

POINT REYES NATIONAL SEASHORE



A WORK GUIDE
FOR
TRAIL CONSTRUCTION
& MAINTENANCE

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SECTION I

INTRODUCTION

The Hiking Trail System at Point Reyes National Seashore consists of 147 miles of maintained trails. These trails are classified into four different Trail Types according to their usage and each of these categories require different maintenance schedules. The four Trail Types are:

1. Corridor Trails - These corridors are used by service and emergency vehicles as well as hikers, horseback riders and bicyclists. The corridors consist of former ranch roads with an 8-10 foot travelway. These trails are maintained as roads.
2. Wilderness Emergency Fire Access Trails - These trails are designated in the wilderness legislation and are to be maintained suitable for emergency vehicle usage.
3. Hiking/Horse Trails - These trails are mostly former ranch roads and used primarily by hikers and horseback riders. The tread is 3-4 feet.

4. Hiking Trails - These trails are normally used primarily by hikers and only occasionally by horseback riders. The tread is 2-3 feet.

Maintenance of Type 1 trails generally consists of occasional grading, importing & spreading of gravel, ditching, culverts and brushing.

Maintenance of Type 2 trails may require occasional grading in places, but this would be done less frequently only when it becomes infeasible to perform corrective work by hand. Drainage will be by water bars and water dips maintained by hand. Brush control will be also accomplished by hand. Access is by foot, horse or bicycle.

Maintenance of Type 3 & 4 trails will be all done by hand and access by foot, horse or bicycle. This includes tread repairs, ditching, brushing and water erosion control.

Maintenance is further classified into the following sub-categories:

- L. Light - Routine maintenance. Includes cleaning water bars and dips, ditches, removing loose rock and slides, cutting windfalls, trimming and pruning, and the maintenance of tread surface.

- M. Medium - Includes construction of water bars, resurfacing, building minor bridges, repairing rock walls, constructing bog bridges, etc. on short sections of trail.

- H. Heavy - All that is included in medium maintenance, plus rebuilding major bridges, major fills, cuts and retaining walls.

- R. Reconstruction - All work under H above but on entire trails, usually done with construction funds..

TRAIL LISTING

	MILES	TYPE 1	SECTION
1.	1.7	McCurdy	A11
2.	1.5	Randall	A11
3.	10.9	Bolinas Ridge	A11
4.	6.1	Stewart	A11
5.	2.4	Glen	ST-GC
6.	3.4	Bear Valley	HQ-GT
7.	2.5	Coast	AYH-CC
8.	1.4	Sky	LR-SC
9.	4.0	Muddy Hollow Rd.	A11
10.	0.6	Muddy Hollow Tr. to PH	
11.	0.6	Kehoe Beach	A11
12.	0.5	McClures Beach	A11
13.	1.2	Marshall Beach	A11
14.	0.5	FAA Extension	A11
	<u>37.3</u>		

	MILES	TYPE 2	SECTION
1.	9.8	Ridge	ST-LR
2.	0.9	Glen	BV-ST
3.	3.7	Fire Lane	A11
4.	3.7	Lake Ranch	A11
	<u>18.1</u>		

	MILES	TYPE 3	SECTION
1.	13.1	Coast	CC- PAL
2.	6.1	Sky	BV-SC-CT
3.	1.0	Pablo Point	A11
4.	1.8	Teixeira	A11
5.	5.2	Olema Valley	A11
6.	1.1	Bolema	A11
7.	2.8	Crystal Lake	A11

	MILES	TYPE 3	SECTION
8.	3.1	Greenpicker	A11
9.	1.6	Glen Camp Loop	A11
10.	1.2	Ocean Lake	A11
11.	1.0	Baldy	A11
12.	1.9	Old Pine	A11
13.	1.5	Meadow	A11
14.	3.2	Horse	A11
15.	0.8	Mt. Wittenberg	A11
16.	2.2	Laguna	A11
17.	4.5	Inverness Ridge	A11
18.	3.3	Bayview	A11
19.	2.7	Bucklin	A11
20.	2.7	Limantour Beach	A11
	<u>60.00</u>		

	MILES	TYPE 4	SECTION
1.	0.6	Palomarin Beach	A11
2.	0.7	Woodpecker	A11
3.	0.5	Earthquake	A11
4.	0.4	Miwok	A11
5.	1.7	Woodward Valley	A11
6.	1.2	Muddy Hollow	PH-LB
7.	14.0	Estero	A11
8.	1.7	Drakes Beach	A11
9.	0.9	Chimney Rock	A11
10.	1.5	Abbott's Lagoon	A11
11.	4.7	Tomales Point	A11
12.	0.4	Lighthouse	A11
13.	4.7	Rift Zone	A11
	<u>33.0</u>		

147.4 miles

INDEX

ST - Stewart Trail
GC - Glen Camp
HQ - Headquarters

GT - Glen Trail
AYH - Point Reyes Hostel
CC - Coast Camp
LR - Limantour Road
SC - Sky Camp
PH - Pump House
LR - Lake Ranch Trail
BV - Bear Valley Trail
PAL - Palomarin
CT - Coast Trail
LB - Limantour Beach Trail

SECTION 2

MAINTENANCE & CONSTRUCTION

TRAIL PRISM

All trails will be maintained or constructed in accord with the Service-wide standards, and according to the class of trail and location. The back slope on cut sections will vary according to the soil composition, hardness and location.

