

Chapter 18. Railings	18-1
18.1. Applications	18-1
18.1.1. Resource Protection	18-1
18.1.2. Overlooks and Steep Terrain.....	18-1
18.1.3. Structures	18-1
18.2. Types of Railings	18-2
18.2.1. Wooden Railings (Other Than Bridges).....	18-2
18.2.2. Post Sill Design	18-3
18.2.3. Masonry.....	18-9
18.3. Railing Design Specifications	18-9
18.3.1. Equestrian Trails.....	18-9
18.3.2. Accessible Trails.....	18-9

Figures

Figure 18.1 - Railings	18-4
Figure 18.2 - Steel Post Bracket	18-5
Figure 18.3 - Handrail with Buried Post Sills	18-7
Figure 18.4 - Handrail with Buried Post Sills Continued.....	18-8

Photos

Photo 18.1 - Wooden Railing	18-2
Photo 18.2 - Steel Brackets.....	18-3
Photo 18.3 - Railing with Buried Post Sills	18-6
Photo 18.4 - Masonry Railing.....	18-9

Chapter 18. Railings

Railings are horizontal or diagonal structural members attached to vertical posts for the purpose of delineating the trail, protecting vegetation, and providing a barrier for users at precipitous locations.

18.1. Applications

Railings can be used in a variety of applications and situations. The railing designs presented in this chapter are for sturdy and sustainable railings for general trail applications. However, the determination to use railings is site specific based on evaluation of visitor safety, accessibility guidelines, site aesthetics, and resource protection concerns. A site specific evaluation will ultimately determine the design and necessary materials for each railing application.

18.1.1. Resource Protection

Railings are used in areas where the trail needs definition, especially in areas that have a history of users going off trail. Although most railings can be climbed over, under, or through, they provide a psychological barrier to users. In areas with sensitive, fragile, or noxious plant life (like poison oak and nettles), or those identified as having significant cultural resources, railings should be considered.

18.1.2. Overlooks and Steep Terrain

Railings can be used to delineate boundaries at a designated overlook, separate trail users from a hazardous area, or reduce erosion and vegetation degradation. Railings are also used on precipitous terrain, where the trail is located along a cliff edge, or other areas with a steep drop-off where a person could sustain serious injury if they go over the outside edge of the trail.

In areas with potentially hazardous drop-offs, site specific evaluations can determine the potential safety risk and recommend proper design solutions. In addition to railings, other potential edge protection methods include curbing, bull rails, trail tread widening, tread surfacing (traction) improvements, utilization of native vegetation (if strong enough to restrain the user), logs securely fastened to the ground, or large rocks firmly attached to the ground or incorporated into a multi-tier retaining wall. Drop-off protection should allow for overland sheet flow and blend in with the natural surroundings. It is only installed where it is needed and its application is uniform and consistent across the trail system

18.1.3. Structures

Railings are required on all bridges and boardwalks that span a void 4 feet or more in depth. This depth is measured from the top of the decking to the deepest part of the terrain below the structure. Railings may be required on step carriages in high-

use areas with adjacent precipitous side slopes. When combined with handrails, railings can assist accessibility.

18.2. Types of Railings

18.2.1. Wooden Railings (Other Than Bridges)

Railings are constructed by placing two upright 4- x 6-inch posts in the ground a minimum of 24 inches deep and 8 to 10 feet apart. (See Photo 18.1.) An alternate method of post installation, using a fabricated steel post bracket, is also described in this section. (See Photo 18.2. and Figures 18.1 and 18.2.) By minimizing ground contact, this post bracket method increases the post's longevity and allows for easy post replacement. The posts are then spanned by one or two rails. The top of the completed railing should be 42 inches above the trail tread for bicycle and pedestrian trails and 54 inches for equestrian trails.

The standard posts for railings are 4- x 6-inch con heart redwood or cedar. The top rail is fixed to the upright posts with 40d galvanized nails. If required, the diagonal rail is cut flush at the appropriate angle for a firm fit against the upright posts. With multiple rails, splices are made at the center of the top of the post to ensure a secure, durable attachment. Alternative designs for railings are approved on a case-by-case basis to meet historic or aesthetic criteria, but the basic design principles are illustrated in Figure 18.1. See Chapter 16, *Trail Bridges*, for further information on laying out, notching, and installing rails.



