TRANSPLAN Technical Advisory Committee

Participating entities: Cities of Antioch, Brentwood, Oakley and Pittsburg • Contra Costa County
Tri Delta Transit • 511 Contra Costa • Contra Costa Transportation Authority (CCTA) • Caltrans District 4 • BART
TRANSPLAN • State Route 4 Bypass Authority • East Contra Costa Regional Fee & Financing Authority (ECCRFFA)

March 15, 2022 – 1:30 to 3:00 p.m.

Virtual meeting call-in/log-in information:
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AGENDA

*NOTE: The Technical Advisory Committee ("TAC") agenda/packet is only distributed digitally, **no paper copies will be sent.** If you need a printed copy, please contact TRANSPLAN staff.*

Action/Discussion Items (see attachments where noted [♦])

Item 1: Public Comment: The public will have an opportunity to comment on items not on the agenda**.**

Item 2: Pedestrian Needs Assessment. Contra Costa Transportation Authority (CCTA) staff will provide an overview of the Countywide Pedestrian Needs Assessment, which was one of the recommended implementation actions from the 2018 Countywide Bicycle and Pedestrian Plan Update, and requests input from TRANSPLAN TAC. **♦ Page 2**

Item 3: CCTA Smart Signals Project. CCTA staff will provide an update on the Smart Signals Project and requests input from TRANSPLAN TAC. The project will develop, manage, and implement Intelligent Transportation System (ITS) initiatives, such as upgrading the existing legacy systems, providing interconnectivity throughout Contra Costa County signal systems, and enhancing the sharing of real-time information between agencies and the public.

Item 4: Other Business

Item 5: Adjourn to Tuesday, April 19, 2022, at 1:30PM, or other date/time as deemed appropriate by the Committee.

The TAC will meet on the third Tuesday of each month, 1:30 p.m. Meetings are currently held via video conference in response to Contra Costa County Health Services Health Orders related to the COVID-19 pandemic: https://www.coronavirus.cchealth.org/health-orders. Otherwise, the TAC meets at the third floor conference room at Antioch City Hall. The TAC serves the TRANSPLAN Committee, the East Contra Costa Regional Fee & Financing Authority, and the State Route 4 Bypass Authority.

Persons needing a disability-related accommodation should contact Robert Sarmiento, TRANSPLAN staff person, at least 48 hours prior to the starting time of the meeting.

Contra Costa Countywide

Pedestrian Needs

Assessment

Draft

Contra Costa Transportation Authority (CCTA)

June 9, 2021

WC16-3343.01

Contributors include:

FEHR PEERS

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1. Introduction

With the launch of their Vision Zero Framework effort in fall 2019, the Contra Costa Transportation Authority (CCTA) has committed to supporting jurisdictions in preventing mobility- and transportation-related fatalities and severe injuries on public rights-of-way. Vision Zero and the Safe System Approach set shared responsibility on transportation and public health professionals, policymakers, decision-makers, and traffic safety officials, with the fundamental understanding that loss of life or injury can be prevented. Because human error is inevitable, the transportation system should be forgiving, by design. Vision Zero focuses attention on safety for all people and the shortcomings of the transportation system, including the built environment.

Developing a Countywide Vision Zero framework was a key implementation recommendation of the 2018 Countywide Bicycle and Pedestrian Plan (2018 CBPP Update).[1] To date, CCTA's Vision Zero work has focused on countywide data collection and analysis, stakeholder engagement, and developing technical resources such as the *Contra Costa Countywide Transportation Safety Policy and Implementation Guide*, which includes a *Countywide Collision Analysis and Common Bicycle and Pedestrian Collision Patterns* and the development of a *Countywide Toolbox for Designing Safer Travel for People Walking and Biking*. CCTA has also developed a *Vision Zero Database* in GIS, which includes countywide data regarding safety and the built environment, such as collision data and the location of sidewalks and marked crosswalks.

The 2018 CBPP Update also featured the development of the Low-Stress Countywide Bicycle Network, including order-of-magnitude cost estimates for implementing this network.[2] A need to develop similar order-of-magnitude cost estimates, and to understand funding needs for pedestrian projects, has been identified since the 2018 CBPP Update was adopted.

Building on these previous efforts, the Countywide Pedestrian Needs Assessment catalogues and evaluates pedestrian infrastructure in Contra Costa to better understand pedestrian facility gaps and the estimated level of investment needed to improve pedestrian facilities in the Countywide Pedestrian Priority Areas (PPAs) identified in 2018 CBPP Update. This assessment takes a data-driven approach to inventory pedestrian infrastructure in the PPAs, identify "Priority Project Types" based on collision trends and a review of recent local plans, and develop order-of-magnitude cost estimates at the project- and countywide-level to inform overall levels of investment needed, countywide. The five Priority Project Types selected for this study are sidewalk gaps, uncontrolled crossings, signalized intersections, corridor speed management, and pedestrian safety at night.

Given the size and complexity of Contra Costa, and the diversity of its needs, this effort has required several assumptions and simplifications, and these are noted throughout this document. The Countywide Pedestrian Needs

[1] Countywide Bicycle and Pedestrian Plan Update, 2018 (CBPP 2018), Contra Costa Transportation Authority (CCTA), *see Implementation Action 1 "Develop a Vision Zero and Systematic Safety approach for Contra Costa."* Pg. 68.
[2] CBPP 2018, CCTA, see Table 5-1 Cost to Complete 2018 Low-Stress CBN. Pg. 52.

Assessment presents an order-of-magnitude estimate of costs for priority pedestrian projects – with a focus on capital projects – and is unconstrained by available funding levels.

In this report, Chapter 2 summarizes recent local planning efforts that emphasize pedestrian safety; Chapter 3 provides descriptions and example engineering treatments for each Priority Project Type; Chapter 4 presents order-of-magnitude cost estimates for implementing each Priority Project Type, countywide; and Chapter 5 discusses potential next steps related to this study.

1.1 Priority Pedestrian Areas

The Pedestrian Needs Assessment focuses on the CBPP 2018 Pedestrian Priority Areas (PPAs), which represent a diverse mix of uses, higher employment and residential densities, and generally well-connected pedestrian networks that support pedestrian activity.[3] The designated PPAs presented in **Figure 1** include areas within walking distance of schools and major transit stops, in addition to other locations with the greatest concentrations of pedestrian collisions.

[3] CBPP 2018 Update, CCTA, see p. 6.

Figure 1. Countywide Priority Pedestrian Areas

2. Local Context

Contra Costa County, the 9th largest county in California by population, consists of 19 incorporated jurisdictions and dozens of unincorporated communities. Contra Costa is home to many diverse communities, and pedestrian facilities and gaps vary across urban, suburban, and rural contexts. To understand local priorities and needed investments, this assessment builds on CCTA's *Countywide Collision Analysis and Common Bicycle and Pedestrian Collision Patterns*, conducted as part of CCTA's Vision Zero effort. Recent local plans were also reviewed to assemble related recommendations for improvement to local pedestrian facilities and gaps.