Any part or all of a trail width may be built on, or retained by a wall of large rock, or the supporting slope may be benched enough to afford a stable foundation. See figure 1.

Where necessary to retain material on a steep slope, a masonry wall should be laid along the downhill side of the slope. The width of the wall at its base should be roughly $\frac{1}{2}$ of the height of the wall. The face of the wall should be battered or sloped-in approximately three inches to the foot. See figure 2.

In some instances, it may not require a full rock retaining wall as shown in figure 2. In this case, a toe wall may be built on the lower slope and fill carried up from that point. See figure 3.

Figure 1

TYPICAL TRAIL CROSS SECTIONS

AMOUNT OF BENCH VARIES LINEARLY WITH % OF SIDE SLOPE

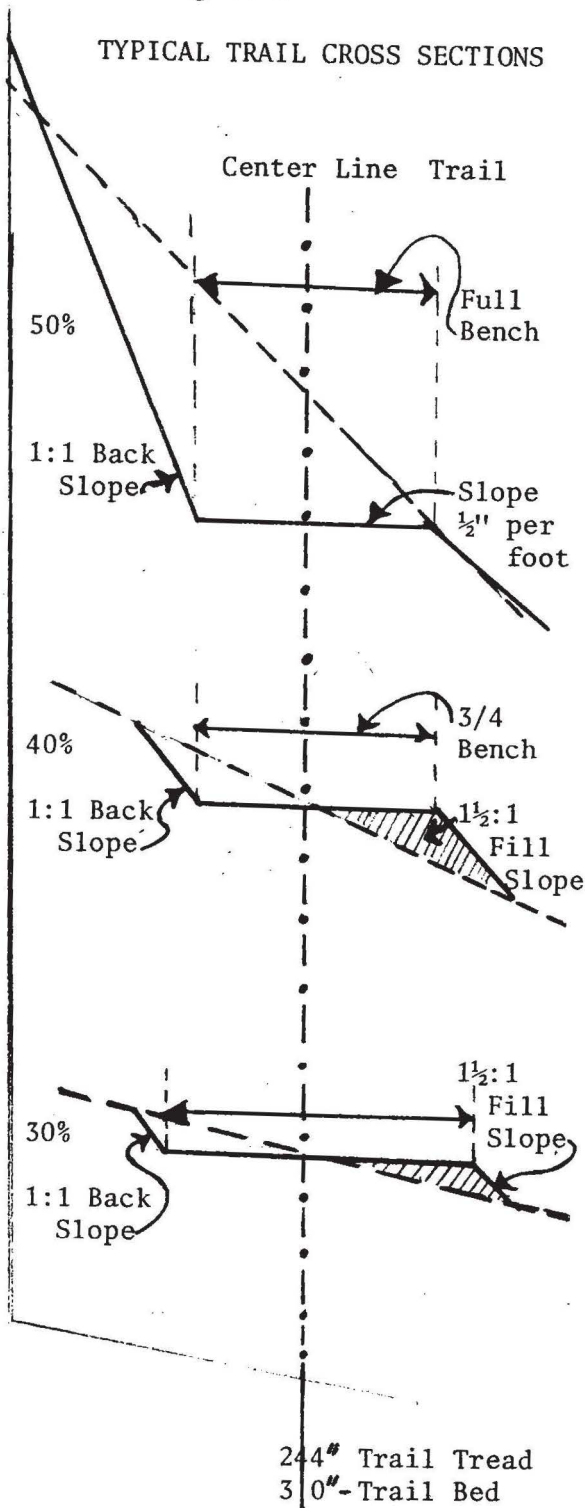
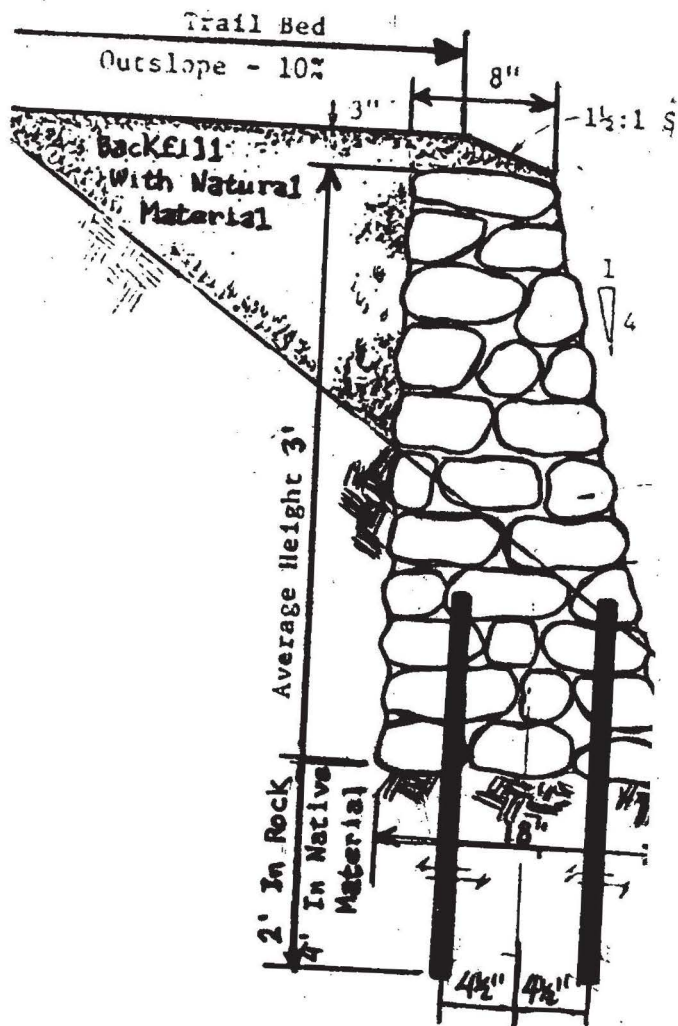
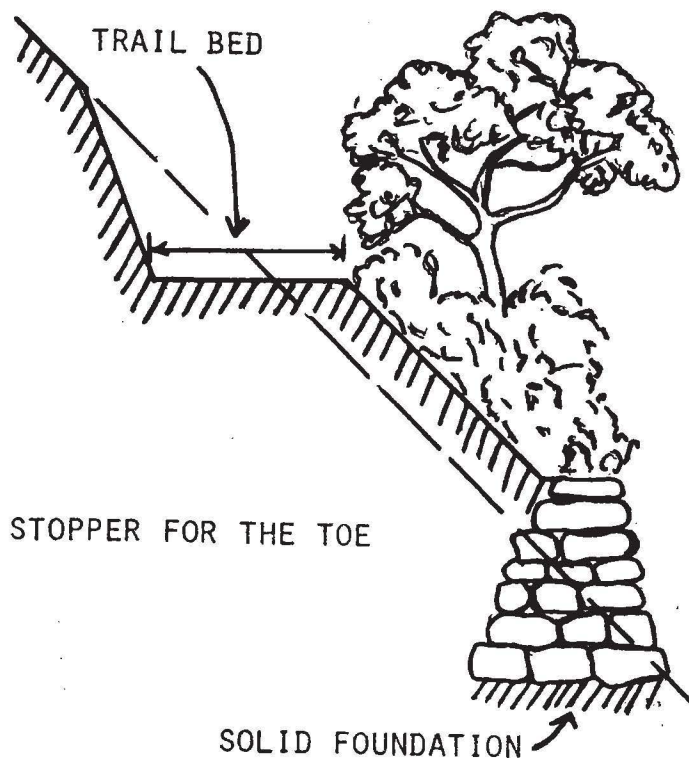


