5. Options Evaluation and Preferred Options

This *Options Evaluation and Preferred Options Chapter* evaluates the pathway design and roadway crossing treatment options for a pathway along the EBMUD Aqueduct ROW and identifies the recommended preferred options.

The chapter consists of the following seven sections:

Section 5.1 presents a preliminary Project Alternatives analysis pursuant to Caltrans project development procedures requirements.

Section 5.2 illustrates the Pathway Study Area segments.

Section 5.3 summarizes the preferred options for pathway design and crossing options, and provides a map illustrating recommended preferred options and cost estimates.

Sections 5.4 through **5.7** present a detailed evaluation of pathway design and roadway crossing options for four distinct pathway segments. Pathway design options consider either a Class I bikeway/ADA-accessible pathway or a multi-use pathway that is not ADA-accessible. Each roadway crossing is discussed within the associated pathway segment. For those roadway crossings that warrant more than one design option, each design option is considered and discussed.

5.1 Project Alternatives

Due to structural, topographic and ROW constraints described in *Chapter 4: Existing Conditions, Opportunities, and Constraints*, the proposed pathway design options require use of the SR 24 ROW in addition to the EBMUD Aqueduct ROW. In order to justify use of Caltrans ROW, all practical alternatives for the proposed project need to be analyzed. This *Options Evaluation and Preferred Options Chapter* investigates use of the Caltrans ROW consistent with discussions with the agency on January 4, 2011. This section includes a preliminary documentation of project alternatives sufficient for inclusion in a Project Study Report/Project Report as outlined in Chapter 6 of the Caltrans Project Development Procedures Manual. [23]

Prior to the adoption of the 2006 City of Lafayette Bikeways Master Plan, City staff and consultants investigated potential bikeway improvements throughout Lafayette, including practical alternatives to a pathway along the EBMUD Aqueduct ROW currently under study. Findings from the Bikeways Master Plan analysis, and related planning efforts are incorporated in the discussion below.

This section considers four alternative alignments for providing bicycle and pedestrian access within the Pathway Study Area: Deer Hill Road; Mt. Diablo Boulevard; exclusive use of the EBMUD Aqueduct ROW (ROW); and combined use of the EBMUD Aqueduct ROW and SR 24 ROW.

[23] http://www.dot.ca.gov/hq/oppd/pdpm/other/PDPM-Chapters.pdf

5.1.1 Deer Hill Road Alternative

Deer Hill Road has existing Class II bicycle lanes and runs parallel to and north of SR 24 and the EBMUD Aqueduct ROW from Happy Valley Road in the west to Brown Avenue in the east. The road continues east to Pleasant Hill Road after crossing over the EBMUD Aqueduct at Brown Avenue. Sidewalks exist along both sides of the road west of First Street, but are discontinuous east of First Street.

Four streets connect Deer Hill Road to Downtown: Happy Valley Road, Oak Hill Road, First Street and Brown Avenue. Steep hills and pedestrian and bicycle conflicts at the SR 24 on- and off-ramps at Laurel Drive limit this roadway's suitability for less experienced and youth bicyclists, who may not feel comfortable using the bicycle lanes.

Construction of a separated pathway (sidepath) along Deer Hill Road is feasible; however, Deer Hill Road does not extend west of Happy Valley Road, thus providing parallel access to only a portion of the Project Study Area. Obstacles to implementation of this alignment include the need to allocate ROW from the BART parking lot or existing travel lanes. In addition, it is a three to five minute walk from Deer Hill Road to shops on Mt. Diablo Boulevard, suggesting that people would most likely not use this roadway to walk between Downtown destinations. Deer Hill Road does provide direct access to the Lafayette BART station, but the alignment is not adjacent to major pedestrian and bicycle traffic generators. Finally, a sidepath on Deer Hill Road would provide benefits for less experienced users traveling this specific street but would be redundant for experienced bicyclists given the existing bicycle lanes.

5.1.2 Mt. Diablo Boulevard Alternative

Mt. Diablo Boulevard is the primary commercial arterial serving Downtown Lafayette and runs directly parallel to and south of the EBMUD Aqueduct ROW. Mt. Diablo Boulevard connects the Lafayette Reservoir, BART, and Downtown shops and serves the majority of east-west local traffic that is not carried by SR 24. Sidewalks exist on both sides of the roadway within most of the Study Area, and the City has invested significantly in improving the pedestrian environment through Downtown. West of the Pathway Study Area, there is an existing wide sidewalk pathway on the south side of Mt. Diablo Boulevard, providing access to the Lafayette Reservoir.

Bicycle lanes exist on both sides of Mt. Diablo Boulevard west of Mountain View Drive and east of First Street. Between Mountain View Drive and First Street, wider sidewalks, on-street parking and medians with mature vegetation reduce the available roadway width for bicycle accommodations. Shared lane markings are provided from Mountain View Drive to First Street in place of bicycle lanes.

Continuous bicycle lanes through Downtown Lafayette along Mt. Diablo Boulevard were considered but locally rejected through preparation of the Bikeways Master Plan. Striping bicycle lanes on Mt. Diablo Boulevard from Mountain View Drive in the west to First Street in the east would require removal of on-street parking or other substantial modifications to the street configuration that would have a significant economic impact on Downtown businesses. Other alternatives for reconfiguring the street would have significant circulation impacts; such as auto travel lane removal, turn lane reconfiguration and median removal. All such concepts were removed from consideration through recent previous planning studies including the Bikeways Master Plan and DSP.

5.1.3 EBMUD Aqueduct ROW Only Alternative

The Bikeways Master Plan generally assumed that the 100-foot-wide EBMUD Aqueduct ROW would provide for development of a paved multi-use pathway without requirement for use of any adjacent property. This assumption was carried through the initiation of this feasibility study.

Limiting construction to within the EBMUD Aqueduct ROW would reduce the financial and administrative costs for permitting, designing, and constructing a pathway. However, as detailed in **Section 4.5.2** in *Chapter 4: Existing Conditions, Opportunities, and Constraints*, due to the topographic constraints of the site and EBMUD structural requirements, it is not feasible to construct a functional pathway along the some key sections of the EBMUD Aqueduct ROW. Any Class I bikeway or multi-purpose pathway constructed entirely within EBMUD Aqueduct ROW and engineered to address the topographic constraints and EBMUD structural requirements would require a significant number of switchback turns with extremely tight turning radii, resulting in a horizontal alignment not suitable for commuter bicycling and creating significant conflicts between pedestrians, bicyclists and other pathway users.

5.1.4 EBMUD Aqueduct/Caltrans SR 24 Combined ROW Alternative

Combined use of the EBMUD Aqueduct ROW and, at key locations, the SR 24 ROW, provides for additional horizontal width that will enable construction of a Class I bikeway or multi-purpose pathway; providing opportunity to navigate the steep grade changes and to avoid areas over the existing aqueduct pipes that impose structural limitations. Encroachment into Caltrans' ROW is preliminarily recommended at three locations: west of the Dolores Drive crossing, at Happy Valley Road and at Oak Hill Road. These options are discussed in further detail in **Sections 5.4** and **5.5**.

5.1.5 Project Alternatives Conclusions

The EBMUD Aqueduct ROW alternatives offer opportunities not provided by the Deer Hill Road or Mt. Diablo Boulevard alternatives: an exclusive pathway with minimum motor vehicle conflicts and short, direct connections to BART and Downtown shopping. However, exclusive use of EBMUD Aqueduct ROW is not feasible given topographic and structural constraints. This Project Alternatives analysis demonstrates that the combined use of EBMUD Aqueduct ROW and SR 24 ROW is the only feasible alternative that achieves the goals and objectives defined for this study.

5.2 Study Area Pathway Segments

The pathway segments are defined from west to east based on site topography, surrounding land use context, and anticipated use. The pathway segments are shown in **Figure 5-1** and consist of:

- Pathway Segment 1: Risa Road to BART
    - Includes Risa Road, Private Drive, Dolores Drive, Happy Valley Road crossings
- Pathway Segment 2: BART to Oak Hill Road
    - Includes Oak Hill Road crossing
- Pathway Segment 3: Oak Hill Road to First Street
    - Includes First Street crossing
- Pathway Segment 4: First Street to Brown Avenue

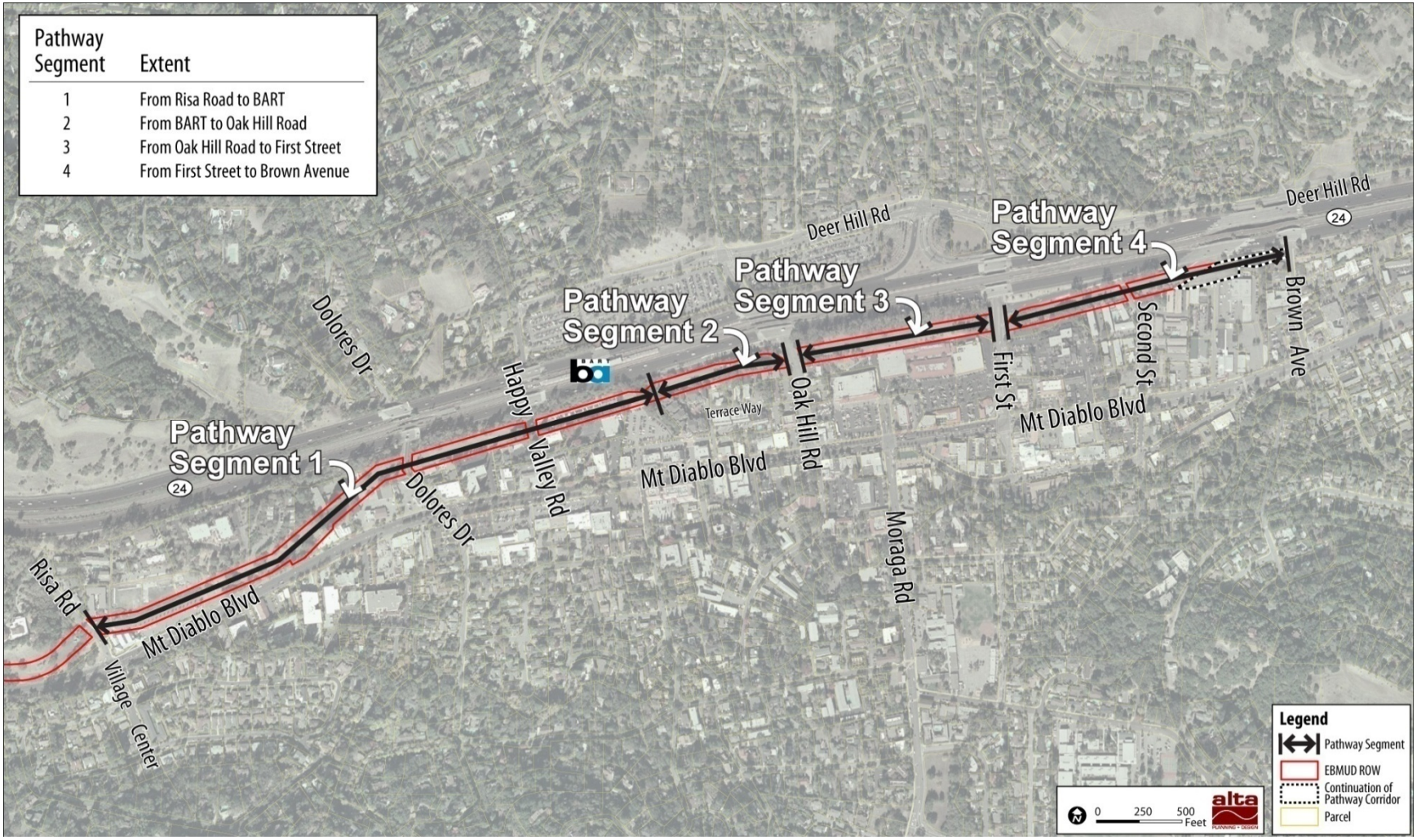

Figure 5-1: Pathway Segments

5.3 Summary of Pathway Design Options and Preferred Options

This section summarizes the preliminary pathway design and roadway treatment options and presents the preferred options and rationale for choosing each one. Further detail is provided in the segment descriptions, **Sections 5.4** through **5.7**.

5.3.1 Pathway Design

It is feasible to construct a pathway along the EBMUD Aqueduct ROW that meets the goals of this Study. However, ROW availability, topographic constraints, and structural requirements limit the possible design options. Assuming the combined use of the EBMUD and Caltrans ROWs, facility design options for a pathway along the EBMUD Aqueduct ROW include:

- A paved Class I bikeway/ADA-accessible pathway
- An unpaved multi-use pathway (not ADA-accessible)

The preferred pathway design is a paved Class I bikeway/ADA-accessible pathway that conforms as best as feasible to the requirements set forth in Caltrans Chapter 1000, 1003.1 Class I bikeways, the structural requirements presented by the EBMUD and design guidance provided by City of Lafayette staff, the TAG, the CAC, and the general public (see **Figure 5-2**). This design option combines two of the three designs described in *Chapter 4* and meets design requirements of both. Compared to the unpaved multi-use pathway option, the Class I bikeway/ADA-accessible pathway his will serve a greater range of users, will provide greater transportation benefits and is eligible for a larger pot of grant funding for construction.

The preferred alignment, shown in **Figure 5-3**, provides an ADA-accessible pathway that minimizes fill and excavation in the EBMUD Aqueduct ROW. Where the pathway alignment proposes to add fill over the EBMUD aqueducts, the aqueducts will need to be potholed and the potential loading from the fill will need to be analyzed at each location to ensure the aqueducts will be able to continue to operate as normal. The preferred alignment enters Caltrans ROW in three locations, described in more detail below.

The preferred pathway cross section assumes a minimum 10-foot paved width, 2-foot clear shoulders, pathway lighting at intersections, and site landscaping and amenities as appropriate to the land use context for each segment. Where EBMUD maintenance vehicles are expected to use the pathway, the paved width of the pathway must be 12 feet to accommodate maintenance vehicles and reduce pathway deterioration. The basic civil engineering requirements and costs for the design options and preferred option are presented in detail in **Sections 5.4** through **5.7** and are summarized in *Chapter 7, Phasing Plan and Next Steps*.

If the City decides to pursue construction of the pathway, additional discussions with EBMUD, review and approval of the pathway design, and issuance of an encroachment permit for construction will be needed during future planning and design phases.

Caltrans Chapter 1000 design exceptions[24] will be required to implement the pathway, including but not limited to design speed and horizontal curvatures (Chapter 1000, 1003.1(7)) and slope greater than five (5) percent. (Chapter 1000, 1003.1 (12)). As noted in Chapter 1000, however, steeper grades can be tolerated for short segments (e.g., up to about 150 meters; approximately 500 feet). The switchbacks presented in the conceptual design in the segment descriptions (**Sections 5.4 through 5.7**) reduce the slope to the extent feasible, and within the slope parameters promulgated by Caltrans, but require tight curves as a result. Turn radii for Class I bikeways is a function of the superelevation rate[25] of the bikeway surface, the coefficient of friction between the bicycle tires and the bicycle path surface, and the speed of the bicycle. Caltrans has granted a similar design exception for the design speed and pathway horizontal curvatures on numerous pathway projects in the San Francisco Bay Area in recent years.

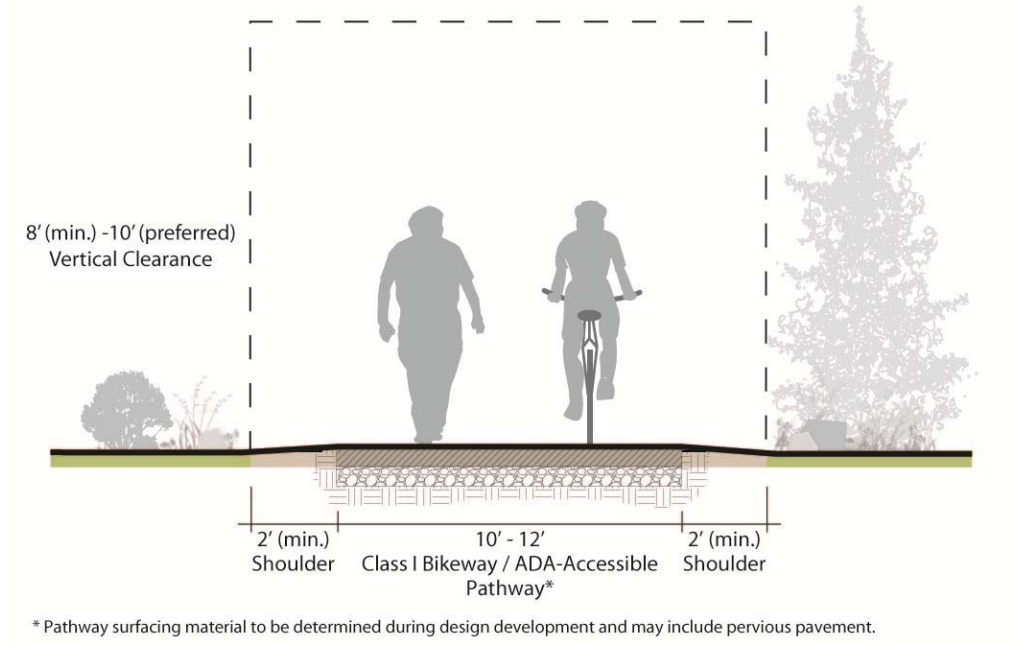

Figure 5-2: Preferred Pathway Design Standard

5.3.2 Roadway Crossings

A pathway along the EBMUD Aqueduct ROW would be required to cross six roadways. Three of the six roadway crossings have only one design option, an at-grade uncontrolled crossing: Risa Road, Private Drive, and Dolores Drive. The remaining three roadway crossings, Happy Valley Road, Oak Hill Road and First Street require a combination of significant civil engineering and traffic engineering changes in order to provide for a continuous pedestrian and bicycle pathway.

[24] The Caltrans Project Development Procedures Manual (Chapter 21) outlines the required process for obtaining approval to mandatory and advisory design standards. Additional detailed consultation with Caltrans Design Division staff from District 4 and Headquarters is required to determine the specific design exceptions required for this project.
[25] Superelevation is sloping the path or roadway to help offset centripetal forces developed as the bicycle or vehicle goes around a curve, and is comparable to cross-slope. ADA-accessible pathways require a maximum cross-slope of 2 percent.

The preferred options for Happy Valley Road, Oak Hill Road and First Street are summarized below and in **Figure 5-3**. Detailed descriptions for design options (when applicable) and preferred options for all six crossings are provided in **Section 5.4** through **5.7**.

Happy Valley Road

Two preliminary crossing options were evaluated for Happy Valley Road: (1) an at-grade crossing entirely within EBMUD Aqueduct ROW, which would require numerous switchbacks in order to meet grade at Happy Valley Road; and (2) a bicycle and pedestrian bridge constructed in the Caltrans ROW.

The preferred option for the Happy Valley Road crossing is a bicycle and pedestrian bridge. The bicycle and pedestrian bridge enables an alignment that is compliant with Caltrans Chapter 1000 Class I bikeways standards, with the potential exception of the horizontal curvatures, as described in **Section 5.3.1**. While it is more costly and requires securing an encroachment permit from Caltrans, the bridge allows a pathway designed to meet EBMUD's structural requirements and Caltrans' Class I bikeway requirements and is eligible for transportation funding.

Further detail is provided in **Section 5.5 Segment 1: Risa Road to BART**.

Oak Hill Road

Three preliminary roadway crossing options were evaluated for Oak Hill Road:

1. **Mt. Diablo Boulevard Crossing**. This option would route pathway users to the signalized intersection of Oak Hill Road and Mount Diablo Boulevard to cross. This option was not selected due to the additional distance pathway users would have to travel and safety issues related to high traffic volumes and speeds on Oak Hill Road.
2. **Signalized Crossing at Oak Hill Road /SR 24 Eastbound Off-Ramp.** This option would signalize the intersection of Oak Hill Road and the SR24 Eastbound Off-ramp, install curb extensions at pathway crossings, install high-visibility crosswalks and advanced stop bars, and widen the sidewalk on the east side of Oak Hill Road from the pathway to Mount Diablo Boulevard.