2.1 Countywide Collision Analysis & Common Collision Patterns

Nationwide, pedestrian collisions and fatalities have been on the rise – increasing 45 percent between 2010 and 2019.[4] Pedestrian safety trends in Contra Costa mirror this pattern; the number of collisions in Contra Costa that involve a person walking has increased 24 percent from approximately 200 in 2008 to over 250 in 2017. Pedestrian collisions in Contra Costa are also more likely to be fatal collisions than those involving other modes; between 2008 and the end of 2017, pedestrian collisions accounted for 10 percent of all countywide collisions, but represented 31 percent of all fatal collisions. Walking represents approximately 10 percent mode share for all trips in Contra Costa, which further illustrates the disproportionate collision impact on this vulnerable road user group.[5]

Achieving zero transportation-related severe injuries and fatalities requires investments that proactively address the root causes of these collisions. Through the recent development of the *CCTA Vision Zero Database*, CCTA has identified systemic collision patterns for people walking and biking based on built environment factors such as the location of traffic signals, crosswalks, and sidewalks. Key systemic safety issues for people walking in Contra Costa - identified through collision analysis and based on input from CCTA's Vision Zero Working Group (VZWG) – that are relevant for this Pedestrian Needs Assessment include:

- **Speeding:** Unsafe speeds is a common collision profile and key systemic safety issue across Contra Costa. Since injuries and fatalities increase exponentially with vehicle speeds, especially for people walking and biking, reducing speeds is one of the most critical ways to improve safety.
- **Red light violations:** Red light violations occur when either a motorist, bicyclist, or pedestrian enters an intersection against the signal.
- **Highway interchanges:** Interchanges tend to be difficult to navigate for pedestrians and bicyclists due to high volumes of fast-moving vehicles and roadway designs that often prioritize vehicle speeds over the safety and comfort of people walking and biking. This challenge was highlighted as part of community and stakeholder outreach during the development of the 2018 CBPP Update.

[4] Smart Growth America (2021). *Dangerous by Design.* Accessed at https://smartgrowthamerica.org/dangerous-by-design/
[5] CBPP 2018, CCTA, see Table 2-1 Contra Costa Mode Split by trip Type and Length. Pg. 13.

- **Skewed or complex intersections:** Many intersections across Contra Costa are not orthogonal and have skewed or offset approaches, such as five-legged intersections. These intersections may have longer, or less intuitive, pedestrian crossings, and motorists may have limited visibility of pedestrians and vehicles on intersecting roadways.
- **Trail crossings:** Contra Costa has a well-developed system of trails that provides separated connections for people walking and biking, such as the Iron Horse Trail. However, where these trails intersect with other roadways can present potential conflicts between road users.
- **Sidewalk gaps:** In Contra Costa, most pedestrian collisions in PPAs occur where sidewalks are present, but fatal and severe collisions occur twice as frequently where sidewalk gaps exist.
- **Lighting**: Both nationwide and locally, severe and fatal pedestrian collisions are more likely during dark conditions. Insufficient street lighting can also impact pedestrian comfort and personal security while walking at night.

2.2 Local Planning Context

Several recent local and regional plans have analyzed and developed project recommendations to improve safety for people walking within Contra Costa. This section summarizes the focus areas of each plan and their key recommendations related to pedestrian safety, and describes community-based transportation plans, regional plans, active transportation plans and corridor studies, and ADA transition plans that have been developed since approximately 2017. Findings from the local plan review reveal that:

- High-speed arterials and pedestrian crossings are a routine concern, especially where arterials serve as barriers to key destinations such as transit.
- Sidewalk gaps pose a major challenge for people walking, especially for people with disabilities.
- A lack of marked or high-visibility crosswalks can create stressful walking environments and make accessing destinations more difficult and less efficient.

Community-Based Transportation Plans

CCTA recently helped prepare two community-based transportation plans (CBTP) in 2020 for Richmond and Pittsburg/Bay Point. CBTPs focus on addressing the needs of economically disadvantaged communities in Contra Costa through robust community engagement and demographic analysis to identify issues, priorities, and potential solutions for mobility. These studies recommended a series of projects and programs informed by in-depth community outreach as well as a review of existing studies. Recommendations were developed in partnership with a local Project Working Group and prioritized based on four criteria: (1) reflection of community priorities; (2) potential to increase mobility access; (3) financial feasibility; and (4) ease of implementation. Key outcomes from the CBTPs for pedestrian access include:

- **Pittsburg-Bay Point CBTP:** pedestrian access and safety priorities focused largely on major arterials and their crossings, with the highest priority project recommendations on Willow Pass Road, Buchanan Road, Bailey Road, Port Chicago Highway, and W. 10th Street.

- **Richmond Area CBTP:** Priorities for pedestrian access and safety focused on ADA accessibility in North Richmond, sidewalk gaps and arterial safety along San Pablo Avenue, and arterial corridor safety on MacDonald Avenue.

Regional Plans

Several recent regional plans have focused on improving multimodal safety near transit hubs, regional trail corridors, and along and across the state highway system.

BART Walk and Bicycle Network Gap Study

BART's Walk and Bicycle Network Gap Study (2020) evaluated potential pedestrian network improvements within a ½ mile radius of 17 focus stations, including the Concord, El Cerrito Plaza, Orinda, and Richmond stations. The study summarizes the outcomes and near- to mid-term recommendations from a series of stakeholder walk audits that took place over a three-year period. At all four Contra Costa stations, recommendations focused on improving uncontrolled crossings in terms of visibility and safety, as well as installing new crosswalks in key locations to improve pedestrian station access. Sidewalk gap closures and crosswalk improvements at all stations emphasized the importance of improving safety at and along major arterials on streets like Camino Pablo, Clayton Road, and Macdonald Avenue.

Iron Horse Corridor Active Transportation Study

The Contra Costa County Iron Horse Corridor Active Transportation Study (2020) focuses on improving safety, mobility, access, user experience, and project synergy along the Iron Horse Trail Corridor. The study envisions an active transportation spine that supports mobility goals for increased micromobility use and the development of a "bicycle superhighway" facility with minimal conflict points for active users. A major focus of the study is the need for a wider trail facility to accommodate all users, as well as analysis of crossings and intersection safety. Locations identified with the most injury collisions at trail crossings include crossings at major arterials such as , Monument Boulevard, and South Broadway.

Caltrans District 4 Pedestrian Plan

The Caltrans District 4 Pedestrian Plan, completed in 2021, establishes priorities and methods for implementing the goals of the statewide plan, *Toward an Active California* within the Bay Area (District 4). The plan provides an overview of conditions for people walking on Caltrans District 4 roadways and focuses on locations in the district where there are significant gaps or needs for people walking. The plan identifies pedestrian needs on the state highway system using six categories: main street sidewalk gaps, sidewalks in poor condition, sidewalks along high-speed highways, stressful crossings, infrequent crossings, and needs at freeway interchanges. A companion "Story Map" illustrates identified priority projects and a "Pedestrian Toolkit" is currently under development.

