Feasibility Study for the San Diego portion of the California Coastal Trail
Technical Memorandum No. 3: Engineering

Purpose: *Technical Memorandum No. 3: Engineering* provides a summary of engineering-related information relevant to the design of facilities associated with the California Coastal Trail.

Facility Types

The California Coastal Trail (CCT) is unique in design and purpose. The goal of the CCT is to accommodate a diverse set of non-motorized users. Non-motorized methods of travel include pedestrian, bicycle, and equestrian, to name a few. These modes may not necessarily be mutually compatible, and so more than one facility type may be necessary. Using more than one facility in a location to accommodate multiple users is known as the "braided trail" concept. The CCT routes must consider the context of the community through which they travel. For instance, an equestrian-compatible trail may not be appropriate through a dense suburban area or for local design standards. The most popular non-motorized modes of travel on the CCT will be pedestrian and bicycle.

Several facility types exist for the CCT. Some of these facilities are already in use along the corridor, as mentioned in *Technical Memorandum No. 1: Planning*. Other facilities may need to be constructed throughout the CCT corridor, including off-site improvements (such as staging areas or environmental mitigation). These designs are required to comply with the jurisdiction through which the CCT system cross (see the "Design Standards" section below for more information).

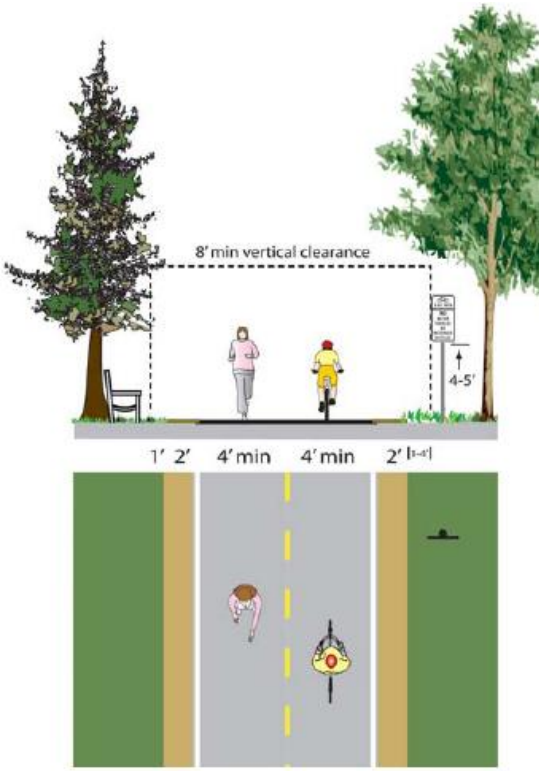
When it is expected that there will be heavy usage by different user groups (walkers, runners, bicyclists, etc.) a dual path is often preferable. "Wheel" users (bicyclist, roller bladers, etc.) use one path and "heel" users (walkers, runners) use a separate path. Variations of this theme are also possible. Runners and walkers can utilize the shoulder area while "wheel" users utilize the hard surface of the trail. Americans with Disabilities Act (ADA) issues may need to be evaluated if "heel" users are asked to utilize a different surface than "wheel" users.

Multi-Use Trail (Class I Bikeway)

For the CCT, a multi-use trail would be the most preferred facility since it has the ability to accommodate a wide range of users. AASHTO recommended minimum widths for a multi-use trail is 8'. However, 10'-14' wide is more common, with a shoulder of 2'-3' feet. The California Department of Transportation (Caltrans) standard for a Class I Bikeway (Bike Path) contains more detailed design requirements (see **Figure 1**). The ultimate width of a multi-use trail is dependent on two factors:

- The number and type of users; and
- The available site conditions.

Figure 1: Typical Class I Bikeway (Bike Path)
(Source: *Draft Bicycle Plan*, City of Los Angeles)



Heavy usage will demand a wider trail. However, volume is not the sole factor in determining trail width. The type of user also must be evaluated. A mix of runners, walkers, bicyclists, roller bladers, etc. would necessitate a wider trail width to accommodate the various speeds and the ability to pass.