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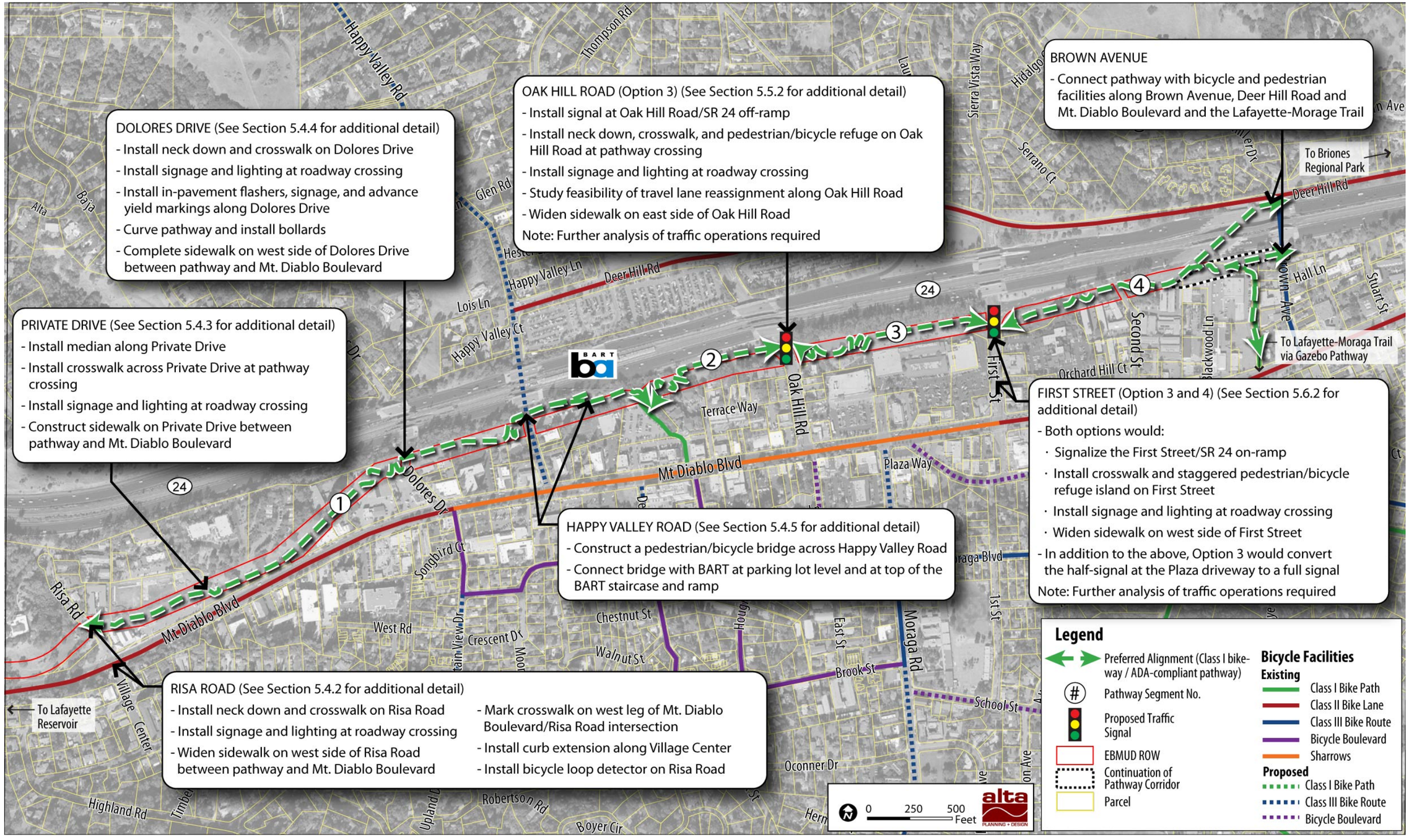

Figure 5-3: The Preferred Option: A Class I Bikeway/ADA-Accessible Pathway (Includes Roadway Crossing Improvements)

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3. **Signalized Crossing with Median Refuge and Lane Reduction on Oak Hill**. This option includes all treatments described in option 2, above, reduces the number of lanes on Oak Hill Road from four lanes to either three or two lanes, and provides a median refuge island for pathway users.

Option 3 is the preferred option for Oak Hill Road, as it provides the greatest benefit to pathway users. Additional conceptual design detail and preliminary traffic analysis are provided in **Section 5.5**.

Additional traffic study is required to fully understand the potential roadway capacity and level of service impacts of signal control and lane reduction on Oak Hill Road.

Further detail is provided in **Section 5.5**.

First Street

Four preliminary roadway crossing options were evaluated for First Street.

1. **Mount Diablo Boulevard Crossing**. This option would route pathway users to the signalized intersection of First Street and Mount Diablo Boulevard to cross. This option was not selected due to the considerable additional distance pathway users would have to travel, which could encourage undesirable mid-block crossings, and safety issues related to high traffic volumes and speeds on First Street.
2. **Signalized Pathway Crossing at the Plaza Parking Lot.** This option would route pathway users to a new full signal and crosswalk at the Plaza parking lot exit and widen the sidewalk on both sides of First Street between the pathway entrance and the proposed signal. Signalizing the Plaza parking lot exit would alleviate the observed jaywalking. However, this option was not selected due to additional travel distance for pathway users, and the need to widen sidewalks on both sides of First Street.
3. **Signalized Pathway Crossing at the SR 24 Eastbound On-Ramp with Full Signal at the Plaza Parking Lot Exit.** This option converts the half-signal at the Plaza driveway to a full signal and installs a signal and staggered crosswalk at the SR 24 on-ramp, as well as the sidewalk improvements presented in Option 1 providing improved connections to Mt. Diablo Boulevard.
4. **Signalized Pathway Crossing at the SR 24 Eastbound On-Ramp Only.** This option installs a signal and staggered pedestrian crossing at the SR 24 eastbound on-ramp and maintains the half-signal at the Plaza parking lot.

In order to provide for a safe pedestrian and bicycle crossing of First Street, traffic signal control at the intersection of First Street, the eastbound SR24 on-ramp, and the EBMUD ROW is required, at a minimum. Given the complexity of signalizing this intersection, some options need to be preserved for further investigation in future studies.

Options 3 and 4 are the preferred options, with the final preferred option to be determined by the results of a future detailed micro-simulation traffic analysis that considers all modes. Further detail is provided in **Section 5.6**.

Encroachment into Caltrans ROW

As described in *Chapter 4: Existing Conditions, Opportunities, and Constraints*, in order to minimize grade changes and switchbacks and to accommodate EBMUD structural requirements, the preferred pathway alignment

enters Caltrans ROW in two areas. These locations are summarized below, and described in more detail in **Sections 5.4** and **5.5.**

1. **East of Dolores Drive**. The preferred pathway alignment enters Caltrans ROW just west of the Dolores Drive crossing to skirt around a steep hill and reduce the number of switchbacks required.
2. **Happy Valley Road Crossing**. The preferred pathway alignment enters Caltrans ROW at Happy Valley Road, where a proposed bicycle and pedestrian bridge would cross Happy Valley Road. The bridge foundations and structure, which are not permitted within EBMUD ROW, are placed within Caltrans ROW.
3. **Oak Hill Road Off-Ramp**. The preferred pathway alignment enters the Caltrans ROW just west of Oak Hill Road. At this location, the pathway connects to the existing sidewalk that runs parallel to the south side of the SR 24 off-ramp. This alignment reduces the number of switchbacks required.

This study also considered a fourth encroachment into Caltrans ROW just east of the BART station. This option, the **BART Flyover**, continues the pathway alignment within Caltrans ROW from the BART station to the Oak Hill Road off-ramp, thus reducing user conflicts at the BART station and minimizing switchbacks. Due to site topography, to maintain grades compliant with ADA guidelines, a significant portion of this pathway must be elevated. This option was not chosen due to the high cost of constructing such an alignment, particularly when there already exists a suitable pathway from BART east to the unimproved EBMUD Aqueduct ROW. More detail is provided in **Section 5.5**.

5.4 Segment 1: Risa Road to BART

Segment 1 extends approximately 0.7 miles from Risa Road in the west to connect with the existing path along Happy Valley Creek in the east.

The preferred option for Segment 1 is a paved Class I bikeway/ADA-accessible pathway, with at-grade crossings at Risa Road, Private Drive, and Dolores Drive, and a pedestrian and bicycle bridge over Happy Valley Road. As proposed, this preferred option would cost approximately $2 million to build, including roadway crossing improvements.

Table 5-1 summarizes the planning-level costs of the preferred option for Segment 1 as well as the costs of other options that were considered. Detailed descriptions of the design options and preferred options, including the rationale for choosing each preferred option are described below.

Table 5-1: Cost Summary for Preferred and Other Considered Options for Segment 1 Risa Road to BART

Preferred Option		Other Considered Options	
Description	*Cost*	*Description*	*Cost*
Class I Bikeway/ ADA-Accessible Pathway	$372,100	Unpaved Multi-Use Pathway	$308,500
Risa Road Crossing Improvements	$144,400 - $148,300	Risa Road Crossing Improvements	$144,400 - $148,300
Private Drive Crossing Improvements	$67,800	Private Drive Crossing Improvements	$67,800
Dolores Drive Crossing Improvements	$249,000	Dolores Drive Crossing Improvements	$249,000
Happy Valley Road Pedestrian and Bicycle Bridge	$1,238,100	At-grade crossing	$2,850
Total Cost of Preferred Option	**$2,071,400 - $2,075,300**	**Total Cost of Other Considered Options**	**$772,600 - $776,500**

5.4.1 Pathway Design

Summary of Existing Conditions, Opportunities, and Constraints

Surrounding land uses include the Lafayette BART station, Downtown, and residential, office, and commercial space. The Woodbury Project, a new residential development approved by the City, is proposed north of the EBMUD Aqueduct ROW at Risa Road. The Woodbury Project includes construction of a pathway segment and landscaping along the EBMUD Aqueduct ROW for the length of the Woodbury property.

Topography along the segment varies, and is illustrated and described in detail in *Chapter 4: Existing Conditions, Opportunities, and Constraints*. Between Risa Road and Dolores Drive, the EBMUD Aqueduct ROW is relatively flat. Just west of Dolores Drive lies the first of two significant hills. The alignment rises again just west of Happy Valley Road, and drops down to Happy Valley Road at a 33 percent slope.

Design constraints through this Pathway Segment include shallow cover above the aqueduct pipes immediately west of Dolores Drive. This project should address the existing drainage ditch located approximately 300 feet east of Private Drive.

Roadway crossings within Segment 1 include Risa Road, the Private Drive east of the Lafayette Veteran's Memorial Building, Dolores Drive, and Happy Valley Road. Bicycle and pedestrian access across Risa Road and through the Mt. Diablo Boulevard/Risa Road intersection are also included in Segment 1. These are described in detail in following sections.

Options Evaluation and Preferred Option

Two facility design standards are considered for this pathway segment: a paved Class I bikeway/ADA-accessible pathway and an unpaved multi-use pathway. As shown in **Figure 5-4**, the Class I bikeway/ADA-accessible pathway alignment would require some switchbacks along the steeper portions of the EBMUD Aqueduct ROW. Approximately 70 square feet of keystone retaining wall would be needed along the switchback within the EBMUD Aqueduct ROW west of Happy Valley Road. An unpaved multi-use pathway would follow the existing slope profile and incorporate timber stairs immediately west of Happy Valley Road.

The timber stairs would be constructed using railroad ties and rebar to hold them in place. Construction would require minor ground disturbances at the timber stair location. The timber stairs would not be placed on top of the aqueducts or considered permanent structures. As described in **Section 5.3**, the preferred option for the pathway design is the Class I bikeway/ADA-accessible pathway.

Potential Timber Stair Designs
Sources: http://downtoearthscapes.com, http://buzzbakerconstruction.wordpress.com

Planning-Level Cost Estimate for Pathway Construction

Table 5-2 and **Table 5-3** present cost estimates for the two design standards for Segment 1. As proposed, an unpaved multi-use pathway would cost approximately $308,500 to build, not including roadway crossing improvements. A Class I bikeway/ADA-accessible pathway would cost approximately $372,100 to build, not including roadway crossing improvements or a pedestrian/bicycle overcrossing at Happy Valley Road. Costs associated with the crossing improvements are presented in the following sections.

Table 5-2: Segment 1 Cost Estimate for an Unpaved Multi-Use Pathway (Not Including Roadway Crossing Improvements)

No.	Description	Quantity	Unit	Unit Price	Amount
Unpaved Multi-Use Pathway Improvements					
1	Clear, Grub & Tree Removal	49,600	SF	$0.50	$24,800
2	Grading	49,600	SF	$0.75	$37,200
3	6" Aggregate Base (Class 2)	655	CY	$45	$29,475
4	Timber Stairs	1	LS	$60,000	$60,000
5	Minor Items (10% of Construction Items)	1	LS	$16,831	$16,831
6	Additions (10% of Construction Items)	1	LS	$16,831	$16,831
7	Mobilization (10% of Total Construction Cost)	1	LS	$20,571	$20,571
				SEGMENT 1 SUBTOTAL	**$205,700**
				25% SOFT COSTS[1]	**$51,400**
				25% CONTINGENCY	**$51,400**
				SEGMENT 1 TOTAL	**$308,500**

[1]*Soft costs include survey, design, permitting, and administration costs.*

LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

Table 5-3: Segment 1 Cost Estimate for a Class I Bike Path/ADA-Accessible Pathway (Not Including Roadway Crossing Improvements)

No.	Description	Quantity	Unit	Unit Price	Amount
Pathway Improvements					
1	Import Borrow	2,100	CY	$25	$52,500
2	Fine Grading	56,700	SF	$0.50	$28,350
3	3" Hot Mix Asphalt (Type A)	760	TON	$85	$64,600
4	6" Aggregate Base (Class 2)	750	CY	$45	$33,750
5	Keystone Retaining Wall	70	SF	$50	$3,500
6	Minor Items *(10% of Construction Items)*	1	LS	$20,300	$20,300
7	Additions *(10% of Construction Items)*	1	LS	$20,300	$20,300
8	Mobilization *(10% of Total Construction Cost)*	1	LS	$24,812	$24,812
				SEGMENT 1 SUBTOTAL	**$248,100**
				25% SOFT COSTS[1]	**$62,000**
				25% CONTINGENCY	**$62,000**
				SEGMENT 1 TOTAL	**$372,100**

[1]*Soft costs include survey, design, permitting, and administration costs.*

LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

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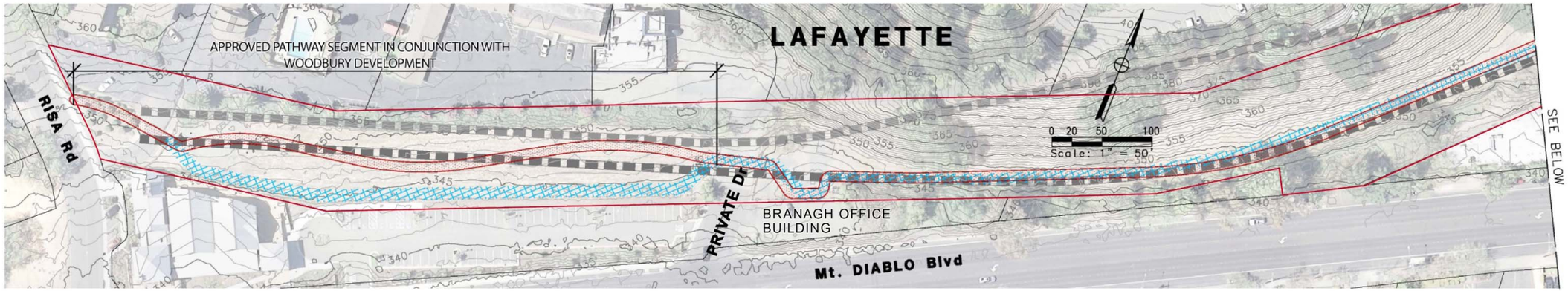

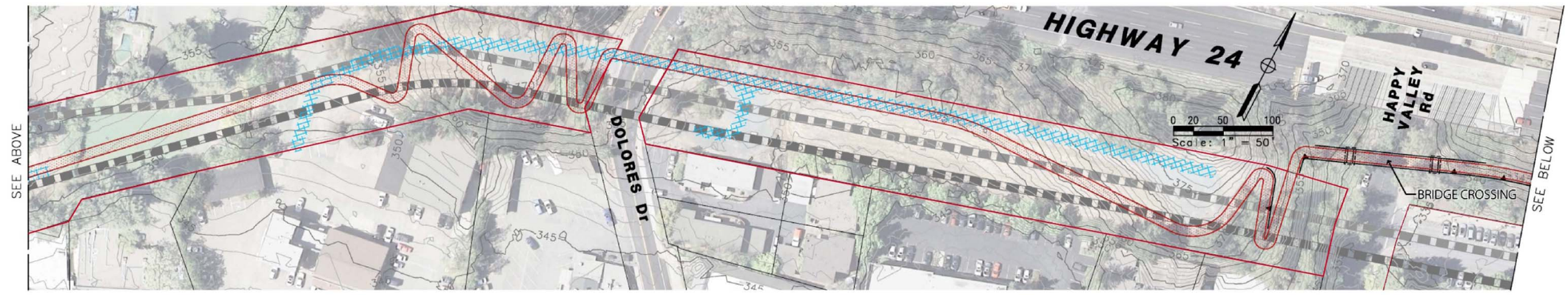

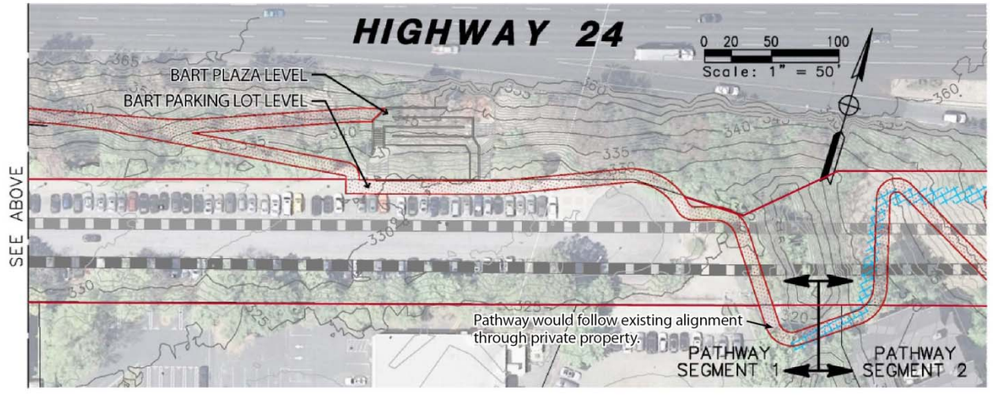

LEGEND

- AQUEDUCT 1
- AQUEDUCT 2
- EXISTING MAINTENANCE PATH*
- PROPOSED PATHWAY
- EBMUD AQUEDUCT RIGHT-OF-WAY

The final pathway alignment may vary from the conceptual alignment shown in this figure in order to accommodate EBMUD access requirements along the EBMUD Aqueduct ROW.

Figure 5-4: Pathway Segment 1 - Class I Bikeway/ADA-Accessible Pathway Alignment

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5.4.2 Risa Road and Mt. Diablo Boulevard Crossings

Risa Road is a two-lane collector that intersects the EBMUD Aqueduct ROW at the west end of the Pathway Study Area. It provides connections to the Lafayette Reservoir via the wide sidewalk on the south side of Mount Diablo Boulevard. Traffic volumes and speeds on Risa Road are low, and sightlines are clear. Traffic volumes and speeds on Mount Diablo Boulevard are high, with 85 percent of vehicles traveling at 45 mph or higher. More detail is provided in *Chapter 4: Existing Conditions, Opportunities, and Constraints.*

Preferred Option

Due to the straightforward conditions at Risa Road and Mount Diablo Boulevard, only one design option was considered: at grade crossing improvements. Recommended improvements facilitate pedestrian and bicycle connections with the existing wide sidewalk on the south side of Mt. Diablo Boulevard. **Figure 5-5** shows a conceptual design for the treatments. Additional long-term opportunities would reconfigure the angled parking spaces on Risa Road adjacent to the Lafayette Memorial Building to improve sight lines between vehicles and on-street bicyclists.

Risa Road: Pathway Entrance Treatments

The following treatments are recommended to enhance the safety and access for potential users accessing the pathway at Risa Road.

1. **Stripe a High-Visibility Ladder Crosswalk** at the pathway entrance to connect users to the west side of Risa Road.
2. **Install Neck-Downs** at the crosswalk entrance to shorten the crossing time for users, enhance safety by decreasing vehicle speeds and increase visibility.
3. **Install Advance Signage** on northbound and southbound approach on Risa Road to warn drivers of an upcoming pedestrian/bicycle crossing.
4. **Install Pedestrian Scale Lights** at the pathway entrance to improve visibility between drivers and pathway users and to enhance personal security at night. Light poles should be installed within City of Lafayette's ROW or easement over the EBMUD Aqueduct ROW.
5. **Install Stop Signs** on the pathway to ensure pathway users stop and look for oncoming traffic before crossing Risa Road.
6. **Widen Sidewalk on the west side of Risa Road between** the pathway crossing and Mt. Diablo Boulevard to eight feet in width for pedestrians and less experienced bicyclists and to discourage wrong way riding.
7. **Long-Term Opportunity:** Change the front-in parking at the Veteran's Memorial Building to reduce potential conflicts between vehicles backing out of the spaces and bicyclists accessing the pathway. The following are a list of options to consider:
    a. Remove angled parking spaces (four spaces total)
    b. Reconfigure to back-in angled parking (no loss of parking spaces)
    c. Reconfigure to parallel parking (likely loss of two parking spaces)

If the Woodbury Project does not come to fruition or is redesigned, the City may seek to place the pathway on the south side of the Woodbury Project Driveway and the pathway/Risa Road crossing adjacent to the south of driveway.

Mt. Diablo Boulevard Crossing Enhancements

The following treatments are recommended to enhance the safety and access for potential pathway users navigating the Risa Road/Mt. Diablo Boulevard intersection.

1. **Install Curb Extension** on the southeast corner of the Mt. Diablo Boulevard and Risa Road intersection. A curb extension would help bicyclists who need to make a two legged turn. Use of the waiting area would enhance bicycle safety as they connect to/from Mt. Diablo Boulevard and the Lafayette Reservoir.
2. **Stripe a Crosswalk** on the west leg of the Mt. Diablo Boulevard and Risa Road intersection. Adding a crosswalk at this location provides a direct connection to the west side sidewalk on Risa Road and may minimize wrong-way riding.

The existing curb extension southwest of the Risa Road/Mt. Diablo Boulevard/Village Center intersection creates a shorter crossing distance and a larger waiting area for pedestrians and bicyclists than a standard curb

3. **Install a Bicycle Loop Detector** along southbound Risa Road to trigger the traffic signal when bicyclists are waiting to turn left onto Mt. Diablo Boulevard.