Figure 2



ROCK RETAINING WALL
(STONE MASONRY)

Figure 3



Particular care should be given to locating the beginning and end of the wall. Wherever possible, it should begin and end in some natural formation such as a large boulder or brush. See figure 4

A rock rubble wall should be utilized where possible to avoid an unnecessarily large cut slope section, or excessive blasting. When crossing an unstable slope, it may be necessary to construct a suitable dry rubble wall on the uphill side to retain and stabilize slide material above the trail. See figure 5. The surface of the trail on talus slope should be covered with dirt or other suitable fine material.

In the event that suitable rock is not available, pressure treated logs may be used to construct retaining walls. Logs must be secured and angled to hold slope into place. Retaining wall design shall be approved by the Park Engineer or Trail Foreman.

CLEARING

Clear and trim brush and trees to a sufficient height and width to provide unobstructed passage of the user for the type of trail. The required widths are:

1. Type 1 & 2 Trails - Trail tread 8-10 feet wide, brush clearing 10 feet wide & 10 feet high.
2. Type 3 Trails - Trail tread 4-6 feet wide, brush clearing

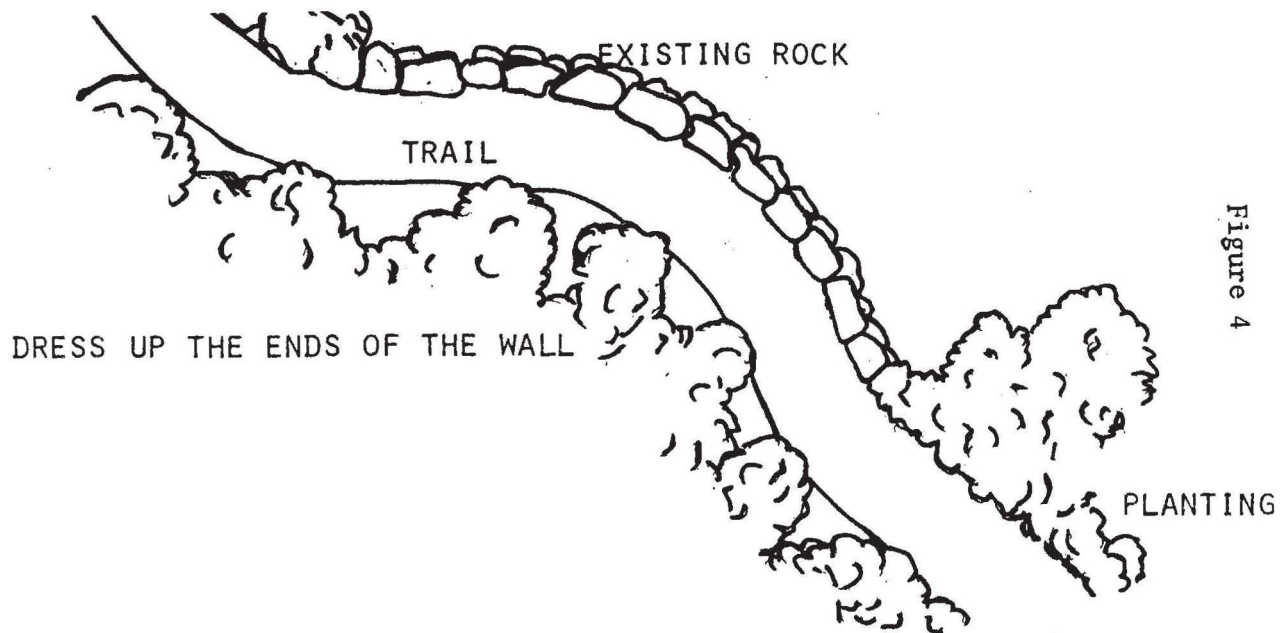


Figure 4

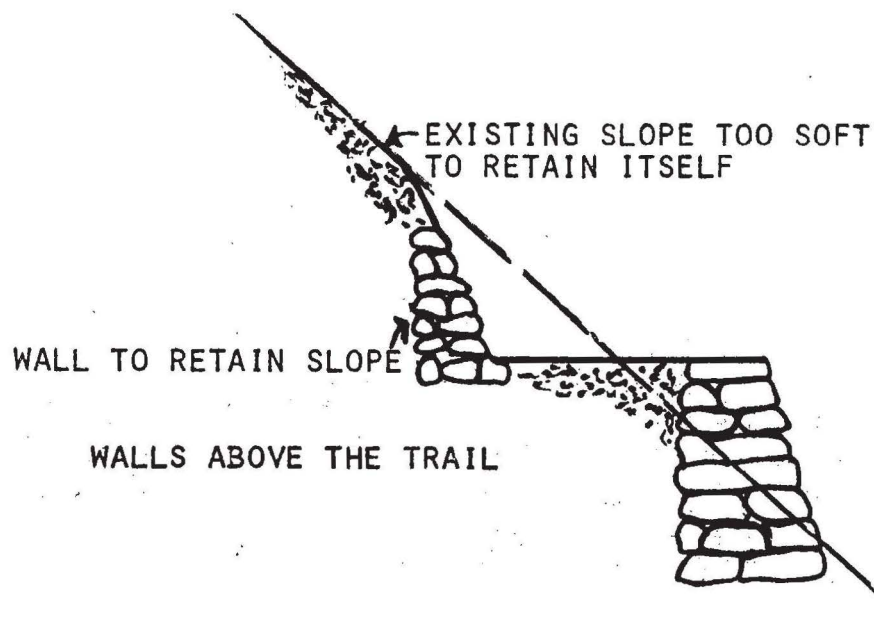


Figure 5

6 feet wide and 10 feet high.

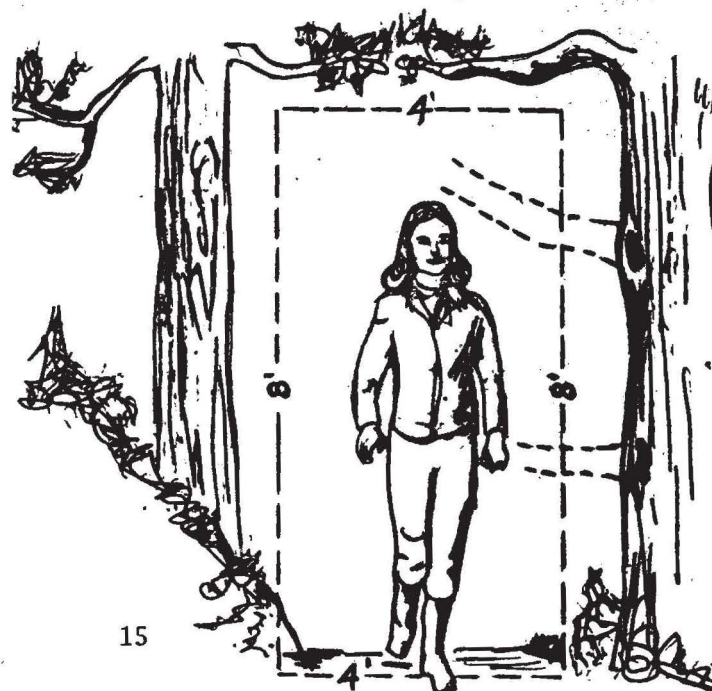
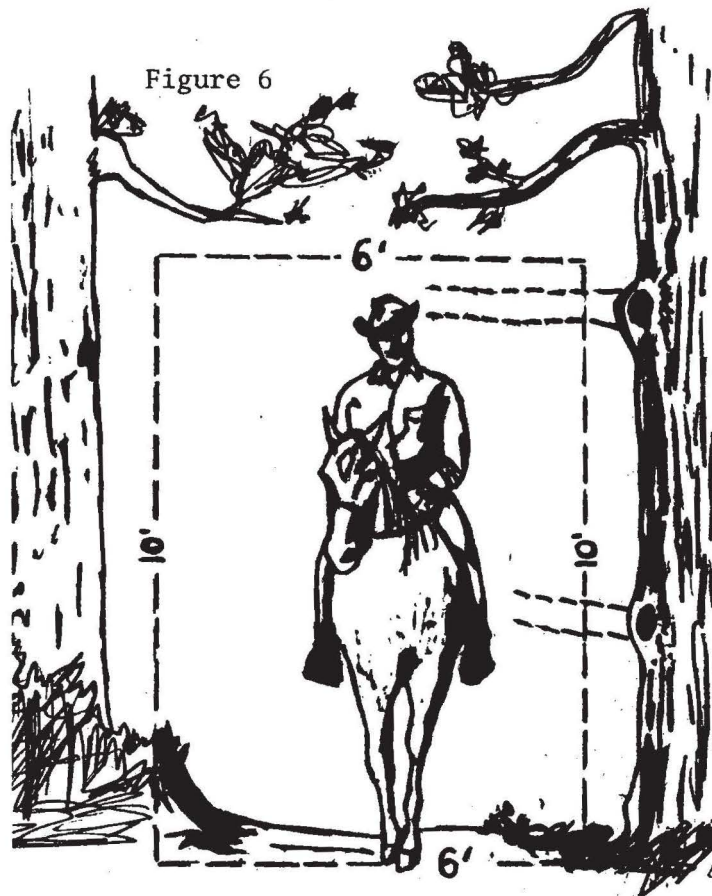
3. Type 4 Trails - Trail tread 3-4 feet wide, brush clearing 6 feet wide and 8 feet high. See figure 6.