Photo 18.1 - Wooden Railing



Photo 18.2 - Steel Brackets

18.2.2. Post Sill Design

Sometimes the ground conditions prohibit digging 24-inch deep post holes. An alternative design is to use post sills with diagonal braces. (See Photo 18.3.) A footing is excavated into the trail bed, perpendicular to the path of travel. The footing is a minimum of 20 inches deep and 12 inches wide. The bottom of the footing must be in undisturbed mineral soil and level in all directions. A 6- x 8-inch sill is laid into the footing and pinned with two pieces of 5/8- x 30-inch rebar.

The length of the sill depends on the designed trail width. The sill must extend beyond the outside edge of the trail sufficiently to install a post brace at a 45-degree angle. (See Figure 18.3.) The 4- x 6-inch post is attached to the sill by toe nailing it into the sill with 40d galvanized nails. A post brace is then installed to support the post. The 4- x 6-inch brace is installed at a 45-degree angle and must be long enough to span from the end of the sill to half way up the post. (See Figure 18.3.) The post brace is toe nailed into the sill and post with 30d galvanized nails.

A 3- x 12- x 20-inch soil dam is installed in the footing, up against the post. It is notched around the post sill and is the same width as the 12-inch footing. This soil dam is required to contain the backfill material placed on top of the sill. It is nailed to the post and toe nailed into the sill with 30d galvanized nails. Once the soil dam is installed, the footing is backfilled with crushed aggregate in compacted 3-inch lifts until the designed trail surface is achieved. (See Figure 18.3.) The remaining top and diagonal rails are installed as per Figure 18.1.

