Exhibit 39

SAN FRANCISCO BAY TRAIL

DESIGN GUIDELINES AND TOOLKIT

SAN FRANCISCO BAY TRAIL DESIGN GUIDELINES AND TOOLKIT

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California Coastal Conservancy

ACKNOWLEDGEMENTS

BAY TRAIL BOARD OF DIRECTORS

A 28-member board that governs the Bay Trail. The Board of Directors represents a broad range of public agency, non-governmental organizations, and private interests.

A smaller steering committee of the Board addresses program, planning, design, use, and management issues particular to the Bay Trail.

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1 Introduction

These guidelines offer direction and define goals to facilitate the design and development of a San Francisco Bay Trail system that is safe, connected and continuous; provides a positive user experience that encourages people to use the trail; and maximizes access to and use by the broadest spectrum of people possible. The guidelines are general in scope due to the varied conditions through which the San Francisco Bay Trail passes and the variety of users and types of uses that occur along the trail. They are applicable to all development of the San Francisco Bay Trail and are intended to complement national, state, and local design standards and guidelines. Different segments of the San Francisco Bay Trail will likely need to address different site opportunities and constraints.

Background: Berkeley

WHAT IS THE SAN FRANCISCO 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, much to the benefit of millions of residents and visitors. The San Francisco Bay is the dominant open space amenity of the Bay Area.

When completed, the San Francisco Bay Trail (the Bay Trail) will be a 500-mile green transportation and recreation route for walking and cycling around the entire San Francisco Bay. The Bay Trail will run through all nine Bay Area counties, 47 cities, and across seven toll bridges. As a long-distance trail, the Bay Trail links people and communities with each other, links people with their environment, and links 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.

WHY IS THERE A SAN FRANCISCO BAY TRAIL?

Legislative History

Senate Bill 100, authored by former State Senator Bill Lockyer and passed into law in 1987, created the vision of 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, includes 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. The majority of 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.

Mission Bay, San Francisco

Needs and Public Benefits

The importance of the Bay Trail to the quality of life for millions of Bay Area residents and visitors cannot be overstated. The San Francisco Bay Trail is a one-of-a-kind signature amenity for the Bay Area. At over 500 miles in length, the completed Bay Trail and the benefits it provides will be unparalleled in the nation. Public benefits of the Bay Trail include:

- **Transportation**: As a transportation facility, the Bay Trail serves as an important commute alternative for cyclists and pedestrians, and connects to numerous public transportation features, including ferry terminals, airports, light-rail lines, bus stops, Caltrain, Amtrak, and BART.
- **Recreation**: The Bay Trail provides scenic recreation for a wide variety of users, including hikers, joggers, bicyclists, skaters, and wheelchair users, among others.
- **Health**: The Bay Trail facilitates physical activity through settings that provide multiple benefits for the body and mind.
- **Natural Resources**: Following the Bay's shoreline, the Bay Trail allows the public to discover, experience and appreciate the Bay's waters and wildlife. The Bay Trail fosters education and public support for Bay resource protection, including habitat acquisition and restoration.
- **Connections**: The Bay Trail offers access to commercial, industrial and residential neighborhoods; points of historic, natural and cultural interest; and recreational areas like beaches, marinas, fishing piers, and boat launches. The Bay Trail connects over 130 parks and wildlife areas totaling over 57,000 acres of open space. It links highly urbanized areas like downtown San Francisco to remote natural areas like the Don Edwards San Francisco Bay National Wildlife Refuge.
- **Tourism**: The Bay Trail is a scenic route that visitors from throughout the world use to experience the Bay.

BAY TRAIL FACTS

- Over 2.7 million people, nearly 40% of the local population, live within 2 miles of the Bay Trail.
- There are now 1.6 million jobs within the same 2-mile area, accounting for over 50% of all the jobs in the Bay Area.
- The completed Bay Trail will be accessible to over 7,000,000 people living in the Bay Area in 2015 and over 9,250,000 projected to live in the area by 2040.

Richmond Marina
Source: Flickr (San Francisco Bay Trail Project)

PURPOSE OF THESE DESIGN GUIDELINES AND TOOLKIT

The purpose of these guidelines and toolkit is to provide the San Francisco Bay region with a design resource applicable to any project that includes the San Francisco Bay Trail. These guidelines provide goals and direction for site planning and trail design to facilitate achievement of the Bay Trail vision. These guidelines establish a set of design principles aimed at developing and managing the San Francisco Bay Trail while providing for the protection of Bay resources, regional livability, and local economic prosperity.

These Guidelines and Toolkit reflect a Bay Trail that:

- is intended to be a system of shoreline multi-use paths separated from vehicular traffic.
- consists of a shoreline, off-street, multi-use trail, or in some cases where a trail may not be achievable, either dedicated bicycle lanes or separated bikeways with complementary pedestrian walkways and promenades.
- is to be sustainable over time, reflect current safety standards, accommodate future use levels when the entire Bay Trail system is completed, and recognize changing needs and environmental conditions such as sea level rise.

These guidelines and tools should not constrain inspiration when an opportunity exists for a trail design that is visionary.

WHO WILL USE THESE GUIDELINES AND TOOLKIT?

The Bay Trail Design Guidelines and Toolkit have been developed for use by:

- **Design Team** – Developers, land planners, landscape architects, engineers, architects, and other members of professional teams designing projects along the shoreline with access to and along it.
- **Public Agencies** – Cities, counties, special districts, and regional, state, and federal agencies involved in resource protection, land use planning, and the development of transportation and recreation trail facilities.
- **San Francisco Bay Conservation and Development Commission** – Staff, Design Review Board members, and Commission members when considering the siting and design of shoreline public access proposals.
- **The Public** – Community groups and individuals where understanding the goals of the Bay Trail and ways it may be implemented will facilitate completion of the trail system and upgrading trail facilities over time.

HOW TO USE THESE GUIDELINES AND TOOLKIT

The Design Guidelines are broad statements about trail dynamics that should be considered in designing any segment of the Bay Trail. The Toolkit presents design scenarios for the Bay Trail and general performance specifications.

The four-step process below should help everyone plan, design, and evaluate the Bay Trail for its effectiveness in creating a valuable multi-use trail.

1. Comprehend the **Design Approach** considerations outlined in Chapter 2.
2. Meet the **Design Principles and Objectives** found in Chapter 3.
3. Understand the variety of settings and context for the Bay Trail as characterized in Chapter 4: **A Gallery of Settings**.
4. Refer to the **Toolkit** in Chapter 5 and develop a Bay Trail design that reflects the setting within which it occurs while meeting the Bay Trail Design Principles and Objectives.

THE BAY TRAIL, PUBLIC ACCESS, AND THE SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION

The San Francisco Bay Conservation and Development Commission (BCDC) was created by the California Legislature in 1965 under the McAteer-Petris Act in response to broad public concern over the future of the San Francisco Bay. The Commission is charged with, among other activities, regulating new development within 100 feet of the Bay shoreline to ensure that maximum feasible public access to the Bay is provided. As defined by the Commission's *San Francisco Bay Plan,* "public access" includes physical public access to and along the shoreline of the Bay and visual public access (views) to the Bay from other public spaces. In most cases, this public access involves accommodating the San Francisco Bay Trail.

The BCDC publication *Shoreline Spaces: Public Access Design Guidelines for the San Francisco Bay* provides general guidance about the design variables that the Commission addresses in conducting its design review of permit applications, including reference to the Bay Trail. The Bay Trail Design Guidelines and Toolkit are intended to be complementary to those of BCDC relating to shoreline access.

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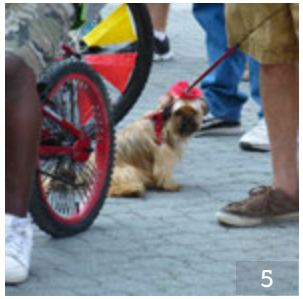
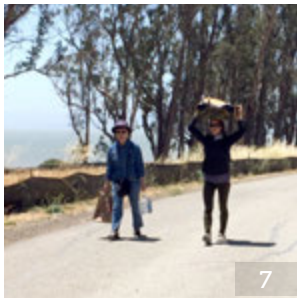
2

Design Approach

Background: Emeryville | Source: BCDC





UNDERSTAND WHO USES THE BAY TRAIL

The Bay Trail, simply defined, accommodates pedestrian, bicycle, and other non-motorized forms of movement. However, Bay Trail users cannot be easily characterized as simply bicyclists or pedestrians. The goal of the Bay Trail is to accommodate and provide access to the largest spectrum of non-motorized users possible.

Bay Trail users can be:

- any age with any level of physical, audial, and visual ability.
- solo travelers, small groups that might be traveling side-by-side, or part of a bicycle club or large group led by a docent or teacher.
- on individual bicycles, tandem bicycles, bicycles with trailers, or tricycles.
- using skateboards, rollerblades, or non-motorized scooters.
- carrying nothing or carrying picnic baskets, coolers, fishing equipment, surf and windsailing equipment, or kayaks.
- pushing strollers or pulling wagons with children in them.
- walking, running, or bicycling with one or more dogs.

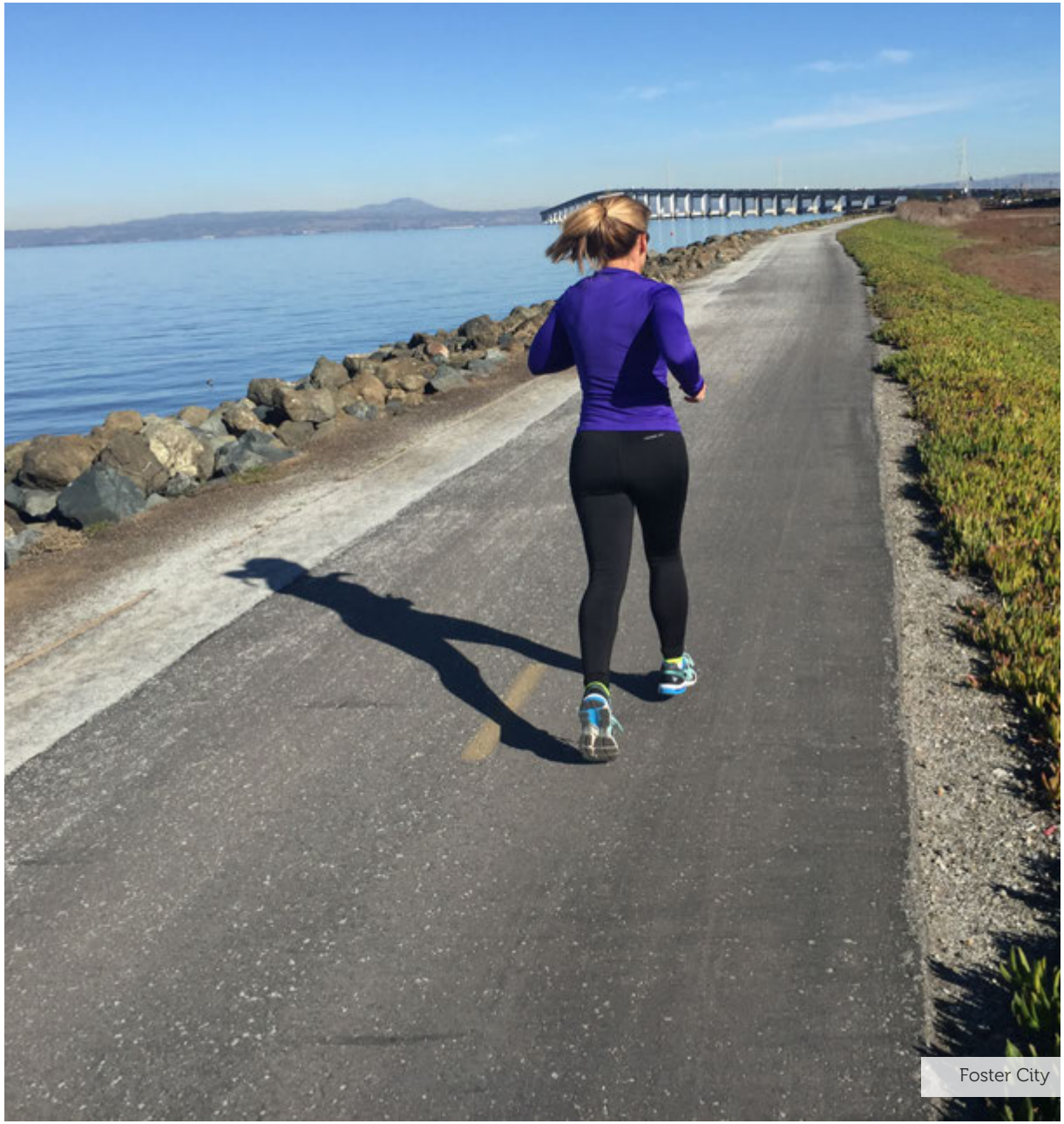
1. Hamilton Wetlands Preserve
   Source: SF Bay Trail Project
2. Hamilton Wetlands Preserve
   Source: Pamela via marinmommies.com
3. Mission Bay, San Francisco
4. Berkeley Marina
5. Oakland | Source: Flickr (Robert Prinz)
6. Richmond | Source: Flickr (SF Bay Trail Project)
7. San Francisco
8. Palo Alto Bayland
   Source: Flickr (SF Bay Trail Project)
9. Tiburon | Source:SF Bay Trail Project
10. Berkeley
11. Crissy Field | Source: Presidio Trust
12. Foster City

UNDERSTAND BAY TRAIL USE DYNAMICS

Bay Trail users can be:

- moving quickly such as when commuting to work on a bicycle.
- not moving at all to take in views of the Bay and the activities occurring on it.
- moving along at any speed in between.

Because of this varied use, the paramount design consideration related to the Bay Trail is understanding the dynamics of shared-use and user safety. The most significant design challenge is that trail use cannot be easily categorized. A chief Bay Trail design goal is to provide sufficient future capacity, width, line of sight, and in some cases delineating the trail corridor to accommodate this variety of use and help minimize conflicts among uses. A critical concept in design of the Bay Trail is consideration of its use level when the entire Bay Trail system is completed and linked to nearby communities.



Foster City

Berkeley Marina

DESIGN COMPREHENSIVELY

Design implies intent, and each segment of the Bay Trail involves a wide range of opportunities and constraints requiring careful investigation and thoughtful design decisions.

Sometimes trail design choices are clear and straightforward, as when a perennial stream must be crossed and a bridge is needed. Sometimes the choices are more complex. Key design considerations include:

- **Collaboration:** Designing the Bay Trail should not be done in a vacuum. There are numerous local and regional agencies whose individual policies and standards about the Bay Trail and its setting need to be considered. These will vary from trail segment to trail segment. Communication among involved professionals is paramount to a successful design that can be both permitted and constructed.
- **Width and Sight Lines:** With some exceptions, the Bay Trail rarely travels in a straight line. It turns because of topography, to avoid obstacles, or to capture important views of the Bay. The Bay Trail travels up and down slopes, over and under roads, railroads, and streams, and follows the contours of the Bay itself. The Bay Trail corridor, i.e., the right-of-way around the actual trail, should be planned and designed to be wide enough to accommodate the expected future level of use when the Bay Trail system is fully completed.
- **Surface:** The Bay Trail surface will typically be paved but may also include non-paved shoulders for a variety of uses. In limited cases, such as in areas of sensitive habitat or on levees with particular maintenance conditions, the entire trail tread may be composed of stabilized natural materials. See also Sections 5.1 and 5.2.
- **Water Quality:** To protect the Bay, storm water runoff from the trail should be managed with sheet drainage directed to a system of water quality control features or through use of permeable paving materials.
- **Constrained Right-of-Way:** On occasion, the planning and design of the Bay Trail involves adapting to existing physical conditions. In these instances, creative solutions are required such as reducing the width of adjacent road travel lanes, eliminating trail shoulders, or adding signage or other safety measures.

3

Design Principles and Objectives

Background: Berkeley

Benicia State Recreation Area

DESIGN PRINCIPLES

In designing the Bay Trail, there are seven essential principles that should be considered and addressed for any trail segment. These principles include:

- 3.1 User Experience and Safety
- 3.2 Continuity and Connectivity
- 3.3 Universal Access
- 3.4 Proximity to the Bay
- 3.5 Expected Levels of Use
- 3.6 Compatibility with Wildlife
- 3.7 Sea Level Rise

The following sections elaborate on the above principles and provide design objectives for each.

