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TRAIL BUILDING AND MAINTENANCE GUIDE

!!! This manual is intended as a guide and a reference for you to get acquainted with trail work before hitting the trail. All trail maintenance projects must first be authorized by the Jackson Ranger District. You must contact us before doing any trail work on the forest!!!

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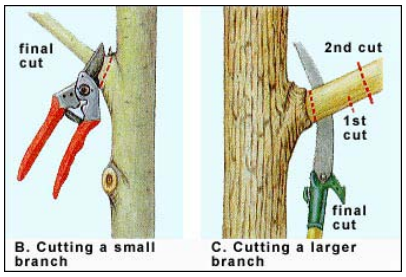
Clearing Trail Corridor:

1. How wide, how high?
    - There are specific U.S.F.S. standards for trail widths and heights, generally about 8 ft. wide and 10 ft. high, however these can be varied based on several different factors. Be sure to check with U.S.F.S. trail workers before deciding how to cut the corridor.
        1) *Vegetation type and growth rate*- Some species do not grow over a certain height or width and are not typically a problem in the corridor such as flowers or berries. These can be left to help enhance the natural beauty of the trail. However, tree saplings in the corridor should be removed. Species that grow very fast such as willows should also be removed or heavily trimmed.

2) *Type of Users*- Consider who is using the trail. Equestrians need a wider corridor and more importantly a higher trail ceiling, usually at least 10 ft. high. Hikers do no not need as high or as wide of a corridor so if it is exclusively a hiking trail, the corridor can be tighter. Mountain bike trails lie somewhere in between as they need good sight distance around corners and room to maneuver around obstacles.
3) *Speed of Users*- This mostly applies to mountain bikers. A tighter corridor will slow bikers while an open corridor will invite more speed.
4) *Number of Users*- Trails with high amounts of traffic need a larger corridor to allow for passing and visibility around corners.
5) *Maintenance frequency*- If this trail typically only gets brushed once every few years cut the corridor wider and higher to allow room for growth. If it gets brushed every year, cut the corridor to the exact parameters.

2. Trimming and cutting branches
   - Be sure to use the proper tool when cutting brush and limbs. If the vegetation is clearly too thick for loppers, use a pruning saw. Conversely, use loppers for small brush rather than trying to mow it down with a pruning saw.
   - The thickened section of bark just outside the spot where a branch joins the tree is called the "bark collar". When cutting branches, always cut just to the outside of this. Make sure it is cut flat and not pointed in any way as this could injure other passing users.



   - When cutting large branches, make a partial cut underneath before cutting down from the top. This will ensure that the cut is clean and doesn't strip away bark when it falls.
   - Place all cut brush as far away as possible from the trail corridor, at least out of sight, with the butt end facing away from the trail.

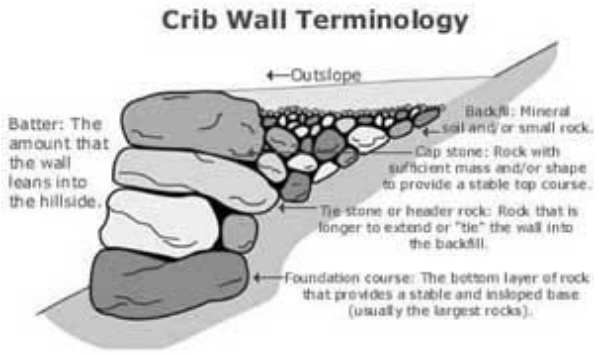
Rock Work

1. Do I remove the rock or leave it?
   - It depends. On bench cut trail on side hills, remove the rocks from the inside edges. These will only push users to the outside edge of the trail and cause the tread to creep downhill. Placing rocks at random places on the outside of the tread however can serve to keep users in the center of the tread. Be sure to dig

these in well and make sure they are large enough to stay in place. Do not line the outside edge with rocks as this will cause water to get trapped on the tread.

- If you are on a horse trail, rocks that are too large can cause a slipping hazard for horses and should be removed and filled with gravel and dirt. Sharp, pointy rocks should also be removed as they tend to force users off the trail.
- If a rock is loose, it should be removed.

2. Transporting rocks for structures
    - Find the appropriate rock for the appropriate spot. Take measurement s if necessary to ensure that you do not waste your energy moving a rock that doesn't fit.
    - If you are retrieving a rock for a rock wall or to help support a structure, ask for help and go big. When building with rock we want these structures to last forever so find a big, solid rock that won't move even if kicked or stepped on.
3. Building rock walls
    1) *Choose your rock*- Go big! The sheer weight of a larger rock lends greater strength to the structure. If you can lift it by yourself it is probably not big enough. Also be sure not to grab weak or crumbly rock such as decomposed granite. This type of rock will only break down and most likely fall apart while being transported to the structure. Look for rocks that are angular rather than round.
    2) *Excavate a footing*- This may be the most important part of your wall. A poorly excavated footing will only fail under the weight of the wall. Look for natural objects on the slope to anchor in to such as an already existing boulder. Be sure your footing is actual solid ground and not just excavated fill. Very Important!!
    3) *Lay a foundation course*- This should consist of some of your largest rocks as the whole wall will be supported by them. Spend time getting them to fit together and minimize the gaps between them. Make sure the rocks do not wobble or shift at all.



