SAN FRANCISCO BAY TRAIL

Design Guidelines and Toolkit 2.0

JULY 2025

Acknowledgments

The Bay Trail is a joint project of MTC and the Association of Bay Area Governments.

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Information contained in this document is for planning purposes and should not be used for final design of any project. Field verification, site condition assessments, engineering analysis, and design are necessary prior to implementing recommendations contained herein.

Cover photo: Albany Beach, Albany

Contents

Table of Contents

List of Figures

List of Tables

Golden Gate National Recreation Area, San Francisco

1 Bay Trail Foundation: San Francisco Bay and Trail Management

This chapter provides foundational background information about the Bay Trail context and management. In this chapter, you'll find the following topics:

1.1 About the Bay Trail

San Francisco Bay, one of the largest estuaries in North America, influences and enhances the natural, aesthetic, and economic vitality of the entire Bay region, to the benefit of millions of residents and visitors. The San Francisco Bay is the primary open space amenity of the Bay Area. When completed, the Bay Trail will be a 500-mile green transportation and recreation route for walking, biking, and rolling around the entire San Francisco Bay. **Figure 1** is an overview map; the Bay Trail Interactive Map provides more detail.

As a long-distance trail, the Bay Trail connects people and communities with each other, connects people with their environment, and connects people with their own sense of well-being and health. Because the Bay Trail leads to and runs along the shoreline of the Bay, it also provides access for fishing, picnicking, windsurfing, boating, nature education, and other waterfront activities.

The Bay Trail also provides access to:

- Commercial and residential neighborhoods
- Points of historic, natural, and cultural interest
- Over 130 parks totaling 57,000 acres of open space
- Recreational areas like beaches, marinas, and fishing piers

The Bay Trail facilitates access to numerous recreational and transportation places and activities such as:

- Scenic bike rides, walking, and running
- Shoreline access and scenic viewpoints
- Birdwatching and fishing
- Playgrounds
- Access to water-based activities
- Picnicking
- Dog walking and dog parks
- Commute options and access to transit
- Environmental education, interpretive signs, and audio tours

255 Airport Blvd, Burlingame

San Francisco Bay Trail

BY THE NUMBERS

352
miles of trail (2025)

500
miles when complete

Travels through **9** counties
and **47** cities

Crosses **7** toll bridges

FIGURE 1 Bay Trail Map

1.2 How to Use this Guide

This document provides guidance for **designing a unified, consistent trail to create a positive user experience.** Guidelines specific to the Bay Trail are intended to help agencies and other implementation partners respond to the varied contexts and challenges along the trail, as well as the many types of trail users.

A lot has changed since the previous guide was released in 2016. While new segments of the trail have been implemented, many of the remaining miles of trails that have not been completed are located in challenging contexts. Climate resilience and sea-level rise are being addressed across the region. There are also more user types on the trail – people who use shared mobility (where applicable), electric mobility, and newer mobility devices. The new design guidelines and toolkit incorporate considerations to help address these changes.

The design guidelines focus on developing a Bay Trail that:

- **Is responsive and tailored to local contexts**
- **Provides equitable access for communities who haven't historically benefited from the Bay Trail**
- **Maximizes access to and use by the broadest possible spectrum of people**
- **Is resilient to climate change and sea-level rise**

To accomplish these goals, the guidelines provide context-sensitive solutions to address varied conditions through which the Bay Trail passes and to accommodate its many kinds of users. They are applicable to all development of the Bay Trail and are intended to complement national, state, and local design standards and guidelines.

The Bay Trail Design Guidelines and Toolkit provide high-level information and support guidance from the Bay Conservation and Development Commission (BCDC) and other agencies. While some BCDC guidance documents are mentioned in this document, always consult with BCDC on all Bay Trail segments that are within their jurisdiction.

Chapter 1: Bay Trail Foundation: San Francisco Bay and Trail Governance

Consult this chapter for an overview of the physical and governance foundations of the Bay Trail, the purpose of the design guidelines, and the intended audiences.

Chapter 2: Design Approach Foundation

Start here for background on the design philosophies that shape the guidelines.

Chapter 3: Bay Trail Design Toolkit

Begin with an exploration of the trail typology to understand context and general design approach, then select appropriate design treatments from the guidelines.

Chapter 4: References

Consult this chapter for supporting information and important reference information, such as federal and state design standards.

Local Agencies and Property Owners

Local agencies and private property owners (e.g., hotels, condos, businesses, etc.) own, build, and maintain Bay Trail segments.

Local agency partners may be most interested in Chapters

2 3 4

Designers

Designers may include private developers, land planners, landscape architects, engineers, or architects.

Designers are important Bay Trail partners because a well-prepared trail plan can bring funding and build the support needed to develop trail segments. Understanding the goals of the Metropolitan Transportation Commission (MTC) for the Bay Trail can help developers create a safe, useful, and attractive Bay Trail.

Designers may be most interested in Chapters

2 3

Regulatory Agencies

Many regulatory agencies across the region and state set policies and regulations that impact the Bay Trail.

These agencies include San Francisco Bay Conservation and Development Commission (BCDC), Caltrans, San Francisco Estuary Partnership, and others.

Agency partners and regulatory agencies may be most interested in Chapters

1 2 3 4

Advocates

Advocates encourage accountability and transparency for Bay Trail development and management.

Local agency partners may be most interested in Chapters

1 2 3 4

1.3 Bay Trail History and Trail Management

The California legislature adopted Senate Bill 100 in 1987, which formally described the vision of developing a continuous recreational corridor along the Bay. In July 1989, the Association of Bay Area Governments (ABAG) adopted the Bay Trail Plan, which included a planned alignment, a set of policies to guide the future selection and construction of routes, and strategies for implementation and financing. Since then, ABAG and the Metropolitan Transportation Commission (MTC) have worked together to develop strategic plans, the first design guidelines, numerous studies, and communication plans to develop and promote the Bay Trail while supporting local agencies as they advance implementation. For a concise history of the Bay Trail, jump to **Chapter 4: References.**

The Bay Trail is constructed, operated, and maintained by a variety of public agencies at the local, state, federal, and special district levels.

The Bay Trail passes through 47 cities and other jurisdictions such as Caltrans rights-of-way (R/W), all of which may have their own design guidelines. The Bay Trail Design Guidelines work with these design guidelines to create safe and environmentally-protected trails and helps to ensure unified design and maintenance to provide a seamless Bay Trail experience.

Regardless of where the Bay Trail is located, it must follow certain key design standards, such as Americans with Disabilities Act (ADA) standards, and the Public Right-of-Way Accessibility Guidelines (PROWAG). These guidelines are not intended to replace those standards and where there is a conflict the governing agency's standards should be used.

Metropolitan Transportation Commission (MTC) / Association of Bay Area Governments (ABAG)

MTC and ABAG act as regional conveners, administer funding through grant programs, and provide comprehensive, regional Bay Trail planning guidance, and technical assistance.

San Francisco Bay Conservation and Development Commission (BCDC)

One of BCDC's primary mandates is to ensure the public has access to the Bay and along its shoreline. Advancing "responsible, productive, and equitable uses" of the shore is a shared goal with the Bay Trail partners. As a regulatory permitting authority, BCDC issues permits for developments along and adjacent to the Bay Trail and will include improvements to the trail as a permitting condition. BCDC also manages the regional strategy for climate change and sea-level rise for the Bay Area.

Local agencies and private property owners

Local agencies and private property owners implement, manage, and maintain the Bay Trail system.

Other regional and state agencies and partners

Other regional agencies and partners, such as Caltrans, San Francisco Estuary Partnership, and the State Coastal Conservancy, generally advocate for the trail.

Adobe Creek Trail Bridge, Palo Alto

1.4 Key Terms Used in the Guidelines

Chapter 4: References includes a complete glossary and list of abbreviations and acronyms used throughout this document, but the following key terms are used frequently throughout the guidelines.

- **Context-sensitive design:** Design that is informed by the landscape, land use, or transportation context of the area. Instead of taking a cookie-cutter approach to design solutions, context-sensitive design responds to the surrounding environment.
- **Equitable access:** Equitable access ensures that everyone – regardless of race, gender, income, or ability – can access and enjoy the Bay Trail.
- **Ecological design:** Design that is informed by ecological elements. Ecological design considers the environment, local wildlife, the impact of sea-level rise, and other critical elements to co-living with our natural environment.

Equity Tips and Resilience Tips are called out throughout the document, emphasizing ways that equity and resilience can be centered in the planning and design of the Bay Trail.

Albany Beach, Albany

India Basin, San Francisco

2 Bay Trail Design Approach

This chapter describes the philosophy that guides the design of the Bay Trail and the factors that inform that philosophy, from the people who use the trail to the variety of contexts it passes through.

2.1 Design Approach Overview: Designing for People, Place, and Purpose

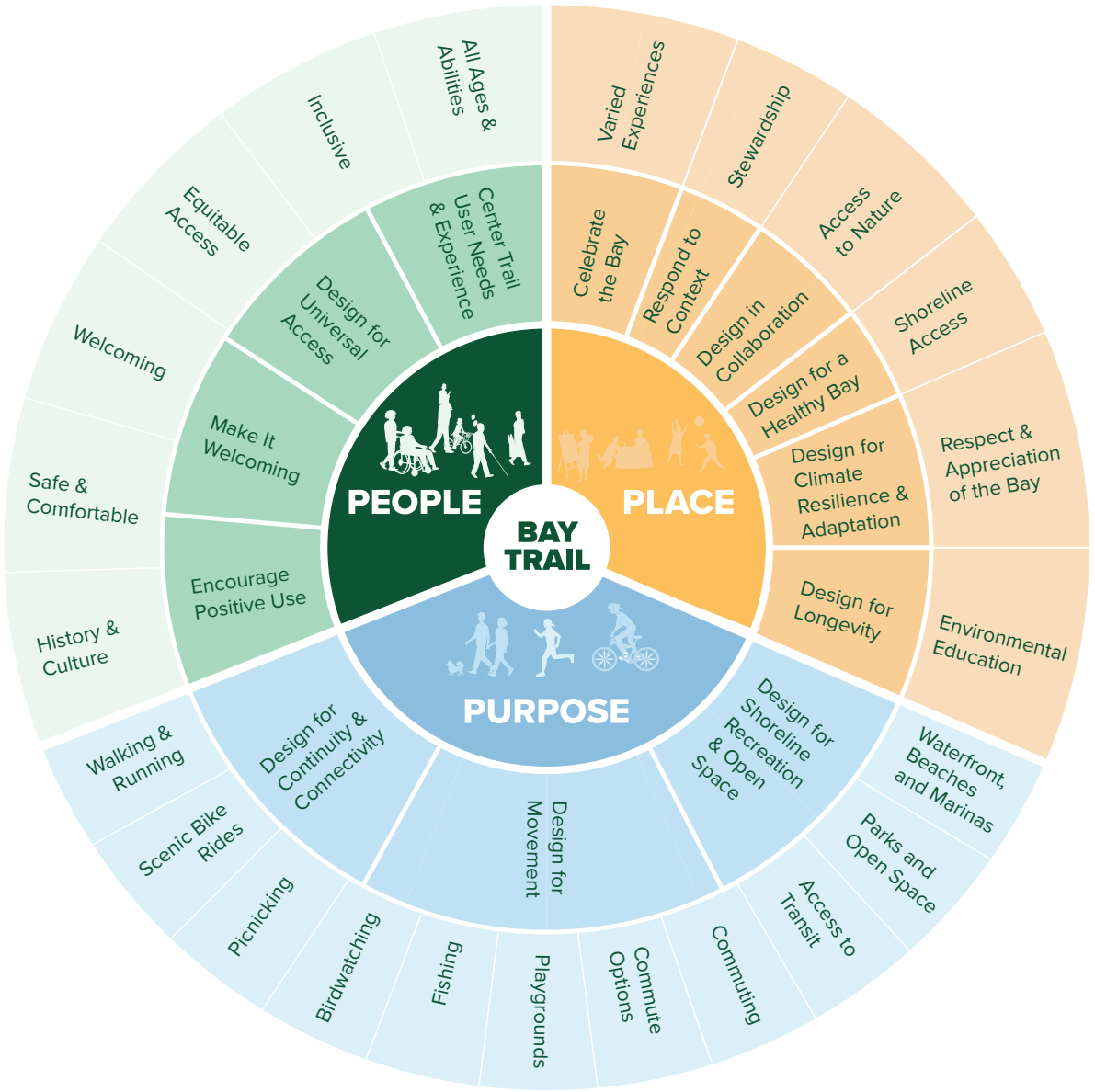
Each segment of the Bay Trail presents numerous opportunities and constraints to a potential design, which require careful consideration and thoughtful decision-making.

However, three main drivers should guide the design approach to the Bay Trail: People, Place, and Purpose.

- **Design for People:** Meeting needs of the broad spectrum of users of the Bay Trail.
- **Design with Place:** Working with – and in support of – the location, landscape, and land use context through which the Bay Trail travels.
- **Design for Purpose:** Providing opportunities for the wide range of recreational, travel, and commute activities to occur comfortably and safely along the Bay Trail.

These drivers and related elements are depicted in **Figure 2** and explored in greater detail in the following pages.

FIGURE 2 Design Approach Framework



2.2 Designing for People: Who Uses the Bay Trail?

New and improved segments should continue to support the wide range of existing trail users, while encouraging new and historically excluded users. The section below provides guidance on design concepts that support different trail principles as well as information about current and potential trail user types.

Golden Gate Fields, Albany

Principles for Designing for People

Center the Needs and Experience of Bay Trail Users

Design of the Bay Trail should focus on user safety and experience, considering the broad range of user types and their potential interactions. A well-designed trail is a safe trail that minimizes conflicts between trail users and other nearby activities, encourages frequent use, and reduces the managing organization's operations and maintenance requirements.

Design for Universal Access

The entire Bay Trail should be designed to not just meet minimum accessibility requirements, but to create a comfortable, enjoyable experience for people of all ages and abilities, including users with disabilities (e.g., physical, visual, auditory, and cognitive); users traveling for recreational purposes as well as transportation purposes like commuting; and users traveling alone and in groups.

Make it Welcoming

The design of the Bay Trail should foster a sense of welcoming and belonging, particularly for new users and those who have historically been marginalized or unwelcome in certain public spaces and activities. Equitable access to and an inclusive experience on the trail can be supported through design elements such as clear and consistent signage in multiple languages, easily accessible information on trail conditions (including slope, width, and availability of water and restrooms), and trail support facilities that accommodate both solo users and groups.

Encourage Positive Use

To support a sense of personal safety and encourage more use by both new and existing Bay Trail users, the trail itself should maintain good physical and visual connections to the surrounding areas, long sight distances, and minimize isolated areas. Crime Prevention through Environmental Design (CPTED) principles, the strategic use of lighting, and security cameras, when used with community input and support, can deter potential nuisance activities.

Bay Trail User Types

The Bay Trail should welcome everyone who wants shoreline and open space access, recreation, and active transportation opportunities. Understanding the needs of Bay Trail user types will create a comfortable, safe, and high-quality experience for all. The following pages describes the movement characteristics and design considerations for major user types of the Bay Trail.

People with disabilities (e.g. physical, visual, auditory, and cognitive) may fall within any of the user types listed below and their needs must be considered in all situations.

India Basin, San Francisco

Bay Trail User Dynamics

Safety is a fundamental design priority for the Bay Trail and serves as the foundation for the design treatments presented in **Chapter 3: Bay Trail Design Toolkit**. In addition to catering to the needs of each individual user group, the design of the Bay Trail should also account for how different user groups may interact. The Bay Trail must be wide enough to provide safe and comfortable conditions for all users, and consider the following:

- **Speed differential.** The speed differential between trail user types is the most common cause of conflict on shared use paths, at trail intersections, and at trail access points.
- **User volumes.** Some segments of the Bay Trail experience higher volumes than others and most segments of the Bay Trail are popular with people traveling in groups and socializing. An approach to identifying the recommended trail width (and design treatments to separate faster and slower users) based on antipcated user volumes is presented in Chapter 3, **Section 3.1 Bay Trail Cross-Sectional Building Blocks**.
- **User abilities and needs.** Bay Trail users may include older adults, children, people with dogs, people using wheelchairs, people with physical, visual, auditory or cognitive disabilities, micromobility users, and bicyclists of different abilities and speeds. Each of these user groups have different ways of moving and managing their mobility as it relates to the trail and to other users. The design of the Bay Trail should be intuitive to navigate, ADA-accessible, and flexible to meet the needs of these users.

Pedestrians

Walkers; people using wheelchairs; dog walkers; people walking with baby strollers; people with one or more disabilities (physical, vision, auditory, and/or cognitive); runners

Movement Characteristics	Design Considerations
• 1-3 mph average travel speed (walking & non-motorized wheelchairs) • 3-5 mph average travel speed (motorized wheelchairs) • 5-9 mph (runners) • Runners' speeds may match a slower bicycle rider and therefore they may be more comfortable sharing spaces with bicyclists instead of pedestrians • Runners and joggers often prefer softer, unpaved surfaces to reduce impacts to their bodies • Many people, including social groups, deaf trail users who are signing, and wheelchair users typically prefer to travel side-by-side • Older adults, children, people with dogs, people with mobility needs, and people with disabilities that cause mobility challenges may have varying levels of ability to quickly maneuver around other users	• Wider paths support the social function of the trail and give more space to safely and comfortably pass slower trail users • Wider paths also provide space for people with disabilities to use the trail socially, allowing people who use wheelchairs and other assistive devices or people who communicate with sign language to travel side-by-side • Consider separation of users, either with striping or fully separated trails • At road crossings, use the slower travel speed of a walking pedestrian to calculate the timing of traffic signals • Long sight distances can give people of varying speeds more time to avoid conflicts • Speed limit and etiquette signs can reinforce behavior norms

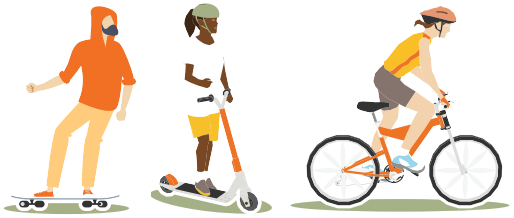
Slower bicyclists and micromobility device users

New and/or casual bicyclists; children and families bicycling together; people on tricycles, tandem bicycles, recumbent bicycles, adaptive bicycles, or pulling bike trailers; people on self-propelled micromobility devices such as in-line skates, roller skates, kick scooters, and skateboards

Movement Characteristics	Design Considerations
• 6-12 mph average travel speed • May stop more frequently than faster bicyclists • May require a wider operating space for more side-to-side movement than experienced bicyclists • People bicycling in groups typically prefer to socialize and travel side-by-side • Skateboarders and in-line skaters often have a “sweep” width of 5 feet (i.e., wider than a bicyclist’s operating width)	• Wider paths support the social function of the trail and operating width of users • Establish sight distances based on the lower eye height and faster travel speed of recumbent bicycles • Establish turning radii based on the wider turning needs of adaptive bicycles and bicycles pulling trailers • Create regular pull out areas to allow users to stop and pull completely off the trail

Faster bicyclists and micromobility device users

Faster bicyclists; people using electric micromobility devices like e-bikes (adaptive e-bikes), e-scooters, and hoverboards



Movement Characteristics	Design Considerations
• 12-25 mph average travel speed; note some users may travel faster; many trails are signed with a 15 mph speed limit, but bicyclists can travel faster on on-road Class VI facilities • May prefer to travel in a space dedicated for exclusive bicycle use instead of on a shared path • Typically prefer wider trails with room to pass slower users such as pedestrians and non-electric bicyclists and micromobility device users • E-bikes and e-scooters may accelerate and decelerate faster than non-electric devices	• Establish geometric design controls such as design speed, path width, horizontal and vertical curves, tapers, and clearances, based on the travel speed of faster bicyclists • Striped or dedicated separated lanes for different user groups can reduce the potential for and perception of conflict • Long sight distances can give faster users more time to adjust their movements to slower trail users

Micromobility

The Presidio, San Francisco

255 Airport Blvd, Burlingame

Micromobility devices refer to single-person, human- or electric-powered, low-speed transportation vehicles like e-bikes or e-scooters. Micromobility devices may be privately owned or used through shared mobility programs, like Baywheels, which operates a pedal and e-bike share system in San Francisco, the East Bay, and San Jose.

Implications of Micromobility

As technology and mobility continue to evolve, new travel choices are becoming increasingly popular, and Bay Trail users now use a variety of micromobility devices, also referred to a new mobility. The popularity of micromobility devices also means there are new needs for users of the Bay Trail, including:

- Charging stations along the trail that can be used for a range of electric devices, including electric micromobility devices, electric wheelchairs, and adaptive e-bikes;
- A design approach to sharing the trail with micromobility users; and
- A design and communication strategy to educate users on safety and trail etiquette that promotes positive interactions among trail user types through understanding and connection.

2.3 Designing for Place: How does context inform the design of the Bay Trail?

The context, purpose, and facility needs of each Bay Trail segment will inform its design as well as the Bay Trail Typology presented in **Section 3.2: Bay Trail Typology**.

Principles for Designing with Place

Celebrate the Bay

Align the Bay Trail to enhance both physical and visual access to the water and emphasize the trail's unique connection to the Bay. The shoreline experience is central to the trail's identity. Thoughtfully curated viewsheds, along with recreational and educational opportunities, should balance access with natural resource protection, offering meaningful ways for trail users to engage with the Bay.

Respond to Context

Recognize and respond to the unique opportunities and constraints of each site, including environmental factors, land uses, and user groups. This may involve adapting surface materials, trail support facilities (e.g., benches, picnic areas, drinking fountains, restrooms etc.), and trail widths to fit the surrounding context. It could also mean incorporating environmental education and resource protection or adding user-requested features, such as fishing rod holders and cleaning stations near popular fishing areas.

Design in Collaboration

Recognize the role of and collaborate with all relevant agencies, community-based organizations (CBOs), and local partners. These partners represent valuable communities and can help shape trail improvements into multi-benefit projects, ensuring the Bay Trail both serves local communities and meets the Bay Trail goals and vision. Where local agencies have existing design guidelines, integrate their design language and standards to create a trail that aligns with local agency operations, connects seamlessly to the larger system, and reflects the local community.

Design for a Healthy Bay

The design of the Bay Trail should strive to protect and enhance the ecological health of the region while providing opportunities for public access. Create and improve native landscapes and shoreline habitats wherever possible by incorporating native plants as well as locally appropriate non-native plants, avoiding or minimizing environmental impacts, and preserving water quality.

Design for Climate Resilience and Adaptation

To ensure the Bay Trail's resilience in the face of our changing climate, the trail should be designed to withstand or adapt to sea-level rise, storm surges, extreme tides, inland flooding, and tsunamis. This will require thoughtful vertical and horizontal alignment of the trail, including adaptive or managed retreat. In some cases, this may mean placing trail surfaces above future flood levels. In other cases, this may mean creating redundant, parallel routes where a lower bayside alignment is expected to be flooded. These approaches should also preserve or expand space for wetlands and protect shoreline habitat, which provides many critical benefits, including buffering heavily populated areas from some effects of climate change such as storm surges and extreme tides.

Design for Longevity

To reduce lifecycle costs, construction impacts, and maintenance over time, Bay Trail designers should prioritize durable materials that are appropriate for the context and use, and that are composed of recycled, recyclable, or reused materials, and/or certified sustainably produced.

Bay Trail Contexts

The table below provides an overview of different contexts encountered along the Bay Trail and key design considerations for each. These contexts are meant to serve as examples and don't cover all potential contexts. The Bay Trail is intended to provide equitable access and opportunities for all users—whether for recreation or transportation, for daily use or occasional visits, and for those who live nearby or travel from afar. The Bay Trail is intended to provide 24/7 public access. While the trail is intended to serve everyone, different settings support some uses more than others and therefore present unique opportunities and design considerations.

EQUITY TIP

A directional sign can be printed with raised letters, braille, and raised arrows to assist sight-impaired trail users.

TABLE 1 Bay Trail Contexts and Design Considerations

Urban and Suburban Contexts

Context	Description	Example Locations	Critical Design Considerations
Urban and Suburban Parklands	• Public parks and recreation areas that front the Bay • Provide both passive and active recreation • May include activity centers, such as playgrounds, picnic areas, and boat launches	• Crissy Field (San Francisco) • Alvarez Ninth Street Park (Benicia) • Alameda Waterfront Park (Alameda)	• Bay Trail signs should always be used to indicate the Bay Trail route • Where space allows, provide separated trails for different user types such as pedestrian path and bicycle path • Place trail support facilities, such as benches, drinking fountains, bike parking and bike repair stations, and restrooms, close to the trail, or provide clear accessible directional signs to these facilities • Locate the trail within sight of, but not directly through, activity centers, such as playgrounds and picnic areas, or provide clear accessible directional signs to activity centers  Sea Plane Lagoon Promenade, Alameda
Office Parks / Campuses	• Corporate, government, or institutional campuses that front the Bay • May include accessory retail and/or hospitality services and programming • May include gathering spaces	• Burlingame Point (Burlingame) • Sierra Point (Brisbane) • Oyster Point (South San Francisco)	• Clearly direct users to trail entrances and exits • Coordinate with campus tenants to provide trail support facilities such as benches, drinking fountains, restrooms, bike repair stations, and bike racks • Include safety and security lighting to facilitate 24 hours a day, 7 days a week access where appropriate • Locate the trail so that it is visible and easily accessible to campus tenants • Provide public parking for trail access  Oyster Point, South San Francisco

Context	Description	Example Locations	Critical Design Considerations
Plazas and Promenades	• Civic, memorial, historic places that feature gathering spaces • Typically include a wide range of passive activities such as gathering, sitting, and resting, as well as commercial activities such as cafes, restaurants, and shopping	• Vallejo Waterfront (Vallejo) • Jack London Square (Oakland) • Embarcadero (San Francisco)	• Provide clear cues to locate the trail and to allow users to follow it through the plaza or promenade. • Delineate the trail edges with seating, planters, or pavement changes rather than fencing/barriers. • Where buildings open directly onto the trail, provide design cues and allow for large mixing areas to allow people to choose how to move through the space and reduce conflicts.
Residential	• Single- and multi-family houses, townhouses, and apartment buildings • May or may not be managed by homeowners or tenant associations • Residences may have direct access to the trail	• Redwood Shores (Redwood City) • Bay Farm Island (Alameda) • Victoria by the Bay (Hercules) • Marin Lagoon (San Rafael)	• Use design elements, such as setbacks and landscaped buffers, where needed to provide privacy and security between homes and the trail. • Where possible, place gathering spaces and trail support facilities, such as benches, water, restrooms, bike repair stations, and bike racks on the opposite side of the trail from residences. • In existing residential areas, collaborate with homeowners or tenants' associations to provide trail support facilities where feasible and to determine appropriate lighting and security measures. • In new residential developments, ensure that adequate trail support facilities are included early in the planning and design process.


The Embarcardero, San Francisco


Richmond Marina, Richmond

EQUITY TIP

Trail users with low vision may need non-visual cues, such as tactile walking surface indicator guidance strips, to follow the trail through complex settings.

Context	Description	Example Locations	Critical Design Considerations
High-Security Lands	• Public and private utilities, airports, refineries, ports, and military bases	• Chevron Refinery (Richmond) • Oakland Airport • Sunnyvale Wastewater Treatment Plant (Sunnyvale)	• Work with the facility manager to determine appropriate security measures, such as screening, or physical barriers. • Provide accessible interpretive panels to educate trail users on topics such as wastewater treatment, aviation history, and global shipping. • Accessibility Tip: use raised letters, braille, and/or QR codes to assist sight-impaired and others with various disabilities to ensure that all users have access to this information. QR codes can also be used for language translation.

EBMUD Wet Weather Treatment Plant, Richmond

EQUITY TIP

Use raised letters, braille, and/or QR codes to assist sight-impaired and others with disabilities to ensure that all users have access to this information. QR codes can also be used for language translation.

Berkeley, CA

Rural, Agricultural, and Open Space Contexts

Context	Description	Example Locations	Critical Design Considerations
Agricultural and Production Lands	• Farms, vineyards, and ranchlands • May include livestock, orchards, row crops, rural residential, and other farming operations • Salt Ponds	• Stanly Crossroad and Stanly Lane (Napa) • Napa Valley Vine Trail (Napa County)	• Collaborate with agricultural operators about equipment clearances, biosecurity measures, or seasonal changes that may impact trail use. • Design features that allow trail and agricultural uses to remain compatible including vegetated buffers, fencing, and trail surface changes (to support agricultural equipment or reduce runoff). • Provide accessible interpretive panels to educate trail users on topics such as biosecurity, food sources, and agricultural history.  Salt Ponds, Redwood City
Open Space, Refuges and Nature Preserves	• Natural areas along the Bay that are managed for habitat protection • Shoreline open space • May include levees, marshes, wetlands • May be managed by a county, regional, state, or national agency	• Ravenswood (East Palo Alto) • Dotson Family Marsh (Richmond) • Hamilton Wetlands (Novato) • Benicia State Recreation Area (Benicia) • Wetlands Edge Park (American Canyon)	• Align the trail to maximize visual access to the shoreline and the Bay. • Locate trails in desirable areas to deter users from creating informal access into and through sensitive locations. • Incorporate design features that balance trail use and habitat protection, such as wildlife-friendly fencing or buffers; regulatory signs can also be used to prevent pet access to habitat areas.  Seal Point Park, San Mateo • Use context-sensitive design, such as elevated boardwalk or causeway trails, to reduce habitat fragmentation in very sensitive areas. • Coordinate with the land manager, such as USFWS, to determine appropriate trail surface materials that balance durability, permeability, and impact reduction. • Direct trail lighting away from habitat areas, and do not install lighting in areas where it would impact sensitive species. • Where the Bay Trail is part of an open space trail network, use the Bay Trail sign to distinguish it from other trails in the park and to visually indicate it is part of the larger Bay Trail network. • Provide consistent accessible wayfinding, such as mile markers, where there are longer distances between access points. • Provide information on the availability of trail support facilities, such as restrooms, drinking fountains , and benches, which may be less frequent in open space areas. • Provide accessible interpretive panels to educate trail users on topics such as common wildlife, rare or protected species, and ecosystem function. • Provide wildlife viewing resources, such as strategically placed benches, overlooks, elevated trails, and bird blinds.

EQUITY TIP

Enable trail users with disabilities to determine an appropriate route for their needs by including key trail information at trailheads. This information might include trail length, surface, width, grade, and cross slope. It also may incude a map with distances between benches or other seating areas for people who need to rest often.

2.4 Designing for Purpose: How is the Bay Trail Used?

The Bay Trail is multifunctional infrastructure that serves communities in many ways and provides numerous benefits. It offers people of all ages and abilities a safe space to walk, bike, or use mobility devices, separated from motor vehicle traffic, while also providing access to the Bay, nature, and nearby communities. The natural landscapes surrounding the San Francisco Bay are an invaluable resource that supports recreation, transportation, wildlife habitat, and resilience against climate change. Bay Trail users travel at fast, destination-driven speeds as well as more leisurely paces, which can encourage discovery and, in turn, boost spending at local businesses.

Byxbee Park, Palo Alto

Principles for Designing for Purpose

Design for Shoreline Recreation and Open Space Access

The Bay Trail should be designed to support shoreline recreation by providing safe, convenient access to both active recreation—such as kayaking, fishing, and bicycling—and more passive experiences like birdwatching, picnicking, and enjoying scenic open spaces, as well as ensure a balance between recreation and environmental stewardship.

Design for Movement

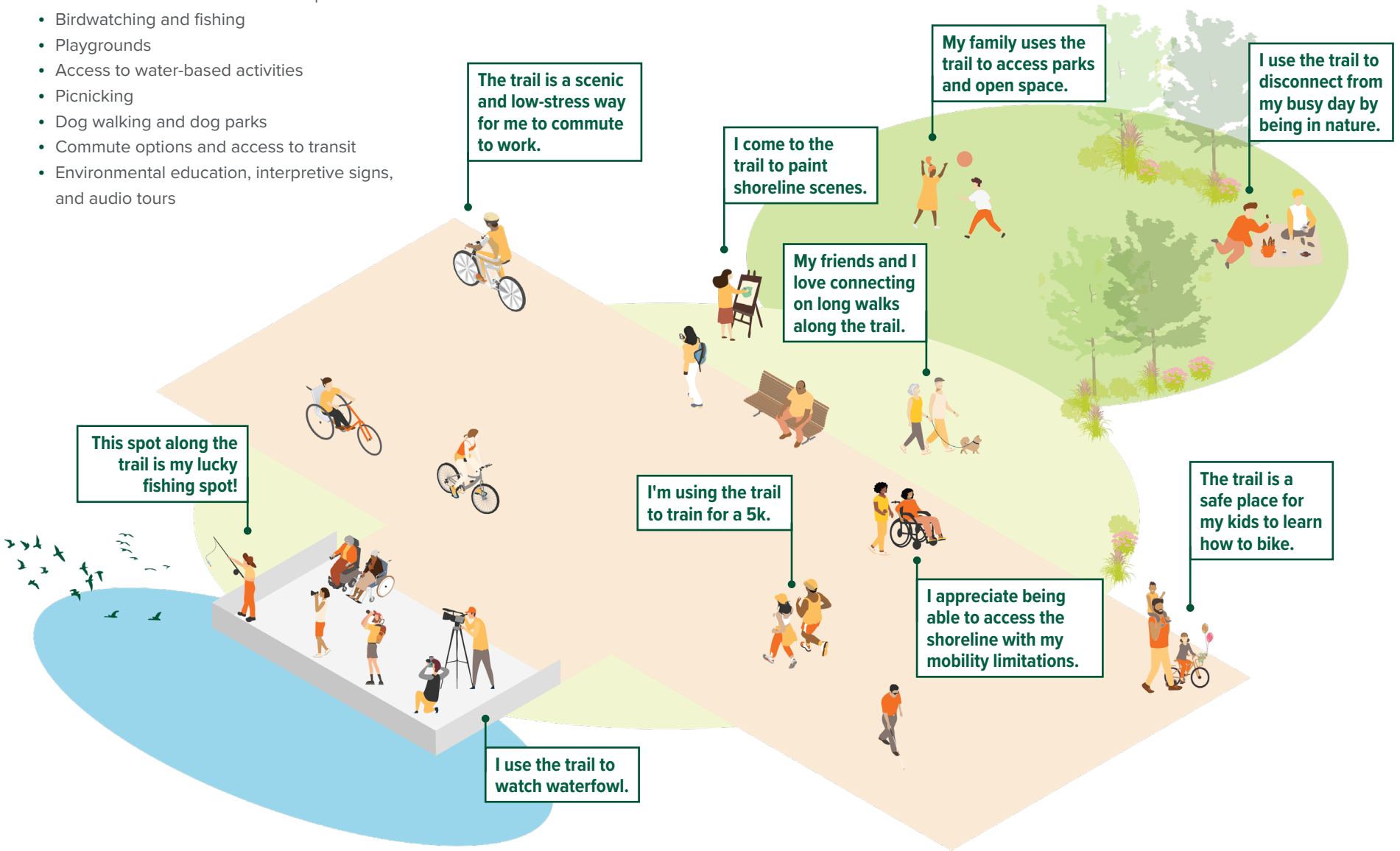
The Bay Trail should be designed to facilitate active transportation to connect people to important destinations along the trail. The design for through movement must reflect Bay Trail user needs and local context but also balance the needs of both passive and active recreation uses of the trail.

Design for Continuity And Connectivity

The Bay Trail should be designed to ensure seamless continuity and connectivity, providing direct pedestrian and bicycle links to adjacent cities, activity centers, parks, recreation areas, and public transit facilities, including BART, Caltran, SMART, local light rail, and ferry service. A well-connected and easy-to-follow network should include not only the main trail spine but also clearly marked spurs and connector trails that enhance access, close gaps, and integrate with local and regional transportation systems, ensuring users can easily navigate the Bay Trail and its connections.

FIGURE 3 The Bay Trail serves a variety of purposes

- Scenic bike rides, walking, and running
- Shoreline access and scenic viewpoints
- Birdwatching and fishing
- Playgrounds
- Access to water-based activities
- Picnicking
- Dog walking and dog parks
- Commute options and access to transit
- Environmental education, interpretive signs, and audio tours



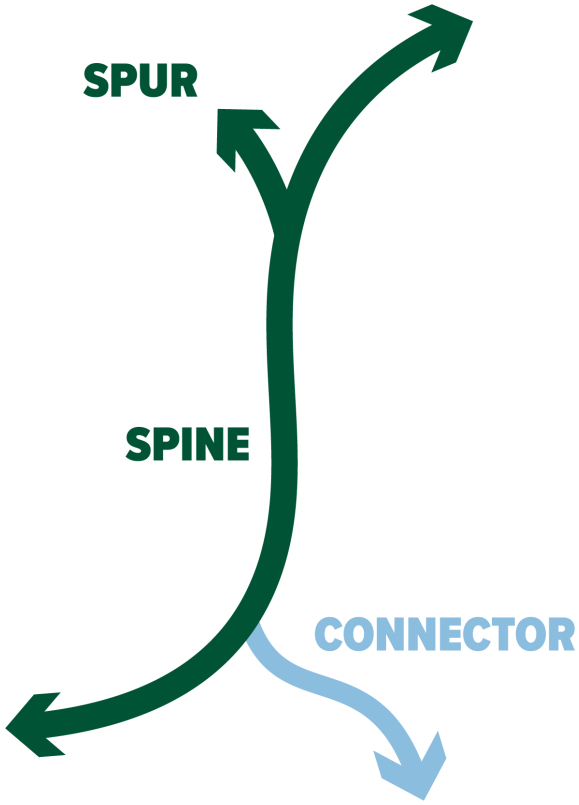
The System: Bay Trail Spine, Spurs, and Connectors

The Bay Trail consists of spine and spur trails, with connector trails that support the Bay Trail system (**Figure 4**):

- The **spine** is the primary Bay Trail and must follow the design criteria presented in Chapter 3. Spine segments should advance the goal of a continuous loop around the Bay, though may not necessarily take the most direct route, may include smaller loops, and in some instances may include temporary segments to provide a connection before a permanent option is available. Spine segments should be located as close to the Bay as possible.
- **Spurs** are trail segments that connect to the spine, providing access to the shoreline or other key destinations where the spine cannot. On Bay Trail maps, spine and spur segments may share the same symbology, and spur trails should meet the same design criteria as the spine whenever possible.
- **Connector** trails are not formally part of the Bay Trail but are part of the broader system that links the Bay Trail to surrounding communities and may be a part of the broader Bay Area Trails Collaborative (BATC) network. Connector Trails may include on-street bicycle and pedestrian facilitys. The Bay Trail Design Guidelines do not address the design of connector trails.


Refugio Creek, Hercules

FIGURE 4 The Bay Trail System Hierarchy



Connector Trail Criteria

Not every trail connecting to the Bay Trail is considered a Connector Trail. In order to be included on Bay Trail maps and in the Bay Trail planning process, a Connector Trail must:

Meet all of the following criteria:

- Be part of the Bay Area Trails Collaborative network; and
- Meet Bay Trail Design Guidelines standards (e.g., Class I or Class IV with adjacent sidewalk(s)); and
- Connect directly to the Bay Trail.