3.1 USER EXPERIENCE AND SAFETY

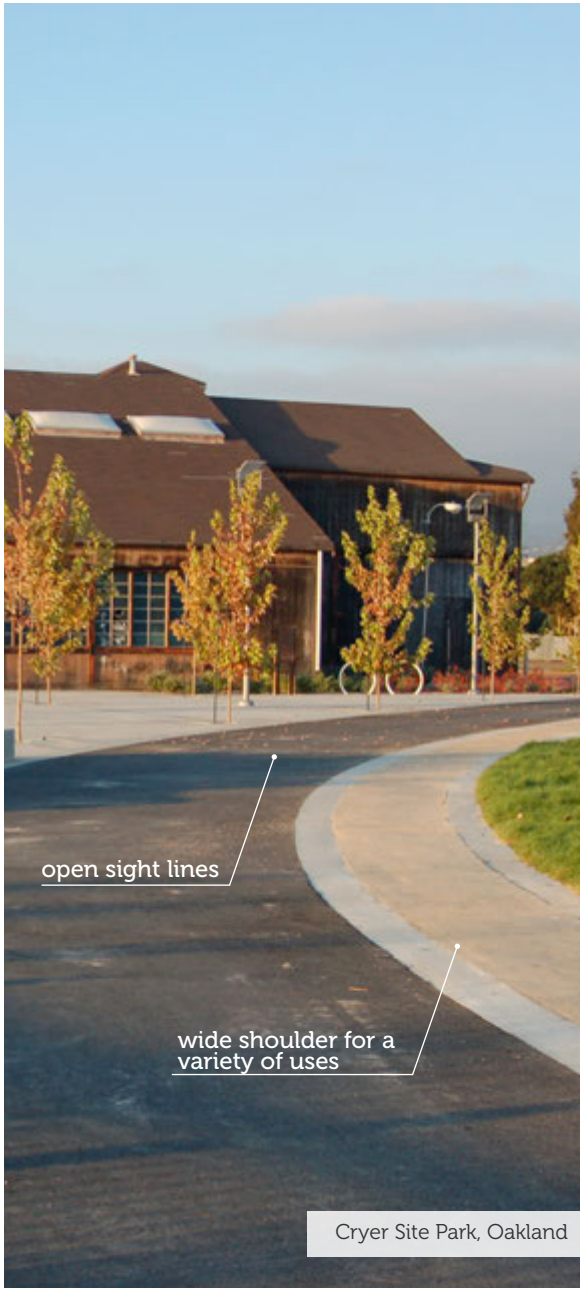
MAKE THE BAY TRAIL ENJOYABLE AND SAFE FOR ALL

Safety will always be the prime directive of Bay Trail design. A well-designed trail is a safe trail that minimizes conflicts between trail users and other nearby activities. At the same time a well-designed trail encourages use, improves the user experience, and reduces the managing agency's liabilities.

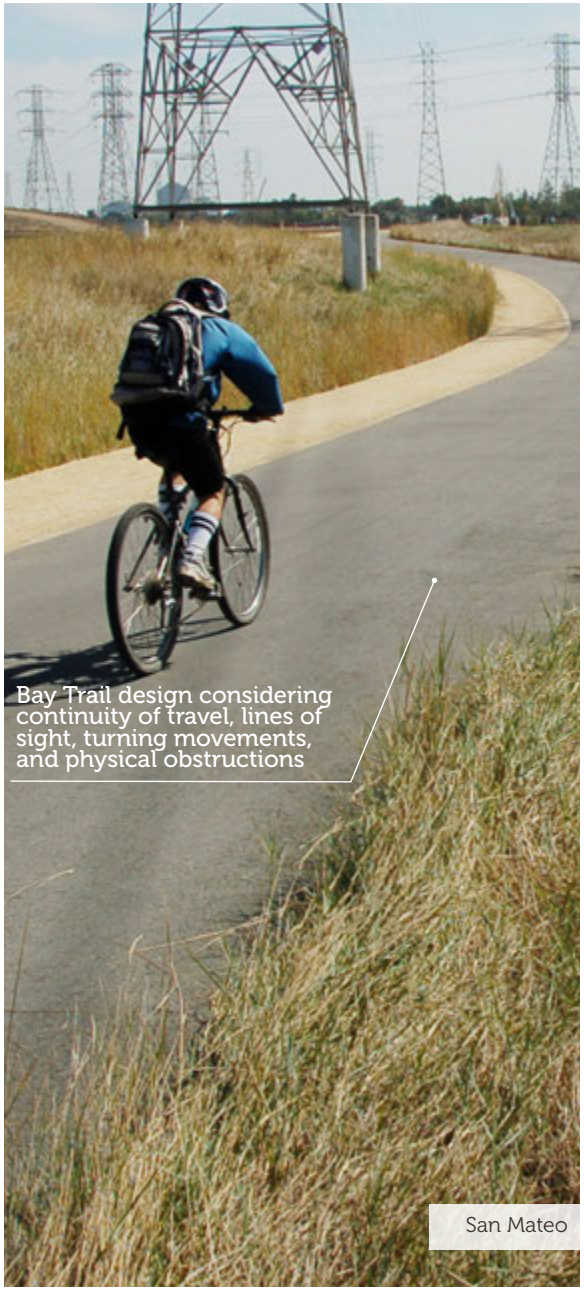
OBJECTIVES TO ACCOMPLISH THIS PRINCIPLE:

- Developing a complete trail around the Bay that is separate from motor vehicles.
- Providing an adequate buffer to create a safe and positive user experience that considers design elements of sights, sounds and fresh air.
- Designing a trail wide enough to accommodate expected future levels and types of use, and to provide adequate capacity in order to minimize conflicts between trail users.
- Developing the Bay Trail with open sight lines so that existing and future users can more easily avoid obstructions and also for personal safety.
- Specifying trail and shoulder surfaces that accommodate different users such as bicyclists and joggers.
- Avoiding constraining trail conditions such as being enclosed by fences or other vertical features that reduce the functional width of the trail.
- Providing safety and security lighting to facilitate 24 hours a day, 7 days a week access where appropriate.
- Providing essential public amenities such as benches, drinking fountains, bike repair stations, and restrooms that encourage and support long-distance travel.
- Providing clear and visible wayfinding and distance signage at all decision-making points to identify the Bay Trail and at regular intervals as needed when the Bay Trail is located on-street.

66th Avenue Gateway, Oakland



Cryer Site Park, Oakland



3.2 CONTINUITY AND CONNECTIVITY

ASSURE A CONTINUOUS LINEAR EXPERIENCE

Continuity

The Bay Trail is about continuous linear travel. The Bay Trail will be fully functional when it provides a continuous loop around the Bay and connects all 9 counties of the Bay Area and the 47 cities that front the Bay. From a functional standpoint, the Bay Trail design must consider all the dynamics involved with two-way circulation for bicyclists and pedestrians, including continuity of travel, lines of sight, turning movements, user interactions, traffic signs and signalization, and physical obstructions.

Connectivity

Direct pedestrian and bicycle connections with adjacent cities, activity centers, park and recreation areas, and public transit facilities, including BART, light rail, and ferry service, will exponentially increase Bay Trail use by the general public.

OBJECTIVES TO ACCOMPLISH THIS PRINCIPLE:

- Incorporating the Bay Trail into all shoreline projects and providing clear, continuous and seamless transitions to adjacent segments of the Bay Trail and local and regional trail systems.
- Working with property owners and local jurisdictions to provide clear transitions to the Bay Trail from other pedestrian and bicycle facilities.
- Providing clear transitions when bicycle and pedestrian facilities shift between Class I bike paths, Class II bike lanes, Class IV separated bikeways, and sidewalks.
- Connecting the Bay Trail to all transit sources within walking and bicycling distance, such as water taxis, ferries, buses and rail systems.
- Connecting the Bay Trail with schools, civic areas and government offices, commercial districts, businesses, and other activity centers in adjacent cities.
- Coordinating Bay Trail staging areas and access points with regional parks and open spaces and local municipal parks.
- Providing clear wayfinding signs at all decision points.
- Coordinating with transit agencies to include amenities such as bike stations, bike racks, and real-time applications that encourage use.

3.3 UNIVERSAL ACCESS

ACCOMMODATE ALL USER GROUPS

The Bay Trail in its entirety, including all associated trail features, should be designed to be usable by as many people as possible including all the user types described in Chapter 2.

OBJECTIVES TO ACCOMPLISH THIS PRINCIPLE:

- Incorporating accessibility into the design of the Bay Trail and all related trail amenities, to the maximum feasible extent. For additional information, refer to the *U.S. Access Board's Design Guidelines* (www.access-board.gov), the California Building Code, and local regulations on accessibility.
- Designing the trail for all forms of non-motorized use.
- Ensuring the trail design width accommodates bi-directional bicycle and pedestrian use for the expected level of future use when the Bay Trail is completed.
- Recognizing the role of the Bay Trail as a commuter route that may benefit from specialized signs and lighting.

Napa River

San Mateo

3.4 PROXIMITY TO THE BAY

PROVIDE ACCESS TO THE BAY AND ITS SHORELINE

Access is both physical and visual. Development of the Bay Trail should take maximum advantage of opportunities to see the Bay and use its waters for a variety of recreational and educational activities.

OBJECTIVES TO ACCOMPLISH THIS PRINCIPLE:

- Locating the trail as close to the shoreline as possible.
- Providing the public with opportunities to safely view:
  - Wildlife
  - All kinds of water-based recreation activities such as swimming, sail boating, windsurfing, kitesurfing, kayaking, and the like
  - Airplane comings and goings
  - Port activities
  - Bridges
  - City skylines, mountain peaks, and ridgelines
- Ensuring that the design affords views to the water and provides access to shoreline amenities, such as beaches, tidal stairs, ramps, and floating docks where possible.
- Encouraging designs where shoreline structures do not visually separate the Bay Trail from the Bay or opposite shores and landmarks, such as islands, bridges, city skylines, and backdrop mountains.

3.5 EXPECTED LEVELS OF USE

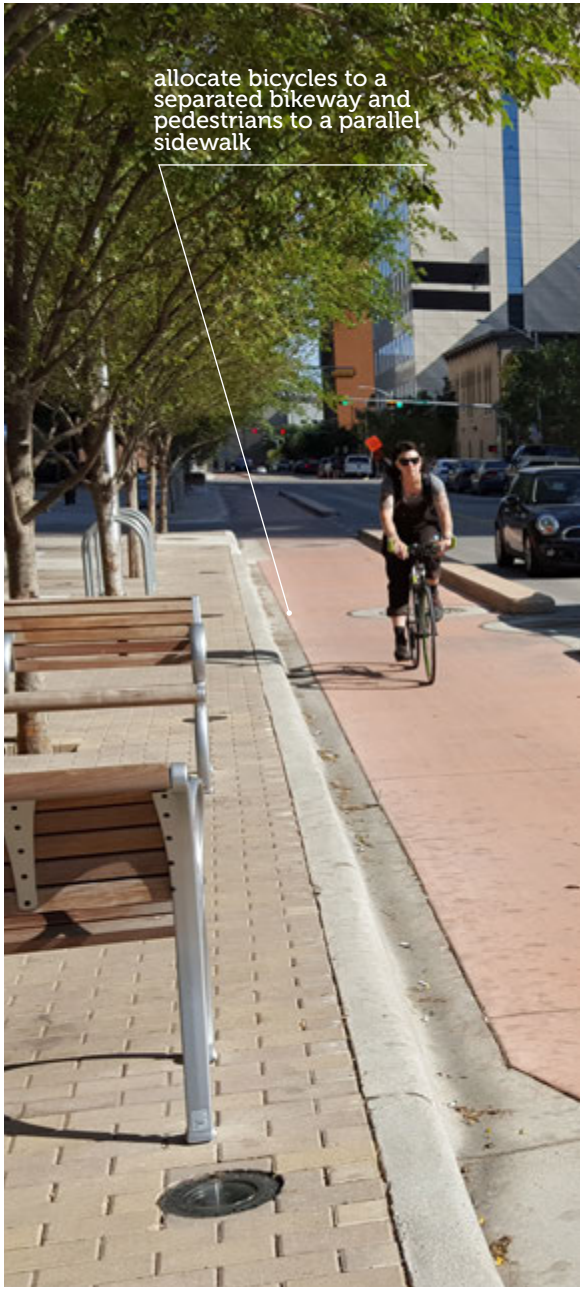
REFLECT FUTURE USE CONDITIONS

Since its inception, the Bay Trail has drawn a growing number of users each year. With every additional segment of the Bay Trail completed, and more direct connections from other bicycle and pedestrian systems being made, more connectivity is created and even more use occurs. The higher the user numbers and the greater the variety in users traveling at different speeds for different purposes, the more the need will increase for designs that expand the capacity and width of the Bay Trail. The trail must be designed to accommodate the growing population of the Bay Area and the expected increased use of the Bay Trail system. Once it is fully completed, the idea of embarking on a trip around the entire 500-mile loop will draw a significant number of people onto the Bay Trail.

OBJECTIVES TO ACCOMPLISH THIS PRINCIPLE:

- Providing a wider trail where the anticipated volume of use is expected to be higher than typical.
- On wider trails, separating faster-moving wheeled use (bicycling, rollerblading, or skateboarding for example) from slower-moving pedestrian use employing one of the following options.
  - Indicating the separation by striping.
  - Visually distinguishing the pedestrian path from the bike path by using different pavement surface types/colors.
  - Providing two physically separate trails, one for bicycles and other faster-moving wheeled use, and one for pedestrians.
  - Allocating bicycles to a separated bikeway within a road right-of-way while directing other users to a parallel promenade or sidewalk.

Larkspur Ferry Terminal
Source: Flickr (SF Bay Trail Project)



3.6 COMPATIBILITY WITH WILDLIFE

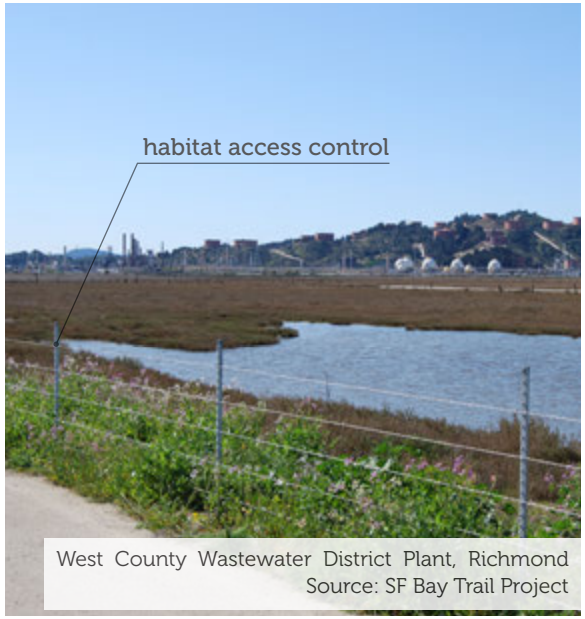
ENSURE THE BAY TRAIL IS COMPATIBLE WITH WILDLIFE THROUGH SITING AND DESIGN

In some locations, the Bay Trail's setting is composed of the Bay's open waters, tidal mudflats and wetlands, seasonal wetlands, and upland edges used by migratory waterfowl and resident wildlife species, some of which are threatened or endangered. The design of the Bay Trail and adjacent habitat conditions should complement each other through thoughtful trail siting and design to minimize or eliminate public access and wildlife compatibility concerns. In some cases, the Bay Trail may be a benefit to habitat conditions by directing use away from random informal access that disrupts habitat.

OBJECTIVES TO ACCOMPLISH THIS PRINCIPLE:

- Locating the Bay Trail and related use areas to avoid habitat fragmentation, vegetation trampling, and erosion.
- Employing appropriate design features within the Bay Trail corridor to minimize or eliminate adverse human and wildlife interactions. See also Section 5.8.
- Using durable trail surface materials that are sustainable over time thus reducing erosion impacts on adjacent habitats. See also Section 5.9.
- Providing designated trails in desirable areas to deter users from creating informal access into and through sensitive locations.
- Directing trail lighting away from habitat areas, and in areas where lighting would impact sensitive species, no lighting at all.
- Incorporating educational and interpretive elements about the value of habitat resources and related species.

66th Avenue Gateway, Oakland



West County Wastewater District Plant, Richmond
Source: SF Bay Trail Project

Richmond | Source: Flickr (SF Bay Trail Project)

San Mateo | Source: RHAA

3.7 SEA LEVEL RISE

ADDRESS SEA LEVEL RISE THROUGH TRAIL DESIGN

While scientific uncertainty remains regarding the pace and amount of future sea level rise, the Bay Trail design should use the most current regional sea level rise projections available.

