would be located north of I-580 instead of in the I-580 median. An aerial flyover structure would be required east of Hacienda Drive to connect the existing tracks in the median of I-580 to the elevated guideway on the north side of I-580. The elevated guideway would traverse above the on- and off-ramps and roadways at the I-580 interchanges at Tassajara Road/Santa Rita Road, Fallon Road/El Charro Road, Airway Boulevard, and Isabel Avenue by approximately 25 to 35 feet above grade.

The aerial track would require approximately 10 feet of ROW, which would be less than the ROW required for the Proposed Project (approximately 46 feet). In addition, under this variant, the location of the proposed Isabel Station north of I-580 (instead of in the I-580 median) would result in increased engineering challenges should BART ever be extended beyond the Isabel Station. The Isabel Station would occupy undeveloped land that is currently being planned for development as part of the City of Livermore's INP, reducing the opportunities for TOD, which is one of the project objectives. The Aerial Track North of I-580 variant would cost approximately 7 percent or \$93 million more than the Proposed Project.³⁷

- **Aerial Track South of I-580.** This variant would consist of an elevated BART track south of I-580. The elevated section of the track would extend from east of Hacienda Drive to the proposed Isabel Station, which would be located south of I-580 instead of in the I-580 median. An aerial flyover structure would be required east of Hacienda Drive to connect the existing tracks in the median of I-580 to the elevated guideway on the south side of I-580. The elevated guideway would traverse above the on- and off-ramps and roadways at the I-580 interchanges by approximately 25 to 55 feet above grade.

³⁶ Arup, 2013. BLVX Alternatives Analysis, Alternative Analysis Scoping Summary (Draft). December.

³⁷ Amounts are in 2016 dollars.

Similar to the variant north of I-580, the aerial track would require approximately 10 feet of ROW, which would be less than the total ROW required for the Proposed Project (approximately 46 feet). The aerial structure south of I-580 would be in the vicinity of the Livermore Municipal Airport. Compliance with Federal Aviation Administration regulations may affect the viability of this variant. An aerial track south of I-580 would have greater ROW requirements and cost than an aerial track north of I-580, because the area south of I-580 has more development than the area north of I-580.

- **Aerial Track in I-580 Median.** This variant would consist of an elevated BART track in the I-580 median extending BART service from the Dublin/Pleasanton Station to the proposed Isabel Station. The elevated section would extend from east of Hacienda Drive to the proposed Isabel Station. The elevated guideway would traverse above the road overcrossings at the I-580 interchanges by approximately 25 to 55 feet above grade. This variant would require less widening of the I-580 ROW to accommodate the columns and structures to support the BART tracks (approximately 12 feet) than would the Proposed Project (approximately 46 feet). The Aerial Track in I-580 Median variant would cost approximately 35 percent or \$465 million more than the at-grade design of the Proposed Project.³⁸

The variants outside the I-580 median would require less relocation of I-580 and would result in a shorter construction duration than the Proposed Project. Furthermore, BART riders would have a more pleasant station experience while waiting for trains on the Isabel Station platform because it would not be located in the I-580 median.

The elevated BART track variants were rejected from further consideration because the height of the elevated structures above the freeway interchanges would result in substantially greater adverse visual impacts than the Proposed Project. In addition, the Aerial Track North of I-580 variant would require the station to occupy undeveloped land that is currently being planned for development as part of the INP, reducing the opportunities for TOD, which is one of the project objectives. The Aerial Track South of I-580 variant would cause greater disruption to existing and planned land uses because there is more development south of I-580 where all right-of-way acquisition would occur. Lastly, all three variants would both cost more than the Proposed Project.

b. Underground BART Tracks

Underground tracks were considered for the BART track alignment instead of the at-grade alignment under the Proposed Project.³⁹ Under this variant, BART service would also be

³⁸ Amounts are in 2016 dollars.

³⁹ Arup, 2013. BLVX Alternatives Analysis, Alternative Analysis Scoping Summary (Draft). December.

extended approximately 5.5 miles from the Dublin/Pleasanton Station to the proposed Isabel Station, similar to the Proposed Project. Two different construction techniques were considered for the underground tracks, as described below.

- **Bored Tunnel.** The tunnel boring technique entails the use of a boring machine to drill or excavate a tunnel horizontally underground through the soil. Launching and receiving pits are required for the start and end of the tunnel. The boring machine is placed in the launch pit, from which the machine proceeds to remove soils. As the machine bores, tunnel liner segments are fixed and bolted into place behind it, forming the inside wall of the tunnel. Bore launching/reception pits, located within the I-580 median, would be required to accommodate the boring machine, requiring approximately 80 feet of ROW acquisition at these locations. The Bored Tunnel variant is estimated to cost approximately 150 percent or \$1.99 billion more than the at-grade design of the Proposed Project.⁴⁰
- **Cut and Cover Tunnel.** With this construction technique, the ground is excavated, and the tunnel (subway) is built inside an excavation. Once construction is complete, the tunnel is covered over with backfill material (such as soils). It typically involves installation of shoring or retaining walls, excavation for the trench, construction of the tunnel within the trench, covering the tunnel with soils, and restoration of the surface. This construction technique would require widening I-580 to make room for the excavation. Thus, it needs as much ROW acquisition, if not more, than the Proposed Project, increasing impacts to adjacent land uses. The Cut and Cover Tunnel would cost approximately 37 percent or \$492 million more than the Proposed Project.⁴¹