BASE & SURFACE MATERIAL

In most instances, the material found in trail construction will be satisfactory for base material. However, if the material is composed of large amounts of topsoil and organic matter, this material should be set aside for use later as a cover and planting surface for exposed sub-soil. Usually a source of base material may be found by carefully removing deposited material below water bars. If the trail surface has been dished out from wear or erosion, don't overlook the possibility of using small rock for fill and covering with base material.

If no other source of material is available, borrow material can be obtained by opening a borrow pit in the vicinity but out of sight of the trail. The pits should be kept small and as shallow as possible. Do not attempt to remove too much material from any one pit. When finished, slope the sides, fill with unneeded rock and cover with organic material. Permission from the trail foreman should be obtained before opening a pit.

Figure 6



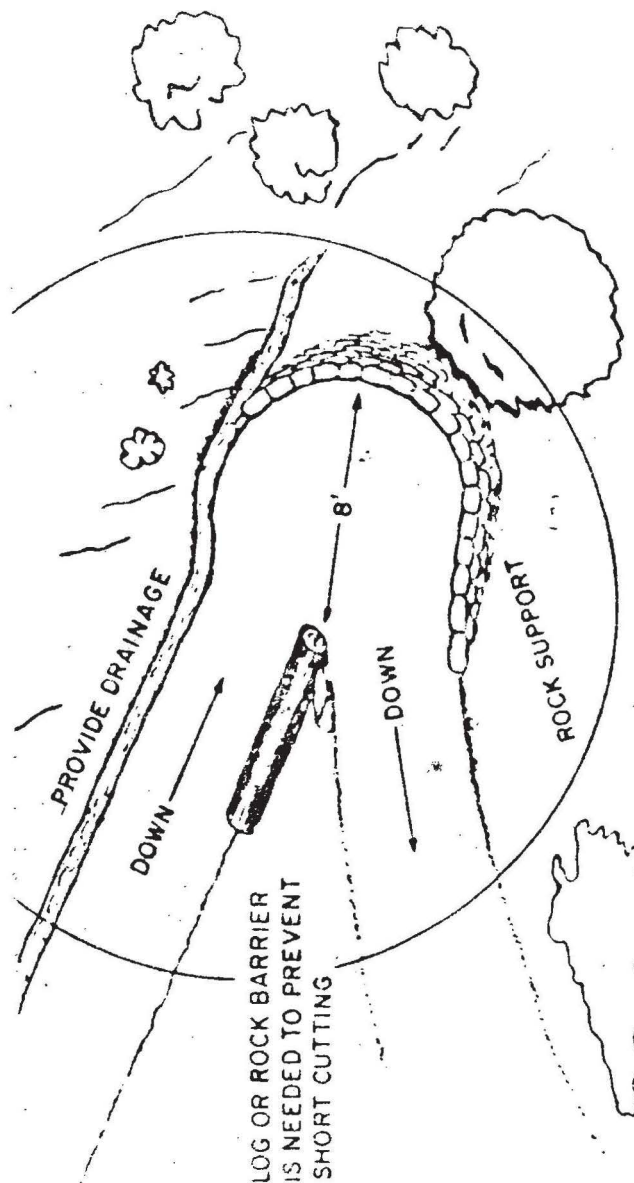
TRAIL GRADE

Trail grade is usually referred to in percentage and refers to the number of feet change in elevation per 100 feet of trail. The percentage of grade should not be more than that of 15% except in extreme cases, and should remain around 7 - 10%.

In short stretches of not over 150 feet, a grade of 18% may be used, providing a considerable cost can be shown, both from the standpoint of construction as well as maintenance.

Switchbacks can sometimes be used to a very good advantage where it is necessary to gain a considerable amount of elevation in a short distance. In considering switchbacks, consider if switchbacks are the only solution. A longer traverse is preferable if possible, as visitors have a tendency to short cut the trail if a series of switchbacks are visible below. Disguise the turning radius into and out of the switchbacks by utilizing natural features, that is trees, rocks or brush. When switchbacks are used, sufficient room shall be provided for the turn to be made on level ground, if at all practical. See figure 7. This may involve cut sections, fill, or retaining walls. The turn should be large enough to enable a horse to negotiate the turn, unless horses are specifically prohibited from that particular trail.