OBJECTIVES TO ACCOMPLISH THIS PRINCIPLE:

- Siting the Bay Trail to:
  - Be elevated above expected extreme tides, storm surges, and flood levels.
  - Where needed, designed to tolerate occasional flooding.
- Where possible, dedicating a linear public access corridor for the Bay Trail with sufficient width to allow the trail in the future to migrate to higher elevations should sea level rise threaten the trail.
- Integrating the Bay Trail into the design of new protection structures and assuring that the top elevations are sufficiently wide to accommodate the Bay Trail.
- Involving knowledgeable geotechnical and civil engineering professionals in the design of the trail.
- Including adjacent structural (e.g., levees, seawalls) and non-structural (e.g., wetlands, vegetative buffers) erosion control measures to protect the Bay Trail from damage.

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4

A Gallery of Settings

A combination of diverse urban growth patterns and active resource stewardship actions in the San Francisco Bay Area over the last fifty years has created a wide diversity of settings, from urban to rural, through which the Bay Trail navigates. The design of the Bay Trail should respect and understand the spectrum of surroundings and the intended land uses through which it traverses.

Background: South San Francisco | Source: Corinne DeBra

Near Park Street Bridge, Oakland | Source: Flickr (SF Bay Trail Project)

GENERAL LOCALE

Urban Land Use Fabric

Located within the highly urbanized Bay Area, the Bay Trail often passes by, and sometimes through, urban residential, office, retail, hotel, and industrial land uses. For most of these settings, connecting to the Bay Trail is desirable as the trail is both a recreation and commute amenity for residents and workers alike. At the same time, design solutions need to address privacy and security concerns that may exist.

Urban Parklands

The Bay Trail is used to access the many national, state, regional, county, and city parks and recreation areas that front the Bay. These range in scale from thousand-acre urban parklands to parks less than one acre. These lands provide opportunities for both active and passive recreation.

1,300-acre Presidio, San Francisco | Source: Presidio Trust

0.8-acre Cryer Site Park, Oakland

Secure Land Uses

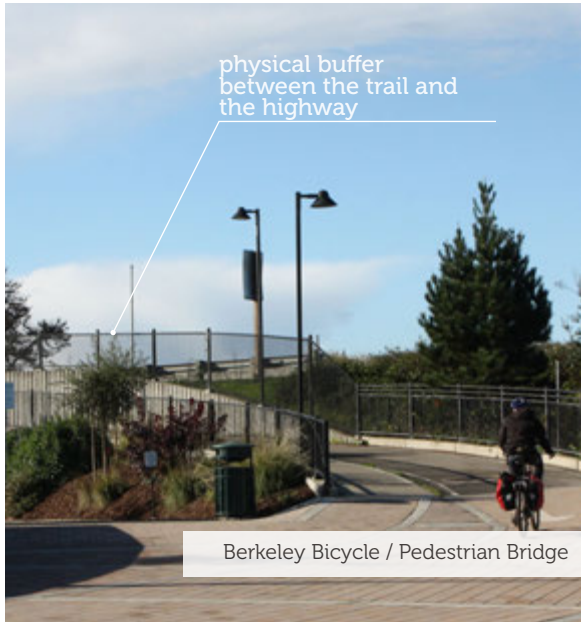
There are many land uses along the margins of the Bay that fall directly under the policies of the Department of Homeland Security or warrant extraordinary security considerations. These include military bases, ports, airports, highways, refineries, and energy production facilities among others. There may be design requirements for the Bay Trail such as setbacks and physical buffers, fencing, and user information to consider.

Rural and Agricultural Lands

The Bay's margins include privately held farms and ranchlands used for a variety of purposes. These include rural residential developments, grazing lands, and active agriculture such as vineyards or grain production. These land uses may necessitate that the Bay Trail design includes specific privacy and security measures.

Wildlife Habitats

The open space system of the Bay Area provides for passive recreation in a variety of natural, relatively undeveloped settings rich in habitat resources. Access provided by the Bay Trail and conservation of wildlife habitat are both important concepts that support each other. Wildlife and its varied habitats attract Bay Trail users, enhance the outdoor human experience, and in turn build public support and interest in protecting wild areas and funding restoration projects. The design of the Bay Trail and adjacent habitat areas should complement each other.

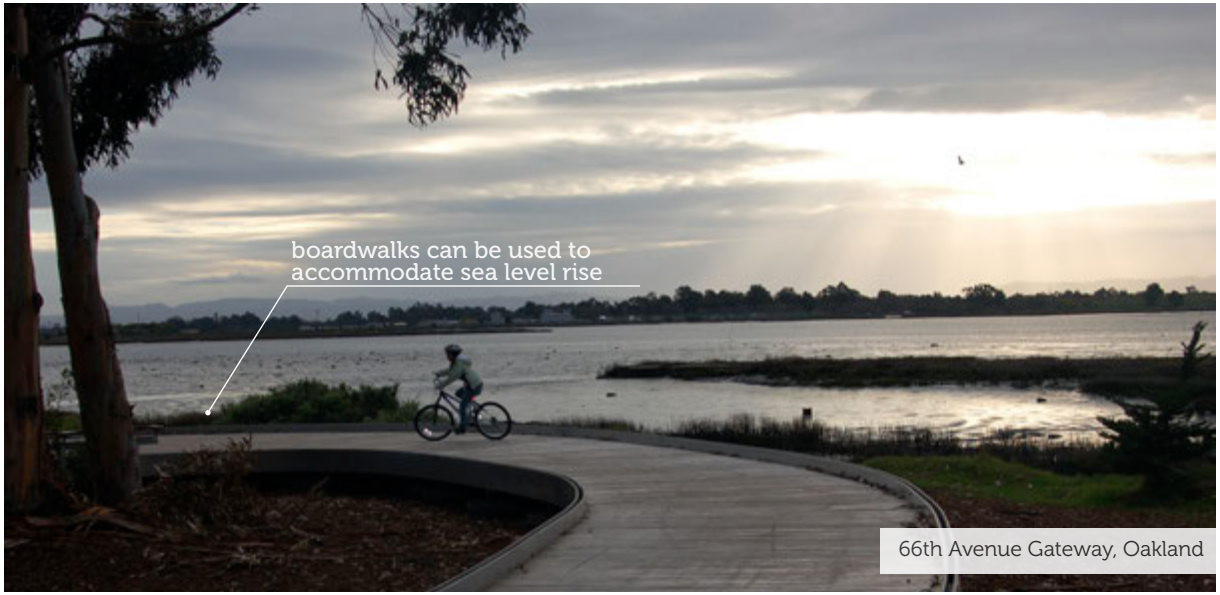


Berkeley Bicycle / Pedestrian Bridge

Bay Trail next to EBMUD Wastewater Treatment Plant, Oakland

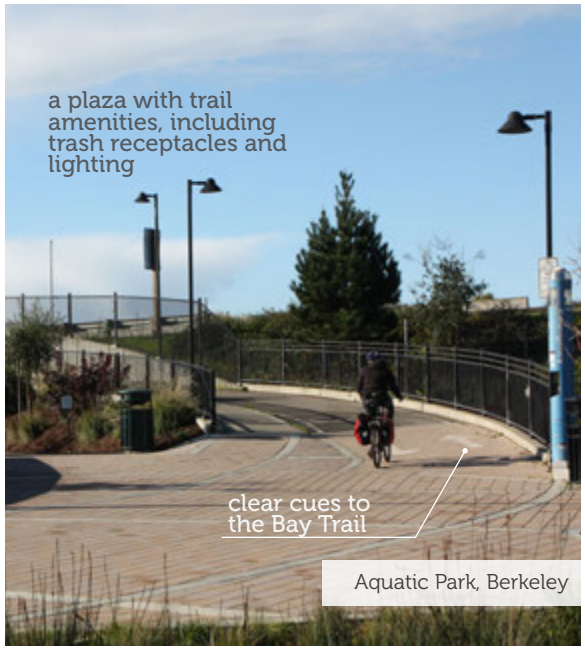
Stanly Lane, Napa County
Source: SF Bay Trail Project

San Mateo Shoreline
Source: SF Bay Trail Project



66th Avenue Gateway, Oakland

Kaiser Shipyard 3 Trail, Richmond



Aquatic Park, Berkeley

SPECIFIC CONDITIONS

Levees and Boardwalks

Anticipating the advent of sea level rise is an important design scenario for the Bay Trail. Parts of the existing Bay Trail are built on levees around the margins of the Bay and the rivers and streams that drain into it. As new Bay Trail segments are designed or existing segments are redeveloped, there will be a need to raise the Bay Trail to a benchmark elevation that will accommodate sea level rise, such as through the use of levees or boardwalks.

Plazas

The Bay Trail may be part of civic, memorial or historic places. There may be a plaza that is part of the Bay Trail such as at intersections with connector trails where gathering places, wayfinding information, or other trail amenities are provided. Visually informing the trail user about congested areas and providing clear cues as to where the trail is located are necessary design considerations.

Promenades

More and more cities around the Bay are developing linear promenades that promote civic functions and support the local economy. Land uses along promenades can range from office industrial parks to multi-use family and apartment complexes to shops and restaurants taking advantage of the Bay views. The Bay Trail user's speed will vary as some may want to sit and rest, some window-shop, some stop and talk, and some want to just be able to pass through easily and quietly.

Streets

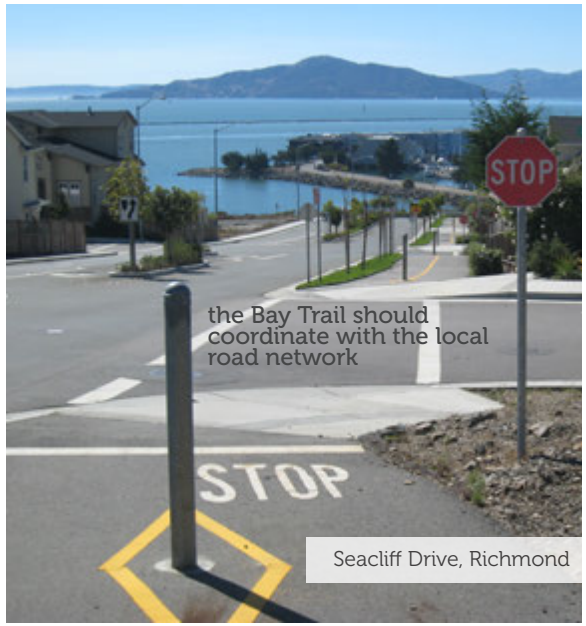
There will be some urban segments along the Bay Trail route where a corridor for a shared-use trail cannot be created that is sufficiently wide to accommodate the anticipated volume of use without affecting existing development patterns. In these circumstances, either sidewalks with a Class IV separated bikeway or a designated Class II bike lane will be required to assure trail connectivity.

Street Intersections and Crossings

As one component of a comprehensive transportation system, the Bay Trail's circulation function needs to interact with local pedestrian and bicycle systems that connect with it and with the surrounding road network. At-grade connections and transitions present different design challenges that need to be coordinated using traffic control devices such as signs, crosswalks, flashing lights, or signalization depending on the circumstances.

Jack London Square, Oakland

Embarcadero, San Francisco



Seacliff Drive, Richmond

Interstate 80, Berkeley Marina | Source: Corinne DeBra

Highway 84, Menlo Park | Source: Corinne DeBra

Highways

In some locations, the Bay Trail will be adjacent to freeways, highways, or major thoroughfares. Traffic safety for both motorized vehicles and trail users will be of foremost importance. Typically a barrier will be required. Line of sight, noise, visual distractions, air quality, personal and physical safety, and other issues will need to be investigated and resolved. This often involves analysis by a traffic engineer in consultation with Caltrans and/or the roadway owner.

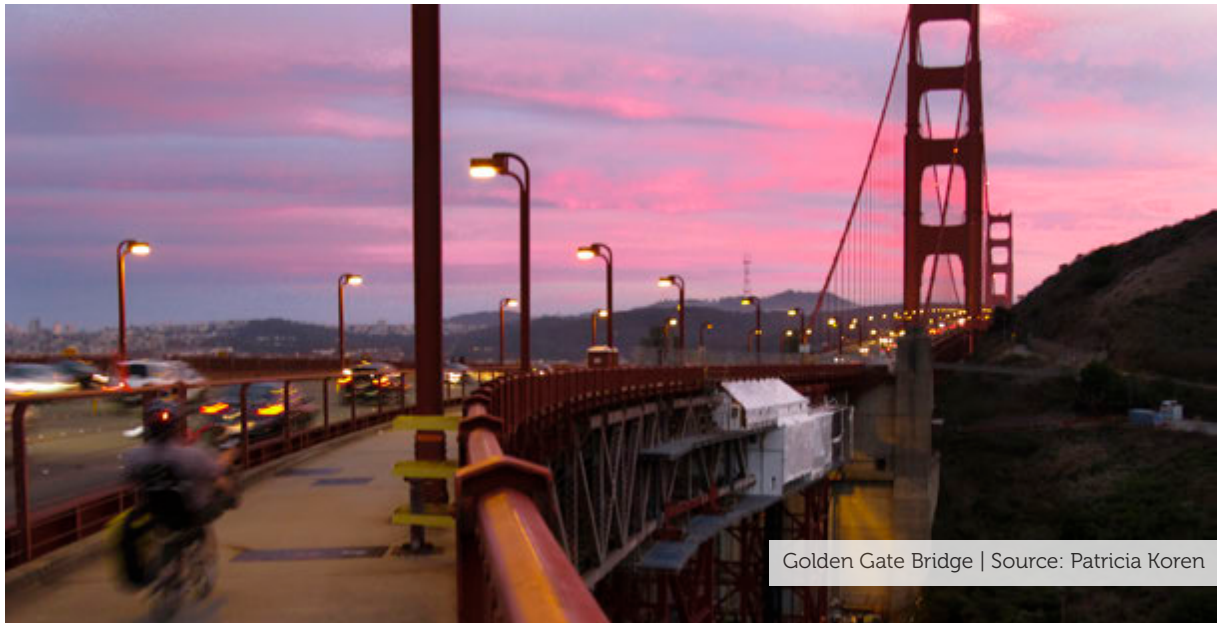
Bridges and Undercrossings

There are many barriers to the Bay Trail that must be surmounted through design to have a continuous transportation facility and user experience. Often these are natural barriers like the Bay itself or the hundreds of creeks that flow into it. Sometimes they are freeways, major thoroughfares, or train or light-rail rights-of-way. The design choices are relatively straightforward, either to go over or under these facilities. Each has implications for accessibility, views, experience, capital cost, and operations.

Bay Bridge
Source: Flickr (SF Bay Trail Project)

Heron's Head Park, San Francisco

San Mateo Shoreline Parks
Source: Flickr (Martin Taylor)



Golden Gate Bridge | Source: Patricia Koren

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5

Toolkit

The Bay Trail Toolkit (Toolkit) describes and illustrates design solutions that represent creative responses and best practices for use by government agencies and developers, as well as their qualified trail design professionals in planning, designing, and developing any Bay Trail segment. The Toolkit is intended as an aid in addressing common design issues that could exist along the Bay Trail. Although the Toolkit provides examples of design solutions, it is not meant to preclude creativity in design based on individual project site and contextual considerations or as exemplified in other agency or industry standards and guidelines.

The Toolkit is to be used in combination with the California Department of Transportation's standards and additional guidelines contained in the Highway Design Manual (HDM) for bikeways, as well as other national, state, regional and local municipality guidelines about shared-use trails. Appendix A includes a partial list of references for more information.

Background: Foster City

SELECTED TERMINOLOGY USED IN THE TOOLKIT

"**Shared-Use Trail**" is used to describe the Bay Trail where it provides a completely separated right-of-way for exclusive non-motorized use with cross-flow minimized to the extent possible. A shared-use trail is used by people of all shapes, sizes, ages, and abilities generally defined as either bicyclists or pedestrians. A shared-use trail is analogous to the terms "Class I" bike path used in the California Highway Design Manual and the term "Shared-Use Path" used by the American Association of State Highway Transportation Officials.

"San Francisco Bay Trail" or "Bay Trail" or "Trail" refers to the paved and/or natural surface portion that defines the user's primary travel space, including trail shoulders if present. In cases where the Bay Trail passes through heavily used areas such as urban plazas, striped pavement edge markings may define the trail.

