SAN PABLO AVENUE CORRIDOR PROJECT

PHASE 1 CONCEPT SUMMARY REPORT

ALAMEDA
County Transportation Commission

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GLOSSARY

Concept	A description of modifications to the roadway cross-section representing the types of facilities to be provided in the roadway. A concept may include multiple different cross-sections (e.g., center-running vs. side-running bus lanes).
Prototype	Concepts are illustrated through "prototypes." A prototype drawing depicts a concept at the plan view level for a 73' right-of-way width, the prevailing width of San Pablo Avenue throughout Alameda County. Prototypes reflect the application of the concept at intersections with and without signals and with and without bus stops. Illustrative drawings were prepared for at least one prototype for each concept that was used for public outreach.
Alternative	An application of concepts to specific geographic segments of San Pablo Avenue.
Managed Lane	A lane that changes in its use by time of day. In the context of this project, concepts with a managed lane would utilize the curbside lane on San Pablo Avenue as either on-street parking or a mixed-flow auto lane depending on the time of day.
Star Intersections	A five-legged intersection common along San Pablo Avenue in the southern section of the City of Oakland.
Mixed-flow Lanes	Travel lanes that may be used by all motorized modes, including automobiles, trucks, and transit vehicles.
Bulb-out	Curb extensions that visually and physically narrow the roadway and increase the space available for street furniture, benches, plantings, and street trees. They increase the overall visibility of pedestrians by

	aligning them with the parking lane and reducing the crossing distance for pedestrians. (National Association of City Transportation Officials [NACTO]).
Bus Bulb	Curb extensions that align the bus stop with the parking lane, allowing buses to stop and board passengers without leaving the travel lane. (NACTO).
Transit Island	Similar to a bus bulb, but includes a bike channel between the transit waiting/loading area and the sidewalk that allows for cyclists to avoid a conflict with transit vehicles and boarding patrons. (referenced as a Side Boarding Island Stop in NACTO).
Pedestrian Hybrid Beacon (PHB)	A traffic control device used to warn and control traffic for pedestrian crossings at uncontrolled marked crosswalk locations. A PHB is distinct from pre-timed traffic signals and constant flash warning beacons because it is only activated by pedestrians when needed. The ability to control traffic makes it preferable for higher speed roadways compared to rectangular rapid-flashing beacons (RRFBs). (Federal Highway Administration [FHWA]).
Rectangular rapid-flashing beacons (RRFBs)	A traffic control device with pedestrian-actuated, high-frequency flashes that draw drivers' attention to pedestrian warning signs and the need to yield to a waiting pedestrian. (FHWA).

1. INTRODUCTION

San Pablo Avenue is an interjurisdictional roadway that traverses multiple cities in northern Alameda County and western Contra Costa County. It is the spine of a critical multimodal travel corridor that connects tens of thousands of people every day between residential communities, employment centers, schools, centers of public life, and other activity hubs.

San Pablo Avenue provides north-south connections parallel to the BART Richmond (Red/Orange) Line and Interstate 80 (I-80) and is a reliever route for freeway traffic during incidents on I-80. It carries local, rapid, and express/Transbay buses, includes many high-activity pedestrian areas, and is designated as a bicycle route in many local jurisdiction plans. Demand for travel on San Pablo Avenue is projected to increase as jurisdictions concentrate growth along the corridor in several Priority Development Areas (PDAs), with several high-density, mixed-use developments recently completed and numerous others under consideration.

To address increasing multimodal demands along the San Pablo Avenue corridor, the Alameda County Transportation Commission (Alameda CTC), in partnership with Contra Costa Transportation Authority (CCTA) and West Contra Costa Transportation Advisory Committee (WCCTAC), is undertaking the San Pablo Avenue Corridor Project (project) to identify short- and long-term improvements along the corridor. The project study area encompasses seven cities: four cities in Alameda County (Oakland, Emeryville, Berkeley, and Albany), and three cities in Contra Costa County (El Cerrito, Richmond, and San Pablo).

Phase 1 of the project was conducted from Fall 2017 through Summer 2020 and consisted of identification and refinement of a range of concepts for improvement of San Pablo Avenue. The process undertaken during Phase 1 is described in detail in Section 2.1.

1.1 PURPOSE OF SUMMARY REPORT

This Summary Report summarizes the findings of Phase 1 of the San Pablo Avenue Corridor project including the recommended concepts and parallel bike network options that will be advanced for additional engineering, design, and detailed operational analysis in future phases of the project as well as phasing considerations and a description of issues remaining for resolution in future phases of work. This report includes analysis that covers the entire San Pablo Avenue Corridor study area which spans both Western Contra

Costa County and northern Alameda County, although Phase 1 corridor concepts in Alameda County were more fully developed and therefore are described more specifically in several places in this report.

This Summary Report is divided into the following sections, as described below:

1. **Introduction** – discusses the purpose and organization of the Report.
2. **Description of Long-Term Concepts to Advance** – summarizes the roadway design concepts to be advanced for additional study in future project phases.
3. **Long-Term Concepts to Advance by Alameda County Jurisdiction** – applies the concepts to the different cities throughout the corridor, discusses the justification behind the geographic application, and highlights specific challenges and trade-offs.
4. **Near-Term Improvements** – summarizes very near-term and near-term solutions being considered in Alameda County and how those solutions may interface with future long-term opportunities throughout the corridor.
5. **Areas for Further Development and Analysis** – identifies elements for further analysis and consideration in subsequent project development efforts.
6. **Phasing Considerations** – describes considerations for phasing of project improvements over time.

The following terms are used throughout this report:

- **"Concepts"** refers to a description of types of modifications to the roadway cross-section and are described in Chapter 2.
- **"Prototypes"** apply the types of treatments from each concept to a typical 73-foot-wide right-of-way in plan view. Prototypes illustrate each concept at signalized and unsignalized instersections and intersections with and without bus stops. For Phase 1, illustrative drawings were prepared for at least one prototype for each concept and used for public outreach. The illustrative drawings for each concept are included in Chapter 2, while the prototypes are included in **Appendix A**. The concepts to advance for additional analysis in future phases in each jurisdiction are noted in Chapter 3.
- **"Alternatives"** are applications of individual concepts to specific segments along San Pablo Avenue.

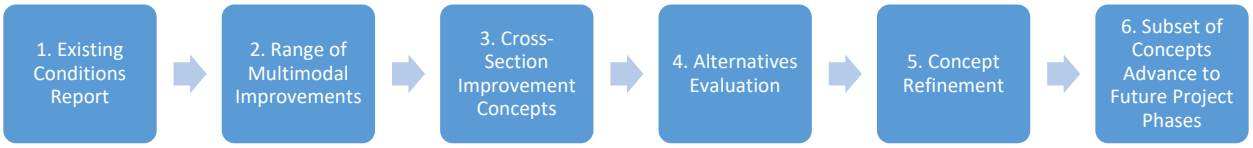
2. DESCRIPTION OF LONG-TERM CONCEPTS TO ADVANCE

2.1 CONCEPT DEVELOPMENT PROCESS

The Phase 1 process to identify and refine long-term concepts and alternatives for the San Pablo Avenue corridor occurred in several stages, as shown in **Figure 2-1**, starting with the Existing Conditions Report, which helped define the range of appropriate multimodal improvements to be considered. These were then developed into concepts and combined into corridor alternatives by applying each concept to specific geographic locations along the corridor, which were studied through an alternatives evaluation process. Public and stakeholder outreach was conducted throughout this process to solicit and receive feedback about community needs and types of desired improvements, which were summarized in the Phase 1 Outreach and Engagement Report.

Based on the findings of Phase 1, three concepts were selected to advance for additional development and analysis in future project phases. These concepts were also applied to specific segments of the corridor based on Phase 1 findings to create the alternatives to be advanced for further study; this is further discussed in Chapter 3.

Figure 2-1: Concepts and Alternatives Development Process



2.2 SUMMARY OF CONCEPTS

Phase 1 studied transportation needs throughout the study area consisting of ½-mile on either side of San Pablo Avenue from Oakland through the City of San Pablo. The primary focus of design was on San Pablo Avenue as the multimodal spine of the study area; however, it is not feasible for the roadway to meet all of the transportation needs in the corridor. Leveraging parallel facilities such as I-80, BART, and parallel neighborhood streets was an important consideration to address the overall corridor transportation need. As such, concepts examined in Phase 1 focus on potential treatments for San Pablo Avenue and utilization of parallel routes, particularly for bicycle travel.

As noted in Chapter 1, the term "concept" is used to define a combination of proposed modifications to the typical configuration of San Pablo Avenue. Concepts are depicted in all illustrative drawings and prototypes with a curb-to-curb width of 73 feet, the prevailing width of San Pablo Avenue throughout much of Alameda County. The true cross-section throughout the corridor, however, varies from 68 to 96 feet, with wider segments predominately in El Cerrito and other short segments of the roadway in Contra Costa County (as depicted in the right-of-way diagram shown in **Appendix A**).

There were four concepts considered during Phase 1: Concepts A, B, C, and D. Outreach primarily focused on Concepts A-C because these represent more dramatic departures from the existing conditions on San Pablo Avenue. Through the analysis and engagement efforts, Concept C was eliminated from further consideration, as described in more detail below.

The three concepts that were selected to advance into future project phases are briefly described here:

- **Concept A** seeks to accommodate all travel modes on San Pablo Avenue. It proposes dedicated bus lanes, on-street bikeways, and one mixed-flow travel lane in each direction, with limited space for on-street parking and loading, mostly mid-block away from intersections.
- **Concept B** seeks to optimize San Pablo Avenue for transit vehicles, with bicycle travel directed to nearby parallel routes. It proposes dedicated bus lanes, one mixed-flow travel lane in each direction, and on-street parking lanes. One of the on-street parking lanes could be a "managed lane" meaning it would convert to a second travel lane during peak period(s). Designated parallel routes would be optimized for bicycle travel.
- **Concept D** seeks to modestly improve transit operations while retaining the existing automobile orientation of San Pablo Avenue. Bicycle travel would be directed to nearby parallel routes. The concept proposes bus bulbs and queue jump lanes, two mixed-flow travel lanes in each direction, and on-street parking/loading lanes on both sides of the street.

Of the concepts presented to the public, only **Concept C** was eliminated from further consideration in Alameda County as a result of Phase 1 project efforts. This was due to the concept offering fewer benefits and receiving less support during the public outreach process than other concepts. Concept C:

- Was the least popular option in Alameda County
- Results in very limited bus performance benefits: Enhancing the effectiveness of the bus service on San Pablo Avenue in Alameda County was widely viewed as a priority for the corridor; however, Concept C resulted in the least benefit to transit service on San Pablo Avenue of all the concepts.
- Does not achieve the objective of an "all ages and abilities" bicycle facility on San Pablo Avenue
- Results in significant parking loss

Detailed descriptions of each of the concepts being advanced for further study and an overview of the trade-offs involved with each are described in Sections 2.2 through 2.4. Prototype drawings developed for each concept, which depict proposed configurations of each concept at intersections and bus stops and include call-out boxes noting specific features, are included in **Appendix A**. Additional concepts considered during Phase 1 and ultimately rejected as part of the concept development, evaluation, and refinement process are described in **Appendix B**.

A full discussion of the trade-offs of side-running versus center-running bus lanes is included in Chapter 5.

2.2.1 UNIVERSAL IMPROVEMENTS

In addition to the unique improvements represented by each concept, a set of universal improvements were developed to be implemented for all three concepts to improve overall safety and pedestrian accessibility. These improvements include:

- High-visibility crosswalk striping at existing and new crosswalks
- Curb ramp and other accessibility improvements
- Pedestrian hybrid beacons (PHBs) and rectangular rapid-flashing beacons (RRFBs) at uncontrolled crosswalks as recommended by FHWA STEP Guide for Improving Pedestrian Safety at Unsignalized Locations
- Improved bicycle crossings of San Pablo Avenue for intersecting bicycle facilities
- Raised pedestrian islands where right-of-way allows
- Parking removal where needed to meet sight distance requirements at intersections and crosswalks
- Lighting enhancements with emphasis on unsignalized intersections and transit stations

- Additional crosswalks to provide at least an average crosswalk spacing of 500 feet along San Pablo Avenue
- Sidewalk gap closures (currently gaps exist primarily in Contra Costa County)
- Landscaping at transit islands/BRT stations and in the median
- Continuous street trees along the corridor
- Intersection realignment to improve safety at select locations (e.g., at skewed intersections)
- Turn lane and slip lane modifications to improve queue storage capacity and safety at select locations
- Signal phasing, timing optimization, and controller upgrades to enhance transit prioritization at select signalized intersections

The universal improvements are not included in figures illustrating the concepts or analysis of trade-offs in the interest of legibility and because they would apply equally to each.

2.3 CONCEPT A

Concept A envisions San Pablo Avenue as a primary thoroughfare and seeks to provide right-of-way allocations for every travel mode with dedicated bus lanes and bikeways on San Pablo Avenue, separated from other modes where feasible. The dedicated bus lanes could either be provided in a center-running or side-running configuration. Concept A would provide one mixed-flow travel lane in each direction. Most parking along San Pablo Avenue would be eliminated in this concept, although on-street parking and loading zones could be provided mid-block on one side of the street in some locations. Plan view illustrations depicting the configuration of Concept A on a typical segment of San Pablo Avenue in Alameda County are shown in **Figure 2-2** and **Figure 2-3** for the center-running and side-running bus lane options, respectively. The prototypical illustrative plans developed for this concept are included in **Appendix A**.

