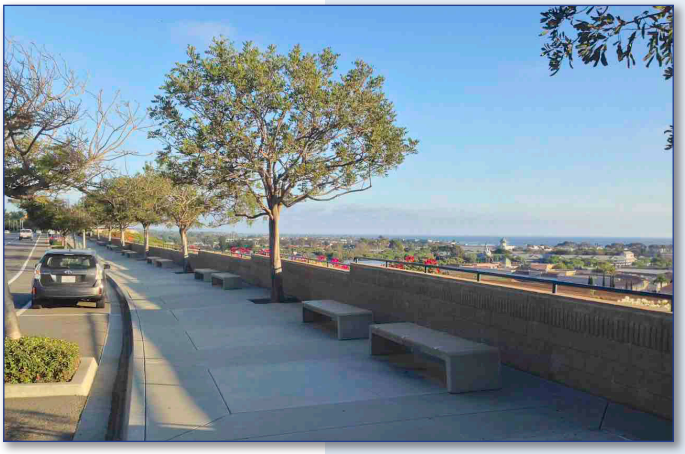
Chapter 6 - Trail Standards & Design Guidelines

This chapter summarizes the recommended trail classification system for the City of Carlsbad. Trail design guidelines found in this chapter are organized around the trail types, which describe what should be expected in terms of width, trail surface, steepness, firmness of the surface and types of trail amenities. Appendix A Trail Design Specifications & Standard Construction Details provides standard construction details for various trail types, and typical trail amenities.

The distribution of trails tend to follow the steeper areas of Carlsbad where development is more difficult, or near canyons, riparian zones or around the lagoons. Certain areas, such as the northeast corner of the Lake Calavera Preserve or the southwest corner of the Rancho La Costa Preserve, have a high concentration of Type 1 and Type 2 trails with a complex crisscross pattern of trails, indicating a heavy use by mountain bike riders.

Type 1 trails tend to be in areas of steeper terrain and, in many instances, were not constructed or improved in relation to private developments or constructed to any standard. Many of these trails were simply created as foot paths, old agricultural roads, or mountain biking trails, with minor trail construction efforts or surface improvements. These nature trails tend to have varied grades, high variability in widths, and often have tighter curves.



Carlsbad trails range from very natural and challenging such as this Type 1: Nature Trail shown above, to very urban and improved as shown below with this Type 6 - Multi-use Path

Most of the trails developed in Carlsbad that are in open space fall into the Type 2 category of multi-use recreational trails. They have been constructed using highly compacted decomposed granite surfaces and are typically 8-foot wide. There are also a large number of roadside and connector trails (Type 4) and connector sidewalks (Type 5) composed of concrete, asphalt or compacted and stabilized decomposed granite. These trails were often built as part of adjacent developments to design standards that have been in place for many years and align with many of the design guidelines outlined in the 1992 OSCRMP.

6.1 Trail Types

Carlsbad's trail types were developed specifically to address local conditions. The development of the trail design criteria was intended to enhance public welfare, improve safety, minimize maintenance and avoid environmental impacts. The standards define maximum width, the range of surface types and overall grades for open space trails (Types 1, 2 and 3) and for transportation based trails (Types 4, 5 & 6). The widths are developed to accommodate a range of users, with wider trails required for areas

Type 1 - Nature Trail

Typically these are located in natural open space, are 4-feet wide and surfaced with local naturally occurring materials, usually a mix of soil and fine to coarsely broken rock (see Figure 6.1 “Type 1 Nature Trail Diagram and Sample Images”). In order to limit impacts of Type 1 trails, the widths and horizontal and vertical changes can be more abrupt. By providing flexibility in layout, sensitive or protected habitat can be avoided or impacted to the least degree possible and the relationship of the trail to nature can be better integrated. However, this flexibility also results in less access to those with limited physical endurance and would not likely be considered Americans with Disabilities Act (ADA) accessible due to vertical slope and trail surfaces.

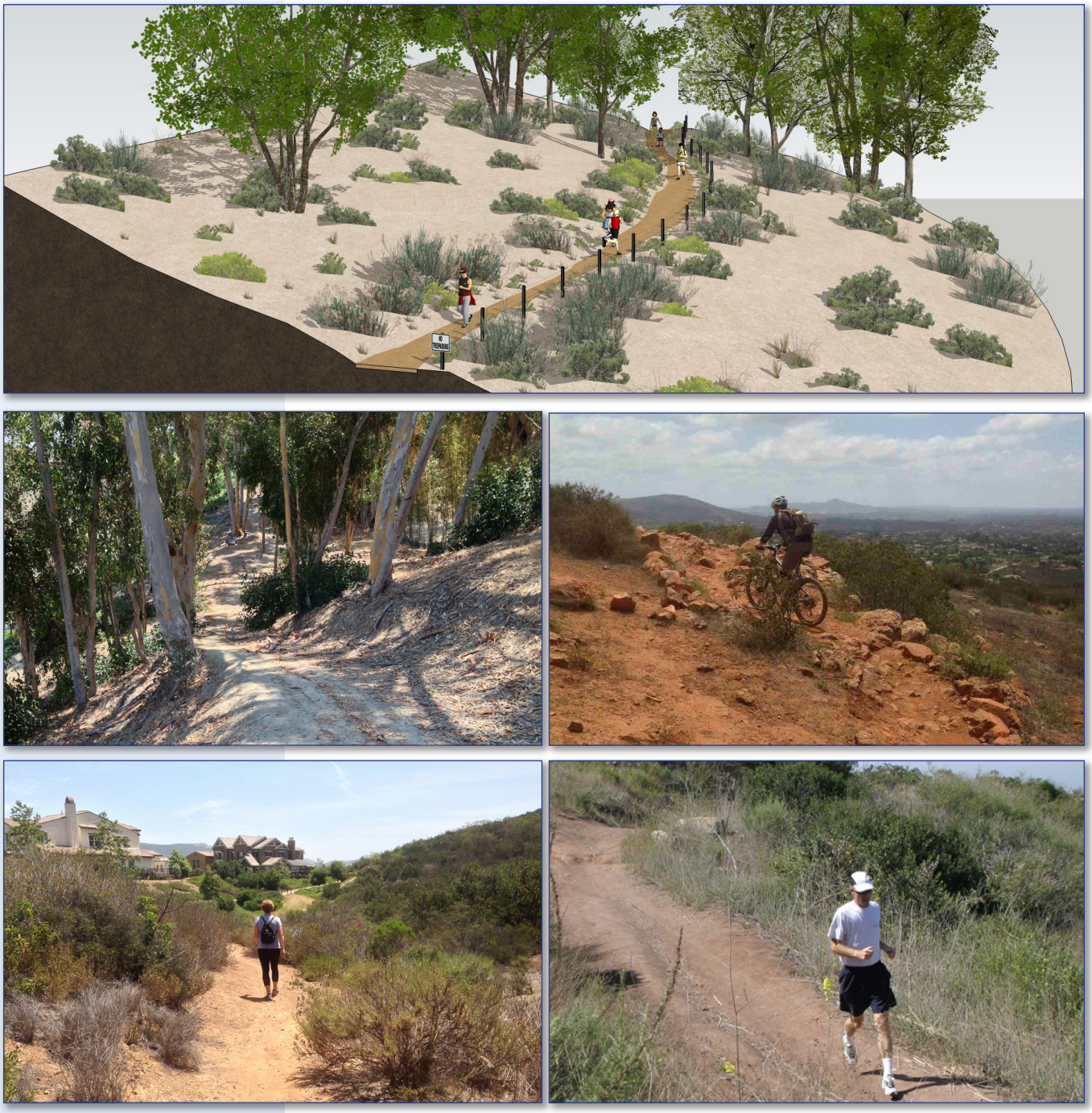


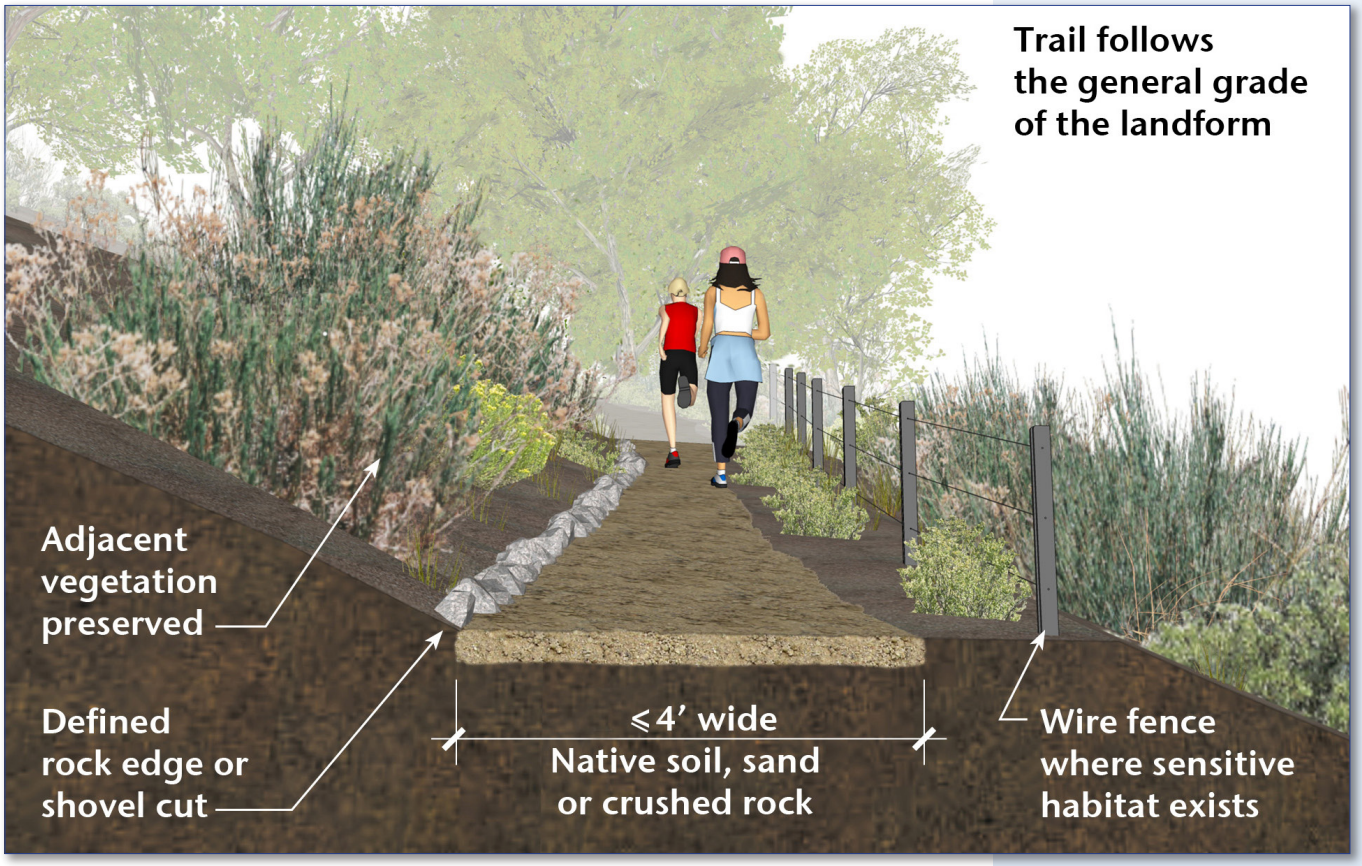
Figure 6.1 Type 1 - Nature Trail Diagram and Sample Images

Public education and interpretive panels are highly recommended to promote the natural environment. The objective of the trail is to have the least impact on the adjacent sensitive or natural resources of the area. As such, grading would not require making trails level and in many cases, the trail would not meet ADA requirements since implementation of these grade restrictions would result in damage to natural resources and a change in character of these natural areas.

These trails should be kept to a minimum of width and without railings or fences (unless next to sensitive habitats) in order to maximize the trail user experience and limit the amount of disturbance in natural areas. Fencing, where necessary to protect habitat areas, should be consistent with applicable preserve management plans, visually unobtrusive and should allow for wildlife movement.

The trail surfaces is typically soft surfaces. Abrupt changes in elevation, path obstructions and trip hazards should be expected by trail users. Regular road bikes or commute/hybrid bikes are not likely to be able to pass through these soft surface and highly changing trails.

The need to accommodate side by side walking is not a priority. Width for two hikers passing can be as little as two feet in a natural setting. Amenities are kept to a minimum, although trailhead kiosks, trash containers at trailhead, regulatory signs, interpretive panels and viewpoints should be provided. No lighting is desired. Off-street parking is generally not needed unless the trail connects to a variety of other trail types that may generate larger than normal trail user levels.



Type 2 - Multi-Use Recreation Trail

This trail type is similar to Type 1 trails, but is minimum 6-foot wide for existing trails, and 8-foot wide for all new construction. Trail easement width is 6 to 12 feet wide (see Figure 6.2 "Type 2 - Recreation Trail Diagram and Sample Images"). New development Type 2 trails should be constructed to the width, vertical slope and surface treatment standards to meet accessibility requirements, where possible. These multi-use trails accommodate a broader range of trail users.