Existing conditions are often the primary factor in determining trail width. With an 8' wide trail and 2' shoulders, a 12' minimum width would be required for the trail. Often site conditions such as steep slopes, property issues, or environmental sensitive areas preclude the availability for a certain width trail or makes widening the trail unfeasible due to additional costs.

Other variations to providing a wider path include a dual path, but with one-way traffic on each path. Or for short loop areas, one-way traffic with slower users staying to the right can be a good way to accommodate multiple user types.

Bike Lane (Class II Bikeway)

Bike lanes are dedicated lanes along roadways for the exclusive use of bicycles. These lanes are supported by special pavement markings and signing to separate them from vehicular traffic. These facilities are intended for bicycle users who are familiar with traffic laws. Consideration will need to be given to evaluate the transportation-related needs of the CCT, and the benefits realized by providing better services to entice additional bicycle commuters.

One special consideration for bike lanes is on-street parking and the danger it can pose to a bicyclist. Bike lanes are always one-way, and are typically situated on each side of a two-way street. Bike lane widths vary from 4' to 8', depending on the use and construction of the roadway. A minimum of 5' should be provided when bike lanes are adjacent to on-street parking.

Shared Roadway (Signed) (Class III Bikeway)

Shared roadways (signed) are similar to the above category, except that the roadway is signed as a Bike Route and is intended to be preferred as a bikeway because of conditions such as wide lanes, low volume, and low speed vehicular traffic. Modifications to existing roadways to make them more bicycle friendly include: widening the outside lane, paved shoulders, or re-striping to increase the width of the outside lane.

Preferred candidates for a shared roadway are low volume and low speed roads. Lane width should be a minimum of 12', but preferably 14' to 16'. Other considerations for shared roadways include the type of grates used, the presence of rumble strips, and the maintenance of the edge of the roadway for loose gravel or litter.

Since a shared roadway may necessitate that bicycle users are taken further away from the ocean, a parallel trail for pedestrians that is closer to the coastline should be investigated in certain locations.

Shared Roadway (No Bikeway Designation)

For the CCT, unsigned shared roadways would not be a desirable facility for bicycle use. These facilities preclude all user types such as pedestrians and are typically reserved for situations where other facility types are impractical due to various constraints. Typically, all road classifications allow bicyclists except for interstates. However, the lack of bikeway designation may make this type of facility ineligible for certain funding programs (refer to *Technical Memorandum No. 5: Funding* for more information on funding sources).

User Factors

The following user factors should be taken into consideration when recommending alternatives for the CCT:

- Age of potential users should be carefully evaluated. Young and elderly users will have needs and concerns that more experienced users will not.
- Ability of users will need to be evaluated. American with Disabilities Act (ADA) requirements will need to be analyzed.
- Safety issues such as design speed, trail slopes, line of sight, and emergency access will need to be evaluated based on the context of the trail location.
- Potential Use of the trail may include separation of non-motorized modes (for example, a pedestrian-only path in congested areas or natural-surface facilities); this may also mean providing emergency vehicle access or maintenance vehicle access in certain locations.

Steps in the Study Process

Inventory Existing Conditions

An inventory of existing conditions should take place, including, but not limited to:

- Slopes;
- Topography;
- Soil types;
- Utilities;
- Easements;
- Property boundaries;
- Existing trails (width, condition, location, users, etc.);
- Existing plans;
- Environmental (wetlands, sensitive habitat, etc);
- Vegetation; and
- Viewsheds.

Conduct Analysis

Once an inventory of existing conditions is gathered, an analysis of the inventory should take place to prioritize key conditions and locations for improvements.

Identify Obstacles (Key Pinch Points)

When planning trail corridors, certain pinch points often become key obstacles to the successful implementation of the trail. Common obstacles often include crossings (roadway, railroads, water bodies, etc), environmental constraints, and property impacts.