Figure 2-2: Concept A with Center-running Bus Lanes

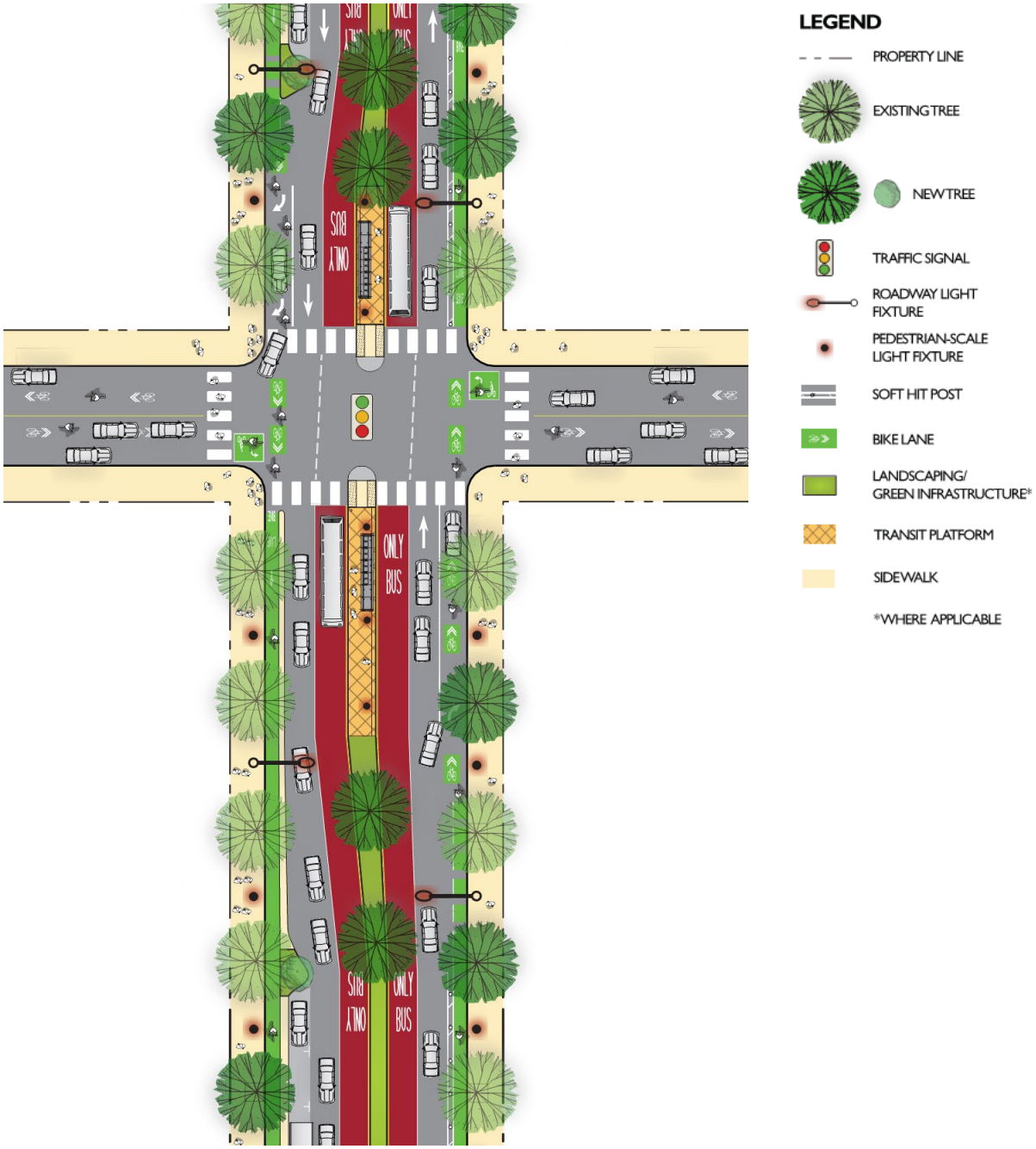
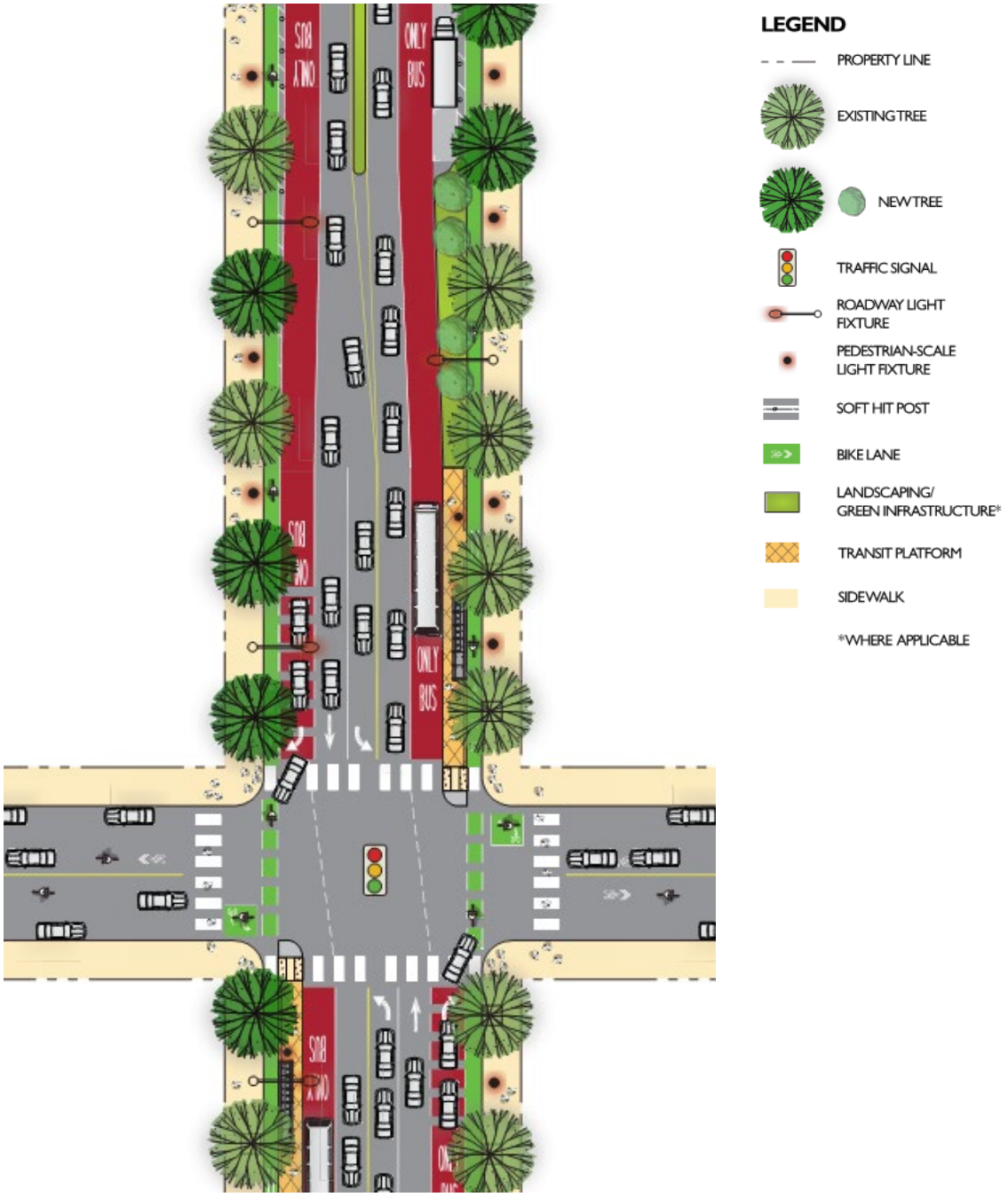


Figure 2-3: Concept A with Side-running Bus Lanes



2.3.1 BENEFITS AND TRADE-OFFS

Transit: The dedicated bus lanes in Concept A would substantially improve transit speed, reliability, and user comfort along San Pablo Avenue by allowing riders to bypass congestion and avoid weaving in and out of traffic. These improvements are expected to increase transit ridership on San Pablo Avenue and shift roadway use from lower-occupancy personal automobiles to high-capacity transit, meeting project goals for efficiency and sustainability.

Both center-running and side-running bus lanes would reduce transit delay and improve reliability. Each has its pros and cons but at a high level, center-running lanes would result in greater improvements to transit performance whereas side-running lanes provide more right-of-way flexibility, easier constructability, and may provide a more desirable environment for bicyclists by creating a larger buffer between cyclists and autos. Further analysis is needed to determine which configuration is optimal; a full discussion of the trade-offs of side-running versus center-running bus lanes is included in Chapter 5.

Bicycle: Concept A would also substantially improve safety and ease of travel for bicyclists along San Pablo Avenue by providing a designated on-street bike facility. Locating bicycle facilities on San Pablo Avenue would allow bicyclists to travel through the area using a direct and secure route providing direct access to commercial establishments along the corridor. Bicycle facilities would be protected at mid-block locations between driveways; however, due to limited right-of-way and the confluence of many demands, protection cannot be provided at most intersections. Where right-turn lanes are provided, bicyclists would share the lane with right-turning autos, resulting in a less comfortable bicycle facility. Therefore, the conflicts with vehicles at intersections and driveways combined with the high auto speeds and volumes on San Pablo Avenue would mean that a truly “all ages and abilities” low-stress riding environment could not be achieved on San Pablo Avenue.

Pedestrian: At crossings with stations, Concept A would result in shorter crossing lengths; however, opportunities for bulb-outs and pedestrian safety islands would be limited in most segments throughout the corridor.

Automobile: Concept A would reduce the number of mixed-flow travel lanes from two to one in each direction, which is expected to result in an increase in automobile delay at some signalized intersections and redistribute a substantial amount of pass-through

traffic to I-80. Parallel arterials and local streets would be expected to receive a more limited redistribution of traffic volumes.

Local Auto Access: Existing right-turn lanes would be maintained at many signalized intersections to reduce the increase in vehicle delay caused by the reduction in through lanes. Right-turning vehicles, however, would conflict with bicyclists and, in the side-running bus option, with transit vehicles. Left-turn lanes at signalized intersections would be retained, except in the center-running option at intersections with bus stations, where there is insufficient space to fit left-turn lanes and stations. Therefore, left-turn maneuvers at intersections proposed for bus stops would shift to other nearby signalized intersections. For intersections without stations, providing or retaining left-turn lanes for automobiles would result in substantial lane shifts for transit vehicles at some locations. The impacts and possible solutions to the conflicts related to turn lanes will need to be assessed in more detail in future refined design and operational analysis on an intersection-by-intersection basis.

Auto access to and from cross streets would also change with Concept A, with right turns on red prohibited in many locations to ensure undisturbed and safe through movements for transit vehicles (in side-running lane options), bicycles, and automobiles on San Pablo Avenue. In the center-running option, left turns from and onto streets at unsignalized locations would also be prohibited for similar reasons. In high level analysis conducted for Phase 1, new signal-controlled intersections, including left-turn access and pedestrian crossings, were proposed at several minor intersections to allow for sufficient neighborhood vehicle access and to provide reasonable distances between signalized crossings for pedestrians. Detailed operational analysis in future phases will determine exact locations for new signalized intersections and assess the potential for increased transit delay from more signals and how this delay could be reduced.

Curb Space: There would be a substantial reduction in parking on San Pablo Avenue with Concept A, which would mean that vehicles seeking to park would be shifted to nearby streets or off-street lots, where available. However, the substantial improvements to transit operations and bicycle facilities on San Pablo Avenue would provide high-quality alternatives to automobile travel and could reduce demand for parking. Concept A would also decrease curb space available for vehicle loading, which includes deliveries and pick-up/drop-off activities (such as Uber or Lyft). These activities may shift to nearby streets or off-street lots or some drivers may opt to block the right lane (side-running bus lane or mixed-flow lane in center-running bus option).

2.4 CONCEPT B

Concept B envisions San Pablo Avenue as a primary thoroughfare for transit vehicles and automobiles, with bicycles routed to improved nearby parallel facilities. Concept B would provide dedicated center-running or side-running bus lanes and at least one mixed-flow lane in each direction. Most on-street parking would be retained on both sides of the street, and the concept would include the option to convert an on-street parking lane to a second mixed-flow lane during peak periods. This concept is referred to as a "managed lane" as the allowed use of the lane would vary by time-of-day. Plan view illustrations depicting the configuration of Concept B on a typical segment of San Pablo Avenue in Alameda County are shown in **Figure 2-4** and **Figure 2-5** for the center-running and side-running bus lane options, respectively. The prototypical illustrative plans developed for this concept are included in **Appendix A**.

Figure 2-4: Concept B with Center-running Bus Lanes

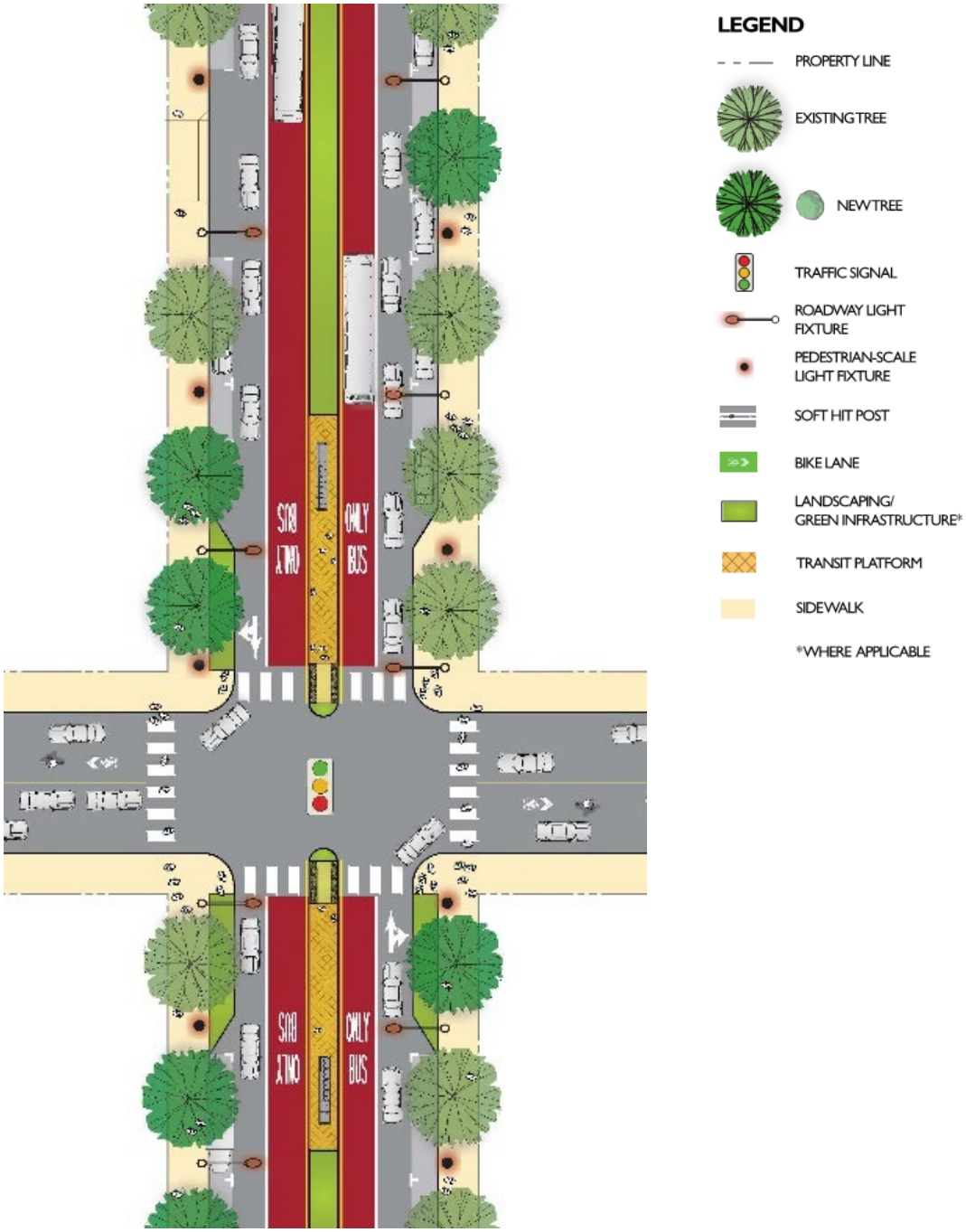
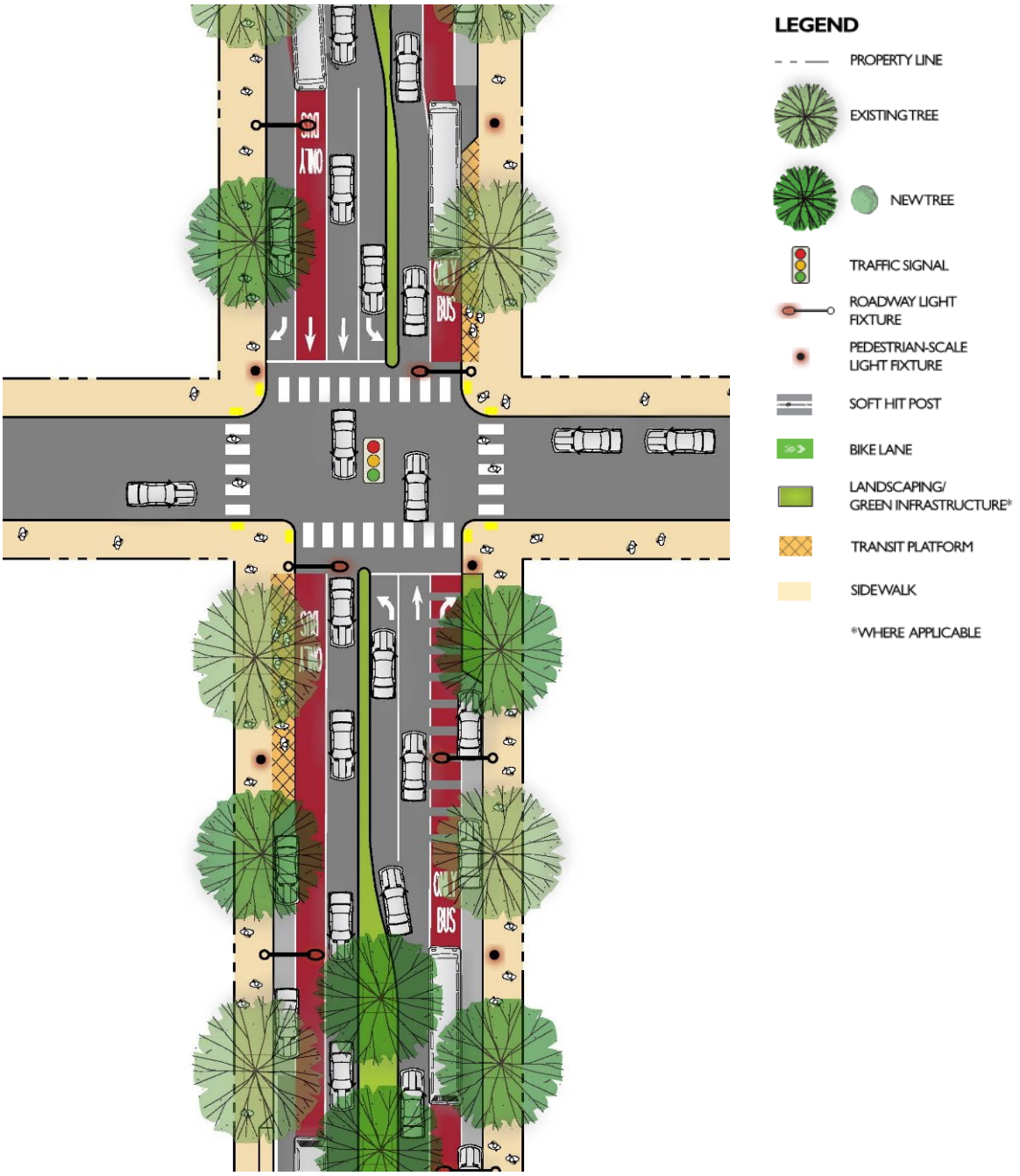