A multi-use recreation trail is intended to be a firm surface trail that to the greatest extent possible, meets the requirements for ADA compliance and construct-

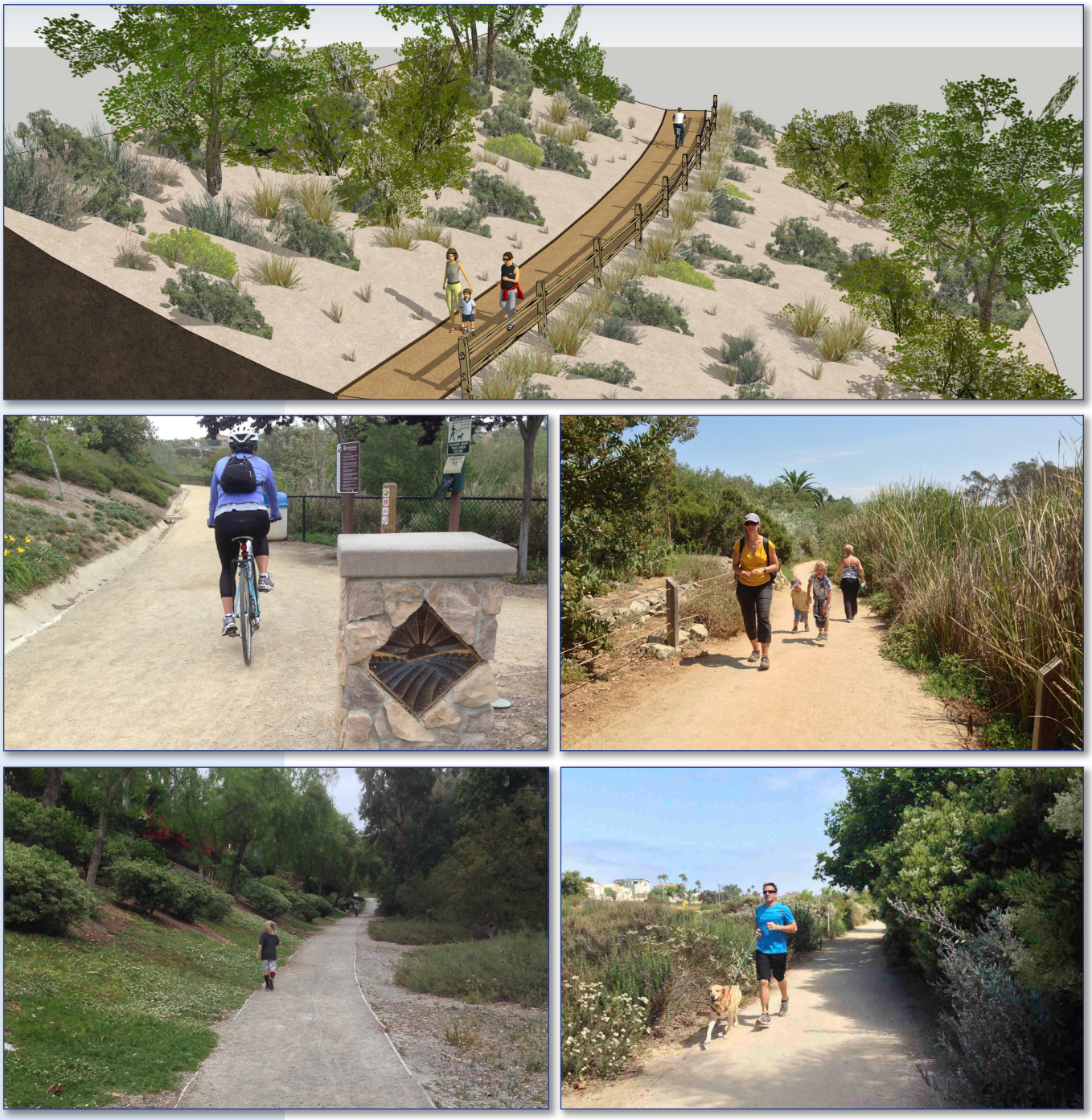
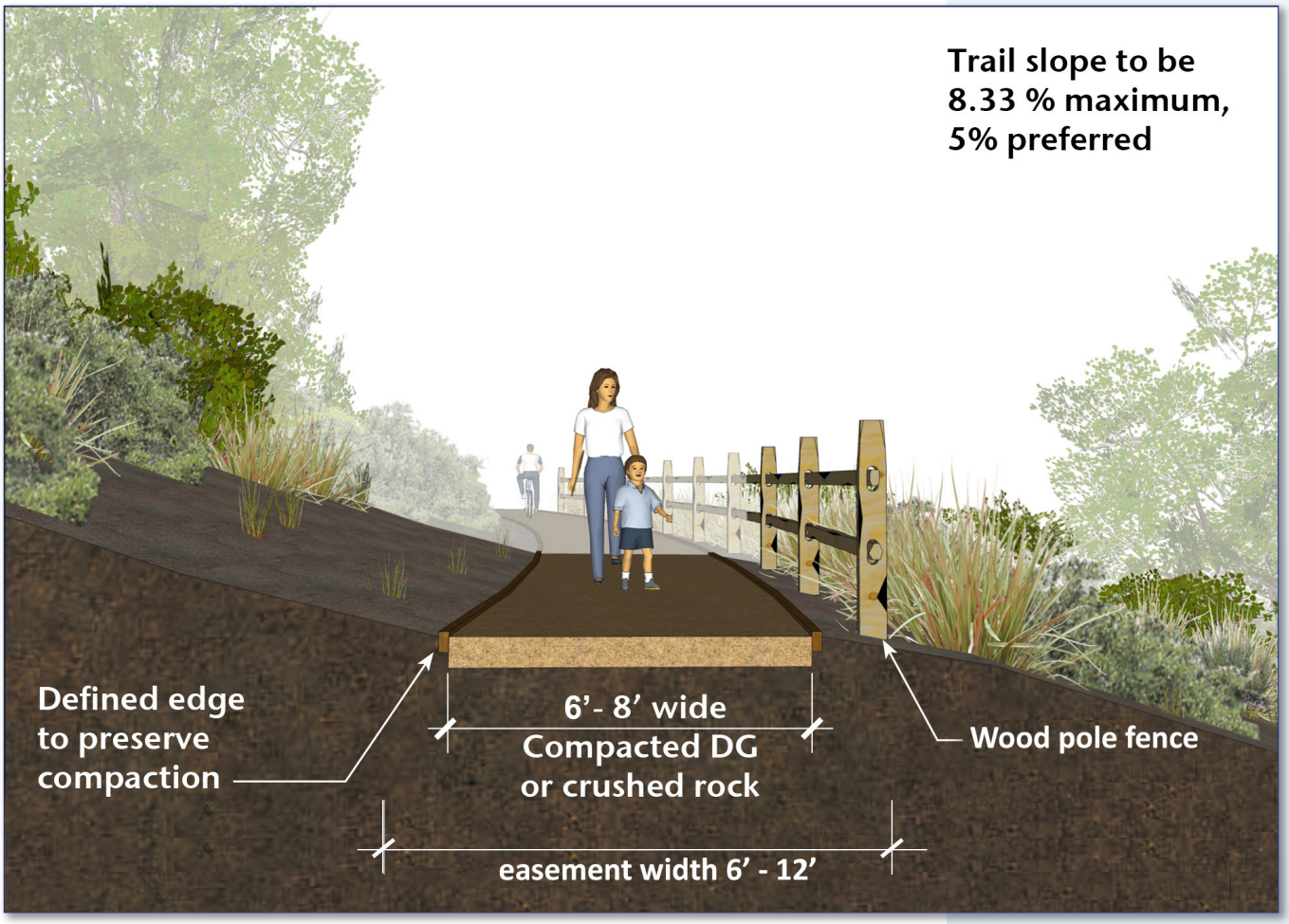


Figure 6.2 Type 2 - Recreation Trail Diagram and Sample Images

ed of a compacted chipped stone or decomposed granite so a wheelchair, wide-tired jogger or medium-tired bike can maneuver. Even though these activities can be accommodated on this type of surface, the trail will have a permeable yet firm surface. Defined edge such as split rail or peeler log with notched vertical posts may be incorporated. The trail needs to be wide enough to accommodate multiple users walking together, passing bikes, and to allow for two opposing directions to pass each other safely.



Type 3 - Wide Dirt Trails or Utility Roadbeds

These trails are generally unpaved roads, usually with a surface of imported or locally sourced crushed rock (see Figure 6.3 “Type 3 - Wide Dirt Trails or Utility Roadbed Diagram and Sample Images”). These utility easements or maintenance access roads are often used as trails. They vary in width from 8 feet to 14 feet. Sometimes these roads also serve as a firebreak when located in native canopy hillsides, valleys or canyons. They are often steep with wide radius turns. Typically, they do not meet ADA accessibility standard due to steepness or surface

Figure 6.3: Type 3 - Wide Dirt Trails or Utility Roadbed Diagram and Sample Images

treatments. They are not likely to include certain amenities, such as restrooms or formal parking area, since they are joint use access roads, subservient to the primary utility access function and requirements. The loose nature of gravel surface makes these trail types less desirable for strollers or medium to thin tired bikes.

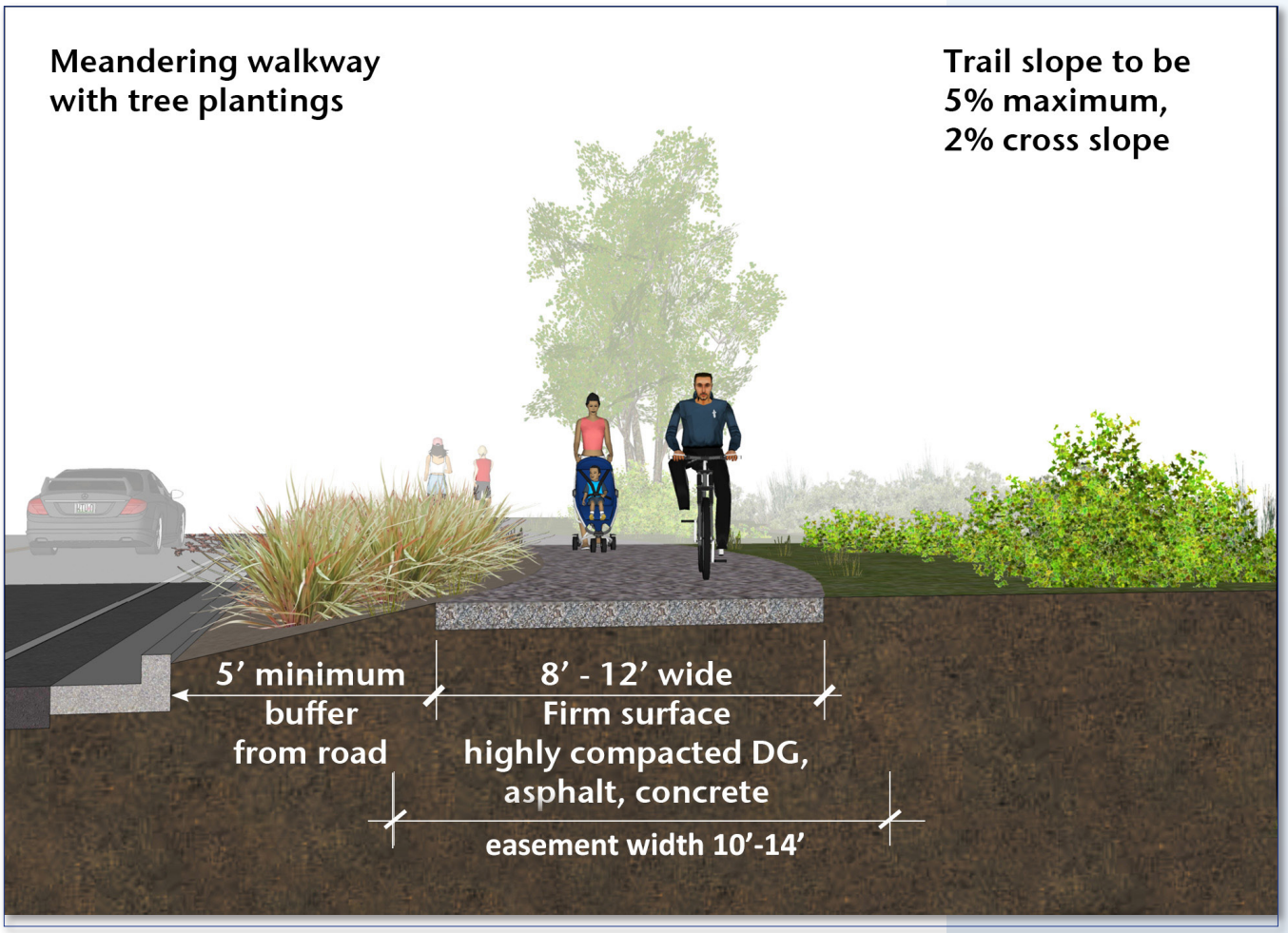
Type 4 - Roadside or Connector Trails

Type 4 Roadside or Connector Trail (see Figure 6.4 “Type 4 - Roadside or Connector Trail Sample Images”), provides a trail like experience, even if it is along a roadway. A Type 4 trail is typically stabilized decomposed granite with a width between 8-foot and 12-foot wide and separated from the vehicle traffic by at least a 5-foot buffer. Trail easement should be 10 to 14 feet wide.

Carlsbad has been the pioneer in the region for establishing great examples of roadside trails. Many municipalities have meandering walkways or equestrian

Figure 6.4: Type 4 - Roadside or Connector Trail Sample Images

trails along many of its roads. But not many have the look and appearance of a soft surface natural trail, while offering the performance of a firm surface. The intent of the Type 4 trail is to be located along a highly traveled road but in a manner that is buffered from the roadway. This requires both a visual separation, as well as physical barriers that make the trail user feel comfortable that they are protected from vehicular collisions. The use of trees in the buffer area is desirable. Trees provide shade for a physical comfort and a sense of separation from vehicular traffic.



Type 5 - Connector Sidewalks or Special Street Crossings

A roadway edge sidewalk that is paved with little or no buffer is considered to be a Type 5 Connector Sidewalk (see Figure 6.5 “Type 5 - Connector Sidewalks or Special Street Crossings Sample Images”). This category also includes mid-block crossings (signalized or non-signalized) and regular intersection crosswalks if they are used to access trails.

Based on the definition in this plan, a connector sidewalk needs to connect an existing open space trail (Type 1, 2, or 3) or another circulation based trail (Type

Figure 6.5: Type 5 - Connector Sidewalks or Special Street Crossings Sample Images

4 or 6). Most of the sidewalks that fall under this category already exist and are being included to show how the other trail types can be connected via the sidewalk system. Connector sidewalks do not count in the citywide trail mileage.

A Type 5 trail is intended to support nearby roadway connections, in order to walk or bike to other open space trails and trailheads. Type 5 sidewalk connection provides looping opportunities. This category also includes a number of in the road trail crossings that utilize either a signalized intersection, an intersection controlled by stop signs or a mid-block crossing.