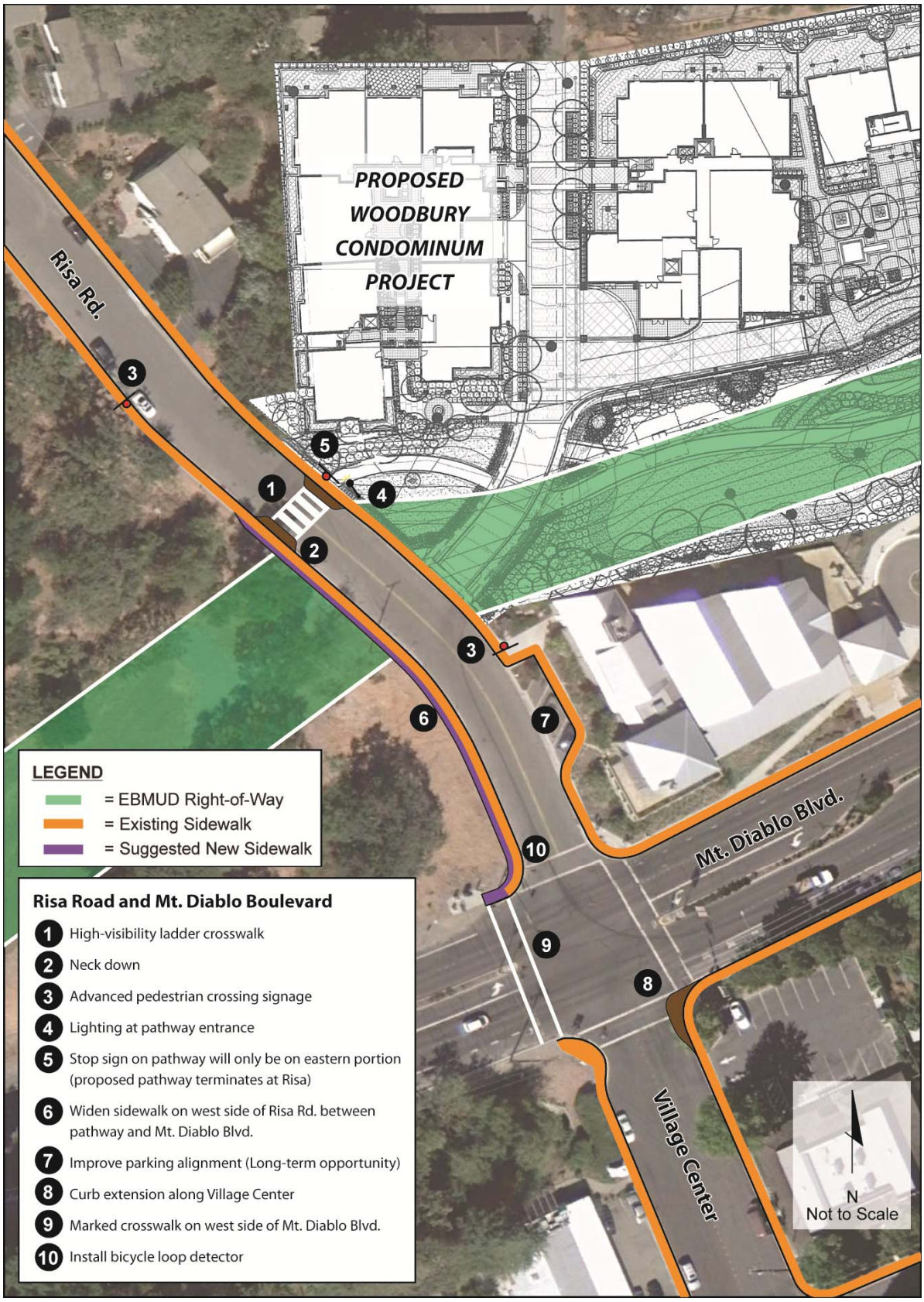

Figure 5-5: Risa Road and Mt. Diablo Boulevard Crossing Improvements

Risa Road and Mt. Diablo Boulevard Crossings Planning-Level Cost Estimates

Planning-level construction cost estimates are presented in **Table 5-4**. The improvements to Risa Road and Mt. Diablo Boulevard would cost between $144,400 and $148,300, depending on whether the angled-parking on Risa Road is removed and, if so, which alternative parking configuration is put in place.

Table 5-4: Cost Estimate for Risa Road and Mt. Diablo Boulevard Improvements

No.	Description	Quantity	Unit	Unit Price	Amount
Risa Road					
1	Ladder Crosswalk at Pathway Entrance	250	LF	$7	$1,750
2	Neck-Downs	1	LS	$25,000	$25,000
3	Advanced Signage	2	EA	$700	$1,400
4	Lights at Pathway Entrance	2	EA	$1,000	$2,000
5	Stop Sign for Pathway Users	2	EA	$700	$1,400
6	Widen Sidewalk on West Side to 8′	975	SF	$20	$19,500
7	Bicycle Loop Detector	1	EA	$500	$500
8	Landscaping and Irrigation at Pathway Entrance	300	SF	$20	$6,000
Crossing improvements (Mt. Diablo Blvd./Risa Rd.)					
9	Crosswalk	160	LF	$7	$1,120
10	Pedestrian Signal Heads/Buttons	2	LS	$2,000	$4,000
11	Curb Extension (SE corner Village Center/Mt. Diablo Blvd. intersection)	120	SF	$20	$2,400
12	Minor Items (10% of Construction Items)	1	LS	$7,230	$7,230
13	Additions *(10% of Construction Items)*	1	LS	$7,230	$7,230
14	Mobilization *(10% of Total Construction Cost)*	1	LS	$8,837	$8,837
	CROSSING IMPROVEMENTS SUBTOTAL				**$84,800**
Long-Term Opportunity					
(1) Reconfigure to Back-In Angled Parking					
15	New Sidewalk	250	SF	$20.00	$5,000
16	Striping Removal and New	100	LF	$4.00	$400
17	Landscape Removal	120	SF	$16.67	$2,000
18	New Landscaping	150	SF	$20.00	$3,000
19	Minor Items *(10% of Construction Items)*	1	LS	$1,156	$1,156
20	Additions *(10% of Construction Items)*	1	LS	$1,156	$1,156
21	Mobilization *(10% of Total Construction Cost)*	1	LS	$1,413	$1,413
	LONG-TERM OPPORTUNITY 1 SUBTOTAL				**$14,100**

Table 5-4: Cost Estimate for Risa Road and Mt. Diablo Boulevard Improvements (continued)

No.	Description	Quantity	Unit	Unit Price	Amount
(2) Change to Parallel Parking					
22	New Sidewalk	300	SF	$20.00	$6,000
23	Striping Removal and New	100	LF	$4.00	$400
24	Landscape Removal	120	SF	$16.67	$2,000
25	Minor Items *(10% of Construction Items)*	1	LS	$934	$934
24	Additions *(10% of Construction Items)*	1	LS	$934	$934
25	Mobilization *(10% of Total Construction Cost)*	1	LS	$1,141	$1,141
	LONG-TERM OPPORTUNITY 2 SUBTOTAL				**$11,400**
	25% SOFT COSTS[1] (CROSSING IMPROVEMENTS)				**$21,200**
	25% CONTINGENCY (CROSSING IMPROVEMENTS)				**$21,200**
	CROSSING IMPROVEMENTS TOTAL				**$127,200**
	25% SOFT COSTS[1] (LONG-TERM OPPORTUNITIES)				**$2,900 - $3,500**
	25% CONTINGENCY (LONG-TERM OPPORTUNITIES)				**$2,900 - $3,500**
	LONG-TERM OPPORTUNITIES TOTAL[2]				**$17,200 - 21,100**
	CROSSING IMPROVEMENTS AND LONG-TERM OPPORTUNITIES TOTAL				**$144,400 - $148,300**

[1] *Soft costs include survey, design, permitting, and administration costs.*

[2] *A range is presented to capture both long-term recommendations.*

LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

5.4.3 Private Drive Crossing

Private Drive is located east of the Veteran's Memorial Building and accessed from Mt. Diablo Boulevard. Traffic volumes and speeds are low, and sightlines approaching the proposed pathway crossing are adequate. Additional detail is provided in *Chapter 4: Existing Conditions, Opportunities, and Constraints.*

Preferred Option

Due to the low traffic speeds and volumes at Private Drive, only one design option was considered: an uncontrolled at-grade crossing. Recommended treatments to Private Drive are described below and illustrated in Figure 5-6.

Crossing Treatments

1. **Stripe a High-Visibility Ladder Crosswalk** across Private Drive.
2. **Install Advance Signage** on northbound and southbound approach of Private Drive to alert drivers to the upcoming pedestrian/bicycle crossing.
3. **Install Pedestrian Scale Lights** at the pathway entrance to improve visibility between drivers and pathway users and to enhance security. Light poles should be installed within City of Lafayette's ROW or easement over the EBMUD Aqueduct ROW.

4. **Install Stop Signs** on the pathway to ensure pathway users stop and look for on-coming traffic before crossing.
5. **Complete the Sidewalk** on both sides of Private Drive and between the pathway and Mt. Diablo Boulevard.
6. **Install Median on Private Drive**. The proposed plans for the Branagh Office Building include a median at the entrance of the Private Drive from Mt. Diablo Boulevard to the proposed driveway entrance of the office building. Consider extending the median north of the Branagh Office Building along Private Drive to the Woodbury Condominium Project driveway; extension of the median would define the roadway and slow vehicles as they pass the pathway crossing. This extension of the median falls within the City's easement over the EBMUD Aqueduct ROW. If a raised median is not feasible per EBMUD's procedures, a painted median can be considered as an alternative. The median would be a minimum of six feet wide at the pathway crossing and include a gap to accommodate the length of a bicycle. A second gap in the median would be maintained to allow vehicular access to the proposed Branagh project driveway. Vehicles exiting the Branagh Office Building use a separate one-way egress on Mt. Diablo Boulevard and would not be impacted by the median.

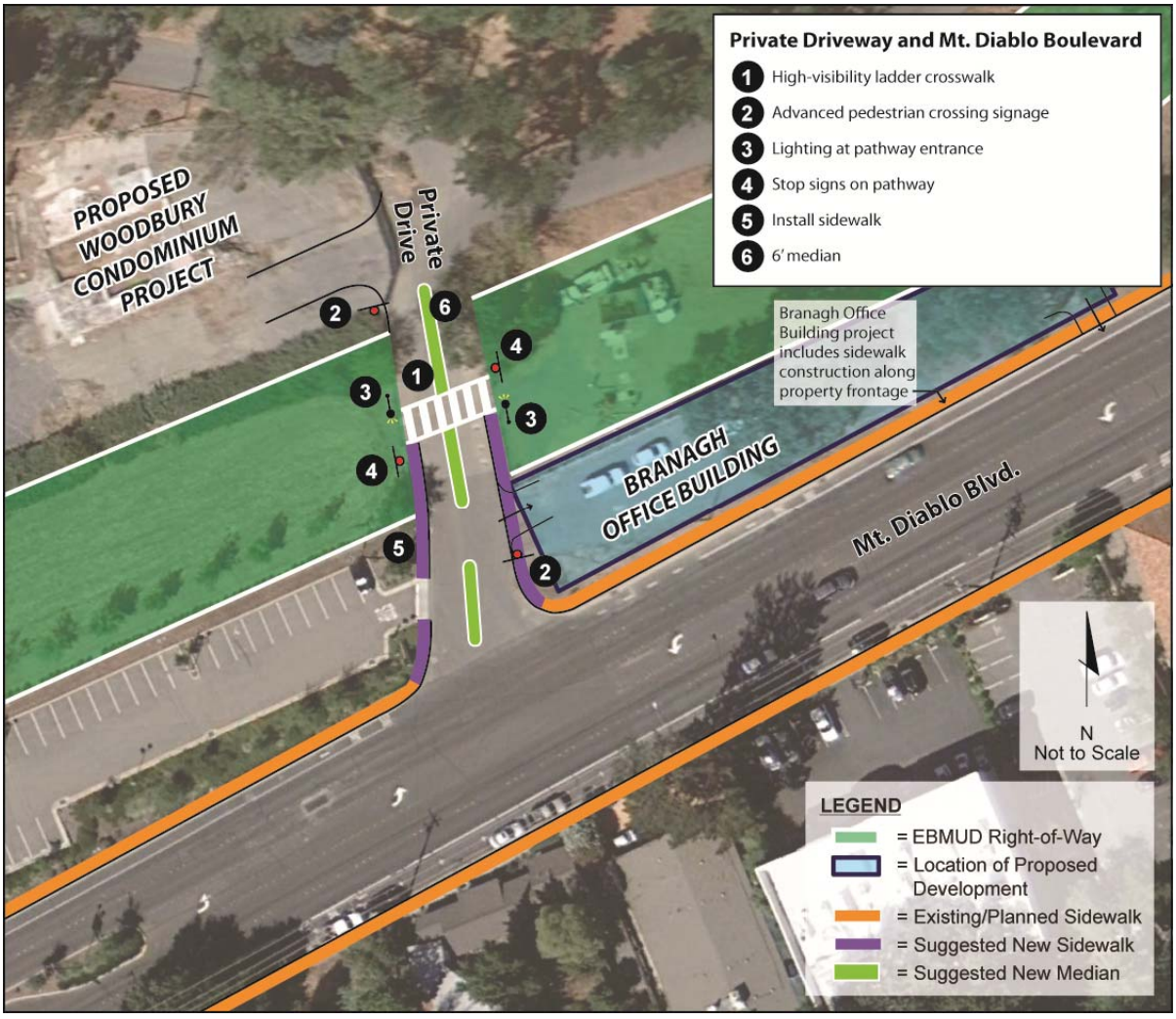

Figure 5-6: Private Drive Crossing Improvements

Private Drive Crossing Planning-Level Cost Estimates

Table 5-5 presents planning-level construction cost estimates. As proposed, the improvements to Private Drive are estimated at $67,800.

Table 5-5: Cost Estimate for Private Drive Improvements

No.	Description	Quantity	Unit	Unit Price	Amount
Private Drive					
1	Ladder Crosswalk	290	LF	$7	$2,030
2	Advanced Signage	2	EA	$700	$1,400
3	Lights for Pathway Entrance	2	EA	$1,000	$2,000
4	Stop Sign for Pathway Users	2	EA	$700	$1,400
5	Sidewalk	600	SF	$20	$12,000
6	Landscaping and Irrigation at Pathway Entrance	300	SF	$20	$6,000
7	Vertical Median	160	LF	$22	$3,520
8	Median Concrete Surface	450	SF	$11	$4,950
9	Minor Items *(10% of Construction Items)*	1	LS	$3,700	$3,700
10	Additions *(10% of Construction Items)*	1	LS	$3,700	$3,700
11	Mobilization *(10% of Total Construction Cost)*	1	LS	$4,523	$4,523
				SUBTOTAL	**$45,200**
				25% SOFT COSTS[1]	**$11,300**
				25% CONTINGENCY	**$11,300**
				CROSSING IMPROVEMENTS TOTAL	**$67,800**

[1]*Soft costs include survey, design, permitting, and administration costs.*

LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

5.4.4 Dolores Drive Crossing

Dolores Drive is a two-lane collector with a posted speed limit of 25 mph. The geometric design of Dolores Drive poses sight distance (especially for the northbound approach) and speed control issues for both motorists and pathway users. Additional detail is provided in *Chapter 4: Existing Conditions, Opportunities, and Constraints.*

Preferred Option

Due to the straightforward conditions at Dolores Drive, only one design option was considered: at grade crossing improvements. Recommended treatments to Dolores Drive are described below and illustrated in Figure 5-7.

Crossing Treatments

1. **Stripe a High-Visibility Ladder Crosswalk** across Dolores Drive.

2. **Stripe Advance Yield Lines** in advance of the crosswalk to warn drivers where to stop in advance of the crosswalk when it is occupied.

3a. **Install Advanced Signage with Activated Flashers** on the northbound and southbound approach on Dolores Drive to alert drivers to the upcoming pedestrian/bicycle crossing. The purpose of the advanced flashing signage is to warn drivers with limited sight stopping distance that the mid-block crossing will be in use.

3b. **Passive video detection** should be installed to detect pathway users approximately 200 feet in advance of the crossing, to activate flashing signage only when pedestrians or bicyclists are present. As pedestrians will take longer than a bicyclist to arrive at the crossing, flashers need to remain activated long enough for pedestrians to pass through the crossing. Add a detection point for pedestrians approaching from the south on Dolores Drive who wish to cross at the mid-block crossing as well. Cameras should either be installed outside of the EBMUD ROW, which would require an encroachment permit from adjacent property owners (Caltrans or other), or at the roadway crossing looking back at the path, on City of Lafayette's ROW.

4. **Install Curb Extensions/Neck Down** at the crossing entrance to enhance safety by shortening the roadway exposure time for pathway users and by decreasing vehicle speeds. Curb extensions may also improve the sight distance issues on Dolores Drive as pathway users will be more visible at the extended curb and will also improve sightlines for approaching vehicles. **Remove Parking Space** immediately north of the eastern curb extension to improve pathway user view of southbound motor vehicles. **Stripe Northbound Shoulder** approaching the crosswalk to guide northbound motor vehicles toward the centerline, thereby improving sight distances.

5. **Install Pedestrian Scale Lights** at the pathway entrance to improve visibility between drivers and pathway users and to enhance personal security of pathway users. Light poles should be installed within City of Lafayette's ROW or easement over the EBMUD Aqueduct ROW.

6. **Install In-Pavement Flashers** in northbound and southbound directions which flash as pathway users cross the marked crosswalk. The in-pavement flashers will help drivers be more aware of pedestrian and bicycle activity at the mid-block crossing. In-pavement flashers can be activated passively, using a bollard detector, or can require pathway users to press a pedestrian push button to activate. Costs are given for a passive bollard detector. If EBMUD will not support in-pavement flashers at this location, consider a rapid flashing beacon that could be installed in advance of the crossing and away from EBMUD infrastructure.

Pathway Treatments

The following treatments recommended along the pathway would enhance the safety for pathway users.

1. **Install Stop Signs** on the pathway to ensure pathway users stop and look for on-coming traffic before crossing.

2. **Install Bollards** and **Curve the Pathway** at the pathway entrances to slow down bicyclists as they approach the roadway. Bollards narrow the pathway, requiring bicyclists to slow down to navigate. Reducing bicyclist speeds are particularly important at this crossing due to limited sight distances on Dolores Drive.

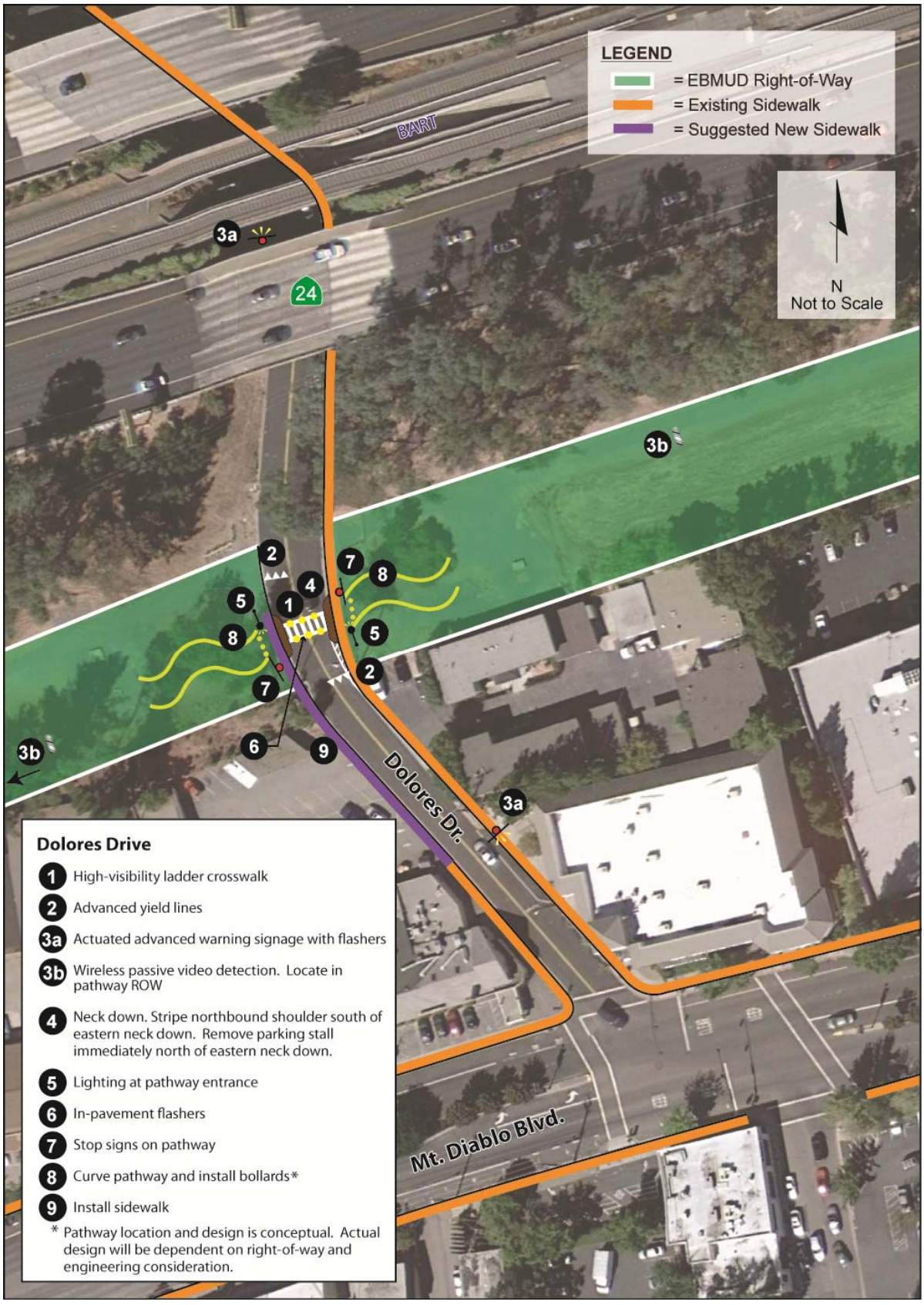

Figure 5-7: Dolores Drive Crossing Improvements

Other Improvements

Sidewalk treatments along Dolores Drive would improve pedestrian connections with pedestrian facilities along Deer Hill Road and Mt. Diablo Boulevard and with nearby land uses.

1. **Complete the Sidewalk** along the west side of Dolores Drive, south of the EBMUD Aqueduct ROW, to improve safe connections between the pathway and Mt. Diablo Boulevard. In addition, the existing sidewalk on the east side of Dolores Drive north of the EBMUD Aqueduct ROW should be cleared of debris and vegetation to provide a clear path of travel for pedestrians.

Dolores Drive Planning-Level Cost Estimates

Planning-level construction cost estimates are presented in **Table 5-6**. As proposed, the improvements to Dolores Drive are estimated at $249,000.