Determine Access Points

Where users access the trail is an important consideration and there must be a balance between connecting the main trail to access points versus utilizing trail spurs that will connect the trail to trailheads, residential areas, businesses, and destinations.

Potential Design Materials

Pavement Components

The main component of the trail cost will be the trail surface, sub-base, and sub-grade. Even at a feasibility study level, enough information shall be gathered on proposed trail surfaces in order to accurately produce a feasibility level cost estimate. Trail surface materials and preparation can vary dramatically, and thus dramatically affect costs.
The most common type of trail surfaces includes: concrete, asphalt, and aggregate surfaces. The criteria for choosing type of surfaces includes: the type of user, location, and cost.

Structural Elements

Possible structures required for the trail may include walls, bridges, and tunnels. Tunnels and bridges fall into the following three categories:

- Minor structures would be considered bridges less than 100' in length that, depending on the location, are fairly simple in placement, abutments, and geotechnical. Prefabricated bridge structures are typically used.
- Major bridges would be bridges 100' or greater, that even with a prefabricated structure, requires detailed engineering for abutments, geotechnical, and construction staging.
- Signature bridges would include bridges at highly visible location that would be an architecturally significant design.

Magnitude of tunnels would depend on the location and existing conditions, more so than the length.

Railings / Fencing

Railing types would vary on the location, but generally would be required to be 54" in height. Where fall protection is required, fence openings would be required to meet the 4" sphere test, unless more stringent local codes apply. Where railings are used to keep bicyclists from steep slopes beyond the shoulder, three rail fencing would be governed by AASHTO standards, unless more stringent local codes apply.

Signing

Signing falls into the following three categories:

- Regulatory signs must meet the *Manual of Uniform Traffic Control Devices (MUTCD)*
- Wayfinding and educational signs can vary for the project, and be customized to provide a consistent design aesthetic for the trail
- Route signs designate a particular segment of trail or path as being a specific route, such as the CCT; route signs have already been designed for installation on the CCT, using the official CCT emblem as shown in **Figure 2**

Figure 2: California Coastal Trail Route Symbol
(Source: <*http://www.californiacoastaltrail.info*>, Coastwalk)

Greenspace

The greenspace with the right-of-way or easement of the trail is an opportunity for a variety of uses including wildlife habitat, native vegetation, and stormwater management.

Design Standards

During the feasibility study, applicable project design standards for design speed, trail width, and trail longitudinal slope will be required. Applicable national, state, and local design standards include, but are not limited to the following:

Federal and National Design Standards

- *Accessible Rights-of-Way: A Design Guide,* United States Access Board
- *Guide for the Development of Bicycle Facilities*, AASHTO
- *Guide for the Planning, Design, and Operation of Pedestrian Facilities*, AASHTO
- *Guide Specifications for Design of Pedestrian Bridges*, AASHTO
- *Designing Sidewalks and Trails for Access*, Federal Highway Administration
- *Trails for the Twenty-First Century*, Flink, Olka, and Searns

State Design Standards

- *Highway Design Manual – Chapter 1000 Bikeway Planning and Design*, California Department of Transportation (Caltrans)
- *California Manual of Uniform Traffic Control Devices,* Caltrans
- *Pedestrian and Bicycle Facilities in California*, Caltrans

Local Design Standards

- *San Diego County Community Trails Master Plan*, County of San Diego
- *Planning and Designing for Pedestrians: Model Guidelines for the San Diego Region,* San Diego Association of Governments (SANDAG)
- *Regional Standards Book*, San Diego Area Regional Standards Committee
- *Engineering Standards*, City of Carlsbad
- *Engineering Design Manual*, City of Oceanside
- *Engineering Design Manual*, City of Encinitas
- *Standard Drawings 2006*, City of San Diego
- *Coronado Annotations*, City of Coronado
- *Design Standards*, City of Chula Vista