Figure 2-5: Concept B with Side-running Bus Lanes



2.4.1 BENEFITS AND TRADE-OFFS

Transit: The dedicated bus lanes in Concept B would substantially improve transit speed, reliability, and user comfort on San Pablo Avenue by allowing riders to bypass congestion and avoid weaving in and out of traffic. These improvements are expected to increase transit ridership on San Pablo Avenue and shift roadway use from lower-occupancy personal automobiles to high-capacity transit, meeting project goals for efficiency and sustainability. Trade-offs between a center-running versus side-running transit lane are very similar to Concept A. Further analysis is needed to determine which configuration is optimal; a full discussion of the trade-offs of side-running versus center-running bus lanes is included in Chapter 5.

Bicycle: Concept B would improve and connect bicycle facilities nearby and parallel to San Pablo Avenue which would improve the experience of bicyclists traveling through the corridor, although not along San Pablo Avenue itself. These parallel facilities would provide a low-stress environment for most riders, avoiding the high speeds, heavy traffic volumes, and frequent intersections and driveways that exist on San Pablo Avenue. In many parts of the corridor there are good parallel route alternatives. However, the suitability of parallel routes to provide a direct and intelligible alternative to San Pablo Avenue in Downtown Oakland, West Oakland, and Emeryville is limited. A description of the options for improvements and routes of the parallel bicycle network are presented in Section 2.6. Since some bicyclists would continue to use San Pablo Avenue, future project phases will need to address how to improve safety for these cyclists in Concept B.

Pedestrian: Concept B would improve pedestrian safety with bulb-outs on at least one side of many intersections, as well as pedestrian refuge islands at unsignalized intersections and intersections with bus stops in center-running bus designs. If a managed lane is not provided and parking lanes are preserved on both sides of the street at all times of day, this would offer additional opportunities for adding bulb-outs. It is possible to implement bulb-outs on both sides of the street at nearly every intersection with a crosswalk; however, this would be at the expense of providing right-turn lanes.

Automobile: For automobiles, Concept B would reduce the number of mixed-flow travel lanes from two to one in each direction, which is expected to result in an increase in automobile delay at some signalized intersections and redistribute some pass-through traffic to I-80 and cause a more limited redistribution of traffic volumes to parallel arterials and local streets. However, with the use of a managed lane, two through lanes

could be provided in one direction of travel during peak travel periods. This would maintain existing automobile capacity in that direction and lessen impacts.

Local Auto Access: Similar to Concept A, existing right-turn lanes would be maintained at many signalized intersections to reduce the increase in vehicle delay caused by the reduction in through lanes. At each intersection, considerations would be made between providing a right-turn lane or a pedestrian bulb-out. Left-turn lanes at signalized intersections would be retained, except at intersections with bus stations in the center-running option, where left-turn lanes do not fit. As a result, left-turn maneuvers at intersections proposed for bus stops would need to shift to other nearby signalized intersections. For intersections without stations, providing or retaining left-turn lanes for automobiles would result in substantial lane shifts for transit vehicles at some locations. The impacts and possible solutions to the conflicts related to turn lanes will need to be assessed in the refined design and operational analysis on an intersection-by-intersection basis.

Crossing street operations would also change with Concept B, with right turns on red prohibited to ensure undisturbed and safe through movements for transit vehicles, bicycles, and automobiles on San Pablo Avenue. In the center-running option, left turns from and onto cross streets at unsignalized locations would also be prohibited for similar reasons. New signal-controlled intersections, including left-turn access and pedestrian crossings, are proposed at several minor intersections to allow for sufficient neighborhood vehicle access and to provide reasonable distances between signalized crossings for pedestrians. Detailed operational analysis will determine exact locations for new signalized intersections and assess the potential for increased transit delay from more signals and how this delay could be reduced.

Curb/Parking/Loading: Most existing parking would be retained in Concept B, with some spaces adjacent to intersections eliminated to provide bulb-outs to enhance pedestrian safety. If a managed parking lane is implemented and utilized during peak periods, on-street parking and loading would be eliminated on one side of the road during those times. However, that reduction in parking would be for a limited time, and the substantial improvements to transit operations on San Pablo Avenue would provide a high-quality alternative to automobile travel and could reduce demand for parking.

2.4.2 MANAGED LANE

Phase 1 included an evaluation of utilizing a northbound managed parking lane that converts to a travel lane during the peak travel period. This evaluation concluded that northbound traffic would operate similarly to existing conditions when vehicle volumes are highest, while still providing on-street parking for most of the day when vehicle volumes are lower. Further operational analysis is necessary to assess the effectiveness of a managed lane in either direction, including determination of optimal time periods.

One primary trade-off involved with providing managed parking lanes, regardless of when they are used, is that managed parking lanes preclude bulb-outs at intersections in Concept B. For a parking lane to be able to be converted to a travel lane, there must be a clear path through the intersection, and bulb-outs would impede that path. Therefore, although managed lanes provide flexibility to maintain peak automobile capacity, they would preclude bulb-outs and associated benefits to pedestrian safety. Regardless of whether a managed lane is ultimately implemented, Concept B would provide a high level of pedestrian safety as a result of other proposed improvements.

A second key challenge with managed lanes is ensuring adherence to parking restrictions during periods when the lane will be utilized for auto travel. In order to provide the desired throughput benefits of the managed lane, frequent enforcement is needed to ticket and remove vehicles parking in that lane when prohibited. City agency staff indicated that sufficient levels of enforcement may be difficult to achieve. In addition, managed lanes may create some driver confusion and lead to undesirable driver behavior, as has been noted by general feedback from the project's technical advisory committee members and the public concerning the managed lane treatment implemented on Ashby Avenue in Berkeley. Further consideration would be needed regarding the signing and marking treatments for a managed lane given the experience on Ashby Avenue.

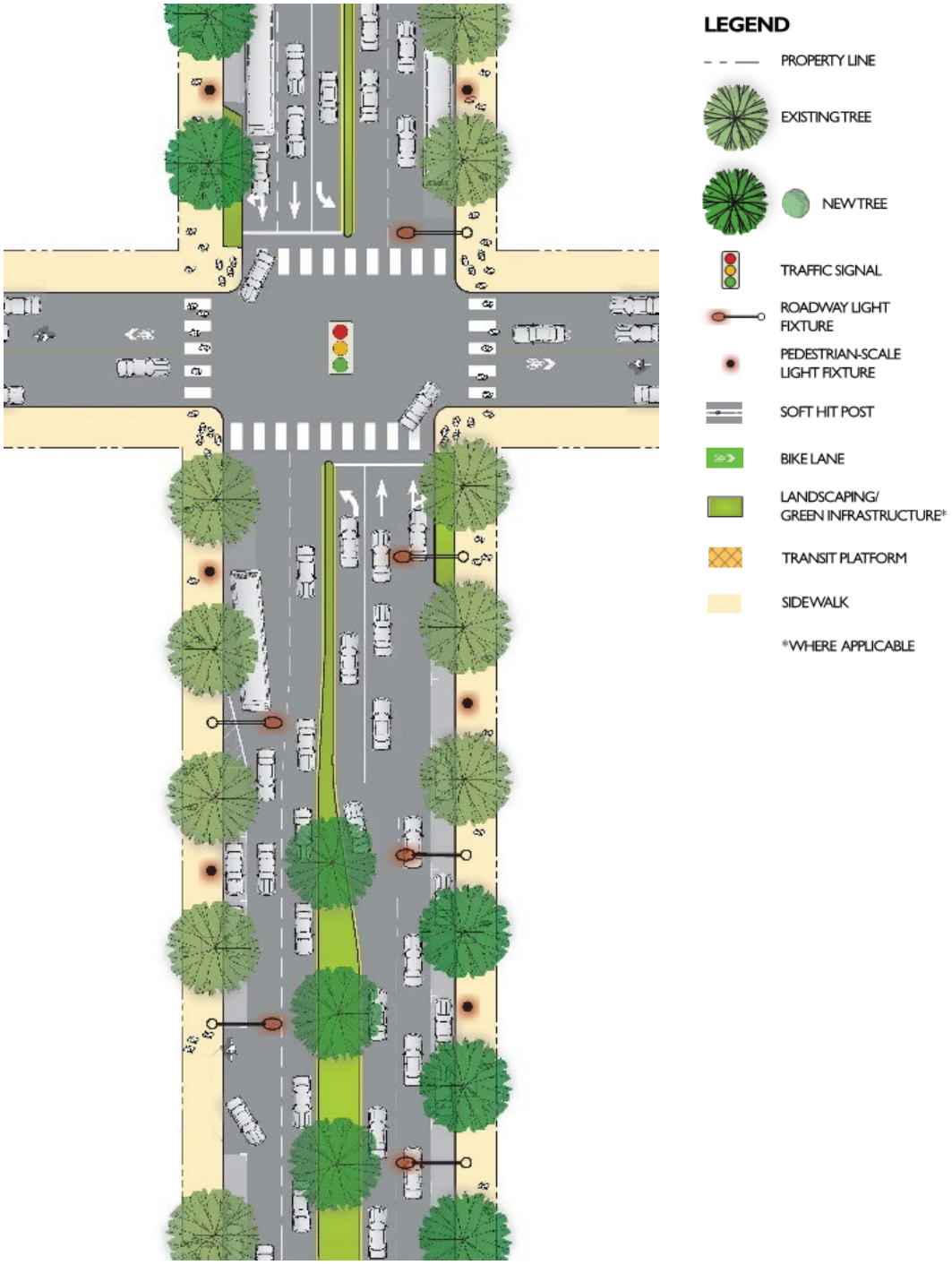
The managed lane concept would only be feasible with a center-running bus lane configuration.

2.5 CONCEPT D

Concept D would implement moderate transit improvements on San Pablo Avenue without substantially altering the existing automobile-oriented cross-section. Concept D would provide targeted transit improvements like bus bulbs and queue jump lanes at key locations, while retaining two mixed-flow lanes in each direction and on-street parking

and loading on both sides of the street. Similar to Concept B, there is an option to provide either a right-turn lane or a pedestrian bulb-out for the near-side; pedestrian bulb-outs are feasible everywhere on the far-side of San Pablo Avenue intersections. Bicycles would also be directed to improved nearby parallel facilities. A plan view illustration depicting the configuration of Concept D on a typical segment of San Pablo Avenue in Alameda County is shown in **Figure 2-6.** Note that a queue jump lane is not depicted in the illustration and is only feasible in select locations along the corridor. The prototypical illustrative plan developed for this concept is included in **Appendix A**.

Figure 2-6: Concept D



2.5.1 BENEFITS AND TRADE-OFFS

Transit: Concept D would modestly improve transit operations by providing bus bulbs that allow buses to stop without pulling in and out of traffic. Bus bulbs would also allow wider pedestrian zones at bus stops. Concept D would also seek to provide bus queue jump lanes to reduce the impact of intersection congestion on transit speed. However, due to geometric constraints, bus queue jump lanes would only be feasible at a handful of locations along the corridor and may provide limited benefit. The effectiveness of the queue jump lane is determined by the length of the vehicle queue, the length of the queue jump, and the proximity to nearby bus stops. Further design development is needed to determine the exact locations where queue jumps would be both beneficial and geometrically feasible. Without more substantial transit priority treatments, with Concept D, bus operations would be impacted by auto congestion on the corridor. As land use continues to densify along the corridor, it is anticipated that increasing congestion will further slow bus speeds. Unlike Concepts A and B, this concept does not provide current automobile users with improved alternative transportation options as congestion continues to increase.