Active Transportation Plans & Corridor Studies

Several Contra Costa cities have recently conducted active transportation plans and major corridor safety studies to improve safety on arterial roadways. The studies have generally sought to provide safe access to transit, implement complete streets designs, reduce potential conflicts between vehicles and active modes, and improve access to key destinations for people walking and biking by incorporating innovative analysis methods and community

engagement techniques. Several recent projects, such as those listed below, are described in more detail in *Appendix B. Contra Costa Local Plan Review* of the *Contra Costa Transportation Safety Policy and Implementation Guide*:

- Pittsburg Moves Active Transportation Plan
- City of Concord Bicycle, Pedestrian, and Safe Routes to Transit Plan
- San Pablo Avenue Safe Routes to Transit, El Cerrito
- Rumrill Boulevard Complete Streets, San Pablo
- Railroad Avenue Complete Streets Study, Pittsburg
- Monument Boulevard Corridor Community-Based Transportation Plan, Concord
- Marsh Creek Corridor Multi-Use Feasibility Study, Contra Costa County

ADA Transition Plans

The Americans with Disabilities Act (ADA) of 1990 is a law enacted to provide comprehensive civil rights protections to persons with disabilities and to prohibit discrimination against people with disabilities in a range of areas, including employment, transportation, public accommodations, communications, and access to state and local government programs and services. Local ADA transition plans establish the jurisdiction's commitment to abide by and implement the guiding principles and laws of the ADA and serve as blueprints for annual updates and compliance solutions related to accessibility. One example of a recent transition plan in Contra Costa is the City of Antioch's ADA Transition Plan, published in March of 2020.

For projects in the public right-of-way, the following ranking identified by the ADA guides prioritization for improvements as funding allows:

1. Requests from persons with disabilities
2. Locations along pedestrian cores or corridors, arterials, or collector streets serving public use
3. Locations along routes to school, at transit stops, senior centers, and community facilities
4. Projects based on other capital improvement plans
5. Other locations as requested

The Antioch ADA Transition Plan, as an example, outlines the mechanisms by which to upgrade curb ramps and sidewalks to ADA standards, including through priority retrofits based on feedback (priority 1), annual street resurfacing, development projects, and capital improvement projects. ADA transition plans present an opportunity to leverage funding and project prioritization by aligning pedestrian safety and ADA transition goals. ADA transition plans also support communities in identifying sidewalk and curb ramp needs and priorities, which can further safety goals as well as provide a model for crosswalk policies and enhancements within a jurisdiction.

As another recent example, the West Contra Costa Transportation Advisory Committee (WCCTAC) prepared a *Needs Assessment Study of West County Measure J-Funded Services for Seniors and People with Disabilities* in 2018. This study focuses on improving inter-agency coordination for access to paratransit and transit services for people with disabilities and seniors. Poor pedestrian facilities are listed as one barrier to fixed-route transit access, but infrastructure is not a main focus of the plan recommendations. This highlights the importance of aligning pedestrian safety projects with efforts to improve facilities and access for seniors and people with disabilities.

3. Priority Project Types

This chapter provides a technical summary of the Priority Project Types, including an overview of each project type and a menu of potential engineering treatments. Based on the Vision Zero countywide collision analysis and outcomes of recent local plans, along with input from the Vision Zero Working Group, the Pedestrian Needs Assessment focused on five Priority Project Types:

1. Sidewalk Gaps
2. Uncontrolled Crossings
3. Signalized Intersections
4. Corridor Speed Management
5. Pedestrian Safety at Night

For each Priority Project Type, a menu of potential engineering treatments is presented, which draws from the *Countywide Toolbox for Designing Safer Travel for People Walking and Biking*.

Because of the importance of context sensitivity in identifying engineering measures, strategies for uncontrolled crossings, signalized intersections, and corridor speed management are broken into separate engineering treatment menus and cost estimate proposals for both two-lane roadways (i.e., roadways with one lane in each direction, with or without a center turn lane) and multi-lane roadways (i.e., roadways with at least two lanes in each direction).

For further information on crash reduction factors (CRF) for engineering measures provided in the *Pedestrian Needs Assessment Summary*, refer to the Crash Modification Factors Clearinghouse or *CBPP 2018 Update Appendix C. Best Practices: Pedestrian and Bicycle Treatments*. The *CBPP 2018 Update design guidelines (Appendix C)* describe best practices in active transportation treatments, including recommendations for contextual design and toolboxes covering best practices for both pedestrian and bicycle treatments. Pedestrian treatments are presented in terms of uncontrolled and signalized intersections, and include CRF information. Information regarding signal design, striping, allocation of the right of way, road geometry, and bicycle treatments are also included.

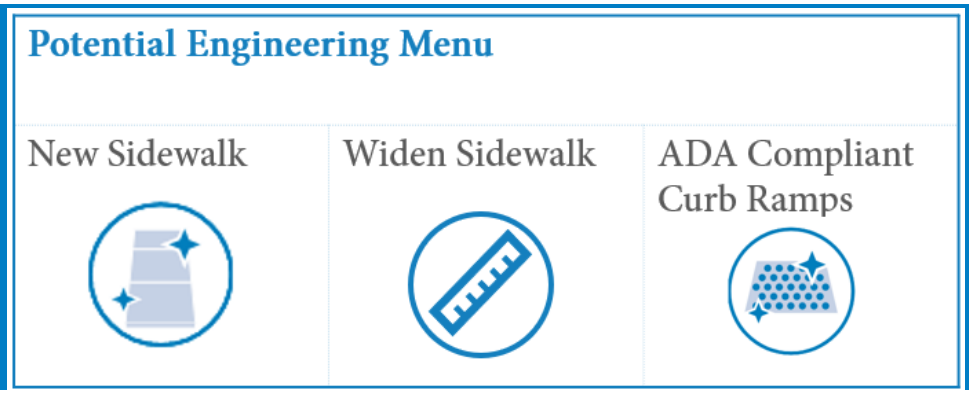
3.1 Sidewalk Gaps

In Contra Costa, most pedestrian collisions in PPAs occur where sidewalks are present, but fatal and severe injury collisions are twice as likely where sidewalk gaps exist. Installing sidewalks provides a separated and continuous facility for people walking and using mobility devices along the roadway.

Considerations

- Closing sidewalk gaps to key destinations also increases accessibility for people with disabilities and can be paired with accessible curb ramp upgrades at intersections.

- The potential engineering menu for sidewalk gaps includes the option to provide an asphalt curb with shoulder stripe as an interim walkway, which may be an appropriate treatment in certain locations where this fits within the aesthetic context (i.e., more rural areas) or for a quick-build option.
- Higher-cost concrete sidewalks are more durable compared to asphalt, and will reduce maintenance and replacement costs in the long term.
- While closing all sidewalk gaps is an ideal outcome, major physical constraints such as narrow bridges, limited right-of-way, or environmental conditions can preclude the installation of sidewalks on both sides of the street. In these cases, appropriate crossing treatments with wayfinding signage should be provided to facilitate pedestrian access along existing sidewalks on one side of the street, where possible.