And must meet at least one of the following criteria:

- Trail is adjacent to a body of water or natural environment experience; or
- Connects to the Bay Trail at two points and provides a more direct transportation route to the more circuitous Bay Trail; or
- Provides a direct, continuous connection between the Bay Trail and the Ridge Trail.

Point Pinole, Richmond

Bay Trail Functions

Not every segment of the Bay Trail can serve every function, but most segments can provide multiple benefits for both trail users and nearby communities. The following pages describe the characteristics and design considerations for the major functions of the Bay Trail and can help decide what to prioritize in different settings.

Recreation and Open Space

Function	Description and Activities	Example Locations	Design Considerations
Shoreline Access	• Allow trail users to be close to, touch, or enjoy views of the water • Birdwatching, fishing, boating, tide pooling	• Albany Bulb (Albany) • China Basin (San Francisco) • Foster City • Crown Beach (Alameda)	• Accessible surfaces may be needed to create accessible routes across sandy beaches or riprap • Include bike racks to allow bike riders to safely lock up their bikes • Provide clearly marked water access points or lookouts to consolidate access points
Access to Nature	• Enable people to discover, experience, and appreciate the Bay's wildlife • Birdwatching, vistas, nature education	• Dotson Marsh (Richmond) • Ravenswood (East Palo Alto)	• Elevated walkways can provide access through wetlands, where appropriate • Short loops or spurs from the main trail can provide access to sensitive areas away from busier segments of the trail • Bird blinds, benches, and shade structures can provide areas for quiet observation • Provide accessible interpretive panels and nature education centers
Linear Open Space	• Link open space along narrow or constrained corridors	• Tiburon Linear Park (Tiburon)	• Where fencing is required, provide frequent openings to prevent discomfort from excessive enclosure
Inclusive & Welcoming Recreation	• Opportunities for people of all ages and abilities to recreate in a setting that is separated from motor vehicle traffic. • Walking, biking, using mobility devices, resting, placemaking, art	• Kennedy Park (Napa) • Byxbee Park (Palo Alto) • Crissy Field (San Francisco)	• The design of the trail and the trail support facilities must be accessible • Provide clear information on the availability of trail support facilities, such as restrooms, drinking fountains, and benches • Provide space for community-led programming such as art and history events or, cultural holidays and events
Health	• Opportunities to improve both physical and mental health outcomes and provide social connection • Walking, biking, exercise, immersed in nature • Access to clean air	• Marina Park (San Leandro)	• Provide space for contemplation and access to nature • Offers access to clean air • Provide exercise stations where appropriate • Include mileage markers help users mark their progress and plan routes
Community Resilience	• Recreational opportunities for health and wellbeing • Critical infrastructure during emergencies	• Bothin Marsh (Mill Valley) • Hayward Shoreline (Hayward)	• Wayfinding and interpretive signage can be used to identify resilience functions • Provide charging stations for communication and mobility devices

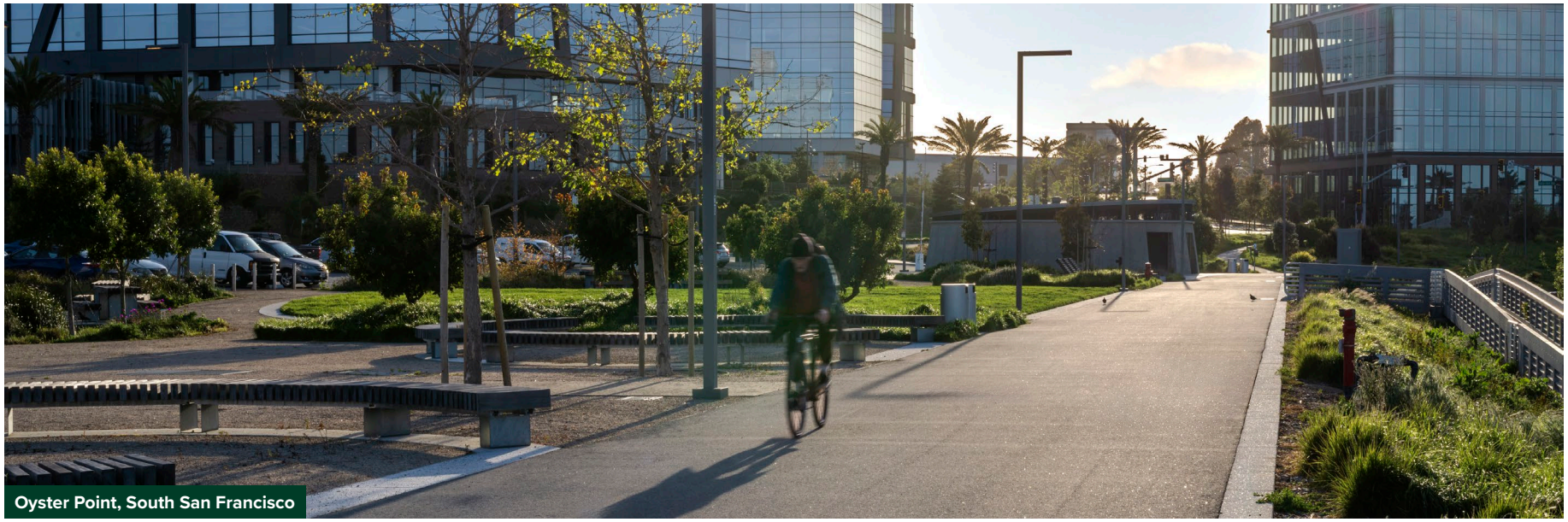
Ecosystem and Shoreline Protection

Function	Description and Activities	Example Locations	Design Considerations
Open Space and Natural Landscapes	• Space for wildlife to live, breed, and forage • Habitat restoration, education	• Ravenswood (East Palo Alto) • Hamilton Wetlands (Novato)	• Align the trail and use materials to enhance natural areas and celebrate the unique characteristics of the landscapes the trail travels through. • Include stormwater management, protect stream corridors and wetlands, and prioritize the use of appropriate native plants.
Shoreline Protection	• Protection from impacts of climate change and rising water elevations • Wetland restoration, education, shoreline modifications	• Hayward Marsh (Hayward) • Heron's Head (San Francisco)	• Include protective features such as living shorelines, sea walls, levees, ecotone slopes, horizontal levees, and habitat buffers, to ensure that the trail endures over time.

Bair Island, Redwood City

Transportation

Function	Description and Activities	Example Locations	Design Considerations
Active Transportation	• Facilitate use of the corridor for transportation uses • Commuting, traveling to commercial and recreation centers	• Eastshore State Park (Berkeley, Albany, Emeryville)	• Limit obstacles and circuitous routes • Provide extra space for different speeds of travel (see Chapter 3 for guidance on trail width) • Include accessible signs with information on access to transportation features (ferries, public transportation, park and rides) (see Chapter 3 for guidance on wayfinding) • Include lighting to support commuting and use of the trail for transportation on winter days with fewer daylight hours. (see Chapter 3 for guidance on lighting)
Connections	• Support connections directly from the trail to destinations and connector trails • Commuting, traveling to commercial and recreation centers	• Stevens Creek Trail in (Mountain View) • Richmond Greenway (Richmond) • Napa Valley Vine Trail (Vallejo) • Guadalupe River Trail (San Jose)	• Include clear, accessible signs with information about destinations (shopping, business districts, campuses) • Include maps with detailed neighborhood information • Make transitions to connector trails smooth and easy to navigate



Oyster Point, South San Francisco

Economic Vitality

Function	Description and Activities	Example Locations	Design Considerations
Tourism	• The scenic qualities of the Bay draw in visitors from near and far • Group and individual visitors	• Embarcadero (San Francisco) • Golden Gate Bridge	• Prioritize views and vistas • Provide opportunities to slow down to a speed of travel that supports discovery • Ensure that the trail is easy to follow
Access to Jobs & Commerce	• Travel to and from recreation and commerce destinations	• Independence Park (Vallejo)	• Provide visibility to and from the trail for nearby businesses • Include accessible signs with information about commerce centers and destinations
Outfitters	• Gear and instruction for specific activities on and near the Bay • Kayaking, bike rentals, windsurfing, kiteboarding	• Baywinds Park (Foster City) • Marina Bay (Richmond)	• Provide space for outfitters, appropriately located, and sized for the specific activity
Art/ Placemaking	• Use art to connect trail users with place – sculpture, historic markers, murals	• Bixbee Park (Palo Alto) • Peoples of the Canal Mural (San Rafael)	• Include accessible signage and translations to allow all trail users to experience the work

The Embarcardero, San Francisco

Byxbee Park, Palo Alto

3 Bay Trail Design Toolkit

In this chapter you'll find the following topics:

The Design Toolkit presents best practices, design solutions, and creative responses for planning, designing, and developing any Bay Trail segment. It should be used by planners and designers involved in the implementation of the Bay Trail, including government agency staff, developers, design consultants, and community partners.

About the Design Guidance

These Bay Trail design guidelines are intended to complement and supplement—rather than replace—the adopted regulations and guidelines of local managing agencies. Successful implementation of the Bay Trail depends on continued collaboration with local communities as well as shoreline property owners; local, regional, state, and federal agencies with jurisdiction over the trail; trusts and foundations that operate in the region; and the many environmental and recreational groups invested in the Bay Area's future. Through a collective use of the Bay Trail design guidelines, the Bay Trail will continue to evolve as a well-integrated, accessible, and sustainable resource for all.

About Facility Classifications

In order to serve the broadest possible range of users, all Bay Trail segments are intended to be off-street or facilities that are separated from traffic, which are defined by Caltrans' facility classification[1] system:

- Class I Bikeways are off-street facilities that provide travel opportunities not offered by the road system. They can be recreational or serve commuting purposes.
- Class II Bikeways create delineated spaces for bicyclists on roadways in high-demand bicycle corridors and are not typically part of the Bay Trail.
- Class III Bikeways are low-volume, low-speed streets where cars and bikes share the roadway space.
- Class IV Bikeways are separated from motor vehicle traffic using vertical elements, grade separation, or parking.

In MTC's 2024 plan to close gaps in the Bay Trail, all future segments were identified as Class I and off-street, or assigned a Class IV designation.[2]

Any designs that deviate from the recommended guidance should be brought to MTC/ABAG for review and discussion to ensure consistency with the Bay Trail and ensure appropriate safety countermeasures are included in the project to support the "All Ages and Abilities" (AAA) network that is included in MTC's Complete Streets policy.

Toolkit Organization

Ecological Design and Resilience

RESILIENCE TIPS

Throughout the Toolkit, this box will highlight ways to bolster resilience of the bay Trail.

Equity

EQUITY TIPS

Throughout the Toolkit, this box will highlight ways to bolster equity, accessibility and universal design on the Bay Trail.

1 CHAPTER 1000

2 Bay Trail Gap Closure Implementation Plan

Chapter Sections

The toolkit is organized into six sections as shown in **Table 2.**

Links to other guidelines chapters and sections are provided throughout, indicated with **colored, bold text**.

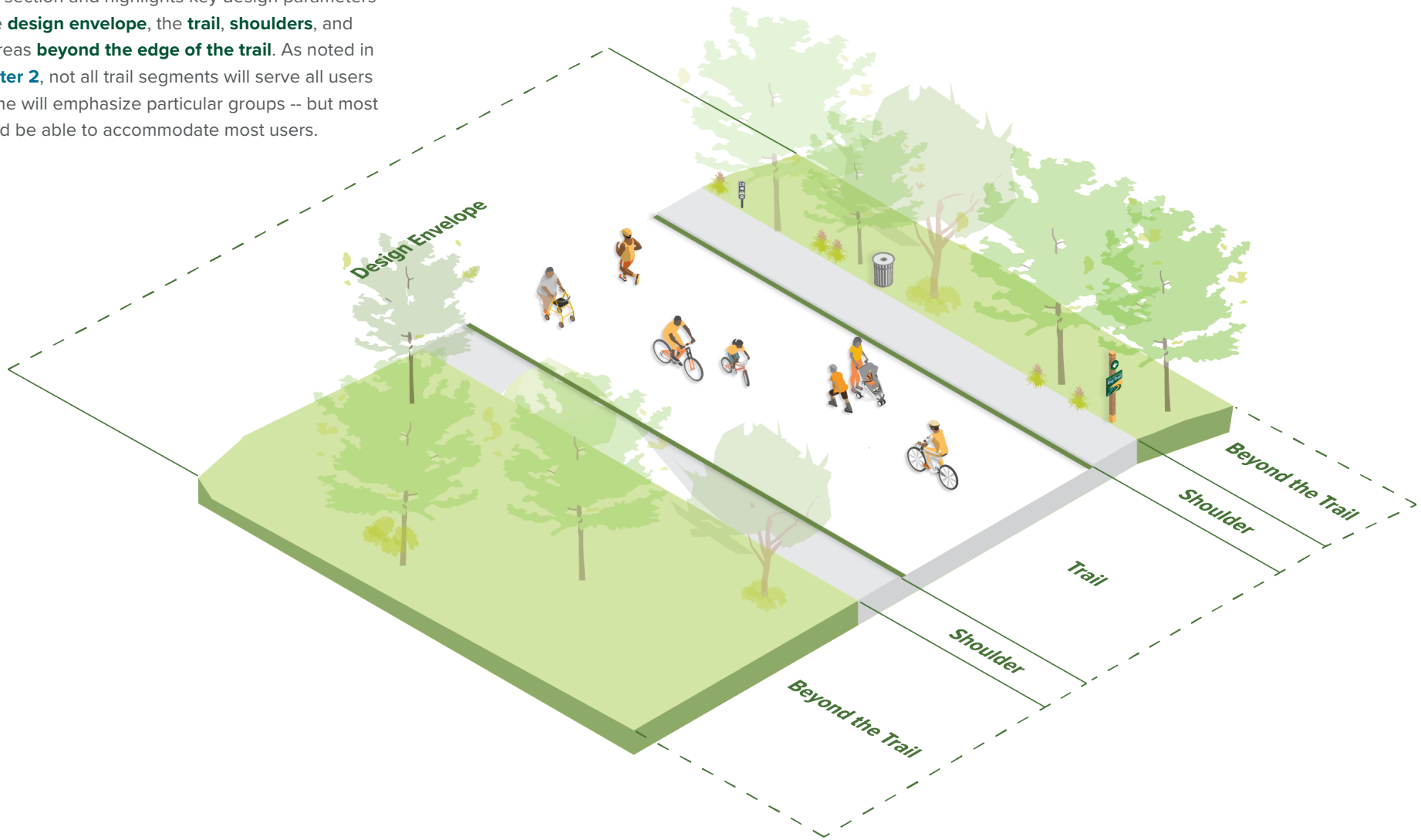
TABLE 2 Toolkit Quick References

3.1 Bay Trail Cross-Sectional Building Blocks	3.2 The Bay Trail Typology	3.3 Linear Design Elements and Approaches	3.4 Site-Specific Design Treatments	3.5 Trail Support Facilities	3.6 Landscape and Ecological Design
Building Blocks Overview	Typology Overview	New Bay Trail Segments	Pavement Markings	Seating – Benches and Picnic Tables	Bay Area Habitats
Design Envelope	Standard and Flexible Bay Trail Design Criteria	General Siting Guidance	Crossings and Intersections	Drinking Water	Plant Selection and Placement
Trail	The Standard Bay Trail	Siting for Habitat Protection	Midblock Crossing	Railings and Fences	Irrigation
Trail Width	The Bay Trail on Levees	Reslience to Sea Level Rise	Roadway Intersections	Gates and Bollards	Maintenance
Shoulders	The Constrained Bay Trail	Linear Trail Design Approach	Caltrans Crossings	Trail Access Points and Parking	
Beyond the Trail	The Unpaved Bay Trail	Horiztonal and Vertical Alignment	Driveway Crossings	Restrooms	
	The Elevated Bay Trail	Drainage	Shared Use Path Approach, Entry, and Trailhead Design	Waste and Recycling Receptacles	
	The On-Street Bay Trail	Rail-with-Trail Design	Intersections of Two Trails	Bicycle Racks and Repair Stations	
		Retrofits	Transitions Between Facility Types	Signage and Wayfinding	
		Quick-Build Projects	At-Grade Rail Crossings	Lighting	
				Fishing Elements	

3.1 Bay Trail Cross-Sectional Building Blocks

Building Blocks Overview

The Bay Trail cross-section is made up of separate elements that, together, make the trail functional for all users and integrate the trail into the landscape or urban fabric. This section defines each part of the cross-section and highlights key design parameters of the **design envelope**, the **trail**, **shoulders**, and the areas **beyond the edge of the trail**. As noted in **Chapter 2**, not all trail segments will serve all users -- some will emphasize particular groups -- but most should be able to accommodate most users.



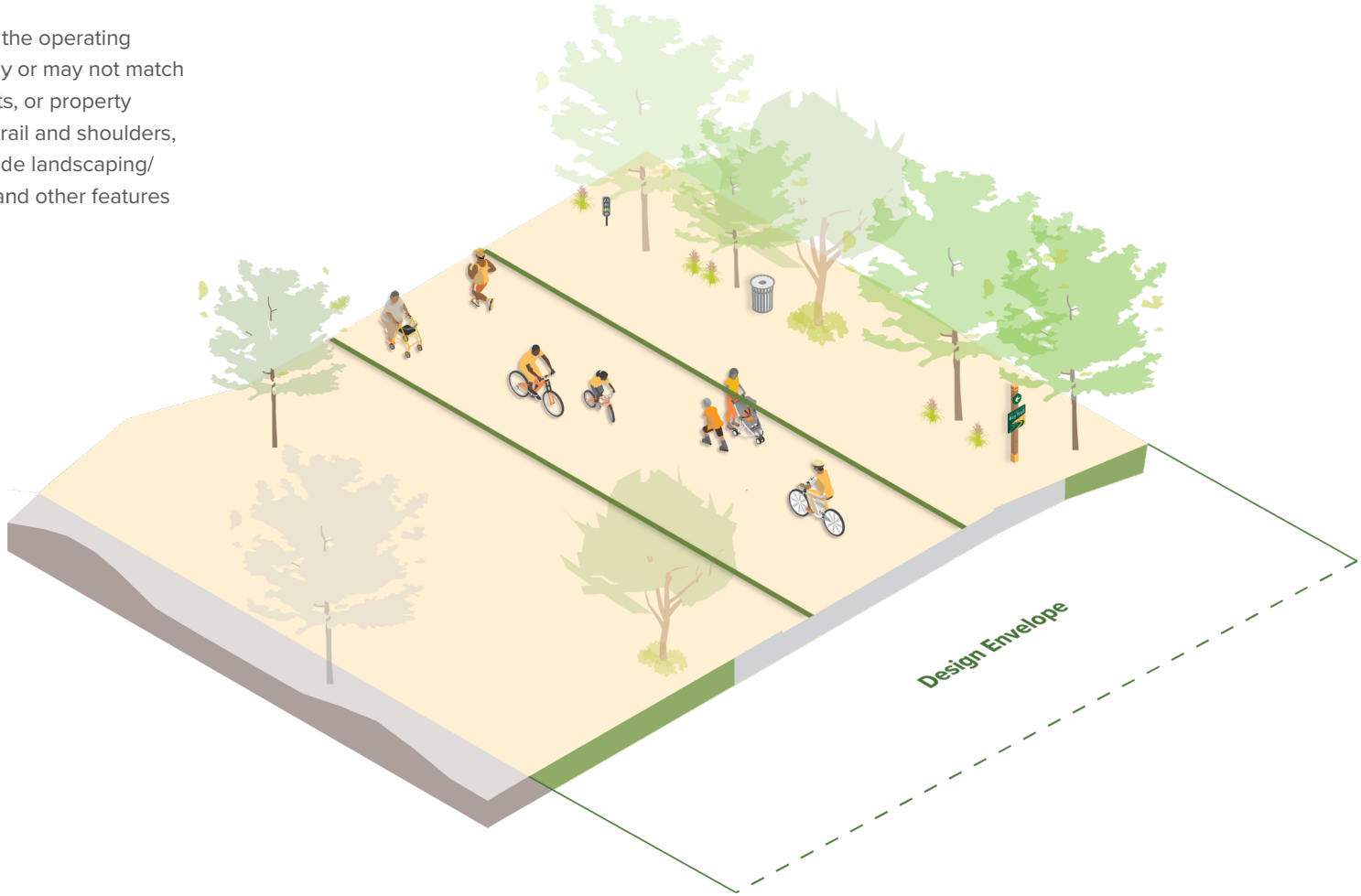
Brooklyn Basin, Oakland

Design Envelope

The space needed for the full trail cross-section and all associated elements of the trail's operation.

Purpose

- The design envelope refers to the operating envelope of the trail, which may or may not match the trail right-of-way, easements, or property boundaries. In addition to the trail and shoulders, the design envelope may include landscaping/ buffers, trail support facilities, and other features



Design

- **Width:** The width of the design envelope is flexible based on context. However, the design envelope must be a sufficient width to accommodate a trail width that matches expected level of future use and all trail operations including maintenance and trail support facilities.
- The construction process may require more space than the final design envelope. Consider using temporary construction easements to provide that space.

RESILIENCE TIPS

- Maximize the design envelope to allow the trail alignment to shift during planning and design, as well as to make space for ecosystem restoration or sea-level rise. Public space in areas subject to sea-level rise should be designed for inundation and with redundant alignments to allow for the Bay Trail to make a gradual retreat upland.
- The design envelope can be used for nature-based solutions to protecting and enhancing the Bay Trail.

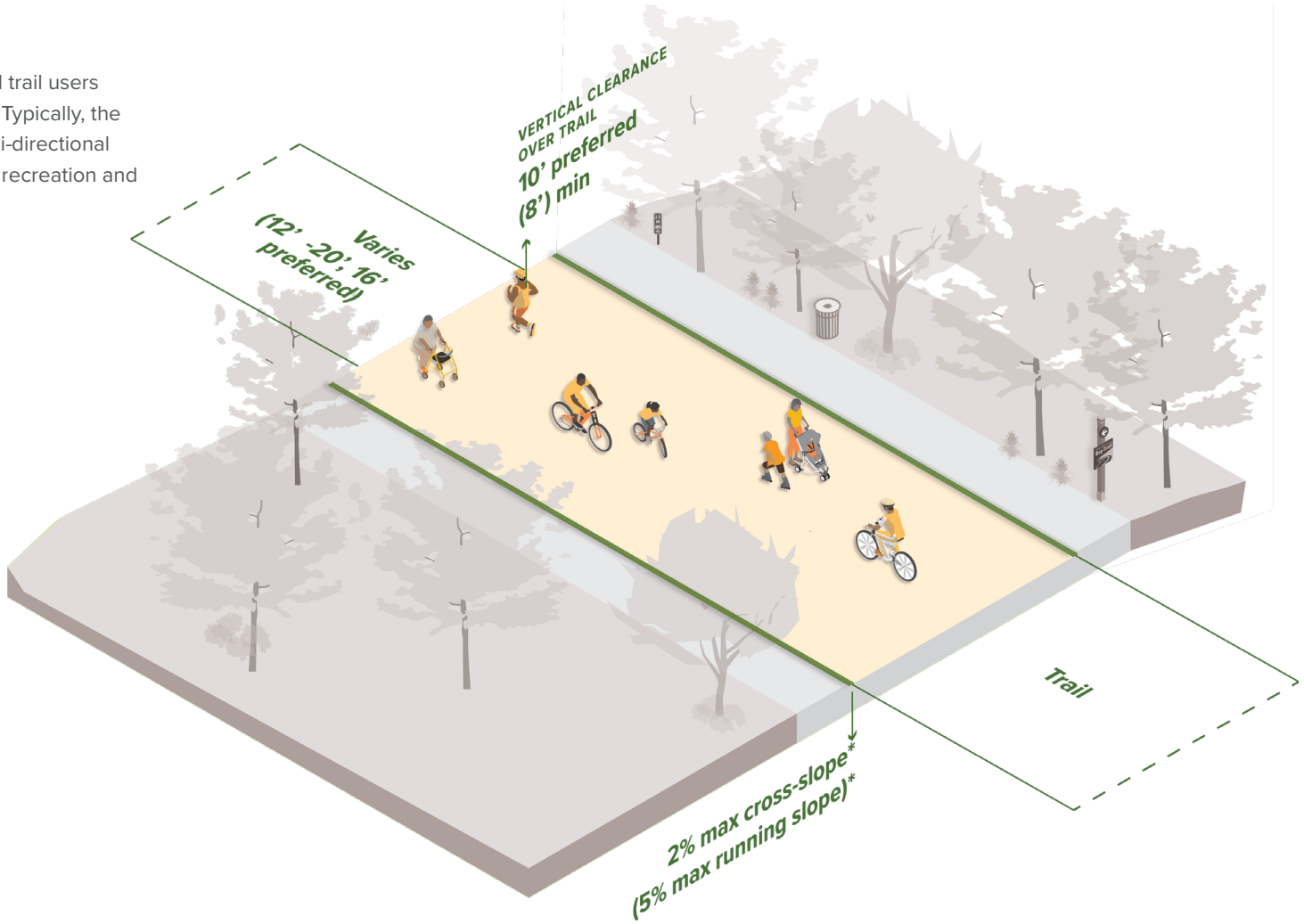
China Basin Park, San Francisco

Trail

The path surface for users of all ages and abilities and all forms of trail use.

Purpose

- The trail is the primary space for all trail users (refer to **Chapter 2** for user types). Typically, the trail is intended to accommodate bi-directional bicycling, walking, and mobility for recreation and active transportation purposes.



Don Edwards SF Bay National Wildlife Refuge, Fremont

Sea Plane Lagoon Promenade, Alameda

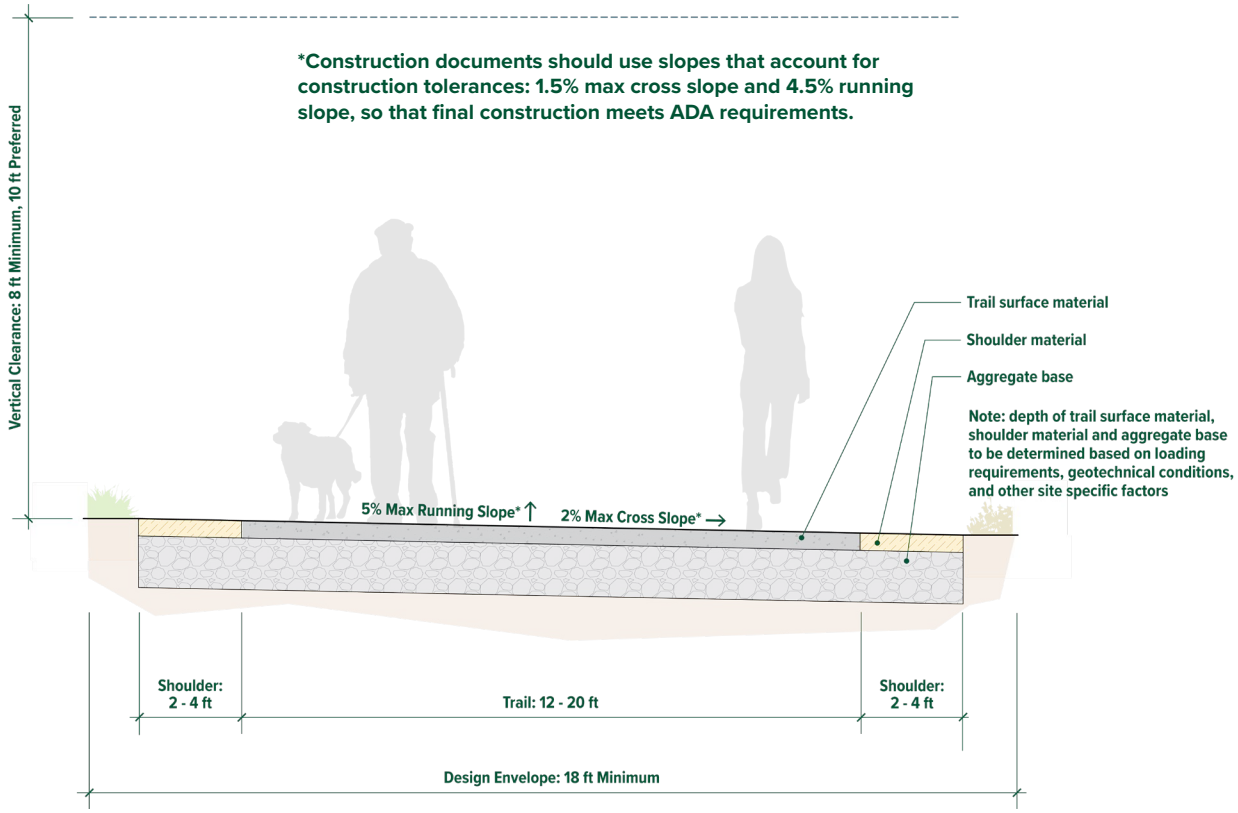
Design

- **Width:** Trail width is based on context. The following page provides guidance on determining width.
- **Grades:** The alignment of the trail must consist of gentle, ADA-compliant grades: a running slope of 5% or less and a cross slope of 2% or less.
- **Vertical clearance:** A vertical clearance of 10 feet is recommended, while at least 8 feet is required over the trail. Vertical obstructions to avoid may include undercrossing and tunnel ceilings, signs, security fencing, and overhanging trees.

RESILIENCE TIPS

- Base the trail cross-section on geotechnical recommendations that emphasize durability. Where possible, design for service and emergency vehicle weights rather than only pedestrian/bicycle loads.
- The long-term durability and longevity of a trail surface depends on the resources available to the managing agency. In general, concrete may have a lower cost to maintain and may last longer than an asphalt surfaced trail, which in turn may have lower ongoing maintenance needs than a natural surfaced trail.

FIGURE 5 Typical Trail Cross-Section.



Trail Surfacing

Trail surfacing options extend far beyond just asphalt or concrete. Selection of trail surfacing is a context-dependent decision influenced by many factors, including:

- **Accessibility, Intended Use, and User Type:** All trail surfacing needs to be firm, stable, and slip-resistant to ensure users with disabilities have full access to the trail system. Beyond accessibility, the type and volume of trail users should be considered in the selection of trail surfacing type(s). For example, bicyclists generally prefer smooth surfaces like asphalt, whereas runners might prefer a lower-impact surface such as crushed or stabilized crushed rock surfaces.
- **Climate and Environmental Factors:** Local weather conditions, such as frequency of rain or potential flooding can affect surface stability and drainage patterns. In addition, soil types, and proximity to sensitive areas like wetlands and streams should inform trail surfacing decisions; permeable surfacing may be required by some regulatory agencies to enable stormwater infiltration and groundwater recharge near sensitive areas.
- **Budget:** Hard surfaces are generally more expensive to install than other types of trail surfacing but may require less intensive and less frequent maintenance than other trail surfacing types.
- **Maintenance:** The ongoing maintenance needs of each material differs. Trail surfacing selection should consider the managing agency's maintenance resources to ensure that the trail can be well-maintained for trail user safety, comfort, and accessibility.

Table 3 highlights key considerations for different types of trail surfacing.

TABLE 3 Trail Surfacing Comparison Chart

Type	Accessible	Relative Installation Cost	Durability	Benefits	Challenges	Maintenance Needs
HARD SURFACE						
Concrete	Yes	$$$$	25+ years	• Longest lasting, most durable hard surfacing • Low maintenance • High-quality ADA-compliant surface (initially and over time)	• Most resistant surface to heat and flooding impacts • Can crack with temperatures fluctuations • Requires a well-prepared base and reinforcement, but no base rock and thus less grading impacts • Uplifting of concrete panels can be an issue adjacent to tree roots • Can be hard on the joints of runners	• Periodic inspection for uplift and settlement, repair as needed
Asphalt	Yes	$$$	8-10 years	• Smooth surface, ideal for wheeled users • Durable and long-lasting in most weather conditions • Less expensive than concrete	• Little structural strength, susceptible to edge cracking and root heaves from nearby vegetation • Can get hot in direct sunlight; high temperature can degrade surface • Requires greater initial excavation for required rock base; grading can impact nearby trees • Can be hard on the joints of runners • Need for ongoing maintenance	• Periodic inspection for uplift and settlement, repair as needed • Periodic need for crack filling and sealing • Resurface every 8-10 years
PERMEABLE SURFACE						
Permeable/ porous concrete	Yes	$$$	15 years	• Allows stormwater infiltration and groundwater recharge • Reduced heat island effects • Lower cost than traditional concrete	• High initial installation costs • Potential for clogging • Limited load capacity • Need for regular/specialized maintenance	• Periodic inspection and repair of damage • Vacuum sweep and pressure wash 4 times/year
Permeable/ porous asphalt	Yes	$$$	8 years	• Allows stormwater infiltration and groundwater recharge • Reduced heat island effects • Lower cost than traditional asphalt	• High initial installation costs • Potential for clogging • Limited load capacity • Need for regular/specialized maintenance	• Periodid inspection and repair of damage • Vacuum sweep and pressure wash 4 times/year • Patch potholes as needed

Type	Accessible	Relative Installation Cost	Durability	Benefits	Challenges	Maintenance Needs
SOFT SURFACE						
Crushed rock with fines (e.g., decomposed granite or DG)	Yes*	$$	10 years	• Holds up well under heavy use • Relatively inexpensive to install • Can accommodate most users if crushed and compacted properly • Provides a softer surface for runners	• Prone to erosion and drainage issues • Can be difficult to walk on and to travel with small, hard-wheeled devices like wheelchairs, skateboards, roller skates • Can create dust • Difficult to meet ADA surface standards	• Redress and recompact in areas with erosion or damage
Crushed rock with stabilizer, (e.g., Granitecrete, Park Tread, etc.)	Yes*	$$$	10-12 years	• Can last longer than crushed rock without stabilizer • Can maintain accessible standard better than crushed rock • Can withstand erosion better than crushed rock • Can reduce migration of the crushed rock material outside of the designated path	• Can be cost prohibitive • Requires specialized installation and maintenance • Overtime, can still unravel and migrate outside of the designated path	• Periodic inspection and repair of damage • Can require patching similar to hard surfaces
BOARDWALKS (Often used in sensitive or wetland areas)						
Timber boardwalk (e.g., redwood, cedar decking)	Yes	$$$	10-20 years, longer with more durable foundations	• High aesthetic value • Renewable resource • Redwood decking can be locally sourced • Gaps between boards can allow for permeability and minimal light transmittance below the deck	• Can be slippery in shady and wet conditions; slip resistant materials (e.g., anti-slip decking paint, matting, or tape) • Not ideal for biking or other wheeled devices such as wheelchairs if not well-maintained • Weather exposure can impact the lifespan • Pressure-treated timber uses chemicals	• Periodic inspection and repair of damage • Regular power washing, sealing, repairs; depending on climate and nearby vegetation, every 1-3 years
Composite decking	Yes	$$$$	25-30 years	• More resistant to UV and water damage • Considered to be more environmentally friendly if made of recycled materials	• Can heat up quickly • Can becomes slippery when wet • Structurally weaker than timber; may be appropriate for high trail user volumes	• Clearing and occasional repairs • Requires less regular maintenance than timber decking

Type	Accessible	Relative Installation Cost	Durability	Benefits	Challenges	Maintenance Needs
Composite decking	Yes	$$$$	25-30 years	• More resistant to UV and water damage • May be considered environmentally friendly if made of recycled materials	• Can heat up quickly • Can becomes slippery when wet • Structurally weaker than timber; may not be appropriate for high trail user volumes • Introduces plastic into the environment	• Cleaning and occasional repairs • Requires less regular maintenance than timber decking
Metal and fiberglass grating	Yes, if the size of the grate openings meet the PROWAG guidelines	$$$$	15+ years	• Allows light transmittance for plant and wildlife below the boardwalk structure • Fully permeable • Elevated structure minimizes impact to water flow	• Can be slippery if slip resistant materials are not used • Can be expensive • Can require specialized installation • Material selection should consider use and environmental factors	• Regular cleaning and replacement of any damaged or rusted parts • Clearing of vegetation that might grow up through the grating

*When installed properly as firm and stable

References with additional information on trail surfacing options:

- Microsoft Word - National Trail Surfaces Study Final Report.docx
- What's Under Foot? - Rails to Trails Conservancy | Rails to Trails Conservancy
- https://www.railstotrails.org/wp-content/uploads/2024/01/National-Trail-Surfaces-Study.pdf
- https://www.como.gov/wp-content/uploads/2021/02/choosing-trail-surface-presentation.pdf

Trail Width

Determining Trail Width

- Trail width is based on context.
  - **People** factors include user safety, mobility, and comfort, or deciding a user group to prioritize.
  - **Place** factors include scenic, aesthetic, historic, physical, and cultural resources, and ecosystem and landscape protection.
  - **Purpose** factors include project goals and objectives.
- Trail width (without shoulder) may vary from 12 feet to 30+ feet wide, with a recommended starting width of 16 feet. See **Table 4** for guidance on determining width. Note that some current trail segments may not meet standards.
- **Table 4** also describes the application and functionality of trail width ranges.

EQUITY TIP

- For people who use wheelchairs or other mobility devices and people who use sign language, wider trails allow them to travel side-by-side and be social with their companions, while also enjoying the view and experience the setting.

TABLE 4 Trail Width Ranges

Trail Width		Design Factors
Constrained trail width	**12–15ft** (16–18ft with shoulders)	• Narrower widths may be appropriate where right-of-way or other physical constraints make providing the preferred width infeasible. • Narrower trails can result in decreased comfort, safety, and functionality and thus should only be considered in constrained conditions or for limited distances.
Typical trail width	**16ft** (22ft with shoulders)	• The typical trail width allows all people to use the trail socially: walking side-by-side, wheelchair users side-by-side, deaf users signing to each other side-by-side, or biking side-by-side, while also allowing people to pass, gather, and fully participate in this community asset. • Note that trail width is context-dependent and that 16 ft is the preferred starting point.
High-use trail width	**20–30+ft** (more than 24ft with shoulders)	• Based on context, expected use (accounting for future volumes), and other unique purposes of a Bay Trail section, a wider trail should be used when the mix or volumes of trail users, such as a higher percentage of bicyclists, has the potential to create user conflicts or degrade the experience of other trails users. A wider trail is also needed for unique situations, such as plazas, promenades, commercial development, ferry terminals, and other situations. See Trail and Separation of Users, following, for more guidance.