"Trail Shoulder" as part of the San Francisco Bay Trail refers to a clear area immediately adjacent to the trail that serves a number of functions that include: use for a wide variety of trail-related activities; providing a safety buffer free of obstructions; and/or being used as a permeable water quality control feature.

"**Separated Bikeway**", also referred to as a "Class IV" separated bikeway or "cycle track," is an exclusive bicycle facility that mimics the experience of a bike path, but in a street environment. A cycle track is physically separated from motor traffic and distinct from a sidewalk used by pedestrians. Pedestrian facilities must be provided in conjunction with a separated bikeway to be considered a completed Bay Trail segment.

TOOLKIT TOPICS

5.1 The Essential Bay Trail
5.2 Bay Trail in Special Circumstances
5.3 Wayfinding and the Bay Trail Logo
5.4 Integration into the Local Street System
5.5 Rail and Light-Rail Lines
5.6 Over or Under
5.7 Sea Level Rise
5.8 Wildlife Compatibility
5.9 Sustainability
5.10 Trail Amenities
5.11 Security, Vandalism, and Privacy

5.1 THE ESSENTIAL BAY TRAIL

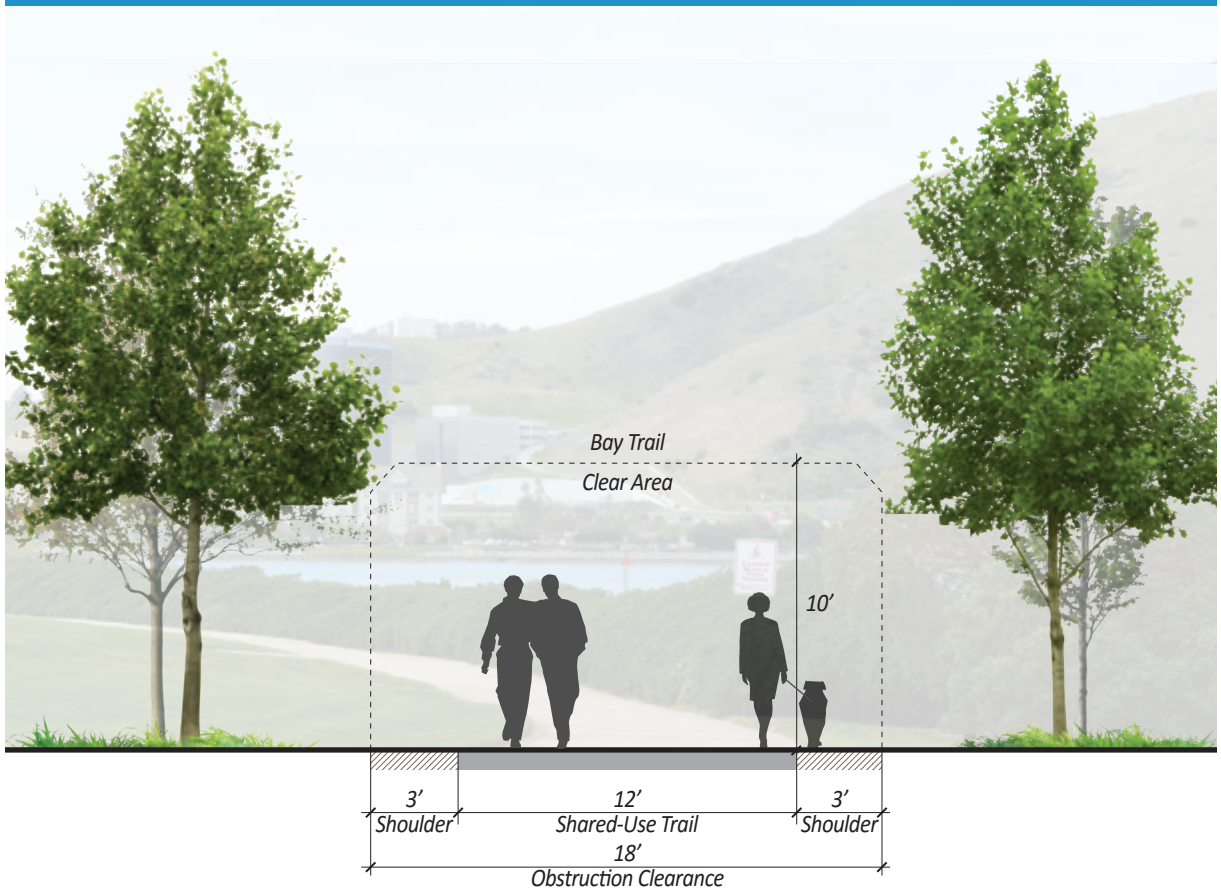
Trail Geometrics

- **Trail Width:** The standard width of the Bay Trail should accommodate the user's primary travel space and the use of shoulders when present. The Bay Trail and its clear space should consist of a minimum 18-foot width. The trail and shoulder widths are considered minimum standards necessary to accommodate a typical level of use along the Bay Trail when completed. In many instances, projected use levels may be high, and therefore the Bay Trail width should be wider, such as along urban waterfront promenades. If use levels are anticipated to be extremely high, consideration should be given to separating fast-moving users (e.g., bicyclists, rollerbladers, or skateboarders) from slower-moving pedestrians. There are a variety of methods to do so, such as pavement striping or inclusion of physical barriers (see Section 5.2. Bay Trail in Special Circumstances). In any case, all Bay Trail users should be able to enjoy a Bay experience, including Bay views.

Bay Trail users should be able to enjoy a Bay experience

San Mateo

FIGURE 5-1: BAY TRAIL WIDTH



- **Horizontal Trail Alignment:** The Bay Trail is one of the most popular shared-use trails in the Bay Area. The horizontal alignment of the Bay Trail is defined in part by a bicycle design speed decided on a project-by-project basis. Low design speeds and trail traffic calming devices could be considered for 1) crowded areas, 2) locations where considerable cross-traffic is projected, and 3) locations with sharp horizontal curvatures where right-of-way widths are constrained.
- **Alternative Surfaces:** In limited circumstances, the entire trail width may be constructed of natural materials that meet accessibility requirements. Depending on soil type and other site-specific conditions, the design could involve compacted gravel, decomposed granite, and/or native soil and may incorporate any number of stabilizing agents. Such surfaces should be firm, smooth, and stable. An example is a trail near sensitive habitat where paving is discouraged by the managing agency.

Obstructions and Clearances

The Bay Trail includes a zone around the trail free of any trailside or overhead obstructions. Obstructions may present hazards to safe, unimpeded trail use. Obstructions may also limit sight lines and/or funnel trail users toward the center of the trail, hence effectively narrowing the width of the usable trail surface.

Obstructions

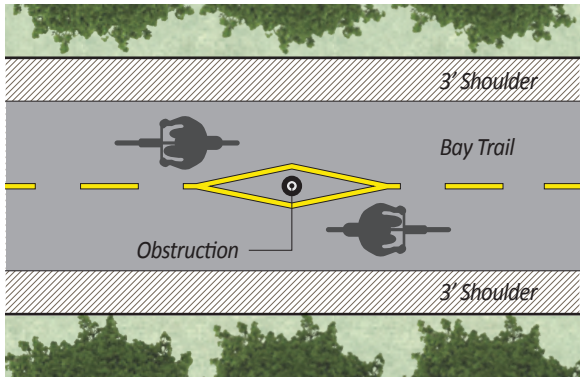
There are many types of obstructions that can intrude into the trail's horizontal clearance zone such as:

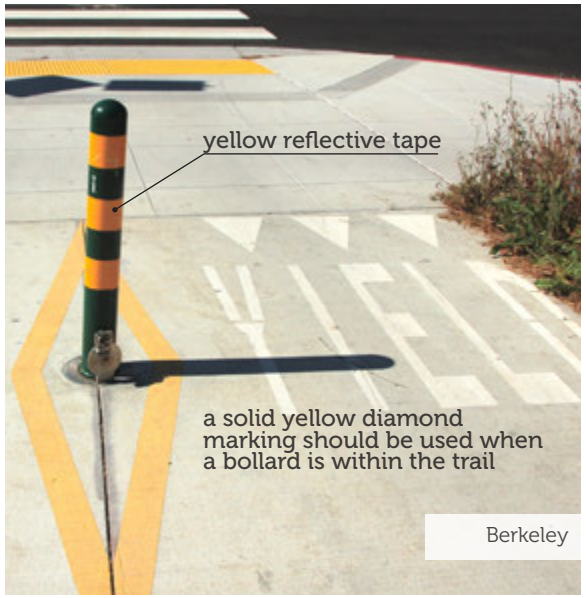
- Bollards
- Lights poles and fixtures
- Sign poles and signs of all types
- Bicycle racks
- Benches and drinking fountains
- Fences and walls
- Railings
- Utility boxes
- Curbs
- Boulders
- Landscaping
- Drains
- Trees

Albany

Obstructions within the Trail

When obstructions within the trail are unavoidable, solid yellow diamond pavement markings should be used. The obstruction should also be identified with yellow reflective tape.

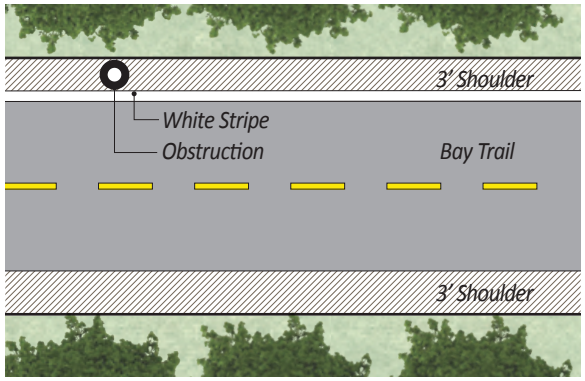




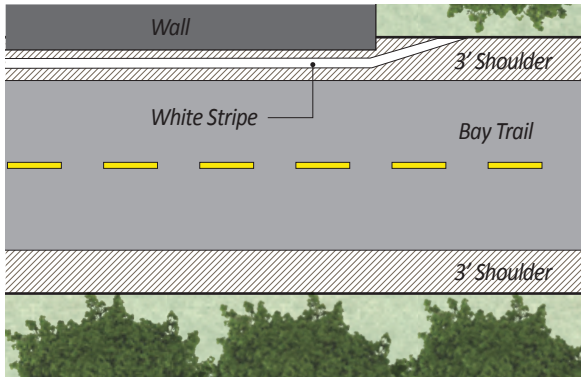
Berkeley

Obstructions within the Trail Shoulder

When an obstruction is unavoidable within the trail shoulder, a solid white stripe should be located along the edge of the trail to visually notify the Bay Trail user about the presence of the obstruction.



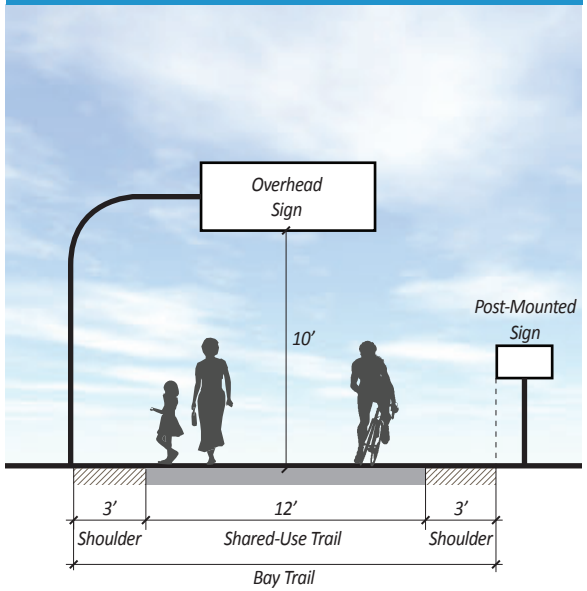
When located within 3 feet of the paved trail, all curbs, freestanding walls, railings on bridges and boardwalks, and retaining walls should be treated as obstructions. There should be a continuous white stripe at the edge of the trail for the length of the feature.



Vertical Clearance

- Vertical clearances include such items as:
  - Undercrossing and tunnel ceilings
  - Overhanging trees
  - Signs
  - Overhead security fencing
- A 10-foot vertical clearance across the width of the Bay Trail is desirable. This clearance applies to signs, overhead fencing, tunnel ceiling heights, and vegetation.

FIGURE 5-2: VERTICAL CLEARANCE



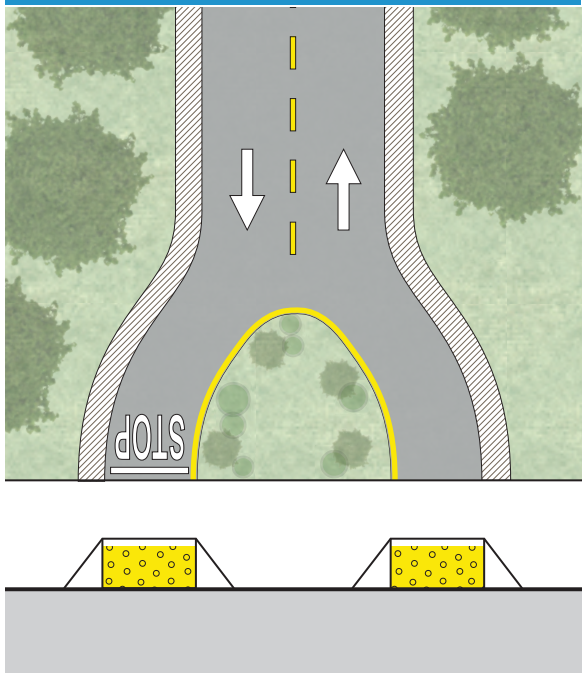
Park Street Bridge, Oakland
Source: Flickr (SF Bay Trail Project)

Barrier Treatments for Trail Entryways

- **Bollards** can be removable, fixed, retractable, or flexible. Whether stand-alone or grouped together, bollards are often used to discourage non-authorized motor vehicles from accessing the Bay Trail. Installing bollards should be considered only as a last resort.
- **Fold-down/collapsible bollards** should not be installed along the Bay Trail because they can be a hazard to users, even when left in the down position.
- **Other design elements** that would help discourage motorized vehicles from entering the Bay Trail are:
  - Gateway design with a strong sense of identity and transition.
  - Entry signage.
  - Prohibition signage with associated fine for violations.
  - Ramps and trail shoulders that look like a shared-use trail, not driveways.
  - Split-path entry into inbound and outbound lanes divided by a narrow median. This has the added benefit of alerting cyclists about the intersection ahead and the need to slow down.

Sonoma Baylands
Source: SF Bay Trail Project

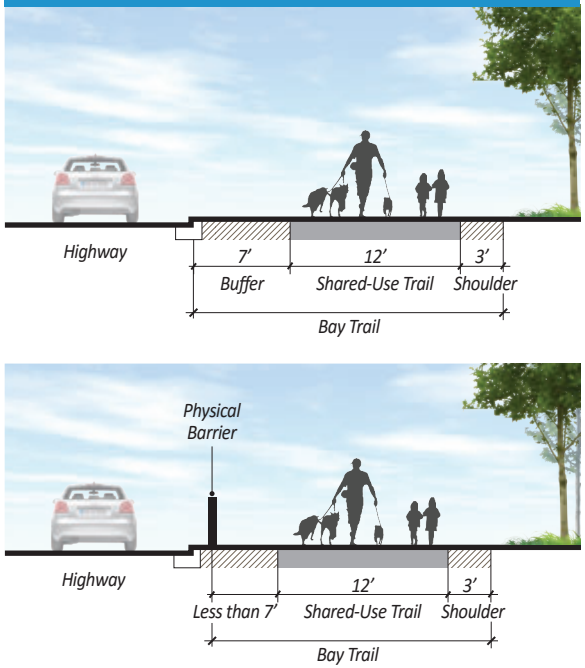
FIGURE 5-3: TYPICAL SPLIT-PATH ENTRY DESIGN



Clearance Between the Bay Trail and Streets and Highways

- The separation between the edge of the Bay Trail and the edge of a parallel road or street should be at least 7 feet.
- If the trail is less than 7 feet away from the street, a fence or other physical barrier separation should be included to prevent the Bay Trail user from straying into the street. A physical barrier should be at the outside edge of the shoulder (3 feet away from the trail) unless obstacle striping is used at the edge of the trail.

