Contents

Design Needs for Specific Non-Motorized Trail User Groups

In order to design a trail it is important to understand the type of trail you are designing and the intended users of the trail.

This chapter details the characteristics of each non-motorized trail type, their respective users, and the corresponding design requirements, as they vary between the different uses. This includes:

- Hiking Trails
- Mountain Biking Trails
- Shared Use Paths and Rail-Trails
- Rails-with-Trails
- Equestrian Trails
- Cross Country Skiing Trails
- Snowshoeing and Winter Hiking Trails

While this chapter details the characteristics and design requirements for each type of trail use, all trails should strive to be accessible. The last section in this chapter discusses the requirements for accessible trails. These requirements should be applied to all trails where practical, as required by law.

Chapter 3 discusses aspects of sustainable trail design that should be incorporated into your trails. Ultimately your goal is to prepare plans and specifications to communicate all aspects of the design to those responsible for building trails, amenities, and support facilities in a sustainable manner.

Allegrippis Trails at Raystown Lake
Huntingdon County

32 miles of sustainably planned, designed and constructed single track mountain bike trails.

Photo Credit: Lesile Kehmeier

Trail Design

Design and construction of trails is a complex combination of skills and should be accomplished by experts. Experience in trail design, construction, and management is essential for implementing projects that involve poor soils, complex topography, high levels of use, and extensive improvements, such as surfacing or structures. Experience is also essential for the design of multiple-use trail corridors that meet standards to allow for the safe use of a trail.

In addition to consulting experts in trail design and construction, it is important to seek advice from experts in resource disciplines. Two of the most common problems of backcountry trails, deterioration through overuse of popular trails and the development of undesired routes at popular destinations, can be avoided by drawing on personnel or outside experts with trail design and management experience and by following commonly accepted standards of trail design after thorough field study.

Observing proposed or existing routes through several seasons, including winter, will assist the planning team in determining the fitness of new corridors for trail development, as well as the level of improvement or rerouting required to achieve sustainability for rebuilt trails.

There are a variety of factors necessary for a sustainable, low-impact trail. By carefully fitting the trail profile to the local topography, erosion will be minimized, thus increasing the durability and sustainability of the natural surfaces.

Natural Resource Management Manual # 77[1]

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1   Natural Resource Management Manual # 77, National Park Service: 2006 available ***Here***.

User Characteristics and Design Requirements for Non-Motorized Trails

Hiking Trails

The development of hiking trails provides naturally surfaced routes for pedestrian use. These trails offer hikers and joggers the opportunity to experience and interact with nature with little disturbance from other trail users.

General Characteristics of Hikers[2]
The following information defines the general preferences and motivations of hiking trail users and the design requirements to accommodate use.

User Information
Whether the intended users are walkers, hunters, hikers, overnight backpackers, or destination hikers, hiking trails accommodate users seeking multiple experiences. Motivations for using natural trails vary widely, ranging from physical challenge to experiencing nature.

A large percentage of hikers enjoy escaping from motorized activity and value experiencing nature. Maintaining a natural setting with wooded, rolling terrain that features wildlife-viewing opportunities remains especially important to users of this type of trail. To accommodate overnight backpackers, remember to incorporate some amenities like camping areas, access to water, and composting toilets.

Include signage containing trail difficulty ratings at trail access points to aid users in determining which routes they will select. Include maps, route guides, and general information about trail features in publications and signage along each trail. Trail length preferences vary widely based on individual skills and preferences.

Destination Hiker Characteristics
Trail Use Pattern
- Seeks out trails for a desired experience (such as solitude), whether near home or at some travel distance
- Prefers looped systems over out-and-back trails to vary the experience
- Will seek out trails of varying difficulty
- Likes to stop along the trail to rest, observe, and socialize if hiking in a group
- Expects trail to be of varying difficulty consistent with landscape characteristics
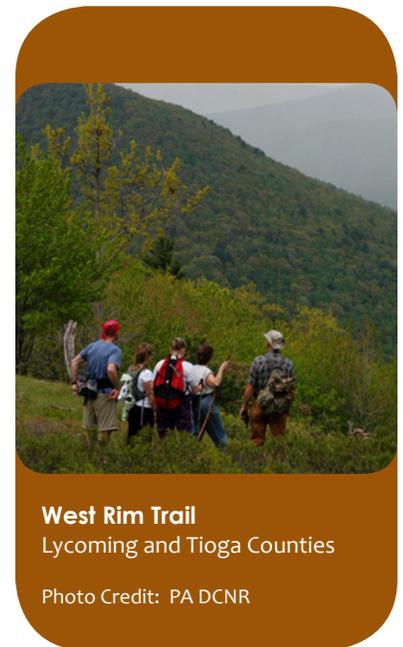
West Rim Trail
Lycoming and Tioga Counties

Photo Credit: PA DCNR

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2   Adapted from Trail Planning, Design, and Development Guidelines, Minnesota Department of Natural Resources: 2007, available for purchase *HERE*.

- Natural settings remain important to all users, with wooded, rolling terrain and wildlife viewing opportunities commonly preferred
- Trail difficulty often serves as an important determinant in trail selection, with a desire for a wide range of challenges
- Access to the trail is predictor of use levels
- Length preferences vary widely with skills and preference, with beginners liking shorter loops of 2–4 miles and day hikers preferring 5–9 miles
- Minimum preferred width is 18 inches

Overnight Backpacker Characteristics

Overnight backpackers have many of the same preferences as destination hikers, only with a few nuances associated with overnight stays. Those preferences include:

- Camping areas at intervals of 5–10 miles are desired, with average daily hiking distance up to 10 miles
- Access to water, especially at camps
- A desire and need for composting/pit toilets at designated camp areas to minimize environmental impacts
- Outing length varies from 5–100 miles, with 25–35 miles being a common distance

Hiking Trail Classifications

The design of natural hiking trails should accommodate trail users on a local, county, regional, and state level. Designers can further subdivide these trails to accommodate general hikers, walkers, hunters, and overnight backpackers.

General Hiking Trail: General hiking trails often have a natural surface tread. You can find this type of trail in parks or greenways where adequate open space exists to form a trail loop. These trails provide users various opportunities to observe wildlife and interact with nature.

Nature Interpretive Trail: Nature interpretive trails, similar to general hiking trails, allow users to interact with, enjoy, and learn about nature and wildlife. You can typically find trails of this kind within designated conservation areas and arboretums.

Walker/Hunter Trail: Walker/hunter trails often take advantage of old logging access trails and roads. These routes typically have a non-motorized designation. Authorized forest management activities often occur near them.

Hiking General Speeds and Distances

Hunter Walker
- 1-2 miles per hour
- 2-4 miles

General Hiker/Backpacker
- 2-3 miles per hour
- 4-10 miles

Fitness Hiker/Backpacker
- 3-4 miles per hour
- 6-15 miles

Trail Jogger
- 6-7 miles per hour
- 3-15 miles

Hiking Trail Layout Configurations

Hiking trail design normally responds to the landscape's topography and highlights a sequence of naturally occurring events that enhances the trail users' experience. In parks and natural areas the design often integrates a looped trail system at a specific site, while larger landscape settings normally incorporate a linear trail design. Designers should carefully employ design elements in the trail that fit with the existing landscape on all levels to decrease ecological degradation, maximize views, and embrace natural features along the route.

Difficulty Rating System

Difficulty Standards for Hiking Trails, as defined by the Pennsylvania DCNR[3]

Golden Eagle Trail Hikers
Lycoming County

Photo Credit: PA DCNR

Trail Type	Easiest (Interpretive)	More Difficult	Most Difficult
Clearing Height	8-10 feet	8 feet	8 feet
Clearing Width*	4 feet	3-4 feet	3 feet
Treadway Width**	1.5 to 2+ feet	1-1 ½'	1-2 feet
Treadway Slope***	Less than: 5%	Less than: 12%	Less than: 18%
	Maximum: 20% up to 100 feet	Maximum: 30% up to 300 feet	Maximum: 30+% up to 500 feet
Treadway Cross Slope	0-3%	0-5%	0-8%
Turning Radius	NA	NA	NA
Sight Distance	NA	NA	NA
Surface Materials	Uniform, firm and stable surface. Smooth tread with no obstacles. Pavement may be appropriate in highly developed settings.	Native surface with some imported material. Sidehill trail is constructed. Generally clear of obstacles, steps to 10 inches.	Native surface with constructed sidehill trail. Obstacles, roots, rocks, and steps to 24 inches.

* Curve alignment to avoid cutting large trees.
** Increase tread width six inches on switchbacks or where side slopes exceed 60%.
*** Upper limit of treadway slope and distance depends on soil type, amount of rock, vegetation type, and other conditions affecting trail surface stability.

Note: Some features on this chart are not considered sustainable for most situations and may be existing trails or trails in an unusual circumstance like the Appalachian Trail.