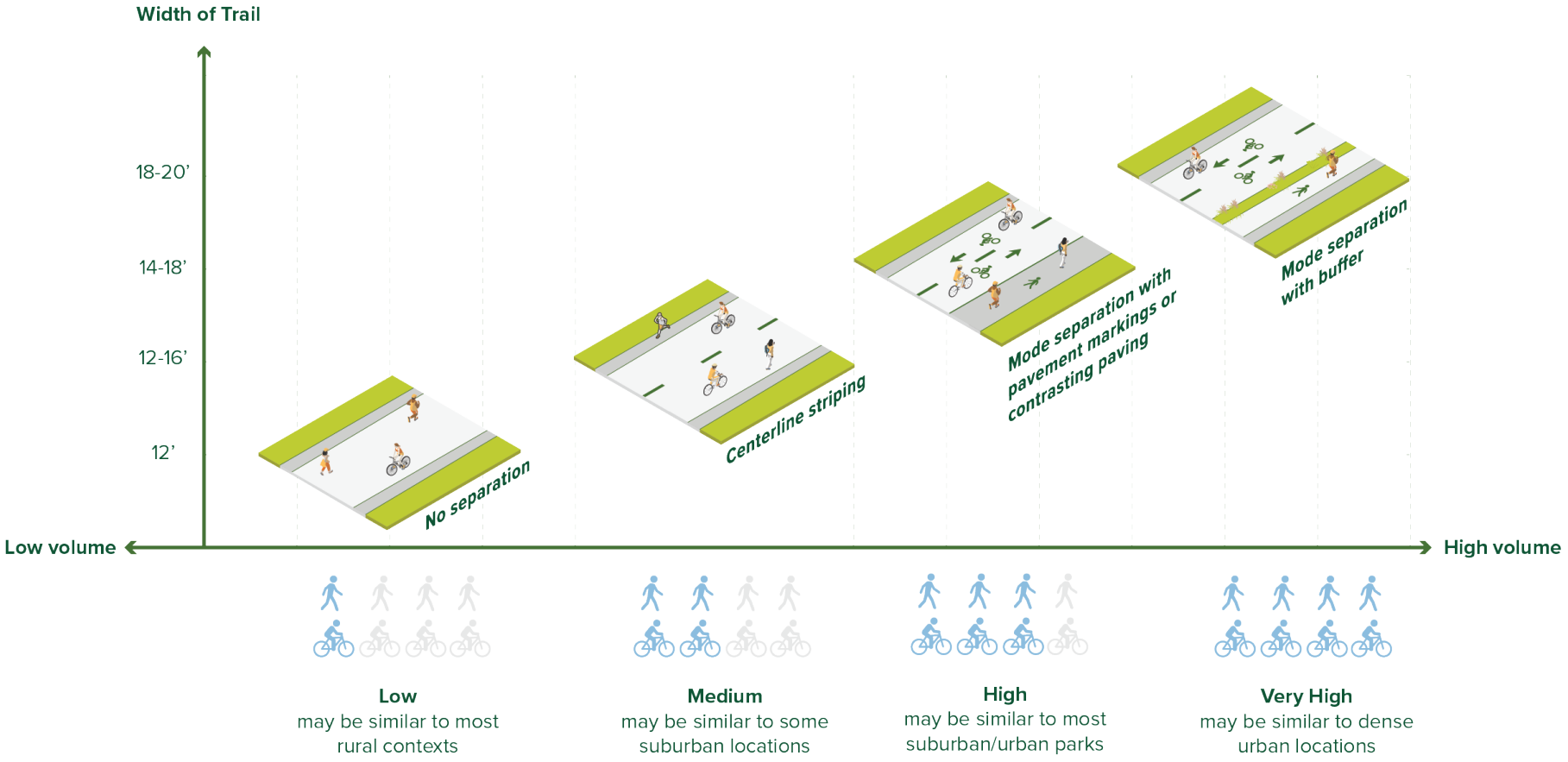
Trail Width and Separation of Users

Where there are higher volumes of faster-moving wheeled uses (such as bicycling, skateboarding, and skating), wider trail widths, along with separation of wheeled users from slower-moving pedestrian users, can both facilitate ease of use and prevent conflicts due to travel speeds.

Separation can be created through striping, surfacing, or separated paths. **Figure 6** shows a scalable approach to trail width and separation based on user volumes and mix.

The graphic below refers to user counts. Recognizing that bicycle/pedestrians counts are not done regularly by agencies, the following examples below may give a better sense of trail volumes as they relate to trail widths.

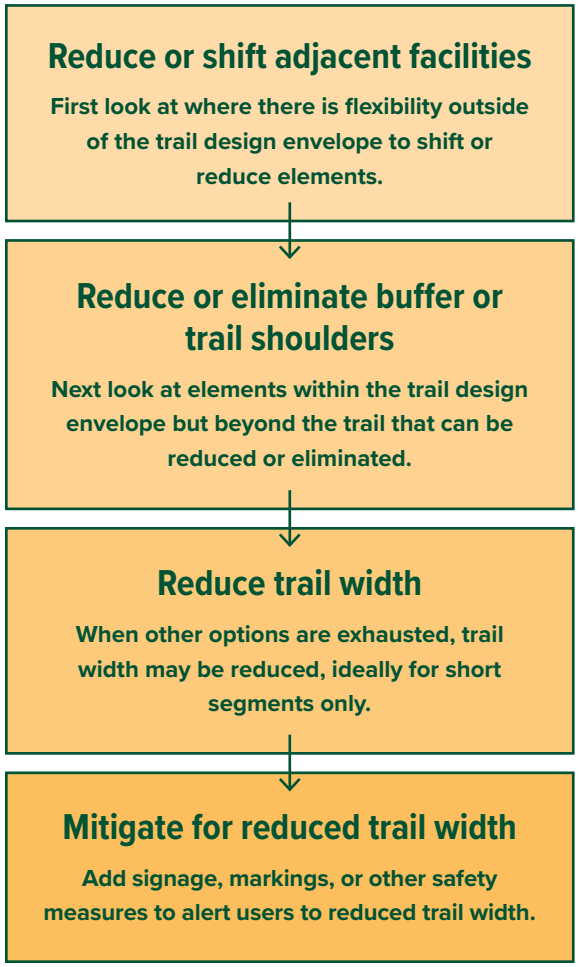
FIGURE 6 Approach to Trail Width and Separation of Modes



Trail Width in Constrained Conditions

In areas where physical constraints or other conditions make it challenging to provide the preferred trail width, designers should prioritize trail width over other elements. Figure 3 details a design approach for maintaining trail width in constrained conditions. However, reducing trail width should be the last resort.

FIGURE 7 Design Approach for Adapting to Constrained Conditions

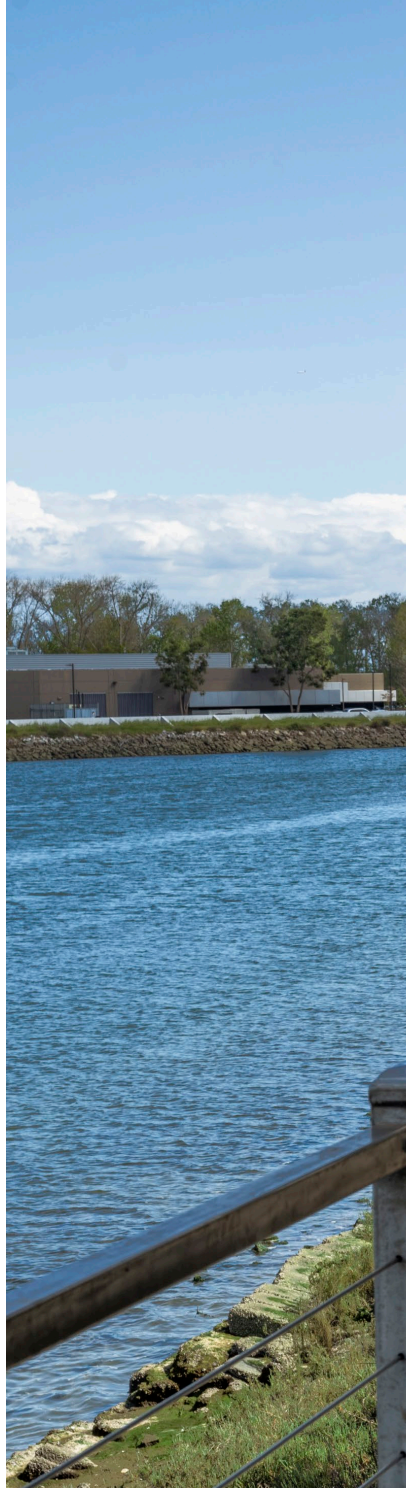


Other Constrained Conditions

Though not ideal, there are highly constrained corridors where a Class I facility will not fit within the existing right-of-way. Under these conditions a less optimal design approach is taken. Class IV bikeways with sidewalks are the preferred facility for providing a trail-like experience for Bay Trail users. Where Class IV bikeways and sidewalks are not feasible, sidewalks along with Class II bike lanes, Class II bike lanes with buffers, or Class III (bicycle boulevards) facilities may be used to provide connectivity for trail users.

It is important to note that to align with MTC's Complete Streets Policy -- "Projects on the AT Network [including all of the Bay Trail] *shall* incorporate design principles based on designing for "All Ages and Abilities," contextual guidance provided by the National Association of City Transportation Officials (NACTO), and consistent with state and national best practices." This includes consideration of roadway context, including target motor vehicle speeds, maximum motor vehicles volumes, the number of motor vehicles lanes, and other considerations in facility selection.

MTC does not support the removal (and/or consolidation) of FHWA's Proven Safety Countermeasures, including but not limited to marked crosswalks, bicycle lanes, and other pedestrian facilities, as removal of these elements is not consistent with the MTC complete Streets Policy and the Bay Trail Plan.



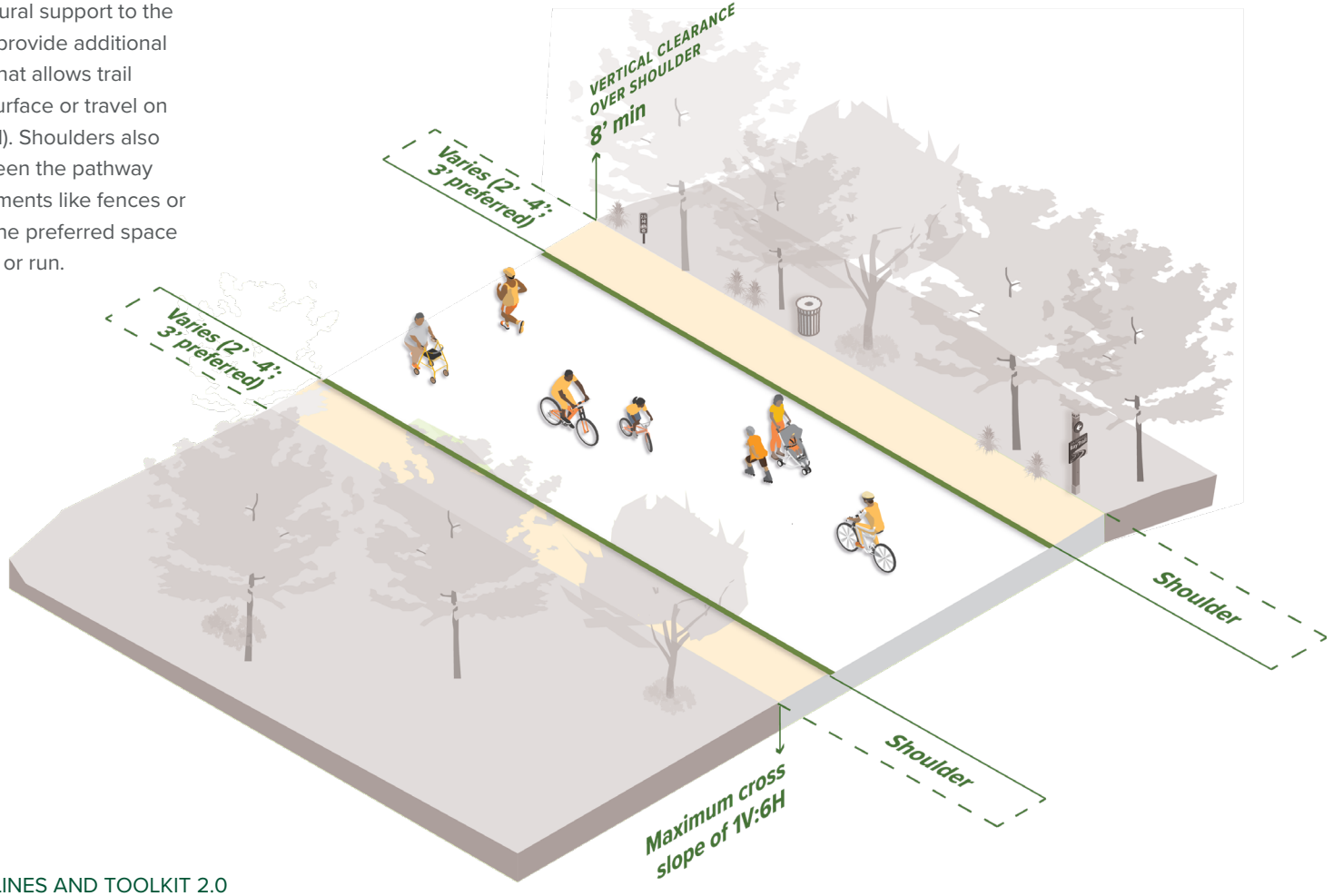
Blu Harbor, Redwood City

Shoulders

The functional edge of the trail and supplemental space.

Purpose

- Trail shoulders serve as the functional edge of the paved trail, providing structural support to the edge of the paving. Shoulders provide additional maneuvering or refuge space that allows trail users to pull off the main trail surface or travel on softer surfacing (when unpaved). Shoulders also provide necessary space between the pathway and landscaping or vertical elements like fences or walls. Shoulders may also be the preferred space by some people who walk, jog, or run.



Design

- **Width:** Three feet is the average shoulder width; however, the shoulder width typically can vary from 2 to 4 feet. Shoulders should be designed in conjunction with horizontal and vertical clearances, noting that clearances from vertical elements are measured from the edge of the shoulder surfacing/tread.
- **Material:** Stabilized natural surface shoulders are most common. If shoulders are paved, they should be indicated with longitudinal pavement striping or use a visually contrasting material to distinguish them from the trail.
- **Grades:** Shoulder grades should match the grades of the adjacent trail and should never exceed accessibility standards.
- **Vertical clearance:** A vertical clearance of at least 8 feet is required over trail shoulders.
- **Additional design:** Trail shoulders are considered part of the travel route and should be clear of all obstructions such as trees, bushes, large rocks, poles, and other structural elements.

EQUITY TIPS

- Unpaved shoulders provide a softer surface for runners, lessening the impact on their bodies.
- Adequate clearances over trail shoulder are an important accessibility factor that ensures people with vision disabilities can use the trail without risk of encountering obstructions.

RESILIENCE TIP

- Consider specifying flush concrete header curbs (unless the trail is concrete) along the trail edge to reduce maintenance and retain integrity over time.

Oyster Point, South San Francisco


Foster City Levee, Foster City

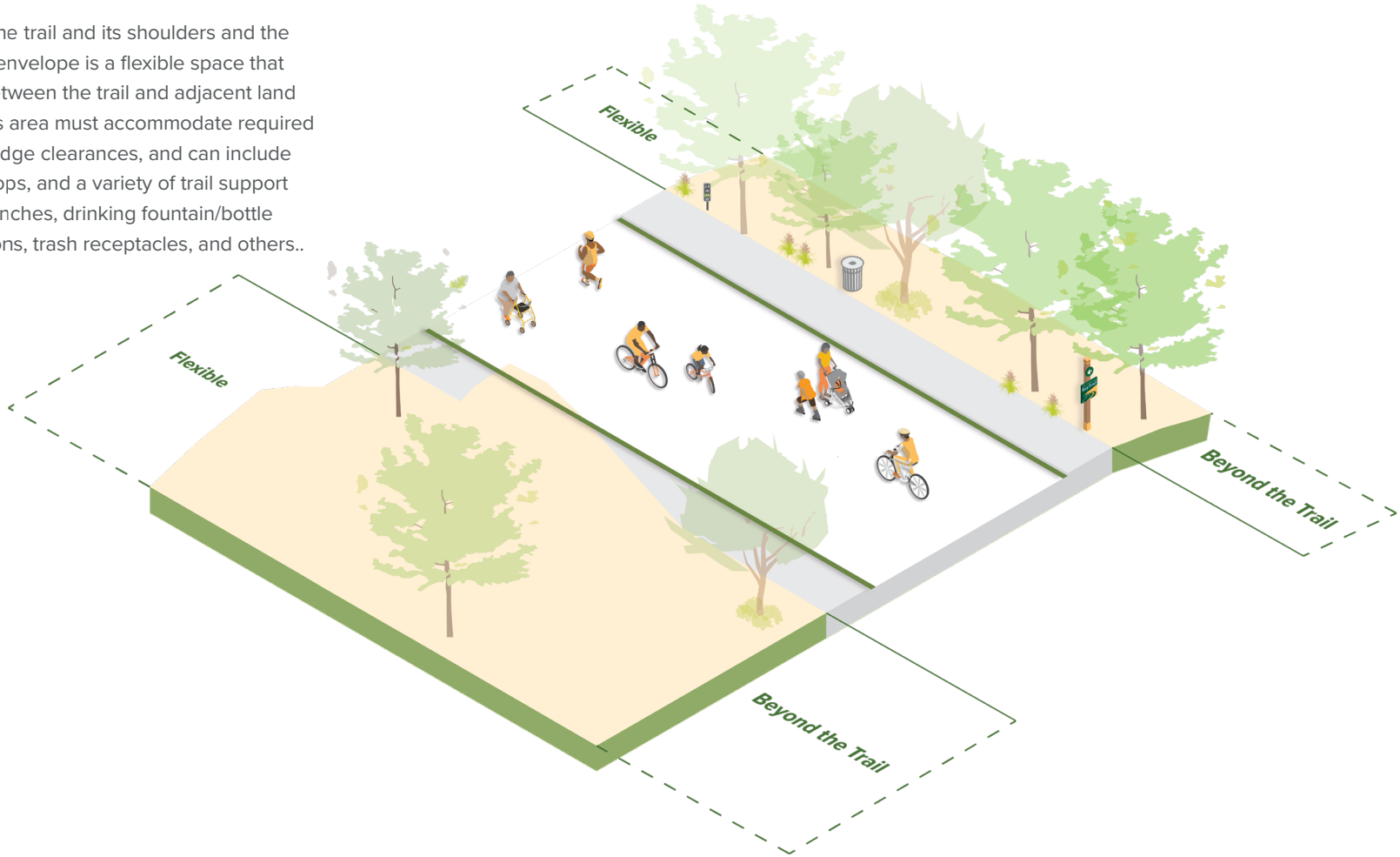

Don Edwards SF Bay National Wildlife Refuge, Fremont

Beyond the Trail

The space between the trail and the edge of the trail design envelope.

Purpose

The area between the trail and its shoulders and the edge of the design envelope is a flexible space that provides a buffer between the trail and adjacent land uses or the bay. This area must accommodate required overhead and trail edge clearances, and can include landscaping, rest stops, and a variety of trail support facilities, such as benches, drinking fountain/bottle refill/dog bowl stations, trash receptacles, and others..



Design

- **Width:** Widths will vary based on context, considering the following:
  - When the trail is adjacent to roadways, there should be at least 7 feet minimum between the trail and roadway.
  - If a 7-foot buffer cannot be accommodated, a fence or other physical barrier should be included to prevent the Bay Trail user from straying into the street. Physical barriers should be used 3 feet from the outside edge of the shoulder of the paved trail.
- **Grades:** Side slopes, which are the spaces beyond the trail and shoulder, should be designed for safety as well as trail structure, as follows:
  - Fill slopes: 1 vertical to 3 horizontal or flatter
  - Cut slopes: 1 vertical to 6 horizontal or flatter
- **Distance to Obstructions:** Clearances must be met to enable trail user movement and avoid potential hazards.
  - **A horizontal clearance** of at least 2 feet from the edge of the trail is required. Horizontal obstructions can include light poles and signs; fences and walls, railings; trees and landscaping; utility grates, drains, and other utility elements. Utility grates and drains should not be placed within the trail area, but if they are, they should be ADA-compliant and bicycle-safe.
  - **A shy distance** of 2 to 3 feet from continuous vertical elements like walls or fences is recommended to minimize crash risk and increase trail user comfort:trails users instinctively avoid proximity to continuous vertical elements. Narrower shy distances can result in reduced effective operating space. Use a white edge line to identify the edge of the operating space in relation to the vertical element.
  - Obstructions within the trail should be avoided, but if not possible, should be clearly marked. Refer to **Section 3.5: Trail Support Facilities** for obstruction striping.
- **Barriers Near Hazardous Conditions:** Where the trail is adjacent to water bodies or steep slopes or where the shoulder and adjacent clearance space is less than 5 feet combined, a continuous physical barrier, railing, or fence is recommended. A slope of 1 vertical to 3 horizontal or steeper and a drop of 6 feet or greater is considered steep. Note that in general BDCD does not advise fencing or barriers next to or along the Bay.
  - A slope of 1 vertical to 2 horizontal or steeper and a drop of 4 feet or greater
  - A slope of 1 vertical to 1 horizontal or greater and a drop of 1 foot or greater
  - Refer to **Section 3.5 Trail Support Facilities** for additional guidance on barriers.
- **Placemaking:** Landscaping, site furnishings, art, and other trail support facilities may be incorporated in this space:
  - Refer to **Section 3.6 Landscape and Ecological Design** for guidance on planting design.
  - Refer to **Section 3.4 Location-Specific Design Treatments** for guidance on the placement and design of site furnishings and other trail support facilities.

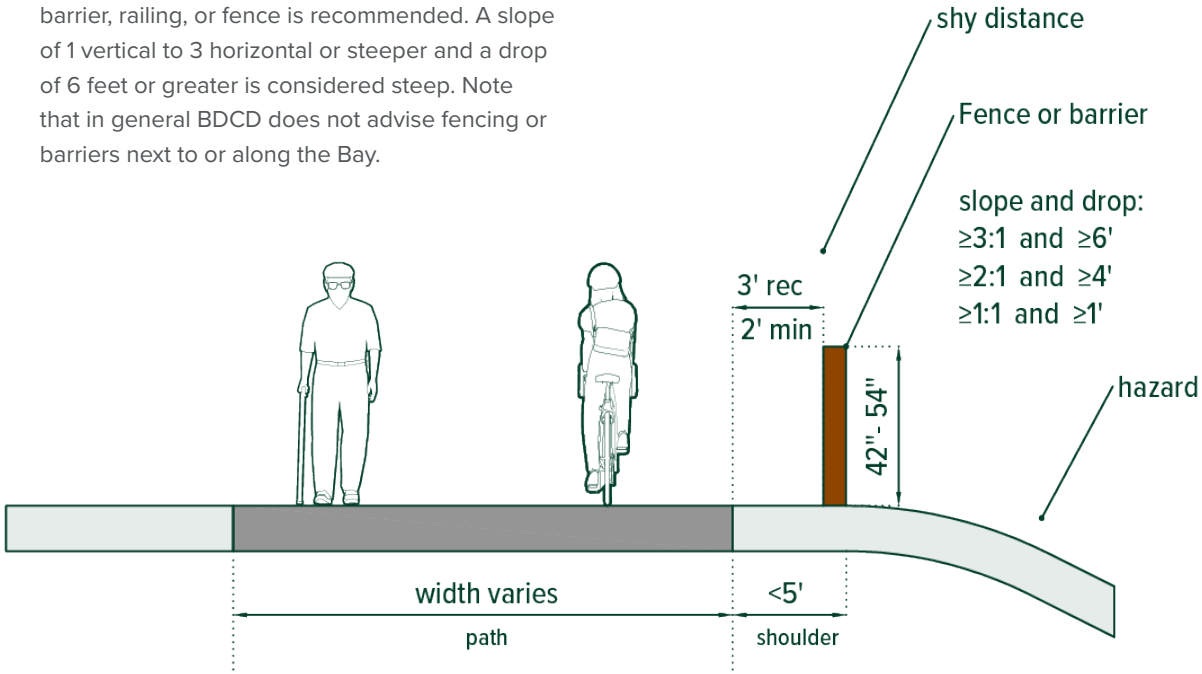


FIGURE 8 Barriers Near Hazardous Conditions

3.2 The Bay Trail Typology

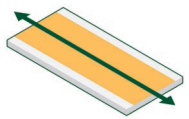
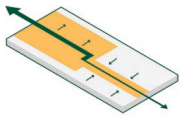
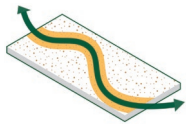
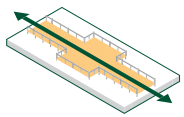
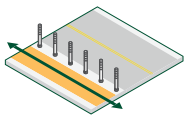
Typology Overview

The Bay Trail system is made up of a variety of trail conditions, including varied widths, surfaces, and other design details. The following typology describes how the Bay Trail responds to typical contexts. The typology comprises five trail types: four off-street and one on-street. They represent a spectrum of alignments that use the standard Bay Trail design criteria. It is important to note that the types can be mixed and matched, e.g., an area may consist of Standard Bay Trail with short segments of Constrained, Unpaved, or Elevated Bay Trail in order to respond to site conditions. **Table 5** provides a summary of types. Each type is described in greater detail on the following pages.

See **Section 3.1: Bay Trail Cross-Sectional Building Blocks** for more information on on-street variations.

The **Section 2.3: Designing for Place** explores critical design considerations by context. This section clarifies which trail criteria should be consistent through the system, and where flexibility within those design criteria is permissible given the context.

TABLE 5 Bay Trail Typology

	Standard Bay Trail	Constrained Bay Trail	Unpaved Bay Trail	Elevated Bay Trail	On-Street Bay Trail
Facility Type	Off-street Class I shared use path	Off-street Class I shared use path	Off-street shared use path (unpaved)	Off-street Class I shared use path	On-street Class IV bikeway (separated bike lanes) and sidewalks/wide sidewalks
Description	Ideal cross-section without any constraints 	Constrained cross-section that meets most standard design criteria 	Unpaved surface 	Raised trail surface above grade to avoid water, wetlands, or other sensitive areas 	High comfort biking and walking facilities where Class I trail is not feasible* 
Context	Any	Any	Typically, open space or coastal, can include remote areas	Wetlands and sensitive habitats	Any, alternative cross-section where off-street alignment is not feasible

Standard Bay Trail Design Criteria

Caltrans Design Criteria
Meets Caltrans Design Criteria for Class I or Class IV bikeways and is thus separated from vehicular traffic.

Accessibility
Meets accessibility requirements in terms of the width, surfacing, and grades of the pedestrian access route (PAR) (see **National Standards and Resources**). Is accessible to users of all ages and abilities and all forms of non-motorized use, for recreation and transportation.

Connectivity
Provides continuous and seamless transitions to adjacent segments of the Bay Trail (the spine and spurs), other regional trail systems, and on-street biking and walking networks (connector trails).

Equitable Access
Enables equitable access to opportunities and resources through direct connections to adjacent cities, activity centers, parks and recreation areas, and public transit facilities (including BART, Caltrain, SMART, local light rail, bus, and ferry).

Consistency
Maintains a consistent facility type.

Context and Users
Considers trail user characteristics and needs, mix of users, and responds to local context.

Emergency Access
Generally, is wide enough to accommodate emergency and maintenance vehicle access, in addition to trail users. Note that this may not be feasible in certain conditions, such as levee top segments of the trail. The trail cross-section is based on geotechnical recommendations that emphasize durability and accommodate occasional use by these vehicles.

Structures along the Bay Trail, such as bridges, viaducts, and boardwalks, are designed to carry service and emergency vehicles.

Lighting, where appropriate, includes emergency fire egress requirements from nearby buildings.

Flexible Bay Trail Design Criteria

Depending on context, the Bay Trail may also:

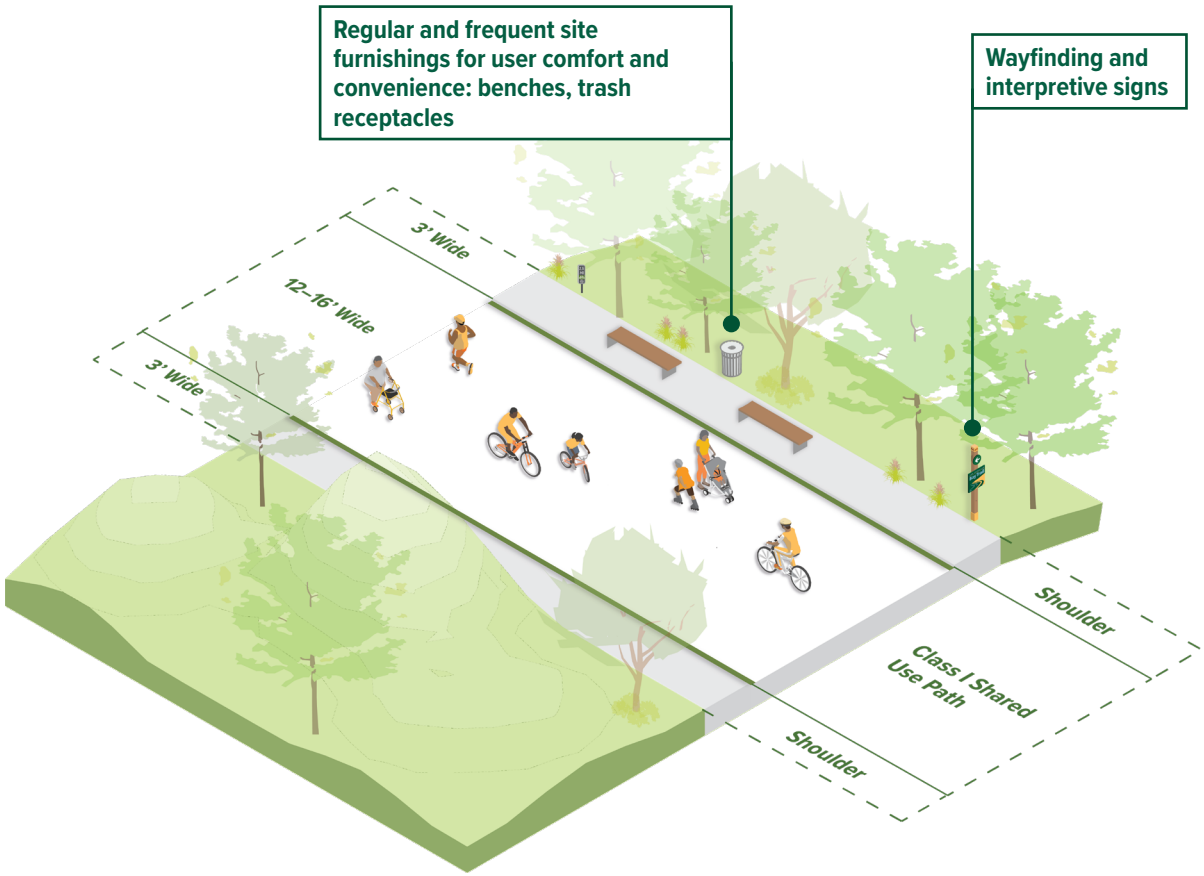
- Have narrower trail width, shoulders, or buffers in response to site constraints.
- Have permeable surfacing or be elevated in certain contexts.
- Consist of on-street bicycle and complementary ADA-compliant pedestrian facilities (e.g., Class IV bikeway with sidewalks or promenades) where a Class I is not feasible.
- Feature quick build treatments.

Dotson Marsh, Richmond

The Standard Bay Trail

Ideal cross-section	
FACILITY TYPE	Class I shared use path
CONTEXT	Varies; generally, all contexts. Includes trails upon levees.
DESIGN	Standard cross-section: • Meets and exceeds all Caltrans Class I Bikeway design criteria • No constraints limit trail width, shoulders, surfacing • Includes buffers, ideally with landscaping • Note that existing segments may not meet these requirements • Context-responsive features (see Section 2.3: Designing for Place)
SUPPORT FACILITIES	• Occasional rest stops • Regular and frequent seating for user comfort and convenience: benches, picnic tables, and places to gather • Wayfinding and interpretive signs • Access to drinking fountains/ bottle refill/dog bowl station and restrooms wherever feasible • Waste and recycling receptacles (including pet waste stations) • Bike repair stations

Albany Beach, Albany



The Bay Trail on Levees

Levees are a complex topic and must be permitted through the Bay Conservation and Development Commission (BCDC). The information described below is for illustrative purposes only and is not to be used for design purposes. This information is included in this guidance document because several sections of the Bay Trail are on top of levees and it is important for regional partners to understand this topic at a high-level.

Design Considerations

Most levee corridors are long and scenic with few road crossings, which make them attractive for trails. A levee crown can typically accommodate trail use, but this use needs to be balanced with the levee's primary function as critical infrastructure. Below are a few considerations specific to designing trails on levees. See **Chapter 4: References** for more levee resources.

- **Maintenance:** While maintenance is not strictly a trail maintenance topic, it is important for regional partners to understand this topic broadly. Ongoing levee maintenance may include road/trail repair, vegetation management, maintenance of fencing, gates, signs, and water control facilities. Major maintenance of the levee structure sometimes occurs as part of a major Capital Improvement Program (CIP), and may include opportunities for additional trail development and improvements.
- **Access:** Because levees are, by design, significantly higher than the surrounding land, a trail-top levee may require ramps or switchbacks for access from adjacent trail connections. Ramps on the waterside slope can also be included to allow access to the water (where allowed). These ramps must be designed to prevent impacts to the levee structure.
- **Trail Surface and Trail Support Facilities:** Just as with other segments, the design of a trail (including the surface materials, width, and support facilities) on a levee should respond to the people, place, and purpose of that segment. In all cases, the design must avoid impacts to the internal structure of the levee.
- **Note on trail width:** Because of the trapezoidal design of most levees, adding width at the top will require significant widening at the bottom of the levee, which may or may not be desirable or feasible.
- **Views, Plants, and Wildlife:** Levees trails are an opportunity to provide views, plant and wildlife restoration and protection, and nature-based shoreline stabilization.
- **Vegetation:** Larger vegetation, such as trees and shrubs, may not be feasible if they have the potential to undermine the internal structure of the levee. Smaller vegetation, such as native grasses and ground covers, may be allowed and can infiltrate rainwater runoff and reduce erosion. Coordinate with project engineers and relevant agencies to determine limitations on planting and irrigation.
- **Other Considerations:** Design must consider wave action, tidal inundation, and sea level rise. Trail placement next to or on the side of the levee may also be an option, depending on the levee structure, location, and expected trail use.

What is a Levee?