Type 6 - Paved Multi-use Trails (Class I)

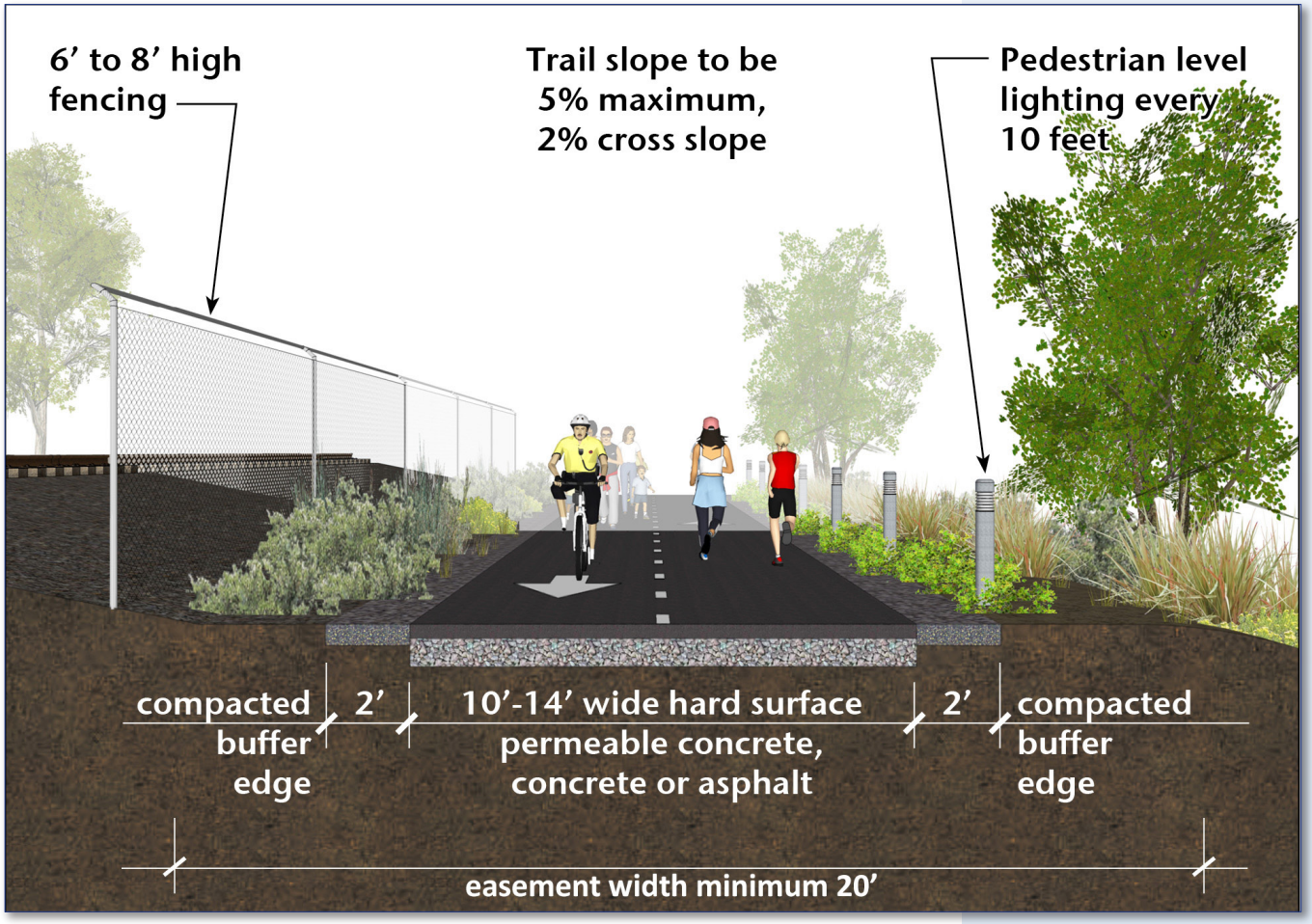
These trails are hard or firm surface (see Table 6.1 “Trail Surface Sample”; Figure 6.6 “Type 6 - Paved Multi-use Trail Diagram and Sample Images”). Type 6 trails are off the roadway and range from 10-foot to 14-foot wide; essentially broad trails with exclusive right-of-way for bicycles, pedestrians and other non-motorized users. This condition allows for fewer user conflicts. Trail easement should be 20 feet wide at minimum. The American Association of State Highway and Transportation Officials (AASHTO) Guide’s “shared-use path” is synonymous with a Type 6 trail. A Caltrans Class 1 Multi-use Path is also synonymous with a Type 6 trail.

This trail type follows Class 1 Caltrans bikeway standards. Bikes of many kinds will utilize this type of facility, as will skateboards, in-line skates and running strollers. Because of the potential speed differences between users, a centerline and directional arrows are used. It is also suggested to include a soft surface side trail for runners and hikers who would prefer a slightly softer surface. By its very nature, this trail type provides direct and protected connection between major destinations.

Figure 6.6: “Type 6 - Paved Multi-use Trail Diagram and Sample Images

City of Carlsbad Mobility Element of the General Plan and the Active Transportation Guidelines propose development of Type 6 trails, many of which will be implemented on Carlsbad Boulevard (Highway 101).

The proposed I-5 North Coast Bike Trail, that is included in the Public Work Plan (PWP) for the I-5 Widening Project is another example of the trail type that will provide opportunities and options for mobility around the city, and will allow for lower carbon emissions and release of greenhouse gases (GHG). This trail type is important for encouraging non-automobile travel, thus contributing toward meeting the city's GHG reduction goals.



6.2 Overall Design Objectives

The city's objective is to design, construct, and maintain trails that:

- Provide safe non-motorized transportation links and/or close-to-home recreational opportunities;
- Provide public access to nature such as at lagoons and preserves;
- Blend with the surrounding environment and minimize impacts on the natural environment;
- Require minimum levels of maintenance.

6.3 Design Considerations

Human Factors

Trails must be planned and constructed with the needs of the trail user in mind. Trail users favor routes that connect areas of significant community activity, such as schools, businesses, shopping areas and parks, as well as other areas of interest such as viewpoints, water, natural areas, scenic corridors, and interesting geologic features. Visual qualities are important to them as well; therefore, trails should be designed to blend with the surrounding environment and to provide vistas. Human behavior should be considered as well. For example, many trail users favor routes that loop back to the trailhead instead of an out and back experience. This relates to the desire of many trail users to experience new views and conditions that are afforded by looped trails. Therefore looped trails should be considered where possible.

Coinciding Easements

Trails are frequently located within easements dedicated for other purposes such as drainage, flood control, public utilities, natural open space, and scenic corridors. In situations where these easements are wider than needed for primary access for maintenance, it may be advantageous to dedicate the same area for the purposes of public trail use. Width of the trail easement should be wide enough to allow for flexibility to properly lay out, design, and construct public trails, and to allow the trail to be positioned away from undesirable areas such as low-flow wash channels, areas of extreme topography, dense vegetation, critical habitats and adjacent properties. This will also allow future realignment of the trail, should such a realignment become necessary.

Adjacent Landowner Privacy

The privacy of landowners adjacent to trails and trail access facilities is an important design consideration. Privacy can be maintained or improved by modifying the trail alignment, planting landscape buffers, creating grade separations, or using a combination of these methods.

Trail Viewshed

The line of sight from a trail to the surrounding landscape, and from the surrounding landscape to a trail, are important design factors. Views from the trail to the surrounding landscape improve the quality of the trail users' experience; therefore, trails should be designed to provide varying views of the surrounding area. Obscuring views of the trail from the surrounding property is important to adjacent landowners who may not want to view the trail from their property.

Mobility Element Trails

The design, construction and maintenance of trails within the City of Carlsbad will take into account the City of Carlsbad Landscape Manual Guidelines when Mobility Element trails are constructed within or near public street rights-of-way. Whenever possible, a two-foot maintenance zone adjacent to the trail shall not include utility or irrigation valve boxes, or electrical boxes. See the construction detail for Mobility Element Trails, Appendix A, Trail Types 4, 5 and 6.

Sensitive Habitat and Wildlife

Trail design and construction within sensitive habitat areas should be evaluated in terms of the effect that the trail will have on this habitat. Pertinent resource agencies such as the California Department of Fish and Wildlife, and the United States Fish and Wildlife Service should be consulted during the trail development process for all projects that have coastal wetlands trail segments to assure that the trail will not have a negative impact on such resources. Seasonal trail closures may be necessary in some situations and the Habitat Management Plan (HMP) shall also be taken into consideration for future trail alignments and construction.

Archaeological and Cultural Resources

Trail design and construction should be evaluated in terms of the effect the trail will have on archaeological or Native American tribal cultural resources. Trail design and construction must be done in accordance with the City's Cultural Resource Guidelines, General Plan policies, and the California Environmental Quality Act (CEQA) in regards to cultural resources. The Cultural Resource Guidelines and General Plan's Arts, History, Culture, and Education Element include procedures, goals and policies intended to protect and preserve historic, archaeological and cultural resources in the City. A Mitigated Negative Declaration (MND) was prepared and adopted for the Trails Master Plan in accordance with CEQA. Part of the MND process included consultation under Assembly Bill (AB) 52 with California Native American tribes regarding potential impacts to Tribal Cultural Resources that may be caused by the construction of trails per the Master Plan. The MND found that there are many archaeological and cultural resources within and along the existing and proposed trails in the Trails Master Plan. In addition, numerous archaeological resources are recorded in proximity to proposed trails. The findings indicate that the Carlsbad area has been in human occupation for thousands of years. The presence or proximity of sites resulted in each trail being rated by a potential constraint level (low, moderate, or high). Mitigation measures require a variety of actions depending on a trail's constraint level. The measures to mitigate potential damage to these resources are:

- Project-level Cultural Resources Record Search & Consultation
- Project-level Cultural Resources Site Survey
- Construction Monitoring
- Resource Recovery Procedures

In the event that the specific design of a trail may result in potential impacts to archaeological or cultural resources that were not previously addressed in the MND, then additional CEQA analysis would be required, as well as notification to those California Native American tribes that requested it about the opportunity to consult under AB 52 regarding potential impacts to Tribal Cultural Resources.

Design for Shared-Use

Trails within the City of Carlsbad are typically open to all non-motorized uses unless otherwise stated or restricted by resource protection and conditioned by resource agencies. Bicycle use on the Batiquitos Lagoon North Shore Trail is prohibited, however, and resource agencies may also require restricted uses on some trails in the city. Decisions to prohibit any non-motorized use from City of Carlsbad trails must be based on coordinated planning efforts involving appropriate user groups and city staff.

The following means of preventing potential user conflicts are based on methods identified in "Conflict of Multiple Use Trails" (Moore, 1994), and should be considered when planning, designing, constructing and maintaining shared-use trails:

- Separate user types at trailheads and along the first, most crowded, stretches of trail;
- provide adequate sight distances;
- build and maintain trails wide enough for safe passing, and/or provide periodic turnouts;
- design trails to control speeds where necessary by varying the trail surface and avoiding long, straight downhill stretches;
- provide adequate trailhead facilities for all user types; and
- provide signage indicating trail uses allowed for a particular trail.

Local Coastal Program

Implementation of any of the trail projects that are located within the city's coastal zone will require a coastal development permit and must be consistent with applicable Local Coastal Program policies. Trail development within or adjacent to sensitive habitat areas shall be evaluated for adverse impacts, and must be consistent with Local Coastal Program and HMP policies and standards protecting environmentally sensitive habitats.

Sea Level Rise Considerations

The city has developed a vulnerability assessment that presents a Carlsbad-specific sea level rise analysis to support an update to the city's Local Coastal Program and Zoning Ordinance. The assessment evaluates the degree to which important community assets, including trails and public access ways, are susceptible to, and unable to, accommodate adverse effects of projected sea level rise.

Adaptation planning involves a range of policy and programmatic measures that can be taken in advance of the potential impacts, or reactively, depending on the degree of preparedness, the willingness to tolerate risk, financial capacity and political willingness. Effective adaptation planning will improve community resilience to natural disasters and climate change.

The document identifies following potential strategies:

Do Nothing Strategy - Choosing to do nothing or non-intervention for non-critical trails.

Accommodate Strategies – Accommodate strategies refer to those strategies that employ methods that modify existing developments or design new developments to decrease hazard risks and thus increase the resiliency of development to the impacts of sea level rise.

- Employ methods that modify the existing trail or design new trails or infrastructure to decrease hazard risks and, therefore, increase the resiliency of the trail to the impacts of sea level rise (i.e. elevating structures, performing retrofits or using materials to increase the strength of the structures, etc.).

Retreat Strategies - Retreat strategies are those strategies that relocate or remove existing development out of hazard areas and limit the construction of new development in vulnerable areas.

- When a trail is threatened, relocate the trail landward in areas where adequate space exists, as the mean high tide line and public trust boundary moves inland with sea level rise.

Protection Strategies - Protection strategies refer to those strategies that employ some sort of engineered structure or other measure to defend development (or other resources) in its current location without changes to the development itself.

- Shoreline protection (i.e. seawall, revetment, sand nourishment, sand dunes, etc.) to maximize public access and recreational use by protecting beaches and other coastal areas suitable for such use.

Hybrid Strategies - combination of strategies where more than one strategy could be used for adaptation for a trail at the same time or more than one strategy could be identified to be used over time depending on triggers. An example would be to accommodate over the short-term and retreat/relocate over the long-term.

Trail development should work in conjunction with the Sea Level Rise Vulnerability Assessment to identify appropriate adaptation strategies for existing and future trail connections.

6.4 State and Federal Trail Standards

California Department of Transportation
California Manual of Uniform Traffic Control Devices (CA MUTCD)

Although the recreational trails (Type 1, 2 and 3) are outside of roadway rights of way, the mobility trails (Type 4, 5 and 6) are commonly in or next to public rights of way with vehicular traffic. In these cases, the California MUTCD is considered to be the guiding document published by the State of California, Department of Transportation (Caltrans). The intent of the document is to adopt uniform standards and specifications for official traffic control devices in California. Traffic control devices are defined as all signs, signals, markings and other devices used to regulate, warn or guide traffic, placed on, over or adjacent to a street, highway, pedestrian facility or bikeway by authority of a public agency or official having jurisdiction, or, in the case of a private road, by authority of the private owner or private official having jurisdiction. The CA MUTCD is not applicable to privately owned and maintained roads or commercial establishments in California, unless the particular city or county enacts an ordinance or resolution to this effect.