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3   Guidelines for Marking Recreational Trails, PA DCNR: 2008, available **Here**

Woodbourne Forest and Wildlife Preserve
Susquehanna County

Photo Credit: The Nature Conservancy

8'-10 Clearance

1'-2'
Shoulder Width

3'-6'
Treadway Width

1'-2'
Shoulder Width
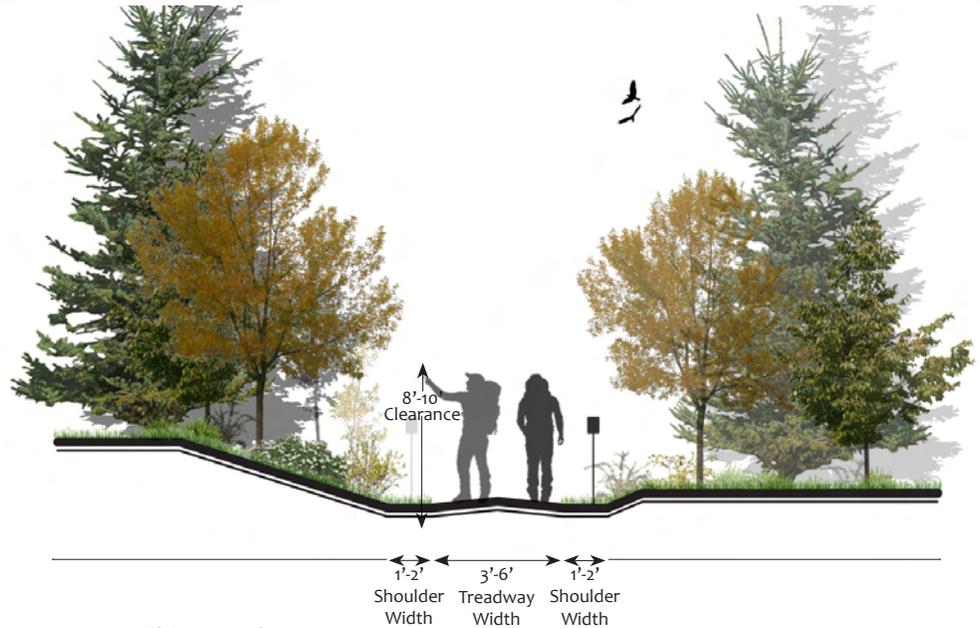
Two-Way Hiking Trail

Sustainable and Accessible Hiking Trail Guidelines and Considerations[4]
Technical Provisions

Trail Grade

- No more than 30% of the total trail length may exceed a trail grade of 8.33%.
- Trail grade of up to 5% can occur for any distance.
- Trail grade of up to 8.33% can occur for up to 200 feet if resting intervals are provided at distances no greater than 200 feet apart.
- Trail grade of up to 10% can occur for up to 30 feet if resting intervals are located at distances no greater than 30 feet apart.
- Trail grade of up to 12.5% can occur for up to 10 feet if resting intervals are located at distances no greater than 10 feet apart.
- At drain dips, a trail grade of 14% can occur for up to 5 feet where the cross slope does not exceed 5%.

Cross Slope

- The cross slope should not exceed 5%.
- At drain dips, a cross slope of up to 10% can occur at the bottom of the dip where the clear tread width equals at least 42 inches.[5]

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4   Requirements as proposed in Draft Final Accessibility Guidelines for Outdoor Developed Areas, United States Access Board: October 19, 2009, available **HERE**, refer to discussion on accessible trails later in the chapter for additional information.

5   As provided for in US Forest Service Forest Service Trail Accessibility Guidelines (FSTAG); May 22, 2006, and available **HERE**.

Resting Intervals

- Where the trail grade exceeds 5%, provide resting intervals. Resting intervals should be at least 60 inches long, be at least as wide as the widest portion of the trail segment leading to the resting intervals, and have a slope not exceeding 5% in any direction.

  Exception: This provision does not apply where resting intervals cannot be constructed because one or more conditions for departure exist.

Surface

- The trail tread surface should be both firm and stable.

Clear Tread Width

- The clear tread width of the trail should equal at least 36 inches.

Passing Spaces

- Where the clear tread width of the trail is less than 60 inches, provide passing spaces at intervals of no more than 1000 feet. Passing spaces should be at least 60 inches by 60 inches in size or an intersection of two walking surfaces that provide a T-shaped space complying with 403.5.3 of the *2010 ADA Standards for Accessible Design*[6] (ADA Standards) available *HERE*, where the arms and stem of the T-shaped space extend at least 48 inches beyond the intersection.
- The cross slope of passing spaces should not exceed 5% in any direction.

Tread Obstacles

- Where tread obstacles exist, they should not exceed a height of 2 inches.

  Exception 1: Tread obstacles with a maximum height of 3 inches are permitted where trail grade and cross slope are 5% or less.

  Exception 2: Where one or more conditions for departure exists that prevent you from meeting exception 1.

Protruding Obstacles

- Objects protruding over the trail should provide at least 80 inches of headroom.

Openings

- Openings in trail tread surfaces should be small enough to prevent passage of a 1/2-inch diameter sphere. Elongated openings should be placed so that the long dimension is perpendicular or diagonal to the dominant direction of travel.
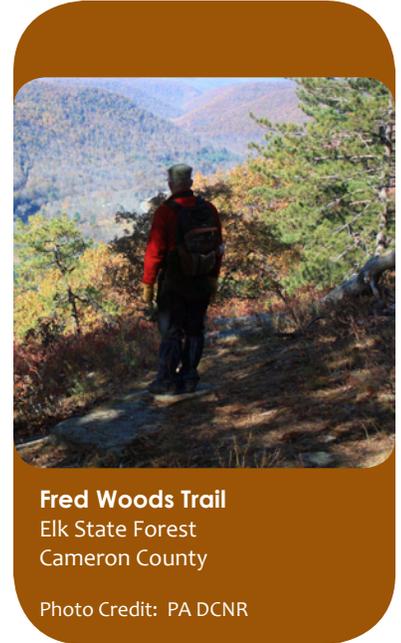
Fred Woods Trail
Elk State Forest
Cameron County

Photo Credit: PA DCNR

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6   2010 ADA Standards for Accessible Design, U.S. Department of Justice: 2010

Old Loggers Path
Lycoming County

Photo Credit: PA DCNR

Standing Stone Trail
Huntingdon, Mifflin, and Fulton Counties

Photo Credit: PA DCNR

Edge Protection

- When you provide edge protection, the edge protection should have a height of at least 3 inches.

Signs

- If an individual needs to obtain materials from or manipulate a sign or kiosk, the sign or kiosk should be designed to meet the reach ranges specified in the 2010 Standards[7]. You should post signs at the trailhead of new or altered trails. In addition to the standard information including the name and length of the trail, these signs should include the typical and maximum trail grade, typical and maximum cross slope, typical and minimum tread width, surface type and firmness, and obstacles. These signs should also state that the posted information reflects the condition of the trail following construction or assessment. The signs should include the dates of these procedures.

- When providing more extensive trail information (e.g., an aerial map of the trail and related facilities), identify the location of specific trail features and obstacles that do not comply with the Forest Service Trail Accessibility Guidelines technical provisions and include a profile of the trail grade.

Sequence of Events

Creating a sequence of events through trail design remains especially important when maximizing the hiker's trail experience. This includes the attempt to decrease a user's visibility from another section of trail. Varying land character coupled with numerous access points, overlooks, and camping opportunities are necessary to offset the out-and-back aspect of looped or linear trails and provide specific points of destination along each route.

Ecological Buffers

Maintaining adequate buffers between trails and sensitive ecological systems, as well as limiting the impact on transitional zones between plant communities remains an integral component of natural trail design. If designed effectively and responsibly, natural trails should blend seamlessly into the existing landscape, with minimal impact on an area's natural systems.

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7   Ibid

Complementary Publications

The following publications are valuable resources that may be consulted:

- *Federal Trail Data Standards*, *U.S. Forest Service, 2011, available **Here**.*
- *Trail Assessment and Condition Survey (TRACS) System*, *U.S. Forest Service, 2009, available **Here**.*
- *Trails Accessibility Guidelines*, *U.S. Forest Service, 2006, available **Here**.*
- *National Trail Drawings and Specification*s, *U.S. Forest Service, 2010,* available *here*.
- *Trail Construction and Maintenance Notebook*, *U.S. Forest Service, 2007, available **Here**.*
- *Trail Bridge Catalog*, *U.S. Forest Service, 2007 Update, available **Here**.*
- *Complete Guide to Trail Building and Maintenance, 4th Edition*, Appalachian Mountain Club, 2008, available for purchase **Here**.
- *Appalachian Trail Design, Construction, and Maintenance*, William Birchard, 2000, available for purchase **Here**.
- *Appalachian Trail Club Presidents Handbook*, 2002, Marty (Martha) Lawthers, Kevin Peterson, Katharine Wroth, et. al., available **Here**.

You can obtain additional information by contacting the Keystone Trails Association (KTA), a volunteer-directed federation of membership organizations and individuals dedicated to providing, preserving, protecting, and promoting recreational hiking trails and hiking opportunities in Pennsylvania. KTA represents and advocates for the interests and concerns of the Pennsylvania hiking community.

Keystone Trails Association
101 N. Front Street, 3rd Floor
Harrisburg, PA 17101
(717) 238-7017
www.kta-hike.org

Hiking Trails Best Practices

- Fred Woods Trail, Cameron County

- Timberdoodle Flats Wildlife Interpretive Trail, McKean County

- Tracy and Johnnycake Trailheads, McKean and Warren Counties

- Minister Creek Recreation Area, Warren and Forest Counties

- Old Loggers Path, Lycoming County

- Standing Stone Trail, Huntingdon, Mifflin, and Fulton Counties

- Woodbourne Forest and Wildlife Preserve, Susquehanna County
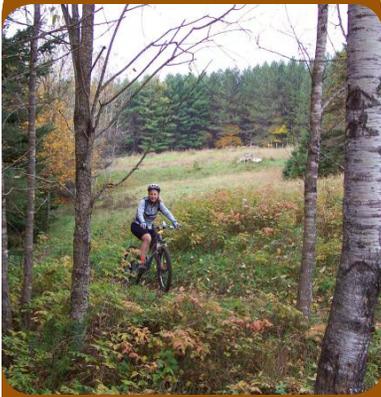
**Nockamixon State Park
Bucks County**
Single Track Trail

Photo Credit: Valley Mountain Bikers

Mountain Biking Trails

The development of mountain biking trails provides a sustainable approach to trail design that encourages more people to explore the outdoors. As a goal the designer should attract bicyclists seeking a challenging experience that many shared use paths lack and users desire.

General Characteristics for Mountain Bicyclists

The following information defines the preferences and motivations of mountain bikers, as well as common trail building mistakes and alternatives designers should take into consideration when planning mountain bike trails.

User Information

Mountain bikers, ranging from beginner to expert, enjoy the excitement and outdoor activity of the sport. Since mountain bikes typically have shock absorbers and wider tires, bikers have the ability to go off-road and take on more challenging courses than traditional biking allows. Prime motivators of mountain bikers include obtaining exercise, experiencing natural settings, and testing riders' technical skills.