Bicycle: Similar to Concept B, Concept D would improve and connect bicycle facilities nearby and parallel to San Pablo Avenue, which would improve the travel experience of bicyclists traveling through the corridor, but not on San Pablo Avenue itself. These parallel facilities would provide a true low-stress environment for most riders, avoiding the high speeds, heavy traffic volumes, and frequent intersections and driveways that exist on San Pablo Avenue. In many parts of the corridor there are good parallel route alternatives. However, the suitability of parallel routes to provide a direct and legible alternative to San Pablo Avenue in Downtown Oakland, West Oakland, and Emeryville is limited. A description of the options for improvements and routes of the parallel bicycle network are presented in Section 2.6. Because some bicyclists would continue to use San Pablo Avenue, refined designs need to address how to improve safety in this concept.

Pedestrian: Concept D would substantially improve pedestrian safety with bulb-outs on at least one side of intersections as well as pedestrian refuge islands at unsignalized intersections. It is possible to implement bulb-outs on both sides of the street at nearly every intersection with a crosswalk; however, this would be at the expense of providing right-turn lanes. Given that there would remain two mixed-flow auto lanes, the impact of eliminating right-turn lanes may be less in this concept than with Concepts A and B. As with Concept B, the far-side bulb-out would not have any trade-offs.

Automobile: For automobile drivers, Concept D would largely preserve current conditions on San Pablo Avenue, preserving two mixed-flow through lanes in each direction and left-turn lanes at most intersections.

Local Auto Access: This concept would not restrict left-turn or right-turn auto access to or from San Pablo Avenue. Through most of the corridor there is not enough right-of-way to accommodate both exclusive queue jump lanes and dedicated right-turn lanes. Consequently, queue jump lanes would either be shared with right turns or right-turn lanes would not be provided. In the former case, where volumes of right turns are high, the bus would be delayed by turning vehicles and not realize much or any benefit from the queue jump. In the latter case, where an exclusive queue jump lane is provided, the queue jump would require its own transit-only signal phase and could deteriorate operations for general traffic and result in additional congestion that could offset the benefits to the bus.

Curb Space: At bus bulbs or queue jumps locations, parking and commercial loading spaces may need to be removed. Trade-offs with parking/loading will need to be considered in the placement and design of bus bulbs and queue jumps if this concept is selected. In other locations, impacts to curb space would be minimal.

2.6 PARALLEL BIKE ROUTE

As noted at the start of Section 2.2, this project recognizes that San Pablo Avenue functions within a network and that parallel facilities serve a critical role in overall transportation movements in the corridor. Given the constrained cross-section of San Pablo Avenue, it is not possible to provide optimal facilities for all modes on San Pablo itself. As such, Concept B and Concept D rely on a parallel bike network to facilitate bicycle travel through the San Pablo Avenue corridor. This parallel network of streets would receive improvements (which are described later in this section) to enhance bike travel along the corridor for concepts where bicycle facilities are not provided on San Pablo Avenue. All concepts include crossing improvements where major perpendicular bike routes intersect with San Pablo Avenue.

An evaluation of parallel bike route suitability that considered the distance and angle of parallel routes to San Pablo was conducted using GIS mapping software to determine if a parallel route would provide a low-stress bikeway alternative for San Pablo Avenue. The evaluation results concluded that potential parallel routes are limited on the far southern and northern ends of the San Pablo Avenue corridor, but direct and low-stress bicycle

facilities may be provided in other segments. In some cases, parallel routes provide more proximate access to destinations in the corridor, such as to restaurant and retail uses on 4th Street in Berkeley.

Considerations for each segment of corridor are as follows:

- In Downtown and West Oakland, San Pablo travels diagonally through the street grid and therefore truly "parallel" streets do not exist. In Emeryville, the closest potential parallel bike routes are far from San Pablo Avenue and therefore would require substantial diversion for bicyclists.
- Routes in Berkeley, Albany, and El Cerrito provide the closest parallel route options for bikeways.
- North of El Cerrito, the grid roadway network deteriorates and thus opportunities for development of high-quality parallel bicycle facilities are limited or non-existent in Richmond and the City of San Pablo.

Figure 2-7, Figure 2-8, Figure 2-9, Figure 2-10, and **Figure 2-11** show the potential parallel bike routes developed during Phase 1.

The next phase of this project will include design refinements and detailed operational analysis to assess which of the potential routes should be considered as part of the parallel network and the exact enhancements those facilities would receive to maximize safety, comfort, and usage by bicyclists. Enhancements to facilities on the parallel bikeway network could include the following:

- Striping, such as for Class II or III or IV bicycle facilities
- Two-stage turn boxes
- Wayfinding signage along the route and to/from San Pablo Avenue
- Traffic calming measures such as traffic circles, traffic diverters (with through-access for bicycles), and speed humps
- Lane reductions where four-lane cross-sections exist
- Prioritization of bicycle route at intersections
- Improved pedestrian-level lighting
- Crossing improvements such as RRFBs, PHBs, signals, high-visibility crosswalks, advanced yield and stop bars, and bulb-outs

- Bike corrals along San Pablo Avenue at intersections with perpendicular bicycle routes to encourage bicyclists to park their bikes and walk to their final destination, rather than ride on San Pablo Avenue if no facilities exist

Figure 2-7: Parallel Bike Route Options Segment 1: Oakland-Emeryville

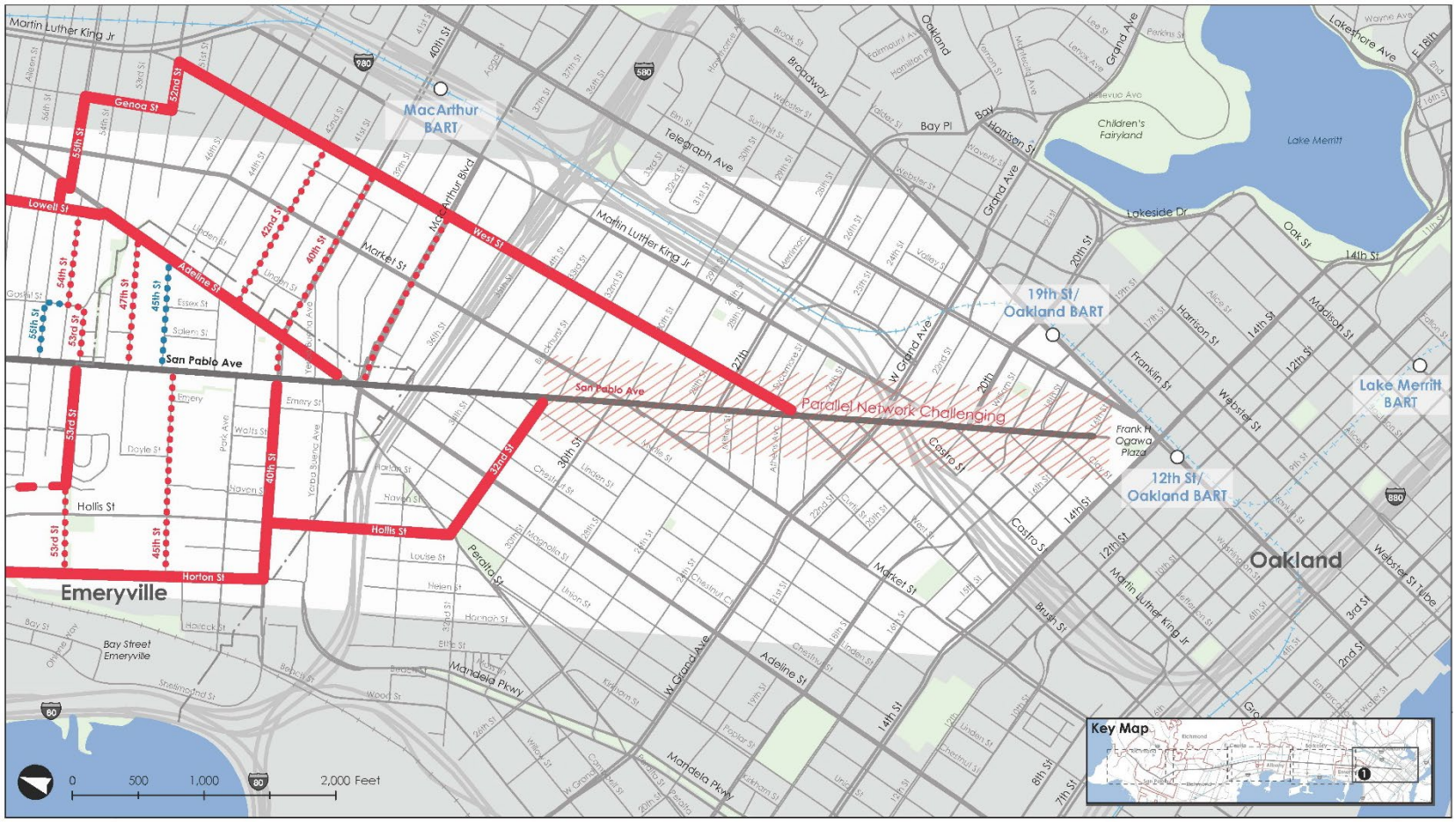


Figure 2-8: Parallel Bike Route Options Segment 2: Emeryville-North Oakland-Berkeley

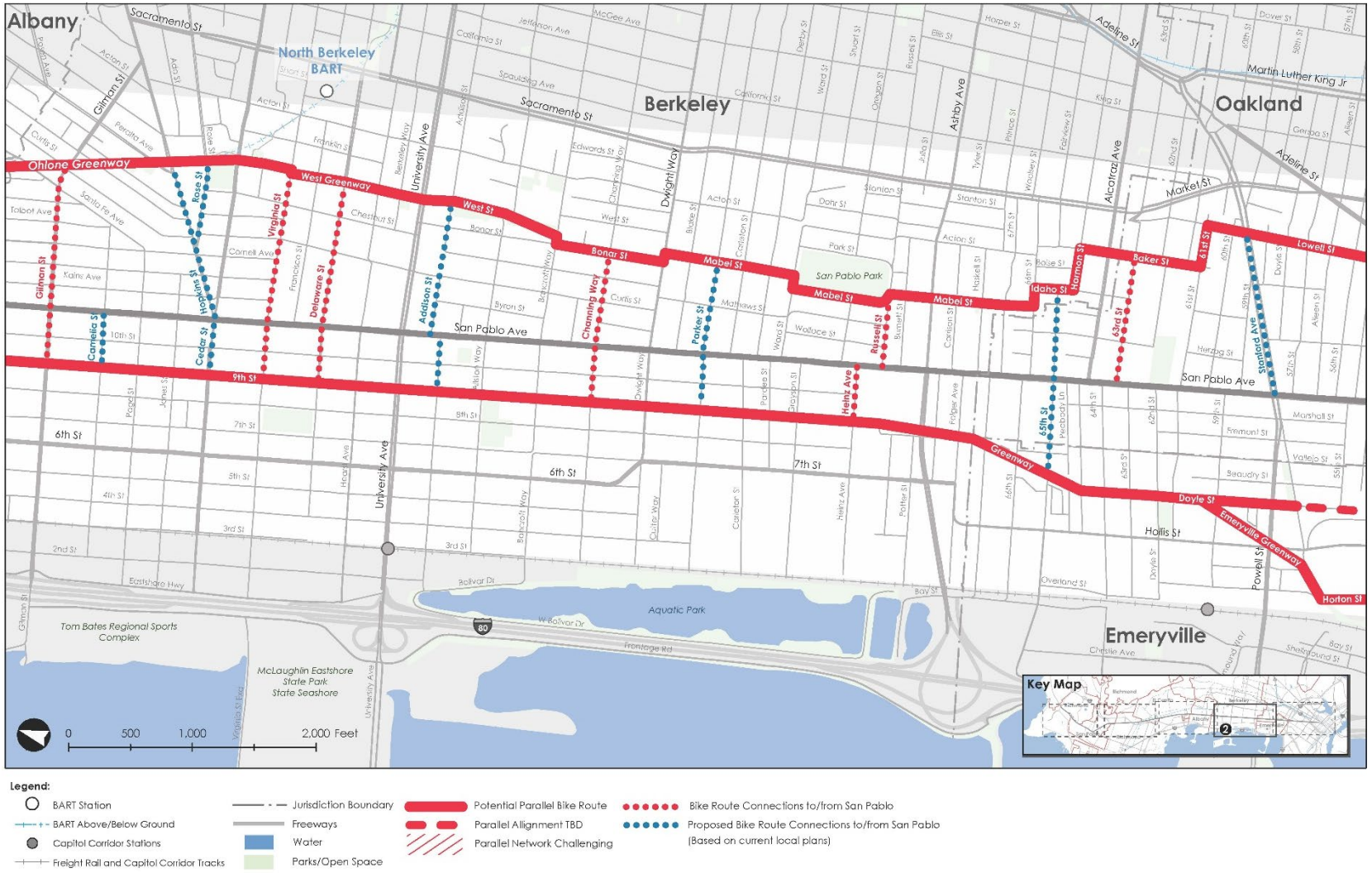


Figure 2-9: Parallel Bike Route Options Segment 3: Berkeley-Albany-El Cerrito

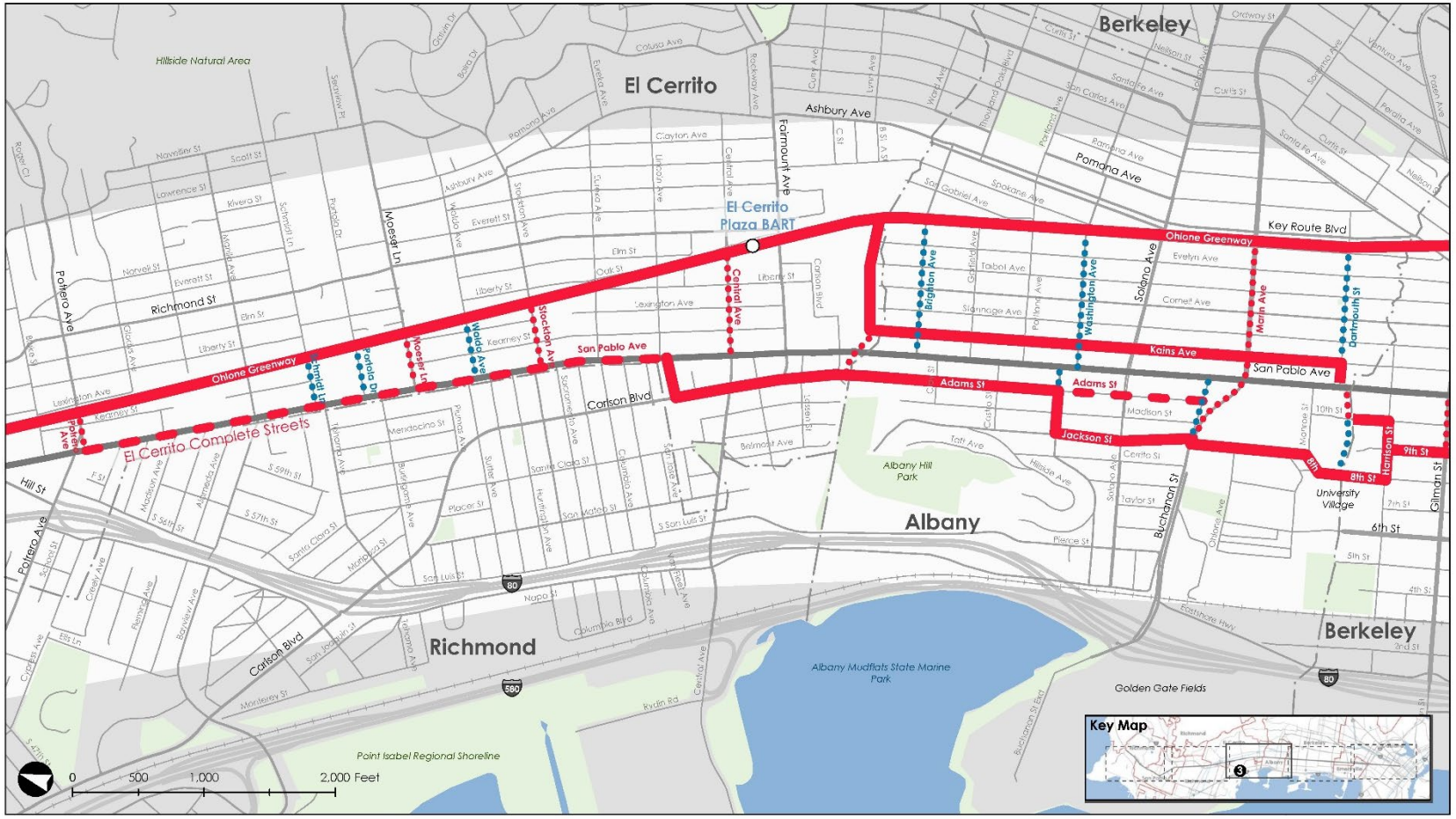


Figure 2-10: Parallel Bike Route Options Segment 4: El Cerrito-Richmond-San Pablo