The underground track variants would have impacts to the existing I-580 roadway interchange foundations that extend beneath the I-580 median, requiring the relocation or reconstruction of support columns. The underground BART track variants were rejected from further consideration because the cost would be substantially greater than the Proposed Project, and in the case of the Cut and Cover Tunnel variant, it would increase ROW impacts.

c. At-Grade Tracks, North of I-580 from Tassajara Road to Isabel Station

This variant would entail at-grade tracks similar to the Proposed Project. The tracks would be within the I-580 median from the Dublin/Pleasanton Station to just east of the Tassajara Road/Santa Rita Road interchange. At that point, the tracks would cross to the north of I-580 and continue adjacent to I-580 to the proposed Isabel Station. Under this variant, the proposed Isabel Station would be located north of I-580 instead of in the I-580

⁴⁰ Amounts are in 2016 dollars.

⁴¹ Amounts are in 2016 dollars.

median. An underpass below I-580, approximately 1,300 feet long, would be required to connect the tracks from the median to north of I-580. Short tunnels would also be needed for the BART tracks to pass below the I-580 on- and off-ramps at three interchanges.⁴²

BART tracks north of I-580 would require less relocation of I-580 lanes, shortening the overall construction schedule by approximately 1.5 years and would require less coordination with Caltrans. Furthermore, under this variant, BART riders would have a more pleasant station experience while waiting for trains on the Isabel Station platform because it would not be in the I-580 median.

As described above, although the area north of I-580 is generally less developed than the area south of I-580 along this portion of the alignment, the variant would still result in disruption of existing and planned land uses. Under the Proposed Project, the total ROW widening would be split between the north and south of I-580; however, under this variant, all of the ROW acquisition would occur north of the freeway, disproportionately affecting uses there. In addition, under this variant, the location of the proposed Isabel Station north of I-580 (instead of in the I-580 median) would result in increased engineering challenges should BART ever be extended beyond the Isabel Station. A station north of I-580 would occupy undeveloped land that is currently being planned for development as part of the INP, reducing the opportunities for TOD, which is one of the project objectives. This variant is estimated to have similar costs to the Proposed Project.

For the above reasons, the at-grade BART alignment north of I-580 was rejected from further consideration.

d. Storage and Maintenance Facility Locations

Several locations were considered for a BART storage and maintenance facility. Initially, the BART facility was to be only a storage yard, but as project plans evolved, BART incorporated a combined storage and maintenance facility into the Proposed Project. Although it is possible to have a stand-alone storage yard, operationally, it is more efficient to locate a storage yard and maintenance facility together. Such co-location reduces unnecessary non-revenue travel time. BART currently does not have a maintenance facility at the east end of the Daly City-Dublin Pleasanton Line; BART cars travel to either the Daly City Yard or the Hayward Maintenance Complex for service. This results in increased car mileage that could be avoided and longer times that BART cars are out of revenue service.

⁴² Arup, 2014. BLVX DMU Median vs. North Conceptual Cost Comparison. October 13.

[Note: Although this document pertains to the DMU Alternative, a similar variant was considered for the Proposed Project.]

Several potential locations were considered for the BART storage yard, which were narrowed to three sites (as shown in Figure 2-26), all north of I-580. The potential locations are as follows: north of I-580 and east of Croak Road near Cottonwood Creek and Doolan Canyon (Location 1); approximately 0.6 mile north of I-580 and east of Portola Avenue in the vicinity of Cayetano Creek (Location 2); and immediately north of I-580 and west of North Livermore Avenue (Location 3). Initially, BART performed a siting analysis for a stand-alone storage yard, and Location 2 along Cayetano Creek was considered the best choice among candidate sites.⁴³ As the design evolved into a combined storage and maintenance facility, an additional siting analysis was not conducted because the basic criteria for the combined site were the same as for the storage yard: undeveloped land, relatively level terrain, access from the median of the freeway, and limited grading. Many of the same factors relevant to the additional maintenance facility element for the Proposed Project had already been evaluated in the siting analysis for the DMU maintenance facility, as discussed below in the Variants to the DMU Alternative subsection. Location 2 continued to be the best choice for the combined BART storage and maintenance facility, and it has been incorporated into the Proposed Project.