Mountain bike trails commonly provide 2- 3 hour riding opportunities that consist of approximately 20-25 miles of contiguous trail. Beginner trails typically have a wider tread and bypass routes at technical challenges like boulder or log obstacles. The most technically challenging mountain biking trails require balance, fitness, and strength. In addition to challenging courses with varying terrain, riders appreciate amenities like water spigots located at trailheads to clean bikes after their rides.

Rider Type Considerations[8]

Mountain biking represents one of the fastest growing recreation experiences across all public lands. Those who share an interest in this sport enjoy various types of riding experiences that appeal to a range of skill levels. Riders ranging from novice to advanced can take part in many types of biking, including:

Local Access and Utilitarian Biking: Utilitarian bicycle riders ride for the fun and fitness benefits of the sport. These riders rely on ease of accessibility to local trail loops and desire courses ranging in both length and technical requirement.

Long Distance Biking: Long distance biking requires determination, endurance, and hard work. Bicyclists dedicated to this sport will often seek out new trails to experience on day or overnight trips.

Downhill Biking: A downhill trail allows riders to test the technological limits of bicycles while finding the best lines for the smoothest rides.

8   Trail Solutions: IMBA's Guide to Building Sweet Singletrack, International Mountain Bicycle Association: 2004, available for purchase *Here.*

Advanced riders seek out faster lines, vertical drops, and jumps that require a higher level of reaction, strength, and agility. This type of riding often includes a lift, like at a ski resort, to get cyclists to the top of the hill.

Progressive Skills Development: This style of mountain biking celebrates the challenges of technical riding, encouraging riders to soar off jumps, balance on log rides, and teeter on high-rise stunts. Speed and on-edge elements do not mix well with equestrians, hikers, and even other mountain bikers.

Mountain Biker User Characteristics[9]

Trail Use Pattern
- Seeks and travels to trails away from home as a day or overnight trip
- Commonly desires 2- 3 hour riding opportunities, 20–25 miles of contiguous trail (although fewer miles are acceptable in challenging terrain)

Recreation Setting Preferences
- Best trails have a natural, challenging character and immerse the rider in nature while providing a good workout and opportunity to test skills
- Use a combination of roads, logging roads, and trails as available, safe, and convenient
- In urban/suburban areas, highly prefer developed mountain bike trails offering looped configurations with varying levels of challenge

Mountain Bike Trail Classifications

Cross-Country Trail: Bikers normally find mountain biking trails in county, regional, and state parks or forests where adequate open space exists to form loop trail systems. These naturally surfaced trails offer casual, dual-track trails, single track, and technical single tracks to accommodate the riders' goals and abilities. In addition, mountain bike trails should incorporate sustainable design techniques to respond to a site's specific setting and geographic location.

Progressive Skills Park: A technical challenge or "Skills Park" consists of numerous dirt jumps, elevated boardwalks, and drops. Technical challenge areas should include a wide variety of challenges, from easy to difficult, to provide for skill progression. Typically you will find these bike parks located in the middle of a trail system, near parking and other recreation facilities.

Best practices recommend surrounding these courses with natural barriers consisting of deadfall to ensure safety and seclusion from other trail users.

Mountain Bike General Speeds and Distances

Recreational Trail Riding
- 6-15 miles per hour
- 10-15 miles

Recreational Technical Riding in a Park Setting
- 3-12 miles per hour
- 3-12 miles

Advanced Recreational Trail Riding
- 10-20 miles per hour
- 15-50 miles

Advanced Recreational Technical Riding in a Park Setting
- 6-18 miles per hour
- 6-20 miles

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9   Adapted from Trail Planning, Design, and Development Guidelines, Minnesota Department of Natural Resources: 2007, available for purchase **HERE**.

Dr. J Freeride Trail
North Park, Allegheny County

Photo Credit: Jon Pratt

Downhill/Freeride: Downhill trails cater to downhill-specific bicycles. They are generally one-way routes with technical trail elements designed to test the limits of advanced bicycle technology. Jumps and vertical drop-offs represent key features that designers should include in downhill trails. Designers should separate downhill courses from trails designed for other users to avoid conflict. Furthermore, these trails normally need more tread maintenance and drainage structures than other trails due to their steep nature.

Mountain Bike Trail Layout Configurations

Mountain bike trail design should provide users with one or two-way trails to accommodate challenging features that appeal to riders. These trails respond to the landscape and highlight interesting natural features throughout. Trails should maintain a consistency or rhythm to create an appealing trail layout. The easiest of trails should maintain a relatively gentle flow with predictable curves, while the most challenging may have tight curves with demanding technical requirements. The design of transitions between sections, which can vary in their degree of openness, should allow riders to predict the upcoming transition and maintain control of their bicycles.

Mountain Bike Trail Guidelines, Level of Difficulty and Other Considerations

Essential Elements of Sustainable Mountain Biking Trails[10]
Take the level of development needed into consideration and base the trail design on a trail's location, use, and other factors. Some trails may have a natural surface tread, while others may consist of more developed surfaces.

Mountain bike trail designs should follow the International Mountain Bicycling Association's (IMBA) essential elements of sustainable trails as detailed in Chapter 3.

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10   Trail Solutions: IMBA's Guide to Building Sweet Singletrack, International Mountain Bicycle Association: 2004, available for purchase *Here.*

IMBA Difficulty Standards for Mountain Biking Trails[11]

Aspect	Easiest (White Circle)	Easy (Green Circle)	More Difficult (Blue Square)	Very Difficult (Black Diamond)	Extremely Difficult (Dbl. Black Diamond)
Trail Width	72 inches or more	36 inches or more	24 inches or more	12 inches or more	6 inches or more
Tread Surface	Hardened or surfaced	Firm and stable	Mostly stable with some variability	Widely variable	Widely variable and unpredictable
Average Grade	Less than 5%	5% or less	10% or less	15% or less	20% or less
Maximum Grade	Maximum 10%	Maximum 15%	Maximum 15% or greater	Maximum 15% or greater	Maximum 15% or greater
Natural Obstacles and Technical Features	None	Unavoidable obstacles 2 inches tall or less Avoidable obstacles may be present Unavoidable bridges 36 inches or wider	Unavoidable obstacles 8 inches tall or less Avoidable obstacles may be present Unavoidable bridges 24 inches or wider Technical trail feature 24 inches high or less, width of deck is greater than ½ the height	Unavoidable obstacles 15 inches tall or less Avoidable obstacles may be present, including loose rocks Unavoidable bridges 24 inches or wider Technical trail feature 48 inches high or less, width of deck is greater than ½ the height Short sections may exceed criteria	Unavoidable obstacles 15 inches tall or less Avoidable obstacles may be present, including loose rocks Unavoidable bridges 24 inches or narrower Technical trail feature 48 inches high or greater, width of deck is un-predictable Many sections may exceed criteria
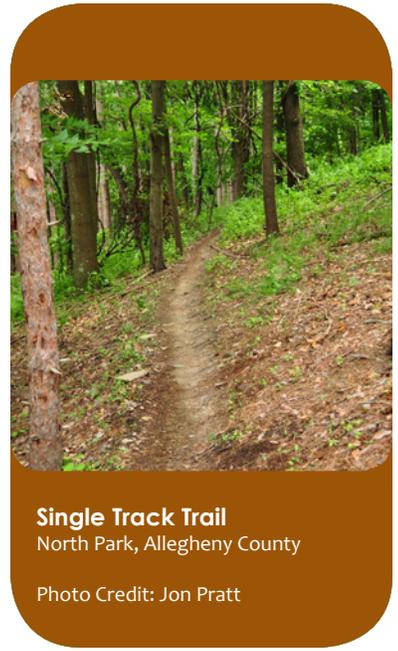
Single Track Trail
North Park, Allegheny County

Photo Credit: Jon Pratt

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11   Ibid

8'-10'
Clearance

1'-2'
Shoulder
Width

3'-6'
Treadway
Width

1'-2'
Shoulder
Width

Two-Way Mountain Biking Trail

Trail Treads

The construction of a trail's surface should accommodate the current and anticipated level of wear and tear from its users. Materials used may provide varying tread conditions that determine the level of stability and difficulty of a mountain biking trail. For example, a trail that contains a paved or surfaced material that remains firm and stable and then transitions to a trail that possesses a loose condition will provide a level of excitement and unpredictably throughout a designated course.

Natural Obstacles

Riders consider the technical design of a mountain bike trail important. Therefore, the success of a trail design hinges on incorporating technical elements. By incorporating a sequence of events through the use of gateways and existing natural features, designers provide riders with destinations along a trail that increase the trail's interest and challenge. By incorporating natural features and technical challenges throughout a trail system, designers distinguish mountain bike trails from shared use natural trails. Some of these features include natural drop-offs, rock gardens, rock slabs, rock chokes, and fallen trees or limbs.
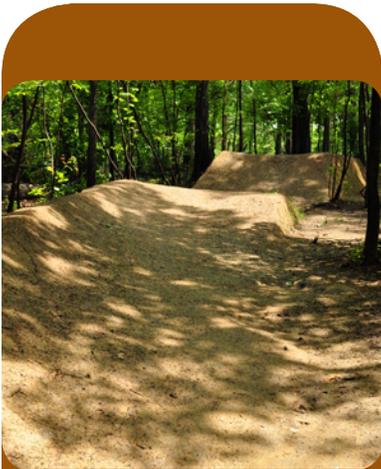
Mountain Bike Skills Park
North Park, Allegheny County

Photo Credit: Pashek Associates

Constructed Technical Design Features

A mix of technical features, both natural and man-made, consistent with each trail rating is important to holding the interest of riders. If the design meets user expectations, riders are more likely to stay on the trail rather than creating new routes. Man-made technical features that improve interest and increase technicality without limiting space requirements include narrow bridges, ladder bridges, anchored bridges, boulders, boardwalks, and stabilized curves. These various elements provide alternate routes and increase the longevity of each trail.

Complementary Publications

Two IMBA publications provide guidelines for addressing each of these aspects. These publications are:

1. *Trail Solutions: IMBA's Guide to Building Sweet Singletrack*, available for purchase **Here**.
2. *Managing Mountain Biking: IMBA's Guide to Providing Great Riding*[12], available for purchase **Here**.