    4) *Building the wall*- While laying your courses, concentrate on splitting the gaps or breaking the joints. This means laying your next rock directly above where the two rocks below it meet. Think of a brick wall. Take your time and find the rock that fits without any teetering. Move the rocks around and if it isn't working, start over and try different combinations. A little patience now

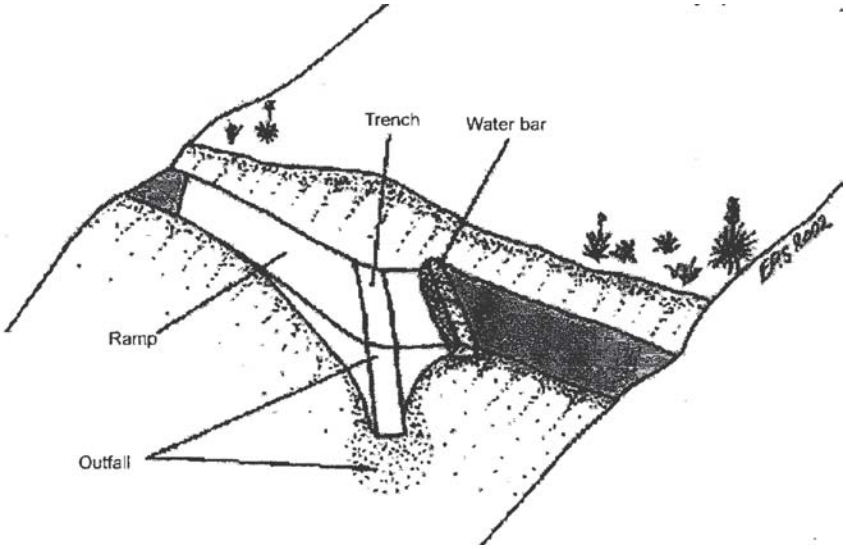
will make the difference in your wall lasting a year or a hundred years. Use smaller angular rocks to fill any gaps as you go. Do not rely on smaller rocks to keep a larger rock in place.

5) *Anchors or header stones*- In each layer of your wall, place a longer rock perpendicular to the wall itself so that it extends into the bank behind the wall itself. This serves as an anchor into the hillside and will help the stability of the wall.
6) *Inslope your wall/batter*- While building, be sure to try to match the slope of the hill you are working on. A wall that is too vertical will be pushed over eventually by gravity and pressure from the trail. This angle is referred to as batter. The batter should never be shallower than 4:1, which means an inward tilt of 1 foot for every 4 feet of height. A batter of 2:1 is better in most cases.
7) *Backfill*- After each layer that you add, fill in the space behind the rocks with gravel and mineral soil. Compact the gravel by tamping it with the bottom of your pick or Pulaski. Be sure to keep any organic material out of the backfill.
8) *Capstones*- Find the best large, flat rocks for the top layer of the wall. The heavier the better as their weight will help hold everything together and ensure that they will not be kicked off the trail. Fill in behind the rocks with backfill and finally a layer of dirt to serve as the tread surface. Fill any remaining holes in the wall with smaller angular rocks.

<u>Water bars/ Reinforced Grade Dips</u>

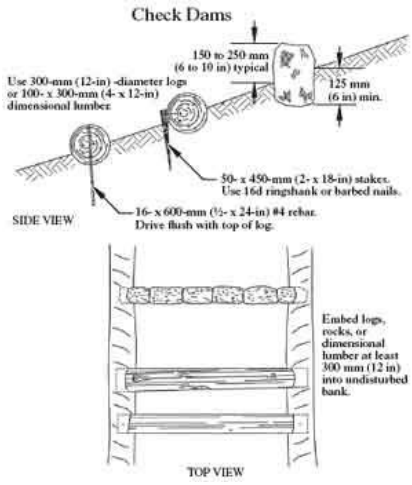
1. *Location, location, location!*
    - Look at the lay of the land. Look for places where water would exit the trail naturally if it had an outlet. Go out on the trail during or just after a rainstorm and it will be evident where the water wants to drain.
2. *Reinforced grade dips*
    - Water bars themselves are the most failed structure on trails. By design, the water hits the bar and is turned, which slows it down. This causes sediment to be dropped in the drain, clogging it and rendering the bar useless. This is why we have gone more to building reinforced grade dips.
3. *Ideal log waterbar/reinforced grade dip anatomy*
    - Essentially a log reinforced drain dip. A constructed grade reversal in an existing trail, not a log barrier!