Table 5-6: Cost Estimate for Dolores Drive Improvements

No.	Description	Quantity	Unit	Unit Price	Amount
1	Ladder Crosswalk	290	LF	$7	$2,030
2	Advanced Yield Lines	10	SF	$8	$80
3	Advanced Signage[1]	4	EA	$700	$2,800
4	Neck-Downs	1	LS	$25,000	$25,000
5	Paint (striping south of eastern neck down)	100	LF	$7	$700
6	Lights at Pathway Entrance	2	EA	$1,000	$2,000
7	In-Pavement Flashers	1	LS	$20,000	$20,000
8	Stop Sign for Pathway Users	2	EA	$700	$1,400
9	Bollards	6	EA	$700	$4,200
10	Sidewalk	2,900	SF	$20	$58,000
11	Landscaping and Irrigation at Pathway Entrance	300	SF	$20	$6,000
12	Minor Items *(10% of Construction Items)*	1	LS	$13,579	$13,579
13	Additions *(10% of Construction Items)*	1	LS	$13,579	$13,579
14	Mobilization *(10% of Total Construction Cost)*	1	LS	$16,597	$16,597
				SUBTOTAL	**$166,000**
				25% SOFT COSTS[2]	**$41,500**
				25% CONTINGENCY	**$41,500**
				CROSSING IMPROVEMENTS TOTAL	**$249,000**

[1] The cost estimated costs do not include costs for conduit and electrical hook-ups. These costs should be calculated in more advanced stages of the project design.

[2] Soft costs include survey, design, permitting, and administration costs.
LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

5.4.5 Happy Valley Road Crossing

Happy Valley Road is a two lane collector with a 25 mph posted speed limit. Surrounding land uses include the Lafayette BART station, Downtown, and office and commercial space. Future land uses include a redevelopment site south east of the EBMUD ROW to a mixed use land use. The geometric design of the EBMUD ROW crossing on Happy Valley Road presents dramatic slopes from 2 percent to 33 percent. More detail is provided in *Chapter 4: Existing Conditions, Opportunities, and Constraints.*

Options Evaluation and Preferred Option

Two options were considered for the Happy Valley Road crossing, an at-grade crossing or a bicycle and pedestrian bridge. Due to topographic constraints, a pedestrian/bicycle bridge is the preferred option at this location.

Crossing Option 1: At-Grade Crossing

An at-grade crossing option would require multiple switchbacks to traverse the west side of the Happy Valley Road where the slopes are approximately 3:1, or 33 percent, and the height from the top of the EBMUD Aqueduct ROW to street level is nearly 50 feet. The geometry of a pathway with an approximately eight percent running slope would be extremely circuitous west of Happy Valley Road and would require engineered fill material and hundreds of square feet of gravity retaining wall. Cutting into the existing slope or placement of permanent foundations within the ROW, which might otherwise permit a less circuitous alignment, are not allowed by EBMUD structural requirements. The City is currently designing a mid-block crossing that will provide a pedestrian connection between the BART parking lot and the west side of Happy Valley Road, where the sidewalk will also be extended north. This crossing would be adequate for the at-grade crossing option. Advanced signage is recommended to alert drivers to the pathway crossing.

Planning-level construction cost estimates for an at-grade crossing are presented in **Table 5-7**. The at-grade improvements are estimated at $2,900.

Table 5-7: Cost Estimate for Happy Valley Road At-Grade Crossing Improvements

No.	Description	Quantity	Unit	Unit Price	Amount
1	Advanced Signage	2	EA	$700	$1,400
2	Minor Items *(10% of Construction Items)*	1	LS	$156	$156
3	Additions *(10% of Construction Items)*	1	LS	$156	$156
4	Mobilization *(10% of Total Construction Cost)*	1	LS	$191	$191
				SUBTOTAL	**$1,900**
				25% SOFT COSTS[1]	**$500**
				25% Contingency	**$500**
				CROSSING IMPROVEMENTS TOTAL	**$2,900**

[1]*Soft costs include survey, design, permitting, and administration costs.*

LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

Crossing Option 2: Pedestrian and Bicycle Overcrossing

The second option uses a pedestrian and bicycle overcrossing to span the roadway and connect the embankments on opposite sides of the roadway, as shown in **Figures 5-8** and **5-9**. The overcrossing would provide a 10- to 12-foot-wide travelway and 17 feet of clearance above Happy Valley Road. This option would require a Caltrans Longitudinal Encroachment in order for the retaining walls, footings, and abutments for the pedestrian and bicycle overcrossing to be placed in state ROW. As discussed in *Chapter 4: Existing Conditions, Opportunities, and Constraints*, EBMUD will not allow these structural features within their ROW.

East of Happy Valley Road, the pathway "splits" such that one pathway directly connects with the top of the BART staircase and ramp and a second pathway slopes down to the level of the BART parking lot. Due to topographic constraints, a pedestrian/bicycle overcrossing is the recommended crossing option at Happy Valley Road. Any potential conflicts with BART utilities would need to be identified and resolved prior to project approval.

Costs associated with a pedestrian and bicycle overcrossing at Happy Valley Road are presented in **Table 5-8**. The pedestrian/bicycle overcrossing is estimated at $1.2 million. Costs include the bridge structure, fill material, and retaining wall needed to bring the bridge span back to existing grades. The overcrossing would be constructed within Caltrans ROW.

Table 5-8: Cost Estimate for Pedestrian/Bicycle Overcrossing at Happy Valley Road

No.	Description	Quantity	Unit	Unit Price	Amount
1	Import Borrow	3,400	CY	$25	$85,000
2	Fine Grading	2,500	SF	$0.50	$1,250
3	3" Hot Mix Asphalt (Type A)	35	TON	$85	$2,975
4	6" Aggregate Base (Class 2)	35	CY	$45	$1,575
5	Railing	2,200	LF	$10	$22,000
6	Retaining Wall (Type 1)	2,140	SF	$100	$214,000
7	Pedestrian Overcrossing (80' Span)	1	LS	$250,000	$250,000
8	Lighting Allowance	1	LS	$25,000	$25,000
9	Landscaping and Irrigation at Pathway Entrance	300	SF	$20	$6,000
10	Minor Items *(10% of Construction Items)*	1	LS	$67,534	$67,534
11	Additions *(10% of Construction Items)*	1	LS	$67,534	$67,534
12	Mobilization *(10% of Total Construction Cost)*	1	LS	$82,541	$82,541
				SEGMENT 1 SUBTOTAL	**$825,400**
				25% SOFT COSTS[1]	**$206,350**
				25% CONTINGENCY	**$206,350**
				SEGMENT 1 TOTAL	**$1,238,100**

[1]*Soft costs include survey, design, permitting, and administration costs.*

LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

Figure 5-8: Happy Valley Road Bicycle and Pedestrian Overcrossing

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Figure 5-9: Photo Simulation of Happy Valley Road Overcrossing (At-Grade Improvements by Others)

5.5 Segment 2: BART to Oak Hill Road

Segment 2 extends approximately 0.2 miles from Happy Valley Creek in the west to Oak Hill Road in the east.

The preferred option for Segment 2 is a paved Class I bikeway/ADA-accessible pathway, with an at-grade crossings at Oak Hill Road. The eastern portion of the pathway would encroach into Caltrans SR 24 ROW to avoid the steep grade changes along this portion of the EBMUD Aqueduct ROW (see **Section 4.4.1** for additional detail). As proposed, this preferred option would cost approximately $2.7 million to build, including roadway crossing improvements.

Table 5-9 summarizes the planning-level costs of the preferred option for Segment 2 as well as the costs of other options that were considered. Detailed descriptions of the design options and preferred options, including the rationale for choosing each preferred option are described below.

Table 5-9: Cost Summary for Preferred and Other Considered Options for Segment 2 BART to Oak Hill Road

Preferred Option		Other Considered Options	
Description	*Cost*	*Description*	*Cost*
Class I Bikeway/ ADA-Accessible Pathway	$1,958,300	Unpaved Multi-Use Pathway	$47,900
Oak Hill Road Crossing Improvements	$721,200	Oak Hill Road Crossing Improvements	$721,200
Total Cost of Preferred Option	**$2,679,500**	**Total Cost of Other Considered Options**	**$769,100**

5.5.1 Pathway Design

Summary of Existing Conditions, Opportunities, and Constraints

Surrounding land uses include residential, office, and commercial to the south and SR 24 to the north. The SR 24 off-ramp, a 5-foot-wide sidewalk and retaining wall are located immediately north of the eastern half of Segment 2. Happy Valley Creek crosses the west end of Segment 2. A path along the creek connects the EBMUD Aqueduct ROW to Lafayette Circle, which connects with Mt. Diablo Boulevard.

Topography along Segment 2 creates a peak approximately midway along the segment (see *Chapter 4: Existing Conditions, Opportunities, and Constraints* for additional detail). The grade along the western portion of Segment 2 increases at approximately 12 percent. The slopes west of Oak Hill Road are approximately 4:1, or 25 percent. The top of the hill west of Oak Hill Road is approximately 55 feet above street level.

Design constraints through this Pathway Segment include steep grades along the entire length of the segment, particularly west of Oak Hill Road. This drop from the peak of the hill to Oak Hill Road represents a significant elevation change.

Roadway crossings within Segment 2 include Oak Hill Road. This crossing is described in detail in the following section.

Options Evaluated and Preferred Options

Two facility design standards were considered for this pathway segment: a paved Class I bikeway/ADA-accessible pathway and an unpaved multi-use pathway. As described in **Section 5.3**, the preferred option for the pathway design is the Class I bikeway/ADA-accessible pathway.

Unpaved Multi-Use Pathway Option

An unpaved multi-use pathway would follow the existing slope profile and would not be ADA-accessible. While an unpaved, non-ADA compliant pathway is estimated to cost about one-third the cost of a Class I bikeway/ADA-accessible pathway, an unpaved, non-ADA compliant pathway would have slopes up to 25 percent over the rise from BART to Oak Hill Road and would be so steep as to be used only by a few intrepid bicyclists. Further, this type of pathway would not meet one of the project's primary goals of providing access to a range of users and improving the ability of less experienced bicyclists to access BART and Downtown Lafayette. A non-ADA-but-bicycle accessible route is not recommended as the preferred option, due to the potential lack of grant funding opportunities and probable lower level of use.

Class I Bikeway/ADA-Accessible Pathway along SR 24 Off-Ramp Option

Figures 5-10 and **5-11** show the Class I bikeway/ADA-accessible pathway alignment. A Class I bikeway/ADA-accessible pathway alignment would require some switchbacks along the western portion of the EBMUD Aqueduct ROW, north of the existing Town Center Residential development. Due to topographic constraints, the eastern portion of the Class I bikeway/ADA-accessible pathway alignment encroaches into Caltrans SR 24 ROW. Implementation of the eastern portion of the pathway would improve the existing sidewalk along the south side of the SR 24 Oak Hill Road off-ramp to meet Class I bikeway/ADA-accessible pathway design standards, as shown in **Figures 5-10** through **5-11**. **Figure 5-12** shows the location where the pathway would transition from EBMUD ROW to Caltrans ROW. The SR 24 off-ramp would need to be realigned and shifted to the north in order to widen the existing 5-foot-wide sidewalk to 10 feet and meet Caltrans standards for travel lane and shoulder widths. Additionally, a retaining wall would be constructed parallel to SR 24, north of the off-ramp travel lanes and within Caltrans ROW. If this off-ramp is signalized, the turn pocket storage would be modified. As proposed, 300 feet of vehicular queuing space would be provided (see **Figure 5-11**). The new storage space would preclude any further widening of SR 24 to the south. This option would require a longitudinal encroachment because the pathway would be within the state ROW along the off-ramp. Crossing treatment options for Oak Hill Road are presented in **Section 5.9.5**.

Class I Bikeway/ADA-Accessible Pathway within EBMUD Aqueduct ROW Option

A pathway entirely within the EBMUD Aqueduct ROW would require several switchbacks west of Oak Hill Road in order to navigate the grade differential between the top of the hill and Oak Hill Road, and maintain an approximately eight percent running slope. This geometry would result in a circuitous pathway and would require gravity retaining walls and engineered fill. EBMUD Revocable License Agreement does not permit installation of permanent retaining walls or cutting into the existing slope.

BART Flyover Option

The BART Flyover option, which would extend the Happy Valley Road bicycle and pedestrian bridge over the BART station, spans portions of Pathway Segments 1 and 2. This option meets Caltrans Class I Bikeways standards and would require a similar level of effort for permitting as an at-grade alignment that encroaches into SR 24 ROW.

Routing the pathway along the BART parking lot sidewalk creates potential conflicts between pathway users and BART patrons, though these conflicts can be mitigated. The BART flyover option proposes a spur connection to the BART station, but avoids the user conflicts at BART by maintaining the pathway elevation and routing it over the BART station to connect with an existing sidewalk on the south side of the SR 24 Oak

Hill Road off-ramp, where it would follow the proposed alignment described above. This alignment also avoids grade changes along the western portion of Segment 2, reducing the need for switchbacks. Due to the slope of the embankment adjacent to SR 24, the BART flyover option would require extensive retaining wall work within Caltrans ROW to maintain ADA-accessible 5 percent grades. As it passes over the BART station, this pathway alignment would come within several feet of the SR 24 deck, perhaps requiring additional permitting.

The BART flyover option would add $1.9 million to the cost of the Happy Valley Road overcrossing (see **Table 5-12**) and is not recommended. Potential conflicts between pathway users and BART patrons adjacent the southern BART parking lot can by minimized through design (e.g. through widening the pathway at the parking lot level and providing adequate sight distances where the pathway meets the sidewalk along the parking lot).

Planning-Level Cost Estimate for Pathway Construction

Table 5-10 through **Table 5-12** present cost estimates for the two facility design standards within Pathway Segment 2 and the BART flyover option. As proposed, a multi-use pathway would cost approximately $47,900 to build. A Class I bikeway/ADA-accessible pathway and SR 24 off-ramp improvements would cost approximately $2.0 million. The BART flyover option is estimated to add $1.9 million to the Class I bikeway/ADA-accessible pathway along the SR 24 off-ramp option. Costs for the BART flyover option include the bridge structure, fill material, and retaining wall. Costs associated with crossing improvements at Oak Hill Road are presented separately.

Table 5-10: Segment 2 Cost Estimate for an Unpaved Multi-Use Pathway
(Not Including Oak Hill Road Crossing Improvements)

No.	Description	Quantity	Unit	Unit Price	Amount
1	Clear, Grub & Tree Removal	12700	SF	$0.50	$6,350
2	Grading	12700	SF	$0.75	$9,525
3	6" Aggregate Base (Class 2)	170	CY	$45.00	$7,650
4	Minor Items *(10% of Construction Items)*	1	LS	$2,614.00	$2,614
5	Additions *(10% of Construction Items)*	1	LS	$2,614.00	$2,614
6	Mobilization *(10% of Total Construction Cost)*	1	LS	$3,195.00	$3,195
				SEGMENT 2 SUBTOTAL	**$31,900**
				25% SOFT COSTS[1]	**$8,000**
				25% CONTINGENCY	**$8,000**
				SEGMENT 2 TOTAL	**$47,900**

[1] *Soft costs include survey, design, permitting, and administration costs.*

LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

Table 5-11: Segment 2 Cost Estimate for a Class I Bikeway/ADA-Accessible Pathway along the SR 24 Off-Ramp (without the BART Flyover)

(Not Including Oak Hill Road Crossing Improvements)

No.	Description	Quantity	Unit	Unit Price	Amount
Pathway Improvements					
1	Import Borrow	1,100	CY	$25	$27,500
2	Fine Grading	16,600	SF	$1	$8,300
3	3" Hot Mix Asphalt (Type A)	230	TON	$45	$10,350
4	6" Aggregate Base (Class 2)	220	CY	$85	$18,700
5	Railing	700	LF	$10	$7,000
6	Minor Items *(10% of Construction Items)*	1	LS	$7,984	$7,984
7	Additions *(10% of Construction Items)*	1	LS	$7,984	$7,984
8	Mobilization *(10% of Total Construction Cost)*	1	LS	$9,758	$9,758
				Pathway Improvements Subtotal	**$97,600**
Off-ramp Improvements					
9	Roadway Excavation	1,000	CY	$20	$20,000
10	Remove Base & Surfacing	6,500	SF	$1	$6,500
11	Remove Curb & Gutter	1,500	LF	$6	$9,000
12	Cold Plane Asphalt Concrete	21,000	SF	$2	$42,000
13	2" Hot Mix Asphalt Overlay (Type A)	260	TON	$85	$22,100
14	4" Hot Mix Asphalt (Type A)	225	TON	$85	$19,125
15	9" Aggregate Base (Class 2)	250	CY	$45	$11,250
16	Relocate Existing Drainage Facilities	1	LS	$50,000	$50,000
17	Retaining Wall (Type 1)	6,400	SF	$100	$640,000
18	Concrete Barrier (Type 60)	625	LF	$100	$62,500
19	Signage	1	LS	$5,000	$5,000
20	Striping	1	LS	$2,000	$2,000
21	Minor Items *(10% of Construction Items)*	1	LS	$98,831	$98,831
22	Additions *(10% of Construction Items)*	1	LS	$98,831	$98,831
23	Mobilization *(10% of Total Construction Cost)*	1	LS	$120,793	$120,793
				Ramp Improvements Subtotal	**$1,207,900**
				SEGMENT 2 SUBTOTAL	**$1,305,500**
				25% SOFT COSTS[1]	**$326,400**
				25% CONTINGENCY	**$326,400**
				SEGMENT 2 TOTAL	**$1,958,300**

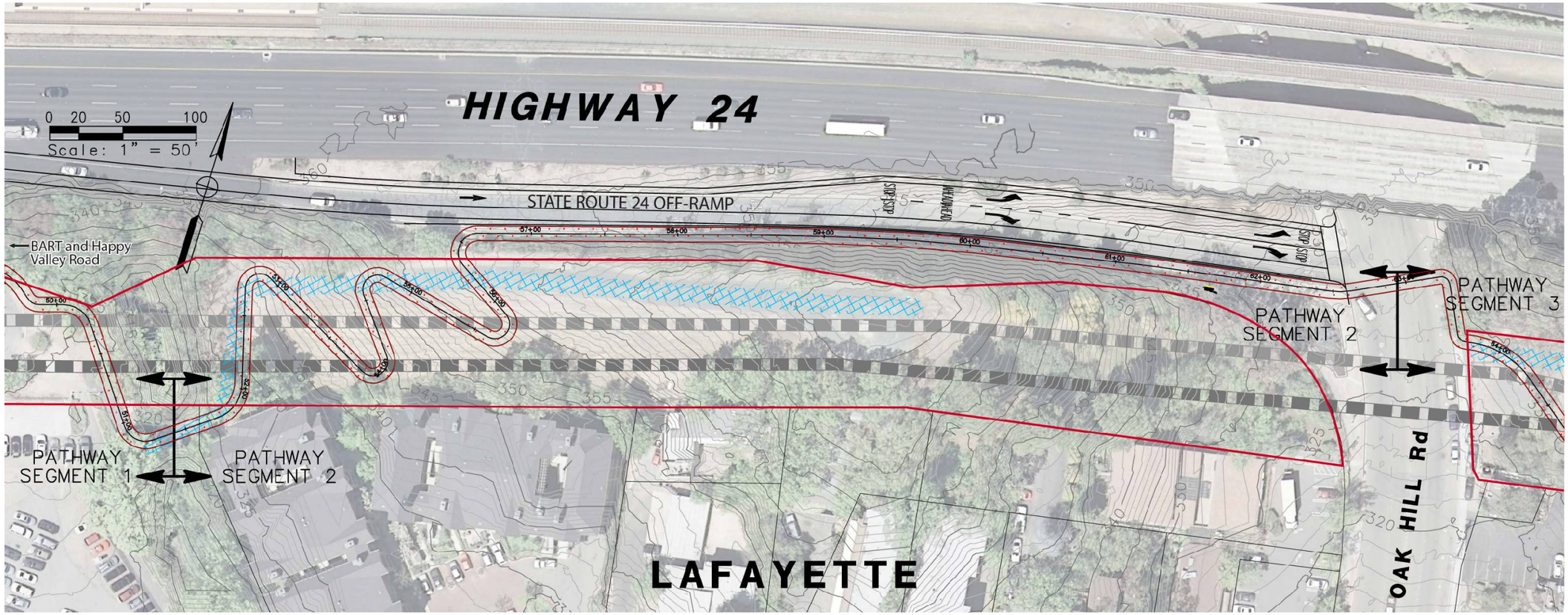
[1]*Soft costs include survey, design, permitting, and administration costs.*

LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

Table 5-12: Cost Estimate for BART Flyover

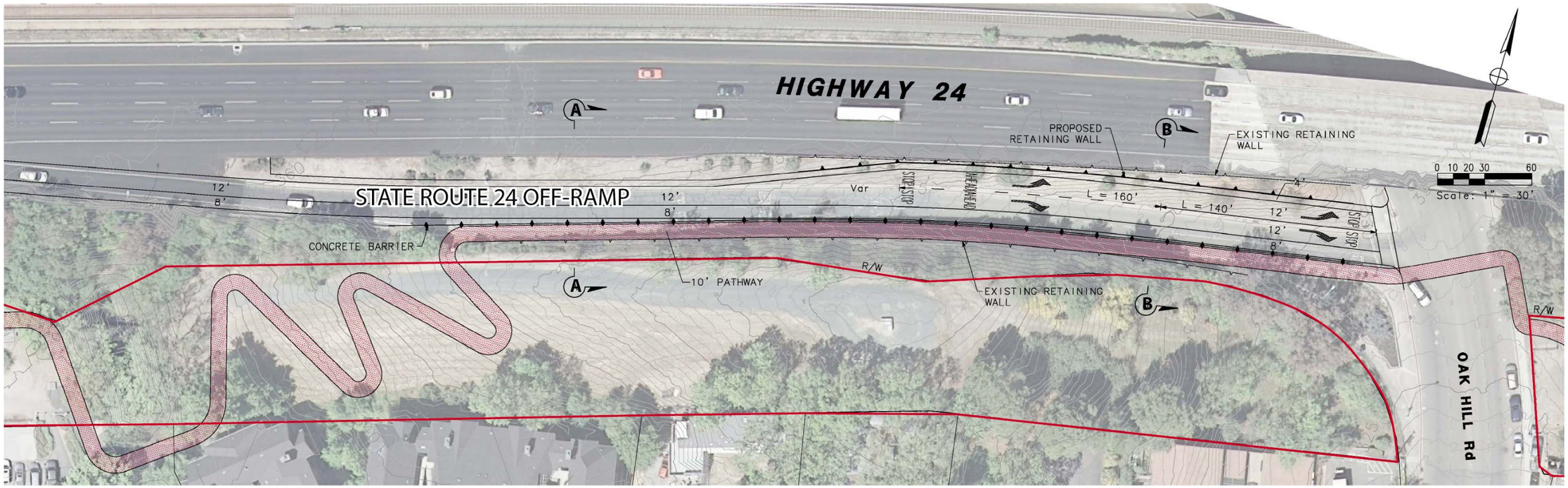
No.	Description	Quantity	Unit	Unit Price	Amount
1	Import Borrow	4,150	CY	25	$103,750
2	Fine Grading	11,900	SF	0.5	$5,950
3	3" Hot Mix Asphalt (Type A)	160	TON	85	$13,600
4	6" Aggregate Base (Class 2)	160	CY	45	$7,200
5	Retaining Wall (Type 1)	6,480	SF	100	$648,000
6	Pedestrian Overcrossing (50' Span)	1	LS	175,000	$175,000
7	Minor Items *(10% of Construction Items)*	1	LS	95,350	$95,350
8	Additions *(10% of Construction Items)*	1	LS	95,350	$95,350
9	Mobilization *(10% of Total Construction Cost)*	1	LS	127,134	$127,134
				BART FLYOVER SUBTOTAL	**$1,271,300**
				25% SOFT COSTS[1]	**$317,800**
				25% CONTINGENCY	**$317,800**
				BART FLYOVER TOTAL	**$1,906,900**

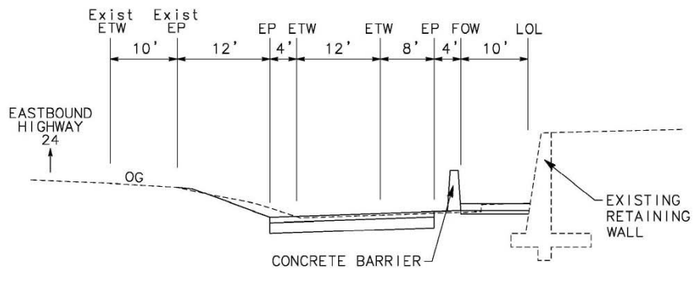
[1]*Soft costs include survey, design, permitting, and administration costs.*
LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum



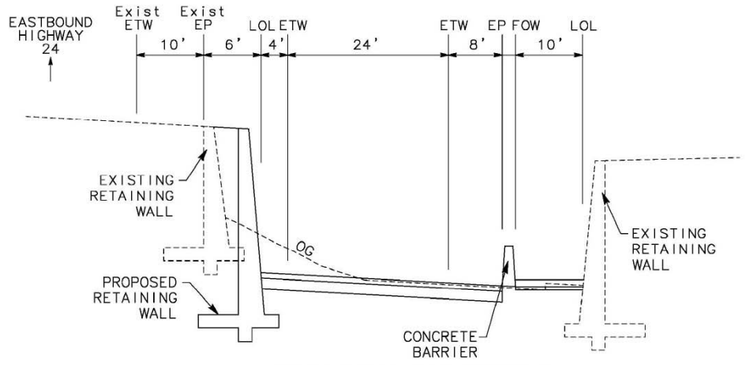
The final pathway alignment may vary from the conceptual alignment shown in this figure in order to accommodate EBMUD access requirements along the EBMUD Aqueduct ROW.

Figure 5-10: Pathway Segment 2 - Class I Bikeway/ADA-Accessible Pathway Alignment





PROPOSED SECTION A-A
NO SCALE
(looking east)



PROPOSED SECTION B-B
NO SCALE
(looking east)

Figure 5-11: Oak Hill Road Crossing Option 2 Along the State Route 24 Oak Hill Road Off-R

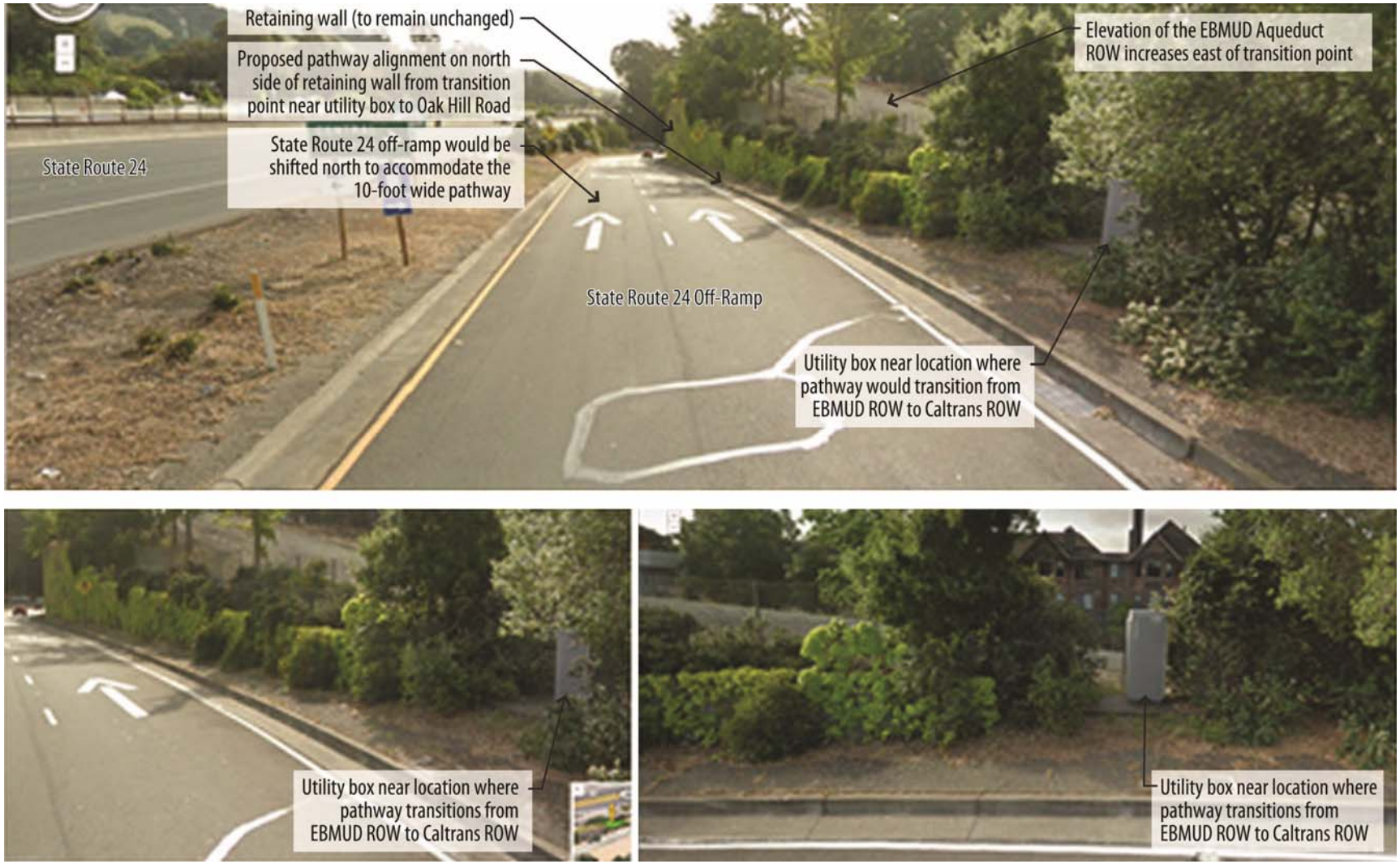


Figure 5-12: Transition point from EBMUD ROW to Caltrans ROW along the SR 24 eastbound off-ramp at Oak Hill Road

5.5.2 Oak Hill Road Crossing Options

Oak Hill Road is a four-lane collector with a posted speed limit of 25 mph, and provides access to multiple destinations, including the Lafayette BART station and commercial businesses in the Downtown area. Drivers accessing the Lafayette BART Station use Oak Hill Road because of the entrance to parking facilities and access to the SR 24 on-ramp and off-ramps. Oak Hill Road experiences high vehicle volumes throughout the day. The EBMUD Aqueduct crosses Oak Hill Road just south of the eastbound off-ramp. Sightlines at the existing crossing are limited. More detail is provided in *Chapter 4: Existing Conditions, Opportunities, and Constraints*.

The SR 24 eastbound off-ramp at Oak Hill Road (looking west)

Preferred Option

Three crossing options were considered for Oak Hill Road. The preferred option includes a traffic signal at the intersection of the eastbound SR 24 off ramp and Oak Hill Road, a median refuge island to protect crossing pedestrian and bicyclists, and modifications to Oak Hill Road. This preferred option is presented as Option 3 below, where additional conceptual design detail and preliminary traffic analysis is provided.

Additional traffic study is required to fully understand the potential roadway capacity and level of service impacts of signal control and lane reduction on Oak Hill Road. The general scope of the required future traffic analysis is detailed below in this section. If ultimately, the reconfiguration of Oak Hill Road presented in Option 3 will adversely affect levels of service, then Option 2 could be pursued.

Crossing Improvement Options Evaluated

The three crossing options considered were:

- Option 1: Mt. Diablo Boulevard crossing
- Option 2: Signalized crossing at Oak Hill Road/SR 24 eastbound off-ramp
- Option 3: Signalized crossing with median refuge and lane reduction on Oak Hill Road

Each option is discussed below. **Figure 5-13** shows a conceptual design for Options 2 and 3. **Figures 5-14** and **5-15** show existing and proposed cross sections along Oak Hill Road, north and south of SR 24. **Figure 5-16** shows a plan view of Option 3 at Oak Hill Road and the SR 24 off-ramp.

Crossing Option 1: Mt. Diablo Boulevard Crossing

The first crossing option would route pathway users south to cross at the Mt. Diablo Boulevard intersection. Existing sidewalks along Oak Hill Boulevard are 5 to 10 feet wide, which would be sufficient for pedestrians but not for bicyclists. In addition, two-way bicycle movement on the sidewalk would raise safety issues at driveways. There are no bicycle facilities on Oak Hill Road and routing bicyclists within the roadway would not be recommended due to high vehicle speeds and volumes.

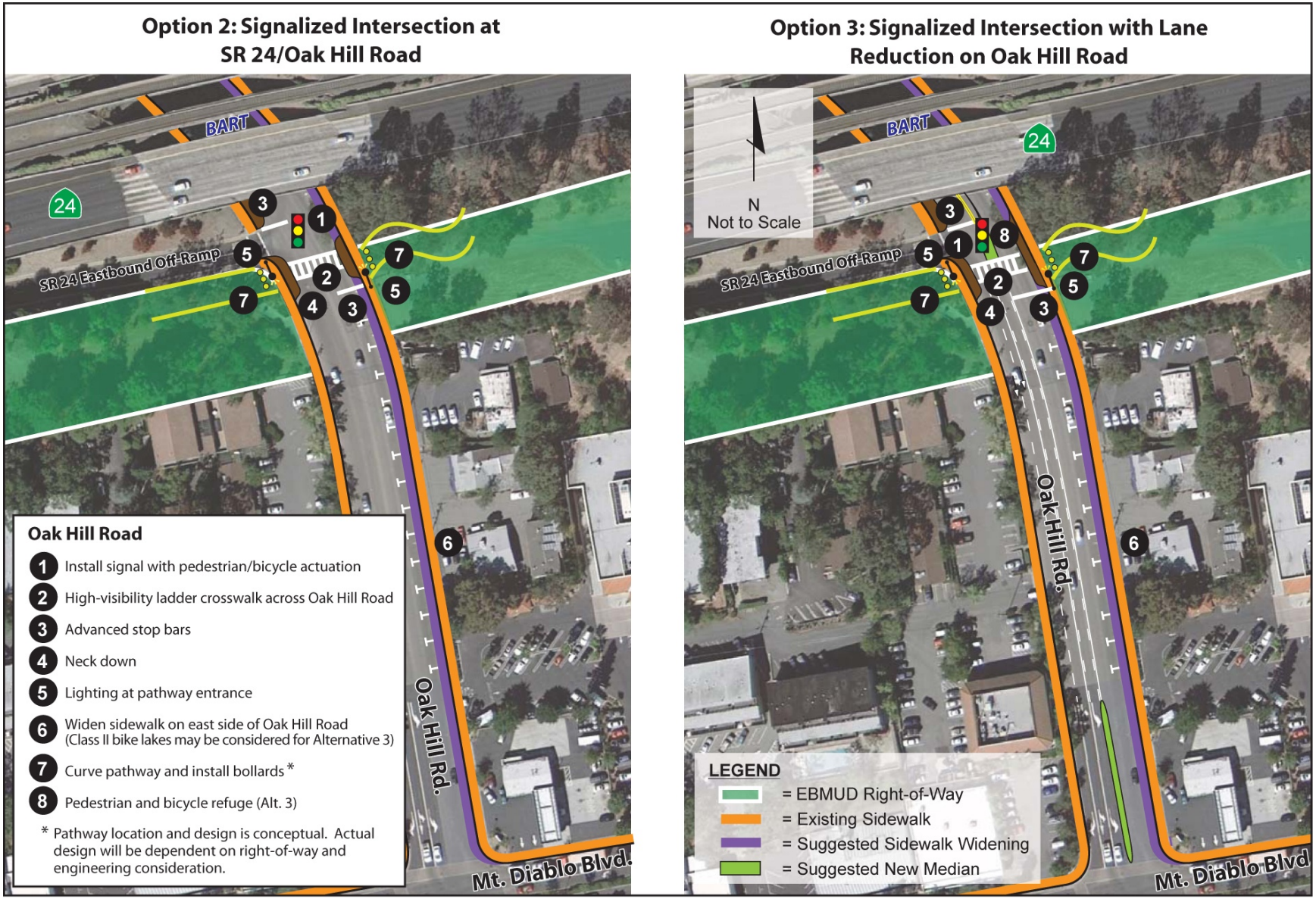


Figure 5-13: Oak Hill Road Crossing Improvements

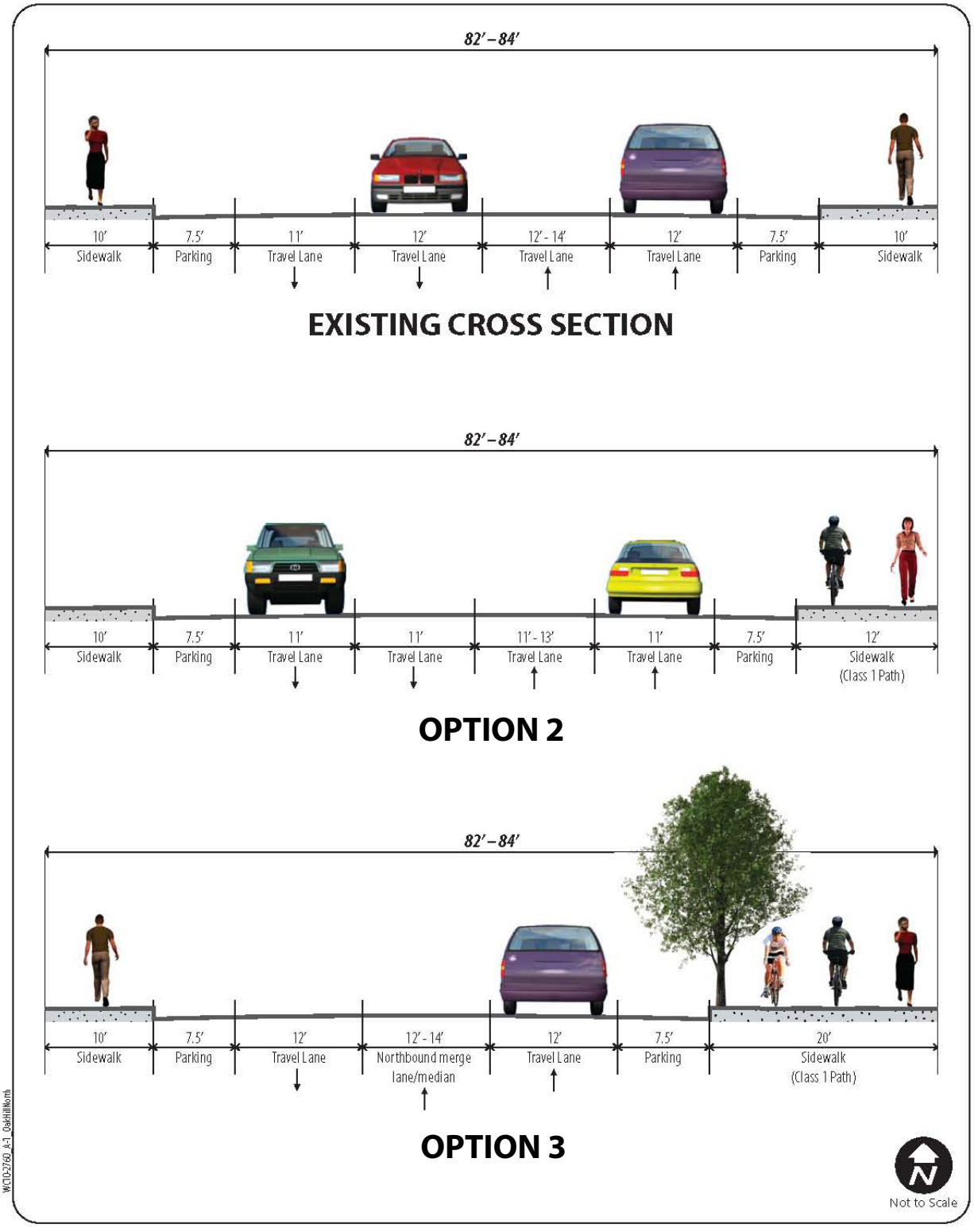


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Figure 5-14: Oak Hill Road North of SR 24: Existing and Proposed Cross Sections