Rattling Creek Trails
Lycoming County

Photo Credit: Rattling Creek Singletrackers
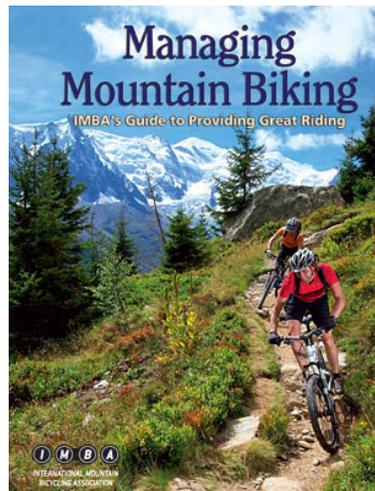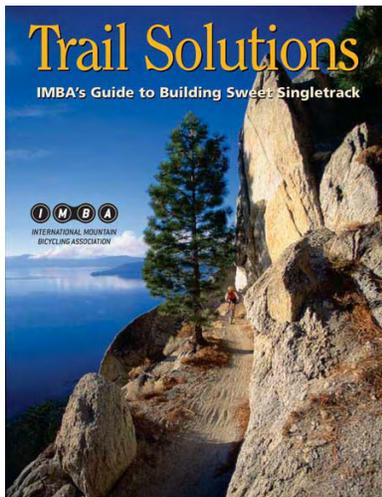
The International Mountain Bicycling Association - Trail Building Resources, available **Here,** also provides a wealth of information about:

- Advocacy and Organizing
- Bike Parks and Freeriding
- Grants and Fundraising
- Kids and Mountain Biking
- Land Access and Protection
- Liability and Insurance
- Logos and Graphics

- Maps and Signs
- Mountain Bike Research
- National Mountain Bike Patrol
- Resource Conservation
- Risk Management
- Trail Building and Design

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12   Managing Mountain Biking: IMBA's Guide to Providing Sweet Riding, International Mountain Bicycling Association: 2007

For additional information contact the International Mountain Biking Association:

International Mountain Biking Association
P.O. Box 7578
Boulder, CO 80306
www.imba.com

Frank Maguire, Mid-Atlantic Regional Director
frank.maguire@imba.com
814-441-7865

Single Track Mountain Bike Trails Best Practices

- Allegrippis Trails, Raystown Lake Army Corps Project, Huntingdon County - This 32 mile destination trail system has over 26,000 visitors a year and requires minimal maintenance. Built with mechanized trail building equipment, the system represents the best example of new trail building techniques in the Commonwealth.

- Swatara State Park, Lebanon and Schuylkill Counties - The 11 miles of trails built by the Susquehanna Area Mountain Bike Association represent a great example of stacked loop trail design, allowing riders to take on as much of an adventure as they desire.

- Lake Nockamixon State Park, Bucks County - the 8 miles of lakeside trails demonstrate good examples of using limited topography to deliver a quality sustainable trail system.

- Rattling Creek Trails, Weiser State Forest, Dauphin County - A more advanced trail system, this 24 mile network above the town of Lykens, including trails on the borough's water authority land, are challenging but still offer great examples of well executed design.

Technical Challenge/Free Ride Courses Best Practices

- Dr. J Trail, North Park, Allegheny County

Shared Use Paths and Rail Trails

A shared use path is a facility within its own right-of-way, which is separate from the vehicular right-of-way. As its name suggests, many different types of users may use a shared use path. Users generally include walkers, joggers, bicyclists, and in-line skaters and sometimes equestrians. Similarly, rails-with-trails often use the same standards and guidelines for their development as shared use paths.

The trail community recognizes the American Association of State Highway Transportation Officials (AASHTO) publication titled *Guide for the Planning, Design, and Operation of Bicycle Facilities*[13] as the authority for shared use path guidelines. During the design phase of a shared use path it is important to consult this guide to ensure that your design follows the guidelines specific to your particular scenario.

General Characteristics of Shared Use Paths

The following information defines a shared use path's various users and how each trail's design can accommodate its use.

User Information

Shared use paths serve virtually every type of user group, whether users want to walk a dog, push a stroller, jog, bicycle, in-line skate, or even horseback ride. The hard surfacing of this type of path provides a high level of accessibility to users of all abilities. For this reason, shared use paths can accommodate the interests of various users, while minimizing ecological impacts and the amount of trails constructed.

Shared use paved trails function at local, county, regional, and state levels. The amount of use, character, width, length, location, and the type of user(s) accommodated serves as a major distinction between the various levels. Moreover, the extensiveness of a shared use trail network depends on the level of service, rate of use, and geographical characteristics.

The amount of value the public places on a shared use path also serves as a determining factor in the development of shared use trails at all levels. These values include convenience, safety, fitness, recreation, as well as transportation. Planners and designers should consider these values heavily in the planning and design of any trail system.
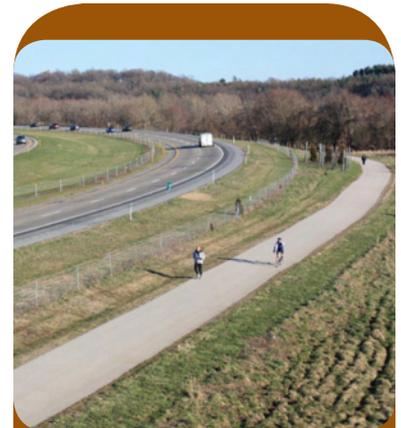
Schuylkill River Trail
Montgomery County

Photo Credit: Montgomery County Planning Commission

Montour Trail
Allegheny & Washington Counties

Photo Credit: Pashek Associates

East Branch Trail
Crawford County

Photo Credit: Crawford County Planning Commission

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13   Guide for the Planning, Design, and Operation of Bicycle Facilities, American Association of State Highway Transportation Officials, 4th Edition: 2012

Hanover Trolley Trail
York County

Photo Credit: PA DCNR

Schuylkill River Trail
Montgomery County

Photo Credit: Montgomery County
Planning Commission

Butler Freeport Trail
Butler County

Photo Credit: Butler Freeport Trail

User Type Characteristics[14]

Shared use paths offer versatility and can accommodate a wide range of user groups. These paths enable users to pursue various activities and may offer connections to local and regional trail networks.

Pedestrian (Walker/Jogger)

Pedestrians utilize shared use trail networks to walk and run for recreational and fitness value. Walkers and joggers of all types use trails year-round for social interaction, scenic beauty, health benefits, and close-to-home recreation.

Bicyclist

Bicyclists of all types utilize shared use trails for convenient, safe travel between parks, rest areas, and other local destinations. Whether a bicyclist uses the path for family, recreational, fitness, or transportation purposes, these trail networks provide invaluable economic and health benefits.

In-line Skater

Recreational, fitness, and commuter in-line skaters value smooth, wide paths that allow for easy navigation. These users' primary motivations revolve around getting exercise, being outdoors, enjoying skating, and ease of transportation.

Wheelchair User

Disabled persons and wheelchair users value smooth, level, wide paths that are easily navigated. Shared use trail networks allow users to be outdoors, experience nature, and socialize.

Equestrian

Shared use paths allow equestrians to take part in social activity and ride on a local scale. These trails should allow for single-file and staggered riding alongside other types of trail users.

Walker, Jogger, In-Line Skater/Recreational and Fitness Walker/ Jogger Characteristics
Trail Use Pattern

- Will use the same trails daily or several times per week if paths offer convenience and ease of access (most live within 3 miles of the trail they use)
- Recreational user wants trails that provide social interaction, scenic beauty, or both
- Will use sidewalks to get to a trail system in urban and suburban settings

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14   Trail Solutions: IMBA's Guide to Building Sweet Singletrack, International Mountain Bicycle Association: 2004

- Want trails close to home and will use trails year-round, although spring, summer, and fall are the most popular seasons

Recreation Setting Preferences
- Recreational user finds sense of place, natural setting, scenery, and being away from traffic important (less so with fitness user)
- Prefers looped configurations in all settings, with 2-4 miles suitable for beginners and 5-9 miles for fitness walkers
- Has a strong desire for safety and security.

Recreational In-line Skater Characteristics
Trail Use Pattern
- Seeks out nearby trails for daily use, but will travel to a specific trail on weekends
- Prefers loop system, with 10-15 miles minimum (will use out and back if no other choice is available)

Recreation Setting Preferences
- Values smooth, wide trails; rough trails prove especially troublesome for beginners
- Seeks trails that do not receive heavy use
- Does not prefer technically difficult trails with sharp turns, too many steep hills, or poor stopping conditions
- Does well on trails designed similar to bike trails, especially when they are 10 feet wide or wider
- Routine sweeping of the trail is important

Fitness In-Line Skater Characteristics
Trail Use Pattern
- Prefers routes that offer challenges and have enough distance to get in a good workout (10- 25 miles)
- May go out daily or several times per week and will routinely use the same trails close to home
- Prefers loop system

Recreation Setting Preferences
- Values smooth, wide trails; rough trails prove especially troublesome for beginners
- Primarily uses a series of streets, roads, and trails to create a long enough route
- Does not desire technically difficult trails with sharp turns, too many steep hills, or poor stopping conditions
- Has facility needs similar to those of bicyclists

Walker, Jogger, and In-Line Skater General Speeds and Distances

Strolling Walker
- 1-2 miles per hour
- 2-3 miles

Casual Walker
- 2-3 miles per hour
- 3-6 miles

Fitness Walker
- 3-4 miles per hour
- 6-9 miles

Fitness Jogger
- 6-7 miles per hour
- 3-15 miles

Casual Inline Skater
- 5-10 miles per hour
- 6-10 miles

Recreational In-line Skater
- 10-15 miles per hour
- 10-20 miles

Fitness In-Line Skater
- 15-20 miles per hour
- 10-25 miles

Elite/ Commuting In-Line Skater
- 15+ miles per hour
- 20-30 miles

Commuting In-Line Skater Characteristics
Trail Use Pattern
- Uses skating as a form of transportation
- Uses trails where available, but will also use streets and roads
- Needs traffic enforcement, security, skate-friendly routes to and from work sites