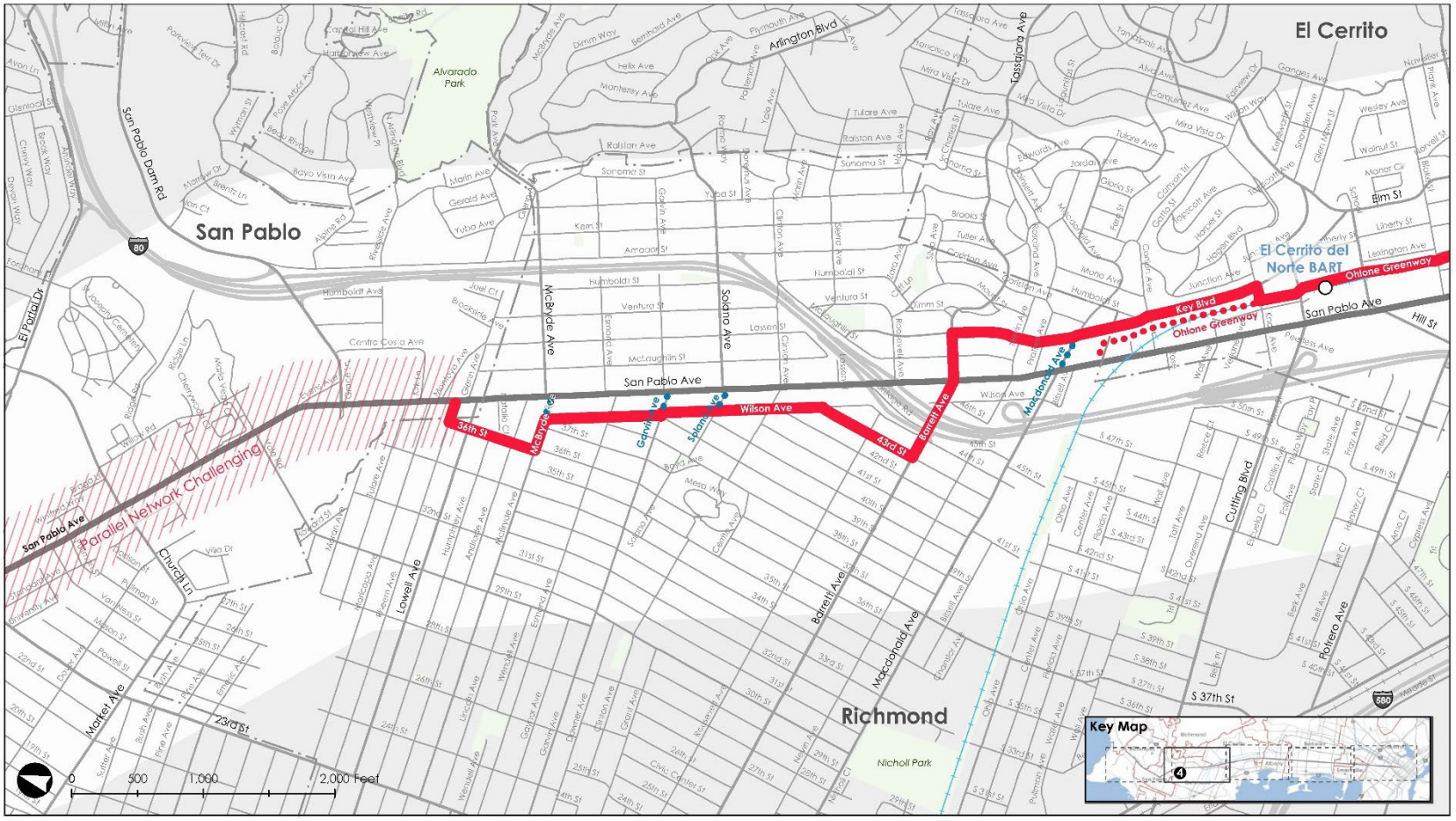
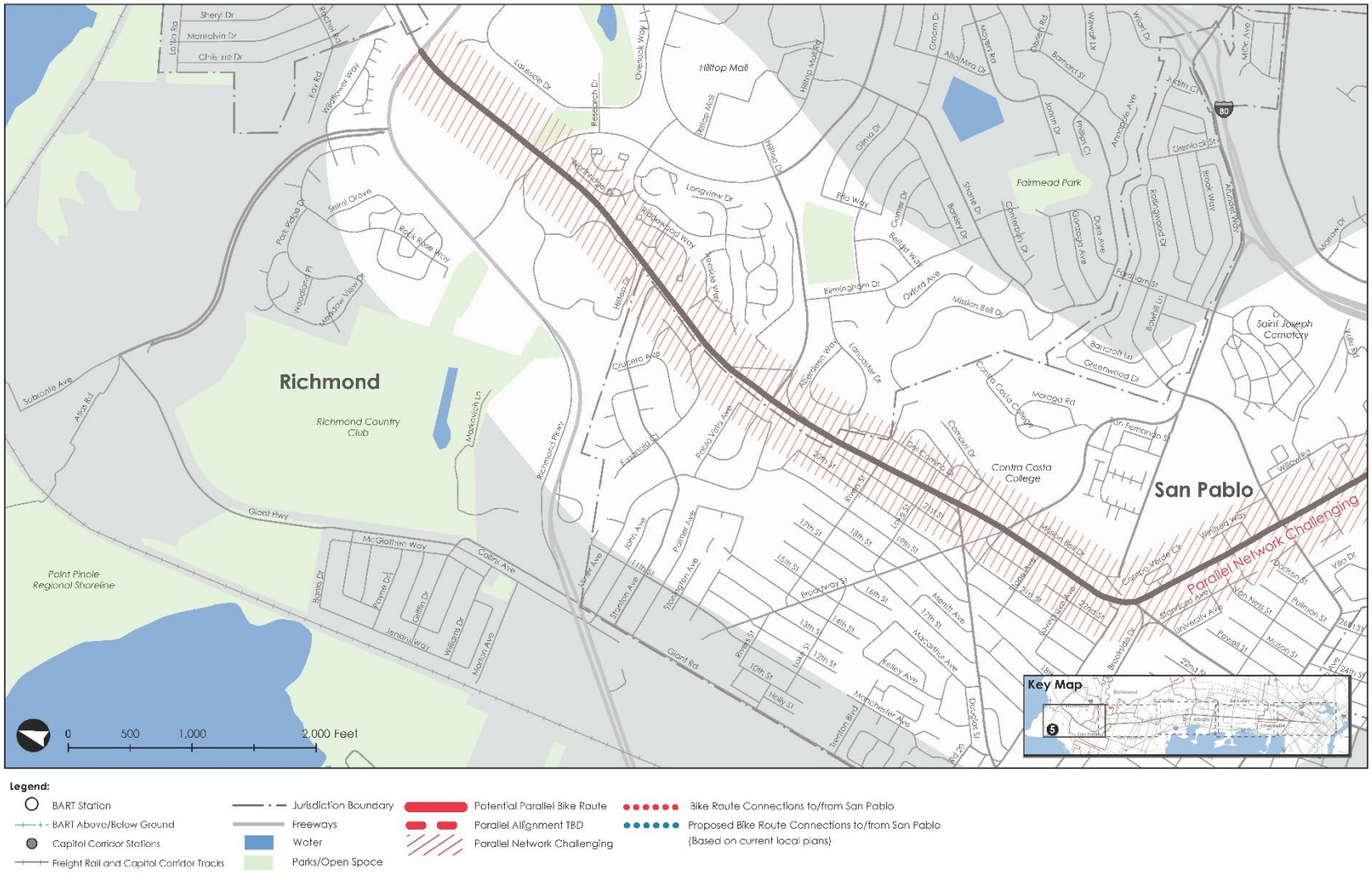


Figure 2-11: Parallel Bike Route Options Segment 5: San Pablo-Richmond



2.7 DESCRIPTION OF TRANSIT OPERATIONS

With implementation of the concepts at a corridor-wide level, the existing AC Transit Lines 72, 72M, and 72R are proposed to be replaced by a single, hybrid BRT service along the San Pablo Avenue corridor. Stations for this BRT service would be spaced approximately every 1/3-mile. While an industry-desired stop spacing for BRT service is stops every ½-mile, more frequent stops are recommended to maintain convenient access for existing transit users. This would represent an increase in the number of stops relative to the 72 Rapid service, but a significant decrease relative to the Local service. If all of the resources allocated to the current 72-series routes were re-allocated to this new BRT service, buses could operate at a frequency of every 5-7 minutes compared to the existing 12-minute peak frequency of the 72 Rapid and 30-minute peak frequency of the 72 Local service.

The specific configuration of this hybrid service would vary depending on the concept adopted. In a center-running bus lane option, stations could be provided in the center or on the side of the center-running busway.

Stations located in the center of San Pablo Avenue would require buses to have left-side doors (a typical bus has only right-side doors). Due to end of line operations (e.g., 20th Street busway with right-side loading), vehicles would be required to have right-side doors as well, therefore doors would be required on both sides of the vehicle. The new East Bay Bus Rapid Transit service was constructed with center and side station configurations and has doors on both sides of the vehicle.

Center stations could either be shared between northbound and southbound directions or split in which the stations for the northbound and southbound directions would be located adjacent to or near each other but not shared. The shared center stations would require additional right-of-way in an already limited corridor, although they would be more comfortable for passengers due to increased width. Both options warrant additional consideration, including feasibility at specific locations, and need additional analysis.

If an option were considered where the stations were located on the right side of the center-running busway, stations would need to be offset across the signalized intersection from each other. Buses would only need to have right-hand doors, but this configuration would likely require a full-lane offset for the bus lanes through the intersection which makes its implementation challenging.

Regardless of concept, bus stops along the corridor are assumed to be upgraded to BRT-quality stops, including upgraded lighting, shelters, wayfinding, and passenger amenities. Implementation of the hybrid service would replace existing 72-series curbside bus stops along San Pablo Avenue. Further analysis will be required to determine how other transit routes in the corridor, such as AC Transit's Transbay, Owl, and Local bus services, would be adjusted as a result.

The ability to implement a hybrid bus service will depend, in part, on the phasing and implementation of the preferred concept. Key outstanding questions related to corridor hybrid bus service include:

- the locations of the northern and southern termini;
- realignment options for Line 72M; and
- whether the routes will deviate off San Pablo Avenue to serve BART stations.

Chapter 4 includes a discussion on additional transit analysis and operations planning needed in subsequent project development efforts.

2.8 CONTRA COSTA COUNTY CONSIDERATIONS

The geometric and operational characteristics of San Pablo Avenue have greater variability in Contra Costa County than in Alameda County. In addition, mode splits are different along San Pablo Avenue in portions of Contra Costa County, with increased reliance on the automobile due to a variety of factors. Input received from outreach to residents and stakeholders in Contra Costa County indicated that there was no clear consensus for significant change as represented by Concept A and Concept B. In addition, due to the widely varying cross-section in Contra Costa County, the 73-foot typical cross-section generally applicable in Alameda County, does not fully represent the geometric opportunities along San Pablo Avenue and further concept exploration is necessary. Therefore, subsequent project development efforts are needed before concepts can be selected to advance for more detailed study. Contra Costa County plans to move forward on a separate but distinct track from Alameda County in the next phase to further evaluate and determine a preferred set of corridor concepts for advancement.

3. LONG-TERM CONCEPTS TO ADVANCE BY ALAMEDA COUNTY JURISDICTION

This chapter discusses the recommended concepts to advance by jurisdiction in Alameda County for additional study in future project phases. As noted in Chapter 2, further outreach and location-specific design development and evaluation is needed in Contra Costa County to select the concepts for further study. Therefore, no recommendations to advance for Contra Costa County are included herein.

A primary goal of this project is to maximize benefits and continuity of treatments along San Pablo Avenue while also respecting local context and preferences. In selecting concepts to advance for further study, consideration was given to segment conditions and context as well as public support for different concepts within geographic areas. The selection process relied both on a detailed technical analysis of the concepts and public feedback received through an extensive engagement process. This information was presented to Alameda CTC Commissioners representing this corridor to inform the selection of the concepts to advance.

3.1 TECHNICAL ANALYSIS

The technical analysis considered a range of factors in evaluating the concepts' abilities to meet the transportation needs of the corridor. Elements such as safety, throughput, connectivity, economic activity, and geometric feasibility were assessed for each concept. A summary of the key factors that informed the selection of the alternatives is provided here:

- Transit is heavily used on the corridor, with the highest bus ridership centered around the BART stations, University Avenue (Berkeley), and near Downtown Oakland. This supports the advancement of concepts with a bus lane.

- Bus speeds have progressively deteriorated over time and reliability has significantly suffered as a result of congestion, especially around traffic signals. Initial benefits from implementation of Rapid service have progressively decreased due to auto congestion. Congestion hot spots are most notable between Berkeley and El Cerrito BART, creating significant challenges with bus reliability and bus travel times. This supports the advancement of concepts with a bus lane.