Location 1 was not chosen because it would entail operational challenges due to BART cars needing to travel on mainline tracks from the Isabel Station west to the storage yard, which could interfere with revenue operations. In addition, Location 1 is considered unacceptable by the City of Dublin because it would require acquiring land that is currently zoned for commercial and industrial uses. Location 3, immediately north of I-580, would require extensive earthworks involving cutting into a steep hillside parallel to I-580. This would result in a significant visual impact, as well as substantially increased project costs. Location 3 would increase the project cost by approximately \$149 million or 11 percent.⁴⁴

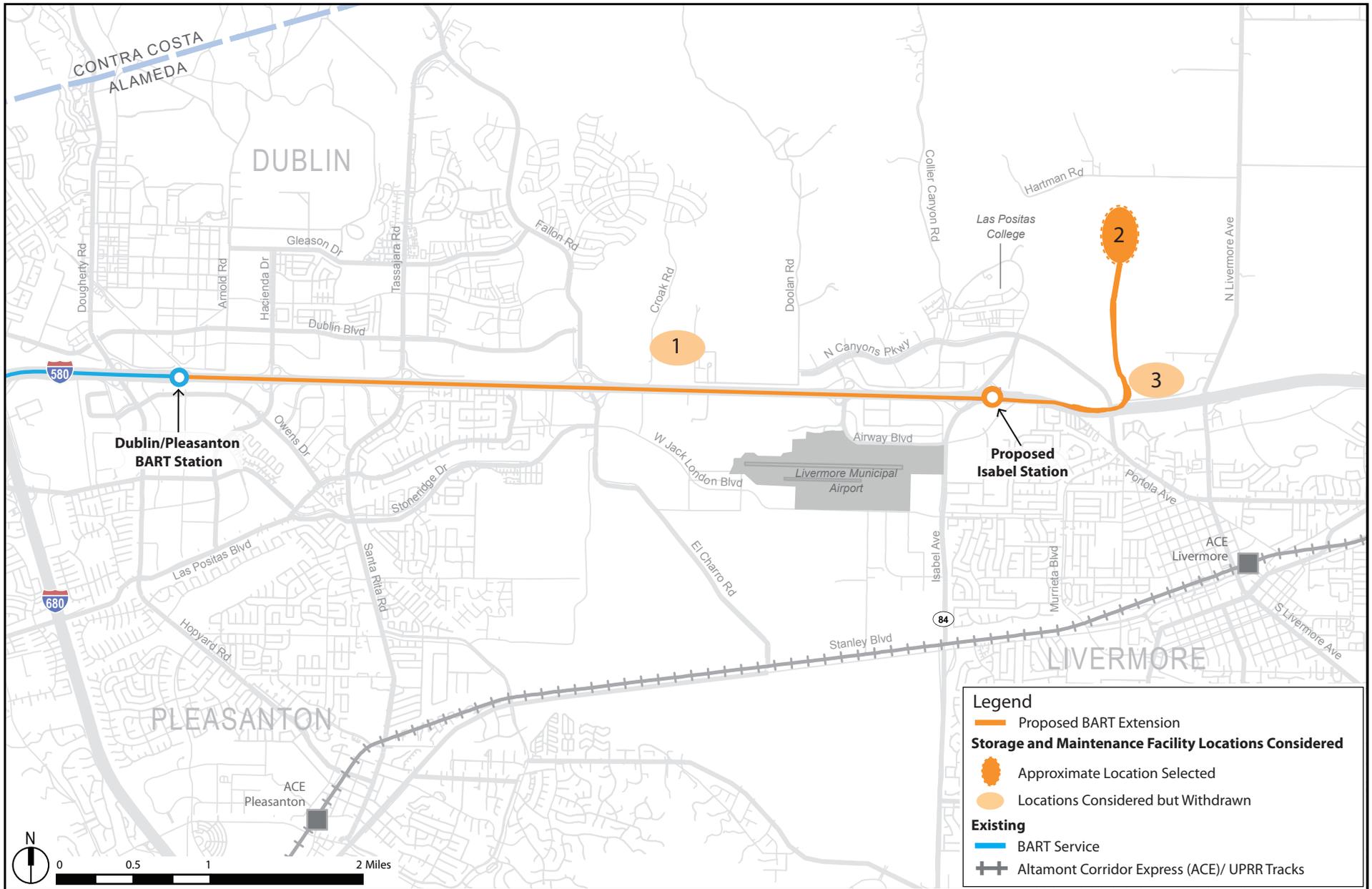
For the reasons presented, the alternative storage yard locations described above were rejected from further consideration.

e. Larger Parking Facility at Isabel Station

The larger parking facility variant at the proposed Isabel Station would entail the construction of a substantially larger number of parking spaces than under the Proposed Project. This variant was considered in response to scoping period comments regarding maximizing parking at the Isabel station. Additional spaces could be provided on site by either adding additional levels to the parking structure and/or providing structured

⁴³ Arup, 2015b. BART Storage Track Locations. July 13.

⁴⁴ Amounts are in 2016 dollars.



Source: Arup, 2017b.