Inset 1. Potential Engineering Treatment Menu: Sidewalk Gaps

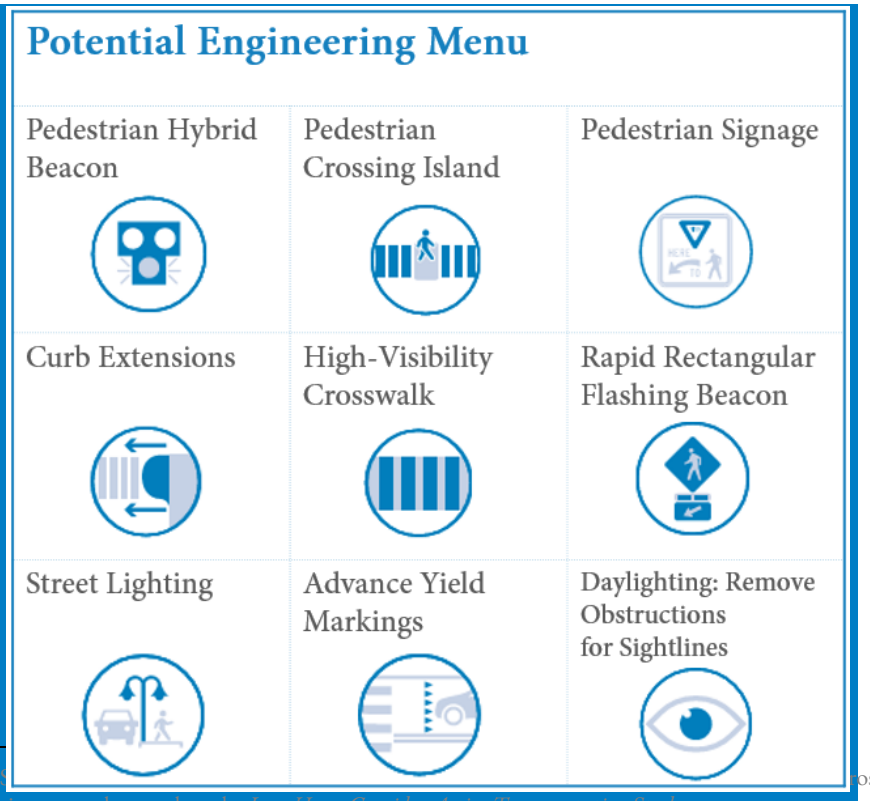
3.2 Uncontrolled Crossings

Uncontrolled crossings are not controlled by a traffic control device like a stop sign or traffic signal—and may be marked or unmarked. The *Countywide Collision Analysis* revealed that pedestrian collisions outside of marked crosswalks are more likely when the crossing location is an unsignalized intersection or mid-block crossing, compared to at signalized intersections. Marking and enhancing crossings at uncontrolled locations can facilitate safer access to key destinations. Marked crosswalks can be considered at locations with existing or latent demand, based on community input, and/or in response to collision history, with consideration first given to adequate sight distance. To determine additional safety enhancements at uncontrolled marked crossings depending on the context, refer to *2018 CBPP Update Appendix C. Best Practices: Pedestrian and Bicycle Treatments* (see page C-23), which is based on FHWA's *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations.*

Both the engineering treatments menu and cost estimates for the uncontrolled crossing project type are broken out for locations on two-lane roadways (one lane in each direction) and multi-lane roadways (two or more lanes in each direction) to align with the more detailed recommendations presented in the FHWA Guide, which considers vehicle volumes, speed limits, medians, and number of lanes at each crossing location.

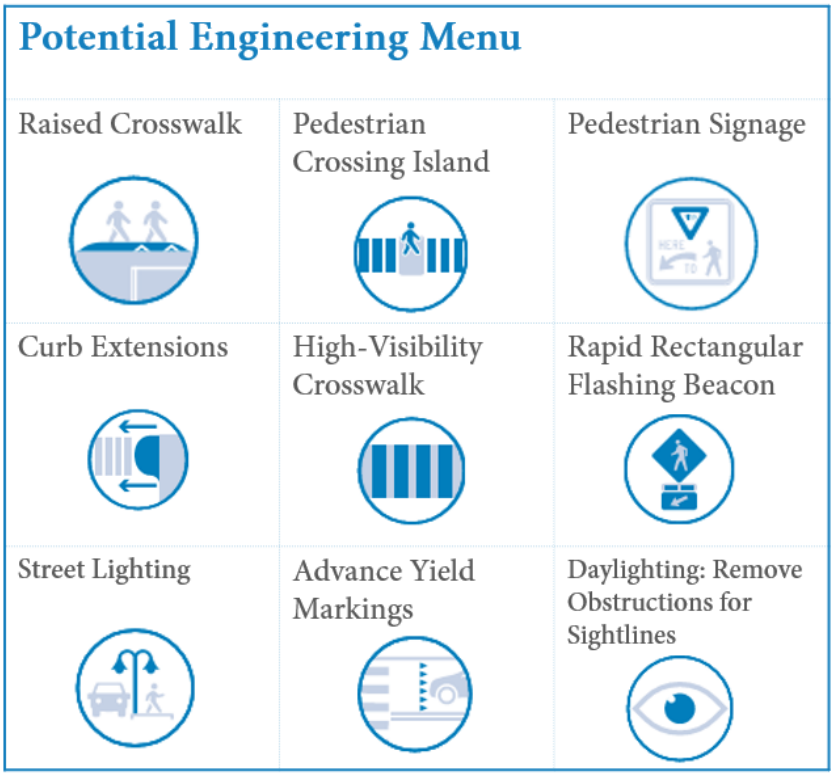
Considerations

- On high-speed roadways with two or more lanes in each direction, the corridor may be evaluated for a lane reconfiguration or lane reduction to provide increased safety, speed management, and cost effectiveness for individual crosswalk measures.
- On two-lane streets with a single lane in each direction, some crosswalk treatments, like raised crosswalks, are possible that may not be appropriate on larger or higher-speed roadways. Raised crosswalks can enhance visibility and calm traffic in areas with high pedestrian activity or that prioritize pedestrian access such as near commercial areas, transit stations, or schools.
- For uncontrolled crossings on both multi-lane and single-lane roadways, engineering measures may be implemented at lower cost using paint and plastic "quick build" materials like painted curb extensions with soft hit bollards. These types of interventions can improve safety with faster implementation timelines but may require more maintenance over time and may be difficult to customize to local aesthetics.
- Some uncontrolled crossings are also trail crossings and may need additional enhancements to accommodate both bicycle and pedestrian crossings.[6]



Inset 2. Potential Engineering Treatment Menu: Multi-Lane Uncontrolled Crosswalks

[6] S ossings are also addressed in more detail in recent plans such as the *Iron Horse Corridor Active Transportation Study*.



Inset 3. Potential Engineering Treatment Menu: Two-Lane Uncontrolled Crosswalks

3.3 Signalized Intersections

In Contra Costa, 45 percent of all pedestrian collisions occur at signalized intersections based on the *Countywide Collision Analysis*. Channelized right turn lanes, skewed or complex intersections, and large intersections with multi-lane approaches can create uncomfortable or inconvenient pedestrian crossings and are associated with higher collision rates. Depending on the number of lanes and intersection configuration, pedestrians may experience multiple conflict points with turning vehicles as they cross at a signalized intersection. Like uncontrolled crossings, intersection safety improvements in this section are separated into multi-lane and two-lane approaches to reflect higher cost engineering measures that may be necessary for larger and more complex intersections.[7]

A variety of signal improvements, like leading pedestrian intervals (LPI), extended crossing times, protected left turn phases, and pedestrian countdown timers are effective measures to reduce or eliminate conflicts, along with changes to intersection geometry, where needed.