- Auto volumes are notably lower in the southern portion of the corridor, particularly in Oakland and Emeryville. The auto traffic and diversion impacts resulting from the conversion of a mixed-flow travel lane to bus-only would be notably less in this segment. This supports the advancement of concepts with the reduction of a travel lane in Oakland and Emeryville.

- The southern end of the corridor (southern Oakland and Emeryville) does not have clear candidate parallel bicycle facilities due to the angled orientation of San Pablo Avenue relative to the surrounding street network and freeway barriers (as described in Section 2.6). South of 59th Street, the parallel network would require diversion for many bicycle trips. North of 59th Street, a high-quality parallel facility is either already provided or is likely achievable through to the northern Albany border. This supports the advancement of concepts with a bicycle facility on San Pablo Avenue in Oakland and Emeryville. Continued consideration of both concepts with a bicycle facility on San Pablo Avenue and upgraded parallel bicycle facilities in Berkeley and Albany is reasonable.

- Bicycle volumes on San Pablo Avenue are highest at the southern end of the corridor, notably south of Market Street in Oakland. This further supports concepts with a bicycle facility on San Pablo Avenue in southern Oakland.

- Much of the corridor within Alameda County, particularly areas in Berkeley, southern Emeryville, and Downtown Oakland, lies within the High-injury Network[1] with high concentrations of bicycle- and pedestrian-involved collisions at intersections. This supports concepts that enhance bicycle and pedestrian safety and calm traffic. This includes concepts that provide bulb-outs and reduce the number of travel lanes.

- Parking utilization varies widely throughout the corridor, with medium utilization in most segments with small pockets of high demand generally centered around commercial corridors. There is high demand for loading areas throughout the corridor, particularly in commercial areas, and a need for loading areas to support access for seniors and persons with disabilities. This supports the advancement of

[1] Alameda County's High-injury Network identifies intersections and corridor segments with higher incidence of bicycle and pedestrian collisions based on aggregated collision data including number of incidents and severity of collisions.

concepts that preserve parking, especially along commercial portions of San Pablo Avenue.

3.2 PUBLIC OUTREACH

Public outreach and online surveys were conducted along the San Pablo Avenue corridor to assess public support for potential modifications to San Pablo Avenue. Refer to the Phase 1 Outreach and Engagement Report for a full description of the engagement performed and the feedback received.

The results of this outreach suggested that residents of Oakland and Emeryville prefer the substantial changes represented by Concept A and Concept B over existing conditions.

Residents and stakeholders in Berkeley and Albany were more divided regarding the level of change they supported on San Pablo Avenue, with a plurality preferring existing conditions over Concept A or Concept B.

3.3 DESCRIPTION OF CONCEPTS TO ADVANCE (ALAMEDA COUNTY)

The technical analysis found that removing a mixed-flow travel lane would have lower impacts to throughput and would provide the most benefits to traffic calming in Emeryville and Oakland (compared to segments farther north). Further, bus ridership is high approaching Downtown Oakland and thus a bus lane would benefit a large number of riders. However, while a bicycle facility on San Pablo Avenue would provide safety and connectivity benefits, the impact of the loss of parking was not fully vetted with the community. Public feedback indicated that the bus lane was a high priority; that major modification to the roadway was preferred (reflected in Concepts A and B); and that traffic calming is strongly desired. Consultation with policymakers in Oakland and Emeryville confirmed that these two concepts aligned with city priorities for the corridor. As such, Concept A and Concept B are being advanced for detailed study and refinement for segments of the corridor in these cities.

The technical analysis found that transit lanes would have significant benefit to transit reliability and reduce bus travel times in Berkeley and Albany. However, public feedback was mixed in those cities, with high levels of support for both the bus lane and for existing conditions. Merchants indicated strong support for retaining parking and loading along

the curb. Additionally, the community strongly supported maintaining the median in Berkeley, which provides mature urban trees that enhance the streetscape.

As far as bike facilities, much better parallel facilities exist through this section of the corridor (compared to further south). There was some public support for a continuous bicycle facility on San Pablo Avenue, but also community support for enhancement of parallel routes. Policymakers in these cities supported bus enhancements to San Pablo Avenue, and continued consideration of a wider variety of options for the corridor due to concerns about reduced on-street parking and the elimination of mixed-flow lanes. Therefore, in addition to Concepts A and B, Concept D is also being advanced for study for these locations.

The concepts under consideration for further study in future project phases for each city along the corridor in Alameda County are shown in **Table 3-1**.

Concept development and preliminary analysis was based on prototypical cross-sections. With the advancement of these concepts for detailed analysis, more granular analysis is needed, including assessment of challenges, trade-offs, and preferences unique to each area. This will include physical differences as well as differences in transportation needs or social context.

Table 3-1 Concepts to Advance into Future Phases by City

		Albany	Berkeley	Oakland	Emeryville	Oakland
Concept Options	San Pablo Ave.	**Concept A** (Bus Lanes & Bike Lanes on SPA)	**Concept A** (Bus Lanes & Bike Lanes on SPA)	**Concept A** (Bus Lanes & Bike Lanes on SPA)	**Concept A** (Bus Lanes & Bike Lanes on SPA)	**Concept A** (Bus Lanes & Bike Lanes on SPA)
	San Pablo Ave.	**Concept B** (Bus Lanes on SPA; Bike Facility on parallel)	**Concept B** (Bus Lanes on SPA; Bike Facility on parallel)	**Concept B** (Bus Lanes on SPA; Bike Facility on parallel)	**Concept B** (Bus Lanes on SPA; Bike Facility on parallel)	**Concept B** (Bus Lanes on SPA; Bike Facility on parallel)
	San Pablo Ave.	**Concept D** (Spot bus improvements & Bike Facility on parallel)	**Concept D** (Spot bus improvements & Bike Facility on parallel)			
Parallel Bike Options	East	• Ohlone Greenway • Kains Ave.	• Mabel St. to Bonar St. to West Street Greenway to Ohlone Greenway	• Lowell to Baker	• Adeline to Lowell	• Telegraph Ave to 27th to MacArthur Blvd • West or Market Streets
	West	• Jackson St. to Adams St. to Carlson Blvd.	• 9th Street	• n/a	• 32nd to Hollis • 40th to Horton to Doyle to Emeryville Greenway • 53rd	• 14th Street to West Street, Market Street or Mandela Parkway

MATRIX NOT TO SCALE

LEGEND

Concept A:
Dedicated bus lanes
- **A1**: Center-running
- **A2**: Side-running

- Class 4 bike lanes
- One mixed-flow lane in each direction
- On-street parking/ loading on one side where possible

Concept B:
Dedicated bus lanes
- **A1**: Center-running
- **A2**: Side-running

- One mixed-flow lane in each direction
- On-street parking/ loading on both sides
- Bike facility on parallel
- Option: Northbound managed lane with parking off-peak and travel peak

Concept D:
- Bus bulbs
- Targeted bus queue jump lanes
- Two mixed-flow lanes in each direction
- On-street parking/ loading on both sides
- Bike facility on parallel

Parallel Bike Route
- Variety of improvements, such as signage, striping, road diets, improved crossings, and other treatments

4. NEAR-TERM IMPROVEMENTS

The corridor improvements discussed in Chapters 2 and 3 will likely take many years to come to fruition for the whole corridor due to the magnitude of changes envisioned. As a result, the project is also advancing solutions that can be implemented on a shorter timeline. Improvements are identified for the very near-term timeframe (less than three years) and the near-term timeframe (less than ten years). Improvements were assigned to these phases based on the currently-assessed feasibility of near-term implementation. This does not preclude expedited implementation of other improvements identified in Chapters 2 and 3, but until further consensus is reached around which concept is preferred, these represent what may be feasible in a shorter-term horizon.

The very near-term improvements focus on improving pedestrian comfort and safety. The corridor has high levels of pedestrian activity but uneven and sometimes deficient pedestrian amenities. This high level of activity, combined with high traffic volumes, create an uncomfortable and often unsafe pedestrian environment along many sections of San Pablo Avenue. Pedestrian safety was identified as a critical need in all parts of the corridor by the technical analysis and public outreach and there is widespread consensus that pedestrian safety improvements are a priority. These improvements are designed to be implemented in less than three years and would not preclude future improvements along the corridor.

The Cities of Oakland and Emeryville have expressed interest in accelerating the implementation of improvements beyond those in the very near-term category as there is more consensus in these areas about making more significant changes to the existing roadway configuration. Based on input from elected officials, city staff, and community priorities in those cities, a set of near-term concepts were developed for consideration in the Oakland and Emeryville segments of the street.

Very near-term and near-term improvements are identified for Alameda County only. Alameda CTC administers Measure BB, which includes a funding allocation that can be utilized to implement improvements along San Pablo Avenue in Alameda County. A similar funding mechanism does not currently exist in Contra Costa County. Therefore, while implementation of improvements is desired in Contra Costa County, the timeframe and nature of that implementation is not yet known. Additional funding and project development work is needed to identify opportunities for nearer-term implementation in Contra Costa County.

4.1 VERY NEAR-TERM SAFETY IMPROVEMENTS IN ALAMEDA COUNTY

A detailed review of the existing corridor within Alameda County and consultation with city staff resulted in identification of a set of very near-term recommendations that can be implemented in less than three years and would not preclude future improvements along the corridor. The very near-term timeframe is a set of targeted improvements that have little to no effect on existing utilities, drainage, vegetation, or business access. Improvements that require more complex agency review or that would be detrimental to any existing travelers on San Pablo Avenue were not considered for very near-term implementation.

The proposed very near-term improvements increase pedestrian visibility, safety, and comfort and improve ADA compliance, particularly for bus stop access. Improvements would enhance bicycle safety and comfort, particularly crossing San Pablo Avenue. Bicycle and transit improvements do not significantly encroach on the right-of-way or preclude longer-term improvements envisioned in Chapters 2 and 3.

Some type of improvement is recommended on every block of San Pablo Avenue; however, focus was given to segments that are part of Alameda County's identified High-injury Network and those characterized by higher levels of walking and transit-boarding activity.

4.1.1 VERY NEAR-TERM IMPROVEMENT ELEMENTS

Improvements types are summarized here and explained thereafter:

- Pedestrian bulbs (bulb-outs)
- ADA-compliant curb ramps and sidewalks
- Pedestrian countdown heads
- Audible pedestrian signal
- Increased visibility crosswalks (replacement of existing crosswalks with high-visibility striping)
- Adaptive pedestrian signals
- PHBs and RRFBs
- Leading pedestrian intervals
- Wayfinding signage
- Modification to star intersections

- Pedestrian lighting at bus stops
- Pedestrian lighting at crosswalks
- Concrete bus pads

Curb ramps located in the project area were built to old standards and no longer comply with ADAAG (Americans with Disabilities Act Accessibility Guidelines), which were established to standardize geometries for facilities utilized by persons with disabilities. As a result, segments of the street may be difficult to navigate for persons with disabilities. Approximately 207 curb ramps are identified for reconstruction as part of the very near-term improvements. Bulb-outs are proposed on side streets to increase the space available to provide an ADA-compliant curb ramp, reduce the crossing distance for pedestrians, and increase visibility of pedestrians for motorists. Nineteen of the curb ramps proposed for reconstruction are part of bulb-outs on side streets.

As noted in the Existing Conditions Report, 37 percent of all fatal and severe injury collisions involved a pedestrian and 27 percent involved a bicycle, representing a far greater than proportionate share relative to the volume of activity by mode on the corridor. In the last five years, four pedestrians and one cyclist have been killed along San Pablo Avenue. Poor pedestrian visibility occurs throughout the corridor and is contributor to the high number of pedestrian-involved collisions. The corridor includes many uncontrolled crosswalks with both limited warning to drivers and visibility obstructions. The Existing Conditions Report notes that 75 percent of all pedestrian collisions occurred while the pedestrian was crossing in a crosswalk. High-visibility crosswalk striping and PHBs or RRFBs are proposed to make pedestrians more visible to motorists and to encourage pedestrians to use these locations for crossing instead of crossing at less safe mid-block locations. Approximately 14 PHBs or RRFBs are identified for installation and locations were selected based on high pedestrian crossing and locations with high concentrations of collisions.

Currently, only some segments of San Pablo Avenue have effective lighting of pedestrian areas; lighting is inconsistent, sometimes non-existent, and, where it is provided, is rarely oriented toward pedestrian-level visibility or illumination. The very near-term improvements include pedestrian-scale lighting in high-impact and high-activity areas, such as crosswalks and bus stops.

In the southernmost segment, in the City of Oakland, many streets intersect San Pablo Avenue at a skew which decreases visibility for vehicles turning to and from San Pablo Avenue and creates unsafe conditions for pedestrians attempting to cross at these skewed intersections. Closure or modification of vehicular access at a select number of side streets

and/or elimination or modification of turning movements are proposed to improve roadway crossings and focus vehicle circulation on streets with additional control measures or fewer visibility concerns.

Berkeley has several high-quality east-west bike boulevards that have challenging crossings of San Pablo Avenue. Consistent with the City of Berkeley Bicycle Plan (2017), median modifications that would impact auto access to/from side streets, but significantly enhance bicycle crossings, are proposed at a several locations. **Figure 4-1** and **Figure 4-2** illustrate examples of existing deficiencies along San Pablo Avenue that would be addressed as part of the very near-term improvements. A comprehensive set of plan view illustrations of recommended very near-term improvements is included in **Appendix C**.

Figure 4-1: Curb Ramp & Crosswalk Deficiency

Figure 4-2: Example of Skewed Crosswalk and Reduced Pedestrian Visibility

4.1.2 VERY NEAR-TERM COST ESTIMATES

Very near-term improvements for Berkeley and Albany are estimated to cost approximately $20 million. Supporting information for the cost estimates is included in **Appendix D**. While the recommendation is to implement all improvements, individual upgrades can be grouped into construction groups with similar projects to facilitate approval and construction and phase implementation based on funding availability if necessary (such as a package for lighting or striping changes).

Oakland and Emeryville very near-term improvements may be incorporated into near-term improvements which are outlined (with cost estimates) in the next section. Costs for just the Very Near-Term improvements in this part of the corridor can be developed as needed in future project phases.

4.2 NEAR-TERM IMPROVEMENTS IN OAKLAND AND EMERYVILLE

The Cities of Oakland and Emeryville expressed interest in advancing a more robust set of near-term improvements due to indications of widespread support by both key decision-makers and the communities in those cities as well as technical analysis as described in Chapter 3.

The near-term improvement options were developed at a greater level of detail by applying concepts discussed in Chapters 2 and 3 to specific roadway segments in order to conduct a more thorough investigation of geometric feasibility and stakeholder reception. Two segments in the City of Oakland were selected for more detailed design—one northern segment (just south of the Berkeley border) and one southern segment (south of Emeryville). In addition, designs were developed for the 40th Street/San Pablo Avenue intersection in Emeryville, likely to be the most challenging intersection in Emeryville given high turning volumes, an ongoing project to implement a bicycle facility on 40th Street, and high bus volumes on both 40th Street and San Pablo Avenue.