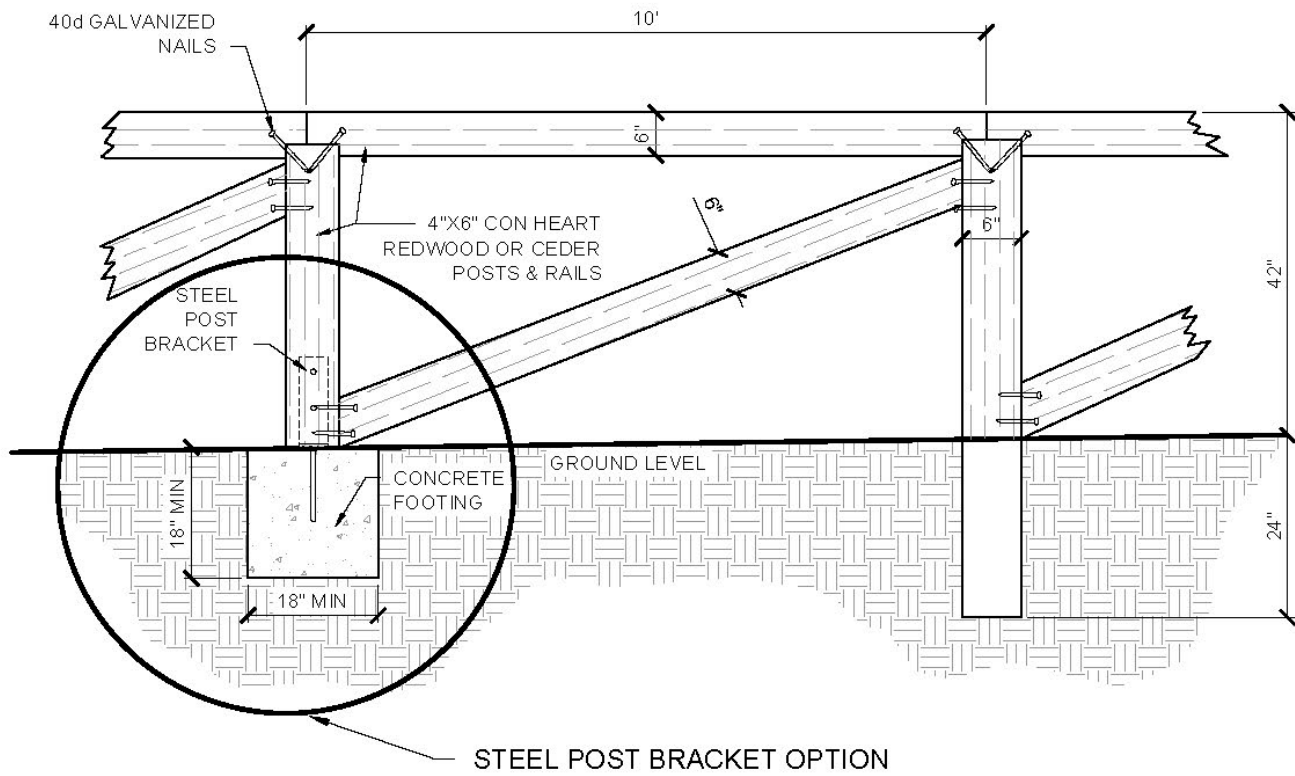


Figure 18.1 - Railings



RAILINGS
CALIFORNIA STATE PARKS

NOT TO SCALE

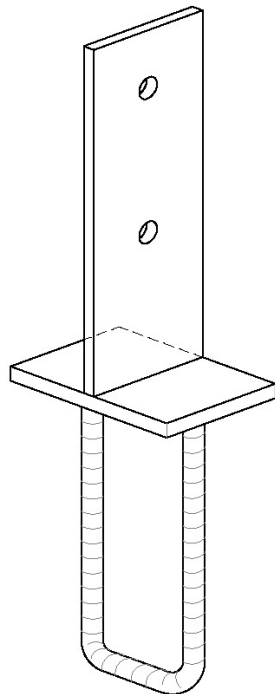
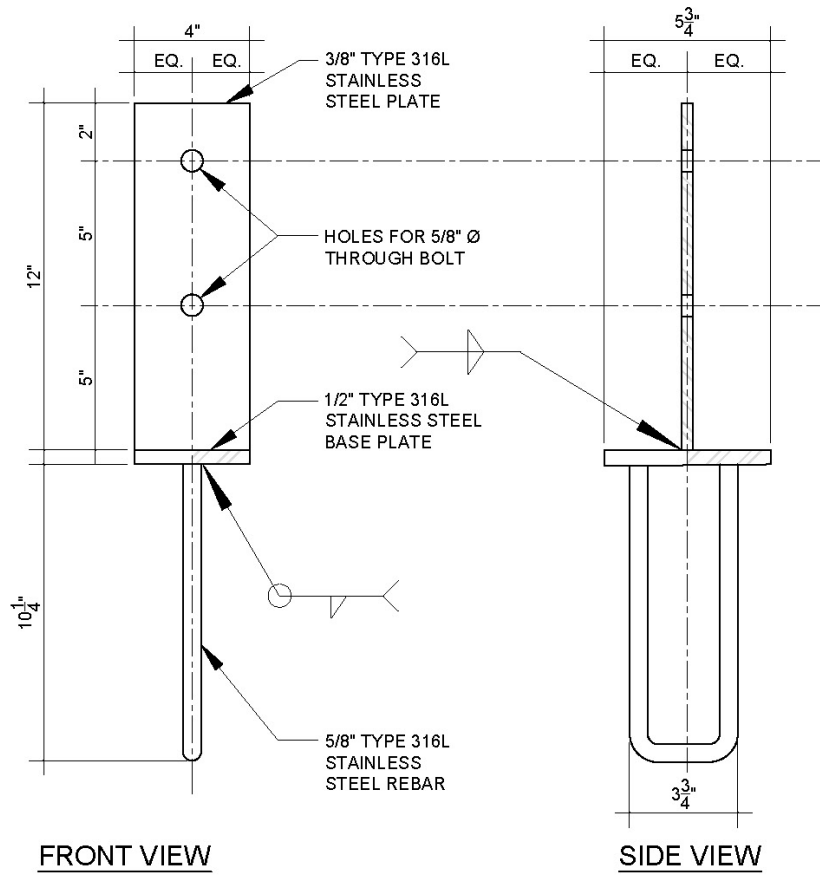