The CA MUTCD 2012 edition incorporates the Federal Highway Administration's

(FHWA) MUTCD (2009 Edition) and includes all policies on traffic control devices issued by Caltrans since 2010 and other editorial, errata and format changes that were necessary to update the previous documents. The CA MUTCD does not supersede Caltrans' Standard Plans, Standard Specifications or its Special Provisions publications, but all CA MUTCD standard statements must be met.

California Department of Transportation Highway Design Manual (HDM)
The Highway Design Manual is used by Caltrans staff and non-Caltrans project managers and planners for project designs within the Caltrans right-of-way and elsewhere. The design standards cover a wide array of focus areas including drainage, pavement and basic design policies. HDM Chapter 1000 specifically addresses bikeway planning and design and defines three bikeway types that coincide with Carlsbad's trail types as described in the following sections. Any trail designated to encroach into or travel within the Caltrans right-of-way must be designed per HDM Chapter 1000, as well as any on-street bicycle facility. However, because HDM Chapter 1000 is essentially the state standard for bicycle facilities, even facilities outside the Caltrans right-of-way should be built to HDM Chapter 1000 criteria to maintain eligibility for federal funding, which is administered in California by Caltrans. The entire document is available online at: www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm.

Additional references include:

- NPS Trails Management Handbook, U.S.D.I. National Park Service, 1983.
- Trail Construction / Maintenance Notebook, U.S.D.A. Forest Service, 1996.
- Trails for the 21st Century, Rails to Trails Conservancy, 1993
- 2013 Architectural Barriers Act (ABA) Accessibility Guidelines; Outdoor Developed Areas
- Habitat Management Plan, Section F.3.D Preserve Management, Adjacency Standards, Fencing, Signs and Lighting

6.5 Guidelines for Trail Layout and Location

Necessary steps to properly layout a trail are consistent for most trails. The following sections cover the steps needed for a successful trail layout and construction.

Reconnaissance

Application of sound principles of trail location, alignment and grade will minimize future operation and maintenance problems. The first step is to examine the most recent topographic maps and aerial photos of the area to identify significant landforms, drainage patterns and vegetation. The next step, for which there is no substitute, is to walk the area and examine potential routes. Conduct a systematic study of the area by walking various routes and viewing the area from different vantage points. Control points, which are features that are favorable for or inhibit trail construction, should be identified through this process. The control points will help to identify the best possible route, with the understanding that situations may exist where trails must pass through negative control points. Control points which are favorable for trail construction are:

- Road crossings such as underpasses, overpasses and intersections with traffic signals or stop signs;

- natural wash crossings;
- ridgelines;
- hillside benches;
- areas of light vegetation;
- scenic vistas;
- areas of well drained soils; and
- areas with good trailhead access.

Control points, which will inhibit trail construction and should be avoided are:

- Wet areas and poorly drained flat areas;
- sensitive wildlife habitats;
- wash bottoms;
- areas adjacent to sources of excessive noise, such as airports;
- areas adjacent to plants that are poisonous to horses, such as oleanders;
- steep rock slopes;
- unstable or fragile soils;
- abrupt elevation changes;
- bluffs, ledges and cliffs except where featured as scenic resources;
- frequent wash crossings;
- locations requiring bridges or culverts;
- areas of heavy or fragile vegetation;
- areas requiring switchbacks;
- areas of archaeological/cultural sensitivity;
- unsafe or uncontrolled road crossings; and
- known habitats of threatened or endangered plant or animal species.

Grade

The degree to which a trail rises or falls over a linear distance is an important factor in determining the length of the trail, level of difficulty, appropriate user types, and drainage and maintenance requirements. Occasional fluctuations in the trail grade should be considered to provide variation for trail users and to facilitate proper drainage. Frequent or drastic changes in grade should be avoided. The grade line between control points can be plotted on paper to determine if switchbacks or other special features will be needed to sustain a certain grade. On moderate to steep side slopes, a periodic reverse in the grade should be included to create dips for drainage purposes. When grade dips are included in the initial trail construction, the need for waterbars is eliminated.

Drainage

Proper drainage of surface water is the most important factor in the design, construction, and maintenance of trails. Surface erosion resulting from improper drainage will have a detrimental impact on the trail surface, causing damage to the natural environment and increasing maintenance requirements. The potential for erosion depends on three factors: soil type, velocity of water on the trail, and the distance water travels down the trail. Alteration of any of these factors can reduce the potential for erosion. Proper outsloping of the trail tread and the installation of grade dips or waterbars will help decrease the potential for

erosion of the trail surface. If distances allow, grade dips are preferred over waterbars. Existing drainage patterns of the surrounding area, such as concentrated drainage channels, must be maintained. Attempts to alter the existing drainage patterns will have a negative effect on the natural environment, and will most likely result in severe damage to the trail.

6.6 Accessibility Requirements

Americans with Disability Act (ADA) regulations require that public facilities be made accessible to people of all ages and abilities. The concept of universal access takes this requirement a bit further and suggests that making all public facilities easier to access benefits all members of society, even those without formal disabilities, including the aged and youth with underdeveloped motor skills. On the other hand, certain types of activities in certain types of unimproved areas are not expected to be made fully accessible if meeting the minimum requirements would be considered damaging to the natural, historical or cultural environment. The primary requirement for accessibility includes grade of the slope and cross slope of the trail and the trail surfaces.

It is the intent of the TMP to designate trail Type 2 (recreation trail), Type 4 (roadside trail or connector trail), Type 5 (sidewalk connector and special street crossings) and Type 6 (class 1 multi-use path) as accessible facilities where possible. Trail Type 1 (nature trail) and Trail Type 3 (dirt roadbed) are commonly sited in areas where a 5% or 8.33% trail slope is not obtainable. To meet this standard, major grading and switchbacks would be needed, making a trail like this damaging to vegetation, habitats, landform, cultural resources and other features. Cross slopes of less than 2% are not obtainable on these trail types due to drainage requirements. Finally, the preferred surface treatments for Trail Type 1 and 3 do not support assisted-walking devices or wheelchairs.

Making a trail accessible to people with disabilities involves more than just the trail itself. It also requires that an accessible pathway leads to accessible trailhead and parking lot. Access points along the trail should also be accessible to people with disabilities. The facilities around the trail should be designed for access. For example:

- Trailhead and destination areas with parking and restrooms should conform to ADA requirements for accessible parking and restrooms.
- Elements such as picnic areas should be connected with a pathway that meets the accessible design recommendations for accessible trails.
- Signage at access points should conform to ADA requirements for font size, font type and contrast.
- While pathways connecting with accessible trails should provide the same accessibility standard of the trail itself, tread width may be adjusted based on expected use levels.

6.7 Trail Surface Standards

Samples of trail surface options are shown on Table 6.1 “Trail Surfaces Samples”.

Surface types recommended for different trail types are shown on Table 6.2 “Recommended Surfaces and Edge Treatments”.

Advancements in new paving types are on-going. Performance is the most important selection criteria for selecting pavement types. The critical performance criteria are based on the movement of wheeled bikes, strollers and wheelchairs, as well as price, longevity and aesthetics. For transportation funded projects or those taking credit for bike related active transportation, a hybrid commute bike should be considered the minimum standard for accommodating. These bikes have slightly wider tires and lower pressure (60-100 pounds per square inch) than a comparable high performance road bikes (100-160 psi) used by more competitive cyclists. A cyclist with a very light and expensive bike is not likely to ride on any surface other than asphalt or concrete, partially due to stability of the bike, drag on the wheels and possible dirt, sand and paint chipping resulting from high pressure tires that often shoot up small particles of rock.

A hybrid commute bike with thinner tires is considered to be the minimum requirement to determine if the trail is usable as a transportation asset. This type of bike can handle firm surface compacted trails but cannot handle the soft surfaces that a wide, medium pressure tire of a mountain bike can handle.

General Surface Classifications

- **Soft surface trails** consist of local native soils with some additional material often added to improve compaction, traction and erosion resistance. Trail surfaces can be loose packed sand (a), gravel or uncompacted decomposed granite (b), or native soil (c).
- **Firm surface trails** include all firm surfaces such as compacted crushed stone (d) and compacted, emulsified or cemented particles of decomposed granite (e).
- **Hard surface trails** include asphalt or colored asphalt (f), concrete or colored concrete (g) and permeable concrete or permeable asphalt (h).

No expectation for ADA access or use by high pressure-narrow profile tires should be implied for Trail Types 1 or 3. A Type 2 trail, on the other hand, should be a firm surface which requires either heavily compacted native soil (with only

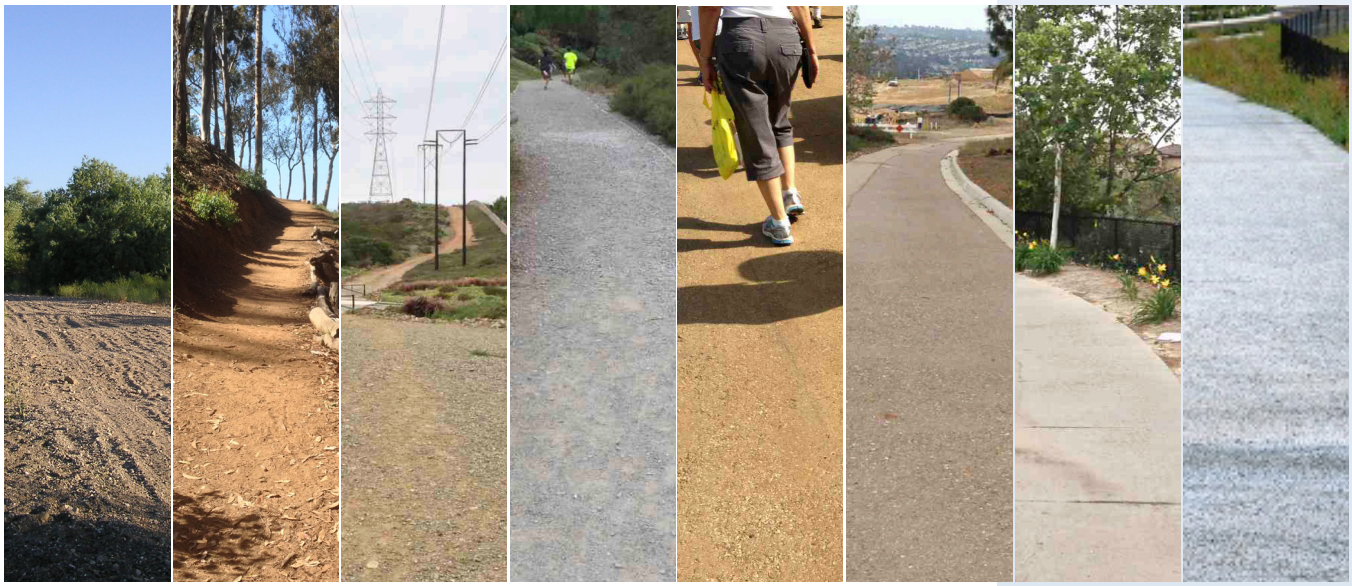


Table 6.1: Trail Surfaces Samples

a small percentage of sand or clay), compacted decomposed granite, crushed compacted stone or chipped stone, stabilized decomposed granite (stabilizers or emulsifiers are additives that bind the soil particles of decomposed granite), or a cement added to the soil mix. In general, if an asphalt or concrete surface is used, it would be considered a hard surface paved trail and should be classified as a Type 4 roadside trail, a Type 5 sidewalk connector or a Type 6 paved multi-use trail.

Paved trails are typically concrete or asphalt. New surfaces of highly compacted and emulsified decomposed granite can be used, or varieties of colored asphalt, colored concrete or permeable asphalt or permeable concrete can be considered. Although much more expensive than standard asphalt or concrete, these enhanced pavement types are useful for their aesthetic appeal, long wear patterns and ability to infiltrate runoff (permeable surface types only).

Since bicycles are easily deflected by surface irregularities, care must be taken to maintain a smooth surface and to avoid longitudinal gaps. Striping or other surface markings must be non-skid paint, emulsified plastic or tape designed for that purpose.

A regular sweeping plan may be helpful, especially wherever a paved trail must be installed low in the topography where debris from storm flows may accumulate, such as dipping down to pass under a bridge. Since the trail will be inundated more often than other segments, these specific locations may be more durably constructed with concrete.

For this plan, the majority of the accessibility recommendations for Type 6 trails are based on the American Association of State Highway and Transportation Officials (AASHTO) “shared-use path” guidelines. However, additional issues not addressed in the AASHTO bicycle facility guide, such as protruding objects, are also included in this section addressing the similarities of Types 4 and 6 trails. Also, grade recommendations in this plan are based on those developed in the Regulatory Negotiation Committee for Outdoor Developed Areas because the maximum grades identified for cyclists in the AASHTO bicycle facility guide do not satisfactorily address the needs of some people with mobility impairments.

Surface Firmness, Stability and Slip-resistance

Surface condition is a significant factor in how easily a person with a disability can travel along a trail. Trail surface firmness, stability and slip-resistance affects all users, but are particularly important for people using mobility devices such as canes, crutches, wheelchairs, or walkers. The accessibility of the trail surface is determined by a variety of factors including:

- surface material;
- surface firmness and stability;
- slip-resistance;
- changes in level; and
- size and design of surface openings

Surfacing material significantly affects which user groups will be capable of using them. Trails surfaced with loose aggregates are unusable by in-line skaters and many cyclists, and reduce all cyclists’ speed. Paved surfaces should be

provided in areas subject to flooding or drainage problems, in areas with steep terrain, and in areas where cyclists or in-line skaters are the primary users.

Firmness is how a surface resists deformation by indentation when a person walks or wheels across it. A firm surface does not compress significantly under the forces of trail use.

Stability is the degree a surface remains unchanged by contaminants or applied force so that when the contaminant or force is removed, the surface returns to its original condition. A stable surface is one not significantly altered by a person walking or maneuvering a wheelchair on it.