4.2.1 OAKLAND NEAR-TERM CONFIGURATIONS

For each of the Oakland segments, a total of four geometric configurations were developed, representing different combinations of bus and bike lanes. All configurations include a transit-only lane including center- or side-running bus lanes and some include dedicated bike lanes. The near-term configurations developed for the Oakland segments are summarized below in **Table 4-1** and further described in **Appendix E**. Detailed outreach has not yet been conducted for the Oakland designs; this will occur during subsequent project phases.

Table 4-1 Near-Term Configurations in Oakland

	Bike Lane Included	No Bike Lane (Preservation of Parking)
Side-Running Bus	Option 1	Option 2
Center-Running Bus	Option 4	Option 3

4.2.2 EMERYVILLE NEAR-TERM CONFIGURATIONS

Five configurations were developed for the Emeryville 40th Street intersection, all of which include both dedicated bus lanes (center-running or side-running) and bike lanes with different variations on bus stop locations, lane geometrics, and turning restrictions. The Emeryville configurations were developed to be shared with the community at an open house in Emeryville and are included in **Appendix F**.

4.2.3 NEAR-TERM COST ESTIMATES

Preliminary estimates of construction costs were prepared for the ~3-mile Oakland-Emeryville segment for Options 2 and 4 which are anticipated to be the lowest and highest cost options, respectively, based on the magnitude of median and curb modifications. To include the universal improvements described in Chapter 2 and the very-near term improvements described in Section 4.1, these cost estimates include pedestrian and streetscape improvements in addition to the bus and bike improvements (e.g., landscaping, lighting, and curb ramp improvements; new BRT stops; and complete roadway resurfacing). Costs range from $177 million for Option 1 to $209 million for Option 4. Supporting information for the cost estimates is included in **Appendix D**.

4.2.4 NEAR-TERM ASSESSMENT

Development of the near-term alternatives in Oakland and Emeryville reinforced one of the conclusions of earlier alternatives analysis: making major geometric modifications to the corridor is both costly and requires a challenging set of trade-offs. Future phases of the project will need to do more in depth consideration of whether there are lower-cost ways to advance near-term improvements. A table of near-term cost estimates can be found in Appendix D.

5. AREAS FOR FURTHER DEVELOPMENT AND ANALYSIS

A great deal of analysis, design, and engagement was done during Phase 1 to narrow the range of concepts under consideration and begin to develop more detailed configurations for certain segments of San Pablo Avenue; however, further work is needed to advance the project toward implementation. Subsequent project efforts will include extensive coordination with stakeholder jurisdictions, Caltrans, and various communities along the corridor to continue the dialogue around trade-offs. Further design work is needed to develop and assess context-specific configurations, particularly given the differing land uses and geometries along the corridor. Additionally, further work is required to determine elements can be implemented most quickly that will benefit safety, connectivity, and transit reliability. These solutions may narrow the geographic focus of the improvements and identify quick-build and low impact treatments.

This chapter outlines key design or operational questions that will require more development, analysis, and engagement in future project phases.

5.1 BUS SERVICE

5.1.1 HYBRID BRT SERVICE

The concepts developed as part of the project assume that the Local and Rapid 72 service on San Pablo Avenue would be converted to a hybrid BRT service. This hybrid service would have stop spacing of roughly 1/3-mile, which is closer than the Rapid, but less dense than the Local. The hybrid service was proposed as a means of a simpler, more legible service with very high frequency that could still preserve a high level of stop accessibility. The resources dedicated to operating the existing Local and Rapid services at current frequencies could be combined into a single route with much higher frequencies. Currently, while the 72, 72M, and 72R all operate on the corridor, given the varying route alignments, stop locations, and headways, the perceived headway on the corridor is generally 12 minutes or longer. If all services could be combined into a single route, then the expected headway could be reduced to around seven minutes without any additional operating cost.

If a center-running transit lane configuration is advanced, a hybrid BRT service would be necessary to avoid Local services that block Rapid services at shared stops or intermixing of Local services with mixed auto flow. However, for a hybrid BRT service to be effective it would need to have transit priority treatments over much of its length. In a scenario

where the corridor improvements are implemented over different geographies in phases, there may be a period where the dedicated transit facilities only extend for a portion of the route. In this case, a hybrid BRT service may not be warranted or beneficial since service speeds would be greatly slowed and variable in segments without transit priority treatments. Further analysis is needed to determine an optimal operational configuration based on different phased implementation scenarios.

A hybrid BRT service requires a number of the existing Local stops on San Pablo Avenue to be removed. While most high-ridership stops are currently Rapid stops that would remain with the hybrid BRT or would be incorporated into the hybrid BRT, there would be riders who would have a longer walk to access transit with such a configuration. While feasible, stop removal is a challenging process that will require further analysis to determine optimal stop locations and focused community engagement to notify and obtain input from existing riders.

5.1.2 LINE 72M OPERATIONS

The new hybrid BRT service would operate on the San Pablo Avenue corridor and act as a replacement for the existing AC Transit 72-series routes: Lines 72, 72M, and 72R. Line 72M would likely remain in some capacity, at a minimum to provide continued service along Macdonald Avenue, a highly utilized transit corridor to Point Richmond. Further analysis is needed to determine where Line 72M's southern terminus would be located.

One option for a 72M southern terminus would be for the route to overlay with the hybrid BRT service along San Pablo Avenue and continue to downtown Oakland. Preliminary modeling indicated that continuing the 72M to downtown Oakland as a separate service would result in higher overall ridership along the corridor route. If this option was adopted, the fleet would need to meet the fleet requirements for the hybrid BRT service (which could include vehicles with doors on both sides and TSP equipment). This would provide greater connectivity for passengers along the portions of Line 72M that are off the San Pablo Avenue corridor.

An alternative Line 72M terminus option would be at El Cerrito Plaza BART or El Cerrito del Norte BART. These options would come with varying impacts to reliability and connectivity; 72M passengers going to or from Downtown Oakland would be required to make a transfer. However, reallocating 72M operating resources to increased frequency of the hybrid BRT service could provide great benefit to the larger number of riders on San Pablo Avenue. This terminus location would also depend on the northern terminus of the hybrid BRT service, which also requires further analysis.

5.2 BRT TERMII

5.2.1 BRT TERMINUS LOCATION IN DOWNTOWN OAKLAND

There are several location options for the southern terminus of the proposed hybrid BRT service. The existing 72-series routes, which the hybrid BRT service would replace, terminate at Jack London Square in Oakland. Terminating the new transit service at Jack London Square would therefore provide a one-for-one replacement of the 72-series routes in terms of connectivity. Ridership is strong through Downtown Oakland but drops off notably south of I-880 and travel speeds through Downtown Oakland are both highly variable and slow. The City of Oakland has an approved project that was implemented in September 2020 to provide transit-only lanes on Broadway between approximately 12th Street and 19th Street. These transit-only lanes are anticipated to improve speeds and reliability for 72-series routes as well as the East Bay BRT service. However, no exclusive transit lanes are planned between 12th Street and Jack London Square, thereby introducing likely variability that could affect bus reliability for northbound service and slightly diminishing the benefits of transit-only facilities along San Pablo Avenue. Eliminating the route segment between Downtown Oakland and Jack London Square has the potential to improve transit reliability as well as allow for shifting route operating costs to increased frequency along San Pablo Avenue. Further analysis is needed to understand how critical it is to provide direct service either through Downtown Oakland or to Jack London Square.

The biggest challenge to truncate the route is finding a proper southern terminus which allows bus layover and turnaround. From a service standpoint, the most logical termini in Downtown Oakland are either the 20th Street Transit Center or the 12th Street/Oakland City Center BART station area; however, both present challenges from layover and turnaround perspectives that would need to be examined and vetted as part of future analysis. The East Bay BRT is constructing a bus layover area underneath I-980 on San Pablo Avenue. Terminating at the 20th Street Transit Center would provide reasonably convenient access to this layover area, although it still would present turn-around challenges and would not provide direct service to major employment areas in Downtown Oakland. Terminating at the 12th Street/Oakland City Center BART station would provide direct access to more destinations in Downtown Oakland; however, terminating at this location would require additional investigation of potential layover locations. The ridership, operational, and travel time implications of the three options under consideration (20th Street, 12th Street, or Jack London Square) require further analysis.

5.2.2 BRT NORTHERN TERMINUS LOCATION

The existing Lines 72 and 72R have their northern termini at Hilltop Mall and Contra Costa College, respectively. The terminus of the proposed hybrid BRT service requires further analysis and consideration. One of the primary factors is the northern extent of transit priority treatments developed as part of this project. Furthermore, the northern extent of transit priority treatments may change with implementation phases, and thus the northern terminus of the transit routing may also vary by phase. Several northern termini are still under consideration.

It is assumed that the northern terminus should be no further south than the El Cerrito Plaza in order to provide connectivity to BART. This would also limit the route length within Contra Costa County where project alternatives and implementation are least certain. Note that the 72R currently does not stop at El Cerrito Plaza and thus transit priority treatments to connect the El Cerrito Plaza bus bays with San Pablo Avenue would need to be considered.

The next logical terminus point is El Cerrito del Norte BART. This would make sense if transit priority treatments are extended through El Cerrito and/or if connectivity to El Cerrito del Norte BART is deemed critical as a major transfer point for many existing transit riders to other operators and routes. This BART station would also provide a logical connection point to any truncated Macdonald Avenue service that may be proposed (if the 72M is indeed truncated; see prior discussion).

Previous analysis found that many Line 72R and 72 riders stay on the bus through El Cerrito del Norte. This indicates that there would be some value in extending the service north of El Cerrito del Norte to the current Line 72R terminus at Contra Costa College. However, for this additional segment to not impact the reliability of operations on the segment of San Pablo Avenue south of El Cerrito del Norte, transit priority treatments would need to be considered in Richmond and San Pablo. San Pablo Avenue is highly constrained in this segment and transit priority treatments will be challenging to implement. Therefore, the analysis will need to consider the trade-off between forced transfers for some users with the increased variability that would be associated with operating in a mixed-flow environment.

5.3 DEVIATION TO BART STATIONS AND DESIGN AT BART STATIONS

Currently, Line 72R does not deviate off San Pablo Avenue to serve El Cerrito Plaza BART but does deviate off San Pablo Avenue to serve El Cerrito del Norte BART, which is located closer to San Pablo Avenue. A route deviation from San Pablo Avenue to these stations is approximately 0.3 and 0.6 miles, respectively. Lines 72 and 72M deviate off the Corridor to serve both BART stations directly. Ridership on both Lines 72 and 72M at El Cerrito Plaza BART is relatively high. The hybrid BRT service is assumed to replace both Local routes, thus raising the question whether the new service should follow the Rapid pattern or the Local pattern as far as direct access to El Cerrito BART stations.

There are many considerations for this decision. The hybrid BRT can connect directly to BART at El Cerrito del Norte more readily, because preserving that connection requires less deviation and therefore less travel time and delay impact. Deviating to El Cerrito Plaza BART presents a challenge due to its distance from San Pablo Avenue and significant delays created by this deviation in current conditions. However, Lines 72 and 72M have a high number of boardings occurring at the El Cerrito Plaza BART station, suggesting that the demand for direct connectivity to the station is high. If direct service at the station is provided, transit priority treatments should be considered to improve the connection between El Cerrito Plaza BART and San Pablo Avenue. Further analysis is required to understand the trade-offs between serving the station directly or serving the station via a stop on San Pablo Avenue.

5.4 TRANSIT RIDERSHIP

Determination of each of the items above will influence the resultant ridership benefits of the project. Future project efforts are needed to develop ridership projections with the proposed improvements. Phase 1 analysis indicated that the potential increase in projected corridor transit ridership may be limited by multiple factors, including:

- *Traffic signals*: The addition of new signals at minor intersections would improve pedestrian access along the corridor; however, it would partially offset the travel time benefits of dedicated transit lanes.
- *BART along corridor*: BART operates generally parallel to this corridor, albeit with limited access points. As it is a completely grade-separated transit service, BART will always be faster for longer-distance trips between areas around BART stations even with enhancements for bus services on San Pablo Avenue. This limits the potential modal capture for buses on San Pablo Avenue.

- *Origin-destination patterns*: Analysis of cell phone data conducted in Phase 1 found that only a portion of auto trips were strong candidates to shift to transit. Many trips in the corridor are very short and thus would lend themselves more to walking or biking trips if enhanced facilities were provided. Additionally, about a third of trips were cut-through trips without an origin or a destination in the corridor and thus are not good candidates for switching to BRT service.
- *Auto travel times*: The Alameda CTC Travel Demand Model is calibrated based on current travel patterns, which are influenced by factors such as land use densities, transit service levels, user behavior and societal modal preferences, first-mile/last-mile options, socio-economic conditions, and parking pricing. Ridership projections are a product of these factors, and as the factors change over time, so will ridership.

5.5 CENTER-RUNNING VS. SIDE-RUNNING DEDICATED TRANSIT LANE

Both Concepts A and B include options for either a center-running or side-running dedicated transit lane. Both center-running and side-running bus lanes would reduce transit delay and improve reliability; however, both alternatives have various trade-offs that will require further consideration.

Center-Running Lane Benefits: Center-running lanes would likely result in greater improvements to transit performance. A center-running lane would avoid any mixed-traffic sections, likely providing a greater improvement in bus reliability and travel time.[2] Riders in the center-running option would only have to cross half of San Pablo Avenue at any one time to travel to/from stops (although they would always have to cross half of the street to get on the bus). For non-transit users, stations in the median in center-running option would provide pedestrian refuge islands that improve safety for all pedestrians.

Center-Running Lanes Challenges: To accommodate a center-running lane, any location with a pedestrian crossing or left turn on or off the corridor would need to be signalized or closed, which would both somewhat offset travel time gains as well as reduce community access and may make the street feel more like a barrier. Depending on the configuration of center-running stations, a special dedicated bus fleet may be needed with doors on the left side of the bus to accommodate left-side boarding at median stations. A center-running configuration would also require greater modification to the existing

[2] The analysis conducted as part of Phase 1 found that bus delay was predominately the result of traffic signal delay and associated traffic acceleration/deceleration and not significantly attributable to right-turn and parking maneuvers, which may indicate a less substantial travel time difference between center- and side-running configurations.

median, impacting more trees and entailing higher cost. In the center-running bus option, dedicated right-turn lanes may or may not be provided. Where right-turn lanes are not provided, right-turning vehicles waiting for pedestrians to cross would block through auto traffic, potentially causing cars to swerve into center bus lane or causing significant delays and reductions in auto throughput. Additionally, although the majority of parking would be removed, in locations where on-street parking would be retained, parking maneuvers would block the mixed-flow lane, causing buses/vehicles to block traffic or weave in and out of the transit lane to bypass.