Figure 18.2 - Steel Post Bracket

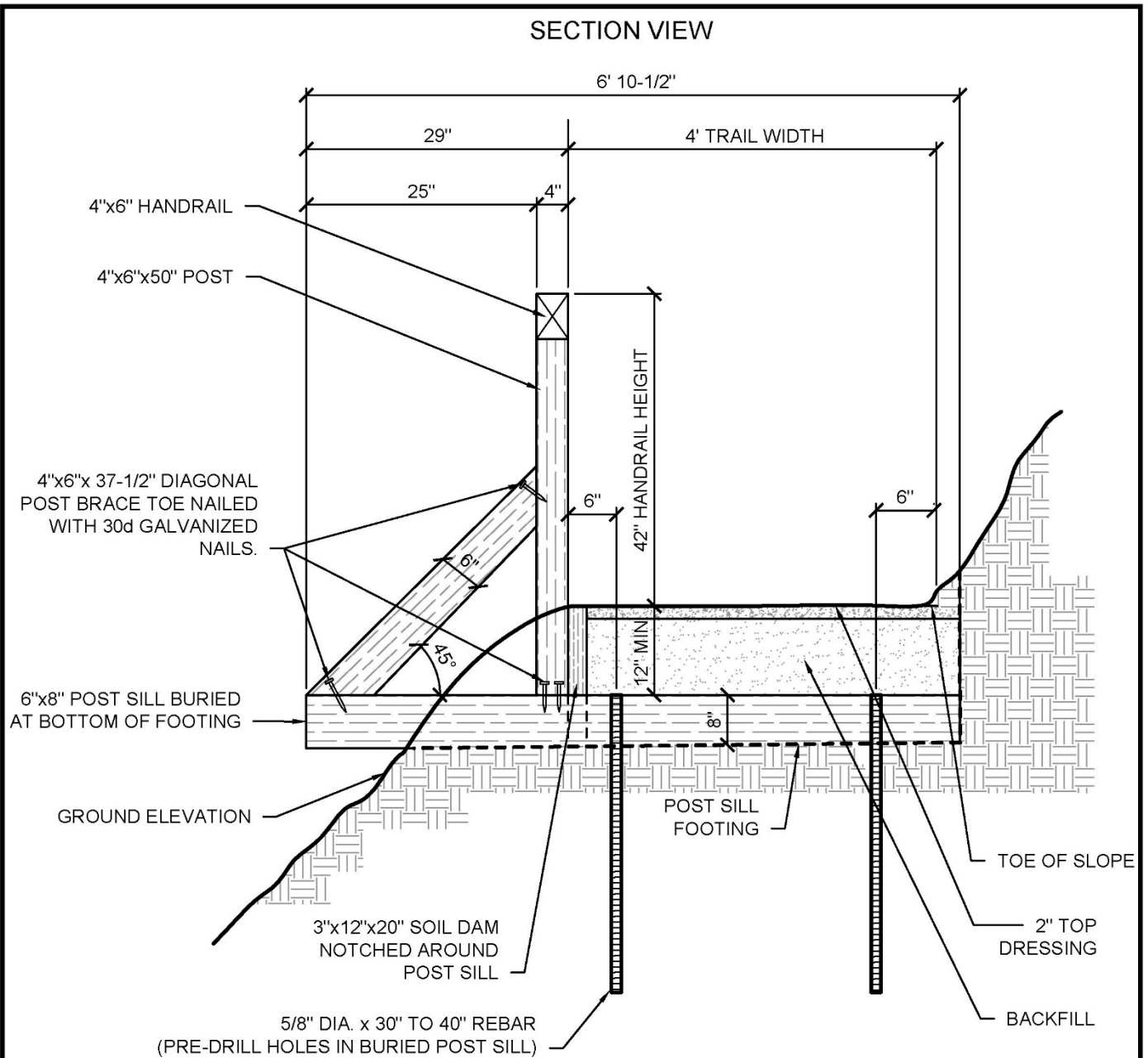
STEEL POST BRACKET
 CALIFORNIA STATE PARKS

NOT TO SCALE





Photo 18.3 - Railing with Buried Post Sills



NOTES:

1. USE PRE-DRILLED PILOT HOLES WHEN SECURING CONNECTIONS WITH 30d GALVANIZED NAILS.
2. PRE-DRILL HOLES IN BURIED POST SILL FOR REBAR.
3. BACKFILL SILL TRENCH WITH STANDARD CLASS 2 BASE AND COMPACT IN MAX. 3" LIFTS. ON TOP 2" OF TRAIL SURFACE, USE FINES AND CRUSHED EXCAVATED MATERIAL (ROCK) FROM TRAIL CUT FOR A TOP DRESSING WHERE POSSIBLE. THIS WILL BLEND TRAIL SURFACE APPEARANCE WITH TRAIL GRADING CUTS.
4. ON ROCK SLOPE EXCAVATIONS, CUT BURIED POST SILL TO FIT AGAINST TOE OF SLOPE. PLACE CUT END ON EXPOSED OUTSIDE END.