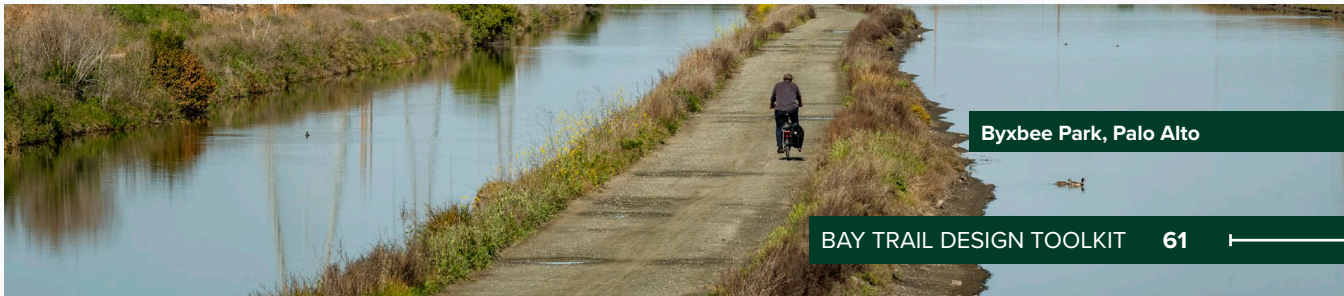
A levee is a long, linear structure built to control flood water, protect from sea level rise, storm surges, and wave run-ups, manage water levels in the salt ponds, and/or create habitat areas. Levees may be made from a combination of soil, rock, and/or concrete. Parts of a levee include:

- **Crown** – top of the levee; usually flat for use by maintenance vehicles
- **Slope (waterside or land-side)** – sides of the levee; may be mostly under water (waterside) or out of water (land-side)
- **Toe (waterside or land-side)** – bottom of the levee where it connects to the non-levee surface

Environmental Permitting

In addition to meeting all applicable local, state, and federal codes, work done on a levee will require other agency permits inculding, but not limited to:

- San Francisco Bay Conservation & Development Commission (BCDC)
- US Army Corps of Engineers (USACE) Section 408
- National Environmental Policy Act (NEPA)
- California Environmental Quality Act (CEQA)
- Endangered Species Act, Section 7
- National Historic Preservation Act, Section 106
- Clean Water Act (CWA) Section 404
- California State Water Resources Control Board

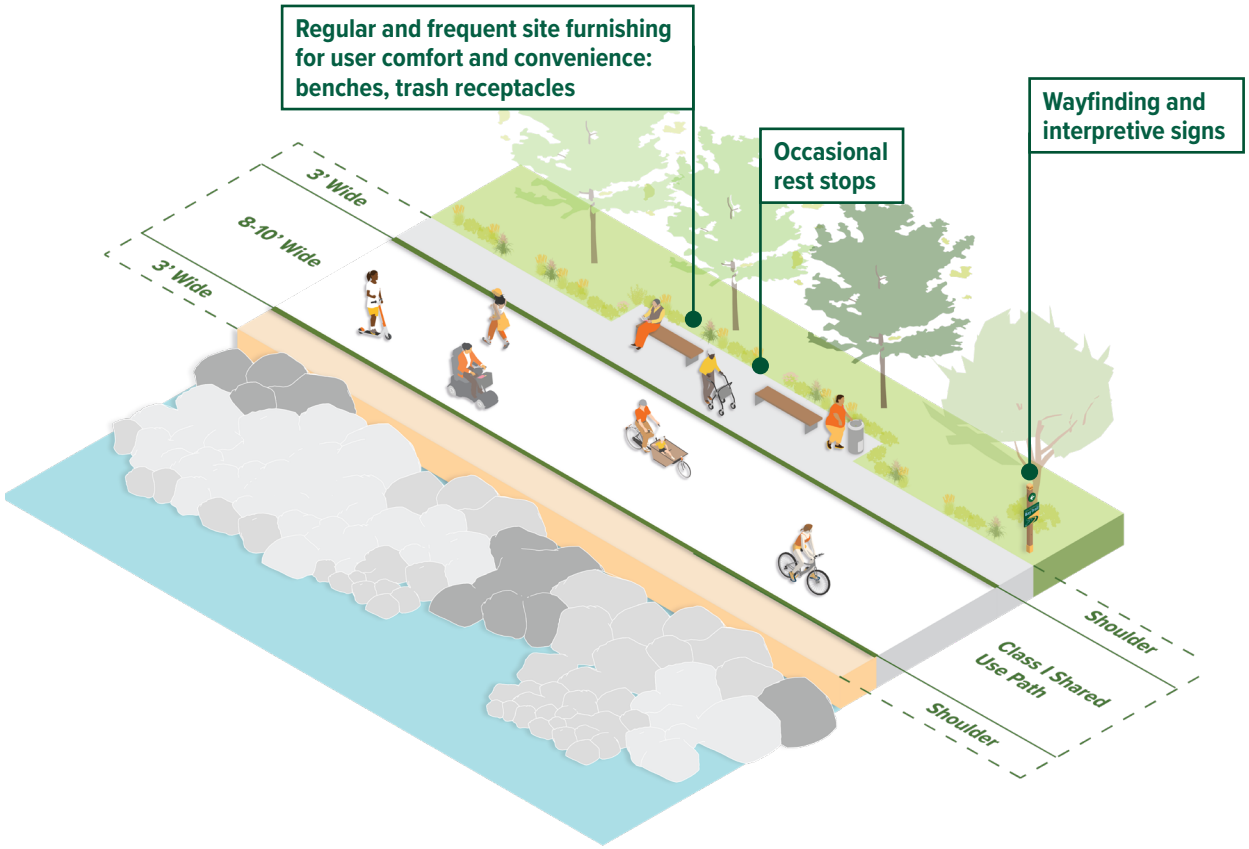


Byxbee Park, Palo Alto

The Constrained Bay Trail

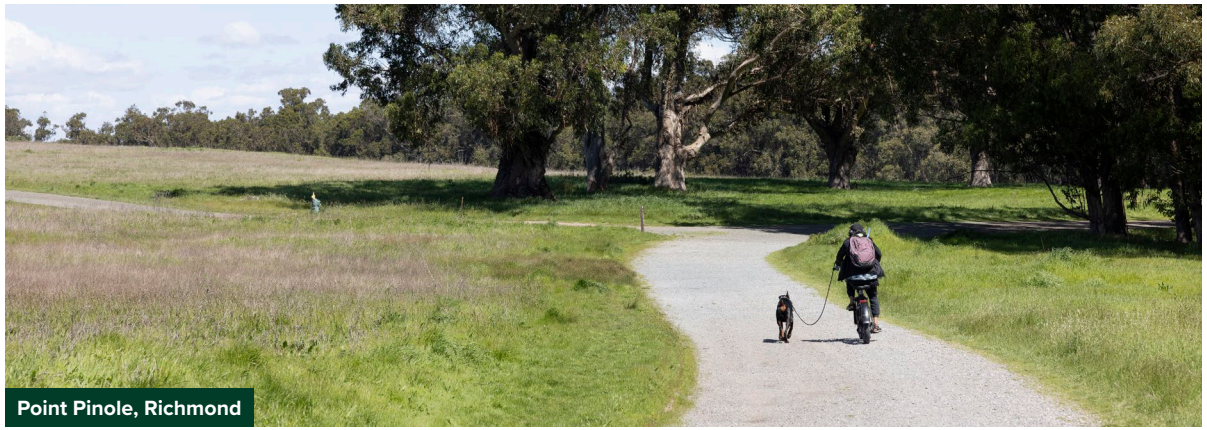
Cross-section with minor constraints	
FACILITY TYPE	Class I shared use path
CONTEXT	Select contexts with site constraints
DESIGN	Standard cross-section: • Meets critical Caltrans Class I Bikeway design criteria • May have narrower width, pinch points, lack shoulders or trail support facilities, or other design compromises that respond to contextual constraints • Design compromises should reflect priorities of the Design Approaches for Adapting to Constraints (see **Figure 7.**)
SUPPORT FACILITIES	• Regular and frequent seating for user comfort and convenience: benches, picnic tables, and places to gather occasional rest stops • Wayfinding and interpretive signs • Access to drinking fountain/ bottle refill/dog bowl stations, bike repair stations, and restrooms wherever feasible • Waste and recycling receptacles (including pet waste stations)

Blu Harbor, Redwood City

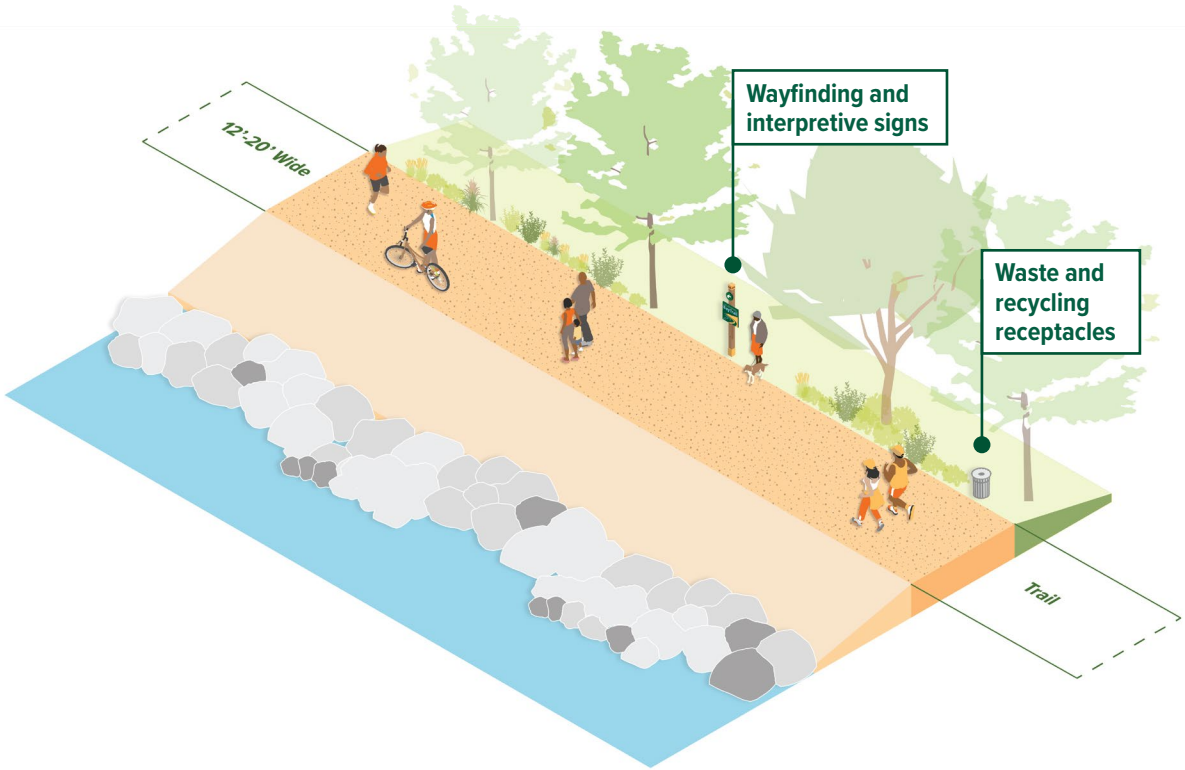


The Unpaved Bay Trail

Trail segments that are unpaved due to site conditions or constraints	
FACILITY TYPE	Class I shared use path
CONTEXT	Select locations, such as areas for habitat restoration or sensitive critical areas
DESIGN	• Alternative cross-section that meets all key Caltrans Class I Bikeway design criteria • Must have firm, stable, slip-resistant surfacing, such as stabilized natural surfacing. Facility owners are responsible for maintaining the natural surface.
SUPPORT FACILITIES	• Seating for user comfort and convenience: benches • At trailheads and staging areas: drinking water and restroom facilities • Wayfinding and interpretive signs • Waste and recycling receptacles (including pet waste stations) – likely only at trailhead locations in sensitive habitat areas



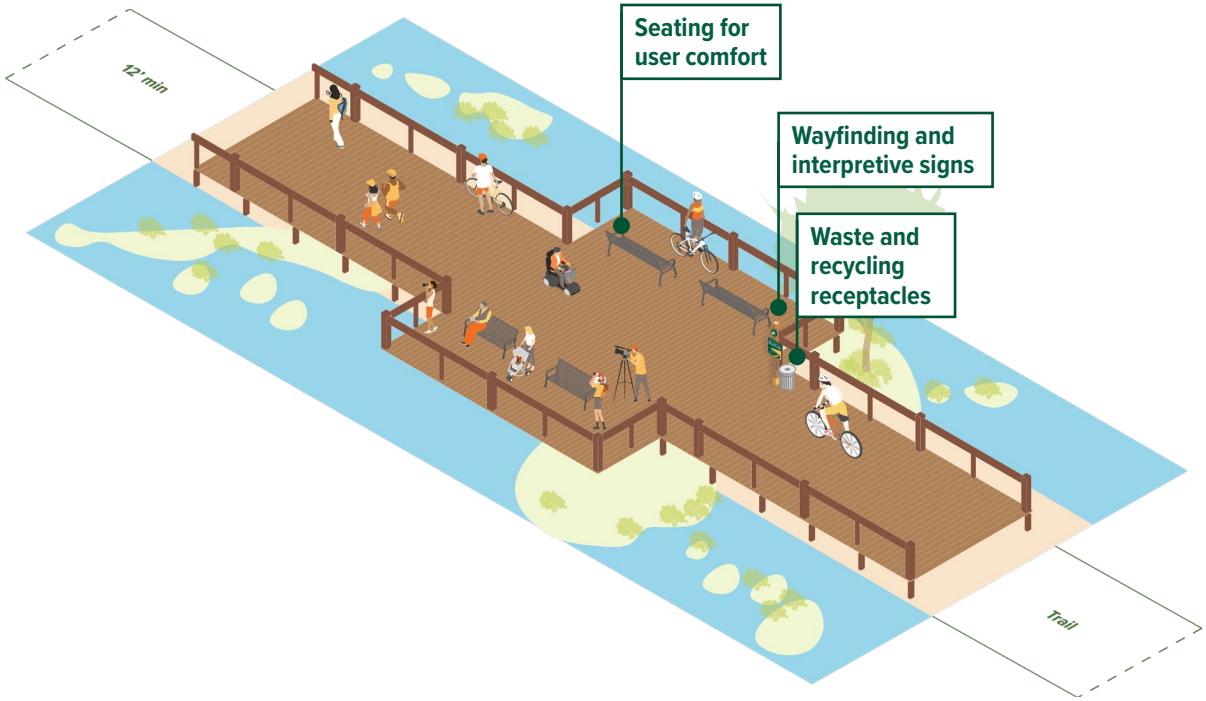
Point Pinole, Richmond



The Elevated Bay Trail

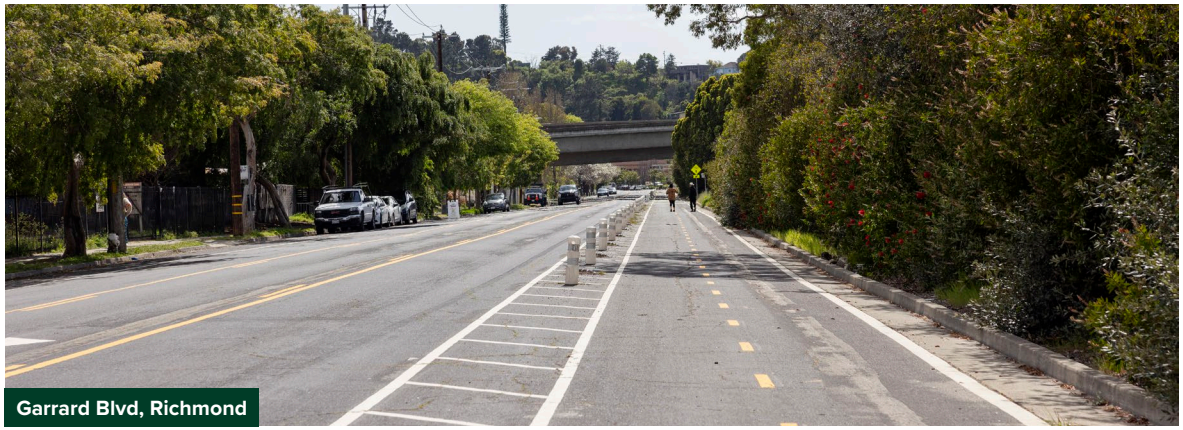
Trail that is raised to avoid water, wetlands, or other sensitive areas	
FACILITY TYPE	Class I shared use path
CONTEXT	Select locations, such as habitat restoration or sensitive critical areas
DESIGN	• Special condition cross-section: • Meets critical Caltrans Class I Bike Path design criteria • Cross-section reflects place-based design responses • Structure intended to be "light on the land" – resting on piers • May include causeways, boardwalks, metal walkways, or alternative trail surfacing and widths • May or may not need to be designed to carry vehicles
SUPPORT FACILITIES	• Seating for user comfort and convenience: benches • At trailheads and staging areas: drinking water and restroom facilities • Wayfinding and interpretive signs • Waste and recycling receptacles (including pet waste stations) – likely only at trailhead locations in sensitive habitat areas • Bumpouts can be used to provide seating and other support facilities

Dotson Marsh, Richmond

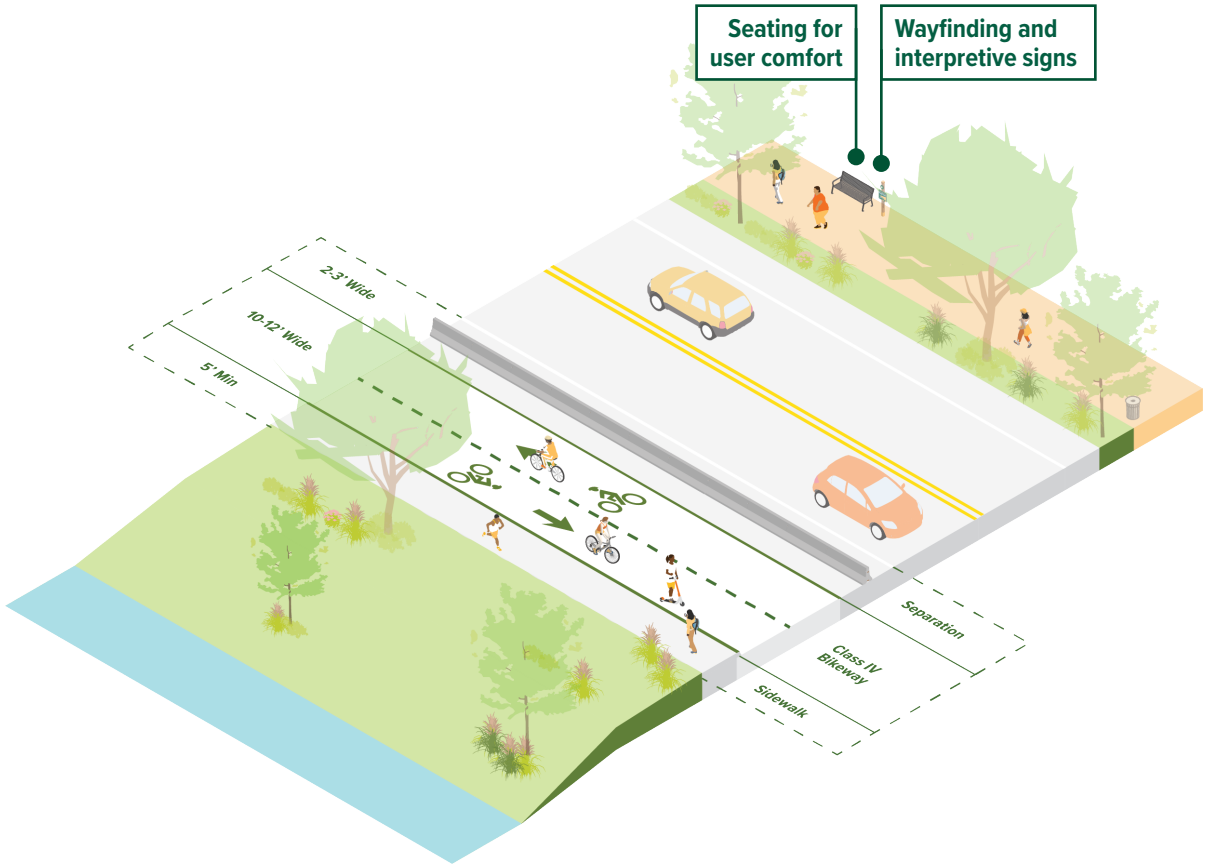


The On-Street Bay Trail

High-comfort on-street biking and walking facilities	
FACILITY TYPE	Class IV separated bikeways (separated bike lanes, bi-directional or two-way) and adjacent sidewalks/ wide sidewalks
CONTEXT	Conditions where Class I shared use paths are not feasible. Emphasis on safety and comfort to ensure an "All Ages and Abilities" (AAA) network.
DESIGN	• Design criteria per Caltrans DIB-89 • Class IV bikeways may be either bi-directional or two-way; separation methods will vary based on context. • This typology can be implemented in a quick-build manner, closing Bay Trail gaps to align with the goals and design principles of the Bay Trail. See Section 3.3: Quick-Build Variations for more details. • Any designs that deviate from the recommended guidance should be brought to MTC/ABAG for review and discussion to ensure consistency and appropriate safety countermeasures are included in the project to support the AAA network included in MTC's Complete Streets policy.
SUPPORT FACILITIES	May include some support facilities within the public right-of-way: • Wayfinding signage • Seating, such as benches • Waste and recycling receptacles (including pet waste stations)



Garrard Blvd, Richmond



3.3 Linear Design Elements and Approaches

This section addresses linear trail design approaches and elements that are continuous along the trail. These elements fall into three categories: newly-constructed trail segments, retrofits, and quick-build projects, each of which requires a unique approach to design.

New Bay Trail Segments

This document does not replace or supplant any guidance from the San Francisco Bay Conservation and Development Commission (BCDC) or other regulatory agency. Always consult with BCDC on any portion of the Bay Trail that is within their jurisdiction. This high-level guidance is illustrative, not exhaustive, and is meant to prompt trail designers to think comprehensively about trail design.

General Siting Guidance

To create a safe and comfortable trail user experience, the trail should be sited away from high-volume noise sources and areas that create perceived safety concerns.

Siting Guidance for Habitat Protection

Design new segments of the Bay Trail to avoid unnecessary impacts to the diverse and valuable ecosystems the trail passes through (including wetlands, salt marshes, and riparian corridors), while striving to create and improve opportunities for public access and education that meet the Bay Trail vision and goals.

- Avoid fragmenting large habitat areas by aligning new trail segments around their edges rather than directly through them.
- Define and delineate places for people and places for wildlife. Provide designated trails with direct access to desirable areas to deter the creation of undesignated “social” trails, and prevent off-leash pets from moving through sensitive habitat areas.
- Strategically place buffer vegetation to physically separate Bay Trail users and highly sensitive habitats, while preserving and enhancing views of the Bay, ridgelines, and other waterways.
- Align trails to take advantage of existing physical barriers, such as drainage channels, to discourage users (and off-leash pets) from leaving the trail and entering sensitive habitats.
- Use existing crossings of streams, creeks, sloughs, and rivers where available and within reasonable travel distances rather than create new crossings. Where new crossings or wider bridges are required, design these elements to minimize impacts to habitat areas.
- Incorporate grading, planting, and seeding strategies that respond to the ecology of the site, either enhancing existing ecosystems or restoring lost ecosystems.
- Ecological design is discussed in more detail in **Section 3.6 Landscape and Ecological Design**.

RESILIENCE TIP

- Designing new trail segments provides the opportunity to holistically address resilience and ecological design. Many of the design treatments described in this section can be considered resilience tips.

Foster City Levee, Foster City

255 Airport Blvd, Burlingame

Resilience to Sea Level Rise

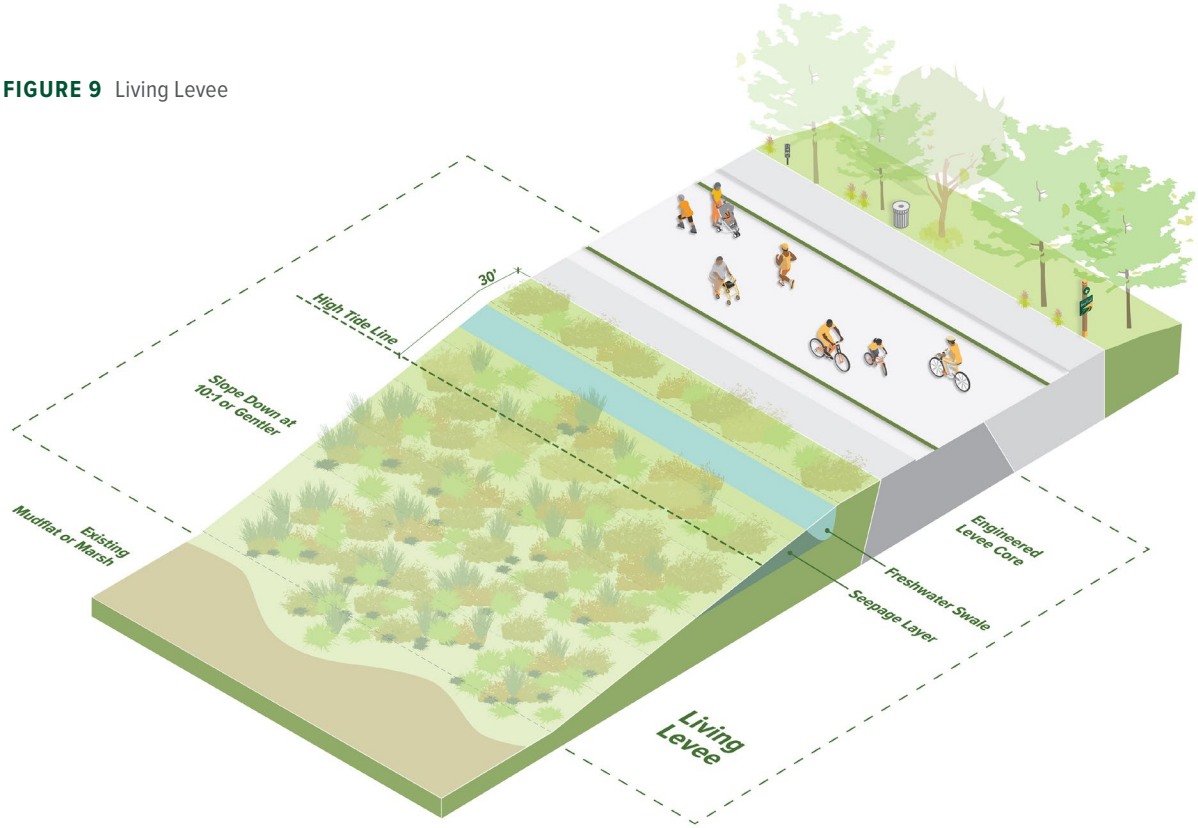
Every project near the Bay must consider how to address resilience and adaptation to sea level rise. Through the Regional Shoreline Adaptation Plan (RSAP), the BCDC provides a coordinated, actionable plan for how the Bay Area can adapt to rising seas and ensure the long-term resilience of its communities, infrastructure, and ecosystems. The RSAP sets the vision, framework, and guidelines for local governments to follow when planning for the impacts of sea level rise along the Bay's shoreline. Each segment of the Bay Trail may play a role in the implementation of this vision. Owners and operators of the Bay Trail must ensure the design aligns with the RSAP and all BCDC regulations.

Every Bay Trail project is unique, and the specific approach to resiliency is dependent on multiple factors. Here are three high-level ways that agencies and owners of the Bay Trail can address resiliency: elevate the trail, develop redundant trails, and manage trail retreat.

Elevate the Trail

- Set the Bay Trail alignment above the expected sea-level rise elevation associated with the segment's projected lifespan. Use the most current sea-level rise guidance from the Bay Conservation and Development Commission (BCDC).
- For existing Bay Trail segments that are at risk of sea level rise, raise the trail elevation above expected sea-level rise using an appropriate method for the specific conditions of the site.
- Examples of elevating the trail: boardwalk, horizontal levee, living levee, other levee, or a combination
- Always work closely with BCDC to ensure your project follows current policies, laws, and requirements.

FIGURE 9 Living Levee



Develop Redundant Trails

- Where an existing segment of the Bay Trail will be inundated by sea level rise, add redundant Bay Trail sections. Over time, this will allow the lower trail to be abandoned as the sea rises, while maintaining continuous public access via the Bay Trail.
- Examples: a lower trail with natural surfaces combined with a trail with hardened surfaces (ie, asphalt, concrete, etc.); in certain areas, the redundant trail may be an on-street facility (Class IV bikeway with wide sidewalks)
- Always work closely with BCDC to ensure your project follows current policies, laws, and requirements.

Manage Trail Retreat

- For existing and future Bay Trail segments, it may be necessary to manage the retreat of the trail from the edge of the Bay.
- When planning for managed retreat, it is critical to keep the Bay Trail as close to the Bay's edge as possible to meet the goals of the Bay Trail. It is also critical to maintain as many community connections to the Bay Trail as possible when planning for managed retreat.
- Always work closely with BCDC to ensure your project follows current policies, laws, and requirements.

General Linear Trail Design Approach

The Bay Trail aims to provide continuous linear travel. Design of the Bay Trail must consider all the dynamics involved with two-way circulation for bicyclists and pedestrians, including travel continuity, sight distances, turning movements, user interactions, traffic signs and signalization, and physical obstructions.

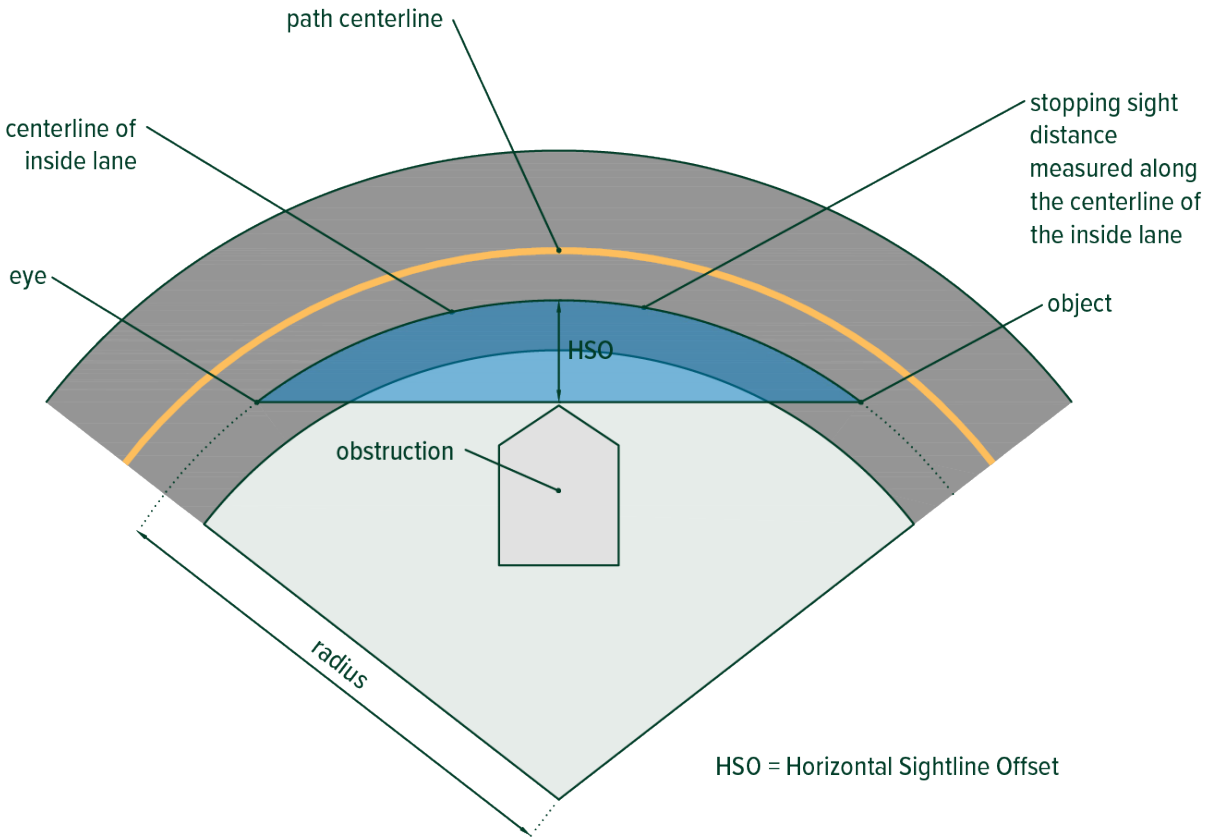
Horizontal and Vertical Trail Alignment

The trail's vertical and horizontal alignments shape the user experience. They should respond to the landforms, built environment, and contours of the Bay itself while maximizing views of and access to the Bay.

- The trail's alignment should be designed to ensure user safety and comfort through ADA-compliant grades, navigable curves, adequate sight distances, seamless connections to the on-street network and obstacle avoidance.
  - Sight distance at horizontal curves should be assessed per the AASHTO Guide for the Development of Bicycle Facilities.[3]
- The horizontal alignment and curve radii of the Bay Trail is defined in part by a bicycle design speed determined by the needs of each project. For most urban conditions with a mix of users, potential for frequent conflicts, and other constraints, a design speed of 15 mph is typical. See **Section 2.2: Designing for People** for typical operating speeds of user types.
- The vertical alignment should have gentle (ADA-compliant) grades: a 5% max running slope (vertical alignment, parallel to the direction of travel along the trail) and 2% max cross-slope (perpendicular to the direction of travel along the trail).
- Open sight distances should be ensured to create a safe and comfortable user environment by allowing trail users to:
  - Avoid obstructions, avoid conflicts with other trail users, and recognize and respond to decision-making points
  - Where an obstruction is unavoidable, centerline markings on curves and obstructions markings should be used.

University Ave Bridge, Berkeley

FIGURE 10 Horizontal sight line offset (HSO) on horizontal curves



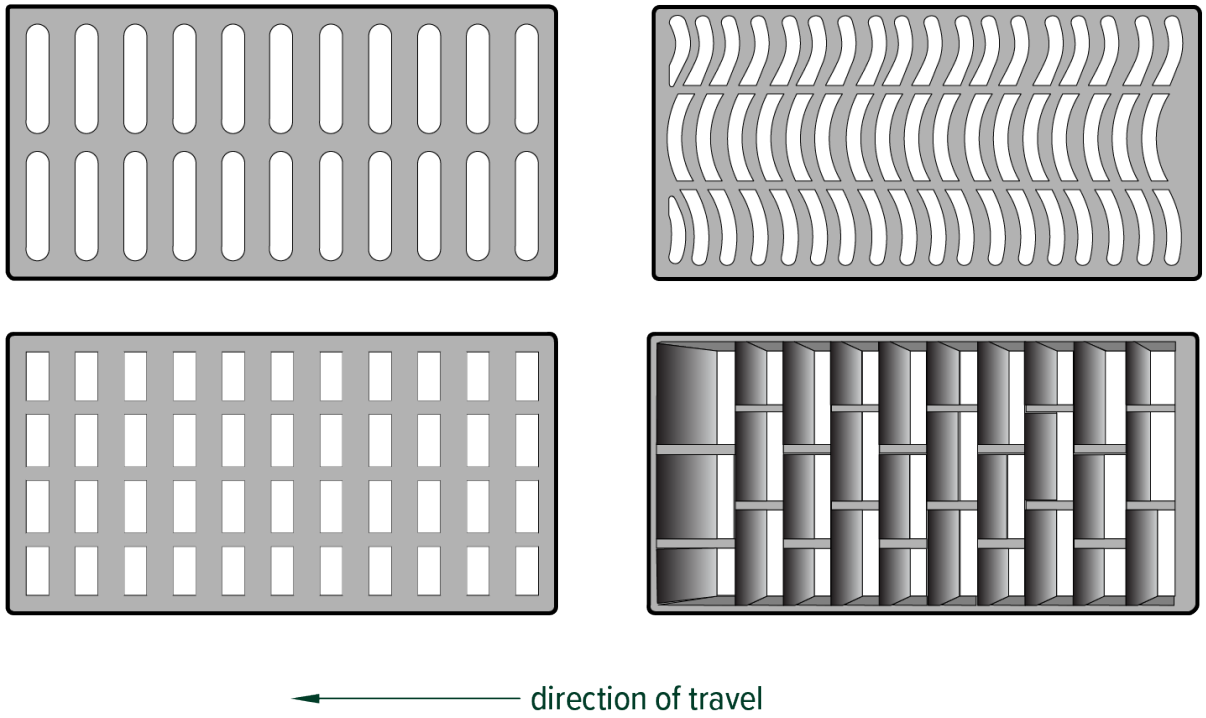
3 AASHTO Guide for the Development of Bicycle Facilities, 5th Edition: https://store.transportation.org/item/collectiondetail/267

Drainage

Design of the Bay Trail should:

- Reduce trail runoff from areas that are directly connected to a storm drain system by reducing impervious surfaces
- Where a paved trail is not appropriate or feasible due to site conditions, use stabilized natural surfacing and permeable paving systems such as porous concrete or porous asphalt
- Direct runoff from the trail's impervious areas through water quality systems or pervious areas, including permeable trail shoulders, and/or small swales or retention areas that are outside the trail shoulder. This is especially important if the trail segment is used regularly by service or maintenance vehicles.
- Ensure adjacent irrigation systems do not spray onto the trail.
- Include low-maintenance landscaping that will not grow into the trail envelope nor require regular maintenance or irrigation. If appropriate plants are used, irrigation should not be needed after the first year.
- Ensure there is positive drainage away from the trail so that standing water is not created from stormwater, storm surges, king tides, or irrigation.
- Where the trail is located on-street, bicycle compatible drainage grates should be used (see **Figure 10**) to prevent bicycle wheels from catching or falling into the grates.

FIGURE 11 Bicycle Compatible Drainage Grates



RESILIENCE TIP

- Generally, the installation cost are higher for porous concrete than most other materials. However, properly installed and maintained pourus concrete can reduce the cost for additional drainage management features and the need to resealing the surface that is required for asphalt surfacing.

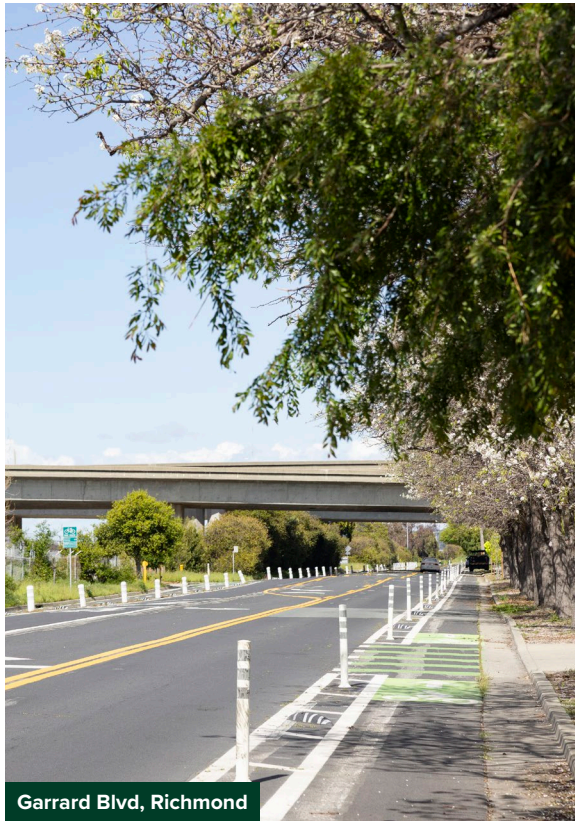
Rail-with-Trail Design

- Coordination with rail corridor owners is required in the design of rail-with-trail facilities and rail crossings.
- To date there are no national standards or guidelines for rail-with-trail facility design. Therefore, special care must be taken to ensure trail user safety near any rail facility. Safety includes preventing physical contact with trains and, depending on their speed, the possibility of material falling from the train onto the trail.
- When the Bay Trail parallels an active rail line, the maximum possible setback should be made. A 6-foot-high fence or physical barrier should be used to separate the trail from active railroad tracks. Mesh fencing or rails should be sized and spaced to prevent climbing. Depending on the surrounding land use circumstances, the managing agency may be required to provide additional safety measures. A combination of vegetation, ditches, berms, and elevation changes combined with fencing could be used to enhance the separation.
- Existing rail-with-trail segments include Embarcadero Bike Path (Palo Alto), the trail adjacent to Bessie Coleman Drive near the Oakland Airport, and segments of the SMART Pathway.
- For information on rail crossings, refer to the discussion on At-Grade Rail Crossings in **Section 3.4 Site-Specific Design Treatments**.

Garrard Blvd, Richmond

Retrofits

Existing trail segments may be retrofitted for a variety of reasons – as part of development projects, utility repairs or upgrades, repaving, or restoration projects. Such projects provide opportunities to bring existing segments up to current trail design standards, remedy failing elements such as paving or drainage issues, or address lack of accessibility. However, unlike new trail segments, retrofits are often constrained by other infrastructure, land use limitations, or other challenges. **Table 5** below highlights a few retrofit examples along with key design considerations that should be prioritized.



Garrard Blvd, Richmond

TABLE 6 Design Considerations for Retrofit Projects

Example Retrofit Projects	Design Considerations
Repair or upgrade of substandard trail segments, e.g., trail resurfacing/repairs, trail widening	• Localized repairs or reconstruction must carefully consider and address existing drainage patterns to avoid creating new drainage problems. • Repaving or paving repair should address the impact of nearby tree roots.
Upgrading existing Class II bike lane to Class IV bikeway	• While two-way separated bikeways are recommended, in some instances, one-way protected bikeways on each side of the street may be considered. An example would be updating existing Class II bike lanes to one-way protected bikeways to avoid reconfiguring intersections and traffic signals.
Upgrade existing Class IV bikeway to Class I trail	• An example might be converting sidewalks and separated bike lanes to a wide side path within the street's right-of-way. Ensure that adequate separation from vehicular travel lanes can be provided; side path buffers generally rely on width rather than physical barriers to separate trail users from vehicle lanes. • Consider how drainage will be addressed. • Ensure that connections to on-street facilities are safe and intuitive to navigate. • Consider how bicycles and pedestrians will gather at corners and navigate crossings; additional space may be necessary to allow bicyclists and pedestrians to queue and move safely around one another.

Quick-Build Projects

Quick-build projects are a useful way to create biking and walking facilities using low-cost, easy-to-install materials. Quick-build projects can be implemented as an interim solution until additional funding can be acquired for full-build implementation. Because they are not permanent and can be changed or reversed as needed, quick-build projects are a useful way to demonstrate proof of concept to community members, project stakeholders, and elected officials.

With its emphasis on continuous, separated biking and walking facilities, the Bay Trail system embraces quick-build facilities to complete the network. **Table 6** highlights a few quick-build examples along the Bay Trail and key design considerations.

Potential quick-build project materials include flex posts, precast curbs, K-rail, planters, signs, and pavement markings. Refer to MTC's toolkit of intervention objects and materials for more details on quick-build materials.[4] While quick-build facilities are typically considered interim until a full rebuild can be completed, these projects should still meet the Bay Trail design dimensions and requirements presented throughout Chapter 3.