Side-Running Lane Benefits: In a side-running option, stations would be located curbside requiring less width for the stations which provides additional flexibility in the allocation of roadway right-of-way. A side-running lane could also be utilized by Local routes, Transbay routes, and other routes beyond the hybrid BRT service. Side-running bus lanes are generally easier to implement and less costly because they require fewer operational changes for buses or automobiles and easier construction staging. Side-running bus lanes also may provide a more desirable environment for bicyclists by creating a larger buffer between cyclists and autos. Stations on transit islands/bulb-outs on the side of the street reduce the overall effective crossing distance, but do not provide a median refuge. Bicyclists have easier access to transit islands associated with side-running lanes than center-median stations.

Side-Running Lane Challenges: A side-running transit lane would have greater friction with mixed-flow traffic and bikes. Non-transit vehicles would utilize the lane for accessing parallel parking spaces and driveways. Buses in side-running bus lanes also conflict with right-turning vehicles at many signalized and unsignalized intersections, which means right-turning vehicles would temporarily block the bus lane, particularly at intersections with high pedestrian volumes. This increased friction with other vehicles could reduce travel time and worsen service reliability. Side-running bus lanes are more difficult to enforce, both through physical design and police enforcement. Treatments that can be used to separate center-running bus lanes from adjacent mixed-flow lanes are not feasible for side-running bus lanes. As a result, the effects of mixed-flow congestion are greater on side-running than center-running bus lanes.

5.6 LOCATION SPECIFIC ISSUES

5.6.1 CONFIGURATION OF "STAR" INTERSECTIONS IN OAKLAND

In Oakland, south of MacArthur Boulevard, San Pablo Avenue is diagonal to the street grid. This orientation creates five-legged "star" intersections, which are challenging for bicyclists and pedestrians to navigate and limits the ability to develop convenient parallel facilities. This section of Oakland also has short block lengths, which means that with addition of bus and bike lanes, no on-street parking/loading could be retained. Further design development and local business engagement is needed to determine additional modifications for these especially challenging intersections. Additional treatments to improve these intersections could include closing one or more legs of the intersection, limiting vehicle movements, and providing enhanced bicycle and pedestrian crossing treatments.

5.6.2 INTEGRATION WITH 40TH AND SAN PABLO BUS HUB CONCEPT DESIGN IN EMERYVILLE

The City of Emeryville is in the process of developing improvements to 40th Street and Shellmound Street to provide exclusive transit lanes and a two-way bikeway between the IKEA Emeryville driveway and Adeline Street. The extents of these improvements will include the San Pablo Avenue/40th Street intersection, where proposed improvements include a protected intersection for bicycles, east-west dedicated transit lanes, and an east-west cycle track. As part of project efforts completed to date, a variety of design options were developed for this intersection (concepts are contained in **Appendix F**). These design options were presented to the community and input was received. Further coordination with the City of Emeryville and design development will be required to integrate the San Pablo Avenue improvements with the final 40th Street improvements.

5.7 EMERGENCY VEHICLE OPERATIONS IN EXCLUSIVE TRANSIT LANES

Emergency vehicles are impacted by congestion similarly to transit vehicles; however, dedicated transit lanes on San Pablo Avenue change that dynamic. Congestion in mixed-flow lanes increase with the conversion of a mixed-flow lane to transit-only use. However, the dedicated transit lane also provides an opportunity to benefit emergency vehicles by allowing them to use the bus lane.

Operations would likely follow the same protocol as is planned for the East Bay BRT where emergency vehicles will be allowed to utilize transit lanes. If emergency vehicles approach a bus from behind, the bus will merge into the mixed flow lanes to clear a path for emergency vehicles. At signalized intersections, emergency vehicles will be able to request signal preemption, as they do today. Since the exclusive lanes will be delineated with striping, and vertical separation will only be provided in the form of easily mountable deflection devices, emergency vehicles will be able to merge in and out of the lanes, or cross the lanes, wherever needed. Thus, emergency vehicle response times could be improved with transit-only lanes. Further coordination is needed with AC Transit and emergency service providers to verify that the operational approach for the corridor benefits both transit and emergency vehicle response.

5.8 QUEUE JUMP LOCATIONS UNDER CONCEPT D

If Concept D is carried forward, further consideration will be needed to identify queue jump locations at intersections which are most effective at congested intersection with long through-movement queues and when the queue jump is sufficiently long for buses to access it during these congested periods. Bus queue jumps are not desired where a far-side stop with a bulb-out is located. In this configuration, the queue jump would then place the bus in the way of the full vehicle platoon, impacting both vehicle operations and creating an environment where drivers could behave erratically.

5.9 PARKING IMPACTS

Concept A with both a transit-only lane and a bike lane causes a significant reduction in parking and loading spaces along San Pablo Avenue. Parking loss could be partially offset through optimizing use of curb space on side streets and the provision of off-street parking in select locations. Further analysis and community engagement are required to determine the magnitude of parking loss and the opportunities to offset this loss. In addition, targeted merchant engagement is needed to understand local perspectives on the trade-off between loading, parking, and enhanced mobility. While numerous studies have shown the benefits to commercial activity associated with increased transit, bicycle, and pedestrian activity, merchants often perceive parking loss as a detriment to their businesses.

5.10 MANAGED LANE CONFIGURATION/OPERATION

Under Concept B, there is an option to provide a managed lane in the one direction which would serve as a general-purpose lane during the peak hour and a parking lane during all

other times. This kind of managed lane creates certain operational requirements. Cars parked in the managed lane during the peak hour would be in violation of the vehicle code and would need to be promptly towed to maintain the utility of the lane. This creates a need for resources to quickly identify cars in violation and tow them away. A similar managed lane is currently in operation on Ashby Avenue in Berkeley, with mixed effect. Further analysis is needed to better understand the enforcement resource requirements of this managed lane and the mechanisms for ensuring that this increased enforcement is provided.

6. PHASING CONSIDERATIONS

Given the magnitude of costs and change that the long-term concepts entail, this chapter discusses several additional considerations for phasing of improvements over time.

6.1 SIGNAL/OPERATIONS UPGRADES

One area of investigation during Phase 1 was whether efficiency could be extracted from the existing signal system to enhance transit performance. This could be a near-term option to improve bus performance without major construction costs while trade-offs associated with major geometric reconfigurations are still being evaluated. Major conclusions of this work were: 1) substantial upgrades have already been undertaken as part of the I-80 Integrated Corridor Mobility project (I-80 ICM) and 2) AC Transit is currently upgrading its Transit Signal Priority (TSP) systems. The GPS-based technology that AC Transit is implementing as part of its ongoing project will allow for additional efficiencies in the operation of TSP that are not currently achievable with the existing legacy technology. Additional coordination between cities and Caltrans is likely necessary during future project phases to ensure the current infrastructure upgrades are maximally utilized to benefit bus movement efficiency.

The I-80 ICM installed advanced technology elements along San Pablo Avenue, including new controllers at numerous locations along the corridor, as well as both changeable and static message signs. Communication systems were installed to allow for remote intervention to manage regional traffic that has diverted onto parallel routes including San Pablo Avenue during an incident on I-80. These improvements all served to enhance traffic operations along the corridor. However, the I-80 ICM improvements did not substantially change TSP performance on San Pablo Avenue. Buses are still limited to one TSP activation every 10 minutes per intersection, TSP is only granted to buses running behind schedule, only Rapid buses are outfitted with TSP technology, and an outdated optical technology is still being used. There is no easily accessible data-logging source to indicate whether the TSP is functioning properly or buses are even being granted priority.

AC Transit is currently addressing these issues through implementation of the Rapid Corridors-San Pablo Avenue TSP project. The project is working to upgrade the TSP performance of the corridor, switching to a GPS-based TSP technology. In conjunction with the technology components of the project, AC Transit is working with Caltrans and the local jurisdictions on revising the operational rules for TSP. The improved technology and modified rules will allow for TSP activation by more buses (including cross-streets),

with greater frequency, along the corridor. This will enhance the overall effectiveness of TSP and should benefit transit performance.

Corridor technology and operations were reviewed to determine if additional measures were available to benefit the multi-modality of the corridor, particularly for transit operations. The corridor is highly constrained for TSP operations due to a few key challenges:

- Short cycle lengths combined with high levels of pedestrian activity result in many intersections not having surplus signal cycle time to re-allocate as part of TSP.
- Major east-west arterials that provide access to I-80 are heavily congested and additional TSP would be impactful to their performance (including to bus routes that operate on those streets).
- Congestion on the corridor results in queues, which prevent buses from reaching the intersection during an extended green provided by TSP, eliminating the benefit of TSP. Many traffic signal controllers are running Caltrans software or are legacy McCain controllers with limited TSP functionality. Caltrans controllers are only capable of handling eight phases, which presents problems for transit priority solutions such as queue jumps at many locations. While they all currently have the functionality to start green phases early, some controllers are only operating extended green.

One potential solution not currently being implemented as part of any active project is to replace the older controllers with ones capable of more sophisticated algorithms and software. To facilitate this and overcome the challenges noted above with Caltrans software, local jurisdictions may need to take control of intersection operations and install a different controller type.

In conjunction with the controller upgrades, one way to combat automobile queueing impacts on bus travel time is to extend the green phase up to 20 seconds instead of 10 seconds. Another improvement would be to implement phase skipping, which is a phase advance that prioritizes the bus phase by skipping select auto phases. These features will require improved controllers and should be considered along with other corridor improvement recommendations. As controller upgrades with advanced TSP functionalities are not being included in the ongoing AC Transit project, they may be a candidate for inclusion in future San Pablo Avenue project efforts.

6.2 SIDE-RUNNING VS. CENTER-RUNNING BUS LANES

The side-running bus lane concept has the greatest flexibility to introduce improvements incrementally over time relative to center-running. It is closer to the existing configuration with sidewalk stops, transit network changes are not necessary, and construction staging is easier than in the center of the street. A side-running transit-only lane configuration can be implemented relatively quickly and the benefits of a transit-only lane can begin to be experienced with even a short initial implementation such as a few blocks or a single jurisdiction.

Center-running bus lanes have the potential to be more effective than side-running for transit operations by reducing interaction with autos. However, a center-running configuration has less flexibility for segmentation and phasing than side-running bus lanes. All bus amenities are currently located on the side of the street; thus, relocating the bus to the center requires new stations as well as median and lane modifications for it to be operable. It may also require an all-new bus fleet, as discussed later in this section. In addition, a longer minimum segment needs to be provided for it to be practicable for the bus to access and egress the center-running lanes and provide value and benefit; such a restriction is not true of a side-running configuration.

With a center-running configuration, additional consideration needs to be given to the variety of transit services currently on San Pablo Avenue. Several AC Transit Local and Transbay services currently operate on segments of San Pablo Avenue. It would be very challenging to relocate these services to the median given their entry/exit points on the corridor and stop spacing generally varies compared to the Rapid services. As a result, these services would likely need to remain on the curbside and would be impacted by and impact congestion in the single mixed-flow lane remaining in each direction on San Pablo Avenue, or these services could be relocated off of San Pablo Avenue which would require substantial further investigation into alternative routing options.

In addition, with side-running bus lanes there is less need for AC Transit to fundamentally change its transit network design such as consolidating the Rapid and Local into a BRT or re-routing other services (see discussion in Chapter 5).

The most feasible design for center-running lanes are left-hand boarding center island stations as they avoid major lane offsets across intersections, are more space-efficient, and create a more comfortable passenger waiting environment. However, they require a special fleet to allow left-hand boarding, and thus aren't feasible for phasing. Providing

right-hand boarding stations at curbside provides greater fleet flexibility to AC Transit and would allow use of the transit lane by a greater number of services.

6.3 TRANSIT ENHANCEMENTS

Bus bulbs can be implemented stop-by-stop over time as funds are available and will provide incremental benefits to bus performance. At stop locations where bus bulbs are recommended as improvements, near-side stops should be converted to the far-side to avoid impacts to right-turning traffic. As most stops along the corridor are already far-side stops, the number of near-side conversions would be minimal. There are temporary lower-cost solutions to providing bus bulbs to facilitate in-lane boarding such as Ziclas, a temporary pad for the bus extension. Ziclas, however, are not as aesthetically pleasing as a curb extension, not as desirable of a waiting area, and the cost savings may not warrant their use.

The use of red paint to designate transit lanes has proven to be effective to increase compliance and the effectiveness of the lanes. This treatment may be phased in at any time.

Cameras for enforcement can enhance the effectiveness of dedicated transit lanes. These are currently used in San Francisco to enforce use of the transit-only lanes, as allowed by Assembly Bill 1287[3], which is specifically limited to the City and County of San Francisco. California Vehicle Code Section 40240 allows AC Transit to use "automated forward-facing parking control devices … for the purpose of video imaging of parking violations occurring in transit-only lanes."[4] This more limited application of automated enforcement (exclusively for parking violations) was recently put in place by AC Transit as part of the East Bay BRT project. Automated camera enforcement of the transit lanes has been effective in New York City. Camera-based enforcement is not a pre-requisite for transit lanes but is encouraged, both for parking violations as allowed by existing law and for potential future modification of AB 1287 to include AC Transit for automated enforcement of moving violations.

6.4 BIKE LANES

[3] Assembly Bill 1287, Amended April 29, 2015
[4] California Vehicle Code, Section 40240

The provision of a bike lane would require removal of much of the existing parking on the corridor. This may require consideration of creating additional on-street parking on side streets or in off-street lots. Further analysis will be needed to determine the need for, locations of, and methods to replace parking.

Bicycle protection treatments could be phased in over time; however, the corridor has limited flexibility in terms of the designation of space. The ultimate configuration of the bicycle facility is tightly constrained at intersections unless auto-turning movements are severely limited. Consideration needs to be given to providing a continuous bicycle facility with each phase including a consistent set of treatments in order to allow for the desired ultimate network connectivity benefits. While a bike lane doesn't necessarily have to be installed concurrently with the transit lane, the configuration of a bike lane would have to be considered to ensure the appropriate design configuration of the transit lane and transit stops.

6.5 RIGHT TURNS

All right-turn configurations must be determined on a location-by-location basis, based on many factors such as right-turn volumes, roadway width, transit stop and lane needs, and pedestrian crossing needs. Difficult trade-offs are required when making turn lane decisions given the multiple demands that converge at intersections. For example, a shared lane between buses and right-turning vehicles risks significantly slowing transit operations when autos stop in the lane to yield to crossing pedestrians, whereas a separate right-turn lane impacts parking significantly and may require modifications to the median to provide sufficient width, thus increasing the implementation cost and difficulty. Given the location-specific nature of these decisions, right-turn lane modifications can be phased as needed in the corridor.

APPENDIX A

RIGHT-OF-WAY AND

CONCEPT PROTOTYPE DRAWINGS

APPENDIX B

OTHER ALTERNATIVES CONSIDERED AND REJECTED

APPENDIX C

VERY NEAR-TERM PLANS

APPENDIX D

VERY NEAR-TERM AND NEAR-TERM

COST ESTIMATES

APPENDIX E

OAKLAND NEAR-TERM DESIGN CONCEPTS

APPENDIX F

40TH STREET AND SAN PABLO AVENUE (EMERYVILLE) INTERSECTION CONCEPTS