Family Bicyclist Characteristics
Trail Use Pattern
- Prefers trails with a lot of visibility
- Prefers limited number of safe road crossings
- Most activity happens close to home, but will also use trails extensively on vacation
- Rides in family groups, often including small children
- Prefers bike trails and quiet streets (to avoid heavy traffic), with preference for trails if conveniently located

Recreation Setting Preferences
- Controlled, traffic-free access to trails is the most important consideration
- Quality of the riding experience is of primary importance, with length being secondary (20 miles maximum)
- Needs good information for planning trips and access to support facilities (rest areas, parking lots, water sources) and prefers permanent restrooms to portable toilets
- Connections to parks and playgrounds are important
- Prefers scenic areas but not challenging terrain, especially when children come along

Recreational Bicyclist Characteristics
Trail Use Pattern
- Seeks out and travels to trails and bicycle-friendly areas away from home, either as a day or overnight trip
- Prefer trails, but will use low volume roads that offer safety, and convenience

Recreation Setting Preferences
- Repeat users do not desire trails shorter than 10 miles; 20 miles is the desired minimum
- Prefer looped configurations of varying lengths over out and back systems
- Sense of place and an interesting experience are important, with riders seeking places that possess scenic quality and interesting natural or built forms

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Bicyclist General Speeds and Distances

Family Bicyclist
- 6-10 miles per hour
- 5-10 miles of distance

Recreational Bicyclist
- 10-15 miles per hour
- 10-20 miles

Fitness Bicyclist
- 15-20 miles per hour
- 20-40 miles

Transportation Bicyclist
- 20+ miles per hour
- 40+ miles

Fitness Bicyclist Characteristics
Trail Use Pattern

- Will use a combination of roads and trails that are long and/or challenging experiences offering a good workout
- Prefers trails of sufficient length (20 or more miles) and width to allow for faster speeds and reduced user conflicts
- Will routinely use the same routes for challenges and timing, daily
- Frequently extends the season by riding earlier in the spring and later in the fall than recreational riders

Recreation Setting Preferences

- Trails need to offer varying difficulty and lengths; prefers interconnected loops
- Not primarily motivated by experiencing a natural setting, but will select this type of trail if other needs are met

Transportation Bicyclist Characteristics
Trail Use Pattern

- Not dependent on trails, but will use them if convenient, safe, and direct

Recreation Setting Preferences

- Lack of a safe system of roads (with bike lanes or routes) is a major barrier
- Prefers low volume roads with low percentage of truck traffic
- Trail design remains critical, with the most important criteria being the ability to go fast with good sight lines and direct routes

Shared Use Paths Guidelines and Considerations[15]

Shared Use Path Widths

The appropriate pavement width for a shared use path is dependent on the context, volume, and mix of users. The minimum width for a two-directional shared use path is 10 feet. However, treads vary in width from 10-14 feet depending on a trail's level of use and variety of users.

In very rare circumstances, designers may use a reduced width of 8 feet in the the following conditions:

- Expectation of low bicycle traffic, even on peak days or during peak hours
- Expectation that pedestrian use of the path is only occasional
- Horizontal and vertical alignments provide safe and frequent passing opportunities
- Regular maintenance traffic will not occur on the path

15   Guide for the Planning, Design, and Operation of Bicycle Facilities, American Association of State Highway Transportation Officials, 4th Edition: 2012

Recumbent Bicyclist

Tandem Bicyclists

Electric Tricyclists

Photo Credit: PA DCNR

In addition, designers may specify a path width of 8 feet for a short distance when physical constraints such as environmental features, bridge abutments, utility structures, or fences exist. Designers should consider the addition of warning signs that indicate when a pathway narrows, per the *Manual on Uniform Traffic Control Devices[16]* (MUTCD), available **HERE**, at these locations.

10'
Clearance

2'	10' Minimum	2'
Shoulder	Width	Shoulder
Width		Width

Two-Way Shared Use Path

Shared use paths require a wider tread when paths are frequently used by both pedestrians and other users. AASHTO[17] recommends wider pathways, typically 11-14 feet, in locations that serve high user volumes. Eleven-foot wide paths enable a bicyclist to pass another user going the same direction, while another user is approaching from the opposite direction at the same time. AASHTO recommends that designers should incorporate wider paths in the following situations:

- Where significant use by in-line skaters, adult tricycles, or other users that need more operating width, occurs
- Where larger maintenance vehicles use the path
- On steep grades to provide an added passing area
- Through curves to provide more operating space

16   Manual on Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation, Federal Highway Administration,: 2009
17   Guide for the Planning, Design, and Operation of Bicycle Facilities, American Association of State Highway Transportation Officials, 4th Edition: 2012

Shared Use Path Shoulders

Ideally, AASHTO[18] recommends the design should maintain a graded shoulder at least 3 to 5 feet wide with a maximum cross-slope of 6:1 on each side of a pathway. At a minimum, the design should provide a 2 foot graded shoulder that has a maximum slope of 6:1 to provide clearance from lateral obstructions such as shrubs, large rocks, bridge abutments, and poles.

Where the design introduces features such as bicycle railings or fences with appropriate flaring end treatments, a lesser clearance (not less than 1 foot) is acceptable. Mark barrier or rail ends that stray from the 2 foot clear area with object markers and warning signs.

Where a path is adjacent to parallel water hazards or downward slopes are 3:1 or steeper, consider a wider separation. A 5 foot separation from the edge of the pavement to the top of a slope is desirable. Depending on the height of the embankment and condition at the bottom, the shoulder design may require a physical barrier such as dense shrubbery, railing, or fencing.

Recovery Area or Protective Rails

Where a recovery area (i.e., distance between the edge of a path pavement and the top of a slope) is less than 5 feet, AASHTO[19] recommends physical barriers or rails be constructed in following situations:

- Slopes 1:1 or steeper, with a drop of 1 foot or greater
- Slopes 2:1 or steeper, with a drop of 4 feet or greater
- Slopes 3:1 or steeper, with a drop of 6 feet or greater
- Slopes 3:1 or steeper, adjacent to a parallel water hazard or other obvious hazard

Protective railings, fences, or barriers on either side of a shared use path should be a minimum of 42 inches. In some locations consider a 48 inch high railing to prevent bicyclists from falling over the railing in the event of a crash. This includes bridges or bridge approaches where high-speed and/or steep-angle (25 degrees or greater) impacts between a bicyclist and a railing may occur. For example, at a curve at the end of a long, descending grade where the curve radius is less than that appropriate for the design speed or anticipated speed.

On elevated structures, the openings between horizontal or vertical members on railings should be small enough that a 4 inch sphere cannot pass through them in the lower 27 inches. For the portion of railing higher than 27 inches, openings may be spaced so that an 8 inch sphere cannot pass through them. This prevents children from falling through the openings. Where a bicyclist's handlebar may encounter a railing or barrier, a smooth, wide rub-rail may be
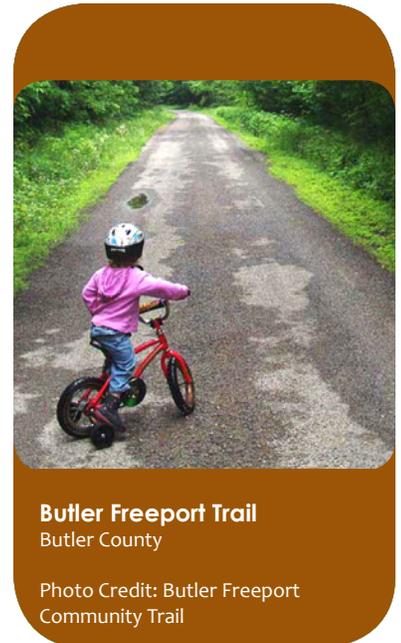
Butler Freeport Trail
Butler County

Photo Credit: Butler Freeport Community Trail

Pine Creek Trail
Tioga and Lycoming Counties

Photo Credit: PA DCNR

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18   Ibid
19   Ibid

installed between 36 inches to 44 inches in height, reducing the likelihood that the railing will contact or catch a bicyclist's handlebar.

Railings that protect users from slopes or where the design uses railing to discourage path users from venturing onto a roadway or neighboring property can typically have relatively large openings. A typical design includes two to four horizontal elements with vertical elements spaced widely, but frequently enough to provide the necessary structural support. Where the path-side hazard is a high vertical drop or a body of water, use engineering judgment to determine whether to use a railing suitable for bridges.

In addition to railings, you may use other materials to separate paths from adjacent areas and hazardous conditions, or to discourage pathway users from venturing onto adjacent properties. Berms or vegetation can serve this function.

A 10 foot vertical clearance to obstructions is desirable. Design should not permit fixed objects to protrude within the vertical or horizontal clearance of a shared use path. Eight feet is the recommended minimum vertical clearance for constrained areas. In some situations, the design may require a vertical clearance greater than 10 feet to provide access for maintenance and emergency vehicles.

Grade[20]

Keep grades on shared use paths, in independent corridors, to a minimum, especially on long inclines. Grades greater than 5 percent are undesirable because the ascents prove difficult for many users, and the descents cause some users to exceed speeds which they can navigate competently. In addition, shared use paths generally remain open to pedestrians, therefore the grades on paths should also follow ADA guidelines.

Limit the grades on paths as follows:

- 5% maximum for any distance
- 8.3% maximum for up to 200 feet
- 10% maximum for up to 30 feet
- 12.5% for up to 10 feet

Additionally, no more than 30 percent of the total path length should have a grade exceeding 8.3 percent. Where grades exceed 5 percent, the design should incorporate a resting interval at the end of any segment of maximum length as described above. A resting interval should be at least 5 feet long, be as wide as the path, and have a maximum slope not exceeding 5 percent.

York County Heritage Trail
York County

Photo Credit: Carl Knoch

20   As of this writing the Architectural and Transportation Barriers Compliance Board, May 2013, issued an advance notice of proposed rulemaking (ANPRM) announcing their intent to develop accessibility guidelines for shared used paths. Those designing shared use paths should check for updates related to this pending legislation before finalizing their designs for shared use paths.

Provide smooth, gradual transitions between sloped segments and resting intervals.