Vera Avenue, Redwood City

TABLE 7 Design Considerations for Quick-Build Projects

Example Quick-Build Projects	Design Considerations
Gap-closure projects	• Gaps in the Bay Trail alignment often exist due to lack of funding or challenging physical conditions, such as a lack of space or right-of-way. • In addition to closing gaps between Bay Trail segments, quick-build projects can be used to close gaps between the Bay Trail and nearby connector trails. Refer to **Section 2.4: Designing for Purpose** for a discussion on Connector Trails. • Note that frequent transitions between different facility classes is discouraged because it can be difficult to navigate these transitions.
Upgrades from Class II bike lanes to Class IV separated bikeways	• Where the roadway has excess width or capacity, Class II bike lanes can be converted to a 12-foot-wide two-way Class IV bikeway on one side of the street with the following features: • A parallel physical barrier (large planters, plastic K-Rails or Jersey Barriers or temporary bollards) to protect Bay Trail bicyclists from adjacent motor vehicle traffic • If connecting segments of the Bay Trail are one-directional Class IV separated bikeways on each side of the street, consider continuing that cross section along the quick-build segment, instead of transitioning to a two-way facility and back to one-way facilities. • Two-way bikeways require signal phasing treatments. For this reason, quick-build separated bikeways may often need to be one-way facilities on each side of the street if the project extents include signals. Refer to **Section 3.4: Site-Specific Design Treatments** for a discussion on intersection treatments.
Curb extensions	• Where the Bay Trail crosses streets with on-street parking, curb extensions can be implemented using paint and vertical elements such as flexposts or planters. • Quick-build curb extensions help to reduce pedestrian crossing distances and increases the visibility of crossing pedestrians to motorists. • If implemented at signals, quick-build curb extensions do not reduce pedestrian crossing times, because curb ramps, detectable warning panels, and pedestrian push buttons remain curbside.

4 MTC toolkit of intervention objects and materials: https://mtc.ca.gov/sites/default/files/InterventionObjects_English.pdf

3.4 Site-Specific Design Treatments

There are many location-specific design decisions that must be made when designing the Bay Trail. This section presents recommended design approaches for pavement markings, roadway crossings and intersections, driveway crossings, trail entry and trailhead designs, trail junctions, at-grade rail crossings, transitions between facility types, and overcrossings and undercrossings.

Willow Rd and Hwy 84, Menlo Park

Pavement Markings

Pavement markings can direct and manage users, provide safety warnings, and can provide an opportunity to emphasize local character. However, pavement markings should follow local agency guidelines or Caltrans requirements.

Pavement markings should use paint or thermoplastic applications that are compatible with the trail surface and easy to maintain. In areas where nighttime use is expected, the markings may be reflective to increase visibility.

The typical markings described below are used on the Bay Trail include:

- Edge Lines
- Center Lines
- Lane Markings
- Obstruction Markings
- Stop and Yield Lines
- Marked Crosswalks
- Arrows and Symbols
- Other Markings

Edge Lines – optional; used to identify the edge of the trail, particularly where the shoulder and trail are the same surface material

- White, 4 to 6 inches wide, solid
- Edge lines should be placed at the edge of the trail, with at least 2 feet of clearance from vertical elements such as walls, railings, or signs
- Edge lines may be beneficial where nighttime use is common, on intersection approaches, or in locations where the width of the trail changes significantly over a short distance.

Center Lines – optional; may not be desired in natural or park settings

- Yellow, 4 to 6 inches wide, broken or solid
- Broken center line indicates that passing is permitted
- Solid center line indicates that passing is inadvisable
- Solid center lines may be beneficial on intersection approaches and departures (the length of the stopping sight distance from the edge of the intersection, when approaching obstructions, on segments with high user volumes, on unlit segments, and on curves with restricted sight distances (refer to **Figure 10**).

Lane Markings – used to delineate separate spaces for different users

- White, 4 to 6 inches wide, solid
- Refer to **Figure 6** for guidance on separating users.
- Should be paired with on-trail stencils and signs clarifying expected use

Arrows and Symbols – used to clarify expected direction of travel and user types

- White, stenciled icons, text
- Arrows and user icons (pedestrian, bicycle, scooter, etc.) can be used individually or combined
- Can include trail information, such as speed limits, warnings, mile markers, or road names

Obstruction Markings –used to identify obstructions within the trail that could not otherwise be removed or avoided

- Yellow or white, 4 to 6 inches wide, solid
- Obstruction markings should be yellow if an obstruction is in the center of the trail (i.e., if it splits the path, like bollards, if used) and white if the obstruction is on the edge of the trail
- Obstruction markings should not be located within the accessible clear width of the trail
- Obstruction markings must be used for bollards (refer to information on **Gates and Bollards**).
- Reference to detail for obstruction striping

Stop and Yield Lines – used to give trail users specific directions and warnings

- White, stenciled text paired with lines (for stop limits) or triangles (for yield limits)
- Size should follow Caltrans standards for bikeways
- Stop and yield lines should be accompanied by appropriate STOP or YIELD signs
- Stop and yield lines should be placed a minimum of two feet behind the intersecting edge of the roadway or the intersecting sidewalk

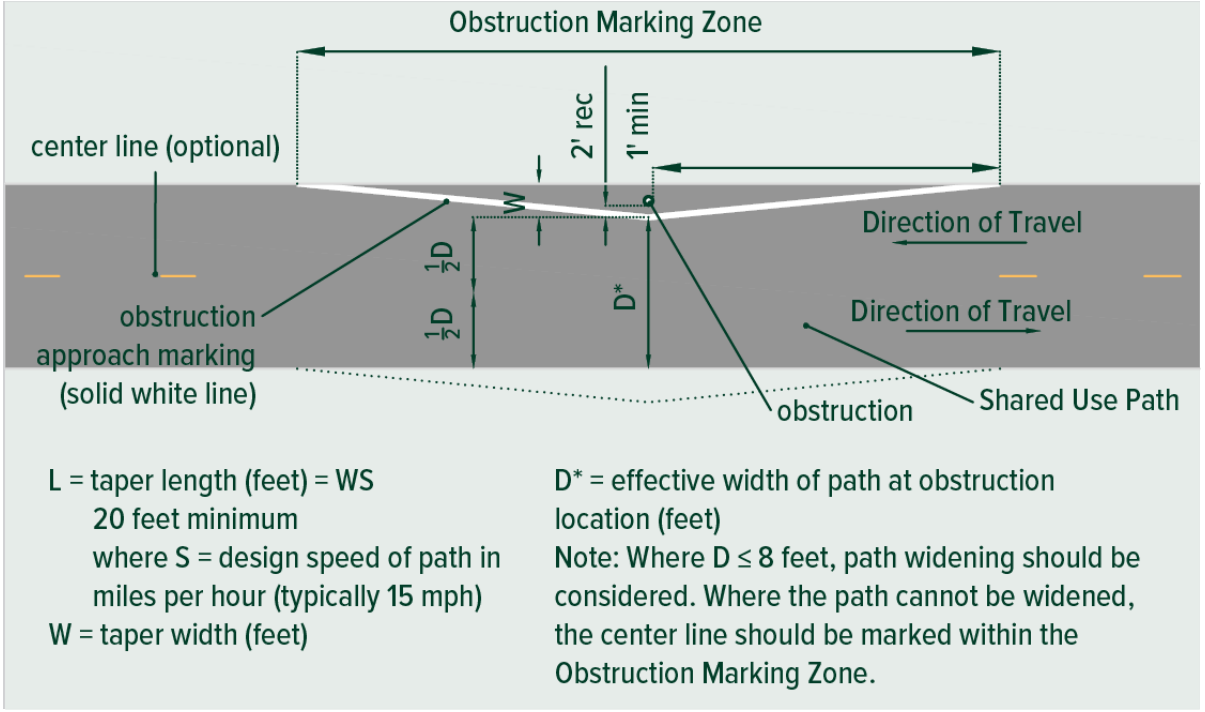
Marked Crosswalks – used when pedestrians are expected to cross the trail or where the trail crosses a roadway

- See **Crosswalk Striping** for more information on crosswalk markings

Other Markings –Graphic designs can be stenciled or painted to highlight intersections

- Graphics can also be used to provide interpretation or education, such as marking the route of an undergrounded creek, showing expected sea-level rise extents, or revealing the historic shorelin

FIGURE 12 Typical Obstruction Striping




Adobe Creek Trail Bridge, Palo Alto


Sea Plane Lagoon Promenade, Alameda

Crossings and Intersections

The Bay Trail must interact with local vehicular, pedestrian, and bicycle systems in a way that minimizes Bay Trail users' exposure to traffic and minimizes the speed differential between intersecting users. Safe and thoughtful Complete Streets design can mitigate these risks. For more information on Complete Streets, see the MTC Complete Streets Policy in **Chapter 4: References.**

This section covers the following crossings and intersection considerations for the Bay Trail:

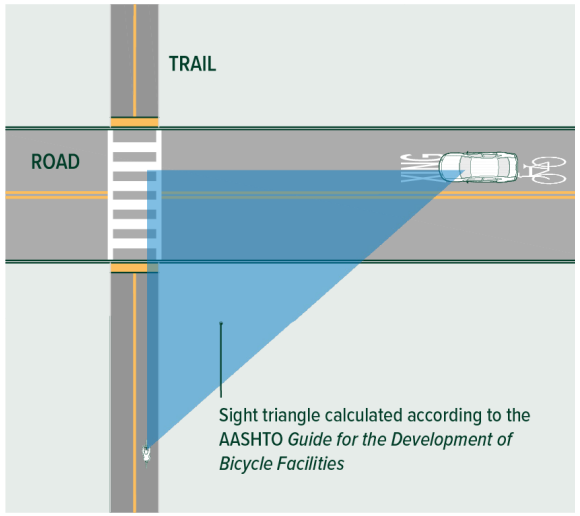
- Mid-block Crossings
- Roadway Intersections
- Caltrans Crossings
- Crosswalk Striping

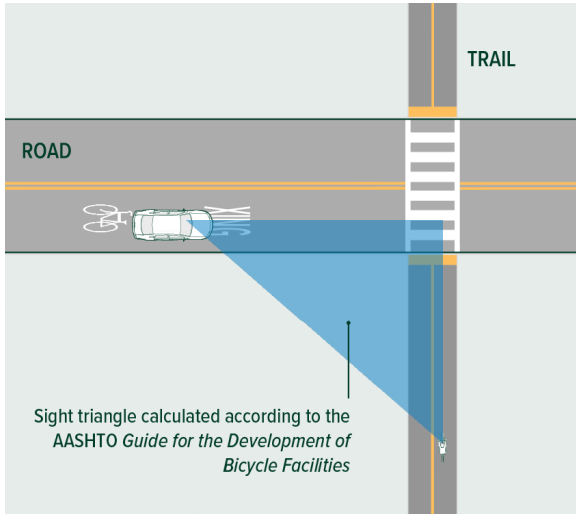
All crossings should be designed in accordance with the following:

- **Sight triangles** (**Figure 13**) should be calculated according to the AASHTO Policy on Geometric Design of Highways and Streets ("Green Book"),[5] depending on the design speeds of the Bay Trail and the roadway. If sufficient stopping sight distance cannot be achieved, additional traffic control such as stop signs or signals should be provided.
- **Crossing angles:** The Bay Trail should cross roadways as close to 90 degrees as possible, to minimize crossing distance and potential conflicts and maximize sight distances.

For on-street facilities, MTC does not support the removal (and/or consolidation) of FHWA's Proven Safety Countermeasures,[6] including but not limited to marked crosswalks, bicycle lanes, and other pedestrian facilities, as removal of these elements is not consistent with the MTC Complete Streets Policy and the Bay Trail Plan. If existing crossings are deemed to be unsafe, they should be supplemented with safety measures, not removed.

FIGURE 13 Sight Triangle for Uncontrolled Mid-Block Path Crossing of an Uncontrolled Roadway





5 AASHTO Policy on Geometric Design of Highways and Streets: https://store.transportation.org/item/collectiondetail/180?AspxAutoDetectCookieSupport=1

6 FHWA Proven Safety Countermeasures: https://highways.dot.gov/safety/proven-safety-countermeasures

Mid-block Crossings

Mid-block crossing treatments vary depending on which users are assigned right-of-way (i.e., which users may proceed, and which users must yield). The total and relative volumes of Bay Trail and intersecting roadway users, as well as the functional classification of the roadway,[7] should determine who has the right-of-way and inform the selection of traffic controls types. Bay Trail volumes should comprise all users (pedestrians, bicyclists, others), while also considering projected or anticipated changes in volume over time. When assigning right-of-way and determining appropriate traffic control for mid-block crossings, consider the following:

- High-visibility crosswalk markings should be used for mid-block crossings.
- At uncontrolled mid-block crossings, sight triangles (see previous page) should provide sufficient stopping sight distance so that motorists perceive Bay Trail users attempting to cross and stop or yield to them. If there is adequate sight distance, the Bay Trail approach should be uncontrolled or yield-controlled to prioritize the movement of Bay Trail users. STOP signs should only be used on the Bay Trail approach if sufficient sight distances cannot be provided for a yield-controlled or uncontrolled approach. The routine installation of STOP signs on the Bay Trail to stop trail users is discouraged.
- Providing YIELD or STOP control on roadway approaches instead of on Bay Trail approaches can minimize total user delay by allowing bicyclists to maintain momentum.
- At crossings of roadways with speed limits of 30 mph or less where Bay Trail users have the right-of-way, add raised crossings to increase visibility of Bay Trail users and increase motorist yielding rates.
- At crossings of collector or arterial roadways, add Rectangular Rapid Flashing Beacons (RRFBs) to increase motorist yielding rates.
- At crossings of roads with on-street parking, add curb extensions to decrease crossing distances and increase visibility between Bay Trail users and drivers on the intersecting roadway.
- At multilane crossings provide a median refuge island so users only need to cross one direction of traffic at a time.
- At crossings of arterials with high volumes of vehicles, consider implementing a signal.
- When Bay Trail volumes are high and/or the Bay Trail intersects an arterial with high speeds and/or high volumes, consider a trail overcrossing/undercrossing of the arterial. Refer to information on **Overcrossings and Undercrossings** for more details.

Table 8 illustrates examples of mid-block crossing control treatments, including typical pavement markings and signage. Refer to the AASHTO Bike Guide[8] for more details on selecting mid-block crossing treatments for the Bay Trail.

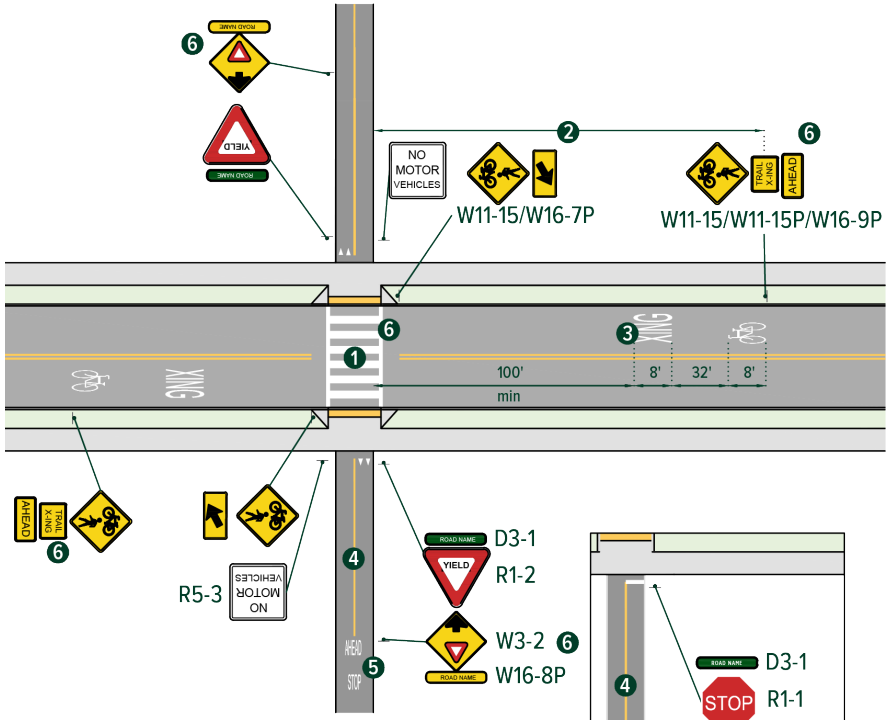
TABLE 8 Crash reduction factors of common crossing treatments

Common Crossing Treatments	Crash Reduction Factor (per FHWA Proven Safety Countermeasures)
Rectangular Rapid Flashing Beacon (RRFB)	47% (pedestrian crashes)
Raised Crosswalk	45% (pedestrian crashes)
Pedestrian Refuge Island	56%
Pedestrian Hybrid Beacon (PHB)	55% (pedestrian crashes); 29% (total crashes)
Leading Pedestrian Interval (LPI)	13%

7 "Functional classification is an ordering system that defines "the part that any particular road or street should play in serving the flow of trips through a highway network." Functional classification categorizes streets according to their ability to 1) move traffic and 2) provide access to adjacent properties. Street types under functional classification include "local streets," medium-sized "collectors," and highway-type "arterials." (NACTO Urban Street Design Guide).

8 AASHTO Guide for the Development of Bicycle Facilities

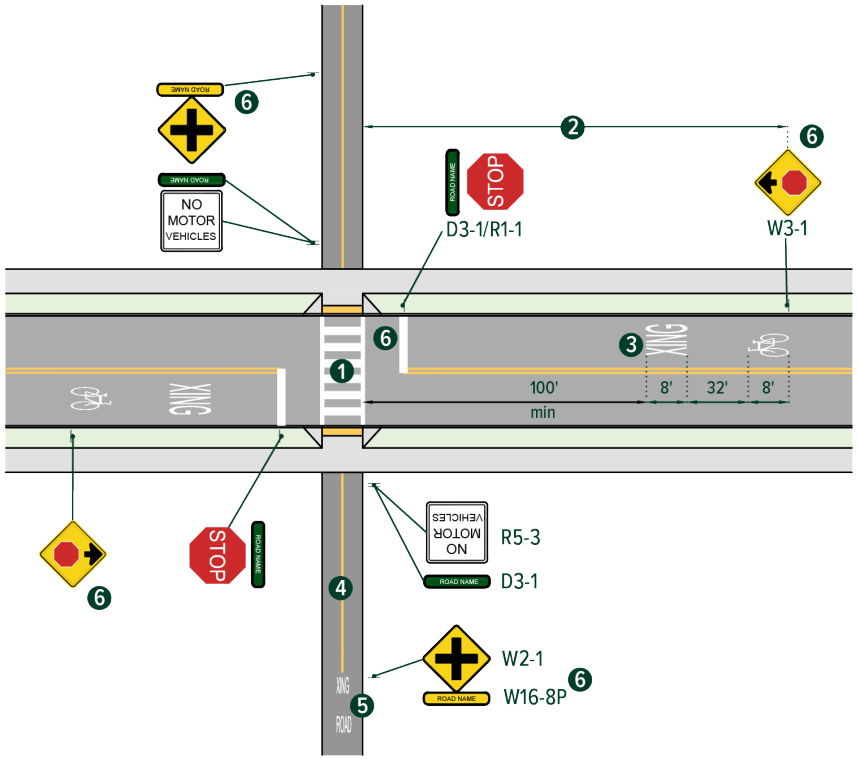
FIGURE 14 Single-Lane Midblock Crossing with Yield or Stop Control on Path



Note: See Section 5.9 for right-of-way assignment guidance

1. crosswalk markings legally establish midblock pedestrian crossing
2. length varies: see MUTCD Table 2C-4
3. optional roadway markings
4. shared-use path centerline as needed
5. optional pathway markings and advance warning signage
6. optional advance warning signs; these signs are recommended where visibility to crossing is limited

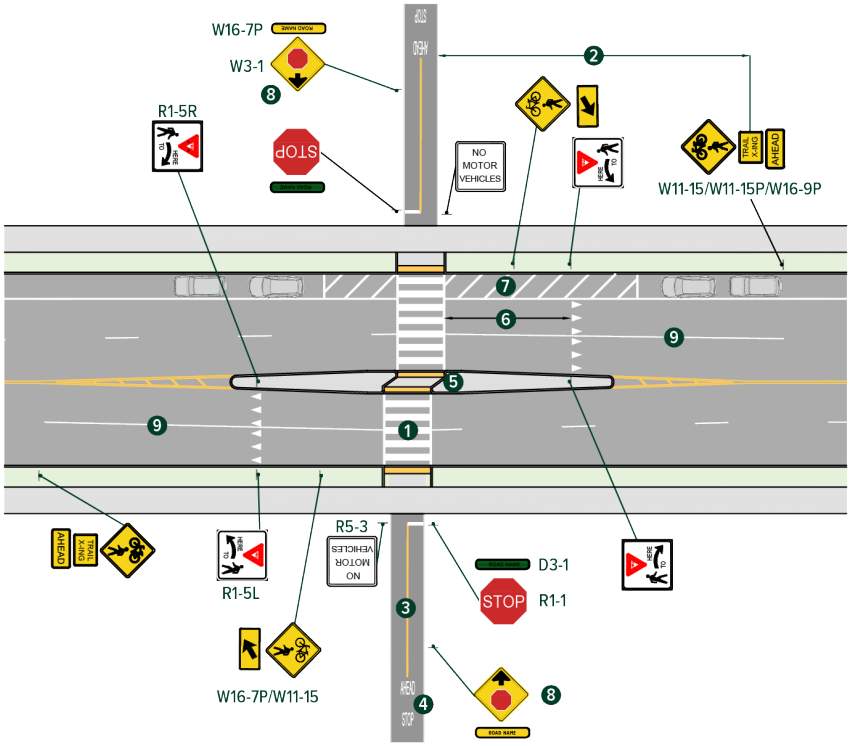
FIGURE 15 Single-Lane Midblock Crossing with Stop Control on Road



Note: See Section 5.9 for right-of-way assignment guidance

1. crosswalk markings legally establish midblock pedestrian crossing
2. length varies: see MUTCD Table 2C-4
3. optional roadway markings
4. shared-use path centerline as needed
5. optional pathway markings and signage
6. optional advance warning signs; these signs are recommended where visibility to crossing is limited

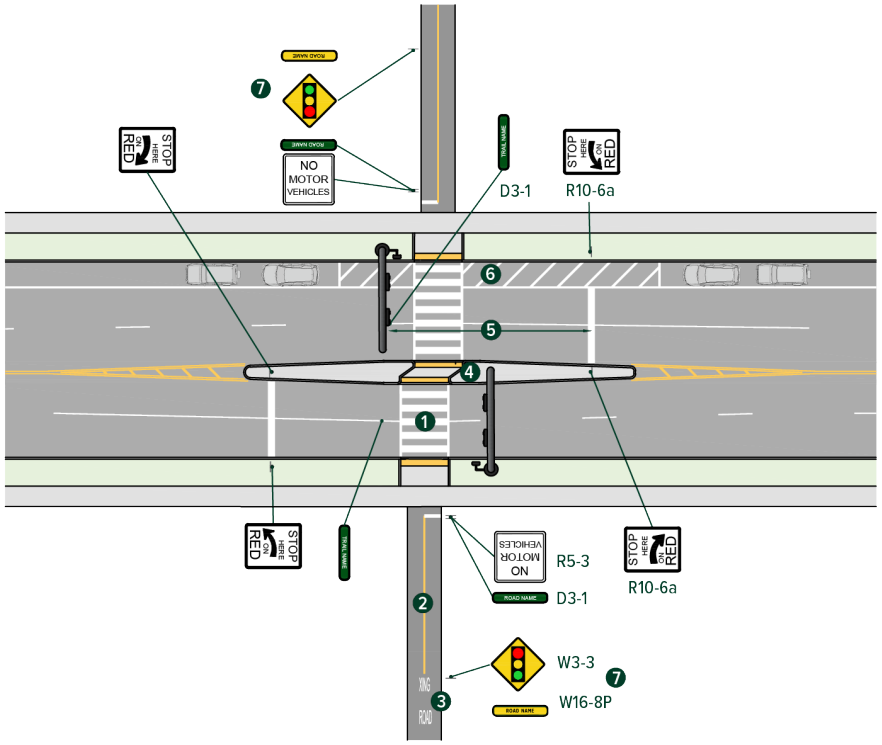
FIGURE 16 Multilane Uncontrolled Midblock Crossing with Advanced Yield Lines



Note: See Section 5.9 for right-of-way assignment guidance

1. crosswalk markings legally establish midblock pedestrian crossing
2. length varies: see MUTCD table 2C-4
3. shared-use path centerline as needed
4. optional pathway markings and signage
5. refuge median
6. yield bar placement 20'-50'
7. parking restricted
8. optional advance warning signs; these signs are recommended where visibility to crossing is limited
9. recommended solid white lane lines to discourage passing matching length of MUTCD table 2C-4

FIGURE 17 Multilane Signalized Mid-Block Crossing



Note: See Section 5.9 for right-of-way assignment guidance

1. crosswalk markings legally establish midblock pedestrian crossing
2. shared-use path centerline as needed
3. optional pathway markings and signage

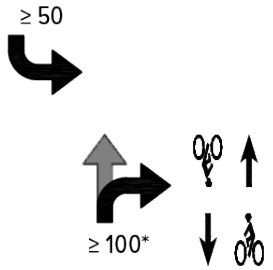
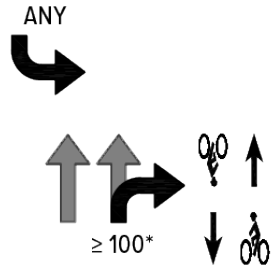
Roadway Intersections

The Bay Trail is typically in an independent alignment, so mid-block crossings are the most common type of roadway crossing; however, the Bay Trail sometimes functions as a shared use path, a separated bikeway with adjacent sidewalk, or other variations of on-street infrastructure, parallel and adjacent to a roadway. In these cases, the Bay Trail crosses at an intersection of two roadways. In these cases, consider the following:

- **Protected signal phases** should be provided to prioritize Bay Trail movement when volumes exceed those shown below, as well as in locations with sight obstructions that limit visibility, locations with high Bay Trail volumes, locations with heavy vehicle volumes of more than 5%(e.g., near ports and similar intermodal locations), and locations where motorists may turn across the bikeway at speeds over 30 mph or on roads with posted speeds of 35 mph or greater.
- **Leading bicycle and pedestrian intervals (LPI/ LBI)** should be considered even when a protected phase is not provided, to reduce the number of potential conflicts between Bay Trail users and motorists. LPIs reduce pedestrian-motorist crashes by 13%, according to FHWA's Proven Safety Countermeasures.
- **Protected intersections** accommodate the needs of users of all ages and abilities by maintaining the separation of a bikeway or shared use path up to the intersection. Protected intersections are proven to reduce exposure to conflicts, reduce motorist turning speeds, and increase driver's yielding rates to pedestrians and bicyclists, and other trail users, and are therefore preferred over designs that require Bay Trail users to mix with motor vehicle traffic. Protected intersections may be implemented at signalized or unsignalized intersections.
- **Roundabouts** may be implemented at intersections to reduce delay and conflict points and increase motorist capacity. Shared use paths and separated bikeways should be continuous around the circulating roadway at roundabouts, and shared use paths should be at least 10 feet wide. At crossings of multilane roundabout exits with poor motorist yielding rates and infrequent gaps during peak hours, Rectangular rapid-flashing beacons (RRFBs) may be beneficial. RRFBs with an accessible pedestrian signal (APS) are also recommended to ensure that blind, low-vision, and others with disabilities can safely use the roundabout crossings. (APS is an integrated device that communicates information in non-visual formats about the WALK and DON'T WALK intervals at signalized intersections). Roundabouts reduce fatal and injury crashes by 78 to 82%, according to the FHWA Proven Safety Countermeasures.

TABLE 9 Recommended Hourly Turning Traffic Thresholds for Time-Separated Movements (AASHTO Bike Guide)

Hourly Volume Thresholds for Separate Turn Phases for Two-Way Separated Bikeways or Sidepaths

Left Turn Crossing One Oncoming Lane	Left Turn Crossing Two Oncoming Lanes
	

EQUITY TIP

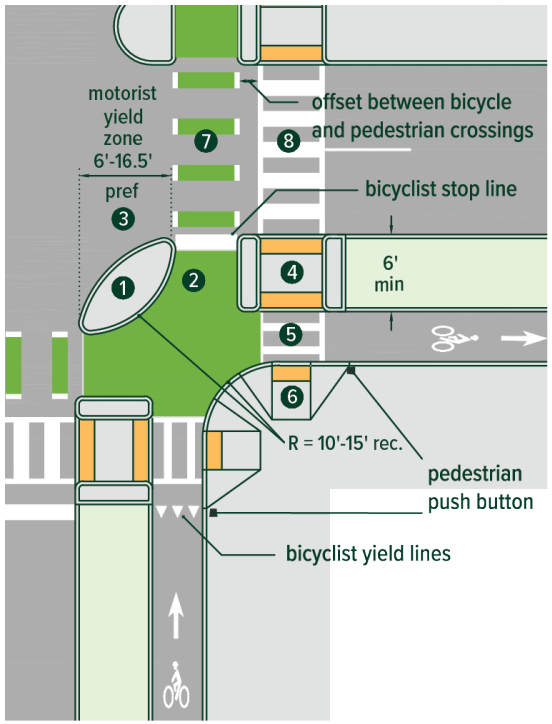
Roundabouts present unique challenges to some people with various disabilities (e.g., vision). Additional treatments may be needed to ensure all users can safely use roundabouts. See Pedestrian Access to Modern Roundabouts from the Access Board.[1]

Improvements for speed control/yielding single lane crossings at entrance and exit include:

- Raised crossings, especially at exit
- 'YIELD-TO-PED' markings/driver signs/ beacons. If a pedestrian button is present, it needs a voice message to clarify there is no red/yellow/green signal**
- Pedestrian lighting
- Yield cameras

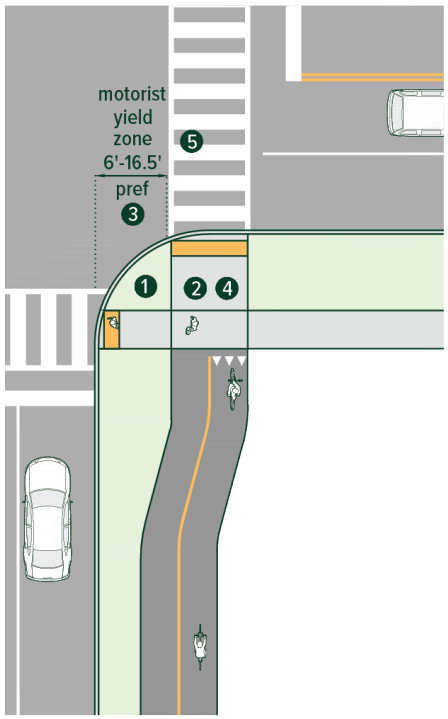
1 US Access Board: Pedestrian Access to Modern Roundabouts: Design and Operational Issues for Pedestrians who are Blind. https://www.access-board.gov/research/prow/roundabouts/crossing-at-roundabouts/#:~:text=The%20curvilinear%20layout%20of%20roundabouts,rarely%20lead%20directly%20to%20crosswalks.

FIGURE 18 Protected intersection design for separated bike lanes (left) and shared use paths (right)



1. corner island
2. forward bicycle queuing area
3. motorist yield zone
4. pedestrian refuge island
5. high-visibility pedestrian crossing of separated bike lane
6. directional pedestrian curb ramp
7. dotted bicycle crossing with dotted green-colored pavement
8. high-visibility pedestrian crosswalk

Note: The use of this treatment requires a Request to Experiment from FHWA. This sign is recommended for inclusion where right-turning vehicles exceed 50 vph or locations where there is a documented issue with motorist yielding.



1. corner island
2. bicycle queuing area
3. motorist yield zone
4. directional ADA-compliant curb ramp
5. high-visibility path crosswalk

Caltrans Crossings

Crossings of Caltrans right-of-way require close and frequent coordination with Caltrans in addition to traffic analysis and consultation with roadway owners. Resources like the AASHTO Bike Guide, Caltrans Complete Intersections Guide[9], and Caltrans DIB 89-02 should be referenced for design guidance at freeway ramps, Caltrans facility on- and off-ramps, intersections, and other crossings of Caltrans right-of-way.

Crossings of entry and exit ramps can present challenges due to the high speed of vehicles and large turning radii at these locations. Each design solution will be context-dependent, but consider the following:

- Stripe high-visibility crosswalks across ramps
- For entry ramps, set the crossing back 6 to 16.5 feet from the face of curb, so vehicles turning onto the ramp are perpendicular to the crossing.
- Apply mountable truck aprons to slow vehicles approaching the crossing while still accommodating larger vehicles.
- Align crossings to be perpendicular to the ramp that they are crossing, to minimize potential conflict area.
- If prevailing vehicle speeds and volumes result in poor yielding behavior or inadequate gaps in traffic for trail users to cross, consider implementing warning devices or traffic signals and/or raised crossings.

9 An update to the 2010 Caltrans Complete Intersections Guide is in progress at the time of writing.

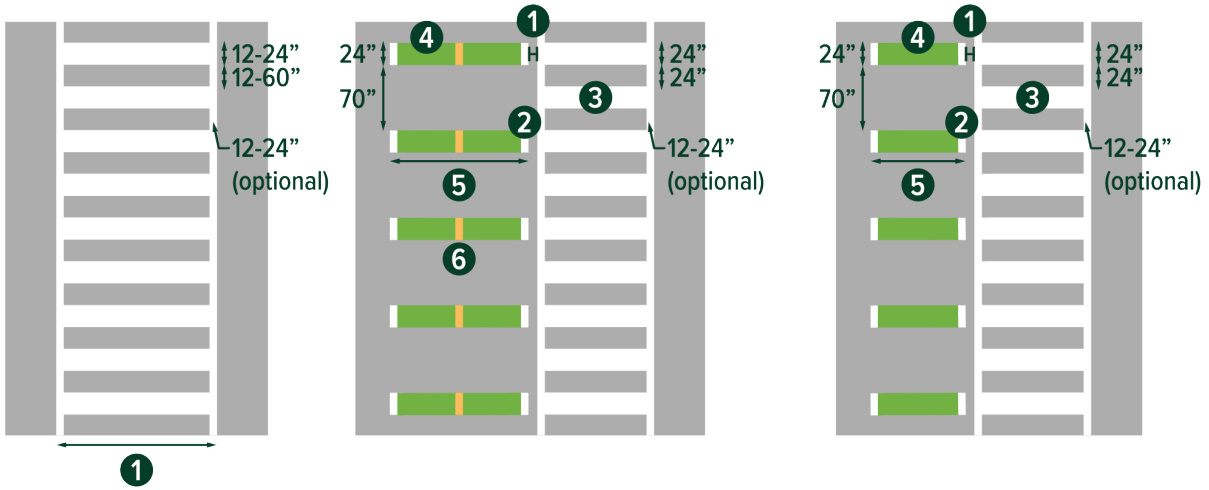
Crosswalk Striping

High-visibility crosswalks are always recommended when the Bay Trail crosses a roadway to alert drivers that people cross the road at this location. The outside edges of the crosswalk or trail crossing should have ladder pavement markings to encourage pedestrians to be on the outer edges of the crosswalk while bicyclists remain in the middle. This technique reflects the dynamic that pedestrians will gravitate to the outer edges of the trail where the traffic signal-control button is typically located.

For locations with an adjacent Class IV Separated Bikeway and sidewalk, the pedestrian crossing should be marked with high-visibility ladder striping, and the edges of the bikeway crossing should be dotted according to applicable standards, with dashed (skip-striping) or solid green colored pavement in the middle of the crossing. Two-way bike crossings should have a dotted yellow centerline and use green dashed, skip-striping, through the intersection. Each crosswalk should be approximately the width of the approaching pedestrian and bicycle trails, respectively, with an offset of at least one foot between them. This offset should extend to the curb, where there should be two distinct crossings (refer to the next section Curb Ramps and Aprons).

MTC does not support the removal (and/or consolidation) of FHWA's Proven Safety Countermeasures, including but not limited to marked crosswalks, bicycle lanes, and other pedestrian facilities, as removal of these elements is not consistent with the MTC complete Streets Policy and the Bay Trail Plan.

FIGURE 19 Crosswalk Striping for Shared Use Paths (left), Two-Way Separated Bikeways (middle), and One-Way Separated Bikeways (right)



1. Match width of shared use path

1. 1-foot minimum offset
2. 6-inch dotted white line
3. High-visibility pedestrian crosswalk
4. Green colored pavement within dotted lines
5. Match width of bike lane
6. 6-inch dotted yellow line

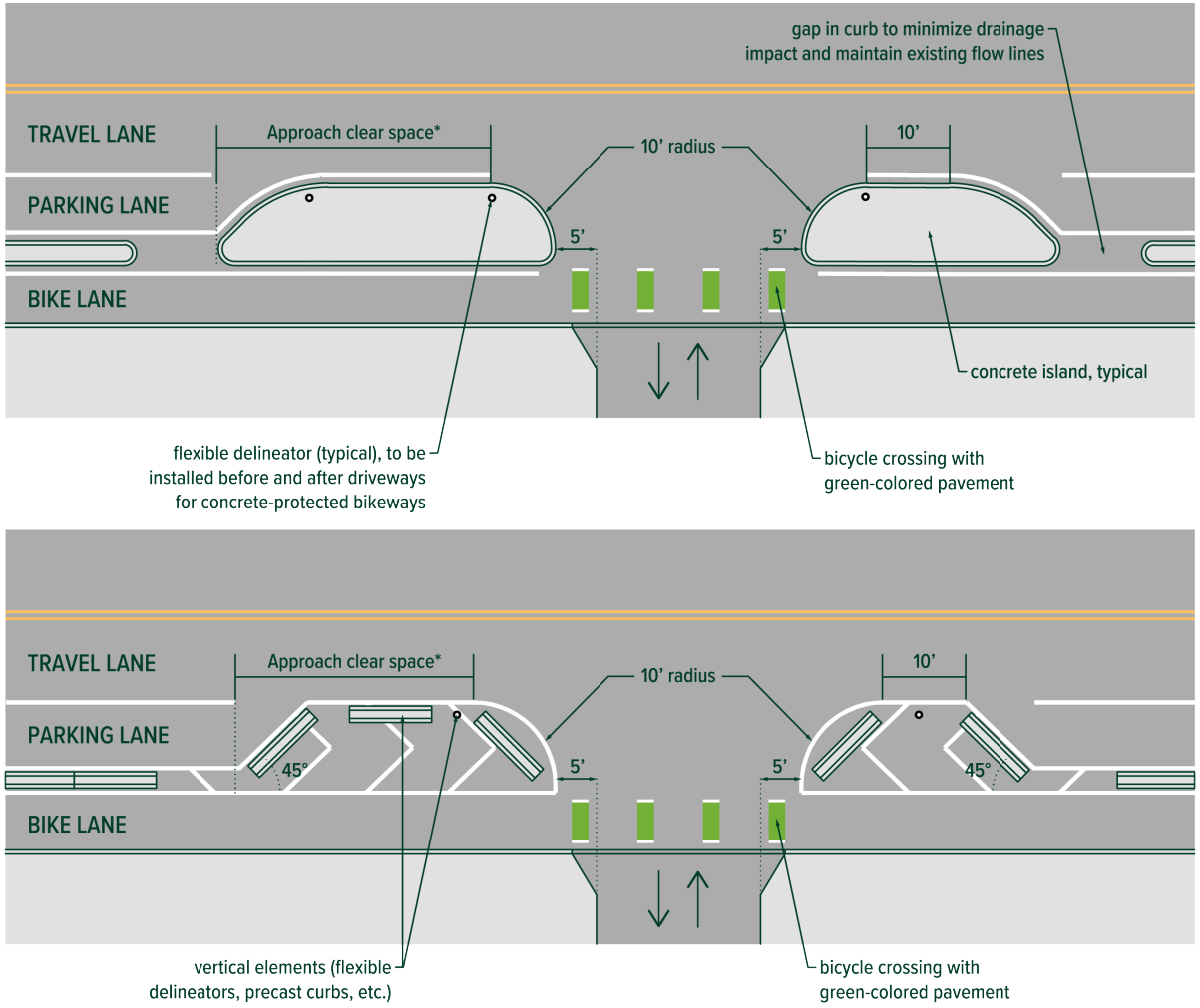
1. 1-foot minimum offset
2. 6-inch dotted white line
3. High-visibility pedestrian crosswalk
4. Green colored pavement within dotted lines
5. Match width of bike lane

Driveway Crossings

In some areas, Bay Trail bicyclists may need to ride on city streets. In these instances, the Bay Trail should transition to a Class IV Separated Bikeway with an adjacent sidewalk (see **Section 3.2: Bay Trail Typology**). Driveway crossings should be designed to emphasize right-of-way for Bay Trail users by using dashed, skip-striping, green paint to provide a visual cue to the driver to expect and yield to bicyclists in the bikeway.