Slip-resistance is based on the frictional force necessary to permit a person to move across a surface without slipping. A slip-resistant surface does not allow a shoe, wheelchair tires, or a crutch tip to slip when crossing the surface. Types 4, 5 and 6 trails should have a firm and stable surface because when a person walks or wheels across a surface that is not firm and stable, energy that would otherwise cause forward motion instead deforms or displaces the surface or is lost through slipping. Asphalt and concrete are firm and stable. Under dry conditions, most asphalt and concrete is also fairly slip-resistant. Other trail materials, such as compacted crushed stone or decomposed granite, are also firm and stable under most conditions, but are sometimes too loose to be ADA-compliant. The addition of bonding agents or emulsifiers can address this issue and will improve longevity. Type 4, 5 and 6 trails should be designed to be slip-resistant during wet weather conditions.

Paving Patterns

Hardscape surface design qualities can be used to reinforce Carlsbad trail branding. There are a wide variety of options to choose from in terms of style and materials. Concepts to consider include a consistent use of materials, finishes, color, stamping or score patterns. Selection should be based on the desired trail theme and cost. Also, it is likely that the level of design would be higher at nodes such as trailheads.

Abrupt Level Changes

Changes in level are defined as the maximum vertical change between two adjacent surfaces. Problematic examples that may occur along Types 4 and 6 trails include uneven transitions between trail bridge surface or walkways, or cracks or change in natural ground level (often caused by seismic activity or tree roots). Although abrupt level changes are not desirable for people with mobility impairments, they are potentially even more of an issue for cyclists and in-line skaters and can also cause pedestrians to trip and fall. The risk is particularly acute for those who have difficulty lifting their feet off the ground or who have limited vision and may be unable to detect the level change. Catching a wheel on an obstacle or level change can easily tip wheeled devices as the individual's momentum continues forward despite the wheels having suddenly stopped. Minimizing or eliminating abrupt level changes will greatly improve Type 6 trail safety for all users.

For Types 4, 5 and 6 trails, the following recommendations should be followed:

- Vertical level changes should not be incorporated in new construction;

- if unavoidable, small level changes up to a quarter inch may remain vertical without edge treatment;
- a beveled surface with a maximum slope of 50 percent should be added to small level changes; and
- level changes, such as curbs exceeding one-half inch, should be ramped or removed.

Grade

People with mobility impairments find climbing steep grades difficult because of the additional effort required to travel over sloped surfaces. Manual wheelchair users may travel rapidly downhill, but will be significantly slower uphill because more energy is required to traverse sloped surfaces than level surfaces. Powered wheelchairs use more battery power on steep grades because they must compensate for the difficult terrain. Also, both powered and manual wheelchairs are less stable on sloped surfaces, particularly if wet. Steep running grades are particularly difficult for users with mobility impairments when resting opportunities are not provided, but even less severe grades that extend over longer distances may tire users as much as shorter, steeper grades. Where possible, steeper segments of the total running grade exceeding 8.33 percent should be less than 30 percent of the total trail length. In general, the lengths of the steep sections should be minimized and kept free of other access barriers.

Because climbing a steep grade requires considerable effort, users should not be required to exert additional energy to simultaneously deal with other factors, such as steep cross slopes and vertical level changes. When designing trails where maximum grades must be met, the following recommendations should be used:

- Ideal: 0% - 5%
- Acceptable: Average running grade of 10% or less, for distances over 200 feet
- Acceptable: Average running grade of 15% or less, for distances under 200 feet
- Acceptable: Average running grade of 20% or less, for distances under 100 feet
- Sufficient switchbacks should be provided to avoid excessive grades
- Type 1 trails may exceed 20% grade due to existing conditions or environmental constraints but for running grades of only brief distances.

Near the top and bottom of the maximum grade segments, the grade should gradually transition to less than five percent.

Cross Slope and Drainage

Severe cross slopes can make it difficult for wheelchair users and others to maintain lateral balance because they must constantly work against the force of gravity pulling them sideways, causing them to veer downhill. The impacts of cross slopes are compounded when combined with steep grades or unstable surfaces. Cross slope can be a barrier to people with mobility impairments, but some cross slope is necessary to drain water quickly off of trails. The negative effect cross slopes have on pedestrian mobility must be balanced against the necessity of including cross slopes to provide adequate drainage. The minimum cross slope necessary should be used for Types 4, 5 and 6 trails. For asphalt and concrete, a

cross slope of two percent should be adequate. For non-paved Trail Types 1, 2 and 3 with surfaces such as crushed aggregate or native soil, the maximum recommended cross slope is five percent.

Trail drainage openings are spaces or holes in the paved trail surface. On recreation trails, openings may occur naturally, such as a crack in a rock surface. However, on Type 4 and 6 trails, openings are usually constructed, such as spaces between the boardwalk planks to allow water to drain from the surface. A catch basin or trench drain grate is an example of a drainage structure with openings that allow water to drain into a conveyance system, typically a framework of latticed or parallel bars that prevents large obstacles from falling through a drainage inlet but permits water and some sediment to pass through.

Openings, such as drainage grates, should be located outside the trail tread. Wheelchair casters or walkers, crutch and cane tips, in-line skate wheels and narrow bicycle tires can get caught in poorly placed grates or gaps, creating a serious safety hazard. If placing openings in the trail cannot be avoided, employ the following specifications:

- Width - The size of the open space should not permit a 1 1/2” diameter sphere to pass through the opening. If a wider gap is unavoidable because of existing design constraints, it may be acceptable to extend the width to a maximum of three-quarters inch.
- Orientation - If the open space is elongated, it must be oriented so that the long dimension is perpendicular to the trail.

Protruding Objects

Examples of protruding objects include light posts, poorly maintained vegetation and signs. Visually impaired users who use guide dogs for navigation need clearance to avoid pathway obstacles up to 80 inches high. Objects that protrude into a trail, but are higher than 80 inches, tend to go unnoticed because most pedestrians require less than 80 inches of headroom.

People with vision impairments who use white canes to navigate can easily detect objects on trails below 27 inches. However, objects that protrude into the trail between 27 inches and 80 inches are more difficult to discern because the cane will not always come in contact with the object before the pedestrian does. Ideally, objects should not protrude into any portion of the clear tread width of trails. If an object must protrude into the travel space, it should not extend more than four inches. Also, a vertical clearance of eight feet should be provided rather than the 80 inches needed for pedestrians to accommodate other trail users, such as cyclists. On shared-use trails where there is the potential for equestrian use or emergency or maintenance vehicles access, it may be necessary to increase the vertical clearance.

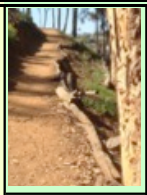
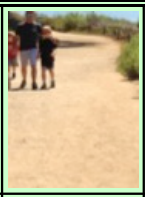
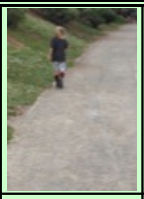
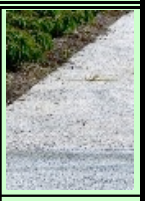
TRAIL OR ROUTE TYPE #	Name	Surface (Tread) Type							
									
	Trail Type Name	SOFT SURFACE: Uncompacted native soil	SOFT SURFACE: Crushed rock, sand or gravel	SOFT SURFACE: Uncompacted decomposed granite (DG)	FIRM SURFACE: Highly compacted chipped stone	FIRM SURFACE: Heavily compacted or emulsified DG	HARD SURFACE: Standard or colored asphalt	HARD SURFACE: Standard or colored concrete	HARD SURFACE: Permeable concrete or asphalt
NATURAL TRAIL TYPES (SOFT OR FIRM SURFACE TRAILS IN OPEN SPACE)									
1	***Nature Trail***	✔	✔	✔					
2	***Recreational Trail***				✔	✔			
3	***Wide Dirt Trail or Utility Roadbed***	✔	✔	✔	✔	✔			
ACTIVE TRANSPORTATION / RECREATION TRAILS (FIRM OR HARD SURFACE MOSTLY NEAR ROADS)									
4	***Roadside or Connector Trails***				✔	✔	✔	✔	✔
5	***Connector Sidewalks or Special Street Crossings***						✔	✔	✔
6	***Paved Multi-use Trail (Class: all Non-motorized Users)***						✔	✔	✔

Table 6.2: Recommended Surfaces Treatments

6.8 Trail Edging and Fencing

Trail edging is designed to control the horizontal movement of trail users for safety or protection of adjacent habitats or property (see Table 6.3 “Recommended Edging and Fence Treatments”). Since the linear requirements are often long for trails, selecting the right type of edge can make a great difference in the overall costs. In some cases, the edge treatment may be an aesthetic choice, while in other cases a fence is required to prevent access into sensitive areas or private property.

Rock edge definer

Minor Edge Definers

In many cases, especially on Trail Types 1 and 2, keeping trail users on the path is important to prevent formation of new, unauthorized trails. Controlling directional use may be as simple as keeping existing taller vegetation in place, or by using rocks or logs to define an edge. Signage can also be placed every few hundreds feet to remind users to stay on the trail. When trying to block off an unauthorized trail, piled cut vegetation and signage is often the most effective. Rock edge definers or cut log definers may be appropriate in many areas to direct movement and control access.

Log edge definer

Fencing

Fencing comes in a wide array of materials and designs. Primarily the types found along trails include wire, chain link, post and rail, post and cable or welded wire segments. The purpose of fencing is to deter trail users from going off trail and to protect against access into areas with sensitive habitat or for safety.

Single strand or braided wire fence on vertical metal posts is the least intrusive of the fencing types and denotes a rural or natural containment system best used with Trail Type 1. Barbed wire or concertina razor wire is prohibited. An individual who wants to obtain access into an area can find a way regardless of the fencing. This treatment can pose a safety hazard and is not appropriate.

Chain link fencing can be used along Trail Type 2 and Trail Type 6 as an appropriate edge definer. The chain link should be black vinyl coated or utilize a stain such as “Nativa” to avoid the cold gray look of galvanized metal. In most cases, a wide open chain link of one inch openings or greater is preferable, since closer spaced chain link tends to close in visually when looking down a long segment of the fence. In most cases, a 42-inch high fence is adequate to contain users and define an edge. Chain link can also be framed with wood or a metal cap to improve its overall rustic look in and around natural areas. Note that this type of fencing prevents some wildlife from traversing the trail, so if the trail is within a wildlife corridor, open railing options or wire may be more appropriate.

Welded wire fencing can be used along Trail Type 6 near the railway. NCTD has requested that a stronger fence be used to deflect any flying material or ballast that could be airborne with a fast moving train. The costs of these fence types are not warranted in general purpose locations, although they do provide vine support.

Railings

Railings provide a compromise between low edge definition and enclosed fencing. If edge protection is needed, the railing should be a minimum height of

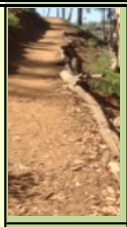
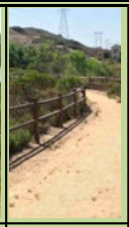
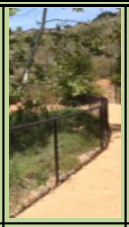
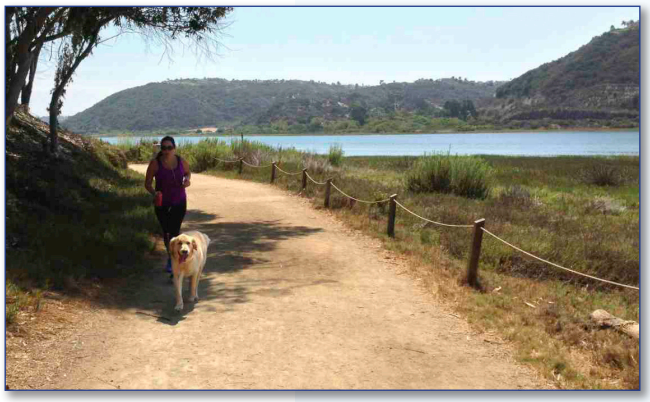
TRAIL OR ROUTE TYPE #	Name	Edge / Fencing Treatments								
										
	Trail Type Name	Shovel Cut Edge / Rock Edge / Tree Limb Edge	Existing Vegetation Edge or New Planter Areas	Braided Wire Fence	Wood Post and Rope / Cable	Post-n-Rail with Notched Rails	Chain Link / Vinyl Covered Chain Link	Metal Post and Cable	Metal Post & Pipe Rail	Welded Wire or Mesh Fence
NATURAL TRAIL TYPES (SOFT OR FIRM SURFACE TRAILS IN OPEN SPACE)										
1	***Nature Trail***	✔	✔	✔	✔					
2	***Recreational Trail***		✔		✔	✔	✔			
3	***Wide Dirt Trail or Utility Roadbed***	✔	✔	✔	✔		✔			
ACTIVE TRANSPORTATION / RECREATION TRAILS (FIRM OR HARD SURFACE MOSTLY NEAR ROADS)										
4	***Roadside or Connector Trails***		✔			✔	✔	✔	✔	
5	***Connector Sidewalks or Special Street Crossings***		✔							
6	***Paved Multi-use Trail (Class: all Non-motorized Users)***		✔		✔		✔	✔	✔	✔

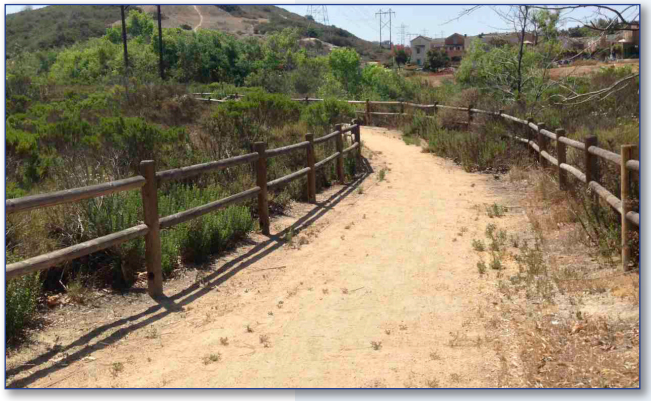
Table 6.3: Recommended Edging and Fencing Treatments

Three strand twisted wire fence



Post and cable

Post-n-Rail, bolted



Post-n-Rail, notched

Black vinyl covered chain link

Welded wire

Metal post and cable

Metal post and three metal rails

42 inches. Railings for Type 1 trails should be used only where a drop-off occurs that needs safety protection. To control access, a variety of railing types can be used, including post and rope, post-n-rail with bolted rails, or post-n-rail with fitted rail. The post and rope, post and cable, or post and chain edge definers are recommended for Trail Type 1. The other railing based edge definers should be used on Trail Type 2 or near road Trail Type 4 or Type 6. The peeler logs seem to work best for Trail Type 2, along roadways for Trail Type 4 and for stand-alone multi-use trails referred to as Trail Type 6. The post and cable or metal railing posts are more expensive, but where maintenance is an issue, such as along the coast, they may be worth the expense.