Options to mitigate excessive grades on shared use pathways include the following:

- Use higher design speeds for horizontal and vertical curvature, stopping sight distance, and other geometric features.
- When using a longer grade, consider an added 4-6 feet of width to permit slower bicyclists to dismount and walk uphill, and to provide more maneuvering space for fast downhill bicyclists.
- Install a hill warning sign for bicyclists and an advisory speed plaque, if appropriate, per the MUTCD.
- Provide signing that alerts path users to the maximum percent of grade as shown in the MUTCD.
- Exceed minimum horizontal clearances, recovery area, or protective railings.
- If other designs prove impracticable, use a series of short switchbacks to traverse the grade. If using this method AASHTO recommends widening the path by 4 to 6 feet to provide additional maneuvering space.
- Provide resting intervals with flatter grades to permit users to safely stop periodically to rest.

Grades steeper than 3 percent may prove impractical for shared use paths with crushed stone or other unpaved surfaces for both bicycle handling and drainage erosion reasons. Typically, avoid grades less than one-half percent, because they do not efficiently convey surface drainage. When building paths on flat terrain, increase the proposed grades to provide a gradual rolling vertical profile. This design conveys surface drainage to outlet locations.

Drainage
Design trails to shed water from the trail as soon as possible, as discussed earlier in Chapter 1 – Planning. Typically, a minimum cross slope of one percent provides adequate drainage for a shared use path. A cross slope design is preferred over a crowned design due to ease of construction and simplification of the drainage design. A smooth, even surface prevents the ponding of water on the tread during the winter months. On compacted stone treads, pay particular attention to drainage design details to avoid erosion of the tread and adjacent surfaces.

Motorized Vehicle Barriers and In-Line Gates
The unauthorized use of paths by motor vehicles is a problem on many paths. Typically, this is a greater issue on paths that extend through independent corridors as the path may not be visible from adjacent roads and properties.
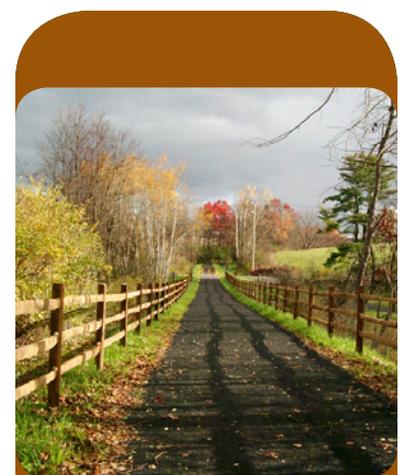
Bellefonte Central Rails to Trail
Centre County

Photo Credit: Carl Knoch

AASHTO[21] discourages the use of bollards and barriers unless a known history of use by unauthorized motor vehicles exists. Bollards, fences, or other similar devices and barriers create permanent fixed object hazards to path users. Bicyclists and other path users often strike bollards on paths, resulting in serious injury.

The preferred design method to restrict entry to motor vehicles is to split the entryway into two sections, by using low landscape features. Each section should be half the nominal path width; for example, split a 10 foot path into two 5 foot sections. Emergency vehicles can still enter if necessary by straddling the landscaping. However, a more appropriate method may be defining emergency vehicle access through secured access drives. Delineate the approach to the split with solid line pavement markings to guide the path user around the split.

Where you can justify the need for bollards or other vertical barriers in the pathway, despite the hazard posed to cyclists, take measures to ensure the bollards or barriers are as safe as possible:

- Mark bollards with a reflective material on both sides and appropriate object markers, per the Section 9B. 26 of MUTCD, *AVAILABLE HERE*.
- Bollards should permit passage, without dismounting, for adult tricycles, bicycles towing trailers, and tandem bicycles. Bollards should not restrict access for people with disabilities. Accommodate all legally permitted users; failure to do so increases the likelihood that the bollards will pose a hazard.
- Bollard placement should provide adequate sight distance to allow users to adjust their speed to avoid hitting them.
- Bollards should be a minimum height of 42 inches and minimum diameter of 4 inches.
- AASHTO recommends striping an envelope around the approach to the post to guide path users around the object.
- One strategy involves using flexible delineators, which may reduce unauthorized vehicle access without causing injuries commonly incurred by rigid bollards.
- Only install bollards in locations where vehicles cannot easily bypass the bollard. The preferred method is to use one bollard in the center of a path. When using more than one bollard, space them 6 feet on center. AASHTO does not recommend using two bollards because they direct opposing path users towards the middle, creating conflict and the possibility of a head-on collision. Wider spacing allows motor vehicles to enter the path, while narrower spacing may prevent adult tricycles, wheelchair users, and bicycles with trailers to enter the path.
- Set bollards back from the roadway edge a minimum of 30 feet. Bollards set back from the intersection allow path users to navigate the potential

21   Guide for the Planning, Design, and Operation of Bicycle Facilities, American Association of State Highway Transportation Officials, 4th Edition: 2012

hazard before approaching the roadway.

- Install hardware in the ground to hold a bollard or post flush with the surface to avoid creating a safety hazard.
- Lockable, removable (or reclining) bollards allow entrance by authorized vehicles.

Intersections

The way intersections between trails and roads are designed significantly impacts the users' comfort and safety. Intersection designs should address cross-traffic movements, as well as trail users entering and exiting the path. Since conflicts may arise at these junctions, it is important to design intersections in a simple manner, in order to maintain orderly movement between trail traffic and other traffic.

The principles that apply to general safety at crossings, regardless of where a trail crosses a roadway, also apply to trail intersection design. There are a wide range of design features that improve pedestrian and bicyclist safety at such intersections. The AASHTO Guide[22] provides a general overview of recommended intersection crossing measures as summarized here.

Trail crossings come in many configurations with many variables, including the number of lanes crossed, divided or undivided roadways, speed and volume of traffic, as well as traffic controls. Since each intersection is unique, designers should exercise judgment to determine an appropriate intersection treatment.

Due to the mixed nature of trail traffic, remember to consider the speed variability of each mode of travel and its resulting effect on design values, when considering design solutions for trail and roadway intersections. Use the fastest vehicle for determining approach speeds, as these users are the most likely to surprise cross traffic at the intersection.

General considerations for the design process include:

Intersection Design Considerations

- Provide positive guidance to pedestrians, bicyclists, and motorists to ensure full awareness at intersections.
- Minimize conflicts and channelize intersections to separate moving conflicts.
- Unavoidable conflicts should occur at right angles.
- Optimize sight triangles, ensure stopping, intersection crossing, and decision sign distances.
- Provide adequate staging and refuge areas for pedestrians and bicyclists.
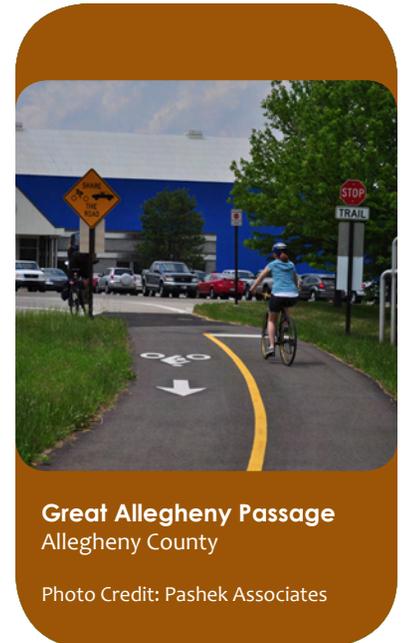
Great Allegheny Passage
Allegheny County

Photo Credit: Pashek Associates

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22   Guide for the Planning, Design, and Operation of Bicycle Facilities, American Association of State Highway Transportation Officials, 4th Edition: 2012

- Avoid obstacles and highlight unavoidable obstacles.
- At signalized intersections, minimize trail user delay by minimizing traffic signal cycle time.
- Provide adequate signal crossing time for pedestrians.
- Provide easily accessible tactile/audible push buttons.
- Design to assist the user to look into the direction of the potential hazard.

Traffic Control Features

Adding additional signage to assign the right of ways to pedestrian and bicycle users provides a simple measure of traffic control, especially on rural roads. On more developed roadways, municipalities should ensure they meet the needs of bicyclists and pedestrians in the initial design process.

Typically, traffic control signals are a last resort if you cannot incorporate pedestrian and bicycle users into a controlled intersection environment. Some current traffic control features include activated traffic control signals and pedestrian countdown signals. Only consider these controls after completing a detailed engineering study for an intersection.

Intersection Treatments

Curb Ramps and Aprons

The opening of a trail at a roadway should be at least the same width as the trail itself. If provided, a curb ramp should also be the full width of the trail. The approach should provide a smooth and accessible transition between the trail and the roadway, with a 5 foot radius or flare at appropriate turns. On unpaved trails the design of a trail-road intersection should include paved aprons that extend a minimum of 20 feet from paved road surfaces.

Widening Paths at Intersections

For locations where queuing at an intersection results in crowding at the roadway edge, consider widening the path approach. This can increase the crossing capacity and help reduce conflicts at path entrances.

Chicanes

Designers can use chicanes, or horizontal curvatures, to reduce trail users' approach speeds at intersections where sight distance is limited or where users should stop and yield. End chicanes far enough in advance of the intersections to allow the user to focus on the curves of the pathway and then the approaching intersection. Design chicanes for speeds less than 8 mph with a solid centerline to reduce users from cutting corners.

Restricting Motor Vehicle Traffic

Unauthorized access by motor vehicles on pedestrian-only trails, especially those that extend through independent corridors, poses a

major issue. The MUTCD[23] permits the R5-3 NO MOTOR VEHICLES sign to be used to reinforce the rules. You can also use bollards or similar barriers to restrict motor vehicle access, but determined individuals who often use the path illegally usually find ways around the physical barrier.

Crossing Islands

Raised medians significantly lower pedestrian crash rates at multi-lane crossings. Crossing islands particularly benefit trail-roadway intersections with high volumes of speeds, multiple lanes, or excessive roadway width. In addition, crossing islands benefit children, the elderly, and those with disabilities. Design crossing islands to be large enough to accommodate multiple trail users including groups of pedestrians or bicyclists, wheelchairs, and equestrians. Design crossing islands in accordance with the *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way*[24] (PROWAG), available *Here*.