FIGURE 5-4: CLEARANCE BETWEEN THE BAY TRAIL AND STREETS

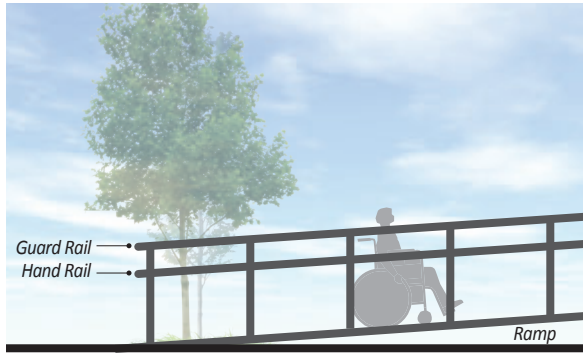


Railings and Visibility

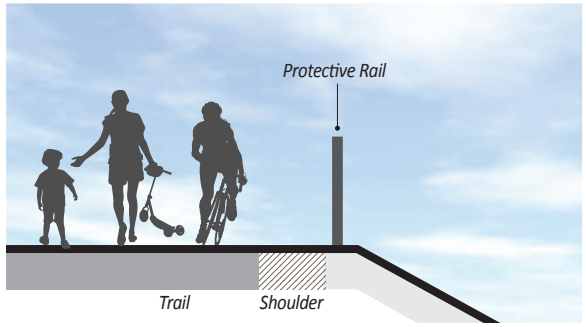
In some situations, the Bay Trail may need to include protective railings. Generally, railing design and materials should preserve views to the Bay and should relate to the architectural or landscape style of the surrounding area. There are three types of railings that could be used along the Bay Trail:

- **Guard Rails:** used to prevent the trail user from falling off a bridge or boardwalk. The height above the adjacent ground or water surface that is used is established by local code. Typically this height is 30 inches. The guard rail should be between 42 and 48 inches in height with no opening greater than 4 inches. Design considerations about guard rails include:
  - Allowing maximum views, especially on bridges. Using vertical pickets or horizontal wire cables is recommended.
  - Providing additional hand rails for accessibility purposes.

  - Including wide "rub rails" in some settings to reduce the likelihood that a bicyclist's handlebar might be caught by the railing.
- **Hand Rails:** used for accessibility purposes on slopes and to help prevent the trail user from going off the trail. Hand rails must meet the dimensioning requirements of the U.S. Access Board and may have broad openings that do not constrain views.



- **Protective Rails:** used to help prevent the trail user from going off the trail into a dangerous situation such as a steep side slope. Like hand rails, protective rails may have broad openings, but should be between 42 and 48 inches in height.



Signs and Markings (see also Wayfinding and the Bay Trail Logo)

- **Signs:** Prohibition, regulatory, and warning signs are an integral part of the Bay Trail. While they are a key component in managing Bay Trail use, signs should be used only when needed. The use and placement of signs and markings are dependent on specific site circumstances.
- **Pavement Markings:** Common pavement markings stenciled on the trail and used to direct and manage use along the Bay Trail include:
  - Solid yellow center lines to separate directions of travel and indicate no passing by trail users. A solid center line stripe is commonly used in heavily travelled sections of trail or around blind turns.
  - Striped yellow center line to separate directions of travel along heavily used sections of trail but where view lines allow passing.
  - Solid yellow markings to inform the trail user of obstructions within the trail (see "Obstructions and Clearances" in Section 5.1).
  - Solid white shoulder stripes to delineate the edge of the trail or to inform the trail user of obstructions.
  - Solid white stripes to separate users into individual lanes.
  - White symbols and arrows for bicyclists and pedestrians that are stenciled on the trail to indicate individual lanes and direction of travel.
  - White railroad crossing, road crossing, stop, or yield markings.
  - Multiple colors and patterns at crosswalks (see "Intersection Crossings" in Section 5.4).

signs are an integral part of the Bay Trail but should be used only when necessary

Seacliff Drive, Richmond

yellow center lines help separate directions of travel

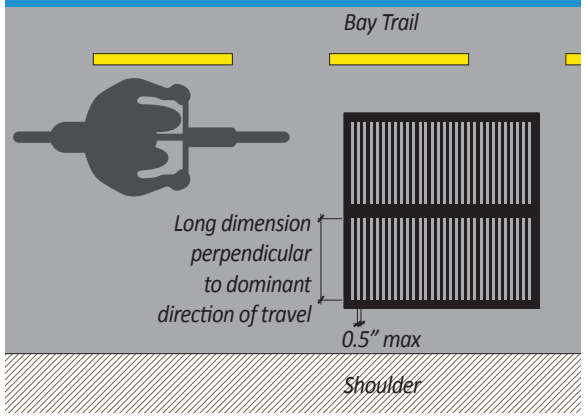
Emeryville

Underground Utilities

These consist of electrical, communications, water, sanitary sewer, or stormwater utility systems.

- Where underground utilities exist within the Bay Trail corridor, utility lines and access covers should be located away from the Bay Trail and shoulders, not within the trail.
- If unavoidable and when within the Bay Trail, including shoulders:
  - Utility covers must meet accessibility guidelines.
  - Utility grates with openings, such as catch basins or drop inlets for stormwater, must be bicycle-safe to prevent a bicycle wheel from catching or falling into the slots of the grate.

FIGURE 5-5: RECOMMENDED UTILITY GRATE DESIGN



Managing Water Quality

A paved Bay Trail has runoff, and where the trail is used by service vehicles, that runoff may enter the Bay. Design of the Bay Trail should:

- Reduce trail runoff by minimizing impervious areas that are directly connected to a storm drain system.
- Use permeable paving systems such as porous concrete, porous asphalt, or permeable pavers, where possible. If appropriate to the surrounding setting, use gravel.
- Direct runoff from the trail's impervious areas to pervious areas, including permeable trail shoulders, and/or small swales or retention areas that are outside the trail shoulder.

Cryer Site Park, Oakland

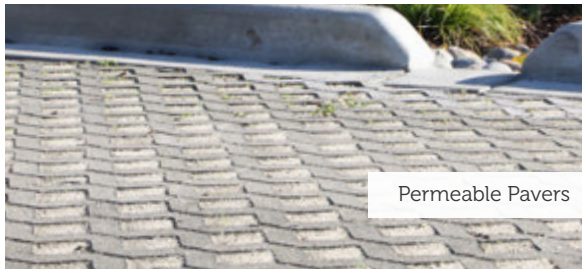
Mandatory Design Standards and Common Design Exceptions

The California Highway Design Manual contains selected mandatory design standards that apply to bikeways. "Mandatory Design Standards" are those requirements presented in the California Highway Design Manual that are considered most essential to achievement of overall design objectives and use the word "shall". Many pertain to requirements of law or regulation.

In certain instances the Bay Trail will need to accommodate the mandatory design standards. Mandatory standards related to trails address:

- Width of paved trail and shoulders
- Horizontal clearance to obstructions
- Bicycle-safe drainage grates

Porous Asphalt


Permeable Pavers

- Clear width between railings on structures
- Vertical clearance to obstructions
- Separation between the edge of the trail and the edge of a roadway
- Design speed
- Stopping sight distance

Where mandatory design standards required by the managing or funding agency for the Bay Trail cannot be achieved, a design exception should be documented and additional design considerations should be taken into account. The common scenarios include:

- Horizontal alignment geometrics and the need to reduce speed limits, provide center line striping, and assure visibility around curves.
- Reduced trail widths and the need to provide smooth transitions, safety signs, and/or pavement markings.
- Obstacles within the shoulder of the trail and the need to provide pavement markings and /or signs to notify the user of their presence.

5.2 BAY TRAIL IN SPECIAL CIRCUMSTANCES

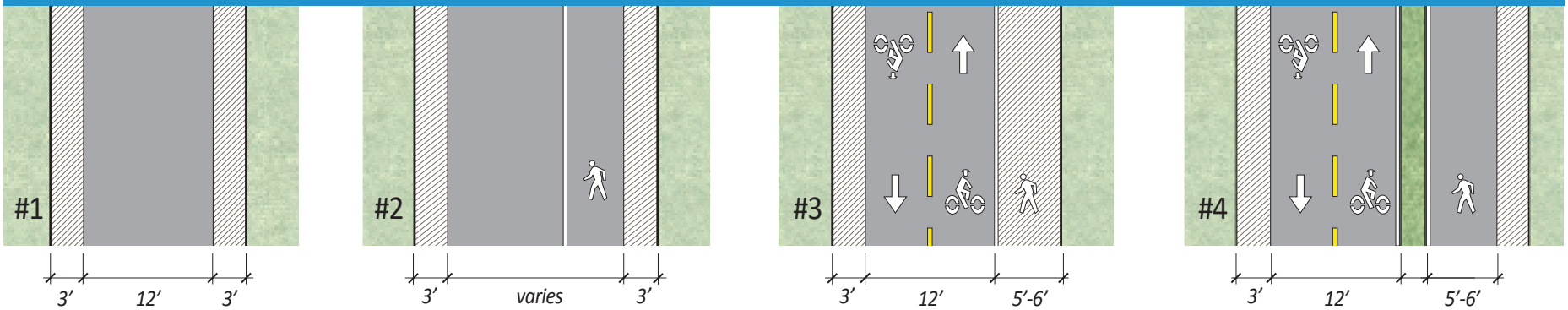
Bay Trail in High Use Areas

On high-volume sections of the Bay Trail, consider separating bicycle and pedestrian use of the trail to both facilitate use and to discourage user conflicts related to different travel speeds. In all cases separated facilities need to provide all trail users with a Bay experience. Separating bicycle and pedestrian use of the trail can be done in a variety of ways, each of which involves a wider trail corridor. Design options are:

- a wider trail with striping and pavement markings to separate bicyclists from pedestrians (Figure 5-6, #2).
- 5- to 6-foot shoulders on one side of the trail or both, with signs and/or pavement markings directing pedestrian use to the shoulder (Figure 5-6, #3).
- two paths separated by landscaping (Figure 5-6, #4).

Cryer Site Park, Oakland
Source: Flickr (SF Bay Trail Project)

FIGURE 5-6: OPTIONAL TRAIL DESIGNS

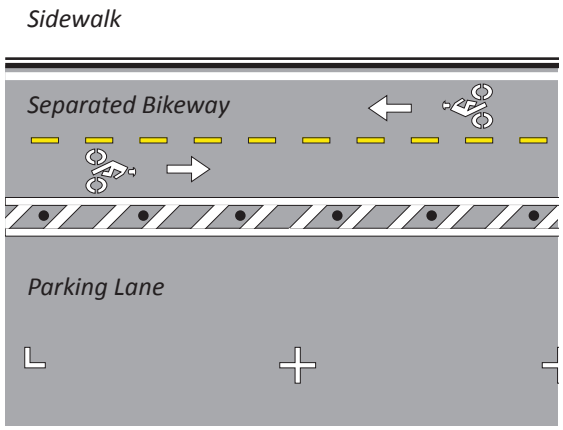


Bay Trail in a Limited Right-of-Way

In some locations, it is not feasible to fit the Bay Trail into the available right-of-way as an off-street Class I bike path. Alternatives to consider that would assure continuity of the Bay Trail include:

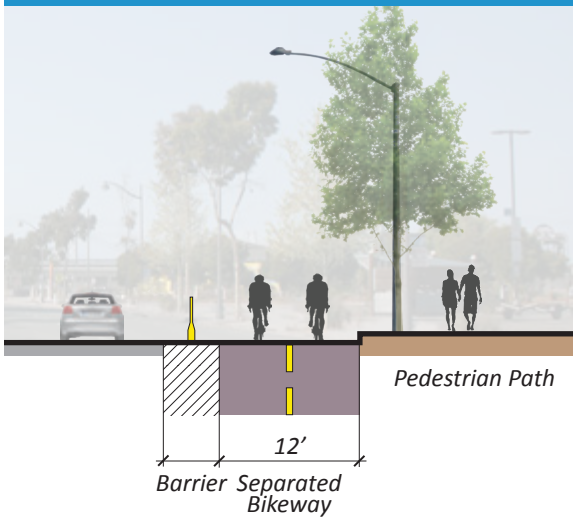
- **Class IV Separated Bikeways**: In some areas, Bay Trail bicyclists may need to ride on city streets. In these instances, it may be necessary to redesign an adjacent street right-of-way to create a dedicated bikeway with pedestrians using the sidewalk. This is particularly relevant where there is a limited number of driveway crossings that would conflict with bicycle use. Bay Trail separated bikeways should include:
  - A 12-foot-wide two-way bicycle facility.
  - A parallel physical barrier (guardrails, raised medians, large planters, or permanent bollards) to protect Bay Trail cyclists from adjacent motor vehicle traffic. Permanent physical barriers are preferred to parked cars.
  - A yellow dashed center line stripe and white edge striping.
  - Where the separated bikeway is at the same grade as either parking or a pedestrian sidewalk, different pavement color/texture could be used to visually separate the bikeway.
  - While two-way separated bikeways are recommended, in some instances one-way protected bikeways on each side of the street could be considered. An example would be updating existing Class II bike lanes to one-way protected bikeways to avoid reconfiguring intersections.

FIGURE 5-7: SEPARATED BIKEWAY BUFFERED BY PERMANENT BOLLARDS AND PARKING



Alameda

FIGURE 5-8: SEPARATED BIKEWAY WITH BARRIER



Alameda

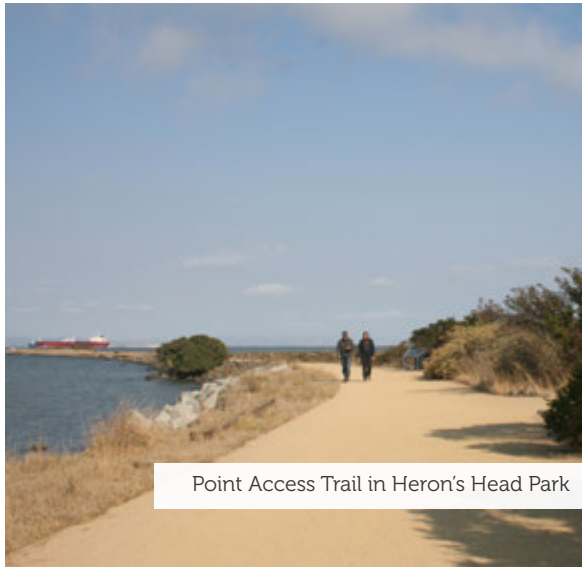
- **Class II Bike Lanes**: In some urban cases there may be physical conditions where it is not possible to develop a separated bikeway within the width of the road right-of-way, even with the option of reconfiguring or downsizing traffic lanes. In such situations, consider a Class II bike lane with pedestrians using the sidewalk. A Class II bike lane serving as the Bay Trail should begin and end at traffic controlled intersections. The Bay Trail bicycle lane should be 6 feet wide. The bike facility should be signed as the Bay Trail with appropriate directional signs, safety signs and markings, and/or other bicycle signal control devices at intersections to safely connect with the shared-use portions of the Bay Trail.

Bike Lane along the Embarcadero
Source: BCDC

Bay Trail to Destinations

There are settings where the Bay Trail takes on the role of a short point access trail leading to a destination but not continuing beyond it. Examples include connections to ferry terminals, a visitor center, marinas, or wildlife overlooks. These segments of the Bay Trail, depending on the managing agency involved, may have restrictions about use or requirements regarding types of trail surfacing.

- **Trail Geometrics:** Generally the trail geometrics should be the same in these situations as any segment of the Bay Trail. In those segments the width of the trail should be at least 8 feet to accommodate pedestrians, bicyclists, and service and emergency vehicle access.



Point Access Trail in Heron's Head Park

- **Alternative Surfaces:** In selected circumstances, compacted gravel surfacing or other natural material, such as decomposed granite that is firm and stable and meets accessibility requirements, may be possible.