Figure 18.3 - Handrail with Buried Post Sills



HANDRAIL WITH BURIED POST SILLS

CALIFORNIA STATE PARKS

NOT TO SCALE

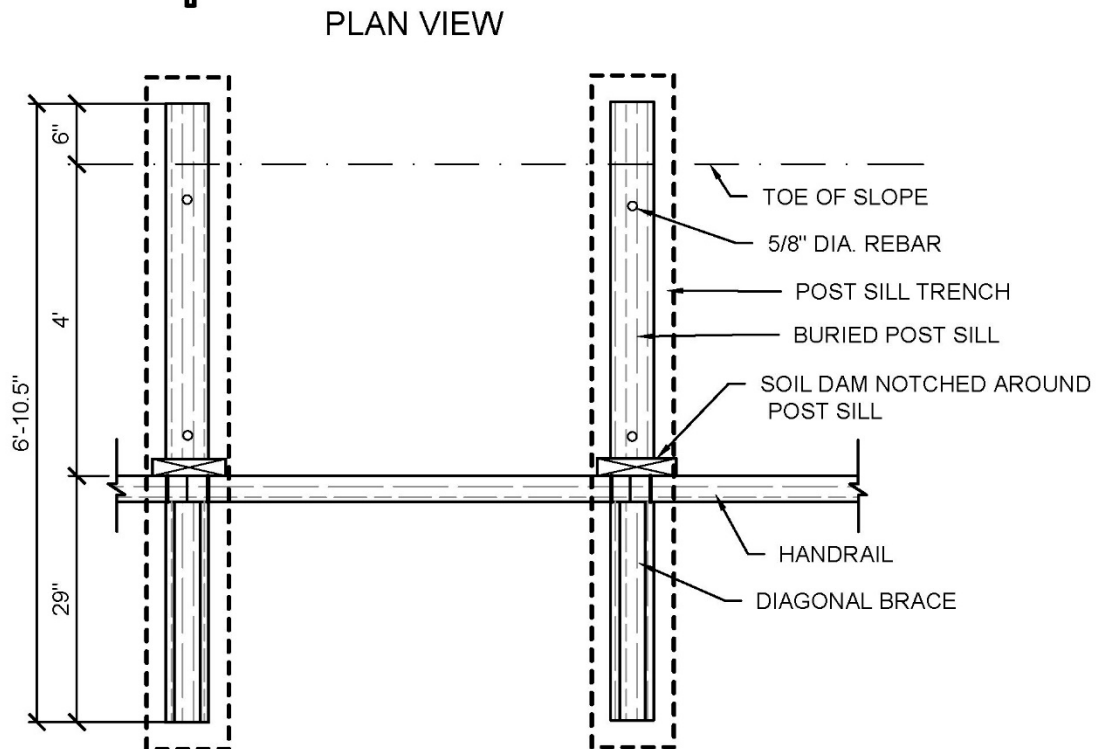
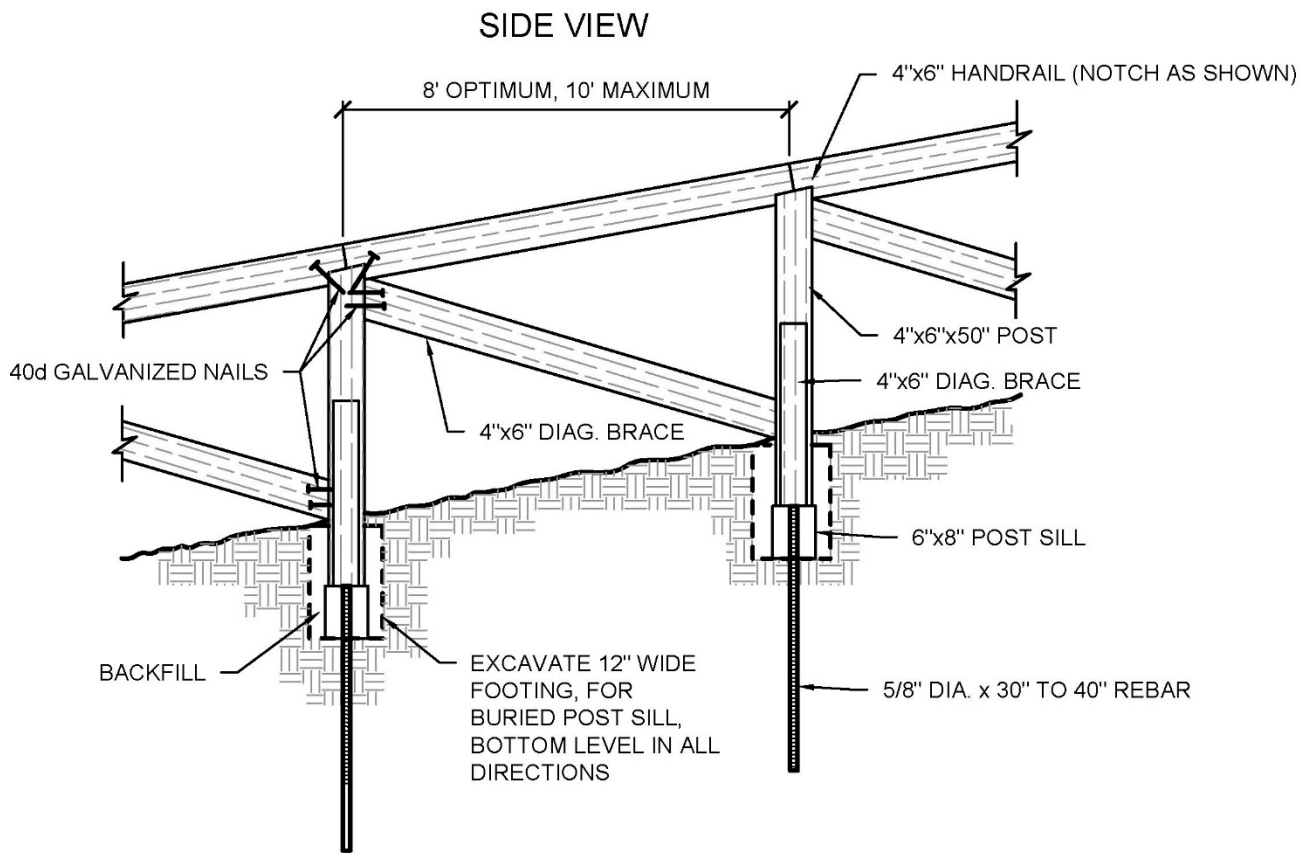