Additional Crossing Considerations

Transition Zones

It is important to integrate a trail into the existing system of sidewalks and bicycle facilities when the path crosses or terminates at an existing roadway. The terminus should transition smoothly into a safe merging or diverging situation. Use appropriate signage to warn and direct both trail users and motorists regarding these transitions. Each crossing serves as an access point whose design should facilitate movements of path users either entering or exiting the path from the road.

Traffic Calming for Intersections

Traffic calming measures may affect crossing locations positively when the speed of approaching traffic is a concern. Appropriate calming measures include crossing islands, speed cushions, curb extensions, chicanes, raised intersections or crosswalks, and curb reduction at corners. These improvements prepare motorists to yield to path users, reducing the frequency and severity of collision.

Shared Use Paths through Interchanges

Provide separation and continuity where a shared use path travels parallel to a roadway intersection. The design should not require users to exit the path, ride on roads or sidewalks through the intersection, and then resume riding on the path. The designer may need to incorporate grade-separated crossings to enable trail users to conveniently and safely navigate through these exchanges.

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23   Manual on Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation, Federal Highway Administration,: 2009
24   Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way, Architectural and Transportation Barriers Compliance Board: 2011

R5-3 No Motor Vehicle Sign
Manual on Uniform Traffic Control Devices

Shared Use Trail and Rail Trail Best Practices
- Great Allegheny Passage, Allegheny, Westmoreland, Fayette, Somerset Counties
- Pine Creek Trail, Lycoming and Tioga Counties
- Butler Freeport Trail, Butler and Allegheny Counties

Shared Use Trail and Rail Trail Trailhead Best Practices
- Pine Creek Rail Trail (various locations, various amenities), Lycoming and Tioga Counties
- Little Toby Rail Trail; Elk and Jefferson Counties
- Lowlands Trail (viewing blinds, parking, kiosk); Cameron and Potter County
- Youghiogheny Trail, Cedar Creek Park, Westmoreland County

The MUTCD[25] regulates the use and design of all traffic control devices. Trail designers may use signs, pavement markings, and signals in compliance with MUTCD standards to guide and regulate trail user traffic on roads and paths.

Urban Bikeway Design

The National Association of City Transportation Officials (NACTO) *Urban Bikeway Design Guide,*[26] *available* **HERE,** provides guidance on solutions that can help create complete streets that are safe and enjoyable for bicyclists.

This guide stems from the experience gained from the best cycling cities in the world. The designs were developed by cities for cities, since unique urban streets require innovative solutions. Those planning trail connections through main street and downtown areas will find the guide useful.

Complementary Publications

For more information on shared use paths and rail trails visit the Rails to Trails Conservancy's on line Trail Building Toolbox, available **HERE**, which provides a wealth of information on each of these topics.

PennDOT recognizes the AASHTO Guide[27] as the standard for designing shared use paths funded through state and federal programs.

Shared Use Path Best Practices
- Great Allegheny Passage, southwestern Pennsylvania

- Pine Creek Trail, north central Pennsylvania

- Delaware and Lehigh Trail, southeastern Pennsylvania

You can obtain additional information by contacting the Northeast Regional office of the Rails to Trails Conservancy at:

- **Rails-to-Trails Conservancy**
  2133 Market Street
  Suite 222
  Camp Hill, PA 17011
  (717) 238-1717
  www.railstotrails.org
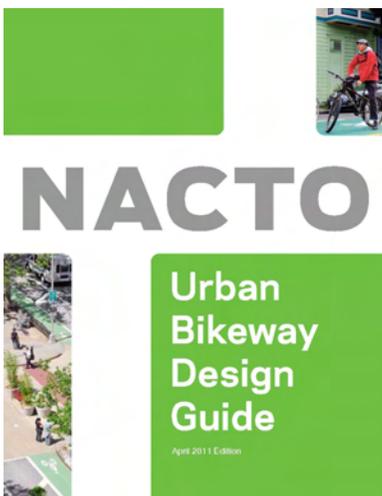
Urban Bikeway Design Guide
National Association of Transportation Officials

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25   Manual on Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation, Federal Highway Administration: 2009
26   Urban Bikeway Design Guide, Second Edition, National Association of City Transportation: 2012
27   Guide for the Planning, Design, and Operation of Bicycle Facilities, American Association of State Highway Transportation Officials, 4th Edition: 2012

Equestrian Trails

When planning trail opportunities, give consideration to equestrians. Equestrian trails attract horseback riders seeking a safe, contiguous trail experience in a natural setting. When designing trails for equestrian use strive to meet the goal of providing accessible and pleasurable trail riding experiences with few or no environmental impacts.

General Considerations for Equestrian Trails[28]

The following information defines the common equestrian trail user, the nature of a horse, and design elements to accommodate equestrians.

User Information

Horseback riders may desire to have an individual experience seeking solitude in nature with their horse, or they may desire a social experience riding with a friend or in groups. Trail riding occurs at a walking pace or slow canter in a couple hours time. This slow pace allows riders to travel safely in groups, but may increase a trail's difficulty for both the rider and animal.

Horseback riders do not need a wide or highly developed trail but they do prefer variety. Water crossings, fallen logs, grade climbs and descents, open areas, and woods create interesting dynamics throughout a trail system. At trailheads where camping is permitted, high lines or roofed tie stalls are preferred and are more desirable than corrals. Horses can easily kick down corrals, corrals take up a lot of space, and require horses to be familiar with each other.

Dedicated equestrians travel to local and regional areas to ride designated trails or a network of varying length looped trails. Local trail riders' trips in the immediate area usually range from 7 to 10 miles per day. Destination trail riders often travel long distances to publicized trail networks and ride about 10 to 15 miles per day and 25-30 miles on an average weekend trip.

Understanding Horses

The average horse used for recreational riding or driving weighs approximately 800 - 1400 pounds and travels 3 to 5 mph at a walk or slow gait. As herd animals, horses feel more secure in groups because there is safety in numbers.

A major concern of equestrians is safety. The safety of horses and their riders depends on minimizing opportunities for horses to be frightened and providing an acceptable trail tread. Good sight lines, clearing width and clearing height of 10 to 12 feet are desirable whether managing the trail as a shared use trail or single use trail.

Green Lake Park Trails
Montgomery County

Photo Credit: Montgomery County Planning Commission

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28   Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds, U.S. Forest Service: 2007

Equestrian General Speeds and Distances

Walking
- 3-5 miles per hour
- 7-10 miles

Walking/ Trotting
- 3-9 miles per hour
- 10-15 miles

Local and Destination Equestrian Rider Profile

Trail Use Pattern
- Destination trail riders travel to trails and public land areas to ride designated trails or a network of trails through the forest; local trail riders use trails in the immediate area where they keep or board their horses
- Destination riders ride 10–15 miles per day, 25–30 miles on an average weekend trip; local riders average 7–10 miles per day
- Prefer looped configurations with varying conditions and mileage
- Local riders need direct access to trails from boarding areas
- Riders like to remain self-contained, with special trailers used for hauling horses and to house riders at night
- Often travel long distances to trail systems that provide many miles of trail

Recreation Setting Preferences
- Do not need a wide or highly developed trail
- Single-file trails make horses easier to handle and need less maintenance
- Need water nearby for stock
- Variety in a trail is desirable, including water crossings, hill climbs and descents, open areas and woods
- Bridges need to be about 6' to 8' wide and clear zone above the trail has to be at least 9' high but prefer 10' to 12' high
- Large, open flat field with good drainage is best for parking; gravel lots are also acceptable
- High lines or hitch rails are preferred over corrals for day use
- High lines 7' from the ground or roofed tie stalls are recommended for overnight camping

Equestrian Trail Classifications

You will usually find equestrian trails in state, regional, and county trail systems. These trails are typically classified by their managed use, as either accommodating equestrian use, shared use, or carriages.

Equestrian Trail: Equestrian trails typically have natural surface. They are located in natural settings offering scenic beauty, wildlife observation opportunities, and adequate open space for looped trail systems.

Carriage Trail: Carriage trails are routes that have the ability to accommodate both horseback riders and carriage drivers. When considered in a design, a minimum trail width of 8 feet is necessary to accommodate carriages.

Shared Use Path: A shared use path is a path physically separated from motorized vehicular traffic by an open space or barrier and either within the highway right-of-way or within an independent right-of-way. Pedestrians, bicyclists, skaters, wheelchair users, joggers, equestrians, and other non-motorized users share this type of path.

Equestrian Trail Layout Configurations

Plan equestrian trail systems based upon a designed riding experience. This layout should highlight scenic qualities of an area, as well as limit impact on nearby ecological systems. In a normal walking gait, horses travel about 3 to 5 miles per hour. Therefore, it is important to plan trails based on the amount of time needed to complete each ride. Looped trail systems offer a desirable experience for riders, as trails of varying lengths are interconnected, giving riders the option of shorter or longer trail rides.

Rule of Thumb for Ride Distances

- *One hour loop*
  3-5 miles

- *Two hour loop*
  6-10 miles

- Three hour loop
  8-15 miles

## Equestrian Trail Guidelines, Level of Difficulty and Other Considerations

PA DCNR Standards for Equestrian Trails[29]

Trail Type	Easiest (Interpretive)	More Difficult	Most Difficult
Clearing Height	10 feet	8 feet	8 feet
Clearing Width*	8 feet	6-8 feet	3-6 feet
Treadway Width**	2 feet	2 feet	18 inches
Treadway Slope***	Less than: 10%	Less than: 10%	Less than: 15%
	Less than 5% Maximum: 15% up to 200 feet	Less than 10% Maximum: 25% up to 300 feet	Less than 15% Maximum: 30% up to 500 feet
Treadway Cross Slope	0-2%	0-5%	0-10%
Turning Radius	Not critical but avoid sharp turns on steep slopes or using switchbacks (30 inches if necessary)	Not critical but avoid sharp turns on steep slopes or using switchbacks (30 inches if necessary)	Not critical but avoid sharp turns on steep slopes or using switchbacks (30 inches if necessary)
Sight Distance	Two-way traffic: 50-100 feet Motorized road crossings: 100-200 feet	Two-way traffic: 50-100 feet Motorized road crossings: 100-200 feet	Two-way traffic: 50-100 feet Motorized road crossings: 100-200 feet
Surface Materials	Surfacing as needed for stability. Native surface with some imported material. Sidehill trail is constructed. Smooth tread with few obstacles.	Native surface with constructed sidehill trails. Occasional roots and rocks to 6 inches.	Native with limited grading. Roots, rocks, and logs to 12 inches.