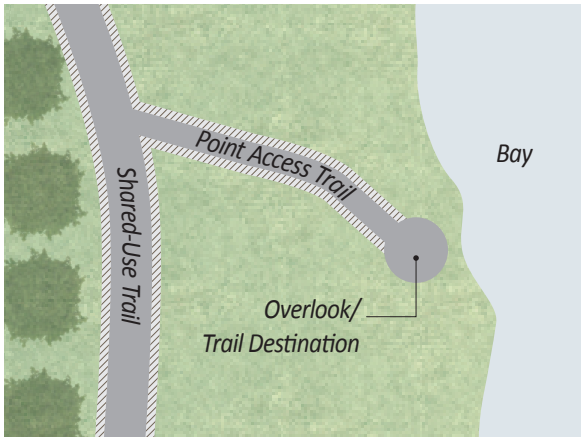
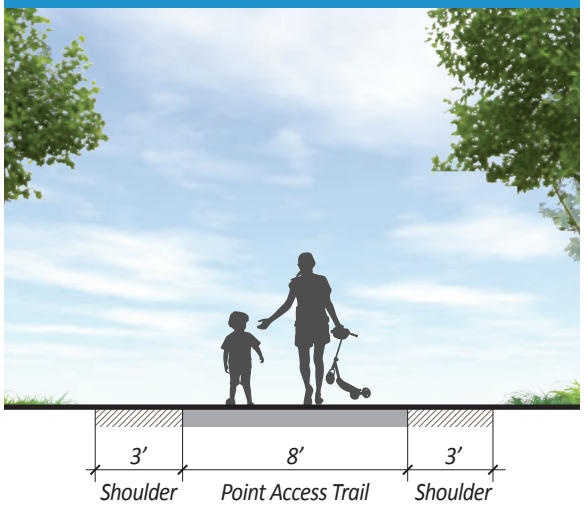


FIGURE 5-9: POINT ACCESS TRAIL GEOMETRICS



5.3 WAYFINDING AND THE BAY TRAIL LOGO

The Bay Trail is a significant public circulation feature and should be visually identifiable. The primary means of identification is through use of the Bay Trail logo signage. The length of the Bay Trail and diversity of environments through which it weaves makes it a spectacular trail, as well as a challenge to mark. With this in mind:

- 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 the trail, and in some cases, to inform users that they are still on the trail and have not made a wrong turn.

The Bay Trail logo identifies trails within the Bay Trail system as distinct from other connecting trails. 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. The Bay Trail logo should only be used on the Bay Trail itself. Signs not on the Bay Trail itself but directing people to the Bay Trail should not use the logo and should instead spell out "Bay Trail."

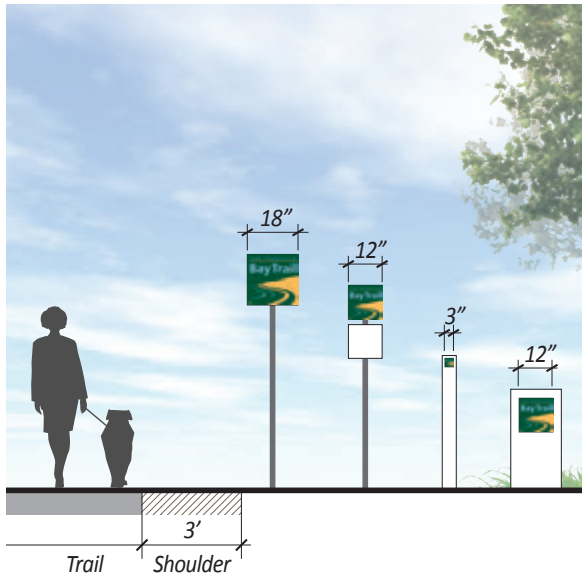
Identification Logo Sign

The size of a Bay Trail logo sign should be based on scale of the surrounding environment and infrastructure as well as the user group.

There are three standard sizes of Bay Trail logo signs:

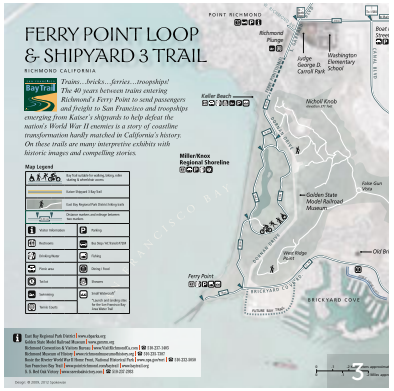
- **Large** Bay Trail logo signs (18" x 18") should be located within the user's view at the entrance from a trailhead to each Bay Trail segment, and where a large visible sign is needed to identify the trail crossing a street. This size of logo sign is useful to both trail users and passing motorists.
- **Medium** Bay Trail logo signs (12" x 12") should be located at intersections with other trails, on long trail stretches with intersections, and along urban streets where the Bay Trail consists of sidewalks and either Class II bike lanes or a Class IV separated bikeway.
- **Small** Bay Trail logo signs (3" x 3") should be used in park settings and also be located along the trail or when either: the pedestrian portion of the Bay Trail is along sidewalks with adjacent separated bikeways or Class II bike lanes; or there are long segments of Bay Trail that run on or parallel to city streets where there are many intersections.

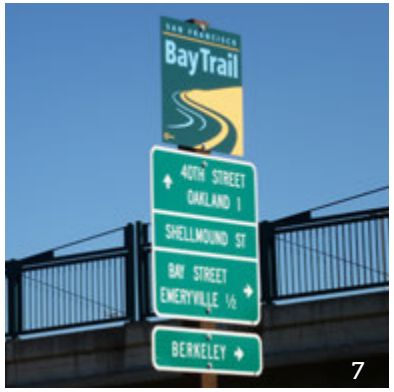
FIGURE 5-10: VARIOUS TYPES AND SIZES OF BAY TRAIL SIGNS



Ideally, there should be one of the above Bay Trail signs at appropriate intervals to reassure trail users they are still on the Bay Trail. Once a user has entered the trail and where long segments exist without intersections, no further Bay Trail signs are needed. However Bay Trail logo signs are needed at entryways and for wayfinding/direction purposes. In urban areas where the Bay Trail crosses streets or intersects with other pedestrian and bicycle facilities, Bay Trail logo signs are needed at more frequent intervals. While a 1/4 mile interval is reasonably appropriate, shorter intervals may be needed where there are numerous intersections or along Bay Trail separated bikeways.

1. Bay Trail Logo, Wayfinding, + Management Signs, Palo Alto | Source: SF Bay Trail Project
2. Bay Trail Logo + Bicycle Lane Sign, Alameda Avenue, Oakland | Source: SF Bay Trail Project
3. Bay Trail Logo + Wayfinding Sign, Ferry Point Loop, Richmond
4. Bay Trail Logo + Directional Signs, Larkspur Ferry Terminal | Source: Flickr (SF Bay Trail Project)
5. Bay Trail 3' Diameter Surface Plate Concept
6. Bay Trail Logo + Funding Partners, Oakland
7. Bay Trail Logo + Directional Signs, Emeryville | Source: Flickr (SF Bay Trail Project)
8. Bay Trail Logo + Management Signs, American Canyon | Source: SF Bay Trail Project
9. Bay Trail Logo, Management Signs, + Wayfinding Map, Emeryville





The Bay Trail identification logo sign may be used on its own or in combination with other management or creative wayfinding signs. Examples include combining signs with that of the San Francisco Bay Water Trail or the San Francisco Bay Conservation and Development Commission's public shoreline access signage. When possible, place Bay Trail logo signs on existing sign or utility poles if such location clearly meets wayfinding sign needs and goals.

Using the Bay Trail logo as a painted pavement marking is discouraged unless long-term maintenance can be assured. Large logos made of a durable material and embedded in the trail pavement, similar to cast iron utility covers, could be a viable alternative to pavement logo paintings.

Directional

Along the Bay Trail, the logo sign could be complemented with arrows in advance of a trail intersection to indicate the direction of the Bay Trail.

FIGURE 5-11: DIRECTIONAL BAY TRAIL SIGNAGE

Other Applications

- Where the construction of a segment of the Bay Trail is recognized as a collaboration of many public, private, and/or non-profit organizations.
- Where construction of a segment of the Bay Trail has been supported by a grant from the Bay Trail Project.
- On interpretive signs and brochures that inform and educate visitors about historical, cultural and natural features along the trail.
- On wayfinding map signs.
- On a temporary construction sign along the Bay Trail.

Ferry Point, Richmond

Bay Trail, San Mateo

Landfill Loop Map, Richmond

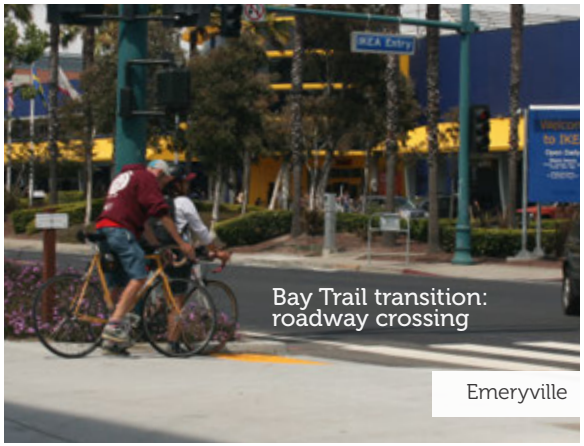
Marina Bay
Source: SF Bay Trail Project

5.4 INTEGRATION INTO THE LOCAL STREET SYSTEM

Transitions to/from On-Street Facilities

There are locations where the Bay Trail will transition from a separate shared-use trail to an on-street bicycle facility and sidewalk. To ensure a smooth and safe transition, different design considerations should be given to pedestrians and bicyclists.

FIGURE 5-12: BICYCLE CROSSING WARNING SIGNS



- **Pedestrians**
  - Provide wayfinding signage at decision-making points.
  - Where pedestrians need to cross the street to get to the Bay Trail, design crosswalks as specified in the next section, "Street Crossings."
- **Bicyclists:** It is a challenge to provide a safe roadway crossing when bicyclists need to cross the street to join the trail. If not adequately designed, then bicyclists may ride illegally on the sidewalk or the wrong way in a bicycle lane. Bicycle transitions to the Bay Trail from a street should:
  - Be made at a location where the motorists have positive traffic control (e.g., stop signs or signalized crossings and intersections).
  - Provide advance warning signs to inform motorists on the roadway that the Bay Trail crossing is approaching and to look for bicyclists as well as pedestrians.
  - Provide advance warning signs to inform bicyclists on the roadway that the Bay Trail is approaching and that they need to cross the street.

Street Crossings

The Bay Trail at times crosses local streets. Trail design for street crossings varies depending on whether the crossing is midblock or at an existing intersection of two streets. Both cases meet the definition of a "Bicycle Path Crossing" as defined by the California Vehicle Code (CVC 231.6). Stop controls, other warning signs, or designs to slow cars and/or trail users at the crossing could be considered.

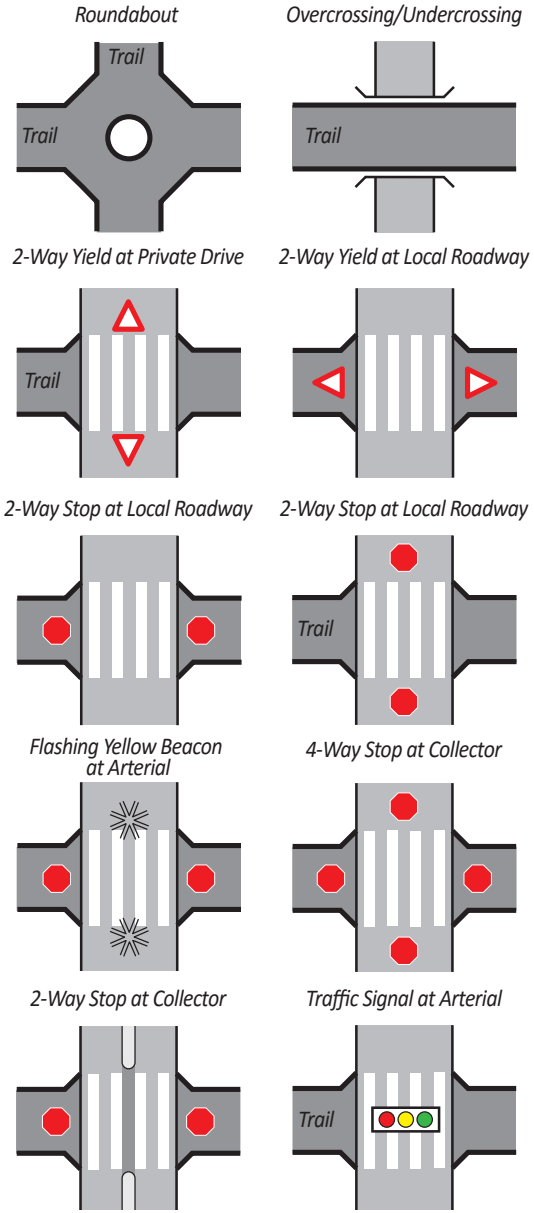
- Where there is no traffic signal, then design of the Bay Trail crossing should employ any number of tools, including high visibility pavement markings, trail and roadway crossing signs, and median pedestrian (and bicycle) refuges if possible. This applies to scenarios both when the motorists have the right-of-way and when they don't.
- If the motorist does have the right-of-way, additional design tools such as rectangular rapid flashing beacons or pedestrian hybrid beacons should be considered.

Assigning the Right-of-Way

The total and relative volumes of use between the trail and roadway determine who has the right-of-way and the type of traffic controls to use at a particular intersection of the Bay Trail with a roadway. All trail users (pedestrians, bicyclists, others) should be counted in the trail volume.

- When the Bay Trail intersects a local or collector street, the right-of-way typically goes to the roadway. If sight distance is adequate, a YIELD sign can be used in lieu of a STOP sign for the trail user. Where the volume on the roadway increases and becomes more difficult to cross, a median

FIGURE 5-13: TRAIL CONTROL OPTIONS AT INTERSECTIONS



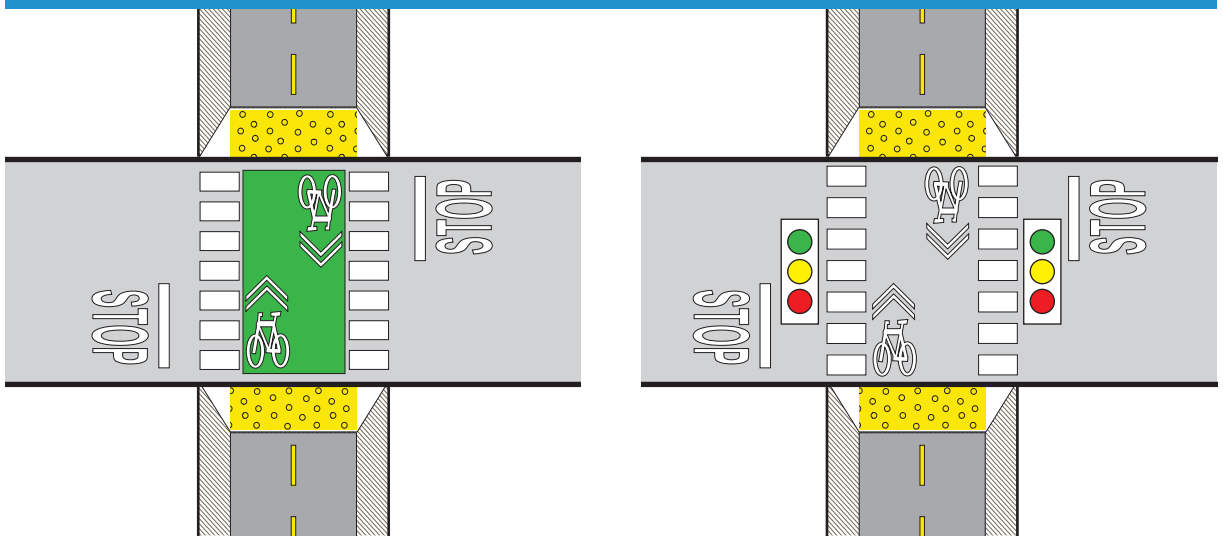
refuge and/or in-pavement flashing lights should be used.

- If the Bay Trail has higher volumes of use than the local or collector street, the right-of-way should be assigned to the trail.
- When a Bay Trail segment intersects an arterial, a pedestrian or bicycle study may be required to assess the need for a signal.
- If the Bay Trail volumes are high and/or the arterial volumes are high, consider a trail overcrossing/undercrossing of the arterial.

Mid-Block Crossings

- **Trail Shared by Bicycles and Pedestrians**
  - Use ladder/zebra style pavement markings on the outside edges of the crosswalk/trail crossing to encourage pedestrians to be on the outer edges of the crosswalk and bicyclists to 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. This can be accomplished in two ways:
    - With a traffic signal: Use bicycle shared-lane markings (a bicycle symbol and two white chevrons also called 'sharrows') in the middle of the crossing.
    - Without a traffic signal: Use a solid green color pavement in the middle of the crosswalk if the intersection is controlled with a two-way stop. This is to increase the visibility of the trail crossing to motorists on the roadway.