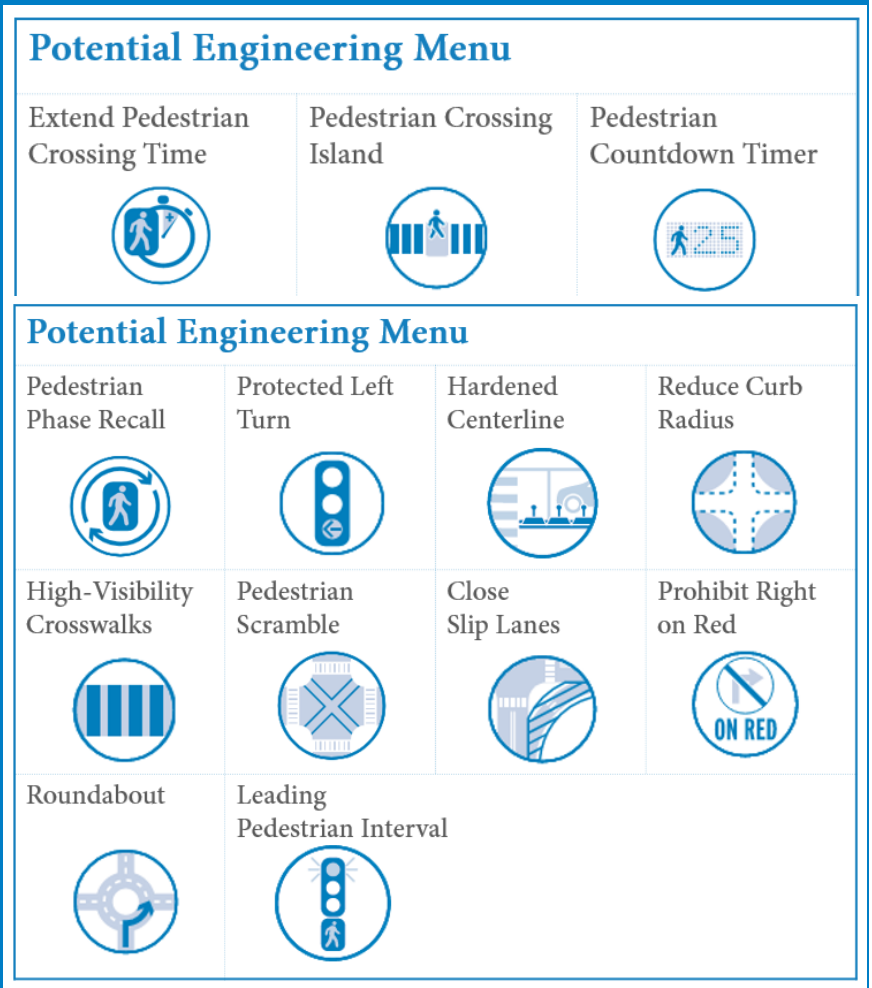
Considerations

- In Contra Costa, many freeway interchanges are signalized intersections. Collaborating with Caltrans District 4 as they implement their Pedestrian Plan may provide opportunities to address safety needs at complex, signalized interchange locations, which were identified as a common pedestrian and bicycle

[7] See *NCHRP Research Report 926: Guidance to Improve Pedestrian and Bicyclist Safety at Intersections* (Chapter 4) for further guidance on engineering measures based on number of lanes, average daily traffic, and crash history.

collision pattern. High speed right turns and ramp geometry may be addressed at freeway interchanges or larger intersections through geometric changes, channelized turn reconfiguration, and or raised crosswalks.

- Older signal infrastructure may not allow for timing adjustments like leading pedestrian intervals. Signal upgrades, replacement, or relocation can significantly increase project costs.
- At locations with multi-lane approaches, intersection geometry changes to reduce curb radii, close slip lanes, and realign skewed intersections can be considered and may result in significant cost variation.
- In business districts, school zones, and other locations with a large number of people crossing at the same time, pedestrian phase recall may be provided and an all-red pedestrian scramble phase may be considered at smaller intersections.
- Some signalized intersections are also trail crossings and may need additional enhancements to accommodate both bicycle and pedestrian crossings.
- Single-lane roundabouts can be considered in lieu of all-way stop control and signalized intersections, where appropriate. Roundabouts improve intersection safety by separating pedestrian-vehicle conflict points from vehicle-vehicle conflict points, reducing the total number of conflict points, and reducing vehicle speeds through an intersection. While single-lane roundabouts have many advantages, multi-lane roundabouts can present challenges for bicyclists and pedestrians (e.g., risk of multiple-threat collision, longer paths of travel).



Inset 4. Potential Engineering Treatment Menu: Multi-Lane Signalized Intersections

Inset 5. Potential Engineering Treatment Menu: Two-Lane Signalized Intersections

3.4 Corridor Speed Management

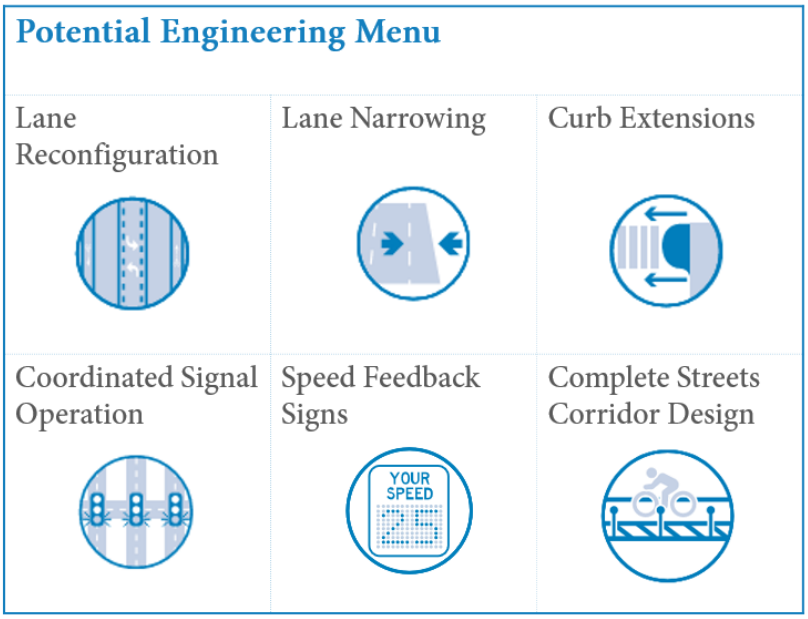
Unsafe speed is a common bicycle and pedestrian collision pattern and key systemic safety issue across Contra Costa. Since injuries and fatalities increase exponentially as vehicle speed increases, especially for people walking and biking, reducing speeds is a critical way to improve safety, countywide. Corridor-wide traffic calming approaches may be implemented together with complete streets and multimodal safety improvements, such as bicycle facilities and intersection improvements.

