Woodland Roads and Sustainable Trails

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So you own some land and want to explore recreational opportunities and benefits...
What would you like to provide and for whom?
Your answer could affect issues related to access, level of development, and liability.
Roads and Parking Areas

• Parking areas are simply a place to store vehicles.

• Roads can have multiple uses which will determine the construction standards that are followed and their level of development.
  – Transport people in vehicles or by foot to access different areas of the property.
  – Remove timber and other resources.
  – or all of the above.
Roads and Parking Areas

• Where do you want the roads to go and why?

• Do you need parking areas? Where should you put them?
Roads and Parking Areas

• Roads and parking areas should be engineered and designed by a professional.

• When more than one acre of land is disturbed, you must consider REGULATIONS.

• Check with your local government or NCDENR – Division of Land Quality.
Trails

- Trails can have multiple uses which will determine the construction standards that are followed and their level of development.
  - Transport people in numerous ways to access different areas of the property for a variety of reasons.
  - Hiking, equestrian, mtn. biking, ATV
  - Recreation and exercise, wildlife watching, education
Trails

• Where do you want the trails to go and why?

• Who will be using the trails?
How are roads and parking areas different then trails?

• Roads and parking areas need to be engineered and designed with drainage structures to handle surface water.

• Trails can be designed to “shed” surface water.
We must work with the landscape to protect the resource and construct sustainable roads and trails.
Sustainable Trails
A sustainable trail . . .

- Supports current and future use with *minimal impact* to the area’s natural systems.
- Does not adversely affect the area’s animal life.
- Accommodates existing use while allowing only appropriate future use.
- Requires little rerouting and *minimal long-term maintenance*.

– NPS, Rocky Mountain Region, January 1991
A sustainable trail . . .

• *Protects* the environment.

• Meets the needs of its users.

• *Requires* *little* *maintenance*.

• Minimizes conflict between different user groups.

– IMBA
Who uses these trails?
How about these?
And these?
Erosion and Impact Problems

- Most erosion and impact problems can be directly attributed to trail design and not use.
- When building and maintaining trails it is imperative that you work with the natural surroundings rather than trying to control them.
- A trail should lay naturally on the land and compliment the natural surroundings – not detract from it.
Types of Impact

• Natural – **WATER**, wind, and gravity
  (We *can not* control these impacts, but we can work with them through proper trail design to minimize their effects.)

• User – biker skidding a tire, horse punching holes in a wet trail, a hiker walking around a puddle and widening the trail. (We *CAN* control these impacts through management decisions and proper trail design.)
Water, a trail’s worst enemy

- Volume and velocity

- When water droplets move together and form high volume and high velocity, trouble starts.

- Water should flow across the trail NOT down it. Volume and velocity should be kept to a minimum.
Fall-Line Trail

Water flowing down a hill will follow the path of least resistance, called the Fall Line.

Trails located on the fall line will be damaged by flowing water.
Sheet Flow

Above: An outsloped trail tread allows water to drain in a gentle, non-erosive manner called "sheet flow."
Rolling Contour Trail

A rolling contour trail is characterized by a gentle grade, undulations called grade reversals, and an outsloped tread.
Beware poor trail design.

- Reoccurring maintenance issues on existing trails can usually be attributed to poor trail design and not necessarily specific user groups (i.e., equestrians, mountain bikers or hikers).

- Users may contribute to the maintenance issues, but this impact can be controlled through education and rules and regulations.

- Poorly designed trails require constant maintenance which translates into more time and money for landowners over time.
The solution for poor trail design?

• The permanent solution for these reoccurring maintenance issues is to reroute the trails. Get them OFF the fall line.

• This is initially an expensive and timely solution, but in the long run it will take less time and money and also limit user and natural impacts.

• Reroutes should be considered for any trail that is not sustainable, whether it is in extremely poor condition or not.

• If a sustainable trail replaces a poorly designed one, not only will we protect the resource, we will allow it to recover.
What does all this mean??

• Do it right in the beginning, and spend less time in the long run for maintenance.

• SUSTAINABLE trail construction will be a one time job.
Designing the Trail

1. Decide who will be using the trail.
   - This will affect trail corridor width and height and tread width.

2. Look at a topographical map of the area.
   - Terrain
   - Control Points (cliffs, swamps, rivers, etc.)

3. Get to know the area.
   - Topo maps never seem to show exactly what it’s like in the field.
Designing the Trail

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Getting to Know Your Property

• Maps, maps, maps
Look for “Control Points”

• Control points tell us where our roads and trails will be constructed.

• If we don’t work with the land, we will create problems which will result in. . .
  – More time
  – More money
  – More impact
What are “Control Points”

- Rivers, creeks, and wetlands
- Steep slopes
- Cliffs
- Swamps
- Roads
- Property boundaries
- Old homesites, views, big trees, and other interesting cultural and natural features.
Rivers, creeks, and wetlands

• Where will you cross? (width of the stream, adjacent terrain features)

• How will you cross? (user group and access)

• Permits?
Steep slopes

- What is the grade (rise/run) of the sideslope you’re building on?