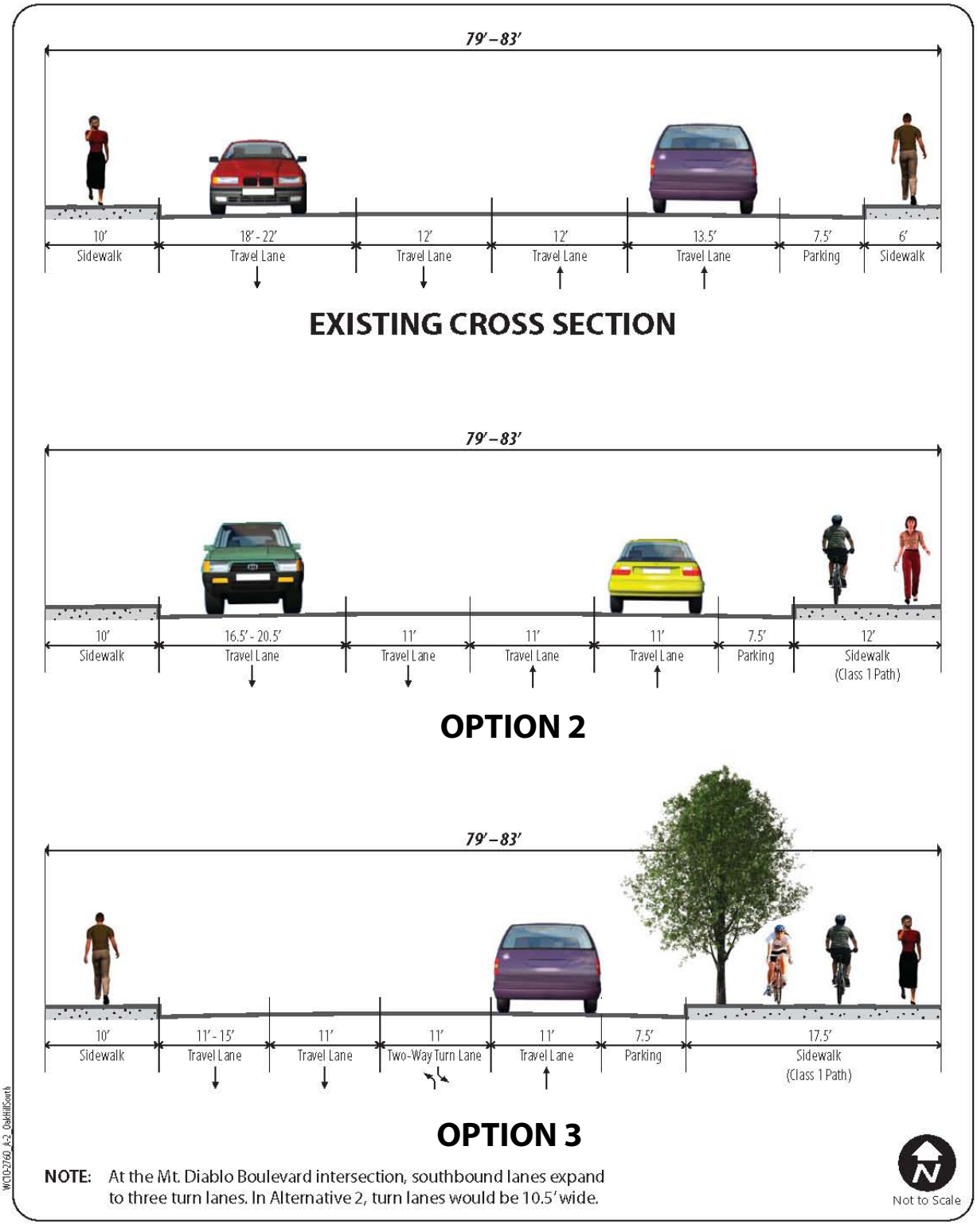

Figure 5-15: Oak Hill Road South of SR 24: Existing and Proposed Cross Sections

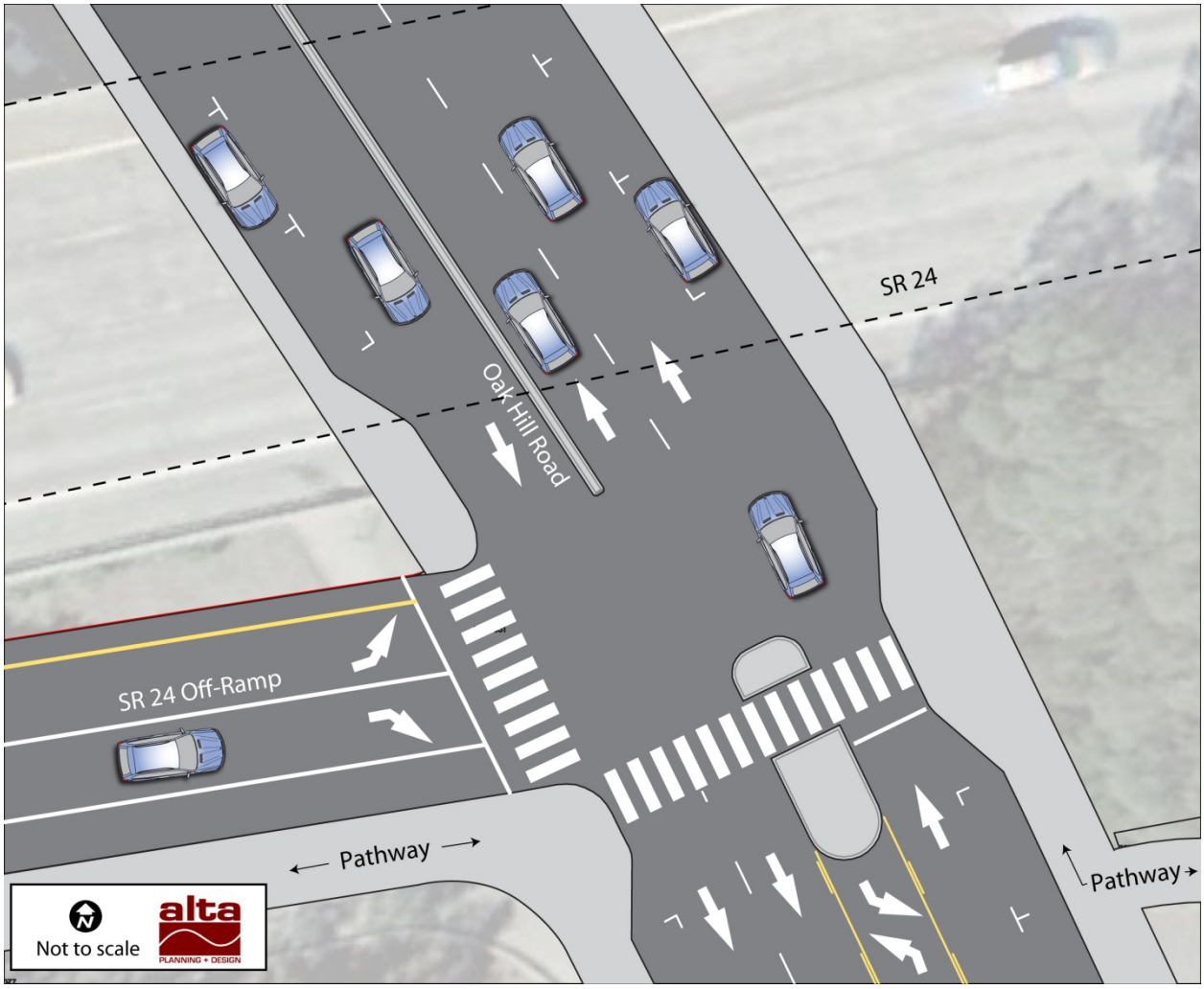

Figure 5-16: Plan View of Oak Hill Road at SR 24: Option 3

The additional travel distance for pedestrians would be approximately one-quarter of a mile, or five to six minutes of walking time. This increase in travel time would be a considerable deterrent to pathway use and could encourage mid-block crossings. Given the safety and access challenges associated with this option it is not recommended.

Crossing Option 2: Signalized Crossing at Oak Hill Road/SR 24 Eastbound Off-Ramp

A second crossing option would signalize the intersection of Oak Hill Road and the SR 24 eastbound off-ramp. Installing a signal at this location would have multiple benefits for all road users. Currently, the roadway configuration of Oak Hill Road between the Deer Hill Road and Mt. Diablo Boulevard intersections is different north and south of SR 24. Under this option, Oak Hill Road between these intersections would be reconfigured to improve pedestrian and bicycle access and safety (see **Figure 5-13** through **Figure 5-15**). The reconfiguration would involve narrowing the travel lanes and would not require additional ROW in order to widen the sidewalk. The Oak Hill Road/Deer Hill Road intersection and Oak Hill Road/Mt. Diablo Boulevard intersection lane configuration would remain unchanged. The following treatments are recommended for a pathway crossing at the Oak Hill Road/SR 24 off-ramp intersection:

1. **Install Signal** – The intersection currently operates with a side-street stop control. Signalizing this intersection with an actuated pedestrian/bicycle phase will improve the safety and traffic operations in the following ways:
    a. One of the proposed pathway alignments is within the Caltrans ROW and would run alongside the south side of the existing SR 24 eastbound off-ramp. A signal is recommended at the intersection of Oak Hill Road to accommodate pedestrian and bicycle crossings. Traffic signal poles should be located within Caltrans' or City of Lafayette's easement over the EBMUD Aqueduct ROW.
    b. A protected crossing phase for pathway users would provide the most direct access and reduce the potential for undesirable midblock crossings.
    c. The Draft Lafayette Downtown Specific Plan Environmental Impact Report (DSP Draft EIR) recommends installing a signal in order to mitigate future ramp queuing issues.
2. **Stripe a High-Visibility Ladder Crosswalk** across the west and south legs of the eastbound SR 24 off-ramp and Oak Hill Road. Locating the crosswalk at the off-ramp intersection would provide the following benefits:
    a. Maximize visibility and sightlines between pathway users and vehicles exiting SR 24. Specifically, if the proposed pathway alignment is routed adjacent to the off-ramp, providing a crossing at the intersection would maintain consistent sightlines along the full length of the ramp from the west approach, creating predictable conditions for the crossing.
    b. Vehicles turning right at the intersection would be moving at a slow speed because they would be accelerating from a complete stop when pathway users have a walk/bike signal.
    c. If the crosswalk is offset to the south, a leading pedestrian interval or a right-turn-on-red restriction should be considered to provide protection for pathway users crossing Oak Hill Road. This would potentially reduce the operational efficiency of the signalized off-ramp.

3. **Advanced Stop Bars** on the northbound and southbound approach indicate to drivers where to stop in advance of the crosswalk. Advanced stop bars are appropriate for signal-controlled crossings. This will help to reduce the number of vehicles encroaching on the pathway crossing.
4. **Install Curb Extensions/Neck-Down** at the crossing entrances to enhance safety by shortening the roadway exposure time for pathway users and to increase the visibility of pedestrians and bicyclists.
5. **Widen the Sidewalk** on the east side of Oak Hill Road between the proposed pathway and Mt. Diablo Boulevard to provide a direct connection to the retail destinations. Though the existing sidewalk widens south of the Safeway shopping center driveway, widening the entire sidewalk is recommended to ensure a consistent sidewalk line along the full length of the roadway. The sidewalk should be a minimum of 12 feet wide to accommodate two-way bicycle and pedestrian travel. Widening the sidewalk under and north of SR 24 is recommended to improve access between the pathway and Deer Hill Road. Widening the sidewalk under SR 24 would require narrowing or removing travel lanes. Widening the sidewalks north of SR 24 would require narrowing three travel lanes as shown in **Figures 5-14** and **5-15**. Two-way bicycle movements on the sidewalk would raise potential safety conflicts at driveways and should be designed for appropriately.

Crossing Option 3: Signalized Crossing with Median Refuge and Lane Reduction on Oak Hill

There are additional opportunities to enhance a pathway crossing at the SR 24 off-ramp/Oak Hill Road intersection. Reducing the number of lanes on Oak Hill Road from four lanes to either three or two lanes would provide space for an additional pedestrian and bicycle refuge area and reduce exposure to vehicle traffic, and could be done while maintaining the same lane configuration at the intersections. It could also provide space to widen the sidewalk on the east side of Oak Hill Road. While these enhancements would further improve the bicycle and pedestrian environment in this area, they are not necessary elements for the feasibility of the pathway. Under Option 3, the Oak Hill Road/Deer Hill Road intersection and Oak Hill Road/Mt. Diablo Boulevard intersection lane configuration would remain unchanged. **Figure 5-13** through **Figure 5-17** show a conceptual design for Option 3, which would narrow Oak Hill Road to two lanes at the potential pathway crossing location. With this modified roadway configuration, additional ROW would not be required in order to widen the sidewalk. This cross section and resultant travel lane configuration has not been tested for this roadway segment and is not recommended without further detailed traffic study.

South of the eastbound SR 24 off-ramp intersection, the proposed concept for Oak Hill Road would have a two-way center turn lane to accommodate auto vehicles accessing the grocery store, gas station, and other retail locations between Mt. Diablo Boulevard and the SR 24 off-ramp and two southbound through lanes. The southbound approach to Mt. Diablo Boulevard would expand back to three lanes to accommodate turning movements at Mt. Diablo Boulevard. Existing on-street parking would not be affected by this design option.

North of the eastbound SR 24 off-ramp intersection, the southbound approach on Oak Hill Road would be reduced to a single travel lane through the pathway crossing. The northbound approach would have one travel lane to accommodate vehicles turning left from the off-ramp and another northbound travel lane for through traffic on Oak Hill Road.

The ramp intersection was analyzed in simulation assuming signalization with a 20-second pedestrian actuated scramble phase for cumulative PM peak hour conditions. All pedestrians and bicyclists cross at the

same time, regardless of direction, while all motor vehicle movements are held. As shown in **Table 5-13**, the intersection would operate at an acceptable level of service (LOS) C. The intersection satisfies the urban peak hour signal warrant under existing conditions and would continue to satisfy the warrant under cumulative conditions. The *California Manual of Uniform Traffic Control Devices* presents eight signal warrants. Generally, meeting one of the signal warrants could justify signalization of an intersection.

Signalization of the SR 24 eastbound off-ramp intersection at Oak Hill Road would significantly reduce average delay and queuing at the ramp. Analysis results indicate that the 95th percentile ramp queue length extends to about 280 feet. Therefore, providing a minimum of 300 feet of storage for the right-turn and left-turn lanes after the single lane off-ramp would accommodate future 95th percentile queue lengths and minimize potential queuing issues at the eastbound off-ramp. For a summary of the downstream effects of signalization of this intersection, refer to Section 4.6.9, which summarizes the traffic analysis conducted for the DSP EIR.

Table 5-13: Oak Hill Road/SR 24 Eastbound Off-Ramp Cumulative PM Peak Hour Analysis

Intersection	Control	LOS[1]	Delay (s)[1]	SR 24 EB Off-Ramp Storage Length (ft)	SR 24 EB Off-Ramp 95th Percentile Queue (ft)
Oak Hill Road/SR 24 EB Off-Ramp	Signalized	C	27.0	1,050	280

Note: Volumes taken from the Cumulative No Project Scenario from the Lafayette Downtown Specific Plan EIR, and analyzed using SimTraffic

[1] *Signalized intersection level of service based on weighted average control delay per vehicle, according to the 2000 Highway Capacity Manual.*

Source: Fehr & Peers, 2011

Pathway Treatments

The following additional treatments are recommended to enhance pathway user and motorist safety:

1. **Install Lights at Pathway Entrance.** Adding lights at the pathway entrance will increase visibility at the pathway crossing.
2. **Install Bollards** at both pathway entrances and **Curve the Pathway** at the pathway entrance on the east side of Oak Hill Road to slow down bicyclists as they approach the roadway. Reducing bicyclist speeds are particularly important at this crossing due to limited sight distances on Oak Hill Road.

Oak Hill Road Crossing Planning-Level Cost Estimates

Planning-level construction cost estimates are presented in **Table 5-14**. The improvements are estimated at $633,100 to $721,200, depending on whether Option 2 or 3 is included. This estimate includes the cost of one traffic signal (totaling approximately $300,000), which is recommended in the DSP Draft EIR to accommodate future traffic along Oak Hill Road. The traffic signal may be needed to as a result of future traffic-generating development (and is not specific to a pathway along the EBMUD Aqueduct ROW); and, therefore, it may be partially or fully paid for with development fees.

Table 5-14: Cost Estimate for Oak Hill Road Crossing Improvements

No	Description	Quantity	Unit	Unit Price	Amount
Option 2					
1	Signal	1	LS	$200,000	$200,000
2	Ladder Crosswalk	700	LF	$7	$4,900
3	Advanced Signage	3	EA	$700	$2,100
4	Advanced Stop Bars	90	LF	$7	$630
5	Curb extensions/ Neck-Downs	1	LS	$25,000	$25,000
6	Widen Sidewalk	3,300	SF	$20	$66,000
7	Lights at Pathway Entrance	2	EA	$1,000	$2,000
8	Bollards	6	EA	$700	$4,200
9	Landscaping and Irrigation at Pathway Entrance	300	SF	$20	$6,000
10	Minor Items *(10% of Construction Items)*	1	LS	$34,537	$34,537
11	Additions *(10% of Construction Items)*	1	LS	$34,537	$34,537
12	Mobilization *(10% of Total Construction Cost)*	1	LS	$42,212	$42,212
				SUBTOTAL	**$422,100**
Option 3 (includes all items in Option 2)					
13	Vertical Median	300	LF	$22	$6,600
14	Median Concrete Surface	600	SF	$11	$6,600
15	Restriping Oak Hill Road	1,200	LF	$25	$30,000
16	Minor Items *(10% of Construction Items)*	1	LS	$4,800	$4,800
17	Additions *(10% of Construction Items)*	1	LS	$4,800	$4,800
18	Mobilization *(10% of Total Construction Cost)*	1	LS	$5,867	$5,867
				SUBTOTAL (includes all items listed in Option 2 & 3)	**$480,800**
				SUBTOTAL	**$422,100 - $480,800**
				25% SOFT COSTS[1]	**$105,500 - $120,200**
				25% CONTINGENCY	**$105,500 - $120,200**
				CROSSING IMPROVEMENTS TOTAL[2]	**$633,100 - $721,200**

[1] *Soft costs include survey, design, permitting, and administration costs.*

[1] *A range is presented to capture the two options.*

LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

Figure 5-17: Photo Simulation of Pathway Along the State Route 24 Oak Hill Road Off-Ramp
(Includes Oak Hill Road Crossing Option 3 Improvements)

5.6 Segment 3: Oak Hill Road to First Street

Segment 3 extends approximately 0.2 miles from Oak Hill Road in the west to First Street in the east.

The preferred option for Segment 3 is a paved Class I bikeway/ADA-accessible pathway, with an at-grade crossing at First Street. As proposed, the preferred option for Segment 3 would cost approximately $1.0 to $1.2 million to build, including roadway crossing improvements.

Table 5-15 summarizes the planning-level costs of the preferred option for Segment 3 and the costs of other options that were considered. Detailed descriptions of the design options and preferred options, including the rationally for choosing each preferred option are described below.

Table 5-15: Cost Summary for Preferred and Other Considered Options for Segment 3 Oak Hill Road to First Street

Preferred Option		Other Considered Options	
Description	*Cost*	*Description*	*Cost*
Class I Bikeway/ ADA-Accessible Pathway	$274,100	Unpaved Multi-Use Pathway	$59,800
First Street Crossing Improvements	$720,000 - $937,900	First Street Crossing Improvements	$720,000 - $937,900
Total Cost of Preferred Option	**$994,100 - $1,212,000**	**Total Cost of Other Considered Options**	**$779,800 - $997,700**

5.6.1 Pathway Design

Summary of Existing Conditions, Opportunities, and Constraints

Surrounding land uses include office and commercial space to the south and SR 24 to the north. The SR 24 on-ramp is located immediately north of the western portion of the EBMUD Aqueduct ROW.

Topography along Segment 3 varies and is illustrated and discussed in detail in *Chapter 4: Existing Conditions, Opportunities, and Constraints*. East of First Street, the topography creates a hill with slopes rising then falling at approximately 22 percent. East of this hill, the topography is relatively flat with slopes of approximately four percent.

Design constraints through this Pathway Segment include steep grades along the western portion of the segment, immediately east of Oak Hill Road.

Roadway crossings within Segment 3 include First Street. This crossing is described in detail in a following section.

Options Evaluated and Preferred Options

The two facility design standards considered for this pathway segment are a Class I bikeway/ADA-accessible pathway and a multi-use pathway. As shown in **Figure 5-18**, the Class I bikeway/ADA-accessible pathway alignment would require some switchbacks east of Oak Hill Road. A multi-use pathway would follow the existing slope profile.

As described in **Section 5.3**, the preferred option for the pathway design is the Class I bikeway/ ADA-accessible pathway.

Planning-Level Cost Estimate for Pathway Construction

Table 5-16 and Table 5-17 present cost estimates for the two facility design standards considered for Pathway Segment 3. As proposed, a multi-use pathway would cost approximately $59,800. A Class I bikeway/ADA-accessible pathway would cost approximately $274,100. Costs associated with roadway crossing improvements are presented in the following section.

Table 5-16: Segment 3 Cost Estimate for an Unpaved Multi-Use Pathway
(Not Including Roadway Crossing Improvements)

No.	Description	Quantity	Unit	Unit Price	Amount
Unpaved Multi-Use Pathway Improvements					
1	Clear, Grub & Tree Removal	15,900	SF	$0.50	$7,950
2	Grading	15,900	SF	$0.75	$11,925
3	6" Aggregate Base (Class 2)	210	CY	$45.00	$9,450
4	Minor Items *(10% of Construction Items)*	1	LS	$3,259.00	$3,259
5	Additions *(10% of Construction Items)*	1	LS	$3,259.00	$3,259
6	Mobilization *(10% of Total Construction Cost)*	1	LS	$3,983.00	$3,983
				SEGMENT 3 SUBTOTAL	**$39,800**
				25% SOFT COSTS[1]	**$10,000**
				25% CONTINGENCY	**$10,000**
				SEGMENT 2 TOTAL	**$59,800**

[1]*Soft costs include survey, design, permitting, and administration costs.*
LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

Table 5-17: Segment 3 Cost Estimate for a Class I Bikeway/ADA-Accessible Pathway
(Not Including Roadway Crossing Improvements)

No.	Description	Quantity	Unit	Unit Price	Amount
Pathway Improvements					
1	Import Borrow	2,800	CY	$25	$70,000
2	Fine Grading	21,900	SF	$1	$10,950
3	3" Hot Mix Asphalt (Type A)	300	TON	$85	$25,500
4	6" Aggregate Base (Class 2)	290	CY	$45	$13,050
5	Railing	1,500	LF	$10	$15,000
6	Minor Items *(10% of Construction Items)*	1	LS	$14,945	$14,945
7	Additions *(10% of Construction Items)*	1	LS	$14,945	$14,945
8	Mobilization *(10% of Total Construction Cost)*	1	LS	$18,266	$18,266
				SEGMENT 3 SUBTOTAL	**$182,700**
				25% SOFT COSTS[1]	**$45,700**
				25% CONTINGENCY	**$45,700**
				SEGMENT 3 TOTAL	**$274,100**

[1]*Soft costs include survey, design, permitting, and administration costs.*
LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

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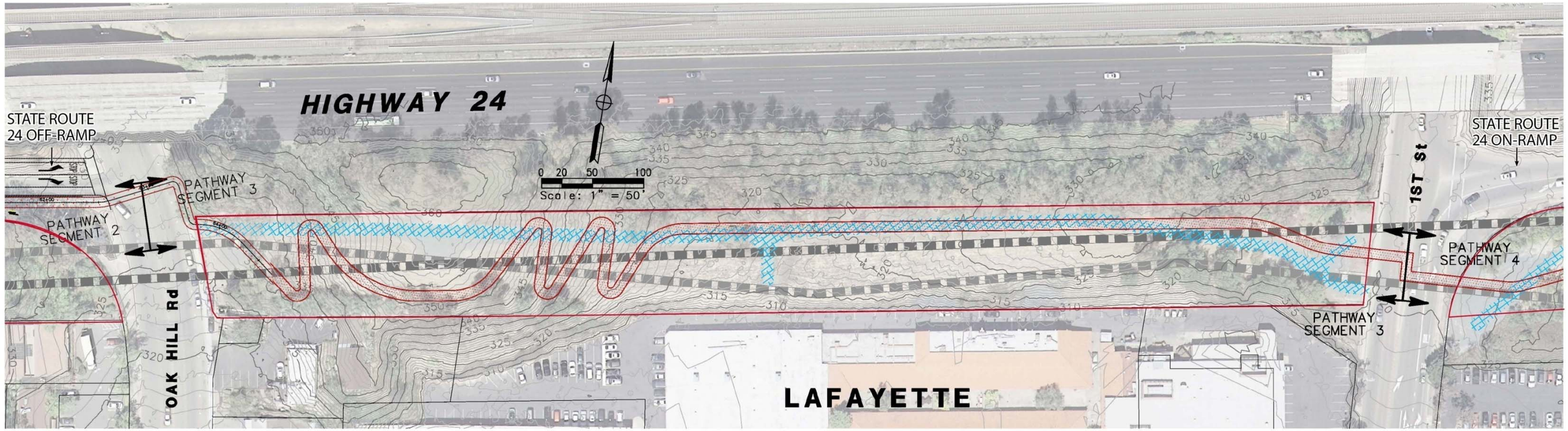

The final pathway alignment may vary from the conceptual alignment shown in this figure in order to accommodate EBMUD access requirements along the EBMUD Aqueduct ROW.