Figure 7



One method that can be used on relatively steep sections of trail is the use of log check steps. See figure 8. These may be used to check the velocity of water flowing down the trail and in so doing, it can also serve as a step for gaining elevation and a break in grade.

DRAINAGE

No factor in trail construction is more important than proper drainage, as many sections of good trail are damaged and destroyed by erosion that could have been prevented. All drainage should be planned ahead and the method of carrying surface water off of each trail section determined in advance.

Three general drainage conditions are encountered in trail maintenance and construction. They are: sheet water, water concentrating in natural basins and water in natural channels. Large channels are not considered here and will require bridges.

Sheet Water: This results when water comes onto a section of trail from a supersaturated uphill slope. This water does not concentrate in drainage channels, but flows over a large area in sheet. In some cases, it may be necessary to concentrate this sheetwater into channels by cutting collection ditches, screened if possible, across the face of the slope, bringing all water into one ditch,

Figure 8

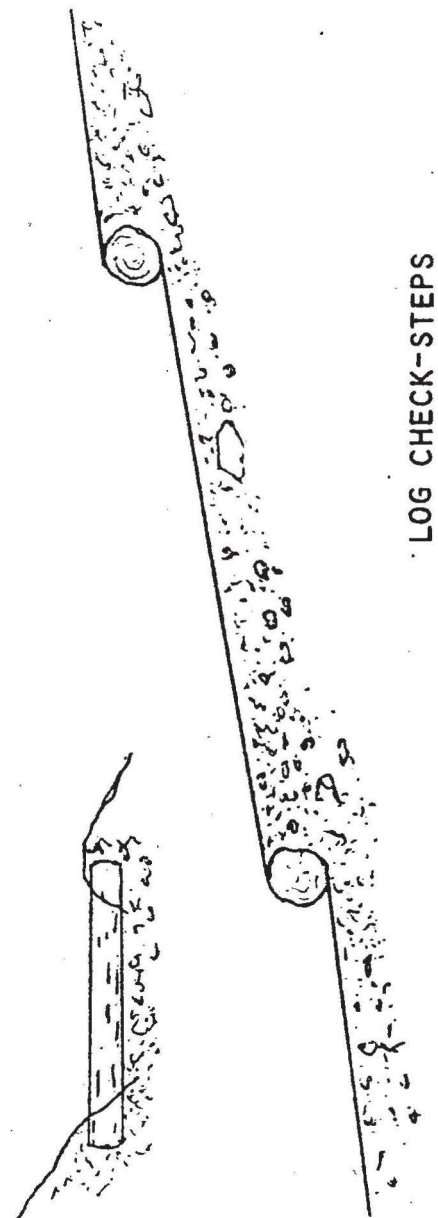


Figure 9
WATER BAR PLACEMENT

then carrying the water across the trail by means of a water drain, water dip or water bar. See figure 9.

Water Concentrating in Natural Basins: Since many trails follow the natural topography of the country they traverse, they will naturally go up and down hills and across meadows. These meadows may collect water from a watershed of considerable size and may be very boggy. In the event that the trail cannot be constructed around the bog area, drainage ditches will have to be constructed to drain off the water or in severe cases; a turnpike trail or bog bridge will need to be constructed. See figure 10.

Natural Channels: Surface water in channels should not be forced to concentrate in such an amount as to cause cutting and erosion. Several water bars, dips or drains are recommended over a few large ones. The placement of these erosion control devices varies directly with the percent of slope of the trail. See figure 11.