6.9 Trail Access and Trailhead Facilities

Trail access points may be provided with various levels of amenities, depending on location, trail types and need. Planned trail amenities can include design features such as bridges, rest areas and vista points, as well as intersection treatments, plant material, fencing, striping and signage (see Table 6.4 “Amenities applied to different trail types:”).

Staging Areas

Staging areas should be provided at major trail system access points. They should be sited above any potential flood flows, especially restroom facilities. Major staging areas may include the following:
shade trees or shade structures;

- seating areas;
- bicycle racks;
- water fountain;
- interpretive and directional signage;
- trash receptacles & pet waste stations;
- off–street parking;
- restrooms;
- minimal security lighting.

Moderate level of entry elements

High level of entry elements

Traiheads

A trailhead is defined as a less developed access point to a trail system that functions as a rest area and orientation point. It is typically smaller, accommodates fewer people and has fewer facilities than a staging area. Trailheads may provide users the following limited features:

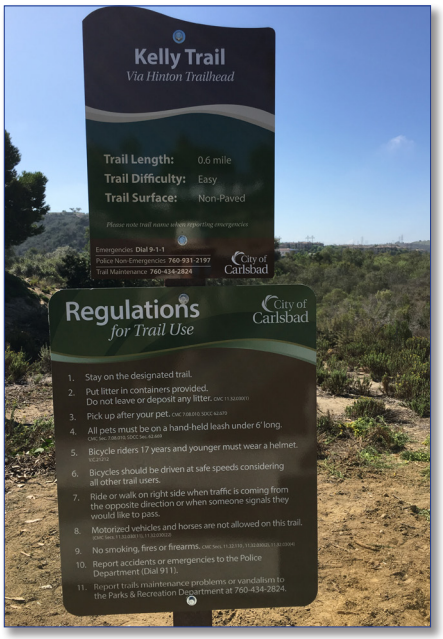
- seating and/or picnic tables (not suggested if homeless and loitering are considered a problem in the area);
- trash receptacles and pet waste stations;
- bicycle racks (no long-term storage);
- shade trees;
- interpretive and directional signs; and
- shade structures.

All Carlsbad trailheads should include trail identification signs, regulatory signs, trail user posts and a kiosk that can provide a place for maps and announcements.

Restrooms

A portable toilet is an interim facility that may be provided early in a staging area's development. Portable toilets may also be brought in temporarily for special events. A permanent restroom or comfort station building is an optional facility that may be provided at a later date at a staging area if demand warrants it. Maintenance costs are high as are the capital costs, so most trailheads do not warrant this facility. A major staging area may warrant the costs of a restroom facility. If a trailhead is next to a park, joint use of that facility.

Shade Structures



Minimal level of entry elements

High level of amenities for a viewing location

A shade structure is an open frame design feature at a staging area, trailhead or rest area. A shade structure may be provided as an option at staging areas and trailheads. However, wherever possible, shade should instead be provided by trees, especially native species. Shade structures are also valuable at the mid-points of trails or where views are available. Benches and tables should be placed under the shade structure whenever possible.

Rest Areas, Turnouts and Vista Points

The trail system may have turnouts, vista points and rest areas along its routes. The characteristics and design for each are described below.

Rest Areas

Rest areas provide an opportunity for users to move off the trail to stop and rest. Periodic rest areas are beneficial, particularly for people with mobility impairments who typically expend more effort to walk than other users. Rest areas are especially crucial when grade or cross slope demands increase. Rest area frequency should vary depending on the terrain and intended use. Popular and more difficult trails should therefore have more frequent opportunities for rest.

In general, rest areas should have the following design characteristics:

- Cross slopes on paved surfaces not exceeding two percent and cross slopes on non-paved surfaces not exceeding five percent;
- firm and stable surface;
- minimum length of ten feet and width of four feet for a standard six foot bench or seat;
- minimal change of grade and cross slope on the segment connecting the rest area with the pathway; and
- ADA accessible seating whenever any seating is provided.

Seating can be important for people with disabilities and those who may have difficulty getting up from a seated position on the ground. Some seating should have backrests to provide support when resting and at least one armrest to provide support to help disabled users resume a standing position. Accessible seating

Simple wood structure and table

High level shade structure and benching

should provide the same benefits as seating for users without disabilities. For example, providing space for a wheelchair facing away from an attractive view would not be appropriate.

Turnouts

A turnout is defined as either a widened section of trail that allows faster trail users to pass or a side path that allows slower trail users to pull over and rest away from the main trail. Turnouts should have:

- Widened pathway;
- shade trees and native vegetation;
- directional and/or mileage signs (optional); and
- fencing as needed.

Vista Points

This is a type of turnout/rest area specifically focused on scenic views. Vista points will have similar features as turnouts. If located on a bridge deck, they will be more limited with only a widened pullout and, if room is available, a bench and signage. In general, interpretive signage may be especially appropriate at viewpoints where trail users are more likely to pause.

Trail Amenities

Most of the existing trails in the city include trailheads with kiosks, signs, trash

Views entice the trail user to stop

Simple way to enhance the view experience

Views can be framed with structure placement

Rustic benches are appropriate for the Type 1 trails

TRAIL OR ROUTE TYPE #	Name	Possible Amenities																					
	Trail Type Name	Off-Street Parking	On-Street Parking	Restrooms	Major Kiosk with Info & Maps	Minor Kiosk with Maps	Trail Name & Regulatory Sign	Trail Users Post with Icons	Gateway Monument or Overhead	Overhead Shade Structures	Interpretive Facilities	Public Art	Vista Pullouts or Viewpoints	Picnic Tables	Benches	Trash Receptacle	Dog Waste Dispenser	Bike Racks	Drinking Fountain	Security Level Lighting	Pedestrian Level Trail Lighting	Non-native Shade Trees and Shrubs	Native Trees & Shrubs
NATURAL TRAIL TYPES (SOFT OR FIRM SURFACE TRAILS IN OPEN SPACE)																							
1	***Nature Trail***		✔			✔	✔	✔			✔	✔	✔		✔	✔	✔					✔	✔
2	***Recreational Trail***	✔	✔		✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔				✔	✔
3	***Wide Dirt Trail or Utility Roadbed***		✔			✔	✔	✔					✔			✔	✔						
ACTIVE TRANSPORTATION / RECREATION TRAILS FIRM OR HARD SURFACE TRAILS MOSTLY NEAR ROADS																							
4	***Roadside or Connector Trails***				✔	✔	✔	✔	✔	✔		✔	✔		✔	✔	✔		✔		✔	✔	✔
5	***Connector Sidewalks or Special Street Crossings***														✔	✔	✔				✔	✔	
6	***Paved Multi-use Trail (Class: all Non-motorized Users)***	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

Table 6.4: Amenities Applied to Different Trail Types

receptacles, pet stations, entry signs and regulatory signs. Few have benches, viewing points or overhead shade structures. Some of the newly developed trails include off-street parking lots or parklets adjacent to trailheads but many of the existing trails rely on the on-street parking, which may be inconvenient at time of increased traffic or large gathering event.

Trail Structures

Trail structures such as retaining and seat walls, shade structures and other physical enhancements should include design features that include a consistent use of materials, forms, finishes and colors that are consistent with the Carlsbad Trail Program branding or the master planned community branding where a trail may be located within a master planned community. The Carlsbad Parks and Recreation Department reviews development plans where future trails are to be built and provides guidance on a case by case basis regarding special characteristics that can be included as part of the trail system.

Public Art

A creative trail art program that provides beauty and learning opportunities is encouraged with the development of new trails. Local artists can be commissioned to create art for the trail system, making it unique, educational and memorable. Themes should draw from the local natural and cultural environment. Many trail art installations can function as or be incorporated into signs, benches, shelters, or even the pavement surface.

6.10 Supporting Infrastructure

Drainage Crossing Structures

The Carlsbad trail system may require the design and construction of drainage crossing structures, and trails should be designed so that no adverse drainage impacts occur due to construction. To minimize potential impacts, trail design should give careful consideration to ponding along property lines and to prevent trail fill from blocking existing drainage patterns. Drainage structures may require review and permitting from agencies such as the California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers and the Regional Water Quality Control Board.

Artistic sculptural expressions, entry signage and amenity special treatments are all artistic expressions

Culverts

A culvert is a drain or pipe that allows water to flow under the trail. Culverts are generally smaller than bridges, ranging from small pipes to large reinforced concrete structures. Culverts should be provided at appropriate intervals and should be sized to convey appropriate drainage flows. A culvert can be a cost-effective solution to bridge a minor drainage flow. Consideration should be given to design provisions such as rock edging and energy dissipaters to prevent downstream erosion in case the culvert clogs with debris and flows over top the trail. Where culverts are employed, regular maintenance during the rainy season is recommended to clear debris.

Culverts tend to be maintenance intensive and can detract from the aesthetics of the natural environment. Culverts should only be constructed where a gentle grade must be maintained, such as with a barrier-free trail or where there is permanently flowing water. In all other situations, a wash crossing should be used. Rock or pipe culverts must match the downstream gradient to accommodate cleaning. Improperly constructed culverts will clog with debris causing water to flow over and damage the trail tread.

The proper construction of rock culverts depends greatly on the proper selection and placement of rocks of sufficient size and shape. The bottom surface of the drainage must be armored with rocks to prevent erosion. Stone headwalls must be placed to armor the outside faces of the crossing. All rocks must be firmly placed similar to the construction of a retaining wall. For pipe culverts, pipe diameter must be at least 12 inches. Embed the pipe in a stable foundation of gravel and soil, and backfill with compacted gravel and soil. Construct a headwall of firmly placed native stone to protect the outside faces of the tread crossing and cover the pipe so it cannot be viewed from the trail. The trail tread should be at least six inches higher than the top of the pipe.

Causeways

Causeways are raised portions of trails used where trails must cross poorly drained areas or where seeps moisten soil tread. These are paths elevated above wet ground using a permeable fill material as a base. Path edges incorporate small boulders or rock rip-rap, usually locally sourced, to contain the permeable fill. Adding rock and elevating the trail allows water to drain to the side and helps prevent the widening that occurs when users try to walk around damp areas. Path construction and detailing depends on site water table depth and surface flows. A stable paving base must be established while allowing for water flow under the trail and should be designed so as not to be compromised by future water flows. Base fill must be firm mineral coarse-grained or granular material, or small, well-graded angular rocks. Causeways are not intended for use to cross wetlands.

Stone Retaining Walls

Stone retaining walls are used to stabilize trails with steep side slopes. Retaining walls are more solid than rip-rap as they must support the full weight of the trail tread. A solid foundation is key to the strength and durability of a retaining wall.

The use of retaining walls alongside trails will require specific analysis on a case by case basis to determine the best methods of construction and may require great skill and previous experience or engineering and should be undertaken by skilled and professional construction crews.

Rip-Rap

Unlike a retaining wall, rip-rap does not support the weight of the trail tread. Instead, rip-rap is used to stabilize steep slopes above and below the trail tread (back slope and fill slope, respectively). Begin by clearing a firm foundation at the downhill edge of the rip-rap. Set the larges rocks in the foundation. Place smaller rocks on the surface of the slope continuing up the slope to the desired location. Be sure that the rip-rap does not impede the flow of surface water off the trail tread. Rip-rap can also be used to protect drainage and lead-off ditches from heavy erosion, and to stabilize switchback turns. Rip-rap should be constructed of native rock. If cement is used to provide additional stability, it must be colored to match the native rock.

Wash Crossings

When trails cross washes, the greatest concern is protecting the trail from flowing water. The trail segments approaching the crossing, and the location where the trail meets each edge of the wash, must be stabilized with securely placed rocks. Trail segments approaching the wash should range from 8 to 15 percent slope, and cross at a 90 degree angle to the wash to prevent water from leaving the primary channel and flowing along the trail surface. The slopes adjacent to the trail may need to be stabilized with rip-rap. A row of large rocks should be embedded along the wash banks at the point of contact with the trail. Be sure that the flowing water will not undercut these rocks.

Trail Access Gates

Gates are typically employed and designed to restrict motorized access to non-motorized use trails, but where vehicular access is needed for maintenance and emergency purposes. Typically these gates should be located at trailheads, where trails cross major roads, and at other points where motorized vehicles are likely to attempt to access a trail. These gates must be constructed of heavy gauge metal or other durable low-maintenance materials.

6.11 Bridges and Tunnels

Future development of the Carlsbad trail system is likely to include bridge crossings, especially in the I-5 corridor areas of the city's three lagoons. The new structures for the trail system that are part of the transportation infrastructure will create opportunities for overlooks, habitat protection, loop trails and critical east/west trail connections to the coast. Bridges and tunnels can also provide maintenance and emergency service access. Potential use, cost-effectiveness and physical constraints will drive potential location for a bridge or tunnel. Bridges and tunnels can enhance wildlife movement since trail use occurs primarily during daylight hours and wildlife movement often occurs at night. The following conceptual bridge and tunnel criteria serve as a general guideline, and each facility will be analyzed case-by-case during the project development phase to assure that appropriate method, size, style, accessibility, and environmental impacts are taken under consideration

Ultimate in safe street crossings, but not always used

Wood Trail Bridge

Wooden bridges can provide a cost-effective solution in connecting minor drainage crossings while supporting local trail character. Bridges should be level and avoid a step-up if the trail is intended to be ADA-compliant or will be used by cyclists. Since the life span of wood is limited, recycled plastic composite lumber may be considered as a feasible alternative for the required deck material. If the fall distance is greater than 30 inches, guardrails should be at least 42 inches higher than the bridge surface. Spans greater than ten feet should generally be engineered and may require site-specific geotechnical work. It should be noted that long span wood construction requires similar requirements for abutments and foundation supports as steel bridges.