- Log should be green, 10-12” in diameter and peeled. FS personnel only will fall trees for bars.
- Bar is buried completely, at least 36” down trail from the bottom of the drain dip.
- Set bar at 45 degrees, less or more to match the force of the water.
- Use well tamped soil or crushed small rocks to reinforce the log.
- The top of the bar should be level with the original surface of the tread on the downhill side.
- Build broad gradual ramps, 15-30 ft in and out.
- The ramp and backramp should form a well out sloped broad apron, not a ditch, that sheds water well before the bar.
- Dig a 24” wide outfall ditch that carries water to a point 12” below trail grade.
- Mound and tamp dirt on both sides of the bar to help reinforce it.
- Place guide rocks or logs at the ends of the bar to keep users from going around.



Checkdams

- Checkdams are wood or rock structures buried perpendicular to the trail in order to trap soil being washed down the tread surface. They should be installed in conjunction with water bars in order to stop a trail gully from deepening.
- Checkdams should be long enough to extend into the banks at least 1 foot and are similar to water bar installation. Dig an appropriate size hole and make sure it is deep and wide enough so that the log sits flush with the ground.



- Fill the gaps next to the log with small rocks, and use another rock or the butt end of a tool to hammer rocks into the spaces. Fill in and tamp with the excavated dirt from the hole.
- Anchor the ends of the checkdam with either wooden spikes or large rocks.
- Be sure to leave at least two inches exposed above the ground on the uphill side to slow or stop water coming down the trail.

Digging Bench and Switchbacks

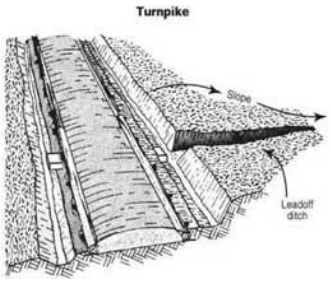
- A full bench trail is constructed by cutting the full width of the tread into the hillside, which is about one Pulaski length. The entire tread is dug down to compacted mineral soil.
- Full bench is preferable in almost all cases as it is far more sustainable in the long term.
- On flat ground, full bench construction is not needed and more of a partial cut can be done.

1. *Clear debris and mark tread line*
   - Before digging, be sure to ask FS employees how the tread has been flagged as this can differ. Sometimes the top of the cut is flagged, sometimes the centerline, or sometimes the bottom edge of the tread.
   - Scratch a line between flags to help serve as a guide and then clear away topsoil and any organic material down to the mineral soil. Broadcast organic material as far as possible down the slope.
2. *Cut the backslope*
   - The backslope is the uphill side of the tread where it blends into the slope above the trail. It is very important to match the backslope of your tread to the existing slope of the land.
   - Use a grubbing tool to dig into the slope and broadcast all material as you dig. Do not pile up dirt on the bottom side of your tread! This is not stable and will not last through the years of use!

- Pay attention as you dig! Following the flag line is very important as any deviation could affect the grade of the trail. Create a solid, slightly out-sloped tread.

3. *Disperse downhill debris*
    - Use a shovel or mcleod to pull down all lose dirt and debris from the bottom edge off the trail. Disperse debris as far as possible so that underlying plants can come back.
    - After dispersing debris, re-check your bench and see just how wide and solid it is. Take the time to dig further if necessary and make it right!!

Building Turnpikes



1. FS personnel will fall trees and cut to length. Peel all bark off the logs using drawknives.
2. Transport logs to the site using log carriers, webbing, or roll on small logs. If there is sufficient rock, use it instead of logs as it will last much longer.
3. Dig ditches for logs to rest in, place logs and pin with spikes or rocks. Make sure logs match up and are stable.
4. Dig drainage ditches on the uphill side above the turnpike, along the entire length of the logs. Make ditches at least 1 foot wide and deep enough to be below the level of the existing tread. It is important to lower the water table below the trail base in order for the turnpike to work. Ditches should lead into some sort of culvert (rock or wood) under the turnpike, and out the other side.
5. Lay geotextile fabric in bottom of the turnpike and fill with rock. Start with larger rocks and move to smaller rocks as you go. Arrange them so as to minimize any gaps.
6. Close geotextile fabric over the top like wrapping a burrito. Pin down with rocks and fill with good mineral soil from a nearby borrow pit. Bring in enough soil so that the tread is elevated above the tops of the guide logs and is capped to help with surface drainage.