- What is the grade of the trail or road you are building?

- Steep slopes = BIG problems
Designing the Trail

1. Decide who will be using the trail.

2. Look at a topographical map of the area.
   – Terrain
   – Control Points (cliffs, swamps, rivers, etc.)

3. Get to know the area.
   – Topo maps never seem to show exactly what it’s like in the field.
Getting to Know Your Property

Get out in the field.

Maps never seem to show exactly what it’s like out there.
Designing the Trail

• Remember the “Rules”:
  – The 10% Rule
    • The average or overall trail grade should not exceed 10%.
  – The Half Rule
    • The trail’s grade shouldn’t exceed half the grade of the hillside or sideslope that the trail traverses.
Designing the Trail

Look at the **BIG** picture.
Questions??
Laying Out the Trail

What do you need?

- Topo Map
- Clinometer
- Flagging
- A Partner
What is grade?

Grade is determined by dividing the elevation gain between two points by the linear distance between them. Percent grade equals rise over run multiplied by 100.

Rise 10 Feet

Run 100 Feet

Grade 10%

10 ÷ 100 x 100 = 10%
Grade = 10%
Laying Out the Trail

• Using a Clinometer
  – Which side do I use?
  – What is level?

• Shooting the grade
  – % of grade = rise/run
  – % not degrees
  – 100% = 45 degrees
Laying Out the Trail

• Remember the “Rules”:
  
  – The 10% Rule
    • The average or overall trail grade should not exceed 10%.
  
  – The Half Rule
    • The trail’s grade shouldn’t exceed half the grade of the hillside or sideslope that the trail traverses. This is especially important for less steep trails.
10% Rule

Average Trail Segment Grade

Elev. 450 feet

Elev. 458 feet

Run = 100 feet

Rise = 8 feet

8 ÷ 100 x 100 = 8%

Average Grade = 8%

Trail Solutions: IMBA's Guide to Building Sweet Singletrack
Laying Out the Trail

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Half Rule

Trail Solutions: IMBA’s Guide to Building Sweet Singletrack
Sheet Flow

Above: An outslped trail tread allows water to drain in a gentle, non-erosive manner called "sheet flow."
Laying Out the Trail

What happens if I don’t follow the rules?

• Your worst enemy (water) will come back to haunt you.

• If your trail is designed, laid out, and constructed properly, you may “stretch” the rules, but . . .

• You **MUST** work with the terrain to get water off the trail.
What happens if I don’t follow the rules?
Laying Out the Trail
Surface Water Control

- Grade reversals
- Rolling grade dips
- Waterbars
Grade Reversal

A grade reversal is part of the trail design. It is put in during trail layout.
Grade Reversal
Rolling Grade Dip

A rolling grade dip is part of trail construction and maintenance. It is constructed if you didn’t plan your grade reversals correctly or you are maintaining existing trail. OR you break the “rules”.

Trail Solutions: IMBA’s Guide to Building Sweet Singletrack
Rolling Grade Dip
**Waterbars**

- A log, row of rocks, treated timber, mound of dirt or anything else that “lies” across the trail to divert water.
What are waterbars?

- A trail maintenance nightmare. Forget you ever heard about them.
Laying Out the Trail

• Determine what is level.
  – (Clinometer + partner)

• Remember the rules.

• Think about water.
A rolling contour trail is characterized by a gentle grade, undulations called grade reversals, and an out-sloped tread.
Trail Corridor

Trail Ceiling

Trail Tread

Trail Corridor
Laying Out the Trail

• Flagging the corridor
  – Knot should be on the side of the tree you want the trail built.
Laying Out the Trail
Getting ready for construction

• Walk the proposed flag line again and again and again. . . in both directions.

• Pin flag where you want the trail tread to be built.
  • Uphill, downhill, or centerline?
General Trail Work Specifications and Trail Standards
Constructing the Trail

• Brush Removal:

  – The trail corridor shall be cleared of all limbs, brush, vines and vegetation. Cut limbs should not protrude from the main stem. All branches should be cut just outside of the branch collar to promote sealing of the wound.

  – Vegetation cut from the trail corridor shall be moved at least 10 feet from the edge of the trail corridor. The cut end should not be visible from the trail.

  – Cut and removed brush and vegetation shall be placed close to the ground, not exceeding three feet in height. Brush should not be placed in piles.

  – In areas where an existing trail is to be abandoned and rehabilitated, the cut and removed brush and vegetation may be used to help accomplish this purpose.
Constructing the Trail

- **Tree Cutting:**
  - The trail will be aligned to avoid removal of trees greater than 10” in diameter where possible. Any trees greater than 10” the contractor believes need to be cut shall be approved by NCDPR staff.
  
  - Stumps located in the trail tread shall be **completely removed**. Those located in the trail corridor should be cut flush to the ground. Stumps and root balls that have been completely removed should be placed to minimize their appearance from the trail.
Constructing the Trail

• Trimming the corridor

  – DO NOT cut brush, small trees, etc. off flush at the ground.