Figure 5-18: Pathway Segment 3 - Class I Bikeway/ ADA-Accessible Pathway Alignment

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5.6.2 First Street Crossing

First Street is a four-lane collector with a raised median and a posted speed limit of 25 mph. The collector provides direct access to the SR 24 eastbound on-ramp and experiences high vehicle volumes throughout the day. First Street also connects to Downtown Lafayette and has several driveways accessing commercial and retail areas. Pedestrians have been observed jaywalking across First Street between the office and commercial uses on opposite sides of the street.

Preferred Option

Four crossing options are considered. Options 3 and 4 presented in this section are the preferred options, with the final preferred alternative to be determined by the results of a detailed micro-simulation traffic analysis that considers all modes. In order to provide for a safe pedestrian and bicycle crossing of First Street, traffic signal control at the intersection of First Street, the eastbound SR24 on-ramp, and the EBMUD ROW is required, at a minimum. Given the complexity of signalizing this intersection, some options need to be preserved for further investigation in future studies.

The general scope for this required future traffic study is included below and in *Chapter 7: Phasing and Next Steps*. Options 3 and 4 each signalize the SR 24 on-ramp, but treat the half-signal at the Plaza driveway differently. Option 4 installs a signal and staggered pedestrian crossing at the SR 24 eastbound on-ramp and maintains the half-signal at the Plaza parking lot. Option 3 converts the half-signal at the Plaza driveway to a full signal and installs a signal and staggered crosswalk at the SR 24 on-ramp. The greater number of interventions required in Option 3 may cause an unacceptable level of traffic impact during peak commute and other peak demand periods.

Crossing Improvement Options Evaluated

The four options considered to enhance the safety and access for potential users accessing the pathway at First Street were:

- Option 1: Route pathway users south through the Mt. Diablo Boulevard intersection.
- Option 2: Fully signalize the Plaza parking lot entrance and provide a single pathway crossing at this location.
- Option 3: Signalize the SR 24 eastbound on-ramp and provide a pathway crossing and fully signalize the Plaza parking lot entrance to further improve pedestrian access across First Street.
- Option 4: Signalize the SR 24 eastbound on-ramp and provide a pathway crossing without altering the Plaza parking lot entrance signal.

Figure 5-19 shows the conceptual plans for Options 2, 3 and 4. **Figure 5-20** shows the conceptual plan for the First Street / SR 24 on-ramp intersection within Options 3 and 4. While there are several opportunities to improve bicycle and pedestrian access and safety on First Street, there are also some considerable limitations with each option, as discussed below.

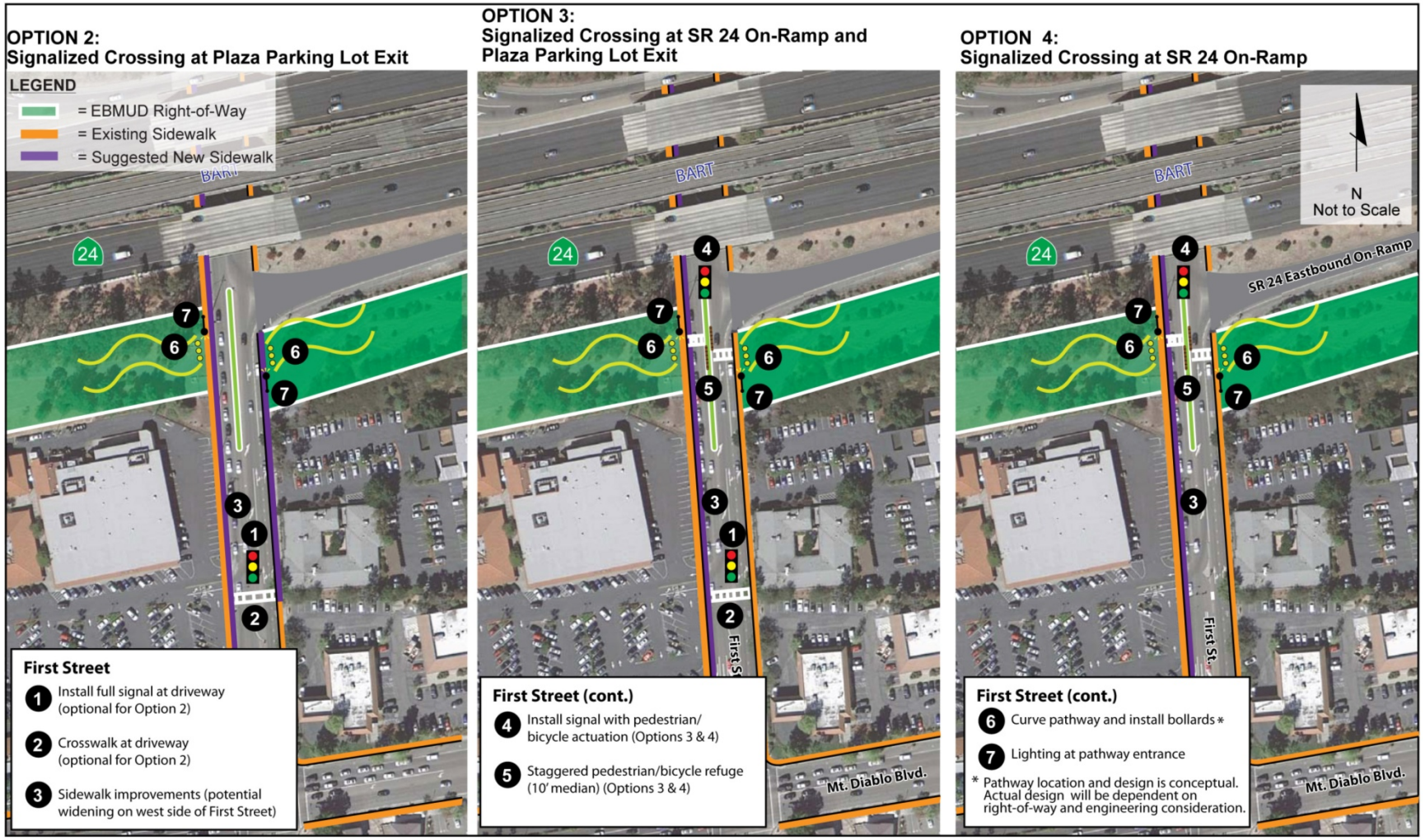


Figure 5-19: First Street Crossing Improvements: Options 2, 3 and 4

A pedestrian/bicycle overcrossing is not considered a viable crossing option at First Street. The topography at First Street would require a very long, and prohibitively expensive overcrossing. Furthermore, EBMUD does not allow construction of any permanent structure foundations (such as footings) that would be difficult to remove in the event of an unexpected emergency repair. The potential to encroach into Caltrans ROW to the north is limited by the presence of the SR 24 on-ramp. Additional considerations are shown in **Figure 5-21**.

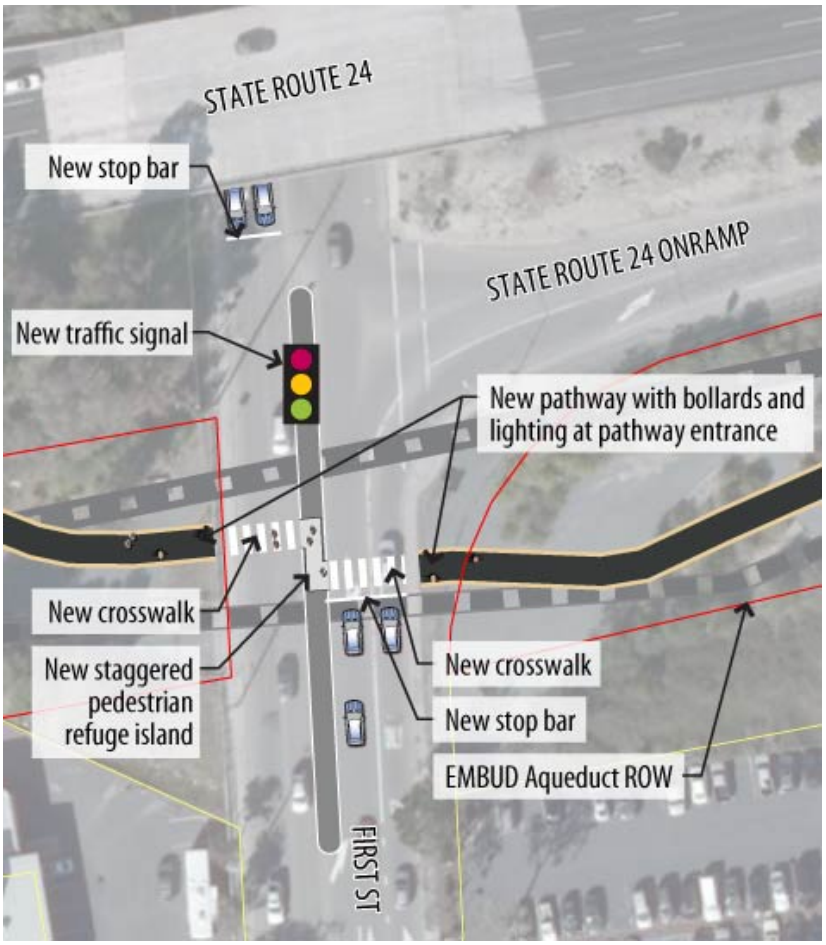


Figure 5-20: First Street/SR 24 On-Ramp intersection showing Crossing Options 3 and 4

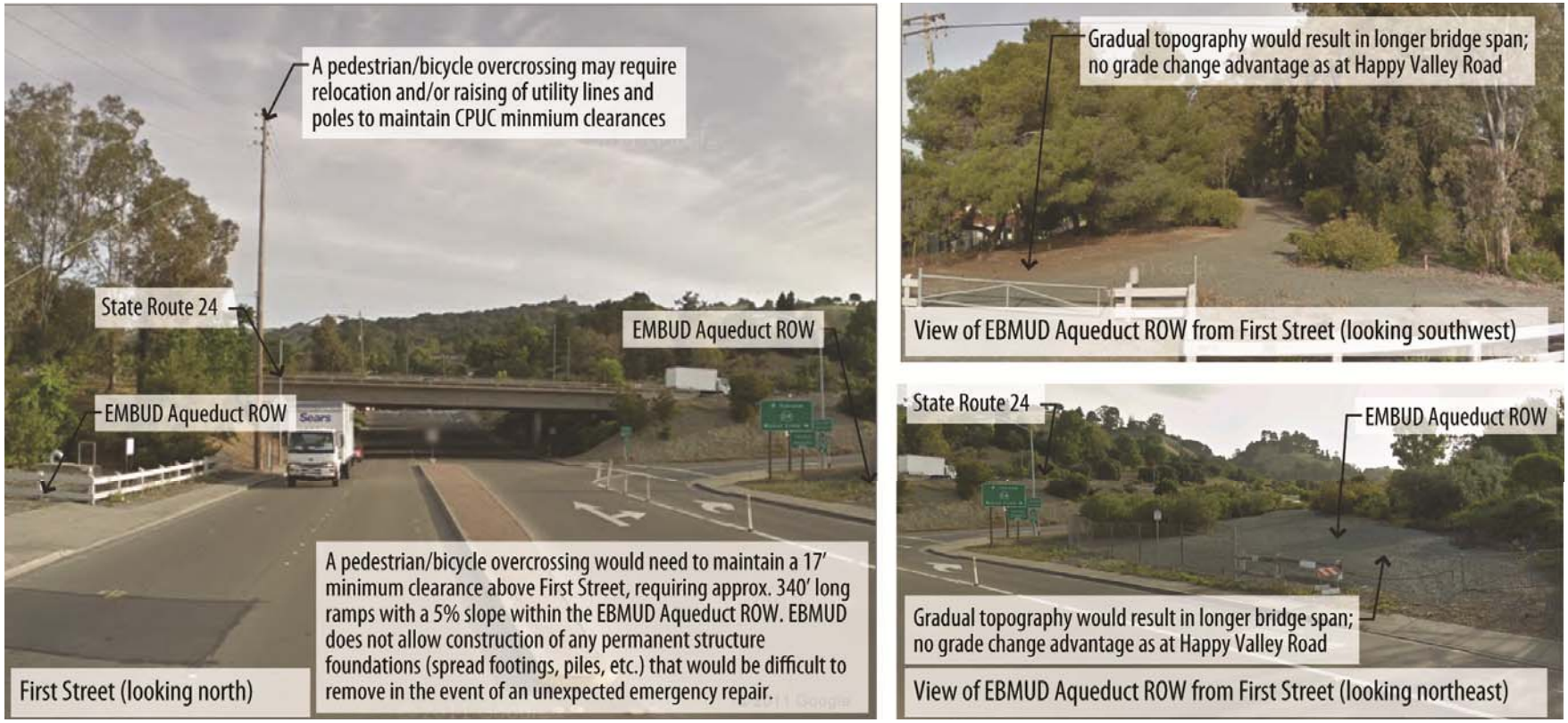


Figure 5-21: Constraints associated with construction of a Pedestrian/Bicycle Overcrossing at First Street

Crossing Option 1: Mt. Diablo Boulevard Crossing

Similar to Crossing Option 1 for Oak Hill Road, the first crossing option for First Street would route pathway users south to cross at the Mt. Diablo Boulevard intersection. Sidewalks along First Street are 5 to 10 feet wide, which would be sufficient for pedestrians but not for bicyclists. In addition, the sidewalk on the west side of First Street is constrained by utility poles and street trees within the pedestrian path of travel and a retaining wall at the future Whole Foods site. Though the sidewalk on the east side of First Street has fewer obstructions, the ROW is also constrained. In order to accommodate pathway users on the sidewalks, the street trees and utility poles should be removed and/or relocated, and the sidewalks should be widened to a minimum of 12 feet, ideally with a landscaped buffer. However, the First Street ROW is constrained, and widening the sidewalk would require either a lane narrowing, or cutting back the slope under SR 24 and potentially cantilevering the sidewalk over the Plaza Shopping Center parking lot. In addition, routing bicyclists on the sidewalks would present potential safety issues with pedestrians and drivers.

There are no bicycle facilities on First Street and routing bicyclists within the roadway is not recommended due to high vehicle speeds and volumes and the difficulty for northbound bicyclists traveling through the First Street/SR 24 on-ramp intersection. The current SR 24 on-ramp configuration of a dedicated right-turn and combined through/right-turn lane presents one of the most challenging designs for bicyclists and is not recommended for less experienced bicyclists. Given the ROW constraints and safety issues along First Street and particularly at the SR 24 eastbound on-ramp, bike lanes are not recommended in this location.

With this option, the additional travel distance for pedestrians and bicyclists would be approximately one quarter of a mile. The resultant increase in travel time would be a considerable deterrent to pathway use and could encourage undesirable mid-block crossings. Given the safety and access challenges associated with Option 1, it is not recommended.

Crossing Option 2: Signalized Pathway Crossing at the Plaza Parking Lot Exit

This option includes installation of a full signal at the Plaza Parking Lot, crossing, and sidewalk improvements as described below:

1. **Install a Full Signal at the Plaza parking lot** exit to provide for an actuated pedestrian crossing. Currently, the half signal accommodates vehicle turning movements out of the parking lot. The signal may be enhanced to provide a pedestrian connection to adjacent destinations. An in-depth discussion of the signal analysis is provided at the end of this section.
2. **Stripe a High-Visibility Ladder Crosswalk on the south side of the Plaza driveway** to provide access to the pathway and adjacent destinations. Locating the crosswalk on the south side would reduce potential conflicts with vehicles exiting the parking lot, heading northbound on First Street.
3. **Widen the Sidewalk on the West Side of First Street** between Deer Hill Road and Mt. Diablo Boulevard. Relocate the street trees and utility poles to provide a clear pedestrian and bicycle path of travel. In order to accommodate bicyclists, the sidewalk should be widened to a minimum of 12 feet. Both bicyclists and pedestrians traveling from the pathway to the library on the southeast corner of the Mt. Diablo Boulevard/First Street intersection would use the widened sidewalks and then cross at the signalized crosswalks on Mt. Diablo Boulevard.

4. **Widen the Sidewalk on the East Side of First Street** between the pathway and proposed crosswalk location to accommodate bicycles. A landscaped buffer is also preferred, but may not be feasible given the ROW constraints.

As discussed in Option 1, there are ROW constraints related to widening sidewalks on either side of First Street. To widen the west side sidewalk, travel lanes would be reduced from 12 to 11 feet. If the west side sidewalk is widened without narrowing or removing lanes, the sidewalk would need to be cantilevered into the Plaza Parking Lot and the slope would need to be dug out and regraded underneath SR 24. To widen the east side sidewalk, travel lanes would need to be further reduced to 10 feet, or widened eastward into the Caltrans and private parking lot ROW. However, if the east side sidewalk were widened further eastward, the building parcel at 1010 First Street would present a pinch point, and the sidewalk width would be limited in this location. A railing or other type of barrier along the outer edge of the sidewalk could be considered to protect bicyclists and pedestrians in the constrained section. The decision to widen the sidewalks on the west or east side of First Street should be made later in the design process, and consider costs and feasibility of ROW acquisition.

By widening the west side sidewalk to 12 feet and permitting two-way bicycle travel, the sidewalk effectively becomes a shared use path adjacent to the roadway, or a sidepath. Two-way sidepaths can introduce operational issues and potential safety problems. Specifically, potential conflicts at the Plaza Parking lot entrance and Deer Hill Road intersection may occur, where drivers may not anticipate two-way bicycle travel. At the Deer Hill Road intersection, clear directional information is needed if this type of design is used, as well as appropriate intersection design to enable bicyclists to safely cross to the other side of the roadway. Specific consideration should be given at the eastbound slip lane at the Deer Hill Road/ First Street intersection, where vehicles from the freeway and the future Whole Foods Parking lot will be turning at high speeds. At the Plaza Parking Lot entrance, signage should be used to indicate that bicyclists will be crossing the driveway entrance. However, signage alone will not remove all potential conflicts and additional design improvements should be considered to create predictable conditions at the driveway.

The AASHTO Guide for the Planning, Design, and Operation of Bicycle Facilities includes detailed guidelines for design considerations for sidepaths and should be consulted as part of any further consideration of sidepath design.

Although this option would provide a crossing at a desirable location for pedestrians accessing nearby destinations, pathway users would be routed away from the most direct crossing point. In addition, preliminary LOS analysis finds that full signalization would have a great impact on roadway operations (see **Table 5-18** and **Table 5-19**). This option is not recommended for these reasons.

Crossing Option 3: Signalized crossing at the SR 24 Eastbound On-Ramp with Full Signal at the Plaza Parking Lot Exit

The following treatments may be considered to provide a crossing at the Plaza parking lot exit and the SR 24 on-ramp:

1. **Install a Full Signal at the Plaza parking lot.** See Option 2 for a description.
2. **Stripe a High-Visibility Ladder Crosswalk on the south side of the Plaza driveway.** See Option 2 for a description.

3. **Install Signal at the SR 24 On-Ramp:** The First Street/SR 24 on-ramp intersection currently operates as a free intersection. Traffic signal poles should be located within Caltrans' or City of Lafayette's easement over the EBMUD Aqueduct ROW. Signalizing this intersection with an actuated pedestrian/bicycle phase would improve the safety and traffic operations in the following ways:

    a. A protected crossing phase for pathway users would provide the most direct east-west access and reduce the potential for undesirable mid-block crossings.

    b. The Draft DSP EIR recommends installing a signal in order to mitigate future queuing issues.

    Vehicles traveling southbound on First Street from Deer Hill Road have limited sight distance due to the freeway over-crossing and grade changes. Consideration should be given to signal placement at the on-ramp so that vehicles anticipate the signal with adequate stopping sight distance.

    An in-depth discussion of the signal analysis is provided at the end of this section.

4. **Stripe a High-Visibility Ladder Crosswalk** at the pathway entrance across First Street and across the SR 24 on-ramp. The crosswalk on First Street should be staggered to discourage pathway users from crossing against the signal (more information on staggered crosswalks and medians is provided in **Appendix C**.) Pathway users would have a green signal phase at the same time as southbound vehicles turning left onto SR 24.

    The proposed pathway would introduce new pedestrian activity to this intersection. The City should consider removing the pedestrian crossing across the SR 24 on-ramp, as the travel lane configuration and signal timing poses pedestrian safety issues. Pedestrians traveling north-south from Deer Hill Road should be routed to the west side of First Street.

5. **Install a Staggered Pedestrian/Bike Refuge Island** by widening the existing median to 10 feet wide to accommodate bicyclists. A staggered refuge island would allow for pathway users to wait within the refuge area if they cannot cross the entire street in one phase. The staggered refuge also slows speeds, thereby discouraging pathway users from darting across the intersection. Widening the median to 10 feet would require narrowing travel lanes from 12 feet to 11 feet.

6. **Widen the Sidewalk on the West Side of First Street.** See Option 2 for a description.

This option is recommended for further study.

Crossing Option 4: Signalized Crossing at the SR 24 Eastbound On-Ramp Only

With this option, the SR 24 eastbound on-ramp could be signalized with a pedestrian and bicycle crossing as described in Option 3, while the Plaza Parking Lot exit would remain as a half signal with no pedestrian crossing. The benefit of this option is that it would maintain free flowing northbound vehicle movements at the Plaza Parking Lot driveway and minimize vehicle delay and queuing back to the Mt. Diablo Boulevard intersection. The signal analysis for this option is discussed in a following section.

The following treatments may be considered to provide a crossing at the SR 24 on-ramp:

1. **Install Signal at the SR 24 On-Ramp.** See Option 3 for a description.

2. **Stripe a High-Visibility Ladder Crosswalk.** See Option 3 for a description.

3. **Install a Staggered Pedestrian/Bike Refuge Island.** See Option 3 for a description.
4. **Widen the Sidewalk on the West Side of First Street.** See Option 2 for a description.