Safe crossing if highly visible and lighted

Prefabricated Steel Truss Trail Bridge

The most common use of prefabricated steel truss bridges is for trail applications in conjunction with parks and trails. Such bridges can be used on relatively long spans of over 100 feet, with virtually unlimited spans possible with intervening supports. Design considerations for prefabricated steel truss bridges include finishes such as weathered (Cor-Ten) steel, paint or galvanizing, as well as deck options such as cast-in-place reinforced concrete, precast planks, open grating, or composite or wood decking. Prefabricated steel truss bridges are available in a variety of design styles and truss types to accommodate project aesthetic and clearance requirements. New bridges should emulate existing installations in the area.

Bridge Width

For Type 6 trails, bridges would be typical of those commonly used for trails and should be the width of the connecting trail. When a wider multi-purpose bridge is desired to accommodate higher use levels, or to support maintenance or patrol vehicles, bridges should be a minimum of 20 feet wide and constructed to the required load rating.

Tunnels

Tunnels are warranted as methods to get across very busy streets and, if planned for well in advance of roadway extensions, can be feasible regarding costs of construction. However, in most cases, at-grade, lower cost, improved pedestrian crossing facilities will be used by the general public.

The openness ratio is important to consider when designing tunnels that can be used by wildlife. It is a function of structure length, which corresponds to the width of the roadway, the appropriate structural dimensions will be determined by road width. A relatively large openness ratio may enhance a structure's use by allowing sight through a crossing structure, as well as by providing more natural lighting conditions.

The most important aspect of the tunnel is to ensure safety and avoid hiding places and alcoves. The use of lighting may be considered, however it may be a deterrent to the wildlife movement, so each facility should be analyzed case by case to ensure that the design addresses user needs and minimize disturbance to wildlife.

Tunnels are typically constructed of precast concrete box culverts. Other varieties of culverts are acceptable provided they meet the required dimensions, and allow

footing that is appropriate for all types of trail users. The width of a trail traveling through an underpass should not be less than 12 feet. Vertical clearance is an important concern. The minimum vertical clearance is 9 feet at a distance of 4 feet from the centerline, and 11 feet at a distance of 3 feet from the centerline. Natural or vandal-resistant electric lighting should be installed for safety. Sight distances approaching and exiting the underpass must be adequate for safety. Underpass design must not allow the accumulation of nuisance water on the trail. If water does not drain from the underpass by gravity flow, a pump system must be provided to remove the water. The surface of the underpass should be slip resistant.

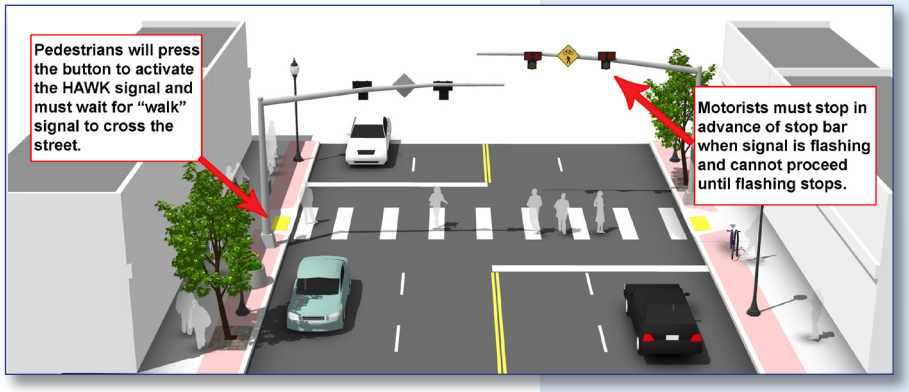
Mid-block Road Crossings

Allowing trails to end at the middle of a busy street is not proper trail planning and

Uncontrolled crosswalks should include signage, a median refuge and a state yield law sign

A hybrid signal and warning system known as a HAWK (high intensity activated crosswalk beacon) or PHB (Pedestrian Hybrid Beacon) is very effective at stopping vehicles

Multiple lanes require positive protection such as this Rectangular Rapid Flashing Beacon



Boardwalk at Lake Calavera Preserve

should be avoided. Placing signs stating the need to walk to the nearest intersection is not a solution unless it is less than 100 feet to the intersection. If the distance is less than 100 feet in either direction, it is reasonable to expect a trail user to use the intersection. If it is further, it is much more likely that a trail user will jaywalk across the roadway. A variety of mid-block crossings address this issue and can improve safety. If only one lane exists in each direction, then a non-controlled crossing may work if median refuges, high visibility striping, signage and mid-street rubberized warnings stating the state law requiring drivers stop for pedestrians are installed. For multiple lanes, a HAWK or a Rectangular Rapid Flashing Beacon system should be used.

6.12 Boardwalks

Boardwalk construction may be used to span sensitive areas such as stream riparian zones, unavoidable wet areas and depressions, and in areas of steep slopes. They can also be used to provide trail access in areas where grading and filling may harm tree roots or create trail surfaces that wildlife will not cross. Boardwalks should be considered in relation to environmental impacts, available budget, potential user needs, and operations and management issues. The following conceptual boardwalk criteria will serve as a guideline for the development of any boardwalks identified in the trail system.

Boardwalk Materials

Proposed boardwalks must meet American Association of State Highway and Transportation Officials (AASHTO) design recommendations for Type 6 trails. Boardwalks should be structurally designed to support the weight of a small truck or a lightweight maintenance vehicle. For boardwalk deck construction, wood lumber is typical. Composite lumber provides a longer useful life compared to wood, is a heavier weight material to reduce floating in flood-prone sites and the pronounced texture can reduce slippery surfaces. While composite lumber typically costs more than wood, its durability can make it more cost-effective over the life of the structure and is now commonly employed for boardwalks and bridge decks in open space.

Boardwalk Height from Ground

The boardwalk height should be set to allow small animal movement under the structure, a minimum of six inches above grade. Footings will vary depending on soil conditions, and a geotechnical investigation is recommended. Prefabricated modular footings are recommended to reduce construction environmental impacts. Boardwalk width should be the same as that of the trail type for which it is built.

Poinsettia Park trail - lighting does not spill over to adjacent habitat areas

Boardwalk Railings

AASHTO recommends 42 inch high railings on any structure or path more than 30 inches above adjacent grade. Boardwalks less than 30 inches above grade may not require a railing according to current building standards. Curb rails alongside the edge of boardwalks are highly recommended to assist in warning trail users that they are traveling close to the edge.

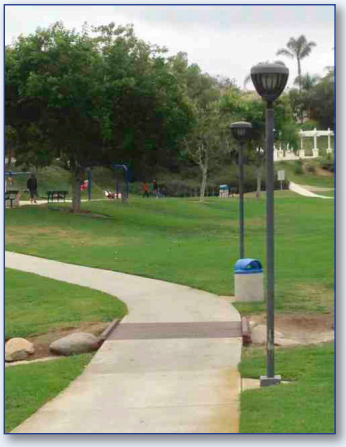
6.13 Lighting

The need for lighting should be carefully determined on a case-by-case basis. Trails themselves do not require lighting, but where there is a demonstrated need, such as urban setting of a mobility trail type 6, lighting is allowed to provide a measure of trail safety and security. Other sites where lighting may be considered are:

- bridges,
- public restrooms and gathering areas along the trails,
- trail access points and trailheads.

Lighting should be eliminated in or adjacent to the preserve except where essential for roadway facility use, and safety and security purposes. Shield should be used on light sources adjacent to the preserve so that the lighting is focused downward. Excessive lighting should be avoided in developments adjacent to linkages through appropriate placement and shielding of light sources.

Light color should be considered in the selection, since consistent color illumination will visually enhance and link the trail at night. All light sources should provide a warm white color light. A wide variety of lighting options are available in terms of style and material selection, as well as energy efficiency. A licensed or qualified lighting expert should be consulted before making any lighting design decisions. Doing so can reduce up-front fixed costs and long-term energy costs. As appropriate, dark sky-compliant lighting should be selected to minimize light pollution cast into the sky while maximizing light cast onto the ground. Stand-alone solar-powered light fixtures continue to come down in cost as fixture, battery and photovoltaic technology improves, and should be utilized where possible for new installations or retrofit projects, especially where supplying electrical power may be prohibitively expensive. Matching or complementing light fixture style and types with other site furnishings will strengthen the overall trail branding.



Type 4 or 6 trails benefit from lighting but great care is needed not to spill over light into adjacent wildlife or development

Roadway Crossings

The design of all trail roadway crossings should include lighting for the comfort, safety and convenience of roadway and trail users. Properly designed lighting provides cues to drivers to expect trail users at crossings. Federal Highway Administration (FHWA) HT-08-053, The Information Report on Lighting Design for Mid-block Crosswalks, found that a vertical illumination of 20 lux in front of the crosswalk, measured at a height of five feet from the road surface, provided adequate detection distances in most circumstances. Although this research specifically addressed mid-block crosswalk placement, the report includes a brief discussion of considerations in lighting crosswalks co-located with intersections and the same lighting principles apply there. Illumination just in front of crosswalks creates optimal visibility of pedestrians. Crosswalk lighting should also provide color contrast from standard roadway lighting.

Energy Conservation

Where lighting is included in projects, some trail and roadway or crossing lighting may be required. The use of energy-efficient Light Emitting Diode (LED) lighting fixtures should be considered for these applications. LED lighting is becoming an alternative illumination source to replace commonly used high pressure sodium vapor (HPSV) lighting.

Branded directional sign

LED efficiency benefits include long life (up to 100,000 hours) and reduced maintenance due to longer periods between lamp module replacements, but the greatest benefit is reduced energy consumption by as much as an estimated 60 percent when compared to comparable output HPSV lamps. LED can have a lifetime of 12-15 years and a cost recovery of approximately three years.

LED lighting can be used with various light fixtures for various applications. The benefit of lower energy consumption and reduced maintenance costs are very attractive and support the installation of LED lighting. The following is a brief summary of advantages to using LED lighting versus conventional technology:

- low power consumption and reduced maintenance costs;
- dimming capability;
- more accurate color rendering;
- quick turn on and restart;
- does not contain toxic lead or gas;
- ease of light spillage control where light is undesirable;
- and high output at low temperatures

LED lighting is in compliance with the Climate Action Plan Measure I: Promote Replacement of Incandescent and Halogen Bulbs with LED or Other Energy Efficient Lamps. Goal is to replace 50 percent of incandescent and halogen light bulbs citywide with LED or similarly efficient lighting by 2035.

6.14 Signage Guidelines and Standards

Signs provide information. They need to do so in a consistent and clear manner. Too many signs negatively affect the trail user experience and clutter the visual environment. Finding the right balance is important. Signs should be limited to trailheads and key decision points for wayfinding along the trail or where important educational opportunities exist. Regulatory signs may need to be placed in areas where extra controls and instructions are needed.

City of Carlsbad Trail Signage Guidelines and Standards

The City of Carlsbad has developed guidelines and standards that should be considered the primary guidance for any signage issues, including specifications such as size and color. The following guidance should be considered supplemental to the city's requirements.

Signage and Trail Branding

Trail signage systems with clear thematic design provide messaging consistency. The Carlsbad trail system's existing route signage conveys uniform quality and credibility, enhancing the trail experience. Incorporating the branding or themes in basic amenities such as site furnishings, fencing and gates, lighting, hardscape and structures, signage and art pieces help reinforce the Carlsbad trail brand or "sense of place." Some trail elements and amenities that can incorporate Carlsbad trail branding are described in the following sections.

Trailhead Signage and Information

Signs that clearly describe trail conditions are an essential component of trail experience. Signs should be provided in an easy-to-understand graphic format

with limited text. Providing accurate, objective information about actual trail conditions will allow people to assess their own interests, experience and skills and to determine whether a particular trail is appropriate or provides access to them with their assistive devices. Providing users with trail condition information is strongly recommended for the following reasons:

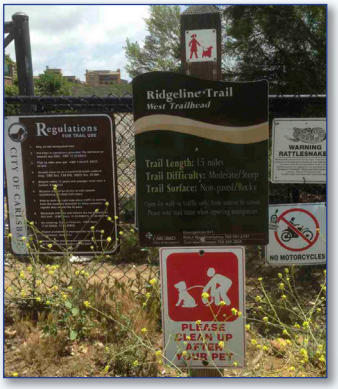
- Users are less likely to find themselves in unsafe situations if they understand the demands of the trail before beginning.
- Frustration is reduced and people are less likely to have to turn around on a trail because they can identify impassible situations, such as steep grades, before they begin.
- Users can select trails that meet their skill level and desired experience.
- The level of satisfaction increases because the user is able to select a trail that meets his or her expectations.
- If more difficult conditions will be encountered, users can prepare for the skill level and equipment required.

At a minimum, the following information should be provided at all trailheads on the main trailhead sign:

- trail name;
- permitted users;
- path length;
- elevation change over total length and maximum elevation obtained;
- average running grade and maximum grades that will be encountered;
- average and maximum cross slopes;
- average tread width and minimum clear width;
- surface type; and
- surface firmness, stability and slip-resistance

A comprehensive signage system ensures that information is provided regarding the safe and appropriate use of all trails, both on and off-road. Signage should establish style, font and color consistency and present a unified appearance to promote the perception and branding of the Carlsbad trails as a unified system. Project signage may include directional, distance, interpretive and regulatory/ advisory.

Directional and other typical signage will occur primarily at staging areas, trail heads and potentially other locations where users may regularly access the trail system. Trail distance markers should occur on a regular interval of at least once per quarter mile for any trail more than one-half mile long. These markers are useful to both trail users and to first responders to locate injured persons. Interpretive signage may occur almost anywhere to coincide with a point of public interest, but will likely be more condensed at the staging areas, trail heads and vista points where users are more likely to spend time off the actual trail surface



Too crowded and poorly arranged signage

Well arranged and designed signage

Simple directional sign

Resource protection signs should be visible from the trail

resting or enjoying the view. For all but regulatory signs, this system's signage should be comprehensively designed as a definitive signature element encompassing the overall trail system.