Figure 20 shows concrete and quick-build driveway crossings for street-level separated bikeways. At locations where sidewalk-level bikeways or side paths cross driveways, bicycle facilities should remain at sidewalk level through the driveway crossing, with turning vehicles ramping up prior to the crossing.

FIGURE 20 Concrete (top) and Quick-Build (bottom) Driveway Crossings Treatments for Street-Level Separated Bikeways



NOTE: At bikeway crossings of stop-controlled intersections and most low-volume driveways and alleys, approach clear space should be 20 feet, which provides an effective turning radius of 18 feet at a turning speed of 10 mph. As the effective turning radius and/or turning speed increase, so should the approach clear space.

Shared Use Path Approach, Entry, and Trailhead Design

Intersection and Crossing Approaches

Speed control: Several measures can be used to reduce the speed of Bay Trail users, particularly wheeled users. Horizontal curves , which reduce sight distance and force trail users to slow to navigate them, can be implemented on intersection approaches where Bay Trail users must stop or yield, or where sight distance is limited. If chicanes are implemented, they should:

- End far enough in advance of the intersection so users can navigate the chicanes first, followed by the intersection, and not have to navigate both at the same time.
- Feature a solid center line stripe to discourage bicyclists from “cutting corners” on curves.
- Be designed for a minimum speed of 8 mph.

If there is not enough space to accommodate chicanes, speed control will need to rely on pavement markings, signage, and sight distances. Physical obstructions like z-gates and bollards should not be used within the Bay Trail, as they present accessibility challenges and crash hazards. Refer to **Restricting Motor Vehicles** for more details.

Capacity accommodation: At congested crossings or locations where queuing results in crowding along the edge of the roadway, the Bay Trail (and corresponding crossing) can be widened upon approach.

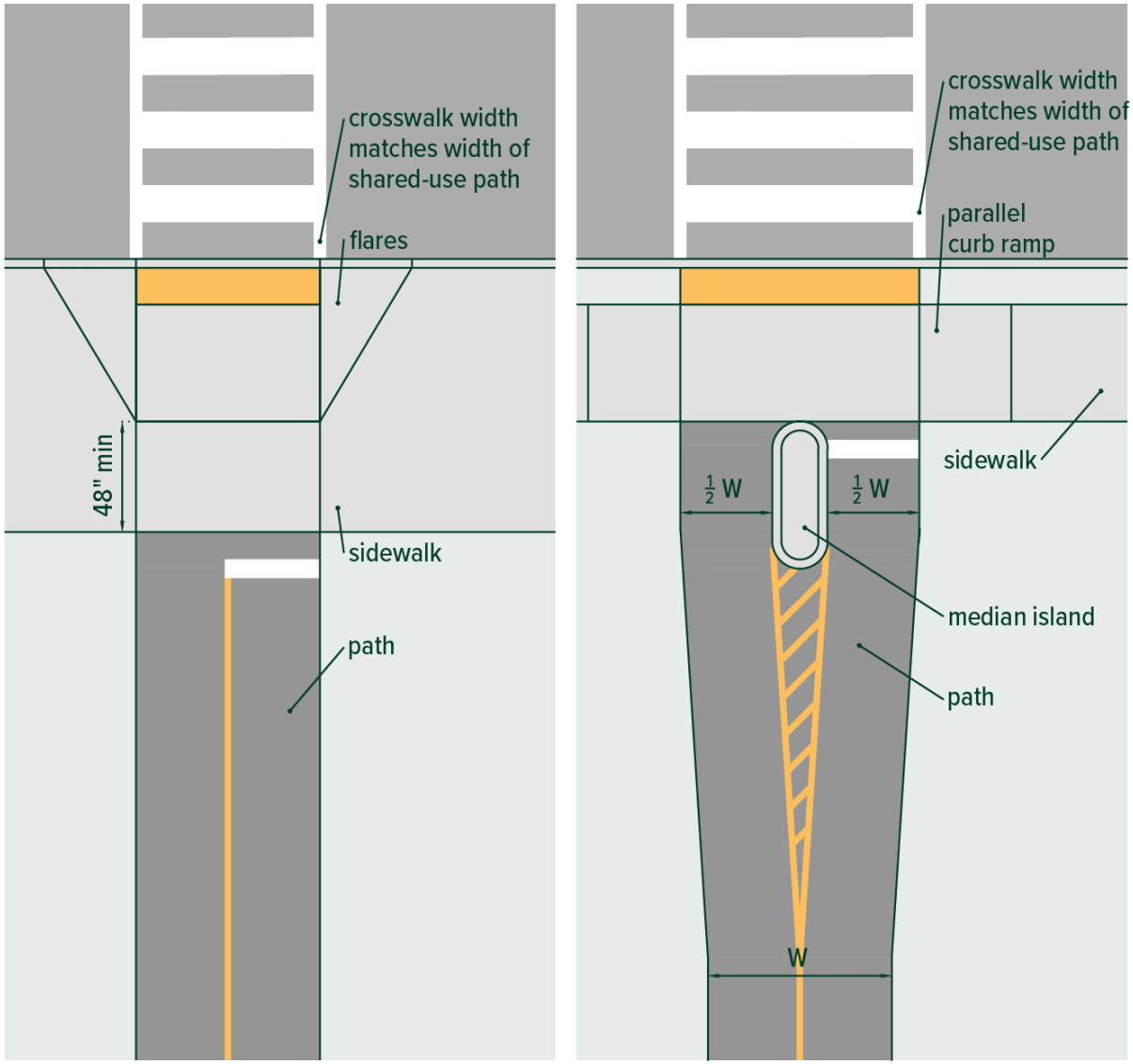
Willow Rd and Hwy 84, Menlo Park

Curb Ramps and Aprons

At intersections and mid-block crossings, Bay Trail openings and curb ramps should be the full width of the Bay Trail, not including any side flares. Curb ramps should be accessible and usable by people with disabilities, and detectable warning surfaces must be placed across the full curb ramp width at the edge of the roadway, even if there are separate bicycle and pedestrian spaces within the Bay Trail.

For locations with an adjacent Class IV Separated Bikeway and sidewalk, two separate ramps should be provided: one accessible curb ramp with detectable warning surfaces for pedestrians using the sidewalk, and a second ramp without detectable warning surfaces for bicyclists. If a Class IV Separated Bikeway is at-grade with the street, it does not require a curb ramp.

FIGURE 21 Curb ramp design for perpendicular curb ramps (left) and parallel curb ramps (right)



Restricting Motor Vehicles

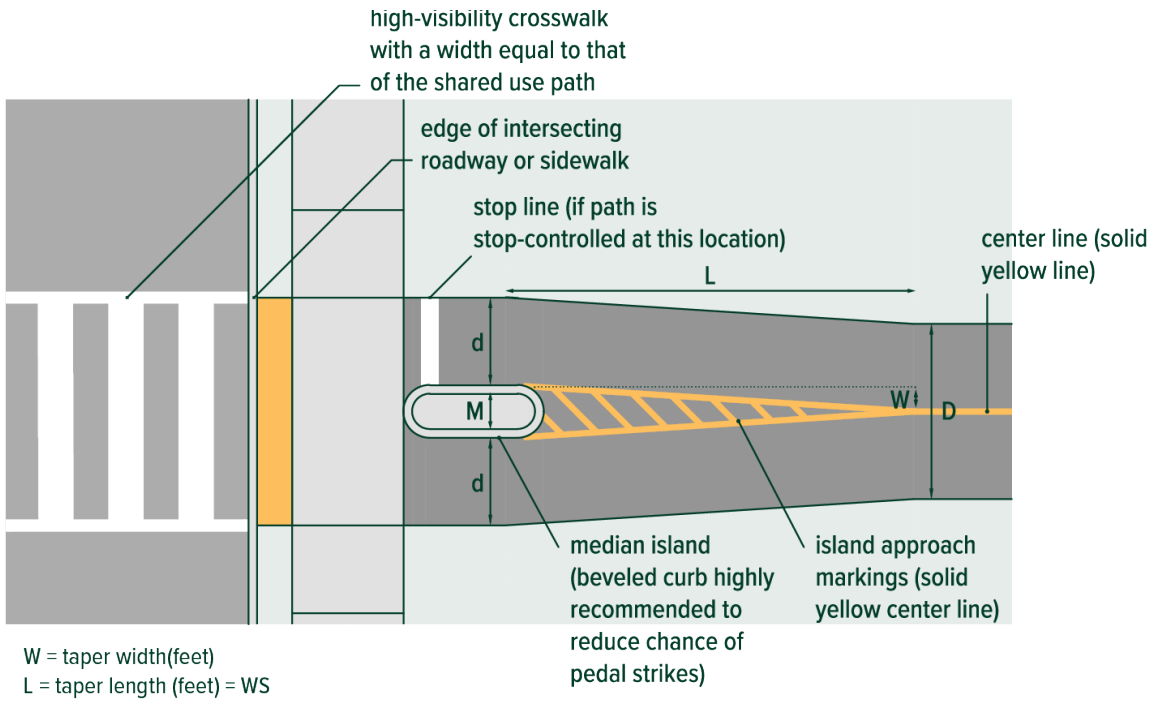
It is not recommended to use bollards, z-gates, fences, and other vertical obstructions within the Bay Trail to restrict unauthorized motor vehicles. These vertical elements create permanent obstacles and are a safety hazard for trail users, are often ineffective at keeping out motor vehicle traffic, and can also slow access for emergency responders.

The following three-step approach should be used to prevent unauthorized motor vehicle entry to the Bay Trail:

1. Post signs that identify the entry as the Bay Trail as well as regulatory signs that prohibit motor vehicle entry; assess whether this signage prevents or reduces unauthorized traffic. If motor vehicle incursion is isolated to a specific location, consider targeted surveillance and enforcement. Signage can indicate an associated fine for violations.
2. Design the entry to clearly indicate that it is not intended for vehicle access. A preferred method of restricting motor vehicle entry is the use of a center island that splits the path into two sections. Curbing used around the perimeter of the island should be beveled or mountable to reduce the risk of pedal strikes for passing bicyclists. The center island can feature landscaping and should be designed to allow emergency and maintenance vehicles to enter the shared use path, if needed, by straddling the island.
3. Alternatively, it may be more appropriate to designate access for emergency and maintenance vehicles via separate access drives adjacent to trail access points, which can be secured by gates or fencing. Separate access drives should not be secured only by removable bollards, as this may encourage potential use by trail users.

If unauthorized motor vehicle access continues to occur after the above steps have been taken, assess if the problems posed by unauthorized vehicle entry exceed the risks and access issues posed by barriers.

FIGURE 22 Preferred trail entry design



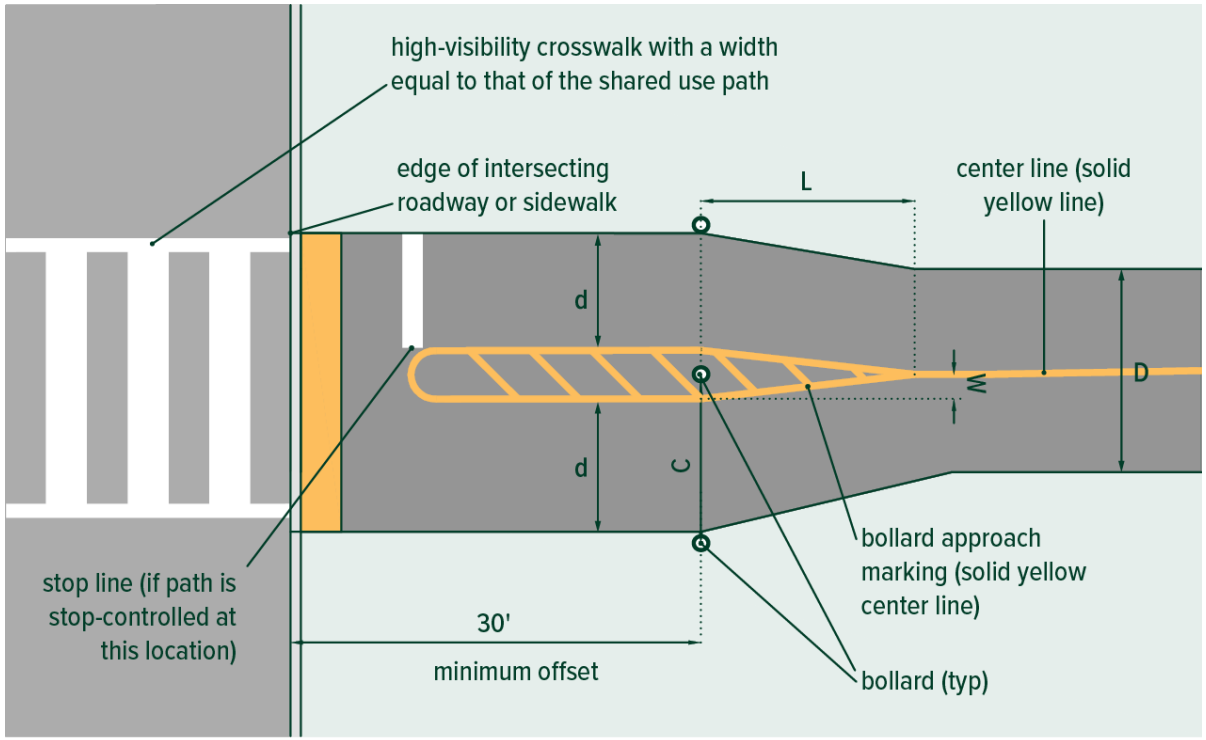
W = taper width(feet)
L = taper length (feet) = WS
    20 feet minimum
    where S = design speed of path in miles per hour (typically 15 mph)
D = width of path
d = width of path at entry
    measured as distance from edge of median island toedge of path
    should equal half of path width (D)
    5-6 feet recommended
    4 feet absolute minimum
    6 feet maximum
M = width of median island
    2 feet minimum
    4.5 feet maximum

Bollard Design

Where bollards or other barriers are determined to be necessary, consider the following to make the bollards as compatible as possible for all Bay Trail users:

- Flexible or spring-mounted delineators should be used before rigid bollards to see whether they effectively dissuade unauthorized vehicle access.
- If rigid bollards are determined to be necessary, fold-down bollards should never be used on the Bay Trail, as they create an obstruction hazard for users. Instead, fully removable bollards should be used. Any hardware that is used to install the bollard shall be flush to the surface, so there is no obstruction when removed. A permanently affixed cover with non-slip surfacing that sits flush to the pavement should be used to close the opening when the bollard is removed.
- All effort should be made to increase the visibility of bollards, including but not limited to using alternating reflective banding of contrasting colors on the bollard (typically white or yellow), using internally lit bollards, and installing pedestrian-scale lighting.
- Rigid bollards should be a minimum of 40 inches high with a minimum diameter of 4 inches and a shy distance of 12 to-24 inches for user safety and comfort.

FIGURE 23 Bollard approach markings



W = lateral width offset (feet)
measured from center of bollard to center of path center line marking
1-2 feet recommended
6 inches minimum
L = taper length (feet) = WS
20 feet minimum
where S = design speed of path in miles per hour (typically 15 mph)
D = width of path
d = width of path at entry

Intersections of Two Trails

When the Bay Trail intersects with another trail segment (such as a spur trail connector trail), the trail intersection should be designed to minimize conflicts between trail users. These intersection locations should:

- Accommodate adequate sight distances so that all users can identify potential conflicts;
- Be designed to a right angle as much as possible;
- Widen trails on approach to accommodate high turning volumes, as needed;
- Be designed with relatively flat grades;
- Be designed with small radii (e.g., 10 feet);
- Provide space for any congregation or activity that may occur at the intersection.

EQUITY TIP

- Curves and trail entry points should be designed to accommodate the wide turning radius of some recumbent and other accessibility bikes.

Adobe Creek Trail Bridge, Palo Alto

Bike Roundabouts

Bike roundabouts may be implemented at the intersection of two two-way bikeways as a design solution to manage high user volumes, mitigate turning conflicts, and adapt to limited sight distances. Turning radii should accommodate bicycles or tricycles with wide turning radii, such as adaptive bikes.

The center space in bike roundabouts presents an opportunity for landscaping, lighting, art, or other placemaking or gateway treatments.

Bike roundabouts may also be implemented at the intersection of two shared use paths, but this treatment warrants additional consideration given the introduction of pedestrians as a user group, especially when present in high volumes. When bike roundabouts are implemented on a shared use path, pedestrians may not follow the intended path of travel, especially if turning left, which may introduce additional safety concerns. Bike roundabout should not be selected as a design treatment at the intersection of two shared use paths prior to careful context and safety analysis.

If the Bay Trail is functioning as adjacent pedestrian and bicycle facilities at a given location, bike roundabouts will require alteration to incorporate treatments at pedestrian crossing locations of the bikeway.

Bayfront Park, Mill Valley

Transitions Between Facility Types

At locations where the Bay Trail terminates, it is important to appropriately transition the off-street trail to on-street bicycle facilities and sidewalks. Merging and diverging transitions should be minimized, intuitive, comfortable, and accessible for pedestrians.

In general, it is preferred to transition from a Class I Shared Use Path to Class IV Separated Bikeways or Class II Standard Bike Lanes on the far side of an intersection, to provide maximize safety for users through the intersection. Shared lanes are discouraged and should only be used in very specific contexts in which vehicles volumes and speeds are very low, such as on a local street. When they are used, it is recommended that the transition from a trail to shared lanes occur on the far side of the intersection.

Transitions should be accompanied by signage to warn and direct all users. Transitions at Bay Trail termini should be facilitated at signalized or stop-controlled intersections or crossings and accompanied by advanced warning signage to inform motorists of the upcoming Bay Trail crossings. Transitions should also have wayfinding signage that clearly guides different user groups to the transition facility.

Notes: Two-stage bicycle turn box must be located outside the path of through and turning traffic on the street parallel to the two-way separated bikeway. On streets with no on-street parking, this may require shifting travel lanes to achieve the minimum two-stage bicycle turn box width of 6.5 feet. Two-stage bicycle turn box must include a bicycle symbol and arrow(s) showing the direction of the turn. The box must be bounded by a solid white line and may be supplemented with green-colored pavement that fills the box.

FIGURE 24 Transitions between Two-Way Separated Bikeways and Shared Lanes on Intersecting Street

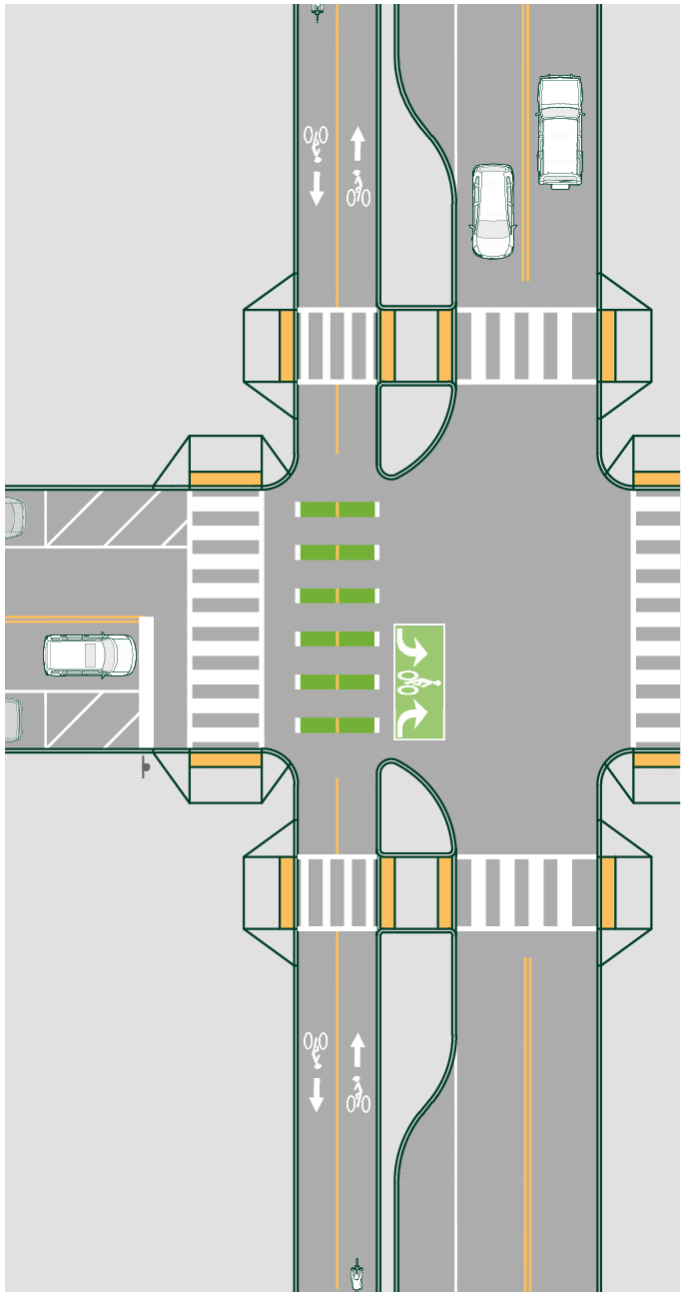
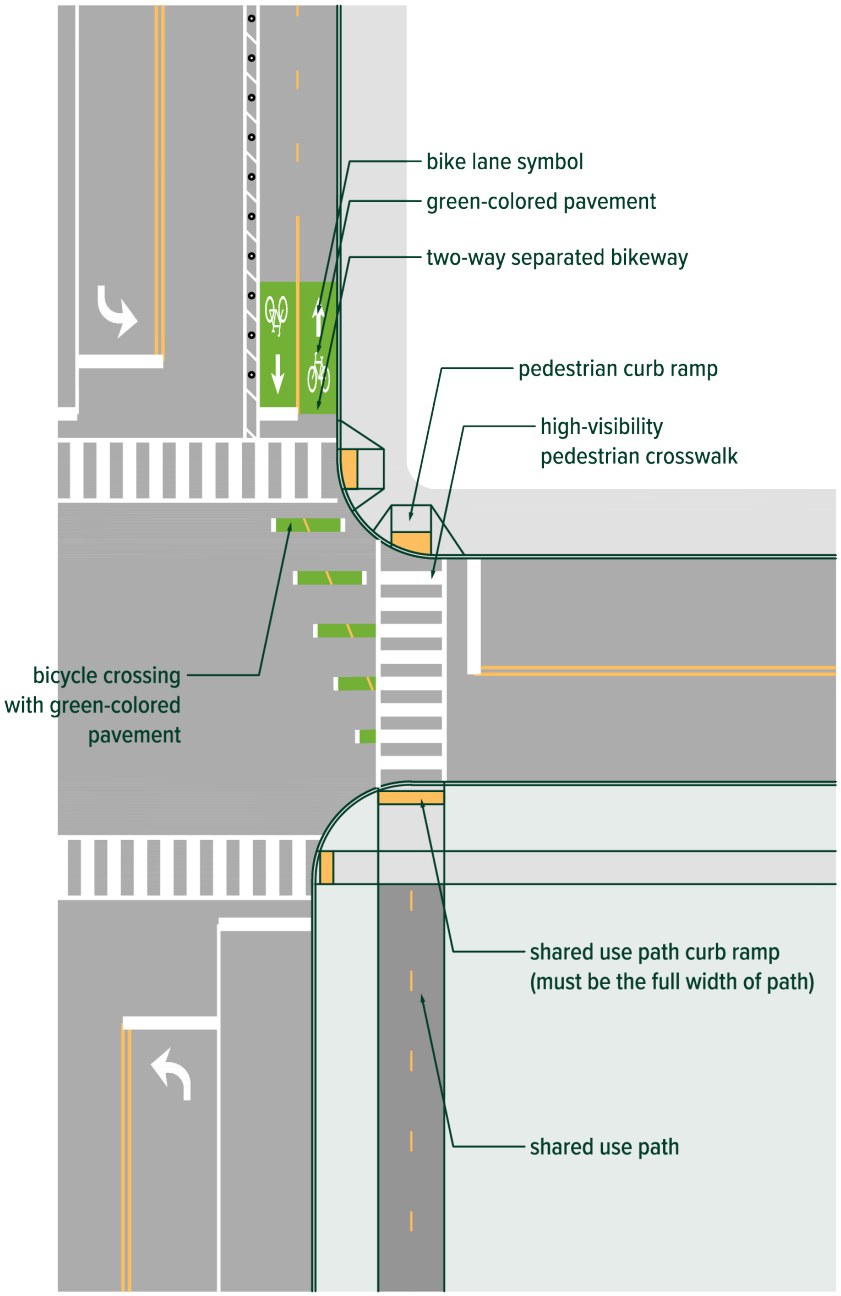


FIGURE 25 Transitions between Shared Use Paths and Two-Way Separated Bikeways

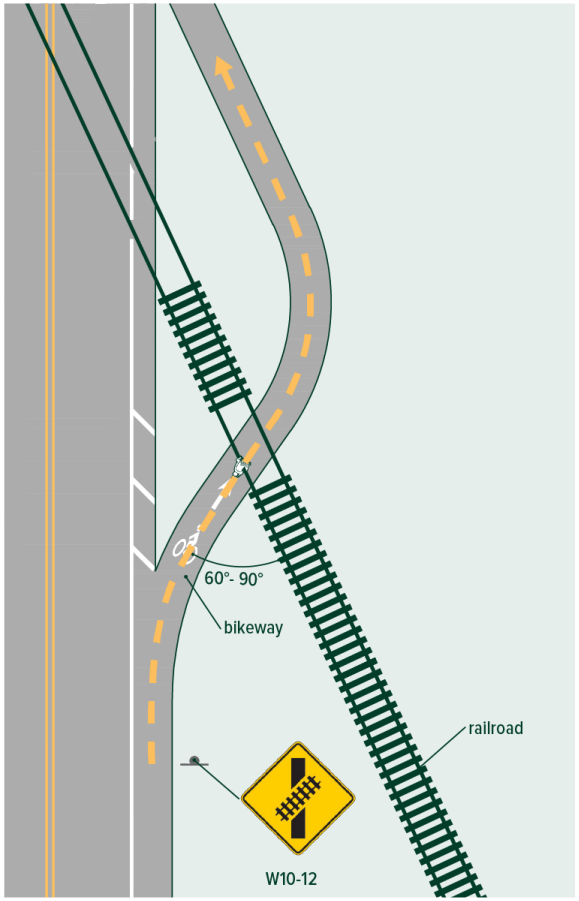


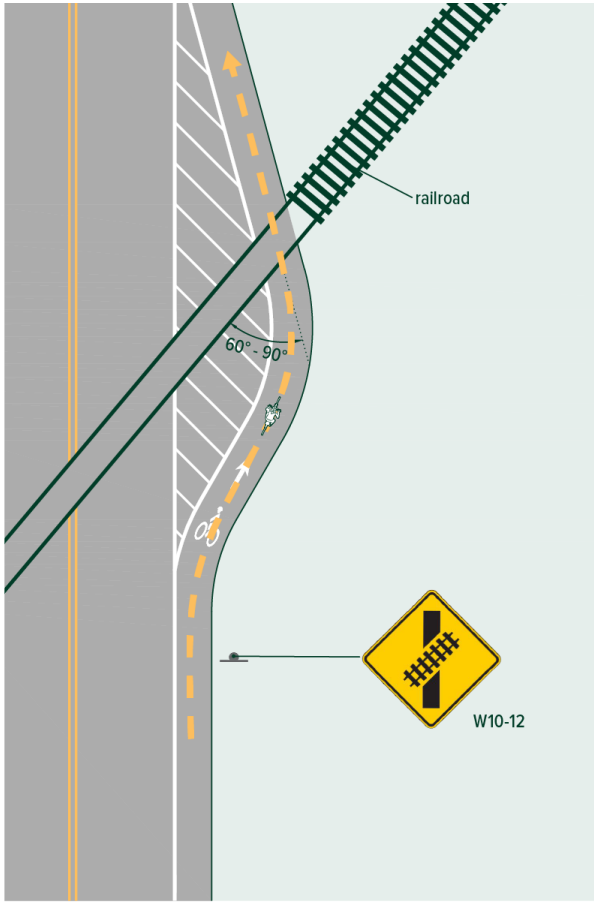
At-Grade Rail Crossings

All railroad crossings are regulated by the California Public Utilities Commission (CPUC) and all new rail crossings must be approved by the CPUC. An at-grade rail or light-rail crossing can be considered where bridges or undercrossings are not feasible, or where trail use levels are low. At-grade rail crossings should:

- Be at least as wide as the trail and shoulders.
- Be straight and at right angles to the rails.
- Have clear line-of-sight up and down the track corridor.
- Include a smooth surface that transitions over the tracks.
- Include flangeway filling strips to meet U.S. Access Board guidelines for pedestrians.
- Include active crossing warning systems (crossing guards and signals) as required.
- For trail segments crossing where a skewed angle crossing is unavoidable, the shoulder width of the trail should be widened to permit bicyclists to cross at right angles.

FIGURE 26 Railroad Crossing Alignment





Overcrossings and Undercrossings

There are many places on the edges of the San Francisco Bay places where the Bay Trail must go over or under obstacles, such as freeways, streets, railroads, rivers, sloughs, and the Bay's waters to achieve continuity. Crossing over or under an obstacle has implications for accessibility, views, experience, capital cost, and operations. If the Bay Trail volumes are high and/or the arterial volumes are high, a trail overcrossing/undercrossing of the arterial is highly encouraged.

Ramps

- Going up or down involves ramping. The U.S. Access Board provides accessibility guidelines for ramps related to grades, rails, and resting places (landings) that apply to the Bay Trail. Ramps shall have landings at the top and the bottom of each ramp run. Landings shall comply with section 405.7.[10]

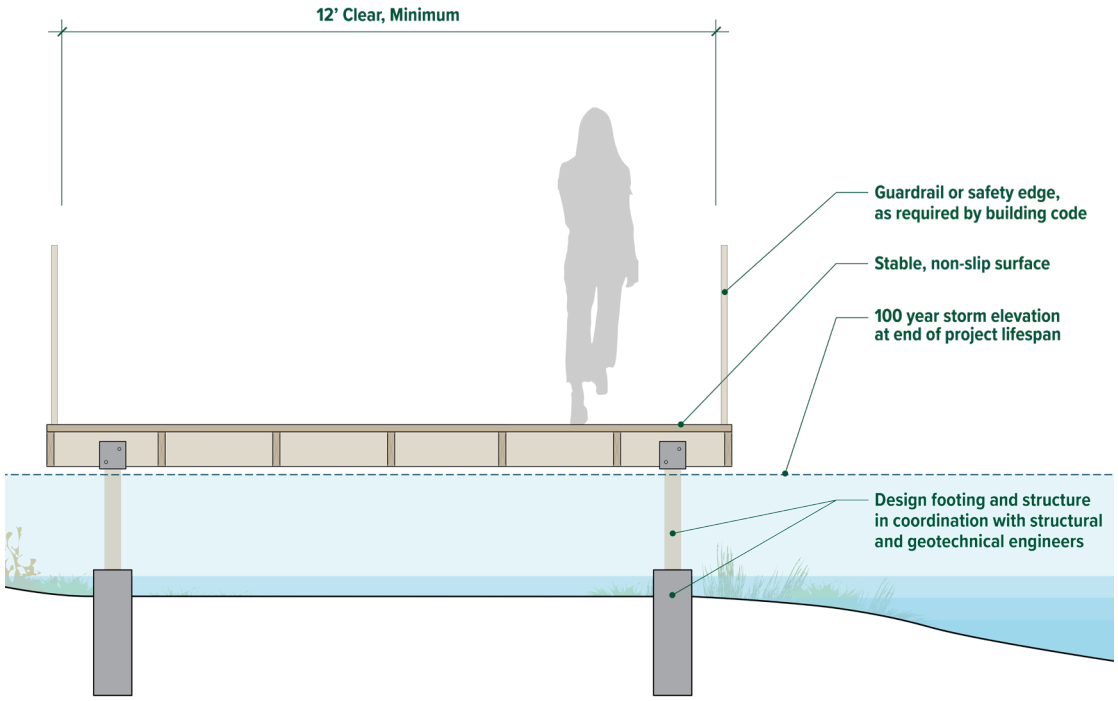
RESILIENCE TIP

- Design foundations/footings for retaining walls and bridge structures on a conservative assumption regarding earthquake hazards. Where possible, avoid designing for a pedestrian load only.

Bridges, Viaducts, and Boardwalks

- The clear, unobstructed width of the Bay Trail between railings should be at least 12 feet.
- Structures may be designed to carry service and emergency vehicles based on the needs of the local agency.
- The clearing height from overhead obstructions, including fencing, should be 10 feet.
- The design style of these Bay Trail features should be compatible with surrounding land uses, habitats, and adjacent developments.
- Per Caltrans requirements, bicycle railings shall be set no lower than 42 inches, or 48 inches from in-plane railings from the top of the riding surface.[11]

FIGURE 27 Boardwalk Construction Cross-Section



10 US Access Board, https://www.access-board.gov/ada/#ada-405_7

11 California Amendments to AASHTO LRFD Bridge Design Specifications, Sixth Ediftion; Chapter 13: Railings. https://dot.ca.gov/-/media/dot-media/programs/engineering/documents/caamendments/aashto-lrfd-6th-ca-amendments-a11y.pdf

Tunnels

- Tunnels, while a less ideal solution due to sea level rise, flooding, and perceived safety issues, may be the best solution in certain conditions.
- The clear, unobstructed width of the Bay Trail between tunnel walls should be at least 12 feet, though ideally wider.
- The ceiling height should be at least 10 feet, though ideally higher.
- Additional lighting or security cameras may be required by the managing agency.
- If the tunnel is prone to flooding, cautionary signs and/or possible trail closure mechanisms (e.g., red and white striped gate arms, warning lights) should be considered along with adequate drainage and pump designs.
- Tunnels are not appropriate near streams, creeks, and other waterways as flooding issues due to climate change will be exacerbated in the future.

RESILIENCE TIP

- If the tunnel is prone to flooding, the local agency should plan for an overcrossing in the future..

Willow Rd and Hwy 84, Menlo Park

3.5 Trail Support Facilities

Trail support facilities (e.g., benches, restrooms, drinking fountains, etc.) and design elements (e.g., signs, pavement markings, railings, etc.) are key pieces of the trail user experience, comfort, and convenience. They are the additional pieces that can encourage new users, bring back returning users, and make the experience better for everyone. The collection of elements, specific design, and materials of the elements may vary depending on the context, but the guidelines below can ensure that the pieces work cohesively in the Bay setting and provides enough consistency throughout the larger Bay Trail system.

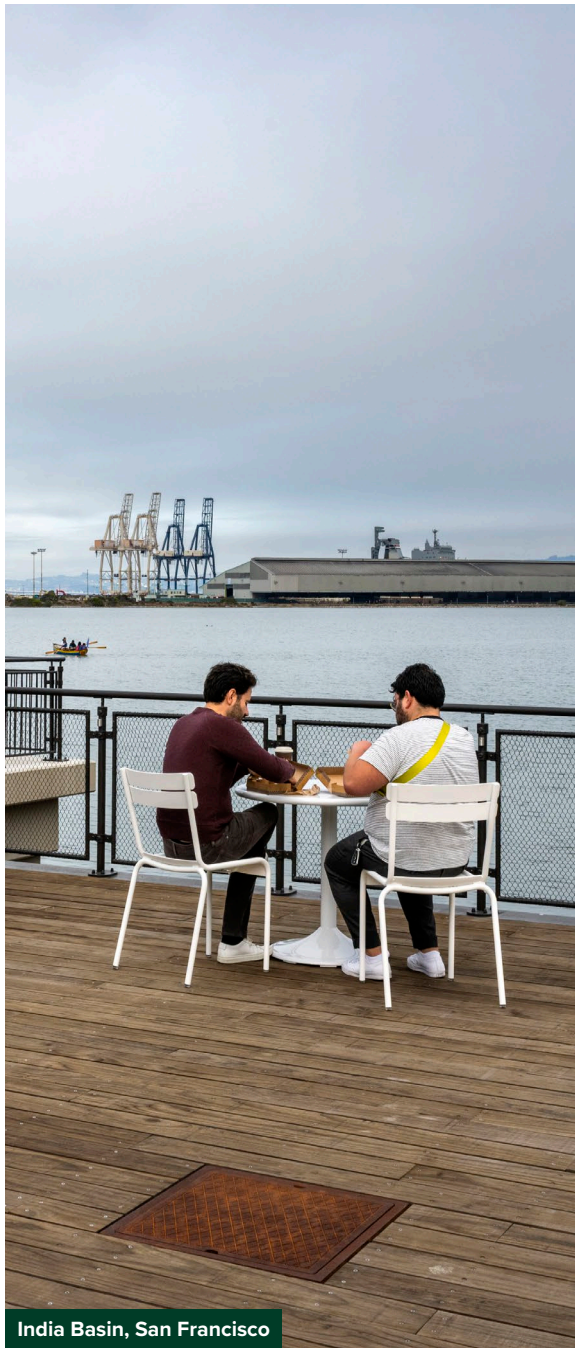
Sea Plane Lagoon Promenade, Alameda

When deciding whether to include specific trail support facilities, consider the following:

- **Ongoing Maintenance** – Is there capacity and funding to ensure ongoing care and replacement? Where there are limited funds, prioritize elements that require less maintenance (such as bike racks and signs) or increase accessibility, such as benches.
- **Context** – Are the elements appropriate for the context? Prioritize locating elements in high-intensity locations, such as populated areas or within developed parks, where access for maintenance is easier and use will be higher.
- **Equity –** What kind of support facilities are needed to make the trail experience comfortable and accommodating for all users? Amenities support the wide range of purposes the trail serves, and help users feel a sense of welcome and belonging in this public space.