Like uncontrolled crossings and signalized intersections, potential engineering menus and cost estimates for corridor speed management are presented separately for multi-lane and two-lane roadway contexts. Multi-lane roadways with two or more lanes in each direction are more likely to require lane narrowing or reconfiguration and signal timing updates to address corridor speeds. Multi-lane roadways may also have more limited options for traffic calming using vertical and horizontal deflection than local streets with two lanes and lower traffic volumes. This report focuses on corridor-level speed management for arterial and collector roadways.[8]

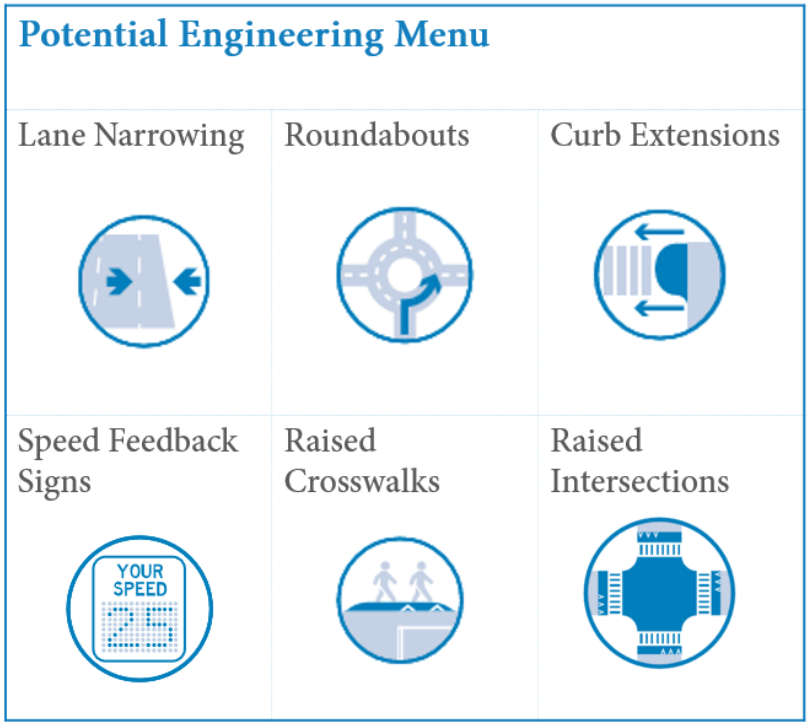
Considerations

- Multi-lane arterials and collectors with two or more lanes in each direction should be evaluated for lane reconfiguration where average daily traffic (ADT) is less than 20,000. Lane narrowing or reconfiguration optimizes street space to benefit all users and encourages motorists to travel at slower speeds.[9]
- Along with lane narrowing, lane reconfiguration, and complete streets design, coordinated signal operation can also encourage safer speeds.
- Speed feedback signs are most effective in specific locations like entering a business district, approaching a school zone, or near speed limit changes.[10]
- Some engineering measures are appropriate on two-lane collectors or local streets but not on major arterials. These include vertical deflection treatments like raised crosswalks and raised intersections.
- Access management (e.g., closing driveways, adding medians or hardened center lines) is an effective way to reduce conflicts on major corridors with frequent driveways and side street intersections. Because some access management strategies can reduce the need for drivers to stop at intersections or slow for entering vehicles, this strategy may, in some cases, increase corridor speeds and should be implemented together with speed management measures.
- Non-infrastructure measures like speed limit policies also can play a role in systemic speed management. Refer to the National Association of City Transportation Officials' *City Limits: Setting Safe Speed Limits on Urban Streets* for further information on speed limit policy. The California State Transportation Agency (CalSTA) *Zero Traffic Fatalities Task Force's* 2020 report suggests alternatives to the 85th percentile methodology for establishing speed limits to give local jurisdictions greater flexibility in managing speeds on local roadways.

[8] For more traffic calming and engineering measures more appropriate for local and neighborhood streets, refer to the Ewing, Reid, & Steven Brown. "US Traffic Calming Manual." APA Planners Press, Washington, DC: 2009..
[9] See 2018 CBPP Appendix C for design guidance and FHWA *Road Diet Informational Guide* for technical information on lane reconfiguration feasibility and operations. https://safety.fhwa.dot.gov/road_diets/guidance/info_guide/
[10] Santiago-Chaparro, K. R., Chitturi, M., Bill, A., & Noyce, D. A. (2012). Spatial Effectiveness of Speed Feedback Signs. Transportation Research Record, 2281(1), 8–15. https://doi.org/10.3141/2281-02



Inset 6. Potential Engineering Treatment Menu: Multi-Lane Speed Management



Inset 7. Potential Engineering Treatment Menu: Two-Lane Speed Management

3.5 Pedestrian Safety at Night

In Contra Costa, fatal and severe injury pedestrian collisions are more likely during dark conditions, with or without streetlights. Insufficient street lighting can also impact pedestrian comfort and personal security while walking at night. Street, pedestrian scale, and intersection lighting help make pedestrians and other road users or hazards more visible to motorists at night. In Contra Costa, the most common collision factors during hours of darkness are driving under the influence (DUI) and unsafe speeds. Lighting can improve safety, but a holistic approach to nighttime safety should also include programs and engineering measures to address common nighttime collision factors.

Considerations

- Because collisions in dark conditions often have multiple factors like unsafe speeds and/or alcohol use, locations with high collision rates at night will benefit from a Safe System response with both engineering and programmatic approaches. Local jurisdictions could assess nighttime collision patterns at specific locations to determine the most relevant engineering treatments and programmatic approaches.
- Example responses to pedestrian safety at night could include lighting upgrades along with speed management or DUI prevention programs in key locations.
- For the purposes of this Needs Assessment and the cost estimate, only the engineering treatment (i.e., lighting) was included for this Project Type.
- For guidance on street lighting design, refer to *FHWA Lighting Handbook*. Typical projects include upgrading to LED bulbs, installing pedestrian-scale lighting, and illuminating crosswalk approaches.

3.6 Accessibility and ADA Considerations

While the Pedestrian Needs Assessment does not assess curb ramps or ADA compliance, this could be part of a future study. Local jurisdictions can coordinate efforts to prioritize and invest in projects that benefit both pedestrian safety and ADA accessibility. For example, uncontrolled crossing and signalized intersection projects could be prioritized at locations with missing or non-compliant ramps. For all project types, designers should reference the Americans with Disability Act and universal design and accessibility best practice resources.[11]

In the city of Richmond, only 25% of curb ramps are ADA compliant, based on the city's current GIS curb ramp inventory.

[11] See the *ADA Standards (ADAS) for Accessible Design*, the *(Proposed) Public Rights-of-Way Accessibility Guidelines (PROWAG)*, or Caltrans *Design Information Bulletin #82* for more details

4. Countywide Cost Estimates

Order-of-magnitude cost estimates for Priority Project Types in PPAs countywide were developed based on a range of cost estimates for example project "proposals," or a sample suite of potential engineering treatments applicable to that Project Type. One lower cost and one higher cost proposal was selected for each Priority Project Type, based on the type of improvements involved, and to reflect the potential range in cost for project implementation. The typical cost estimated for each proposal was multiplied by the estimated number of project locations or lane miles related to the Priority Project Type within countywide PPAs. Data from the *CCTA Vision Zero Database* was used to estimate countywide gaps and project needs, such as miles of sidewalk gaps and number of uncontrolled crossings. This includes data collected in partnership with Ecopia Tech, which uses artificial intelligence (AI) to identify transportation facilities such as sidewalks and crosswalks from aerial imagery.[12]

4.1 Cost Estimates by Project Type

Unit costs for engineering measures included in the project proposals are based on prevailing construction costs per unit typically observed in the Bay Area, validated by information from local jurisdictions, and through the results of recent bid documents. Basic assumptions such as typical block length are built into the cost estimates, as are soft costs and contingency assumptions. Soft cost estimates for construction include costs related to design, environmental, construction management, and contractor mobilization. Soft costs typically do not include separate planning efforts like a complete street corridor study. Since each project is different, cost estimates for project proposals and the resulting countywide cost estimate should be considered a rough order-of-magnitude estimate of investment needs in the region, rather than an exact estimate for a given project.