Figure 2 - 26
 Alternatives Considered but Withdrawn
 Locations Considered for the BART Storage and Maintenance Facility

parking over the areas planned for surface parking. As described in Section 3.B, Transportation, the amount of parking at the proposed Isabel Station was chosen to satisfy all the demand for parking projected in 2040 by the Travel Demand Model. Based on the origins and destinations of passengers most likely to use the Isabel Station, the Travel Demand Model forecast that parking demand would be for 3,200 spaces in 2040. Therefore, the 3,412 parking spaces at the Isabel Station included in the Proposed Project would satisfy the demand.

Any parking spaces beyond 3,412 spaces are projected to remain unoccupied. Constructing substantially more parking would not result in any additional ridership and would increase the cost of the Proposed Project. Furthermore, constructing substantially more parking would result in a correspondingly larger physical footprint compared to the Proposed Project and entail an increase in environmental impacts, including visual impacts.

BART prioritizes investments in station access based on its Station Access Policy, adopted June 9, 2016, and further described in Section 3.B, Transportation.⁴⁵ The proposed Isabel Station is designated as an auto-dependent station. For auto-dependent stations, the primary investment mode is walking, and the secondary investment modes are biking, drop-off, auto parking and transit. Furthermore, the Station Access Policy has the following two goals:

- A3. Prioritize the most sustainable access modes, with a focus on the lowest greenhouse gas and pollutant emissions per trip.
- A4. Reduce the access mode share of the automobile by enhancing multi-modal access to and from BART stations in partnership with communities and access providers.

Building more parking than the projected demand would conflict with the above goals of the Station Access Policy. For these reasons, the larger parking facility variant at the proposed Isabel Station was rejected from further consideration.

As described for the Proposed Project in Chapter 2, Project Description, while the Isabel Station parking facility has been designed to accommodate the anticipated demand, unanticipated demand for parking could exceed supply in the future. To address this possibility, the Isabel Station parking garage would be designed to accommodate the potential future construction of two additional levels of parking if demand were to increase.

⁴⁵ San Francisco Bay Area Rapid Transit District (BART), 2016. BART Station Access Policy. Available at: <http://www.bart.gov/about/planning/access>. Accessed June 2017.

f. Elevated Bus Connections at Isabel Station

Two different bus-to-BART connections were considered for the proposed Isabel Station. Both of the options included a widening of Isabel Avenue to allow bus stops directly above the station; one featured a direct bus ramp to Isabel Avenue above the station and the other featured no direct ramp. For comparison, the Proposed Project would not include a direct ramp, but would provide access to the proposed bus transfer facility north of I-580 from the existing westbound I-580 off-ramps via Isabel Avenue.⁴⁶ Patrons would then use the pedestrian overcrossing of I-580 to reach the station platform.

- **Westbound Direct Ramp, Isabel Avenue Bus-to-BART Connection.** This variant would construct a new bus-only ramp from the westbound I-580 lanes that would allow buses to exit from the left-most lane directly to the Isabel Avenue/I-580 overcrossing. The Isabel Avenue/I-580 overcrossing would be widened to provide a passenger drop-off on the west side and a passenger pick-up on the east side of the overcrossing. Passengers would connect to the Isabel Station BART platform below via stairs/ramps/or elevators from the overcrossing. Eastbound buses would use the existing Isabel Avenue on-ramp to I-580. While this variant would result in a slight decrease in passenger travel time, it would only increase BART systemwide ridership by approximately 1 percent (approximately 100 riders) and would increase costs by approximately 18 percent above the Proposed Project (approximately \$239 million).⁴⁷
- **No Direct Ramp, Isabel Avenue Bus-to-BART Connection.** This variant would not construct a direct ramp from I-580, but would use the existing Isabel Avenue on-/off-ramps from I-580, similar to the Proposed Project. However, similar to the Westbound Direct Ramp connection, this variant would entail the widening of the Isabel Avenue/ I-580 overcrossing to allow for bus-to-BART connections. Passenger drop-off would be on the west side of the overcrossing and a passenger pick-up would be on the east side of the overcrossing. Passengers would connect to the Isabel Station BART platform below via stairs/ramps/or elevators from the overcrossing.

This variant would reduce transfer times from BART-to-bus compared to the Proposed Project because the distance the buses would travel from I-580 to the passenger drop-off/pick-up locations would be shorter and the distance passengers would walk to connect to the BART platform would be reduced.

While this variant would result in a slight decrease in passenger travel time, it would only increase BART systemwide ridership by approximately 1 percent (approximately

⁴⁶ Arup, 2017a. BART to Livermore Extension Bus Operations Technical Memorandum. July.

⁴⁷ Amounts are in 2016 dollars.