  – Leave a “handle” to use for leverage to remove the brush.
Constructing the Trail

- Trail Construction:
  - Corridor width and height and tread width will be specified on the specification page for each project.
  - Unless otherwise specified, the trail shall be constructed with a “full bench cut”.
  - Excavated soil should be distributed downhill of the trail tread to prevent formation of a berm on the outer edge of the tread that will restrict the natural flow of water off the trail. The excess soil should be evenly distributed so it does not appear to be part of the trail tread. Excess soil should be covered with leaves and other organic debris to resemble the surrounding forest floor. The back slope should transition smoothly to the hillside above.
Full Bench Cut

[Diagram showing a full bench cut with labeled parts: Critical Points (Rounded), Backslopes (Gently blended), Sideslopes, and Trail Treads (outsloped 5%).]
Partial or Half Bench Cut

On a partial bench trail, only part of the hill is cut away and the soil that has been removed is placed at the lower edge of the trail to try to establish the desired tread width.

The section of trail tread made of fill soil is soft and not as durable as full bench trail.
Constructing the Trail

• Trail Construction:
  
  – All vegetative/root matter in all trail areas shall be removed. Large feeder roots should be covered with soil to raise the trail tread above the roots.
  
  – All trail tread shall be out sloped 3-5%.
  
  – The trail tread shall have a compacted mineral soil surface. Compaction should be completed using a mechanized tamper such as a vibrating plate compactor. The trail bed shall be shaped to leave an even, compacted, uniform surface free of indentations or protruding roots and stumps. The grading of trail tread, back slope, and drainage features shall be finished to a smooth, stable surface.
Outslope

Above: An outsloped trail tread allows water to drain in a gentle, non-erosive manner called “sheet flow.”

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Constructing the Trail (see handout)

- First, rake or blow leaves out of the trail corridor to use for later. Uphill works best.
- Next, cut out the trail tread. Remember the outslope.
- Cut the backslope.
- Outslope the trail tread. Trim small roots, remove “tripping hazards”, cover larger roots with soil.
- Compact the trail tread.
- Finally, rehab the site.
Constructing the Trail

• Hand tools vs. Mechanized equipment

• Work from the “inside out”.

• Safety, safety, safety!
Hand Tools

• Pulaski

• Fire Rake

• McLeod

• Shovels, loppers, garden rakes
Mechanized Equipment

- Mini excavator
- Trail machine
Constructing the Trail

Climbing Turns and Switchbacks

• Both are part of the trail layout.

• Climbing turns are laid out and built like trail.

• Switchbacks are “constructed”.
Climbing Turns

- Laid out and built on side slopes of 7% or less.
- Turn radius should be as wide as possible with a minimum of 20 feet.
- Grade reversals should be located immediately before and after the turn.
Rolling Crown Switchbacks

- Constructed on side slopes greater than 7%.
- Switchbacks should have a near level turning platform that is slightly crowned.
- The upper leg should be insloped at 5% and should create a drain extending well beyond the platform.
- The lower leg should be outsloped at 5% for proper drainage.
- Grade reversals should be located immediately before and after the switchback.

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Trail Closure and Rehab

- Block sightlines to the old trail.
- Install check dams on badly eroded trails.
- Break up old trail tread.
- Reclaim old trail with soil, rocks, debris, and plants.
Pinnacle Trail Closure
Alder Trail Closure
We can’t build new trails, now what. . .

• Maintain existing trails
  – Clean drainage “structures” *twice* a year (spring and late fall)
  – Construct rolling grade dips
  – Deberm the trail and reestablish a 3-5% outslope.
  – Construct knicks in low areas that hold water.

• Fix the problem, don’t cover it with gravel.

• Get the water off the trail.
Berm

Water flows down sideslope.

Berm develops on outside of tread.

Water trapped on trail.

Deberm the trail by scraping the mounded dirt off the tread’s edge, and reestablish a 5% outslope.
Trail Narrowing

- Think twice when cutting trees that fall across your trails.
- Use brush, rocks, plants, and logs to control the trail user.
- Make the trail interesting, and the user will have to pay closer attention to where they are walking or riding.
Old roads as trails.

- Most old roads were constructed for timber harvest and fire control. They were designed and constructed for short term use.

- These roads usually follow the “fall line” instead of the contours of the land.
Trailer Width

- Who is the trail user?
  - Hiker, horse, bike, ATV, pick-up truck, logging truck or multiple use

- Why do you (the land owner) need access to the trail?
  - Maintenance, forest mgt.,

- How often do you need access?
  - Twice a year or once every 5-10 years
Contracted Labor

• Professional trail builders are knowledgeable about current trail construction techniques and materials. This will result in increased efficiency and consistent work along the length of the trail project.

• It is important that trail work is completed in a timely manner due to the hazard the work may present to the public. Contracted labor can focus on the job at hand and complete it as quickly as possible.
Options for contracted labor

• Design
• Design/build
• Build
• Hybrid
PTBA: Professional Trail Builders Association

www.trailbuilders.org
American Trails

www.americantrails.org
IMBA: International Mountain Bike Association

www.imba.com
Any Questions???
Let’s See Some Trail...