When selecting, designing, and locating specific elements and facilities, consider:

- **Fixed-object hazards** – Avoid hazards by following the clearance guidance in **Section 3.1: Beyond the Trail** above when locating fixed objects, including signs, benches, and waste receptacles close to the trail.
- **Bay experience** – Maintain views of the Bay when placing vertical elements such as fences, restrooms, and signs.
- **User expectations** – Place elements where they are most likely to be expected by and useful to trail users, such as signs at intersections and bike racks at destinations or rest areas, such as restrooms, benches, picnic areas, piers, etc.



India Basin, San Francisco

Seating – Benches and Picnic Tables

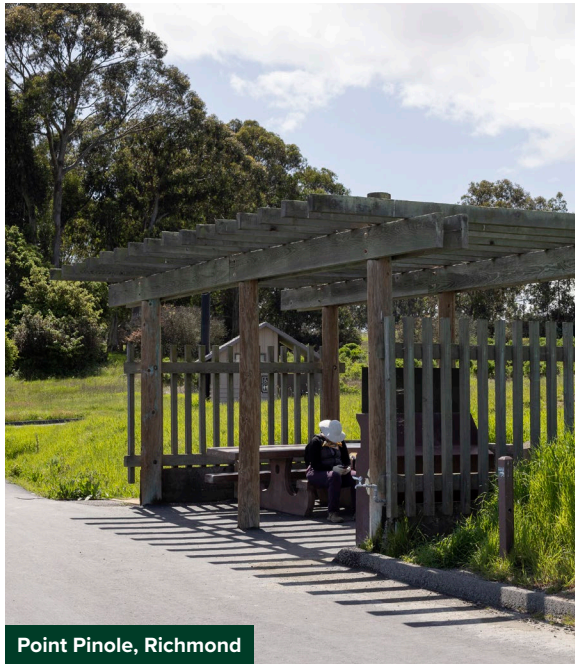
Benches provide resting places that make trails more usable and comfortable. Benches may be located at trail access points, at regular intervals along the trail, and at points of interest, such as viewpoints or nature observation areas. Picnic facilities typically include benches, tables, waste receptacles, and in some cases, overhead shelter. These facilities may be within the trail design envelope, or they may be included in a trail-adjacent park or larger staging areas. In either location, picnic facilities encourage use of the trail by families and groups and provide destination points where trail users can rest.

RESILIENCE TIP

- Specify site furnishings composed of recycled, recyclable orreused materials, and/or certified sustainably produced lumber where appropriate. Avoid pressure treated wood with chemicals that can leach into the watershed.
- Select trail support facility materials that can withstand fire, high heat, wind, and storm surges.

Bench and picnic table design must include accessible options and should reflect the context. This may mean orienting benches toward bay views or toward vistas of opposite shores, bridges, or other landmarks, providing shade and/or wind protection, and providing a variety of seating choices. There are no accessibility standards for park benches, but to ensure programmatic access, it it important to provide companion seating spaces next to benches oriented for shoulder-to-shoulder viewing.

Benches and picnic areas are also good locations for device charging, particularly if photovoltaic (solar) panels can be incorporated into a shade structure. A solar-powered charging station can be useful daily and can become a community lifeline in an emergency or natural disaster.



Point Pinole, Richmond

EQUITY TIP

- Include a flat, stable surface next to the bench for a wheelchair user to rest alongside someone sitting on the bench. This space is also useful for families with strollers, bike riders, or anyone looking for extra space to gather on the side of the trail.

India Basin, San Francisco

Drinking Water

Drinking water is important for the safety of trail users, particularly on Bay Trail sections without shade, for new trail users, and for users travelling long distances. Water can be provided in drinking fountain/bottle refill/dog bowl stations or may be available at stores along the trail. Where water stations are installed, they often accompany full restrooms, but they may be installed at any other location where there is water service and they would support trail use, particularly on long trail corridors. Provide drinking water at least every two miles, where possible. All drinking fountains must include accessible options. Where dogs are allowed, consider including a dog-level drinking bowl. Near beaches, a foot-level faucet is helpful for rinsing feet.

Blu Harbor, Redwood City

Railings and Fences

In some situations, the Bay Trail may need to include railings to prevent falls, fences to restrict access to specific locations, or walls for either purpose. The Bay Trail may also need handrails to assist with stability/movement, especially to help propel people walking forward or for stabilization on steeper trails. The design and materials of these elements should preserve views of the Bay and should relate to the architectural or landscape style of the surrounding area. Local regulations establish the height and openness of guardrails or walls to prevent trail users from falling. Additional considerations for trail use include:

- Including wide “rub rails” in some settings to reduce the likelihood that a bicyclist’s handlebar might be caught by the railing
- Avoid designing a wide top rail that would obstruct views for people in wheelchairs or seated on benches.
- In sensitive habitat areas railing tops needs to be designed to prevent predators from perching, resting, or standing there, which could increase predation of critical species.

Gates and Bollards

Generally, gates and bollards should not be used to restrict access by motor vehicles at trail entrances. See Shared Use Path Approach, Entry, and Trailhead Design section in **Section 3.4: Site-Specific Design Treatments** above for more information.

Blu Harbor, Redwood City

Trail Access Points and Parking

Trail access points are any place where a trail user can get on or off the trail. Every access point should have a fully accessible route from a transit stop, accessible parking space, or an adjacent facility (such as a building or park). This route should meet or exceed the applicable guidelines[12] for exterior routes of travel, including width, slope, cross slope, and surface.

Providing parking is particularly important in areas with limited public transit, sidewalks, and bicycle routes. Parking must meet or exceed applicable guidelines[13] for dimensions, slope, markings, and landscaping as well as the location and quantity of accessible parking spaces. Accessible parking spaces should have the shortest possible safe, accessible route to the trail access point as well as any other site facilities such as benches, restrooms, and drinking fountains.

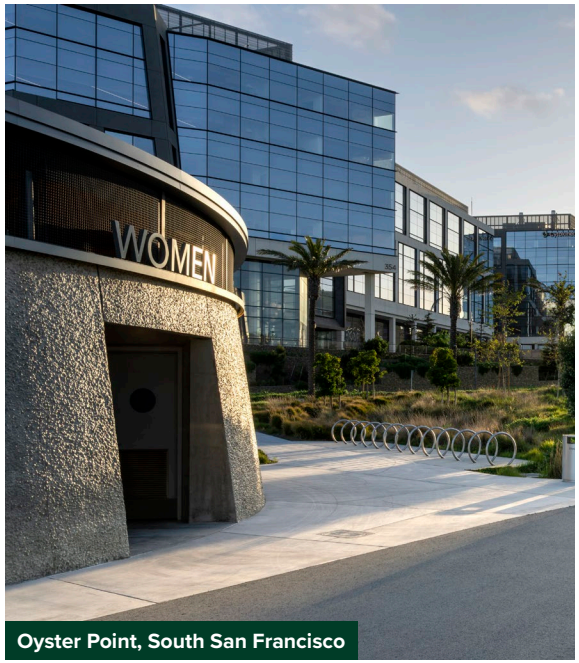
The access route and accessible parking must meet or exceed PROWAG when in the public right of way, and ADA in all other locations. Local jurisdictions may have additional accessibility requirements.

12 U.S. Access Board, Public Right-of-Way Accessibility Guidelines, Chapter 10: Outdoor Developed Areas

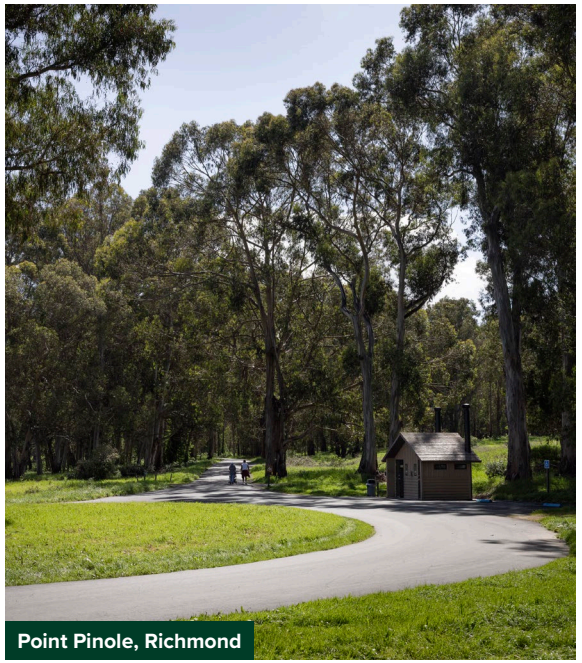
13 U.S. Access Board, Public Right-of-Way Accessibility Guidelines, Chapter 5: Parking

Restrooms

Provide restrooms at least every two miles along the trail, where feasible and based on the surrounding environment and level of use. Restrooms may be at Bay Trail staging areas, along the trail, or associated with restrooms of other Bayside uses such as at San Francisco Bay Area Water Trail launch locations, ferry terminals, harbormasters, shoreline commercial areas, or parks. Restrooms must include accessible options and may be co-located with other trailside elements such as drinking fountains, benches, waste receptacles, and bicycle racks. Restrooms are typically permanent structures and may use vault toilets that need to be emptied regularly or may have water flush toilets where water and sewer service is available. Temporary chemical toilets (e.g., porta-potties), may be used where no other options are possible, but are not recommended due to their high maintenance requirements.



Oyster Point, South San Francisco


Point Pinole, Richmond

Waste and Recycling Receptacles

Easy access to waste and recycling receptacles can increase the cleanliness of the trail, reduce the amount of trail maintenance required, and increase the positive experience of trail users. Dog waste facilities can be co-located with waste receptacles and can include bags to encourage pet waste collection. All waste and recycling facilities should be easily visible to encourage use, and in places that are easily accessible to maintenance staff and/or vehicles, such as near trail entrances. Use fully enclosed bins to prevent scavenger animals from pulling out waste that could blow into the Bay. Waste and recycling receptacles are frequently co-located with other elements such as restrooms and seating.


255 Airport Blvd, Burlingame

Bicycle Racks and Repair Stations

Provide options to securely lock bicycles, scooters, and other micromobility devices along the trail near locations where a trail user may want to pause their ride and engage in another activity. This includes near destinations (schools, shopping, playgrounds, and historic sites), at hiking trails (where bicycling is not allowed), and at meeting points/picnicking areas (where bicycles may be left for extended periods of time).

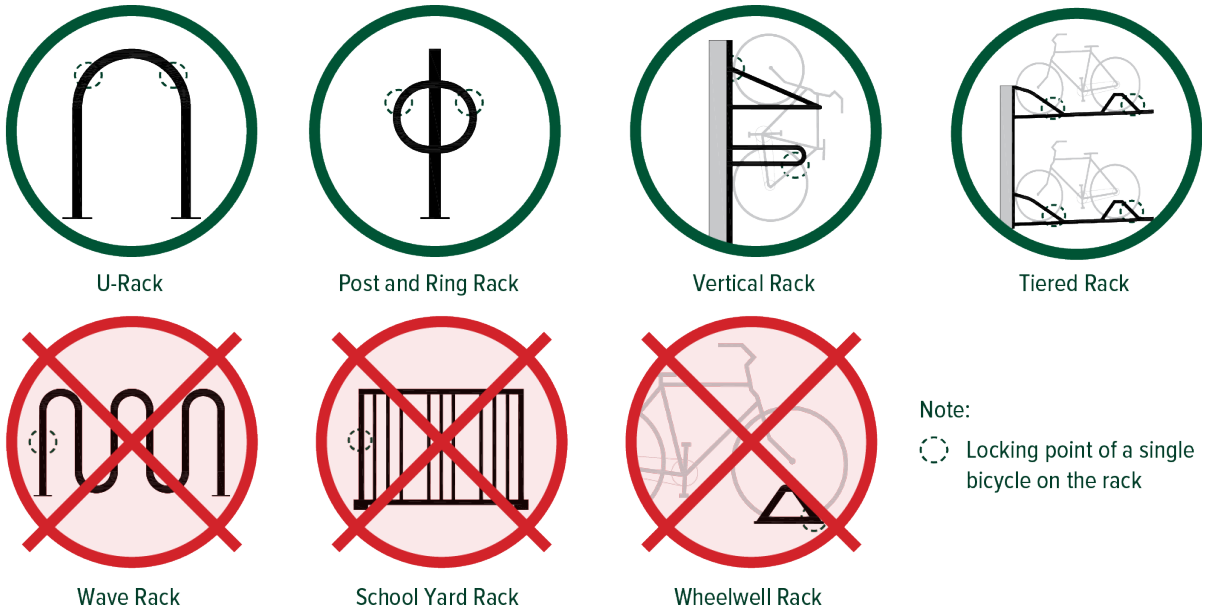
Generally, one bicycle parking space should be 6 feet long by 2 feet wide with at least 7 feet of vertical clearance. Adequate clearance around a rack ensures that bicyclists have enough space to maneuver and lock their bikes, without obstructing adjacent activity. Bicycle racks should be long enough to allow the bicycle to rest on the rack and be locked to it in two places (such as securing the rear wheel and the bike frame). The rack material (such as powder coated steel), thickness, and how the rack is attached to the ground should be substantial enough to deter theft.

Bicycle repair stations can be useful for people on bikes or people using a basic wheelchair to fix simple issues, such as a flat tire. Bicycle repair stations need more clearance around them than bicycle racks. It can be useful to locate them near bike parking, for predictability, and to pair them with a bench and trash receptacle.

EQUITY TIPS

- Consider including electricity for electric micro-mobility charging as well e-mobility devices for people with disabilities.

FIGURE 28 Recommended and Not Recommended Types of Bike Racks



Berkeley Marina, Berkeley

Foster City Levee, Foster City

Signage and Wayfinding

A strong signage and wayfinding system makes the trail network knowable and usable. It also supports emergency response and trail maintenance activities and can provide information about trail conditions. One of the most cost-effective elements of a trail network is the systematic design of signs and wayfinding, to maximize benefits and avoid visual clutter and confusion.

All trail signage should be clear, visible, and relevant to all trail users and must meet accessibility guidelines for placement and content. Providing information in multiple languages and using pictograms can increase the usefulness of signs.

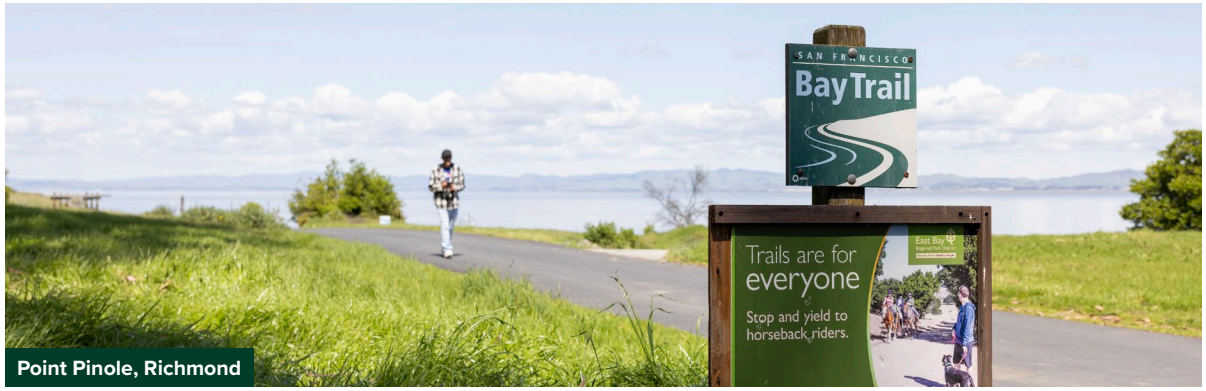
Raised lettering, tactile elements, and technology, such as QR codes, can enhance the user experience and provide information via audio to visually impaired people.

As of spring 2025, MTC is developing new Regional Mapping and Wayfinding Standards. Local agencies and jurisdictions designing signage for connections between the Bay Trail and nearby public transit facilities should consult the standards for relevant design guidance and/or symbology. For more information, visit Regional Mapping & Wayfinding.[14]

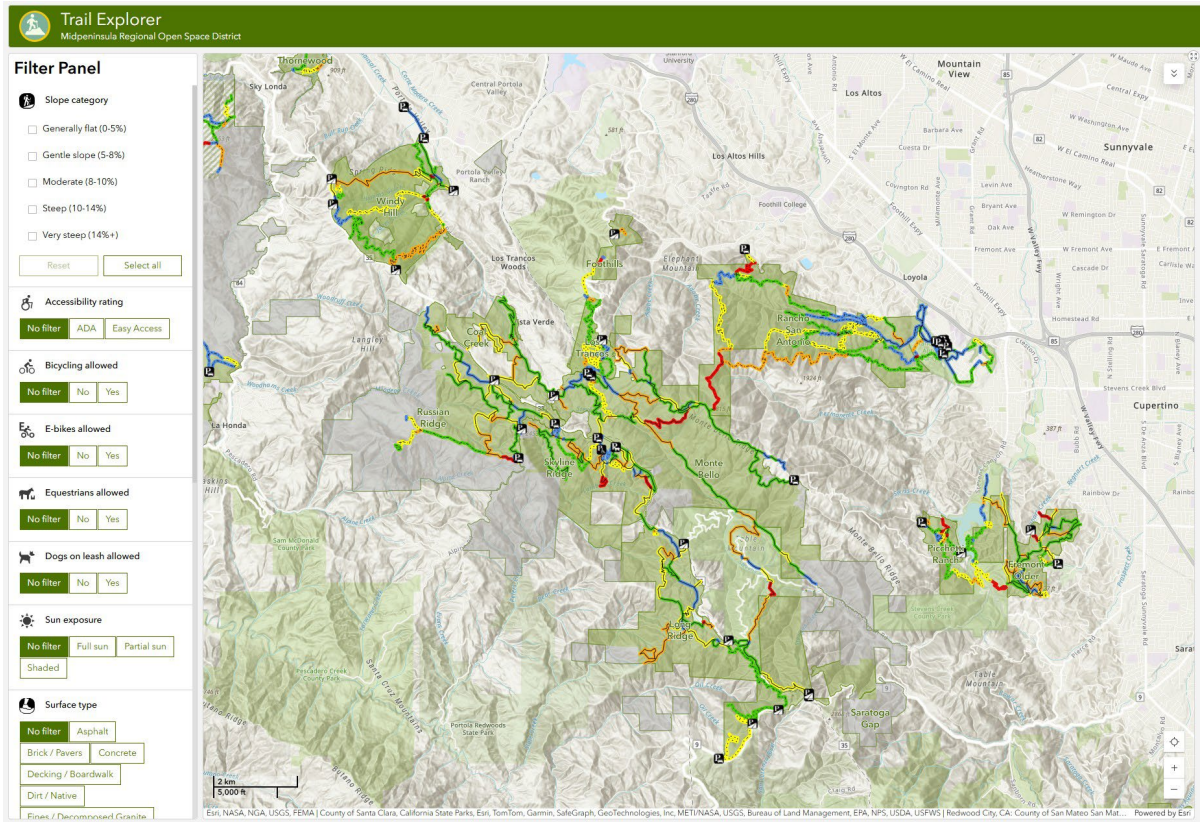
A signage system may include:

- Area-wide and corridor-specific maps
- Trailhead regulatory and information signs
- On-trail junction, confirmation, and mile marker signs or posts
- On-trail roadway name and warning signs
- On-road trail crossing names and warning signs
- On-street directional and guide signs to trailheads

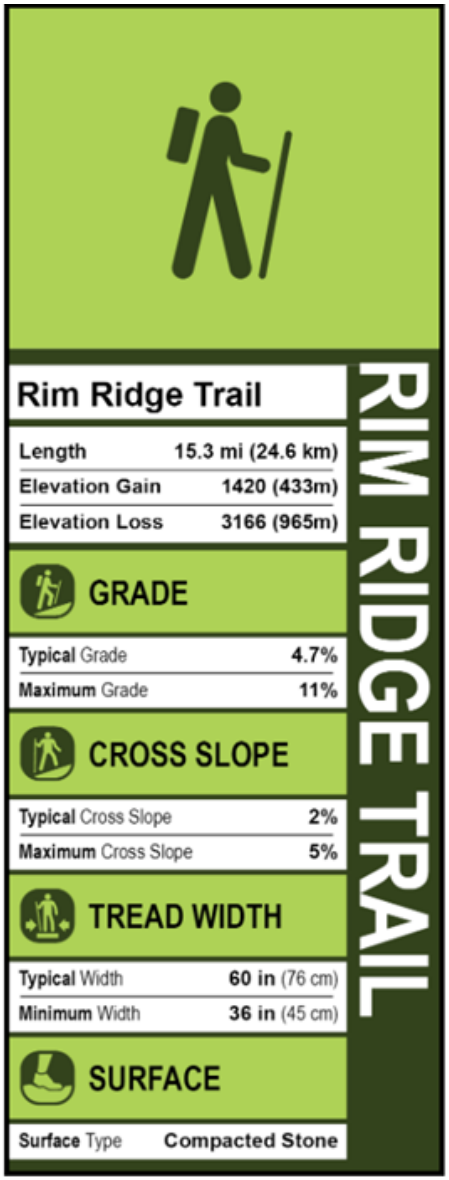
14 Regional Mapping & Wayfinding | Metropolitan Transportation Commission. https://mtc.ca.gov/operations/transit-regional-network-management/regional-mapping-wayfinding.



Point Pinole, Richmond



Trail map that provides accessibility information. (Source: Mid-Pen Trail Explorer GIS Map)



Example of a trail signage that provides accessibility information. (Source: US Access Board Guide to the ABA Accessibility Standards, Chapter 7 Signs [Trailhead Signs])

Bay Trail Signage and Wayfinding

Signage and wayfinding on the Bay Trail will typically follow the local agency's styles and standards but should always use the Bay Trail logo to identify the trail as part of the Bay Trail. The Bay Trail logo should be easy for anyone to recognize from near (small signs) or far (large signs). Recognition of the Bay Trail is critical to inform users that they have arrived at the trail, direct users along it, and in some cases, to inform users that they are still on the trail and have not made a wrong turn.

There are three basic uses of the Bay Trail logo sign, which correspond to the basic stages of wayfinding, as shown in the table at right.

TABLE 10 Uses of the Bay Trail Logo Sign

Sign Types	Function	Application
Identification	To indicate entry to the Bay Trail system	At trailheads, staging areas
Directional	To support wayfinding along the adopted Bay Trail alignment To indicate a turn in the route	In advance of turns
Confirmation	To confirm and reassure trail users they are on the correct routes	After intersecting trails or along streets – frequency will vary based on context and user needs

Yerba Buena Island

Use of the Bay Trail Logo

The Bay Trail logo and Bay Trail branding (Figure 23) are only to be used on the adopted Bay Trail spine and spurs. On connector trails and other on-street routes that lead to the Bay Trail spine, wayfinding signage should spell out “Bay Trail” indicating it as a destination.

The Bay Trail logo is typically applied as a small shield (3”x3”), a medium logo sign (12”x12”) or a large logo sign (18”x18”). The context and scale of the environment will dictate the size of the Bay Trail logo signs used for wayfinding.

Consult the current Shoreline Signs Public Access Signage Guidelines and the BCDC Approved Signage Graphics for the most up-to-date files, including the corresponding directional arrows and icons, and consider the following:

- Along the Bay Trail, the logo sign can be complemented with arrows in advance of a trail intersection to indicate the direction of the Bay Trail.
- As an icon, the logo sign may be used for both identification and directional purposes. It should be used in conjunction with other directional, management, prohibition, and warning signs of the managing agency.
- Large Bay Trail logo signs (18” x 18”) should be located within the user’s view at the entrance to a trailhead on each Bay Trail segment, and where a large visible sign is needed to identify the trail. This size of the logo sign is useful to both trail users and passing motorists.
- Do not use the Bay Trail logo as a painted pavement marking unless long-term maintenance can be assured.

FIGURE 29 Bay Trail logo sign (medium 12”x12” pictured)

FIGURE 30 Bay Trail Signs with Public Shoreline Wayfinding Signage

EQUITY TIP

- Provide a tactile arrow sign to support trail users with sight impairment.

Garrard Blvd, Richmond

Location Signs

All trails should be consistently identified by name at every junction to help users orient themselves. This can be done with simple trail posts, monument signs, or street-name-style signs. Where trail posts are used at trailheads, the posts can efficiently provide context-appropriate location information: trail name visible upon entry, road name visible upon exit.

Additionally, every street crossing should be clearly identified for trail users. This can be accomplished with trail-side street signs or trail posts. Where trails cross under roadways, street names can be posted on the bridge structure.

Finally, off-trail signs can be used to direct drivers, transit riders, pedestrians, and on-road bicycle riders to nearby trails. These signs increase the visibility of the trail network, encouraging use and increasing safety for trail users.

Trailhead Signage

In addition to providing the trail name and Bay Trail logo, trailhead signs should provide all the information that trail users may need for a safe and enjoyable experience. At a minimum, this should include key trail regulations and emergency contact information.

Education and Interpretive Panels

The Bay Trail offers many opportunities to teach trail users about nature, climate change, local history, and much more. Interpretive panels and educational art should be located with enough space to allow trail users to move completely off the trail while engaging with the materials.

India Basin, San Francisco

EQUITY TIP

- Trailhead signage can also show accessibility elements of the trail, such as average slope and cross-slope, average width, surface type, and rest area or bench frequency.

Lighting

Trail lighting can increase the safety and comfort of the trail at night by increasing the visibility of obstructions (fallen trees, debris, etc.) and illuminating trail users at roadway crossings to enhance their visibility to motor vehicles. Trails expected to support commuting should be lit to support those trips when it is dark. Trail lighting can either be connected to an existing electrical grid or each fixture can be powered by on-fixture solar panels.

RESILIENCE TIP

- Solar powered lighting can also include a charging station, which can do double duty as a backup power source for small devices in an emergency.

Trail lighting best practices include:

- Use only dark-sky compliant lighting.
- Avoid any lighting near sensitive habitat or areas where migrating birds are expected.
- Use pedestrian scale fixtures (typically lower and closer together than roadway lighting).
- Focus on critical points, such as trail access points, roadway crossings, tunnels, and bridges, if lighting the entire trail is not feasible.
- Maintain horizontal illumination levels of 0.5 to2-foot candles (5 to22 lux) and avoid creating very bright and very dark areas which make it more difficult for trail users' eyes to adjust quickly enough to see.

Fishing Elements

The Bay Trail connects users to some of the best fishing areas along the shore. Where the trail structure is directly over water, consider providing space beyond the shoulder of the trail equipped with fishing pole holders, benches, and wind breaks. At trailheads near popular fishing areas, provide fish and bait cleaning stations and fishing hook disposal containers. Work with regulatory agencies to add warning signs about mercury and fish consumption in various languages at designated fishing areas. Signage is needed to indicate where fishing is not permitted.

EQUITY TIP

- Short sections of lowered rails can provide fishing access to wheelchair users but also can be useful for shorter people and people who may prefer to sit in their own chair while fishing.

Point Pinole, Richmond

3.6 Landscape and Ecological Design

Landscape and ecological design are complex topics. If a Bay Trail project falls within the jurisdiction of the Bay Conservation and Development Commission (BCDC), the project must consult with BCDC. The information described below is for illustrative purposes only and is not to be used for design purposes. This information is included in this guidance document because it is important for regional partners to understand this topic at a high-level.

Throughout the Bay Area's long history of development, many of the region's critical habitats have been degraded or eliminated to make way for industry, farming, and urbanization. Hydrology, topography, and vegetation have all been radically altered, with major implications for native wildlife and ecosystems.

The Bay Trail provides a unique opportunity to create a connected corridor of native planting and habitat areas that will traverse a variety of ecosystems, providing benefits to humans and wildlife alike and restoring some of the region's diverse environments.

Incorporating ecological design into the Bay Trail corridor provides benefits to both people and wildlife. Native plants enhance the shoreline's aesthetic beauty and create a strong sense of place, re-enforcing connections between people and nature that have been shown to improve both physical and psychological well-being. At the same time, habitat areas provide resources for native wildlife, including space for shelter, nesting, and foraging.

The landscape along the Bay Trail should strive to:

- Create and enhance native habitat areas wherever possible, with the goal of establishing habitats that are complex, diverse, and able to become self-sustaining over time.
- Integrate habitat areas into the urban landscape in a manner that provides benefits to Bay Trail users and communities.
- Reduce erosion and provide slope stabilization, in conjunction with engineering methods.
- Address sea-level rise and climate resilience, which is discussed in more detail in **Section 3.3 Linear Design Elements and Approaches.**

Crissy Field Marsh, San Francisco

Bay Area Habitats

The Bay Area supports a wide array of habitats, thanks to the region's coastal location, dramatic topography, and the resulting weather variations and microclimates. We focus here on the wetland-to-upland transition zone along the edges of the Bay, since those are the vegetation communities that will dominate the landscapes surrounding the Bay Tail. However, project site analysis may reveal habitat types or variations not listed here. To understand a site's target habitat, analyze the site's abiotic conditions and examine the plant assemblages present in nearby, native-plant dominated reference sites.

Tidal Marsh. Tidal marsh complexes are situated below the high tide line where plants are inundated by sea water and may include habitats such as mud flat, salt marsh, and brackish marsh. Key plant species include perennial pickleweed (*Salicornia pacifica*), alkalai bulrush (*Bolboschoenus maritimus*), marsh gumplant (*Grindelia stricta*), and salt grass (*Distichlis spicata*).

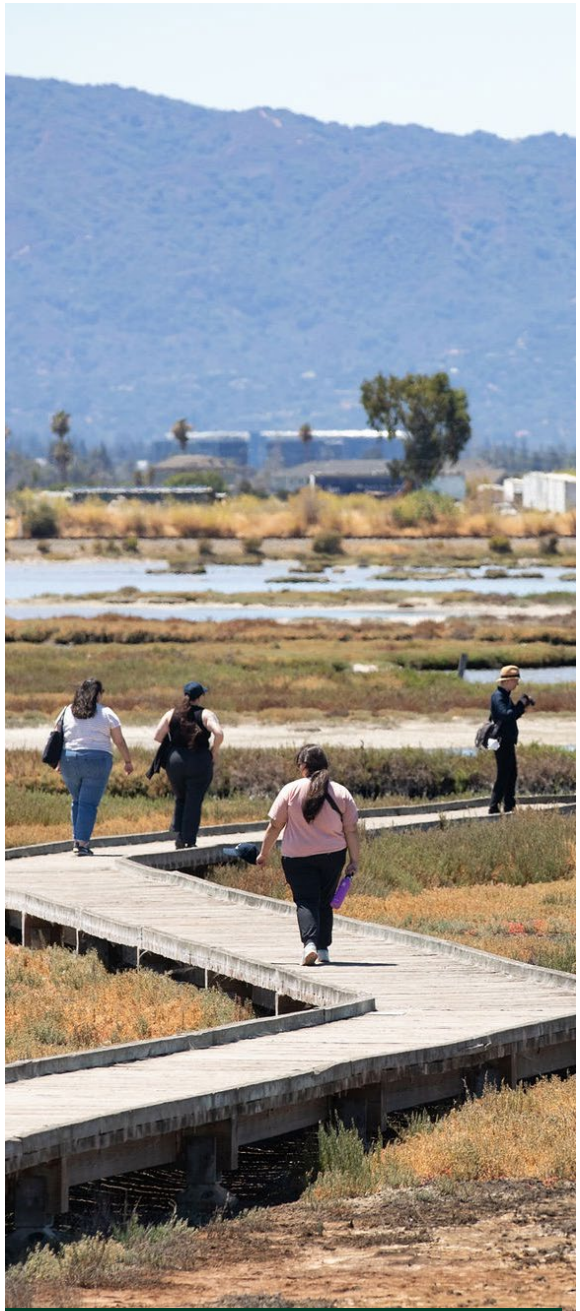
Seasonally-Flooded Wetland. This gradient of habitats includes temporarily or seasonally flooded areas, typically characterized by high groundwater, poor drainage, or the presence of seeps. These may include moist alkali meadows, wet meadows, high marsh pannes, and vernal pool complexes. Key plant species include salt grass (*Distichlis spicata*), creeping wildrye (*Elymus triticoides*), marsh baccharis (*Baccharis glutinosa*), and smooth goldfields *(Lasthenia glabrata).*

Riparian Woodland. This habitat is typically found along creeks or riparian corridors beyond the reach of bay tides. Willow dominated woodlands may also be found in areas of freshwater ponding or high groundwater disconnected from riparian corridors (a willow thicket), including at tidal marsh-upland edges. Key plant species include red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*), and white alder (*Alnus rhombifolia*).

Valley Grassland. Grass-dominated and typically found on hillsides, this habitat type may sometimes include widely scattered native oaks (oak savanna). Key plant species include purple needlegrass (*Stipa pulchra*), foothill needlegrass (*Stipa lepida*), common rush (*Juncus effusus*), and valley oak (*Quercus lobata*).

Mixed Coastal Scrub. This native shrub community is typically found on well-drained, rocky hillsides. Key plant species include coyote brush (*Baccharis pilularis*), toyon (*Heteromeles arbutifolia*), California rose (*Rosa californica*), and monkeyflower (*Diplacus aurantiacus*).

Oak Woodland. Typically found on well-drained hillsides throughout the Bay, key plant species include coast live oak (*Quercus agrifolia*), California bay (*Umbellularia californica*), and toyon (*Heteromeles arbutifolia*).