Figure 18.4 - Handrail with Buried Post Sills Continued



HANDRAIL WITH BURIED POST SILLS CONTINUED

CALIFORNIA STATE PARKS

NOT TO SCALE

18.2.3. Masonry

Masonry railings are used for aesthetic or historic design purposes. When this material is selected, the same principles for placement and design of wooden structures are followed. The minimum height of a masonry wall railing is 42 inches and the minimum thickness is 12 inches. Follow the principles of good masonry construction outlined in Chapter 13, *Retaining Structures*. (See Photo 18.3.)



Photo 18.4 - Masonry Railing

18.3. Railing Design Specifications

18.3.1. Equestrian Trails

Location and placement of equestrian railings follows the previous guidelines in this chapter. On multi-use trails and areas such as overlooks and trails where sufficient room is available for the passage of two horses, the height of the rail is 54 inches. However, in this second case, a diagonal mid-rail of equal size is used for additional structural support and user safety.

18.3.2. Accessible Trails

If a railing is located along an accessible trail, a railing height between 32 and 51 inches should be considered for use at vista points to allow users in wheelchairs to see above or below the railing. The height is measured from the top of the trail surface to the top of the railing. When a railing is planned for an area that is considered hazardous, incorporate a mid-rail, diagonal rail, livestock fencing, plexiglass, wire cables, or similar so a person in a mobility assistive device cannot accidentally travel under, over, or through the railing. On accessible trails, bull rails are installed on puncheon, bridge, and boardwalk structures. See Chapter 15, *Timber Planking, Puncheon, and Boardwalk Structures*, for further information on installing bull rails.