100 riders) and would increase costs by approximately 6 percent above the Proposed Project (approximately \$80 million).⁴⁸

Due to the substantial increased costs and limited increase in ridership, the bus-to-rail connection variants for the proposed Isabel Station were rejected from further consideration.

g. Aerial Tail Track Structure over I-580

An aerial structure was considered to support the BART tail tracks east of the proposed Isabel Station crossing over westbound I-580 from the median to north of I-580, where they would extend to the storage and maintenance facility. The aerial structure would be elevated above grade for approximately 500 feet, and its maximum height at the top of the deck would be approximately 33 feet above I-580. For comparison, the Proposed Project would include an underpass structure under westbound I-580 east of the proposed Isabel Station that would connect the tail tracks from the I-580 median to the north. The tail track aerial structure is estimated to decrease project cost by approximately \$23 million, or 2 percent, compared to the Proposed Project.⁴⁹ However, the aerial structure for the tail tracks was rejected from further consideration because the height of the structure above the freeway would result in substantially greater adverse visual impacts than the Proposed Project.

2. Variants to the DMU Alternative

As described below and listed in Table 2-21, variants to the DMU Alternative include (1) a different horizontal alignment for the DMU tracks (north of I-580 instead of in the I-580 median); (2) extended single-track design; (3) different locations for the storage and maintenance facility; and (4) a DMU transfer platform south of the existing BART platform, instead of north of the existing platform as under the proposed DMU Alternative. Information pertaining to the costs of these variants relative to the DMU Alternative is provided, where available.⁵⁰

⁴⁸ Amounts are in 2016 dollars.

⁴⁹ Amounts are in 2016 dollars.

⁵⁰ The cost of the variants is compared to the unescalated capital cost of the DMU Alternative (\$1.3 billion). See Chapter 2, Project Description, for further detail.

TABLE 2-21 VARIANTS TO THE DMU ALTERNATIVE – CONSIDERED BUT WITHDRAWN

Variant	Location of Variant^a	Reasons for Rejection
At-Grade Tracks, North of I-580 from Tassajara Road to Isabel Station	North of I-580 from Tassajara Road to Isabel Station	<ul style="list-style-type: none"> ▪ ROW impacts would be disproportionately concentrated north of I-580 ▪ Reduced opportunity for TOD
Extended DMU Single-Track Design	0.8 mile east of Dublin/Pleasanton Station to approximately halfway between Fallon Road and Airway Boulevard	<ul style="list-style-type: none"> ▪ Operational performance deficiencies
Storage and Maintenance Facility Locations	Various locations along the alignment	<ul style="list-style-type: none"> ▪ Operational performance deficiencies (Locations 1, 2) ▪ Conflict with local zoning (Location 1) ▪ Increased cost (Locations 2,4) ▪ Significant visual impact (Location 4)
DMU Transfer Platform South of BART Tracks	Dublin/Pleasanton Station	<ul style="list-style-type: none"> ▪ Increased cost ▪ Increased impacts to watercourse

Notes:

^a Location of Variant = along entire alignment (Dublin/Pleasanton Station to proposed Isabel Station) or portion of the alignment.

Source: Arup, 2014; Arup, 2015a; Arup, 2015c; Arup, 2015d.

a. At-Grade Tracks, North of I-580 from Tassajara Road to Isabel Station

This variant to the DMU Alternative would include tracks at-grade in the I-580 median. This is a similar alignment to that described for the Conventional BART Project variants. This design would feature at-grade tracks within the I-580 median from the Dublin/Pleasanton Station to just east of the Tassajara Road/Santa Rita Road interchange. There the tracks would cross to the north of I-580 and extend adjacent to the north side of I-580 to the proposed Isabel Station. Under this variant, the proposed Isabel Station would be located north of I-580 instead of in the I-580 median. An underpass below westbound I-580, approximately 1,300 feet long, would be required to connect the tracks from the median to north of I-580. Short tunnels would also be needed for the DMU tracks to pass below the I-580 on- and off-ramps at three interchanges.⁵¹

⁵¹ Arup, 2014. BLVX DMU Median vs. North Conceptual Cost Comparison. October 13.

This variant would have similar merits to the at-grade BART tracks north of I-580 described as a variant to the Conventional BART Project above; it would require less relocation of I-580 lanes, shortening the overall construction schedule. It would not have any cost savings compared to the DMU Alternative.

The at-grade tracks, north of I-580 from Tassajara Road to the Isabel Station, would have increased ROW impacts to the properties north of I-580. Furthermore, locating the Isabel Station north of I-580 rather than in the median would occupy undeveloped land that is currently being planned for development as part of the INP, reducing the opportunities for TOD, which is one of the project objectives. Therefore, this variant was rejected.

b. Extended DMU Single-Track Design

The extended DMU single-track variant would have a longer stretch of single track than the DMU Alternative.⁵² Under this variant, 3.75 miles of the track (from the Dublin/Pleasanton Station to approximately halfway between Fallon Road and Airway Boulevard) would be single track, with approximately 1.75 miles of double track at the eastern end of the alignment near the proposed Isabel Station. In comparison, under the DMU Alternative, the single-track section would extend from the Dublin/Pleasanton Station approximately 0.8 mile, and the double-track section would extend approximately 4.7 miles to the proposed Isabel Station.