Don Edwards SF Bay National Wildlife Refuge, Fremont

Tidal Marsh

Alkalai bulrush *(Bolboschoenus maritimus)*

Salt grass *(Distichlis spicata)*

Marsh gumplant *(Grindelia stricta)*

Perennial pickleweed *(Salicornia pacifica)*

Seasonally Flooded Wetland

Marsh baccharis *(Baccharis glutinosa)*

Western goldenrod *(Euthamia occidentalis)*

Smooth goldfields *(Lasthenia glabrata)*

Riparian Woodland

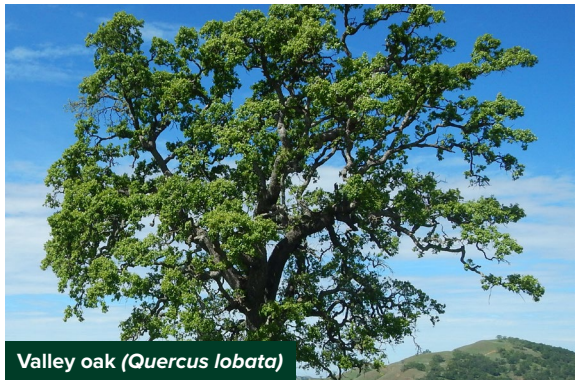
White alder *(Alnus rhombifolia)*

Red willow *(Salix laevigata)*

Arroyo willow *(Salix lasiolepis)*

Valley Grassland

Creeping wildrye *(Elymus triticoides)*



Valley oak *(Quercus lobata)*

Purple needlegrass *(Stipa pulchra)*

Mixed Coastal Scrub

Coyote brush *(Baccharis pilularis)*

Monkeyflower *(Diplacus aurantiacus)*

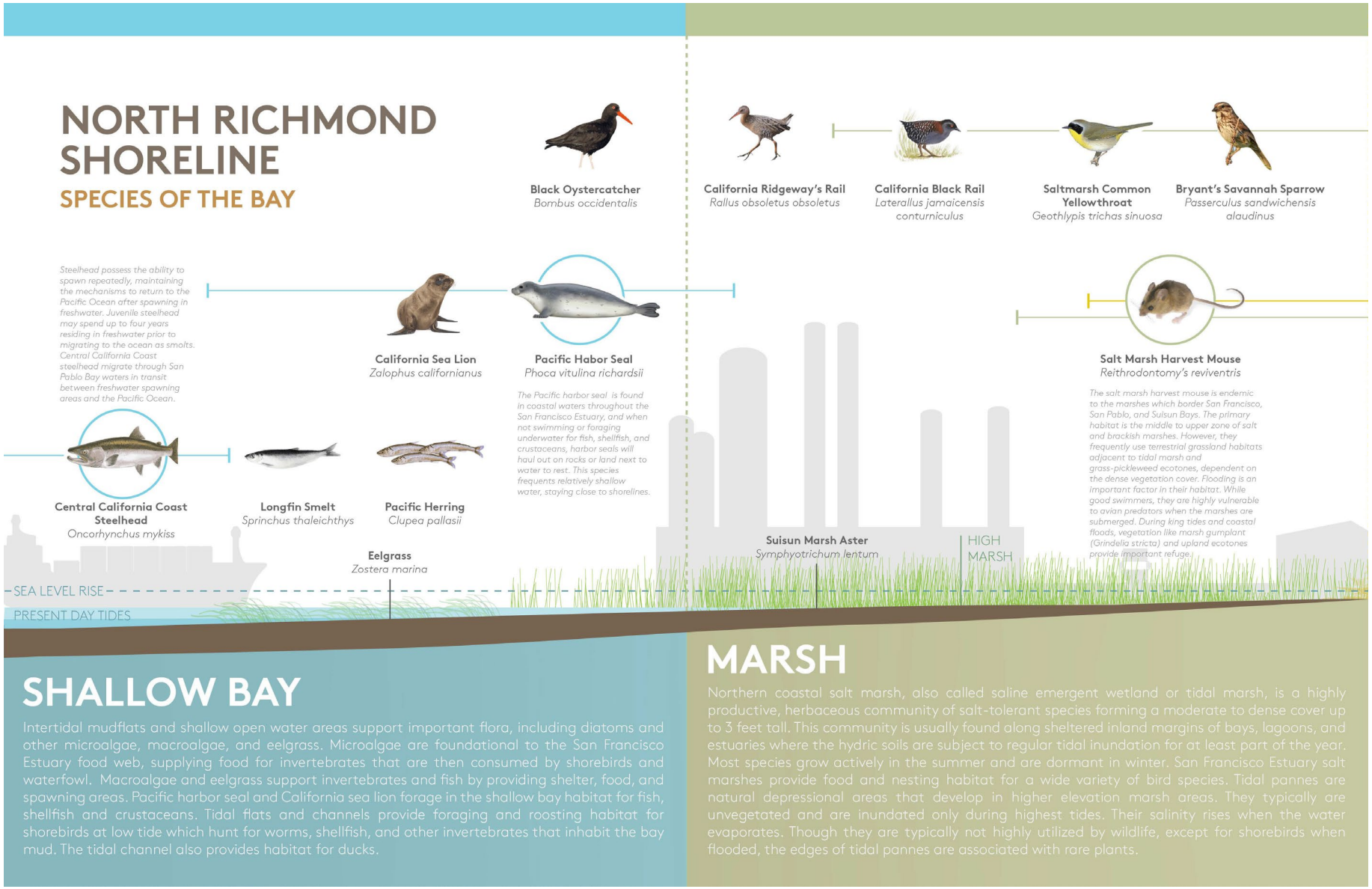
California rose *(Rosa californica)*

Oak Woodland

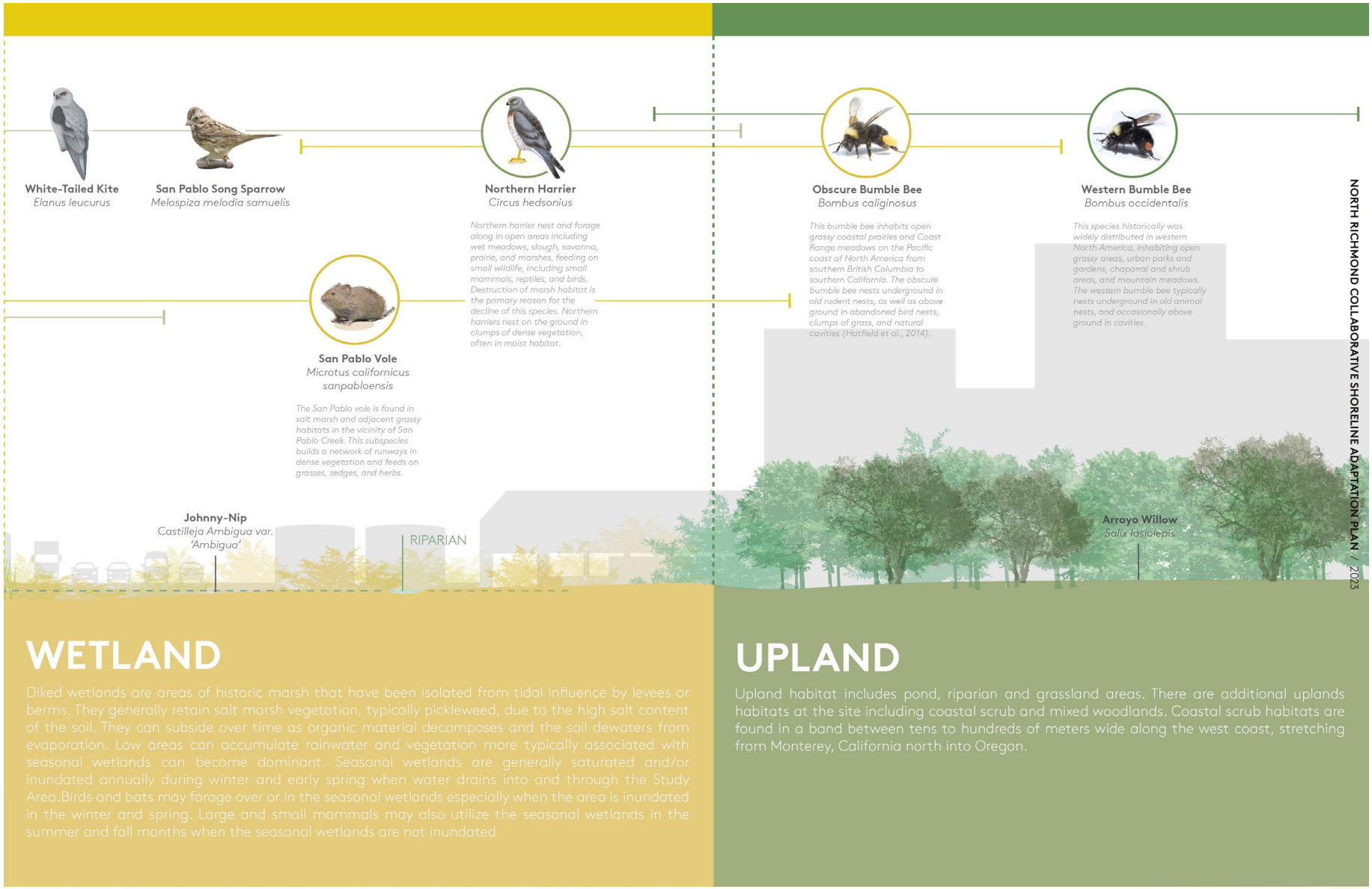
Toyon *(Heteromeles arbutifolia)*

Coast live oak *(Quercus agrifolia),*

California bay *(Umbellularia californica)*



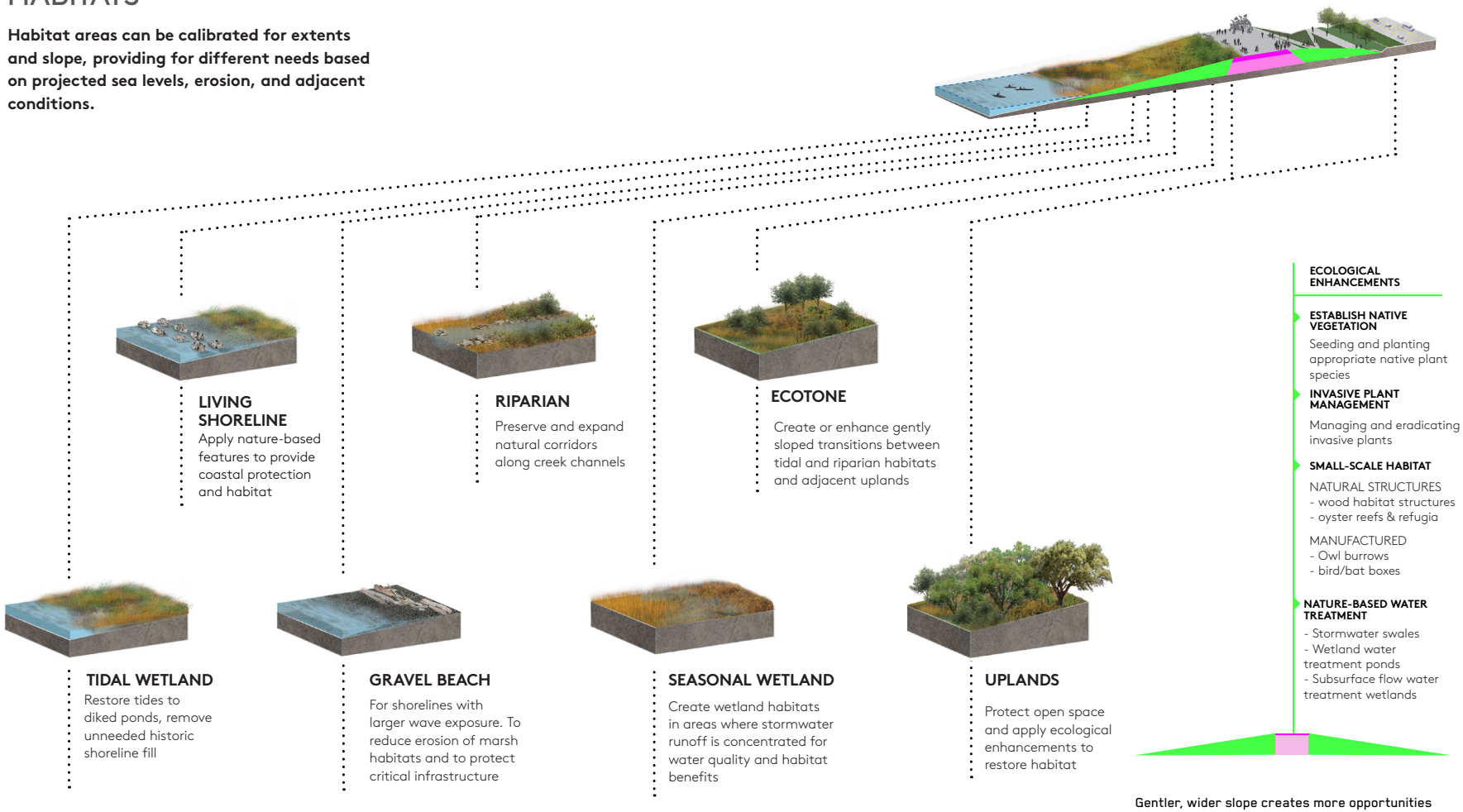
Example Interpretive Panel, from North Richmond Collaborative Shoreline Adaptation Plan



Example Interpretive Panel, from North Richmond Collaborative Shoreline Adaptation Plan

HABITATS

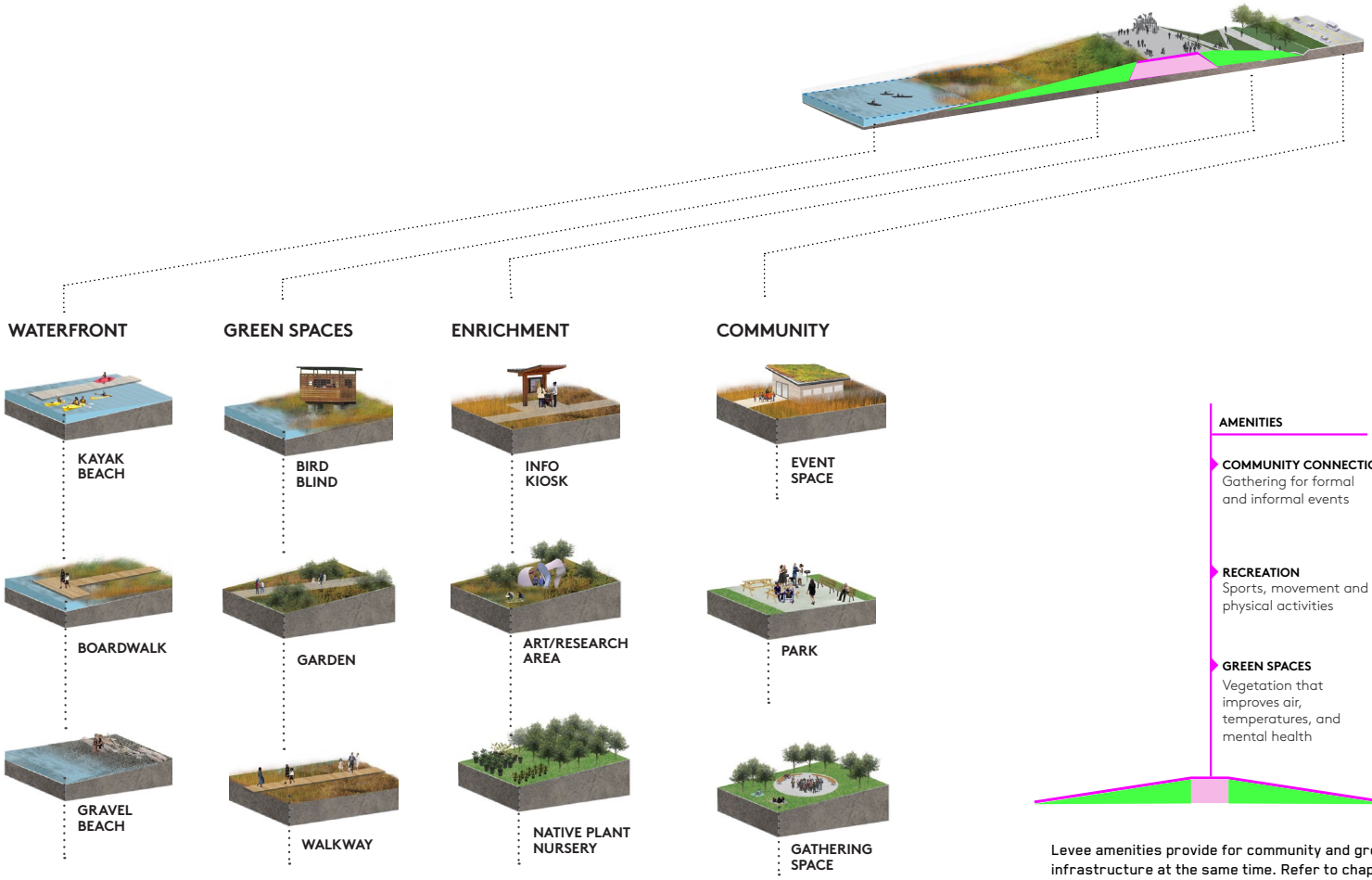
Habitat areas can be calibrated for extents and slope, providing for different needs based on projected sea levels, erosion, and adjacent conditions.



NORTH RICHMOND COLLABORATIVE SHORELINE ADAPTATION PLAN / 2023

Example Interpretive Panel, from North Richmond Collaborative Shoreline Adaptation Plan

AMENITIES



Levee amenities provide for community and green infrastructure at the same time. Refer to chapter 2 for more details.

NORTH RICHMOND COLLABORATIVE SHORELINE ADAPTATION PLAN / 2023

Example Interpretive Panel, from North Richmond Collaborative Shoreline Adaptation Plan

Plant Selection and Placement

Select plants that are adapted to the project location and context. Thoughtful plant selection is critical for the long-term success of a habitat planting area. Determine the project's target habitat type or plant community and planting goals based on site location, soils, hydrology, and other site-specific factors. Use nearby healthy natural landscapes as reference sites, while noting that conditions may vary across relatively small distances.

- Prioritize the use of locally native plants that are appropriate to the target habitat (e.g., salt marsh, grassland, scrub, etc.), and that provide food, shelter, and habitat for native wildlife.
- Emphasize pollinator-friendly plants that provide resources for native bees, butterflies, and other pollinators and floral visitors.
- Consider the project's location: Projects in natural areas will need to approach planting design differently from those in parks, urban areas, or semi-urban areas.
  - In natural areas and restoration sites, involve experts (restoration ecologists, wildlife biologists, etc.) to understand what plant communities will be successful and beneficial. Design and manage the project with native wildlife in mind, and with awareness of those animals' nesting, shelter, and foraging needs.
  - Parks often include recreational resources such as picnic areas, sports fields, lawns, and playgrounds. Provide clear pathways to desired areas and create buffers between high human use areas and sensitive habitats. Limit lawn areas to those necessary for recreational programming.
  - In urban and semi-urban areas, pay special attention to user needs, and incorporate planting wherever possible. Choose plants that fit the specific conditions of the site, and prioritize native plants close to the Bay edge.
- Use plants propagated from locally-collected seeds or cuttings in ecologically sensitive areas. Given appropriate lead time, local native plant nurseries will grow plants collected from a specified watershed or other defined area.
- Consider climate change and future sea-level rise scenarios when assessing these site conditions. Important factors to consider may include soil salinization, sea-level rise projections, and temperature variations.
- Resources for Plant Selection:
  - Shoreline Plants, A Landscape Guide for the San Francisco Bay (BCDC)
  - CalScape, California Native Plant Society

Avoid the use of invasive plants. Invasive plants are those that are "not native to an environment, and once introduced, they establish, quickly reproduce and spread, and cause harm to the environment, economy, or human health" (Cal-IPC).

- Plants that are invasive in the Bay Area include but are not limited to ice plant, giant reed (*Arundo donax*), pampas grass (*Cortaderia jubata* and *C. selloana*), and Scotch broom (*Cytisus scoparius*).
- Remove any invasive non-native plant species that already exist on site.
- Invasive Plant Resources:
  - The California Invasive Plant Council (Cal-IPC) Inventory
  - "Do Not Plant" List in Shoreline Plants, A Landscape Guide for the San Francisco Bay (BCDC)
  - The Weed Worker's Handbook: A Guide to Techniques for Removing Bay Area Invasive Plants (The Watershed Project, Cal-IPC)
  - Practical Guidebook for the Identification and Control of Invasive Aquatic and Wetland Plants of the San Francisco Bay-Delta Region (San Francisco Estuary Institute)

Preserve and protect existing large native trees whenever possible. Mature native trees do not just create shade for users – they also provide important habitat that has developed over time and cannot be replaced quickly. Whenever possible, preserve these assets if they already exist on the project site.

Place plants an appropriate distance from the edge of the Bay Trail so that plants will not grow over the shoulder or into travel lanes. Placement should be based on the expected mature size of the plant, with the goal of eliminating the need to trim or prune plants regularly to maintain trail clearances (vertical and horizontal) as the plants grow.

Design planting areas with varied horizontal structure to provide diverse foraging opportunities for wildlife and to create visual interest for trail users. This can be accomplished by varying levels of plant density and using plants with a variety of widths. Planting density should also support public safety goals (e.g., visual access to the trail), preserve desirable views to the water, and provide visual screening when appropriate (e.g., near visually obtrusive utilities).

Incorporate fire smart planting strategies. Wildfire is a major concern throughout California. Assess the wildfire risk at each individual project site and apply fire safe strategies as appropriate.

- Chose plant species that are less susceptible to fire. Look for plants that have low wax, oil, or resin content, have an open growth habit rather than being densely bushy, and have a high moisture content in the leaves.
- Plant trees and shrubs in discreet groups rather

than in long rows to avoid providing fire with an easy path of travel. Allow space between groups, including between tree canopies. Spacing will vary depending on the slope of the land.
- Incorporate defensible space around structures.
- Fire Safe Resources
  - Fire-Smart and Fire-Hazardous Plants (Fire Safe Marin)
  - Fire Safe(r) Plant List (Calflora)
  - Firescape, Landscaping to Reduce Fire Hazard (East Bay Municipal Utility District)
  - Fire Smart Landscaping (CalFire)

Ensure plants have access to an appropriate quantity of good quality soil. Soil requirements will vary depending on project goals, location, and the target plant palette or habitat type. Assess the existing soil and amend or import soil if necessary to ensure it can support healthy plant growth.

- Assess existing soils with testing. Soils along the Bay edge are often heavily altered from past construction and development, and they can be saline, acidic, highly compacted, low in nutrients, and/or include construction debris. Soil testing is a critical first step in determining whether amendments or import soil should be considered.
- Use caution when bringing in soil amendments or imported soils, especially in sensitive environments. Test imported materials for contaminants and be aware of any regulatory requirements for imported or dredged soil, such as the Regional Water Quality Control Board's Beneficial Reuse of Dredged Materials Sediment Screening and Testing Guidelines.
- Test imported soil at the source facility for pathogens such as *Phytophthora* and reject contaminated soils to avoid introducing pathogens to new sites.
- Ensure trees have access to a soil volume adequate for supporting healthy growth over time. If necessary, employ measures such as structural soil under paving to connect areas of open soil.
- When trees are planted near the trail, install root barriers along the edge of the trail shoulder for at least 20 feet from the tree center.

Irrigation

Wean plants off irrigation as they become established, if possible. Although highly urban planting areas typically require permanent irrigation, well-designed shoreline habitat areas will not need to be irrigated once established. Reduce irrigation over time and turn irrigations systems off completely when they are no longer needed. Remove any above-ground or unsightly components.

Be cautious of recycled water. Recycled water can have high levels of salts and other constituents that can accumulate in the soil over time and negatively affect plant growth. If recycled water is to be used for irrigation, coordinate with the appropriate jurisdiction to determine the quality of the water and select plants that are more tolerant to salts.

Maintenance

Consider the project location, context, goals, and available resources when developing a maintenance regime. Projects in urban areas will have very different maintenance needs than projects in natural areas.

Apply mulch regularly in planting areas that are not susceptible to inundation, and/or allow for the natural accumulation of leaf litter and small fallen branches or twigs. Mulch moderates soil temperature, improves moisture absorption, conserves water by reducing irrigation needs, and protects water quality.

Employ Integrated Pest Management (IPM) strategies rather than using pesticides, herbicides, or other chemicals. Typical IPM programs will require monitoring and identification of pests, and a combination of different types of pest control, including biological controls (such as the use of natural enemies to control pests), cultural controls (such as changing irrigation protocols), mechanical and physical controls (such as traps and barriers), and chemical control (such as the limited use of carefully selected pesticides, only when needed).

Albany Beach, Albany

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China Basin, San Francisco

4 References

This chapter includes reference information, including:

Glossary and Acronyms

National Standards and Resources

History of the Bay Trail

Additional Bay Trail Resources

Glossary and Acronyms

Important Bay Trail Concepts

- **Context-sensitive design:** Design that is informed by the landscape, adjacent and nearby land uses, or transportation context of the area. Instead of adopting a cookie-cutter approach to creating a design solution, design that is context-sensitive responds to the surrounding environment.
- **Equitable access:** Equitable access ensures that everyone – regardless of age, race, gender, income, or ability – can access and enjoy the Bay Trail.
- **Ecological design:** Design that is informed by ecological elements both existing and historical. Ecological design considers the ecosystem, local wildlife and plant life, the impact of sea-level rise, and other critical elements to live with and protect our natural environment.

Trail Types

The preferred standard of the Bay Trail is to provide an ADA-accessible shared use, Class I Bikeway (Bike Path) for all segments. Class I Bikeways are defined in the Caltrans Highway Design Manual Chapter 1000: Bicycle Transportation Design. The design criteria for the Bay Trail is described in-depth in Chapter 3.

- **Shared use path:** Shared use paths are built to accommodate people walking, bicycling, or using other non-vehicle wheeled and micromobility modes.
- **Spine:** The spine of the Bay Trail is the primary route that advances the goal of a continuous loop encircling the Bay.
- **Spur:** Spurs are trail segments that connect to the spine, providing access to the shoreline or other key destinations where the spine cannot. Spurs are considered part of the primary Bay Trail.
- **Connector:** Connector trails are not formally part of the Bay Trail but connect directly to the Bay Trail and are part of the broader system that links the Bay Trail to surrounding communities and other trail networks. Connector trails are primarily Class I or Class IV facilities. Connector Trail criteria is described in more detail in Chapter 2.

Trail Elements

- **Cross-section:** A graphic that shows a section of a trail or other type of infrastructure. It typically shows the distribution of space across the public or private right-of-way.
- **Easement:** An easement is a grant of property rights that authorizes the easement holder to use another person's land for a specific use.
- **Floodplain:** The maximum area adjoining a river, stream, watercourse, or lake that is likely to be flooded by the base flood or the future conditions flood. The floodplain, -prone, and/or -hazard area includes "floodway" areas, "floodway fringe" areas, and future conditions flood hazard areas.
- **Impervious surfaces:** Hard surfaces such as pavement, concrete, or rooftops that prevent water from infiltrating into the ground. These surfaces contribute to increased stormwater runoff and can impact natural hydrological systems.
- **Kiosk:** A freestanding structure that houses informational signs, often found at trailheads and major access points.
- **Pervious surfaces:** Soft surfaces such as dirt, rocks, decomposed gravel, wood chips, and other materials that allow water to infiltrate into the ground.
- **Riparian corridor:** The area of transition between land and water features, such as a stream bank, shoreline, or the border of a wetland. Riparian areas are characterized by frequently waterlogged soils and distinct types of vegetation adapted to these soils.
- **Shoulder:** The area adjacent to a trail, delineated by a different material or an edge line.
- **Sidepath:** A bikeway physically separated from motor vehicle traffic by open space or a physical barrier and located adjacent and parallel to a roadway. Sidepaths are often within the street right-of-way.
- **Stabilized natural surface:** A durable, permeable surface made from natural materials like crushed stone or decomposed granite.
- **Trail support facilities:** Also called amenities, trail support facilities are meant to enhance and support the user experience on the trail. They include benches, drinking water fountains, bottle fill stations, restrooms, bicycle repair stations, shade structures, landfill and recycling receptacles, and other elements
- **Trailhead:** The entry point to a trail, usually marked with signage and often equipped with amenities like maps and restrooms.
- **Trail typology:** The classification of trails based on their characteristics, usage, management, and design features, such as hiking trails, mountain biking trails, or multi-use paths.
- **Tread:** The type of surface material on the trail. This could be dirt, gravel, mulch, pavement, or other materials.

- **User conflicts:** Situations where different types of trail users, such as pedestrians, cyclists, and e-mobility users, have conflicting needs or behaviors that can lead to safety issues or diminished trail enjoyment.
- **User types:** The different categories of individuals who use the trails, such as pedestrians, cyclists and micromobility device users.
- **Utility corridor:** The linear rights-of-way or easements for utilities on either publicly- or privately-owned property.
- **Wayfinding:** The use of signage, maps, and markers to help users navigate and use the trail system. Effective wayfinding ensures that trail users can easily follow paths, locate points of interest, and safely reach their destinations.

Types of On-Street Infrastructure

- **Class II:** A striped bicycle lane, including conventional bicycle lanes (IIA) and upgraded bicycle lanes with striped buffer (IIB). See Caltrans MUTCD, Chapter 9, section 9C.04.
- **Class III:** Generally, a signed bicycle route where cyclists share the travel lane with vehicles. See the Caltrans Highway Design Manual Chapter 1000.
- **Class IV:** A Class IV bikeway, also known as a cycletrack or separated/protected bikeway is an on-street bicycle lane that is physically separated from vehicle traffic. See the Caltrans Highway Design Manual Chapter 1000: Bicycle Transportation Design for more information.

Accessibility/Inclusive Design Terms

- **Access:** Providing physical access to the Bay Trail by some segment of the population, such as by adding a connector trail. Increasing access may or may not also increase accessibility (see below).
- **Accessibility:** The quality of being usable by people with disabilities. The Bay Trail and the trail's support facilities must follow the U.S. Access Board's ADAAG and (PROWAG) (see below).
- **ADA:** Americans with Disabilities Act is a 1990 federal law intended to ensure the accessibility of most public facilities. This term is commonly used as shorthand to refer to the accessibility of infrastructure such as the Bay Trail and the trails support facilities..
- **ADAAG:** ADA Access Guidelines are technical guidelines developed by the U.S. Access Board to provide detailed requirements for compliance with the ADA (see above). The ADAAG applies to the Bay Trail's support facilities, such as benches and railings, but does not specifically address shared use paths, sidewalks, or bike lanes. These facilities are covered under PROWAG (see below)
- **Inclusive design:** Design that goes beyond minimum accessibility requirements and focuses on creating environments and experiences that include as many people as possible, considering users' diverse needs, abilities, backgrounds, and experiences.
- **PROWAG:** Public Rights-of-Way Accessibility Guidelines, are technical guidelines developed by the U.S. Access Board to provide detailed requirements for the accessibility of shared use paths, sidewalks, streets, and other public rights-of-way.
- **Universal Design:** Similar to inclusive design (see above), universal design focuses on providing a single option that works for everyone without adaptation.

Other Important Terms

- **Access:** The ability to reach desired goods, services, routes, activities, and destinations.
- **Active transportation:** Any form of human-powered transportation, such as walking, bicycling, using a wheelchair/mobility device, or other forms of non-motorized movement.
- **Active Recreation:** Activities such as walking, running, bicycling, wheeling, and sports, which promote health and wellbeing by encouraging movement and physical exercise
- **Bikeshare:** A system of shared rental bicycles, both electric or acoustic, located within and adjacent to the street right-of-way and in public spaces. These can be available from docked or undocked locations.
- **Capital improvement projects:** Construction projects that involve more time, effort, funding, and resources than typical projects.
- **Connectivity:** The degree to which the active transportation network (Class I trails, bikeways, sidewalks) are seamlessly interconnected and easily accessible for the adjacent community.
- **Crime Prevention Through Environmental Design (CPTED):** A set of design principles that are intended to reduce or prevent crime in public spaces. Examples of CPTED principles include designing a space that enhances visibility and promotes social cohesion and community.
- **Equity:** The process and outcomes of creating an inclusive Bay Area where everyone can participate, prosper, and reach their full potential. MTC uses the Equity Platform as a guide to

meaningfully reverse disparities in access and dismantle systemic exclusion. Click here to learn more about the Equity Platform: https://mtc.ca.gov/about-mtc/what-mtc/equity-platform. Click here to learn more about Equity Priority Communities in the Bay Area: https://mtc.ca.gov/planning/transportation/access-equity-mobility/equity-priority-communities

- **Feasibility:** The degree to which a project or program can be constructed or implemented and its expected level of impact, including but not limited to environmental, financial, existing infrastructure and utilities, and private property.
- **Intervention objectives:** Objects that create physical and spatial boundaries through points, lines, or planes, creating safer spaces for people using the street. See https://mtc.ca.gov/sites/default/files/InterventionObjects_English.pdf for more information.
- **Passive Recreation:** Activities such as picnicking, nature and wildlife viewing, social gathering, and relaxation.
- **Right-of-way (R/W):** A legal term to describe land ownership. It can describe public or private land. Public right-of-way can be designed for the purpose of transportation, utilities, natural preservation, or other intentions. Public R/W is owned by a public agency or quasi-public agency, such as a utility provider.
- **Safety:** The degree to which trail users are free from injury or harm as well as a perceived feeling of safety and comfort.
- **Traffic calming measures:** Physical infrastructure, such as speed humps, traffic circles, narrow lane widths, or similar devices, intended to discourage speeding and improve the usability of a street for cyclists and pedestrians.
- **Trail-oriented development:** Trail-oriented development (TrOD) is a context-sensitive design approach that uses trails and greenways as a framework to connect communities, using off-street active transportation infrastructure to enhance people's access to recreation, nature, business and mobility hubs, public amenities, and each other (MTC's definition from March 10, 2025).

India Basin, San Francisco

Organizations

The following government organizations are key partners whose work focuses on the San Francisco Bay and aligns with the mission of the Bay Trail.

Bay Conservation and Development Commission (BCDC)

The San Francisco Bay Conservation and Development Commission (BCDC) is a regulatory government agency that protects and enhances the San Francisco Bay and advances responsible, productive, and equitable access to the Bay's shoreline.

https://bcdc.ca.gov/

California State Coastal Conservancy (SCC)

The California State Coastal Conservancy (SCC) is a non-regulatory state agency that works with others along the California coast, in coastal watersheds, and in the San Francisco Bay Area to protect and restore coastal resources, to help people get to and enjoy the coast, and to enhance climate resilience. This is accomplished through grant programs and technical assistance.

https://scc.ca.gov/

San Francisco Estuary Partnership

The San Francisco Estuary Partnership is a collaborative regional program of resource agencies, non-profits, citizens, and scientists working to protect, restore, and enhance water quality and fish and wildlife habitat in and around the San Francisco Bay Delta Estuary. It is housed within MTC.

https://www.sfestuary.org/

National Standards and Resources

Federal

- U.S. Access Board. ADA Accessibility Guidelines (ADAAG) (https://www.access-board.gov/ada/)
- U.S. Access Board. ADA Accessibility Guidelines for the Public Right-of-Way (https://www.access-board.gov/prowag/)
- U.S. Access Board. Outdoor Developed Areas. 2014 (https://www.access-board.gov/files/aba/guides/outdoor-guide.pdf)
- U.S. Access Board. Chapter 1005 Fishing Piers and Platforms (https://www.access-board.gov/ada/#ada-1005)
- U.S. Access Board. Chapter 1008.1, Play Areas (https://www.access-board.gov/ada/#ada-1008)
- Federal Highway Administration (FHWA). Trails as Resilient Infrastructure Guidebook. 2023.
- Federal Highway Administration (FHWA). Bikeway Selection Guide. 2019.
- Federal Highway Administration (FHWA). Guide for Maintaining Active Transportation Infrastructure for Enhanced Safety. 2024.
- Federal Highway Administration (FHWA): Proven Safety Countermeasures.

State and Regional Resources

State of California Department of Transportation (Caltrans)

- California Highway Design Manual, Chapter 1000 — Bicyle Transportation Design. Current Edition.
- California Manual on Uniform Traffic Control Devices. Current Edition. Note this manual is currently being updated on or before January 2026. Check for the most current CA-MUTCD.
- Caltrans Complete Intersections

Design Information Bulletins:

- Design Information Bulletin #89-02: Class IV Bikeway Guidance (Separated Bikeways/Cycle Tracks) - 02-07-2022
- Design Information Bulletin #82-06: Pedestrian Accessibility Guidelines for Highway Projects - 11-16-2017
- Design Information Bulletin #94: Complete Streets: Contextual Design Guidance - 01-16-2024

Design Memoranda:

- Complete Streets Decision Document – Implementation. February 2021.
- Approval and Documentation of Constructed Non-Approved Non-Standard Design Features. September 2020.
  - 07/24/2020 Decision Document: Approval and Documentation of Constructed Non-Approved Non-Standard Design Features (PDF)
  - Attachment 1: Interim Guidance (PDF)
  - Attachment 2: Non-Standard Features Template (DOCX)
- Bikeway Facility Selection Guidance. June 2020.
  - Attachment: 03/11/2020 - Contextual Guidance for Bike Facilities (PDF)
- Design Flexibility in Multimodal Design. April 2014.
- Americans With Disabilities Act (ADA) Compliance. October 2012.
- Additional Guidelines on Curb Ramp Scoping and Design. June 2012.

San Francisco Bay Conservation and Development Commission (BCDC)

- Shoreline Plants – A Landscape Guide for the San Francisco Bay. March 2007.
- Signs – Public Access Signage Guidelines. August 2005.
- Shoreline Spaces Public Access Design Guidelines for the San Francisco Bay. April 2005.

Metropolitan Transportation Commission

- MTC Resolution No. 4493: MTC's Complete Streets Policy. 2022.
- MTC Regional Active Transportation Plan: https://mtc.ca.gov/funding/investment-strategies-commitments/climate-protection/regional-active-transportation-plan
- MTC Equity Platform: https://mtc.ca.gov/about-mtc/what-mtc/equity-platform
- MTC Equity Priority Communities: https://mtc.ca.gov/planning/transportation/access-equity-mobility/equity-priority-communities
- MTC Regional Wayfinding: https://mtc.ca.gov/operations/transit-regional-network-management/regional-mapping-wayfinding
- Access California | Discover Accessible California
- MTC quick-build guide

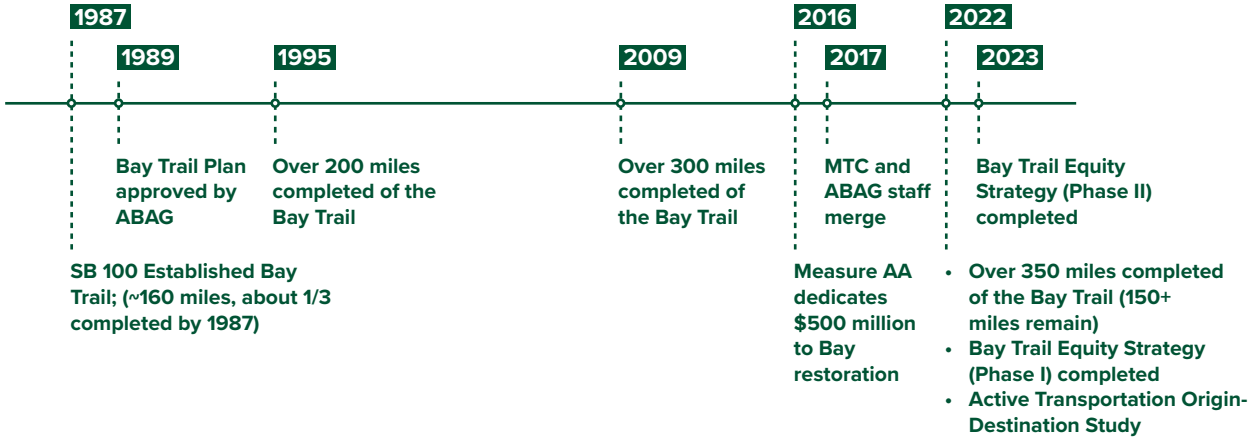
Other Relevant Resources

- Access California, BORP Guide to Accessible Outdoor Adventure (https://accessca.org)
- American Association of State Highway and Transportation Officials (AASHTO).
- Guide for the Development of Bicycle Facilities. Current Edition. 2024.
- Guide for the Development of Pedestrian Facilities. Current Edition. 2021.
- National Association of City Transportation Officials (NACTO): Urban Bikeway Design Guide. Current Edition.
- Rails to Trails Conservancy (RTC): A national nonprofit organization focused on the planning, design, construction, and maintenance elements of converting old rail lines to trails. RTC chairs the Bay Area Trails Collaborative (BATC).
- American Trails: A national nonprofit organization that provides trail data, education, and resources for the purpose of creating trails.
- EBRPD SF Bay Trail Risk Assessment & Adaptation Prioritization Plan (2021): https://www.ebparks.org/sites/default/files/SFBT-RAAPP-Draft-4-2021-web.pdf
- Slow and Say Hello, Marin County Trail Partners Safe Trails Program (https://safetrailsmarin.org)
- California Building Code Accessibility Guidance (https://www.buildingincalifornia.com/accessibility)

History of the Bay Trail

California State Senate Bill 100, authored by former State Senator Bill Lockyer and passed into law in 1987, created the vision for the Bay Trail and directed the Association of Bay Area Governments (ABAG) to develop a plan for a "ring around the Bay." The Bay Trail Plan, adopted by ABAG in July 1989, included a proposed alignment, a set of policies to guide the future selection and implementation of routes, and strategies for implementation and financing. Since its inception, the Bay Trail Plan has enjoyed widespread support. Most counties and cities through which the Bay Trail passes have included the Bay Trail in General Plans, specific plans, bicycle plans, and/or pedestrian plans.

The first Bay Trail Design Guidelines and Toolkit was published in 2016.



Additional Bay Trail Resources

The long history of the Bay Trail is supported by many resources. A selection is provided below.

Active Transportation Origin-Destination Study (2022)

https://mtc.ca.gov/planning/transportation/regional-transportation-studies/origin-destination-study

Bay Trail Equity Strategy:

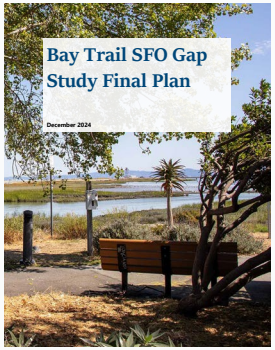
- Phases I and II (2022, 2023)
- Crafting Connections: Art as a Catalyst for Access & Belonging (2025)

https://mtc.ca.gov/operations/regional-trails-parks/san-francisco-bay-trail/bay-trail-equity-strategy

https://mtc.ca.gov/digital-library/5039194-crafting-connections-art-catalyst-access-belonging

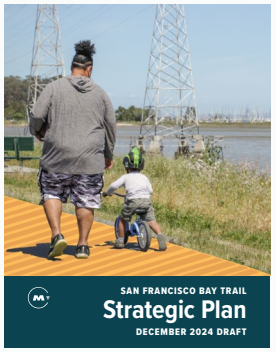
Bay Trail Gap Closure Implementation Plan (2024)

https://mtc.ca.gov/operations/regional-trails-parks/san-francisco-bay-trail/bay-trail-gap-closure-implementation-plan



Bay Trail SFO Gap Study (2025)

https://mtc.ca.gov/operations/regional-trails-parks/san-francisco-bay-trail/bay-trail-sfo-gap-study



Bay Trail Strategic Plan (2025)

https://mtc.ca.gov/operations/regional-trails-parks/san-francisco-bay-trail/about-bay-trail

In progress

Bay Trail Needs, Operations, and Maintenance Assessment (2026)

https://mtc.ca.gov/operations/regional-trails-parks/san-francisco-bay-trail/bay-trail-needs-operations-maintenance-assessment

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MTC	26 (top)
Toole Design Group	24 (top), 24 (middle), 26 (bottom), 66
Zander Westbrook Design	24 (inset)

San Francisco Bay Trail

Design Guidelines and Toolkit