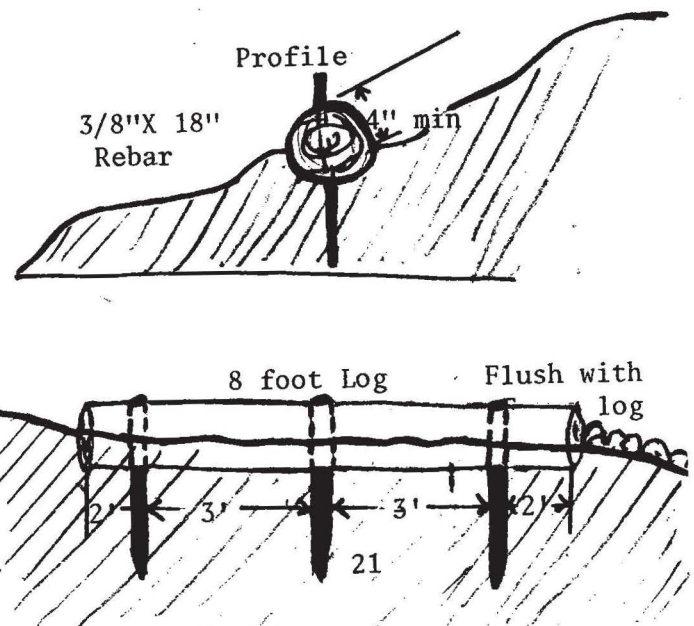
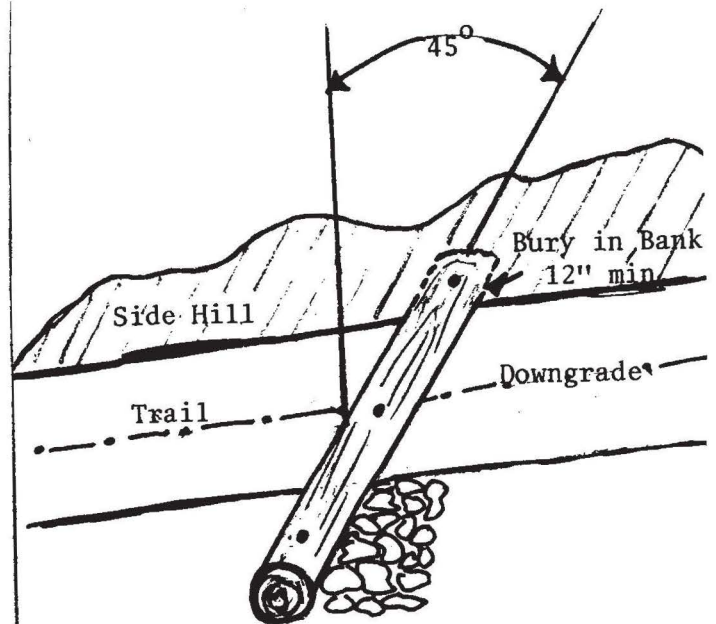
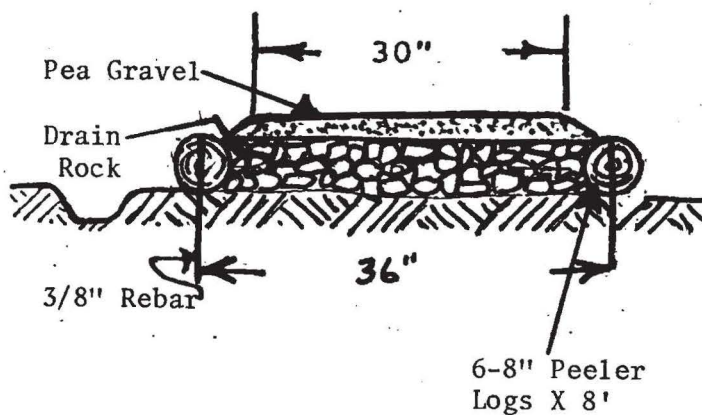
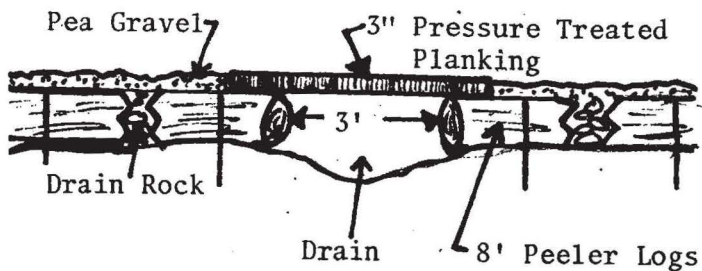


Figure 10



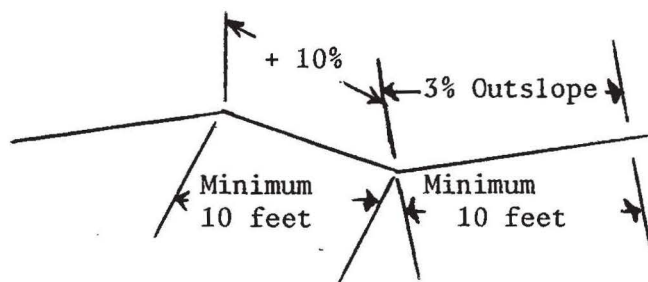
TURNPIKE TRAIL

Figure 11

MAXIMUM ALLOWABLE SPACING
FOR DRAINAGE DIPS

Trail Gradient Percent	Maximum Spacing Feet
1 - 3	1000
4	750
5	600
6	500
7	400
8	380
9	330
10	300

Drainage Dip Plan



TRAIL MANICURE

The ideal trail is one that appears to have been in place for a long time, with natural conditions prevailing along the sides that exhibit no signs of axe marks, freshly cut stumps, raw banks, berms, or freshly broken rock. Any limbs cut should be cut back flush with the tree trunk, brush should be grubbed out and disposed of out of sight of the trail, but scattered, not stacked. To prevent a slash buildup and accelerate decomposition, brush should be cut into small sections for disposal. Stumps are to be dug out and the holes filled in. Excessive rock should be disposed of in the same manner as brush and limbs. Cut banks should be dressed up and where possible, covered with natural topsoil and seeded.

SECTION 3

WORK ORGANIZATION

WORK CREWS

The ideal size for a volunteer Trail Crew is between 8 - 10 workers; this number allows for sufficient manpower on the more demanding tasks, and will easily break down into two 4 - 5 person work units along the same trail.

There should be one individual from each volunteer work group that acts as the liaison between the volunteers and the National Park Service. This representative will inform the Park of work dates, times, trail(s) to be worked and the number of volunteers expected; in turn the Park's coordinator will insure that work assignments are outlined, tools and materials necessary are made available and transportation to and from work sites is arranged.

At the completion of the work day(s), the volunteer representative will be required to fill out a daily work log that outlines the work accomplished, materials used, and outline future work needed to complete the project.