Regulatory Signage

Regulatory signs should state the rules and regulations associated with trail usage, and identify the managing agency. The trail regulations message is to promote user safety and enhance the user enjoyment. It is important to post trail use regulations at trailheads and key access points. Typical trail regulation signs may include:

- route identification, reassurance and confirmation;
- guidance and distance to trail destinations and key points of interest;
- safety features and user safety;
- warnings of known hazards;
- hours of operation;
- pedestrian, bicycle, equestrian and vehicular traffic control;
- dog leash requirements;
- alcoholic beverages are not permitted on trails;
- notice of restrictions where use control is necessary;
- do not wander off of trail onto adjacent properties.

Resource Protection Signs

Resource protection signs identify sensitive habitats excluded from recreational use, and educate about land stewardship. They are placed in the most visible locations directly adjacent to habitat areas, but where they can be easily readable without wandering off the trail.

Bike Route Signage

Mainly within public right-of-ways, Class III bicycle routes are identified through route signage using the standard "Bike Route" sign. The California Manual on Uniform Traffic Control Devices (CA MUTCD) allows alternative bicycle route sign plaques to reflect a numerical route or name designation placed below the route signage. For Class I paved trails, supplemental signs and plaques can be used to direct cyclists and pedestrians to destinations.

Directional Signs

Directional signs should provide route and distance information to major destinations and trail amenities. Directional signs should be installed at staging areas, access points and major trail intersections.

Trail Markers

Trail markers provide visual reassurance that the user is on the desired trail. Trail markers can also double as distance markers and should occur at regular intervals of at least every quarter mile. These markers are useful for recreational purposes, as well as for providing first responders a means to locate injured persons.

Kiosks

Kiosks provide visitors with information to orient themselves, learn about trail conditions and opportunities, trail regulations, hours of operation, local events such as activities programmed for the Parks and Recreation Department or the Carlsbad Trail Volunteer Program, or within the open space. Kiosk design and style should reflect Carlsbad trail sign system character and branding. Kiosks should be readily identifiable by trail users as informational contact stations and provide elements such as bulletin boards, regional trail maps, rules and regulations and accessibility advisories.

Kiosk displaying interpretive material and trail map

Interpretive and Educational Signage

Interpretive signs enhance the trail experience by providing information about the history and culture of the area. Such exhibits may discuss local ecology, people, environmental issues and other educational information. Educational signage may be placed at scenic view areas or in relation to specific elements being interpreted. They may take on many forms including textual messages, plaques, markers, panels and demonstrations.

Interpretive signage

Interpretive signage may occur almost anywhere to coincide with a point of public interest, but will likely be more condensed at staging areas, trailheads and vista points where users are more likely to spend time off the actual trail surface resting or enjoying the view. Because interpretive signs need to relate directly to the needs of a site, no specific guidelines have been established for their format. However, interpretive signs should be concise and integrated into an overall area sign plan, including the wayfinding signs mentioned previously. In addition, they should be constructed of highly resilient materials with easily cleaned or repaired surfaces.

6.15 Specific Trail Signage Guidelines and Standards

Locations

The proper location of signage is important to ensure the safety of trail users, preserve the natural environment, and promote the presence of the trail. The number and location of signs should be carefully considered, as a lack of signage or poorly located signs can create hazardous situations for trail users. An over-abundance of signs can also detract from the aesthetics of the trail and decrease the quality of the trail users' experience.

Interpretive signage provides information about the history, environment and culture of the place

Trail signs are typically located at trailheads, trail intersections, and locations where trails cross roadways, and at any other areas where it may be difficult to follow the route of the trail. Trail signs should be installed two feet from the edge of the trail to allow proper clearance by trail users.

Signage Types and Location Requirements

Primary Signage

Location Requirements: Staging Areas/Primary Access Points- Indicate locations on improvement and landscape plans for primary signage locations. Final locations must meet the approval of the City of Carlsbad.

Required Elements: Preferable information and amenities for this type of signage would be a kiosk or monument with a panel to include:

- trail map;

- trail regulations (attached at end of this section);
- brochure dispenser for trail maps/brochures;
- pet waste station with appropriate signage and waste receptacles; and
- interpretive Information i.e. Historical facts and/or information on local flora and fauna or cultural resources.

Trail Interpretive Signage: Trail interpretive signage may be located at primary entry points, usually referred to as trailheads or trail access points, trail nodes or staging areas. This signage informs the trail users about the unique habitat, wildlife or other characteristics of the trail and to educate the public about the open space system that the trail is located within or about the citywide trail system. It may also include information on trail rules and connections to other points of interest associated with the community such as nearby city parks and trails or nearby schools and businesses. Typically there are two physical components to this type of signage: A base and an interpretive panel with a narrative of information for the trail user as described above.

Interpretive Panels: Interpretive signage panels should consist of a durable material that can withstand the outdoor elements of Southern California and should meet the approval of the city. The City of Carlsbad logo should be included on the interpretive panel. Submit a sample or specification of the materials to be used, a mock up indicating the proposed size, layout, background color and design to the City Parks and Recreation Department.

Interpretive Signage Supports: Recyclable plastic materials and metal posts with a painted powder coat type finish are also acceptable for interpretive sign supports and bases. All post footers must have a 3-foot deep by 12-inch round minimum concrete base.

ADA Compliance: All interpretive signage must be accessible to those with disabilities and comply with the most recent requirements and guidelines for ADA Guidelines, Recreation Facilities. At trailhead parking areas, ADA signage and parking space stamping must be in compliance with current San Diego Area Regional Standard Drawings (SDARSD).

Trail Regulation Signage Standard Specifications

Location Requirements: Trailheads and Staging Areas

A. Blanks

Sign blanks must be 0.080 gauge aluminum. Blanks must be covered with reflective sheeting of street transportation quality vinyl. There must be two pre-drilled 3/8” holes. The holes must be centered horizontally with the center of each hole being ½” from the top and bottom edges. Corners must be rounded with a 1” to 1-½” radius, dependent on the size of the sign.

B. Sign Post/Anchor Specifications

1) Posts-Posts shall be constructed of 1 ¾” x 1 ¾” 12-gauge square steel tubing with 7/16” pre-punched knockouts on 1” centers. Post lengths must be 8’ to allow for 2’ burial below finish grade within the sign post concrete footing. All steel posts shall be sandblasted with 100-grit sand and chemically treated to

provide a natural looking “rust” finish. The application of rust-colored paint is not acceptable.

- Anchors - Anchors shall be 2” x 2” x 30”, 12-gauge galvanized square tubing with 7/16” pre-punched knockouts on 1” centers.
- Sleeves - Sleeves shall be 2 ¼” x 2 ¼” x 12”, 12-gauge galvanized square tubing with 7/16” pre-punched knockouts on 1” centers.
- Anchor Assembly Hardware - 3/8” vandal resistant steel drive rivets.
- Telescoping Properties - The finish post, anchor and sleeve must be straight with a smooth uniform finish to allow each component to telescope with each consecutive larger or smaller piece.

Branded trailhead entry signage

C. Dimensions

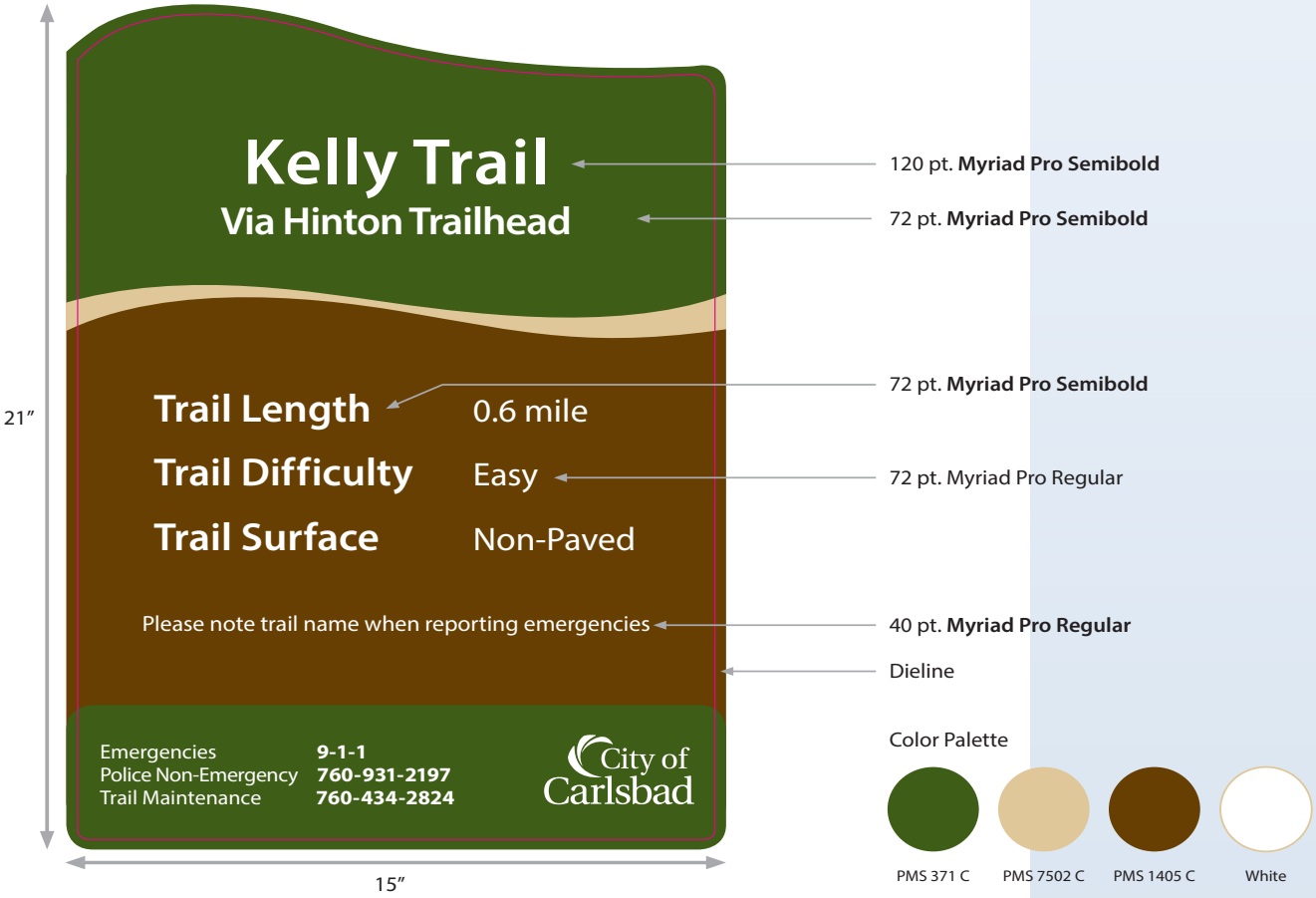
22” wide by 28” high with rounded corners (approx. 1.5 “)

D. Installation

Sign posts are to be installed at locations which meet the approval of the City of Carlsbad. The final height of the metal post shall be 6’ above finish grade. The signage should be placed in more prominent locations such as trail access points or major trail junctions. All signs are to be mounted to the posts with 3/8” vandal resistant drive rivets.

E. Colors:

4-color digitally printed vinyl graphics applied to white aluminum, with graffiti laminate applied.



F. Bleed:

Full bleed

G. Finishing:

Die cut at pink die line in pdf file

H. Proofs:

PDF proofs required for approval before printing.
Send to Communication Dept.

I. Price:

Price approval required before printing

J. Delivery:

To Parks Maintenance Yard at 1166 Carlsbad Village Dr.

K. Vendor::

Sign Studio, 7160 Convoy Ct., San Diego, CA 92111

Trailhead/Trail Entrance I.D.

Location Requirements: Locations for trail entrance I.D. sign shall be indicated on improvement plans and landscape plans. Trail post markers will be required at secondary entrances and key entry points to citywide trails.

Materials Requirements: Trail markers shall be 6”x6” flat bevel top hardwood treated lumber or recycled plastic. Color shall be Desert Tan for recycled plastic products.

Citywide Trail Logo

The city’s trail logo may be obtained in a digital format for signage use by contacting the City Parks and Recreation Department at 760 434-2826.

Specialty Signage

Private Property: Signage requests made to the city and/or when permission is granted by the city to install signage, for example when an HOA managed area is adjacent to an existing citywide trail and they would like to post additional signage.

6.16 Design for Risk Management Considerations

The International Mountain Biking Association’s (IMBA) Managing Mountain Biking: IMBA’s Guide to Providing Great Riding provides an excellent overview of safety and risk management concepts and guidance that are applicable to all types of trails and paths. Much of the information provided here is abstracted from that document. Risk management’s role is not to remove all risk, and therefore the challenging or interesting aspects of a trail system, but to identify and address unreasonable hazards that might cause harm to trail users.

The majority of information sources that addresses risk management on trails agree that the best overall risk management practices are to properly design, construct and maintain trails. When it comes to trails, the old cliché of “preven-

tion is the best medicine" holds true. Risk management techniques both protect trail users from injury and offer a measure of protection from lawsuits for trail managers.

The following risk management practices come from multiple resources and are condensed here for easy reference. These include design techniques, plan implementation and policy guidelines:

- Design for risk management: Many risk management concerns can be mitigated and addressed before a trail system is constructed simply by understanding what risks currently exist in the environment and identifying and understanding the intended users.
- Design the trail system according to City of Carlsbad accepted standards: Hazards and liability can be limited by adopting design standards during the trail design phase, such as American Disability Act (ADA).

Design the trail system using Crime Prevention Through Environmental Design (CPTED) principles defined as the "multidisciplinary approach to deterring criminal behavior through environmental design." The four main CPTED principles are:

- Natural surveillance: Keep the environment maintained so people can be easily seen by other users, staff, and anyone who may pass by the trail system. Design landscaping to avoid blind spots and hiding places. Ensure adequate light levels.
- Natural access control: Control natural access by some means such as fences or landscaped areas. For example, for a hiking only trail, access methods should clearly signal "walk here" and "do not walk" there, so that a walker would not look out of place.
- Territoriality: Use territoriality reinforcement to distinguish public and private spaces, including signage and landscaping. This is intended to indicate that someone owns and cares about a space. A space that looks cared for can deter illegal or undesirable activities.