Table 1 through **Table 8** show lower- and higher-cost proposals for each Priority Project Type with itemized estimates for each engineering measure included in the typical project. All multi-lane project types indicate locations with two or more lanes in each direction. All two-lane project types indicate locations with one lane in each direction, with or without a center turn lane. Additional considerations related to quick build projects and maintenance costs are discussed below.

Lower-Cost and Quick Build Projects

In some cases, the lower cost project proposal represents a "quick build" approach using temporary or semi-permanent features or materials along with striping and signage.

*Inset SEQ Inset * ARABIC 8. Example Quick Build Curb Extension in Fremont, CA*

[12] Ecopia Tech uses artificial intelligence to anal
such as the location of sidewalks, crosswalks,

These project materials, sometimes referred to as "paint and plastic" infrastructure, can provide safety benefits at lower cost and reduced project schedules compared to full-build projects with concrete curb work and signal infrastructure. Using flexible materials can also allow for public feedback and more iterations compared to traditional materials. However, quick build applications may not be appropriate for every project, such as at high volume locations, or on roadways with poor pavement quality.

Lower-cost projects could also be incorporated into routine pavement maintenance and rehabilitation rather than requiring a separate higher-cost project.

Maintenance

Cost estimates do not include maintenance costs, but maintenance is an important consideration in selecting project features. In general, lower-cost or "quick build" features like asphalt curbs or berms, plastic delineators, or other temporary features will increase maintenance and replacement costs as compared to permanent concrete features.[13] More permanent facilities, such as concrete sidewalks and curb extensions, can have a life span of 50 years or more. Where durability or aesthetics are a concern, some projects can be implemented with a combination of permanent and quick build components. For projects that primarily consist of pavement striping, maintenance costs are minimal since striping is typically replaced as part of agencies' pavement maintenance programs.

Table 1. Sidewalk Gaps

Lower-Cost Project Proposal		Higher-Cost Project Proposal	
Asphalt curb (per mile, one side)	$240,000	Sidewalks (per mile, one side)	$1,800,000
Shoulder Stripe (per mile, one side)	$10,000		
Lower-Cost Proposal Total	**$250,000**	**Higher-Cost Proposal Total**	**$1,800,000**

Source: Fehr & Peers, 2021.

Table 2. Multi-Lane Uncontrolled Crossings

Lower-Cost Project Proposal		Higher-Cost Project Proposal	
High-Visibility Crosswalk and Advance Yield Markings	$5,000	High-Visibility Crosswalk and Advance Yield Markings	$5,000
Painted Curb Extensions and Median Refuge	$20,000	Concrete Curb Extensions and Median Refuge	$125,000
Rapid Rectangular Flashing Beacon*	$45,000	Pedestrian Hybrid Beacon*	$170,000
Lower-Cost Proposal Total	**$70,000**	**Higher-Cost Proposal Total**	**$300,000**

*Engineering evaluation should be conducted to determine the appropriate crosswalk enhancements

[13] Painted curb extensions included in the cost estimates assume the project uses plastic bollards or delineators, similar to those depicted in Inset Figure 8.

Source: Fehr & Peers, 2021.

Table 3. Two-Lane Uncontrolled Crossings

Lower-Cost Project Proposal		Higher-Cost Project Proposal	
High-Visibility Crosswalk and Advance Yield Markings	$5,000	High-Visibility Crosswalk and Advance Yield Markings	$5,000
Painted Curb Extensions	$15,000	Concrete Curb Extensions	$100,000
Pedestrian Signs	$3,000	Rapid Rectangular Flashing Beacon	$45,000
Lower-Cost Proposal Total	**$23,000**	**Higher-Cost Proposal Total**	**$150,000**

Source: Fehr & Peers, 2021.

Table 4. Multi-Lane Signalized Intersections

Lower-Cost Project Proposal		Higher-Cost Project Proposal	
High Visibility Crosswalks	$5,000	High Visibility Crosswalks	$5,000
Existing Signal Timing Adjustments*	$10,000	New or Upgraded Signal	$500,000
Painted Curb Extensions	$40,000	Reconstruct Corners to Reduce Curb Radius and Close Slip Lanes	$450,000
Lower-Cost Proposal Total	**$55,000**	**Higher-Cost Proposal Total**	**$955,000**

*Older signal infrastructure may not allow for the certain signal adjustments.
Source: Fehr & Peers, 2021.

Table 5. Two-Lane Signalized Intersections

Lower-Cost Project Proposal		Higher-Cost Project Proposal	
High Visibility Crosswalks	$5,000	High Visibility Crosswalks	$5,000
Existing Signal Timing Adjustments*	$5,000	New or Upgraded Signal	$400,000
Painted Curb Extensions	$40,000	Reconstruct Corners to Reduce Curb Radius	$200,000
Lower-Cost Proposal Total	**$50,000**	**Higher-Cost Proposal Total**	**$605,000**

*Older signal infrastructure may not allow for the needed signal adjustments.
Source: Fehr & Peers, 2021.

Table 6. Multi-Lane Corridor Speed Management (per mile)

Lower-Cost Project Proposal		Higher-Cost Project Proposal	
Restripe with Narrowed or Reconfigured Lanes	$300,000	Complete Streets Corridor Project*	$7,000,000
Painted Curb Extensions	$400,000	Coordinated Signal Operation	$500,000

Lower-Cost Proposal Total	**$700,000**	**Higher-Cost Proposal Total**	**$7,500,000**

*Costs for complete streets corridor projects can vary widely depending on intersection design, bikeway features, green infrastructure, landscaping, and curb and gutter needs.
Source: Fehr & Peers, 2021.

Table 7. Two-Lane Corridor Speed Management (per mile)

Lower-Cost Project Proposal		Higher-Cost Project Proposal	
Restripe Narrow Lanes	$150,000	Restripe Narrow Lanes	$150,000
Painted Curb Extensions (per mile)	$400,000	Concrete Curb Extensions (per mile)	$2,000,000
Lower-Cost Proposal Total	**$550,000**	**Higher-Cost Proposal Total**	**$2,150,000**

Source: Fehr & Peers, 2021.

Table 8. Pedestrian Safety at Night

Typical Lighting Projects Costs	
Roadway Lighting	$750,000
Pedestrian-Scale Lighting (per mile)	$2,000,000
Intersection Lighting	$40,000

Source: Fehr & Peers, 2021.

4.2 Countywide Cost Estimate Analysis

A four-step process was used to determine a rough order-of-magnitude cost estimate for pedestrian improvements in countywide PPAs:

1. First, the approximate total number of potential priority project locations were determined in GIS using the *CCTA Vision Zero Database* (e.g., total mileage of sidewalk gaps, total number of uncontrolled crossings, total number of signalized intersections).
2. Second, since some of the potential priority project locations identified in step #1 are already enhanced with a safety countermeasure, and may not require improvement, the approximate proportion of total locations that require improvement was estimated based on existing data, where available, and an understanding of existing conditions countywide.
3. Third, the average cost for each project type was estimated and weighted to consider the approximate anticipated need for lower-cost vs. higher-cost project

Overall, fully improving pedestrian priority projects countywide is estimated to cost approximately $2.4 billion, which is unconstrained by available funding levels.

proposals for each priority project type, based on existing data, where available, and an understanding of existing conditions countywide.