This variant would have an estimated \$78 million cost savings because it would avoid building a second track and would require less relocation of I-580.⁵³ This would represent a cost savings of approximately 6 percent compared to the DMU Alternative.

However, the extended single-track section would not provide a robust operating scenario. Any failed trains on the single track would shut down the system until those trains could be moved. The increased potential for delayed DMU trains (and subsequent missed connections to BART trains) and the reduced reliability in the DMU service would be inconsistent with the service standards of BART's existing system. Therefore, the extended DMU single-track design was rejected from further consideration.

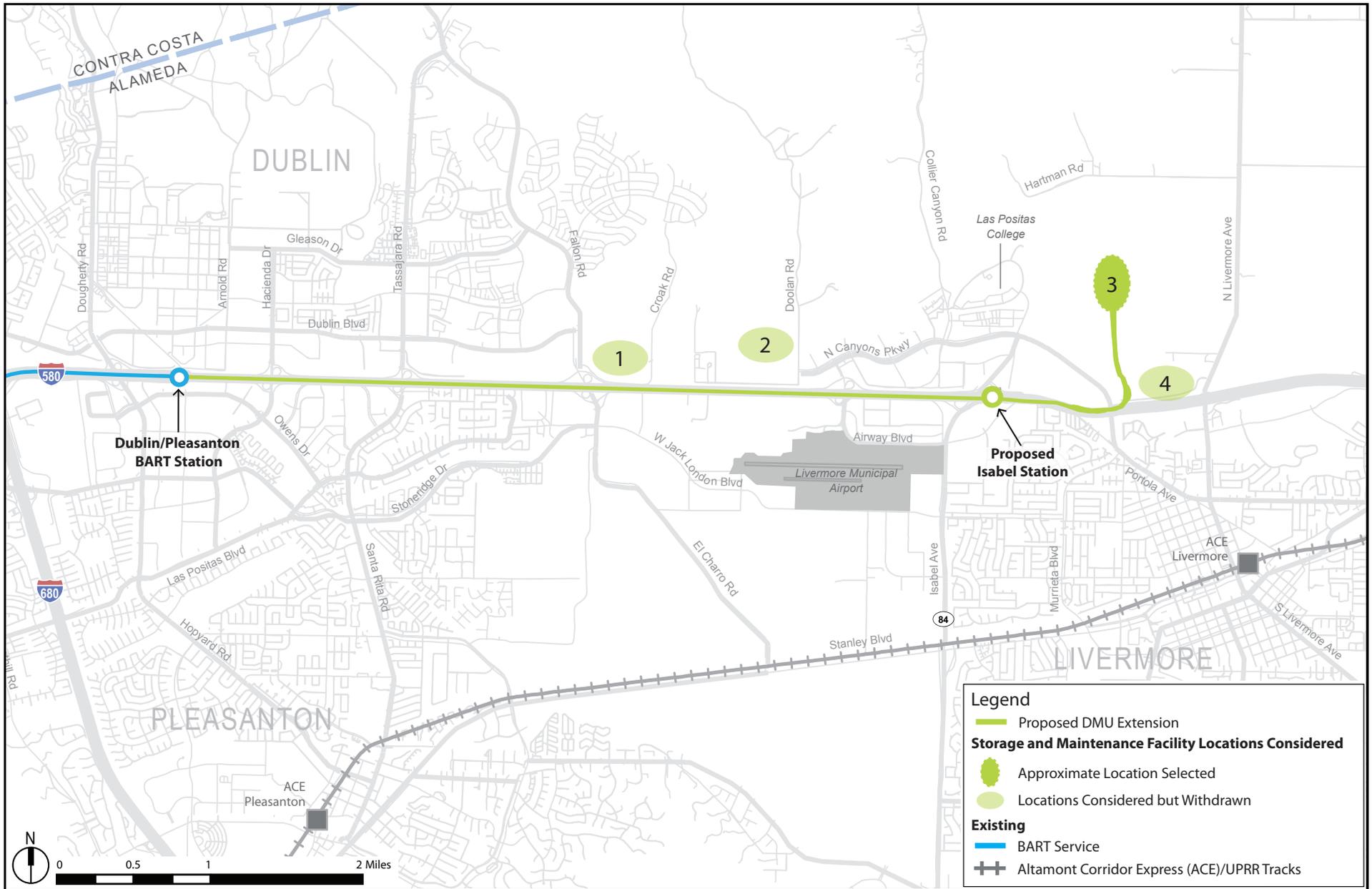
c. Storage and Maintenance Facility Locations

Four potential locations were considered for the storage and maintenance facility under the DMU Alternative.⁵⁴ These locations are shown in Figure 2-27 and are described below. Location 3, located north of I-580 and west of North Livermore Avenue, would require

⁵² Arup, 2015c. DMU/EMU Single Track Analysis. June 2.

⁵³ Amounts are in 2016 dollars.

⁵⁴ Arup, 2015d. DMU/EMU Yard Site Selection Analysis. February 9.