FIGURE 5-14: CROSSWALK OPTIONS FOR A TRAIL SHARED BY BICYCLISTS AND PEDESTRIANS



- **Trail not Shared by Bicycles and Pedestrians:** When bicyclists and pedestrians are on two separate trails or on the same trail separated through pavement markings:
  - Use ladder/zebra style pavement markings for the pedestrians and outside parallel lines for the bike crosswalk with no markings in the center where the bicyclists would ride. Each crosswalk should be approximately the width of the approaching pedestrian and bicycle trails, respectively.
  - Use a non-slippery green-colored pavement surface when not signalized, understanding that use of a solid colored pavement surface presents ongoing maintenance requirements.

Intersection Crossings

Guidelines for mid-block crossings also apply to where the Bay Trail crosses at an existing intersection of two roadways. Additionally, the following three design scenarios can be applied to intersection crossings.

- Providing bicycle-specific traffic signals (also known as signal "heads"). These should be used in conjunction with standard pedestrian signals at a signalized intersection with timing appropriate to the trail users.
- Coordinating existing crosswalk or protected intersection designs on a site-specific basis.
- Assuring curb cuts and truncated domes cover the full width of the trail.

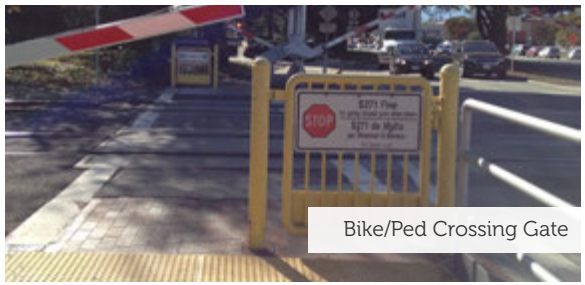
1. Bicycle-specific traffic signals
2. Pavement markings indicating a bicycle crosswalk
3. Outside parallel lines for a bicycle crosswalk
4. Colored paving for bike crossing
5. Protected intersection | Source: City of Davis
6. Mid-block crossing on Brickyard Cove Road, Richmond
7. Colored paving for bike crossing | Source: Flickr (Dylan Passmore)

5.5 RAIL AND LIGHT-RAIL LINES

No national standards or guidelines dictate rail-with-trail facility design. Therefore special care must be taken to ensure that the safety of trail users is protected when near a rail facility. Safety includes preventing physical contact and, depending on the speed of the train, the possibility of ballast or other material being ejected from the train onto the trail.

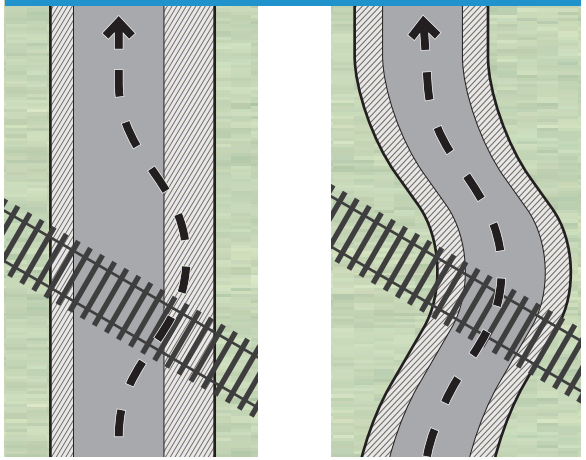
- **Paralleling an Active Rail Line**
  - The maximum setback possible should be made between the Bay Trail and an active railroad track.
  - A 6-foot-high fence or physical barrier should separate the trail from active railroad tracks. Fence meshing or rails should be sized and spaced to prevent climbing. Depending on the surrounding land use circumstances, there may be additional safety requirements placed on the managing agency (see also Security, Vandalism, and Privacy in Section 5.11).
  - A combination of vegetation, ditches, berms and elevation changes combined with fencing could be used to enhance the separation.
- **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 could be considered where bridges or undercrossings are not feasible, or where trail use levels are low. The crossing 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 transitioning over the tracks.
  - Include flangeway filling strips to accommodate U.S. Access Board guidelines for pedestrians.
  - Include active crossing warning systems (crossing guards and signals) as required.
  - For trail segments crossing railroad tracks and where a skewed angle is unavoidable, the shoulder width of the trail could be widened to permit bicyclists to cross at right angles.

Flangeway Filling



Bike/Ped Crossing Gate

FIGURE 5-15: WIDENED SHOULDER OR PERPENDICULAR CROSSING (PREFERRED)



a physical barrier separating the trail from railroad tracks

Source: Bicycle Infrastructure Knowledge Activism and Safety, Joe Linton

5.6 OVER OR UNDER

The edges of the San Francisco Bay include many circumstances where the Bay Trail must go over or under obstacles, such as freeways, streets, railroads, rivers, and the Bay's waters to achieve continuity.

Ramps

- Going either up or down involves ramping. Accessibility guidelines for ramps related to grades, rails, and resting places apply to the Bay Trail.

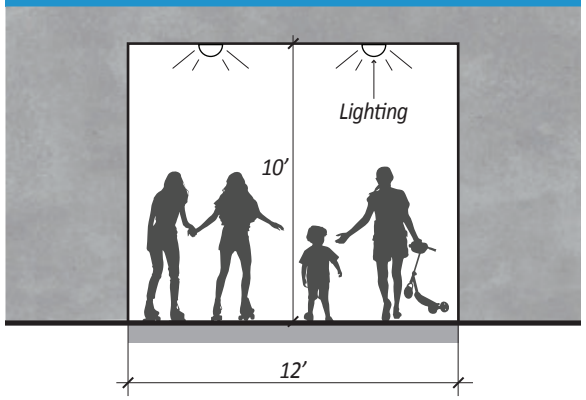
Bridges, Viaducts, and Boardwalks

- The clear, unobstructed width of the Bay Trail between railings should be at least 12 feet.
- Structures could be designed to carry service and emergency vehicles.
- The clearing height from overhead obstructions, including fencing, should be 10 feet.
- The design style of these Bay Trail features should be one that is compatible with surrounding land uses, habitats, and adjacent developments.

Tunnels

- The clear, unobstructed width of the Bay Trail between tunnel walls should be at least 12 feet.
- The ceiling height should be at least 10 feet.
- 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.

FIGURE 5-16: TUNNEL CLEARANCE



San Mateo Creek Bridge

5.7 SEA LEVEL RISE

While the Bay Trail is ideally located at the edge of the Bay to enjoy views of the water, that proximity often creates a vulnerability to rising sea levels. When at the edge of the Bay, a new segment of the Bay Trail may also afford the opportunity of protecting inland areas from the effects of sea level rise.

- **Elevation:** The elevation of the Bay Trail should accommodate projected future sea level rise and should be coordinated with the San Francisco Bay Conservation and Development Commission and other regulatory agencies.
  - The base trail elevation should ideally be set above the projected high water line.
  - For bridge and boardwalk segments of the Bay Trail, the lower support surface should be set above the projected high water line.
  - Where space is limited, the Bay Trail may need to be cantilevered or elevated above the shoreline. In some instances, additional clear vertical space should be allotted so that boats may navigate underneath.
  - Selected segments of the Bay Trail may be designed as a "floating trail" changing elevations with the tides.
- **Materials:** Sections of the Bay Trail, including bridges and boardwalks, that may be subject to direct tidal effects should be composed of materials that can withstand occasional flooding, endure salt water's corrosive effects, and resist erosion that may undercut the trail. Boardwalks should be constructed either with a concrete surface or planks that are oriented horizontally to the direction of bicycle travel and placed closely together to essentially have no gaps. Where the Bay Trail is located on top of a levee:
  - Riprap revetments should be constructed of properly sized and placed materials that meet sound engineering criteria for durability, density and porosity. The material should be generally spheroid-shaped and placed outside the trail shoulder width of 3 feet.
  - Concrete rubble, asphalt concrete, concrete pieces with exposed rebar and large or odd-shaped pieces of concrete should not be used.
  - Riprap material should be placed so that a permanent shoreline is established by means of an engineered slope not steeper than a ratio of two (horizontal) to one (vertical).
  - Riprap erosion control structures should include the placement of a filter layer protected by riprap material of sufficient size to withstand wind and wave conditions at the site.
  - Where marsh establishment has a reasonable chance of success, the design of the trail's protective structure should include provisions for non-structural methods, such as establishing marsh and transitional upland vegetation as part of the protective structure.

FIGURE 5-17: GRADE-LEVEL TRAIL SEGMENT

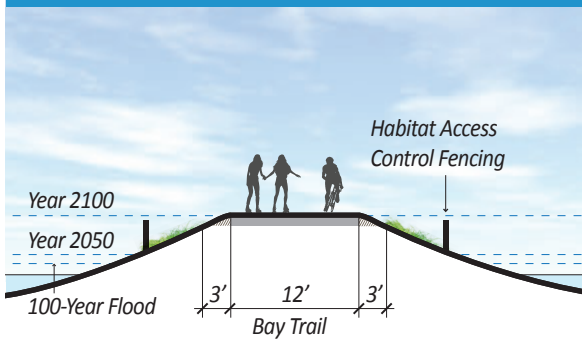
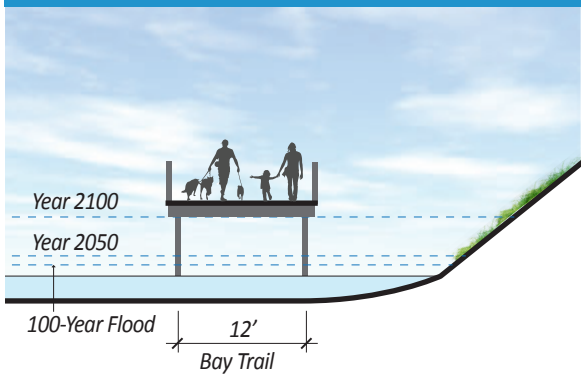


FIGURE 5-18: BOARDWALK TRAIL SEGMENT



San Rafael Shoreline Park
Source: Flickr (SF Bay Trail Project)

5.8 WILDLIFE COMPATIBILITY

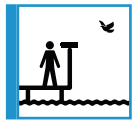
By its very definition and location adjacent to the San Francisco Bay, the Bay Trail physically and visually shares the margins of the Bay with hundreds of aquatic, terrestrial, and avian species. Some of these species are endangered, and without stewardship, face decline. Depending on the site circumstances, there are a number of tools that the managing agency can use to minimize public access and wildlife compatibility conflicts.

Alignment: The Bay Trail should be configured to provide trail users with a fulfilling, varied, and interesting access experience while encouraging users to stay in designated areas and limiting the creation of informal routes. The Bay Trail alignment should minimize compatibility conflicts with sensitive habitat areas.

Parking and Staging: Because use levels along the Bay Trail typically decrease the further away from a trailhead, Bay Trail parking and staging areas should be sited away from the most sensitive habitats.

Education: Interpretive signs should be located at staging areas, and at transition points where the Bay Trail nears or is adjacent to sensitive habitat areas to:

- Increase knowledge of users (regarding wildlife and the implications of users' actions).
- Foster public support for conservation and restoration programs.
- Educate the visitor about the natural resources of the area.



Observation Points: At strategic locations, observation points off of the Bay Trail could be provided to direct use, allow desired visual access, and limit direct proximity to wildlife. Observation points would help provide predictability of human use, increasing the ability of wildlife to adapt to human activity. The observation points should accommodate both the individual trail user and small groups. They may include interpretive panels to educate the user and provide telescopes that will allow views and further discourage access into the habitat area.

Materials Used for Perching: Not providing raptors perching opportunities near Bay wetlands is important to protect many species. To avoid perching within or near protected species habitat, the Bay Trail should:

- Avoid use of tall signs as much as practical.
- Assure the diameter of the top rail of bridge and boardwalk railings are scaled to be a "no perch" feature for raptors.

Lighting: Locate night lighting away from sensitive habitat areas if it is shown to be incompatible with adjacent wildlife.

Physical and Visual Separation: One or a combination of the following features should be used to separate the Bay Trail from habitat areas.

Habitat Access Control Fencing: 4-foot-high wildlife-friendly fencing that includes a gap of 4 to 6 inches at the base to allow wildlife movement underneath. Signs should be posted at regular intervals along the fence stating "no access; protected wildlife area". The fencing should be set back from the trail and located at a lower elevation to allow users to experience unobstructed distant views to the Bay.

Open Space Buffers: An upland buffer between the Bay Trail and wetland areas. The width should vary and could include screening vegetation and habitat access control fencing.

Moats and Wetlands: A series of seasonal wetland areas and extended drainage channels parallel to the Bay Trail. These can provide additional physical barriers to discourage users from leaving the trail and entering sensitive habitat areas.

Vegetation: In limited locations and only when necessary, screening vegetation strategically placed to physically separate the Bay Trail from selected high value Bay habitats while still allowing views to the surrounding mountains and ridgelines. Vegetation can:

- Provide a physical barrier to keep Bay Trail users out of sensitive areas.
- Provide a "natural" barrier that also enhances native plant communities.
- Help control erosion.
- Provide additional wildlife habitat/wildlife cover.

1. Observation point, Alviso | Source: SF Bay Trail Project
2. Vegetation buffer, San Rafael | Source: SF Bay Trail Project
3. Education, Hamilton Wetland Restoration Project
4. Open water buffer, Don Edwards San Francisco Bay National Wildlife Refuge
5. Wetland moat and stabilized gravel trail surface, Hayward Regional Shoreline
6. Fencing and stabilized decomposed granite trail surface, Hamilton Wetland Restoration Project | Source: SF Bay Trail Project
7. Staging areas, Don Edwards San Francisco Bay National Wildlife Refuge

5.9 SUSTAINABILITY

The Bay Trail should maximize sustainability in terms of design and materials selection. For many managing agencies, the typical project life of an asphalt trail is 25 years. There are a number of design considerations that can reduce ongoing maintenance costs and extend the life of the trail.

- **Trail Structure**
  - Over time, a concrete trail will need less maintenance than asphalt; and an asphalt trail less maintenance than a gravel or natural surface one.
  - Base the trail cross-section on geotechnical recommendations emphasizing durability whether for pedestrian/bicycle loads or accommodating use by service and emergency vehicles.
  - 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.
- **Drainage**
  - Assure there is no overspray from adjacent irrigation systems onto the trail.
  - Assure there is positive drainage away from the trail and that there are no standing puddles created from stormwater, storm surges, or irrigation.
  - Direct all trail drainage through water quality systems or use permeable paving systems where allowable.
- **Edging**
  - Consider specifying flush concrete header curbs (unless the trail is concrete) along the trail edge to reduce maintenance and retain integrity over time.
  - For trail shoulders, use natural surface stabilizers.