WORK GUIDELINES

1. Organize the work so as to leave every section of trail complete and finished as possible.
2. Use should be found for as much disturbed material as possible. On every trail, there are points where excess material must be removed, and sections where material will be needed. Rock and soil removed from a cut on one section can find a use as a fill at another, etc..
3. There is no reason why a trail must be worked progressively from beginning to end. Repair the most needed section first. Work the cut sections, and then work the fill areas. Install water diversions before working trail surfacing, allowing for natural drying and easier working conditions. If two crews are working along the same trail, place them on work assignments so as to allow them to exchange equipment and materials.
4. Clean up and finish trail sections along with construction and maintenance work as the work progresses. Postponing trailside cleanup and finishing until later is a poor procedure; it seldom will get done.

SAFETY

Safety is the number one priority in all volunteer trail operations. Safety is the responsibility of all personnel, especially the Work Leaders and the Trail Foreman. Every tool is a potential source of injury. Every Work Leader should learn and teach to his/her crew safe work habits and practices and see that these habits and practices are adhered to.

All Volunteer Trail Workers will be required to wear: long sleeve shirts, long pants, gloves and ankle high boots. Hard hats will be issued and should be worn while performing trail maintenance or construction work.

LIFT IT RIGHT

Put one foot alongside the object, and one foot behind.

Keep your back straight.

Get a good, firm grip with the palms of your hands. A finger grip is much weaker and can easily slip.

Draw the object close to you, and be sure your body weight is centered over your feet.

Lift straight up by straightening

your legs. This will put the strain on the stronger leg muscles and not the back muscles.

Avoid twisting as you turn with a load. Shift your feet instead. If you intend to lift and turn with a load, point the forward foot in the direction of movement before you lift.

Don't try to lift something above the waist level in one motion. Set the load down on a stump or rock, then change your grip for lifting higher.

Putting the object down is easy, and it can be just as safe. Simply follow the lifting procedure - but in reverse.

CARRY IT RIGHT

Be sure to have firm footing. Watch out for tripping or slipping hazards in your path.

Be sure you can see where you are going no matter where you are - especially on steep slopes.

Don't let a light load make you careless. A sudden move or twist can still cause you to pull a muscle.

Carry water bars, lumber and heavy sacks on your shoulder. Keep the front end high and be aware of

where you are going and the length of the extension.

When you hand an object to another person, be sure that they have a good grip before you let go.

If two or more carry a load, decide ahead of time how to handle it. Check your route for obstructions and hazards - communicate with each other.

HAND TOOLS

Use the right tool for the job. Substitutes can damage work - and they can be dangerous.

Keep tools in good condition, don't throw them to the ground, set them down and carry a file and spot sharpen the cutting edges throughout the work day.

Carry all tools with the appropriate guards in place.

At the end of the work day(s), all tools will be cleaned, sharpened, lightly oiled and properly stored.

CHOPPING TOOLS

Axes, adzes, brush hooks, hatchets, pulaskis and McLeods.

Select the best tool for the

conditions. Make sure that it is in good condition, secure and sharp.

When walking, stay at least 6 feet away from your companions.

Protect the edges with a sheath during transport to and from the work site.

Carry the tool in hand on the downhill side when walking in steep terrain.

Never cut towards any part of your body or towards another worker.

Keep a distance of 10 feet when working.

Do not use excessive power when chopping, take several strokes; be aware of the compression and tension of material being cut.

When you must cut between your feet, spread them wide apart. Cut with extreme caution.

When trimming limbs from fallen trees, stand on the opposite side of the trunk.

Be alert at all times, do not let your mind wander from the job at hand.

CUTTING TOOLS

Bow Saws

When inserting a blade in a bow saw frame, keep hands and fingers in the clear when the tension lever snaps into or against the saw frame.

Carry the bow saw over the shoulder with the blade to the rear and guarded.

Files

Equip files with handles and knuckle guards before using on cutting edges.

Wear leather gloves when using a file to sharpen cutting tools.

Discard worn files.

Keep files free from grease, discard files with hard spots.

Bars

Secure fulcrums and toeholds to avoid mashed fingers and toes.

When prying, grasp bar to place it, then push with palms. Keep

foot or other part of body
out of line with the bar.

Lay bar flat and in the
clear when not in use on the
job.

Discard bent or twisted bars.

When applying leverage, keep
body out of danger in case
pry blocks, or load should
slip.

Shovels

Should be kept sharp.

Should not be used as a pry
bar.

Legs should be used as the
fulcrum.

Before using, check handles
for cracks, splits and
slivers; discard if defec-
tive.

Chain Saws

Volunteers operating chain
saws must be checked out by
NPS personnel and certified
as operators before using
chain saws on trail work.

POISON OAK

The Point Reyes vegetation abounds
with poison oak. Be able to
identify poison oak in all stages
of growth. If contacted, wash
areas with Oak and Ivy soap in luke
warm water. Wash all clothes in
hot, soapy water. When working in
or near poison oak, wear long
sleeves, and gloves; avoid touching
face or neck with gloves. If
severe sensitivity exists, notify
supervisor before starting work
assignment.

PUBLIC RELATIONS

While the primary duty of trail
workers is trail construction and
trail maintenance, you
will have frequent contact with
park visitors using the trails.
Be courteous at all times, answer
all questions briefly but politely.
If you do not know the answer, refer
them to someone who does, if possible.

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