Source: Arup, 2017b.

Figure 2 - 27
 Alternatives Considered but Withdrawn
 Locations Considered for the DMU Storage and Maintenance Facility

relatively less earthwork than the other locations and was incorporated into the DMU Alternative.

Location 1, located just east of Fallon Road and north of I-580, is an open field requiring minimal earthworks relative to the other options, and is close to the proposed main DMU trackway, thus requiring a limited length of connection track. Location 1 is the least costly of the locations considered and would decrease the cost of the DMU Alternative by approximately \$70 million, or 5 percent.⁵⁵ However, Location 1 was considered unacceptable by the City of Dublin because it would require acquiring land that is currently zoned for commercial and industrial uses. Location 1 is also west of the proposed Isabel Station. This presents operational challenges because it would require DMU vehicles to travel on mainline tracks from the Isabel Station to the storage and maintenance facility, which could interfere with revenue operations. For the above reasons, this location was rejected.

Location 2, located west of Dolan Road and north of I-580, is close to the proposed main DMU trackway and would also require a short connection track. However, Location 2 would require extensive earthworks involving excavating and grading a steep hillside, and is therefore the second most expensive location. Location 2 would increase the cost of the DMU Alternative by approximately \$41 million, or 3 percent.⁵⁶ Furthermore, Location 2 is also west of the proposed Isabel Station. This presents operational challenges because it would require DMU vehicles to travel on revenue tracks from the Isabel Station to the storage and maintenance facility, which could interfere with revenue operations. Therefore, this location was rejected.

Location 4, located immediately north of I-580 and west of North Livermore Avenue, is the most expensive location because of the large earthworks cutting into a steep hillside, and its substantial distance east of the proposed main DMU trackway. Location 4 would increase the cost of the DMU Alternative by approximately \$44 million, or 3 percent.⁵⁷ This location was rejected due to the increased cost and because the earthworks would result in a significant visual impact.

For the variety of reasons presented, the alternative storage and maintenance facility locations (locations 1, 2, and 4) were rejected from further consideration.

⁵⁵ Amounts are in 2016 dollars.

⁵⁶ Amounts are in 2016 dollars.

⁵⁷ Amounts are in 2016 dollars.

d. DMU Transfer Platform South of BART Tracks

An alternative location was considered for the DMU transfer platform at the Dublin/Pleasanton Station. This option considered locating the DMU platform south of the existing BART platform rather than north of the BART platform as proposed under the DMU Alternative. For this option, the eastbound I-580 lanes would have to be relocated up to 45 feet to the south, which would require an additional 10 feet compared to that needed under the DMU Alternative. This additional relocation could cause greater impacts to the Hacienda Drive interchange, adjacent watercourse (Line G-2), Dublin/Pleasanton Station facilities, local access road, and adjacent property. Approximately 3,100 feet of Line G-2 would have to be realigned.⁵⁸ This option is estimated to increase project cost by \$25 million, or 2 percent, compared to the DMU Alternative.⁵⁹ For the above reasons, this alternative was rejected.

3. Variants to the Express Bus/BRT Alternative

As described below and listed in Table 2-22, variants to the Express Bus/BRT Alternative include: (1) bus ramps from I-580 to an elevated structure above the Dublin/Pleasanton Station; and (2) descending bus ramps from I-580 to the existing ground-level bus facility at the Dublin/Pleasanton Station. These variants would differ from the Express Bus/BRT Alternative, which would have bus ramps from I-580 to at-grade bus platforms north and south of the existing BART platform. Information pertaining to the costs of these variants relative to the Express Bus/BRT Alternative is provided, where available.⁶⁰

a. Elevated Bus Connections at Dublin/Pleasanton Station

Two variants for bus connections at the Dublin/Pleasanton Station would include elevated station designs, with a new bus connection level above the existing BART platform in the I-580 median. This would allow for a direct bus-to-BART connection, similar to the Express Bus/BRT Alternative, and would reduce the amount of ROW acquisition required. In these variants, the bus transfer platforms would be elevated above the existing station, instead of north and south of the station, in the I-580 median.⁶¹

⁵⁸ Arup, 2015a. BLVX DMU/EMU DP North vs. South Conceptual Comparison. February 26.

⁵⁹ Amounts are in 2016 dollars.

⁶⁰ The cost of the variants is compared to the unescalated capital cost of the Express Bus/BRT Alternative (\$305 million). See Chapter 2, Project Description, for further detail.

⁶¹ Arup, 2017e. Elevated Express Bus Station at Dublin/Pleasanton. February 24.

TABLE 2-22 VARIANTS TO THE EXPRESS BUS/BRT ALTERNATIVE – CONSIDERED BUT WITHDRAWN

Variant	Location of Variant^a	Reasons for Rejection
Elevated Bus Connections	Dublin/Pleasanton Station	<ul style="list-style-type: none"> ▪ Increased costs ▪ Increased visual impacts ▪ Complexity of construction and operation (Two-Level Cross Platform Median Station Design)
Descending Bus Ramps from I-580	Dublin/Pleasanton Station	<ul style="list-style-type: none"> ▪ Spatial constraints ▪ Pedestrian safety concerns ▪ Less convenient BART to bus transfers

Notes:

^a Location of Variant = along entire alignment (Dublin/Pleasanton Station to proposed Isabel Station) or portion of the alignment.