FIGURE 5-19: TRAIL STRUCTURE

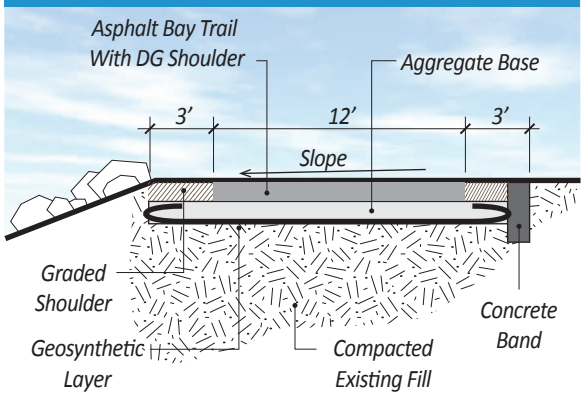


FIGURE 5-20: DRAINAGE

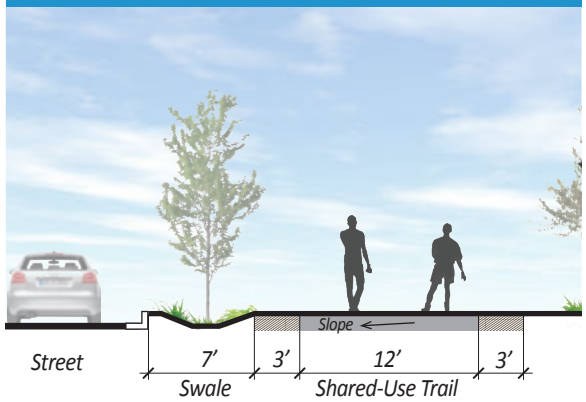
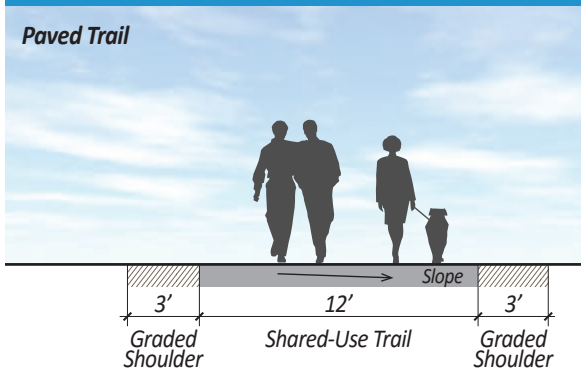
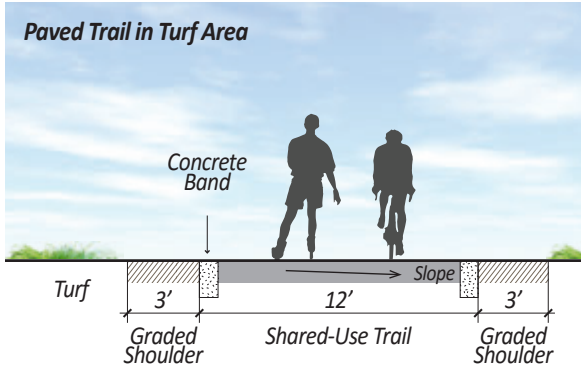
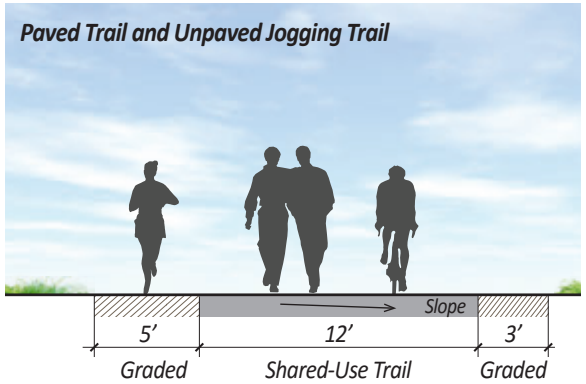


FIGURE 5-21: EDGING OPTIONS



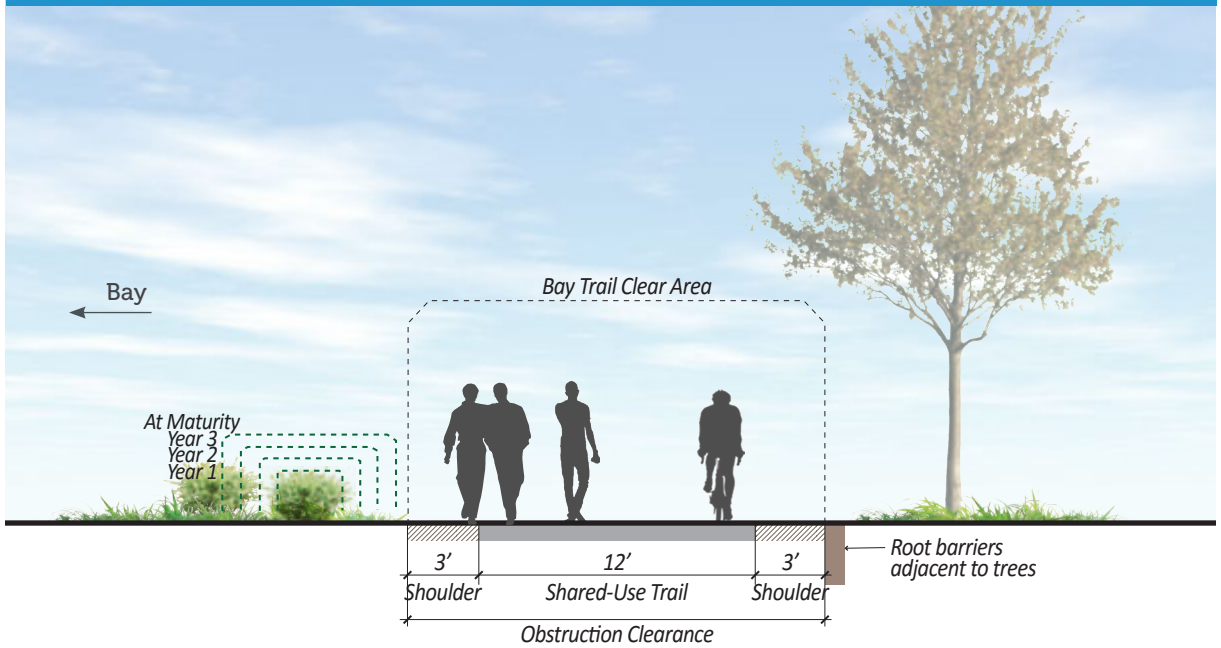




- **Trail-Related Furnishings and Materials**
  - Specify site furnishings that are:
    - Durable to minimize maintenance requirements.
    - Composed of recycled, recyclable, reused materials, and/or certified "sustainably" produced lumber where appropriate.
  - Specify energy-efficient lighting suitable for a Bayside environment.
- **Landscaping**
  - Specify "Bay-Friendly Landscape" materials, particularly mulch to nurture the soil, conserve water, and enhance wildlife habitat while also protecting the water quality of the Bay.
  - Design trailside landscaping to preserve and dramatize Bay views.
  - Use native plants local to the area that provide habitat for wildlife whenever possible.
  - Select and locate trees and shrubs to reflect their growth rates and sizes as they relate to maintaining the obstacle clearances of the Bay Trail to minimize need for landscape maintenance.
  - When trees are planted near the trail, include root barriers along the edge of the trail shoulder for a distance of 20 feet centered on the tree.

Tiburon | Source: SF Bay Trail Project

FIGURE 5-22: LANDSCAPING CONSIDERING PLANTS' GROWTH RATES



Oakland | Source: SF Bay Trail Project

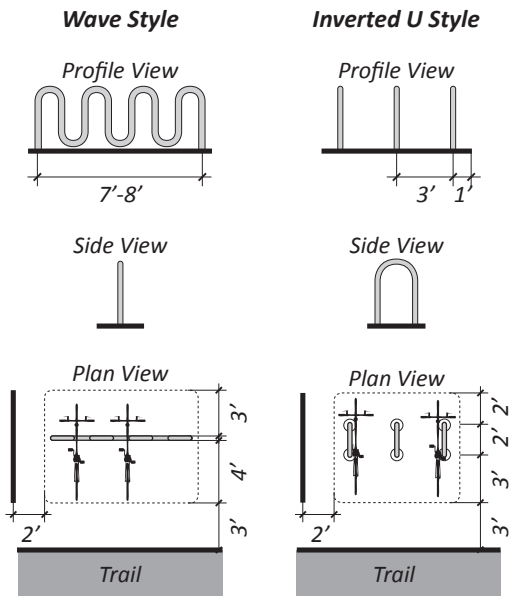
5.10 TRAIL AMENITIES

Specifying trail amenities should involve consistency with the site's characteristics, the managing agency's overall design guidelines, and be appropriate for anticipated levels of use.

- **Trailside Seating**
  - Assure trail seating is accessible and outside the clear space of the Bay Trail.
  - Orient seating toward Bay views or vistas of opposite shores or landmarks, such as bridges or towers.
  - Provide elevated overlook places to sit away from the trail for viewing the Bay where possible.
  - Provide various seating choices. In addition to fixed benches with and without backs, some seating could be in the form of chairs, picnic tables, retaining walls, planter seats, grass berms, or steps.
  - Consider wind-protected seating where the Bay shoreline setting is often cool and breezy.
  - Locate seating at regular intervals along the trail based on the surrounding environment, land uses, and level of use.
  - Provide shade, or place seating where shade is available.
  - Provide for picnic tables for families or small groups where possible.

1. Seating oriented toward Bay views, San Leandro Marina | Source: SF Bay Trail Project
2. Seating in the form of retaining walls
3. Seating and public art, Oakland
4. Benches with shade located outside of the clear space of the trail,, Richmond
5. Concrete block seating with Bay views, Jack London Square | Source: SF Bay Trail Project
6. Stair case seating, Jack London Square | Source: SF Bay Trail Project
7. Elevated outlook with benches and binoculars, San Mateo

FIGURE 5-23: BIKE PARKING DESIGN



- **Bicycle Racks**
  - Anticipate the need for bicycle racks or other storage devices particularly where the Bay Trail is associated with parks, other transit facilities or visitor-serving destination points.
  - Assure bicycles attached to bicycle racks are located outside the clear space of the Bay Trail.
- **Drinking Fountains**
  - Provide a source of drinking water at a minimum of 2-mile intervals along the trail where possible. This could be through stand-alone drinking fountains or at convenience stores associated with a marina or other commercial development.
- **Restrooms**
  - Provide restrooms at a minimum of 2-mile intervals 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.
- **Lighting**
  - Provide lighting along the Bay Trail based on the surrounding land use requirements, the trail's potential function as an alternative transportation corridor, and the need for security.
  - Avoid lighting that would conflict with wildlife habitat.
  - Assure that lighting fixtures are located outside the shoulder of the Bay Trail.
  - Use energy-efficient lighting that conforms to the managing agency's standards, including emergency fire egress requirements from nearby buildings as appropriate.
- **Other Trail Amenity Considerations**
  - Where space away from the shoulder of the trail is available on a bridge or trail structure over water, consider providing fishing pole holders on the railing and fish cleaning stations.
  - Additional trail-related amenities may include such items as:

1. Water fountain, San Francisco
2. Bicycle repair station, Emeryville
3. Pedestrian-scale lighting near benches, Oakland | Source: SF Bay Trail Project
4. Lighting on the Berkeley pedestrian/bicycle bridge, Berkeley
5. Energy-efficient lighting
6. Restroom near the Bay Trail, Oakland | Source: SF Bay Trail Project

- Bicycle repair stations
- Trash and recycling containers
- Pet waste stations at trail entrances

5.11 SECURITY, VANDALISM, AND PRIVACY

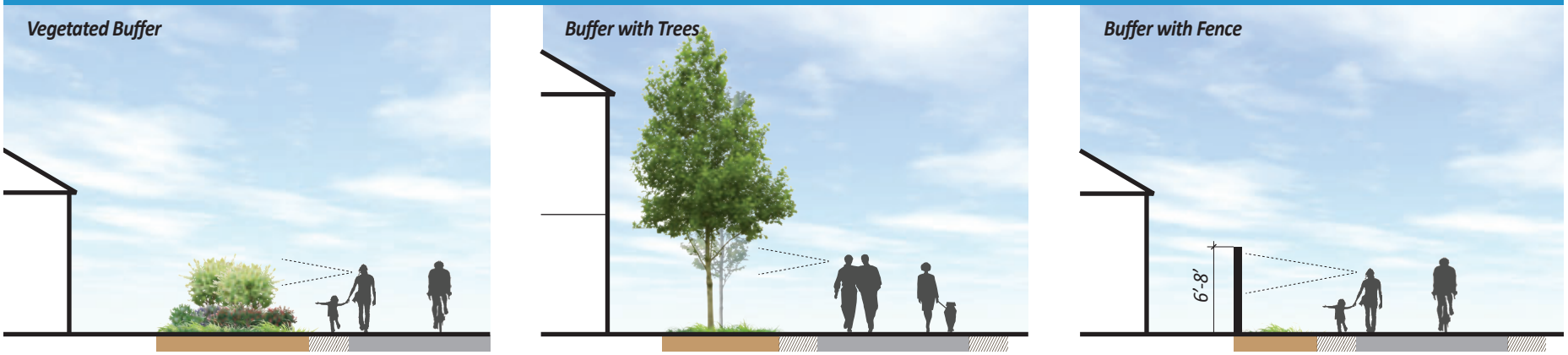
A sense of personal safety is important for the Bay Trail user. This generally means being on a trail that is well used, has open visibility, avoids concealed or isolated areas, and may include lighting and/or security cameras. Achieving this goal needs to be balanced with providing security for selected adjacent land uses.

The Bay Trail may pass through or adjacent to any number of land uses that are considered national security risks and are governed by standards and guidelines of the U.S. Department of Homeland Security. The design should create a positive user experience that does not include undue visual barriers for the trail users while maintaining security and privacy for the adjacent land use. Typical trail provisions involve assuring that all trail users stay on the trail and that the adjacent lands are secure from physical entry, visual intrusions, and protected from objects that may be tossed from the trail. Typical design tools may include providing any or all of the following:

- **Setbacks:** Sufficient horizontal distance between the trail and the secure area so that an object could not enter the secure area.
- **Fencing:** High-security fencing, where required, that is visually pleasing.
- **Visual Barriers:** Screening with fencing systems, walls, or vegetation.
- **Lighting:** Full trail and adjacent area lighting.
- **Camera Surveillance:** 24-hour and full coverage video systems tied either to police departments or the adjacent property owners' security systems.
- **Anti-Graffiti:** Using materials, including plants, to discourage graffiti.

1. Vegetated buffer for privacy, Richmond | Source: Flickr (Joel Williams)
2. Decorative fence, Oakland
3. Wooden fencing
4. Security fencing

FIGURE 5-24: BUFFER DESIGN OPTIONS



Appendix

ADDITIONAL STANDARDS AND GUIDELINES APPLICABLE TO THE BAY TRAIL

Though not exhaustive, the following references when used in combination with standards and guidelines of local jurisdictions and managing agencies, provide the trail designer with more information about many of the topics covered in the Bay Trail Toolkit.

FEDERAL

U.S. Access Board. *ADA Accessibility Guidelines (ADAAG); ADA Standards for Transportation Facilities; Architectural Barriers Act Accessibility Guidelines; 2010 ADA Standards for Accessible Design.*

This publication provides standards and guidelines for making routes of travel accessible under federal law. Particularly important to the Bay Trail are requirements for ramps associated with bridges and undercrossings. All standards should be met by the Bay Trail system.

U.S. Access Board. *Architectural Barriers Act Accessibility Guidelines; Outdoor Developed Areas.* 2013.

The Guidelines identify technical requirements for camping facilities, picnic facilities, viewing areas, trails, and beach access routes. For the Bay Trail, these guidelines involve sites around the Bay owned, managed, or funded by the federal government or other agencies that have adopted the guidelines.

STATE

State of California Department of Transportation. *California Highway Design Manual, Chapter 1000 —* Bikeways. Current Edition.

This chapter of the Highway Design Manual provides mandatory standards, advisory standards, permissive standards, and general design guidance and safety recommendations for shared-use bicycle paths, also referred to as Class I bike paths, as defined in subdivision (a) of Section 890.4 of the Streets and Highways Code. The standards and guidelines are typically referenced for the state's own bikeway projects, transportation projects of local agencies, and projects involving federal or state transportation funding.

State of California Department of Transportation. *California Manual on Uniform Traffic Control Devices.* Current Edition.

The manual provides uniform standards and specifications for all official traffic control devices, in accordance with Section 21400 of the California Vehicle Code. The state's guide to all signage and pavement markings is applicable to streets and highways, including bicycle paths and the Bay Trail.

State of California Department of Transportation. *Design Information Bulletin Number 89: Class IV Bikeway Guidance.* December, 2015.

The memorandum provides design criteria and guidance about best practices related to separated bikeways.

San Francisco Bay Conservation and Development Commission. *Shoreline Plants – A Landscape Guide for the San Francisco Bay.* March, 2007.

This publication provides an overview applicable to the Bay Trail of objectives for how plant materials can improve habitat, improve the public's experience of the Bay, and stabilize the Bay's shorelines. It identifies plant communities native to the Bay and its margins, typical landscapes of today, appropriate plant lists for use, and identifies plants that should not be used.

San Francisco Bay Conservation and Development Commission. *Shoreline Signs – Public Access Signage Guidelines.* August, 2005.

This handbook provides detailed guidelines for signs used at public access areas that are part of development projects along the shoreline of the San Francisco Bay.

San Francisco Bay Conservation and Development Commission. *Shoreline Spaces Public Access Design Guidelines for the San Francisco Bay*. April, 2005.

This publication provides general planning principles, objectives, and examples of site-specific improvements related to public access along the shoreline of the San Francisco Bay that would include and/or affect a Bay Trail design.

OTHER

American Association of State Highway and Transportation Officials (AASHTO). *Guide for the Development of Bicycle Facilities.* Current Edition.

This publication is a comprehensive national guide providing detailed design information on how to accommodate bicycle travel and operations in most riding environments.

National Association of City Transportation Officials (NACTO): *Urban Bikeway Design Guide.* Current Edition.

This national publication provides guidance for on-street bicycle facilities, including separated bikeways that exclude pedestrians.