This option provides fewer crossing options for pedestrians than Option 2. As pedestrians frequently cross mid-block at the Plaza Parking Lot exit and would most likely continue to do so in the future, improving pedestrian safety and access at this location should be a key consideration for encouraging walking trips in the area.

This option is recommended for further study.

Pathway Treatments

The following additional treatments along the pathway approaching First Street are recommended to enhance pathway user and motorist safety:

1. **Install Bollards** and **Curve the Pathway** at the pathway entrances to slow down bicyclists as they approach the roadway. Reducing bicyclist speeds are particularly important at this crossing due to limited sight distances.
2. **Install Lights at Pathway Entrance.** Adding lights at the pathway entrance will improve visibility of the pathway crossing.

Signal Analysis for First Street Options 2, 3, and 4

As part of this Study, intersection operations under Existing and Cumulative Conditions were modeled for three intersections along First Street (that is, the SR 24 on-ramp/ First Street, Plaza driveway/First Street and Mt. Diablo Boulevard/First Street intersections) under a No Project option and for Options 2, 3 and 4.[26] The No Project option represents conditions wherein the pathway project is not approved. Results of the analysis are summarized in **Table 5-18** and **Table 5-19**, respectively.

Existing Conditions

As shown in **Table 5-18**, under the No Project option all intersections are expected to operate at LOS D or better during the AM and PM peak hours, except the SR 24 eastbound on-ramp intersection, which operates at LOS F during the PM peak hour.[27] Similarly, under Option 2 all intersections are expected to operate at LOS D or better during the AM and PM peak hours, except the SR 24 eastbound on-ramp intersection, which operates at LOS F during the PM peak hour. Under Option 3, all intersections operate at LOS C or better during the AM and PM peak hours. Signalization of the eastbound on-ramp intersection at First Street significantly reduces average delay during the PM peak hour compared to unsignalized conditions.

[26] The analysis utilized data from the Cumulative No Project Scenario of the Lafayette Downtown Specific Plan EIR, Lafayette Circulation Commission and Whole Foods Proposal.

[27] Level of service (LOS) is a measure used by traffic engineers to determine the effectiveness of elements of transportation infrastructure. The Highway Capacity Manual defines LOS for signalized and unsignalized intersections as a function of the average vehicle control delay (see **Table 4-3** in *Chapter 4: Existing Conditions, Opportunities, and Constraints* for the delay periods associated with LOS A through F).

Under Option 4, all intersections operate at LOS D or better during the AM and PM peak hours. Similar to Option 2 and 3, signalization of the SR 24 eastbound on-ramp significantly reduces the average delay during the PM peak hour. Maintaining the half-signal at the Plaza Driveway instead of fully signalizing the intersection would also improve delays during the PM peak hour.

The First Street/SR 24 intersection satisfies the urban peak hour signal warrant under Existing Conditions and would continue to satisfy the warrant under Cumulative Conditions. The CA-MUTCD presents eight signal warrants. Generally, meeting one of the signal warrants could justify signalization of an intersection.

Cumulative Conditions

The Cumulative Condition traffic analysis builds on the DSP EIR analysis, which assumes a 20-year Plan horizon (2030). The No Project Cumulative Condition assumes that the projects identified in the DPS are fully built.

Under Cumulative Conditions, under the No Project option the Plaza driveway/First Street intersection is expected to operate at LOS A during the AM and PM peak hours; the Mt. Diablo Boulevard/First Street intersection and SR 24 eastbound on-ramp intersection would operate at LOS F during the PM peak hour. Signalization of the SR 24 eastbound on-ramp intersection would improve operations compared to unsignalized conditions. Signalization would also reduce the queue at the southbound left-turn lane by providing a protected left-turn phase. As shown in **Table 5-19**, the on-ramp intersection would operate at LOS C during the AM peak hour and LOS F during the PM peak hour for Options 2, 3, and 4.

Under Options 2 and 3, the northbound approach at the Plaza Driveway would become signal-controlled, resulting in queues that extend to the Mt. Diablo Boulevard intersection. Queuing at the signal-controlled northbound approach of the Plaza Driveway would impact access from the eastbound left-turn lanes at the Mt. Diablo Boulevard/First Street intersection, thus increasing the delay at this location. Therefore, under Cumulative Conditions, Options 2 and 3 would increase the average delay for the Mt. Diablo Boulevard/First Street intersection.

Under Option 4, the intersection control at the Plaza Driveway would remain a half-signal with free through movements on the northbound approach. Under this option, queues would be reduced on the northbound approach from Mt. Diablo Boulevard. However, the eastbound left-turn approach at the Mt. Diablo Boulevard/First Street intersection would continue to queue because of high left-turn volumes. During the AM Peak hour, Option 4 improves the delay compared to the No Project and other options at the intersection of Mt. Diablo Boulevard and First Street. Overall, Option 4 would have the least vehicle delay compared to Options 2 and 3, particularly during the AM peak hour at the Mt Diablo Boulevard/First Street intersection.

Recommendations

There are competing needs for pedestrian, bicycle and auto vehicle access along First Street. Ultimately, any pedestrian or bicycle improvements along First Street need to be considered in the context that vehicle demand is heavy throughout the day, traffic operations are complex, and that ROW constraints limit the options for pathway connections. Given these limitations, and for the purposes of this feasibility study, Options 3 and 4 are the preferred options for pedestrian and bicyclist mobility, access and safety and should be considered for further study. As shown in **Table 5-18** and **Table 5-19**, Option 4 would result in less vehicle delay compared to Option 3, particularly during the AM peak hour at the Mt. Diablo Boulevard/First Street intersection.

Options 1 and 2 are not recommended due to the increase in travel time necessary to cross at Mt. Diablo Boulevard and the Plaza driveway. Additional travel time would be a considerable deterrent to pathway use and could encourage undesirable mid-block crossings and require the City to address constraints associated with widening the sidewalks along both sides of First Street to accommodate both pedestrians and bicyclists.

Prior to making a final recommendation, the traffic operations analysis for both options should be further refined and expanded to fully address the issues discussed in this section, particularly downstream traffic impacts and synchronization with other signals. In addition to analyzing vehicle traffic operations, a multimodal simulation could also help to evaluate bicycle, pedestrian and transit operations, as well as how these modes interact and affect one another. The transportation analysis should address weekday conditions during the AM commute, morning and afternoon bell times, and PM commute. The detailed analysis should include the intersections of First Street, Moraga Road, Oak Hill Road, and Deer Hill Road. Data collection for these models would include intersection turn counts, GPS travel time studies, and queue counts. The work would also include public outreach focused on traffic flow operations to establish the final preferred option.

Table 5-18: First Street Traffic Analysis Under Existing Conditions

Intersection	Peak Hour	No Project			Option 2: Full Signal at Plaza Parking Lot Exit			Option 3: Full Signal at Plaza Parking Lot Exit & SR 24 On-ramp			Option 4: Half Signal at Plaza Parking Lot Exit & Full Signal at SR 24 On-Ramp		
		Control	LOS[1]	Delay (s)[1]	Control	LOS[1]	Delay (s)[1]	Control	LOS[1]	Delay (s)[1]	Control	LOS[1]	Delay (s)[1]
SR 24 EB On-Ramp & First Street	AM	Unsignalized	A (A)	4.3 (7.4)	Unsignalized	A (B)	5.5 (11.1)	Signalized	B	15.9	Signalized	B	12.3
	PM		**F (F)**[2]	106.6 (190.8)		**F (F)**[2]	72.9 (128.2)		C	29.9		D	37.7
Plaza Driveway & First Street	AM	Half-Signal	A	7.9	Signalized	B	15.4	Signalized	B	11.5	Half-Signal	A	10.0
	PM		A	9.1		B	13.6		A	8.6		A	7.7
Mt. Diablo Boulevard & First Street	AM	Signalized	C	28.8	Signalized	D	41	Signalized	C	29.8	Signalized	C	28.6
	PM		D	35.4		D	41.9		C	34.2		D	35.6

Note: Existing data from the Cumulative No Project Scenario of Lafayette, Downtown Specific Plan EIR, Lafayette Circulation Commission, Whole Foods Proposal, and analyzed using SimTraffic.

Note: Parentheses indicate the approach with the lowest level of service and longest delay (SB approach on First Street) for an unsignalized intersection.

[1] Signalized intersection level of service based on weighted average control delay per vehicle, side-street stop intersection level of service based on weighted average control delay per vehicle and worst approach control delay per vehicle, according to the 2000 Highway Capacity Manual.

[2] LOS F is primarily a result of the southbound left-turn movement, which also affects southbound through movements as the left-turn pocket cannot accommodate the full vehicle queue and spills back into the through lanes.

Source: Fehr & Peers, 2011

Table 5-19: First Street Traffic Analysis Under Cumulative Conditions

Intersection	Peak Hour	No Project			Option 2: Full Signal at Plaza Parking Lot Exit			Option 3: Full Signal at Plaza Parking Lot Exit & SR 24 On-ramp			Option 4: Half Signal at Plaza Parking Lot Exit & Full Signal at SR 24 On-Ramp		
		Control	LOS[1]	Delay (s)[1]	Control	LOS[1]	Delay (s)[1]	Control	LOS[1]	Delay (s)[1]	Control	LOS[1]	Delay (s)[1]
SR 24 EB On-Ramp & First Street	AM	Unsignalized	B (D)	13.1 (26.0)	Unsignalized	B (C)	11.6 (19.1)	Signalized	C	30.2	Signalized	C	22.8
	PM		**F (F)**	>200 (>200)		F (F)	>200 (>200)		**F**	>200		**F**	>200
Plaza Driveway & First Street	AM	Half-Signal	A	9.4	Signalized	C	20.4	Signalized	B	14.8	Half-Signal	B	12.4
	PM		A	8.4		B	14.6		B	15.5		A	9.2
Mt. Diablo Boulevard & First Street	AM	Signalized	D	51.2	Signalized	**F**	>200	Signalized	**F**	89.5	Signalized	D	40.4
	PM		**F**	>200		**F**	>200		**F**	>200		**F**	>200

Note: Existing data from the Cumulative No Project Scenario of Lafayette, Downtown Specific Plan EIR, Lafayette Circulation Commission, Whole Foods Proposal, and analyzed using SimTraffic.

[1] Signalized intersection level of service based on weighted average control delay per vehicle, side-street stop intersection level of service based on weighted average control delay per vehicle and worst approach control delay per vehicle, according to the 2000 Highway Capacity Manual.

Source: Fehr & Peers, 2011

First Street Planning-Level Cost Estimates

Planning-level construction cost estimates are presented in **Table 5-20**. The improvements are estimated at $528,100 to $937,900, depending on whether Crossing Option 2, 3, or 4 is included. This estimate includes the cost of one traffic signal (totaling approximately $300,000), which is recommended in the DSP Draft EIR to accommodate future traffic along First Street. The traffic signal may be needed to as a result of future traffic-generating development (and is not specific to a pathway along the EBMUD Aqueduct ROW), and, therefore, it may be partially or fully paid for with development fees.

Table 5-20: Cost Estimate for the First Street Crossing Improvements

No.	Description	Quantity	Unit	Unit Price	Amount
First Street					
Option 2: Full Signal at Plaza Parking Lot entrance					
1	Signal upgrade at shopping center driveway	1	LS	$100,000	$100,000
2	Ladder Crosswalk	350	LF	$20	$7,000
3	Sidewalk Improvements (east side only, cost of west side included #22 below)	1,500	SF	$20	$30,000
4	Minor Items *(10% of Construction Items)*	1	LS	$15,223	$15,223
5	Additions *(10% of Construction Items)*	1	LS	$15,223	$15,223
6	Mobilization *(10% of Total Construction Cost)*	1	LS	$18,606	$18,606
				SUBTOTAL	**$186,100**
Option 3: Full signal at the SR 24 on-ramp with Full Signal at Plaza Parking Lot entrance					
7	SR 24 Ramp Signal	1	LS	$200,000	$200,000
8	Signal upgrade at shopping center driveway	1	LS	$100,000	$100,000
9	Ladder Crosswalk	920	LF	$20	$18,400
Pedestrian/Bike Refuge Island					
10	Vertical Median	400	LF	$20	$8,000
11	Concrete Surface	1,180	SF	$10	$11,800
12	Minor Items *(10% of Construction Items)*	1	LS	$37,578	$37,578
13	Additions *(10% of Construction Items)*	1	LS	$37,578	$37,578
14	Mobilization *(10% of Total Construction Cost)*	1	LS	$45,929	$45,929
				SUBTOTAL	**$459,300**
Option 4: Full signal at the SR 24 on-ramp and half-signal at the Plaza Parking Lot entrance					
15	SR 24 Ramp Signal	1	LS	$200,000	$200,000
16	Ladder Crosswalk	570	LF	$20	$11,400

Table 5-20: Cost Estimate for the First Street Crossing Improvements (continued)

No.	Description	Quantity	Unit	Unit Price	Amount
Pedestrian Island Refuge					
17	Vertical Median	400	LF	$20	$8,000
18	Concrete Surface	1,180	SF	$10	$11,800
19	Minor Items *(10% of Construction Items)*	1	LS	$25,689	$25,689
20	Additions *(10% of Construction Items)*	1	LS	$25,689	$25,689
21	Mobilization *(10% of Total Construction Cost)*	1	LS	$31,398	$31,398
				SUBTOTAL	**$314,000**
Pedestrian & Bicycle Improvements along First Street					
22	Widen Sidewalk (west side only)	5,500 (approx.)	SF	$20	$110,000
23	Minor Items *(10% of Construction Items)*	1	LS	$12.22	$12,223
24	Additions *(10% of Construction Items)*	1	LS	$12.22	$12,223
25	Mobilization *(10% of Total Construction Cost)*	1	LS	$14,939	$14,939
				SUBTOTAL	**$149,400**
Pathway Treatments					
26	Bollards	6	EA	$700	$4,200
27	Lights at Pathway Entrance	2	EA	$1,000	$2,000
28	Landscaping and Irrigation at Pathway Entrance	300	SF	$20	$6,000
29	Minor Items *(10% of Construction Items)*	1	LS	$1,356	$1,356
30	Additions *(10% of Construction Items)*	1	LS	$1,356	$1,356
31	Mobilization *(10% of Total Construction Cost)*	1	LS	$1,657	$1,657
				SUBTOTAL	**$16,600**
				OPTION 2 TOTAL	**$352,100**
				OPTION 3 TOTAL	**$625,300**
				OPTION 4 TOTAL	**$480,000**
				SUBTOTAL	**$352,100 - $625,300**
				25% SOFT COSTS[1]	**$88,000 - $156,300**
				25% CONTINGENCY	**$88,000 - $156,300**
				CROSSING IMPROVEMENTS TOTAL[2]	**$528,100 - $937,900**

[1] *Soft costs include survey, design, permitting, and administration costs.*

[1] *A range is presented to capture the three options.*

LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

5.7 Segment 4: First Street to Brown Avenue

Segment 4 extends approximately 0.3 miles from First Street in the west to Brown Avenue in the east.

The preferred option for Segment 4 is a paved Class I bikeway/ADA-accessible pathway. The pathway would connect with Brown Avenue and the existing EBRPD trail and City trail located at the east end of the Pathway Study Area. This Segment does not include roadway crossings. As proposed, this preferred option would cost approximately $246,000 to build.

Table 5-21 summarizes the planning-level costs of the preferred option for Segment 4 as well as the costs of other options that were considered. Detailed descriptions of the design options and preferred options, including the rationale for choosing each preferred option are described below.

Table 5-21: Cost Summary for Preferred and Other Considered Options for Segment 4 First Street to Brown Avenue

Preferred Option		Other Considered Options	
Description	*Cost*	*Description*	*Cost*
Class I Bikeway/ ADA-Accessible Pathway	$246,000	Unpaved Multi-Use Pathway	$90,500
Total Cost of Preferred Option	**$246,000**	**Total Cost of Other Considered Options**	**$90,500**

5.7.1 Pathway Design

Summary of Existing Conditions, Opportunities, and Constraints

Surrounding land uses include residential, office, and commercial uses. The EBMUD Aqueduct ROW crosses under SR 24 just west of Brown Avenue. The eastern end of the Pathway Segment connects with an unpaved EBRPD trail that continues north under SR 24 to Briones Regional Park and an unpaved City trail that continues south to Mt. Diablo Boulevard and the Lafayette-Moraga Trail.

Topography along the segment varies, and is illustrated and described in detail in *Chapter 4: Existing Conditions, Opportunities, and Constraints*. The topography rises and falls to create two hills: one east of First Street and the second east of Second Street. Grades along these hills vary from approximately 10 to 19 percent.

Design constraints along this Pathway Segment include waterlogged soil.

Options Evaluated and Preferred Option

The two facility design standards considered for this Pathway Segment are a Class I bikeway/ADA-accessible pathway and an unpaved multi-use pathway. As shown in **Figure 5-22**, the Class I bikeway/ADA-accessible pathway alignment would require some switchbacks in middle of the pathway segment. An unpaved multi-use pathway would follow the existing slope profile.

As described in **Section 5.3**, the preferred option for the pathway design is the Class I bikeway/ADA-accessible pathway.

Planning-Level Cost Estimate for Pathway Construction

Table 5-22 and **Table 5-23** present cost estimates for the two facility design standards within Pathway Segment 4. As proposed, an unpaved multi-use pathway would cost approximately $90,500 to build. A Class I bikeway/ADA-accessible pathway would cost approximately $246,000.

Table 5-22: Segment 4 Cost Estimate for an Unpaved Multi-Use Pathway

No.	Description	Quantity	Unit	Unit Price	Amount
Unpaved Multi-Use Pathway Improvements					
1	Clear, Grub & Tree Removal	24,000	SF	$0.50	$12,000
2	Grading	24,000	SF	$0.75	$18,000
3	6" Aggregate Base (Class 2)	320	CY	$45.00	$14,400
4	Minor Items *(10% of Construction Items)*	1	LS	$4,934.00	$4,934
5	Additions *(10% of Construction Items)*	1	LS	$4,934.00	$4,934
6	Mobilization *(10% of Total Construction Cost)*	1	LS	$6,030.00	$6,030
				SEGMENT 4 SUBTOTAL	**$60,300**
				25% SOFT COSTS[1]	**$15,100**
				25% CONTINGENCY	**$15,100**
				SEGMENT 4 TOTAL	**$90,500**

[1]*Soft costs include survey, design, permitting, and administration costs.*

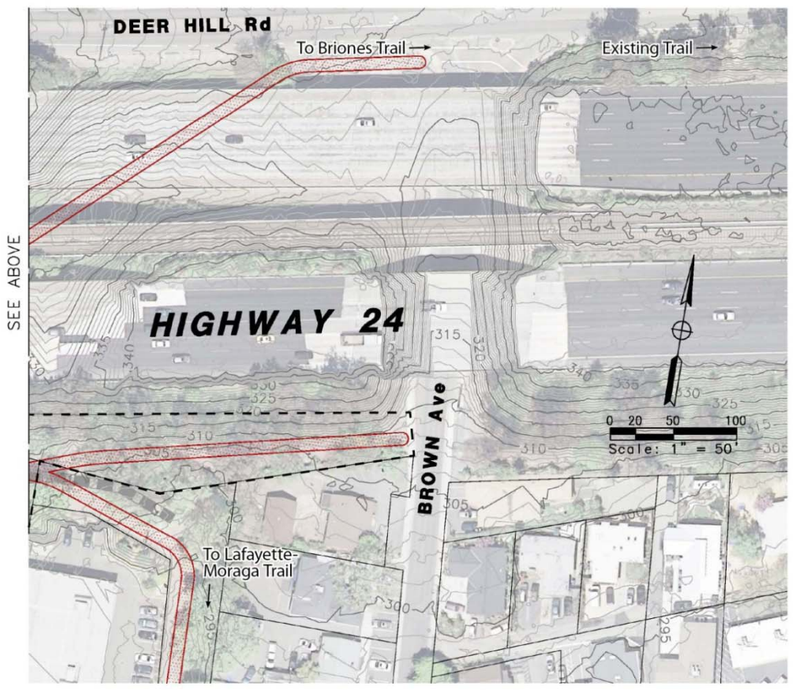
LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum

Table 5-23: Segment 4 Cost Estimate for a Class I Bikeway/ ADA-Accessible Pathway

No.	Description	Quantity	Unit	Unit Price	Amount
Pathway Improvements					
1	Import Borrow	1,500	CY	$25	$37,500
2	Fine Grading	27,200	SF	$1	$13,600
3	3" Hot Mix Asphalt (Type A)	370	TON	$85	$31,450
4	6" Aggregate Base (Class 2)	360	CY	$45	$16,200
5	Railing	2,200	LF	$10	$22,000
6	Minor Items *(10% of Construction Items)*	1	LS	$13,417	$13,417
7	Additions *(10% of Construction Items)*	1	LS	$13,417	$13,417
8	Mobilization *(10% of Total Construction Cost)*	1	LS	$16,399	$16,399
				SEGMENT 4 SUBTOTAL	**$164,000**
				25% SOFT COSTS[1]	**$41,000**
				25% CONTINGENCY	**$41,000**
				SEGMENT 4 TOTAL	**$246,000**

[1]*Soft costs include survey, design, permitting, and administration costs*

LF = Linear Foot - EA = Each - SF = Square Foot - LS = Lump Sum



The final pathway alignment may vary from the conceptual alignment shown in this figure in order to accommodate EBMUD access requirements along the EBMUD Aqueduct ROW.

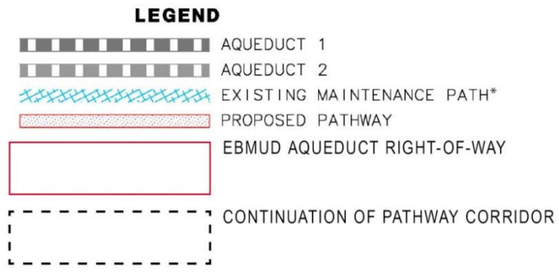


Figure 5-22: Pathway Segment 4 - Class I Bikeway/ ADA-Accessible Pathway Alignment

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