Source: Arup, 2013; Arup, 2017e.

- **Two-Level Median Station Design.** This variant would have a two-level platform, with express buses operating on the upper level and BART operating on the lower level. A new bus-only ramp would be constructed from the westbound I-580 lanes that would allow buses to exit from the left-most lane directly to the north side of the upper level platform, and then cross to the south side of the platform to allow boarding and alighting. The upper level bus platform would be 360 feet long, and the approach ramps would be 22 feet wide and 500 feet long. The upper level would be approximately 30 feet above the existing BART track level. A single escalator, staircase, elevator, and fare collection equipment would be provided for access directly to the BART platform below. Buses would return to I-580 eastbound via a similar bus-only ramp.
- **Two-Level Cross Platform Median Station Design.** Under this variant, a configuration similar to that described above would be constructed; however, this variant would allow for direct cross-platform transfers between buses and BART without requiring passengers to change levels. This would be achieved by separating BART and bus services by direction such that eastbound BART and buses would operate on the first level and westbound BART and buses would operate on the second level. This variant would be a similar height to the two-level median station design.

These variants would reduce the ROW required compared to the Express Bus/BRT Alternative. At the Dublin/Pleasanton Station and east of the Dublin/Pleasanton Station, the Express Bus/BRT Alternative would require the I-580 ROW to be permanently widened by approximately 85 feet. The elevated bus connection variants would reduce the permanent widening needed to approximately 25 feet at the Dublin/Pleasanton Station and 50 feet east of the Dublin/Pleasanton Station. A widening of 25 feet would be needed

at the Dublin/Pleasanton Station to provide room for the columns supporting the upper level. An additional 25 feet would be needed east of the Dublin/Pleasanton Station to provide space for the ramps from I-580 to the upper level. The elevated bus variant would also require one I-580 lane in each direction to be closed for approximately 3 years to allow space for construction.

The Two-Level Median Station Design would increase costs by approximately 10 percent, or \$31 million, compared to the Express Bus/BRT Alternative.⁶² The Two-Level Cross Platform Median Station Design would increase cost by substantially more due to the need to build new BART tracks and BART facilities so that westbound BART trains could operate on the second level.

Furthermore, the Two-Level Cross Platform Median Station Design was considered infeasible due to the complexity of construction and operation, particularly for the relocation of the BART track. This alternative would also require BART to install additional fare gates at both the upper and lower levels, each of which would likely require an additional station attendant.

Due to the substantial increased costs and increased visual impacts from a structure 30 feet above BART track level, the variants to the Express Bus/BRT Alternative providing elevated bus connections at the Dublin/Pleasanton Station were rejected from further consideration.

b. Descending Bus Ramps from I-580 at Dublin/Pleasanton Station

This variant entails bus ramps from I-580 directly to the existing Dublin/Pleasanton Station ground-level bus facilities.⁶³ These ramps would descend from the I-580 express lanes directly to the existing north-south bus access road that crosses under I-580 and provides access to the current Dublin/Pleasanton Station entrance.

While this variant would provide a direct bus route to the Dublin/Pleasanton Station, it was rejected because of various challenges, including less convenient BART to bus transfers, safety concerns, and the need to lower the existing bus access road by at least 1 foot to meet Caltrans standard overhead clearance requirements underneath I-580, which could impact major utility pipelines. Existing freeway overpass columns in the middle of the north-south bus access road would likely have to be relocated. Safety would be a concern with buses transitioning from high freeway speeds while descending the bus ramp toward the main Dublin/Pleasanton Station entrance, where there are many pedestrians.

⁶² Amounts are in 2016 dollars.

⁶³ Arup, 2013. BLVX Alternatives Analysis, Alternative Analysis Scoping Summary (Draft). December.

Furthermore, significantly increased bus activity along the north-south access road could conflict with pedestrian circulation between the parking garage and the station as well as pedestrian circulation to/from the TODs north of the station.

In addition, this variant is less convenient for passengers than the proposed Express Bus/BRT Alternative. The Express Bus/BRT Alternative accommodates passengers transferring between BART and buses at convenient platforms adjacent to the existing BART platforms. Under this variant, buses arriving at the Dublin/Pleasanton Station could drop off passengers near the entrance to the station, but because of space constraints would have to travel to a layover location to wait before picking up passengers. Thus, descending bus ramps at the Dublin/Pleasanton Station would provide a convenient location for passengers transferring from bus to BART, but not for passengers transferring from BART to bus. For the reasons described above, the descending bus ramps from I-580 at the Dublin/Pleasanton Station were rejected.