4. Finally, the number of project locations requiring improvement estimated in step #2 is multiplied by the weighted average for typical project costs estimated in step #3 to determine the total countywide cost estimate.

The key assumptions informing this analysis are described in more detail below. **Table 9** presents the results of steps #1 and #2: the approximate total number of potential priority project locations in countywide PPAs, and the assumed proportion and number that require improvement. **Table 10** summarizes the results of steps #3 and #4: the relative weighting between lower-cost and higher-cost project proposals and the total countywide cost estimate.

Assumptions

The key assumptions that informed the countywide cost estimates are documented below for each project type.

Sidewalk Gaps

- Existing sidewalk gaps were identified on both sides of the street along 740 miles of roadway and on one side of the street along 340 miles roadway (equates to 1,820 sidewalk-miles total).
- Since physical constraints may preclude sidewalk improvements in certain locations and some gaps were identified in residential areas with limited roadway right-of-way, approximately 75 percent of total existing sidewalk gaps are anticipated to need improvement for the purposes of this analysis.
- It is assumed that half of sidewalk gap projects will be lower-cost and half will be higher-cost to reflect an approximate split between projects in downtown or commercial areas, where concrete sidewalks are more appropriate, and residential neighborhoods where an asphalt curb may be more appropriate.

Uncontrolled Crossings

- The proportion of uncontrolled crossings that need to be improved and the proportion requiring a lower-cost vs. higher-cost project improvement were informed by the crosswalk inventory and enhancement analysis performed as part of the *Pittsburg Moves Active Transportation Plan*.
- In Pittsburg, approximately 12% of existing uncontrolled crossings have a Rapid Rectangular Flashing Beacon (RRFB), and approximately 20% of the plan's crosswalk recommendations included a higher-cost project such as an RRFB or Pedestrian Hybrid Beacon (PHB). To account for variability across Contra Costa, 25% of existing uncontrolled crossings were assumed to not require improvement, while 25% of the 75% of crossings identified for improvement would require a higher-cost treatment.

Signalized Intersections

- For signalized intersections, 25% of total locations were assumed to either be adequate and not require improvement or overlap with the corridors identified under the corridor speed management project type.
- Half of signalized intersection projects were assumed to be lower-cost and half as higher-cost.

Corridor Speed Management

- The number of corridor miles identified reflect the total number of two-lane and multi-lane roadways on the Pedestrian Priority Safety Locations Map (presented in the *Contra Costa Transportation Safety Policy and Implementation Guide*) and within Countywide PPAs.
- Eighty percent of corridor speed management projects were assumed to be lower-cost (e.g., repaving and restriping projects) rather than higher-cost, complete streets corridor investments.

Pedestrian Safety at Night

- To estimate lighting needs, the total number of pedestrian crossings locations that may need lighting improvements was estimated by adding together the total number of uncontrolled crossings and signalized intersections identified for the project types described above.
- As a rough estimate, half of these pedestrian crossing locations were assumed to need intersection lighting improvements, since approximately 50% of pedestrian collisions that results in a fatality or severe injury occur during dark conditions.
- Lighting improvements are an important aspect of improving nighttime safety, and a holistic approach would also include programmatic interventions to address common nighttime collision factors such as speeding and driving under the influence of alcohol or drugs.

Table 9. Number of Locations to Improve

Project Type	Total Number	Percent Needing Improvement	Total Number to Improve
Sidewalk Gaps (miles)	1,820	75%	1,365
Multi-Lane Uncontrolled Crossings	220	75%	165
Two-Lane Uncontrolled Crossings	500	75%	375
Multi-Lane Signalized Intersections	1,400	75%	1,050
Two-Lane Signalized Intersections	400	75%	300
Multi-Lane Corridor Speed Management (miles)	120	100%	120
Two-Lane Corridor Speed Management (miles)	20	100%	20
Lighting (intersection)	2,520	50%	1,260

Table 10. Countywide Cost Estimates

Project Type	Total Number to Improve	Percent Lower Cost	Lower Cost Estimate	Percent Higher Cost	Higher Cost Estimate	Countywide Total Cost Estimate
Sidewalk Gaps (per mile)	1,365	50%	$250,000	50%	$1,800,000	$1,399,125,000
Multi-Lane Uncontrolled Crossings (per crosswalk)	165	75%	$70,000	25%	$300,000	$21,037,500
Two-Lane Uncontrolled Crossings (per crosswalk)	375	75%	$23,000	25%	$150,000	$20,531,250

Multi-Lane Signalized Intersections (per intersection)	1,050	50%	$55,000	50%	$955,000	$530,250,000
Two-Lane Signalized Intersections (per intersection	302	50%	$50,000	50%	$605,000	$98,250,000
Multi-Lane Corridor Speed Management (per mile)	119	75%	$700,000	25%	$7,500,000	$288,000,000
Two-Lane Corridor Speed Management (per mile)	20	75%	$550,000	25%	$2,150,000	$19,000,000
Lighting (per intersection)	1,260	100%	$40,000	n/a	n/a	$50,400,000
					Total	**$2,426,593,750**

5. Discussion of Potential

Next Steps

By cataloging existing pedestrian facilities, system gaps, and order-of-magnitude cost estimates to improve countywide facilities, the Pedestrian Needs Assessment supports CCTA's and local jurisdictions' active transportation and safety related efforts. Using the Needs Assessment as a framework for project identification and funding needs, both local jurisdictions and CCTA can continue to implement and support pedestrian safety projects in alignment with Vision Zero.

5.1 Local Jurisdictions

Potential next steps for local jurisdictions based on this Pedestrian Needs Assessment could include:

- Identify and prioritize specific pedestrian improvement projects based on existing recommendations from local active transportation plans and corridor studies, Priority Project Types presented in this report, and Priority Safety Locations Maps presented in the *Contra Costa Transportation Safety Policy and Implementation Guide*
- Identify and apply for funding to support project implementation (see *CBPP 2018 Update Appendix F. Funding Sources* for a description of potential funding sources)

5.2 CCTA

Potential next steps for CCTA could include:

- Incorporate countywide cost estimates into future Transportation Expenditure Plans
- Investigate countywide ADA needs through a curb ramp inventory, assessment of sidewalk obstructions, or grant funding for local ADA transition plans
- Develop additional technical assistance resources for local jurisdictions related to the implementation of pedestrian, bicycle, and safety-related projects, such as
    - *Countywide Safe System Strategies Toolbox:* CCTA could develop more detailed policy and design guidance for all travel modes, including people walking, that reflects the latest Safe System best

practices. A Safe System toolbox would also include non-engineering measures to address factors like user behavior, vehicle technology, and post-crash care.

- *Countywide Crosswalk Policy and Decision-Making Framework:* CCTA could develop a consistent crosswalk policy and decision-making framework for local jurisdictions, similar to Alameda County.

Appendix A. Priority Pedestrian Areas–Detailed Maps