*   Along a precipice or hazardous area, the trail clearing width should be at least to 5 feet to provide safety to riders and their animals.

**   Increase tread width 1 foot on switchbacks.

***   Upper limit of treadway grade and distance depends on soil type, amount of rock, vegetation type, and other conditions affecting trail surface stability.

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29   Guidelines for Marking Recreational Trails, PA DCNR: 2008

10'-12'
Clearance

2'-3'
Shoulder
Width

8' Minimum
Treadway
Width

2'-3'
Shoulder
Width
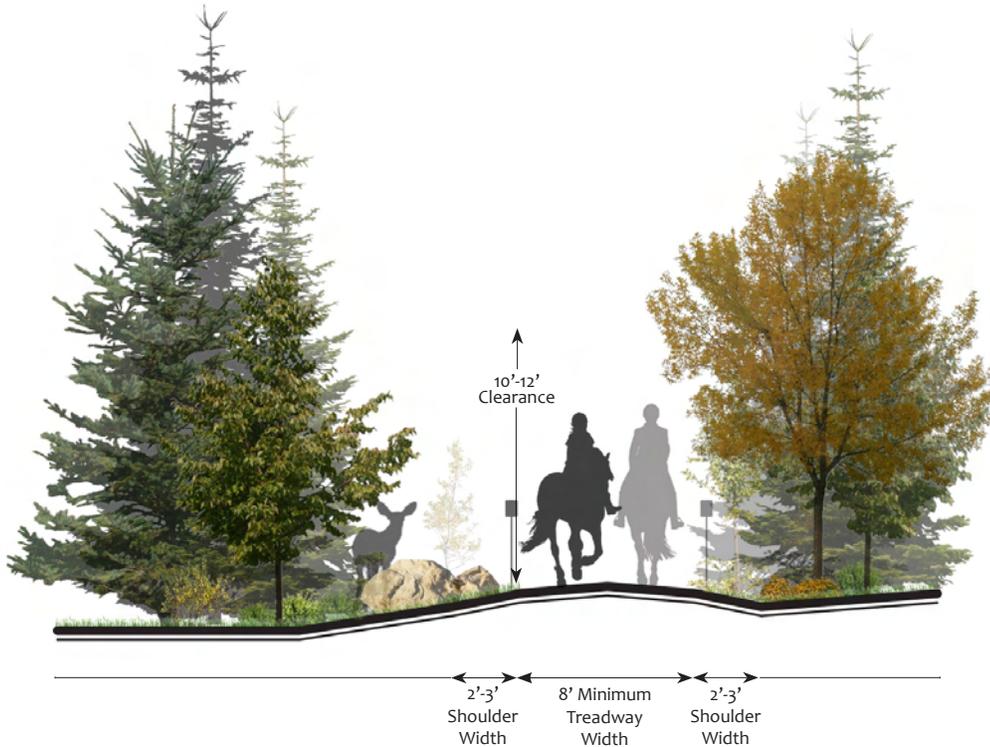
Two-Way Equestrian Trail

Equestrian Trail Treads

Design the treadway to accommodate the weight and motion of animals and riders. The choice of varying tread surface treatments affects the speed at which horses and mules can travel. Fine aggregate provides good traction and provides a surface conducive to safe cantering. However, hard surfaces offer poor traction and limit travel to a walk. Remove tread obstacles such as tree roots, holes, dead or leaning trees, and projecting objects for safety. Natural soils can serve as the tread material provided they meet the requirements described in this chapter.

For durable, all-season urban equestrian trails, plan at least a 4 foot wide tread surface to accommodate single-file use and 8 foot width for side-by-side use. Where existing soils cannot adequately support equestrian use, construct a treadway using geotextile, base rock, compacted aggregate, and compacted cushion layer of rounded stone. Horses do not like to walk across large angular stone; it is uncomfortable on their hooves. Angular stone on the tread surface should be AASHTO No. 57 or smaller in size. Horses tend to favor the outside edges of sidehill trail treads.

The trail designer should recommend proper placement and compaction of fill material at trail edges for equestrian safety. This is of special concern where trails are constructed on fill and where the quality of the fill material
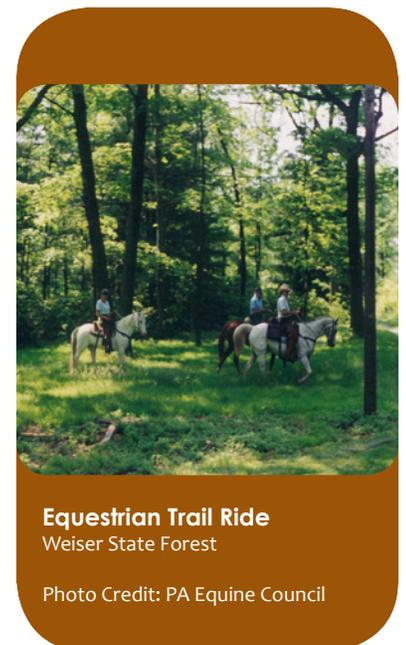
Equestrian Trail Ride
Weiser State Forest

Photo Credit: PA Equine Council

and the construction methods are unknown. Fill consisting of large stones does not accommodate barefoot trail horses, whose numbers are increasing with the natural horsemanship movement. Build retaining walls for newly constructed sidehill trails to stabilize older, deteriorating trails.

Equestrian Trail Amenities

On-Trail Amenities

On-trail amenities encourage equestrian use and enhance a trail user's experience. The design of a loop trail system is preferable to linear trails, allowing the connection of multiple routes. By providing these connections, as well as maintaining natural components of the landscape, the design can feature compelling trail sequences and can provide access to water sources throughout the system. Designers should incorporate a hardened, gentle slope leading to trailside streams or ponds to allow horses to access natural sources of waters and to prevent riparian and stream bank impacts.

Trailhead Amenities

Designers should locate trailheads at the beginning of a trail system. Many equestrian campers are self-contained and include water, toilet, and sleeping quarters. Therefore they do not require as as many amenities. Depending on the type of equestrian user, amenities to consider include: parking, restrooms, picnic areas, signs, and maps. Equestrian trailheads should also include specific amenities to accommodate equestrian use including: potable water, accessible mounting platforms, ordinary mounting blocks (stones or stumps), bunkers for manure disposal, and parking to accommodate haul vehicles and their trailers.

Designers should clearly separate equestrian parking from other trail parking by designing parking lanes approximately 30 feet wide by 80 feet long to accommodate large truck and trailer combinations, as well as to allow for the loading and unloading of animals.

Riders also desire high lines or hitching posts, covered horse tie stalls for overnight camping, and dedicated equestrian access to the shared use trails or paths.

Mapping, camping literature, and signage should clearly indicate the availability and locations of potable water and stock water as well as toilet facilities and manure pits.

Shared Use Paths Accommodating Equestrian Use

Heavy equestrian use of a shared use path with a compacted stone surface, or a natural surface trail, may result in the displacement of the trail's surface, and will require a higher level of maintenance to correct. In areas with low horse populations, the amount of equestrian use typically remains limited and results in less tread displacement. In corridors that provide sufficient width,
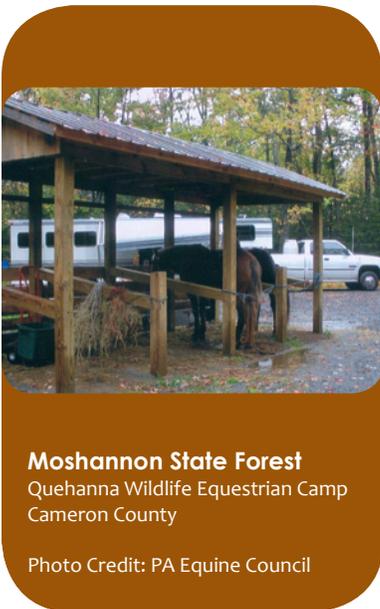
Moshannon State Forest
Quehanna Wildlife Equestrian Camp
Cameron County

Photo Credit: PA Equine Council

a dual-tread trail can separate equestrians from other trail users. See the section on shared use paths earlier in this chapter.

Manure remains a concern of non-equestrian users. When visiting a stable, horse show, or rodeo, visitors expect the atmosphere surrounding these activities. In particular, horse manure is an accepted nuisance. Although visitors walking or biking on trails that allow equestrian use should expect these conditions, tolerance sometimes wanes. Recognizing this concern, a trailhead can address this issue by providing a length of dedicated equestrian trail connecting a shared use path. Horses tend to relieve themselves at the start of their ride. Therefore, providing a separate trail for the first 500 to 2,500 feet can reduce the non-equestrian users' encounters with horse manure.

Trail managers can minimize conflicts by conveying the message that a trail intends to accommodate equine use from the beginning of the planning process. Equestrian-specific amenities by their very nature establish expectations. Trail users who see these amenities at a trailhead and along the trail corridor often accept horses more readily. This is because they realize the trail supports equine activities. Emphasize equestrian use of a shared use path with signage at trail access points and along the trail to remind users of expectations and etiquette. This understanding should work both ways on shared use paths. Encourage equestrian users to clear the path of horse manure when possible, just as hikers are expected to clean up after their animals.

PA Grand Canyon
Tioga and Lycoming Counties

Photo Credit: PA Equine Council

Accessibility on Equestrian Trails

In addition to meeting typical ADA requirements documented elsewhere in this guide, the addition of mounting blocks and ramps at trailheads provides accessibility to those who may not otherwise be able to mount a horse. Mounting blocks and ramps serve a broad range of riders.

Installing mounting blocks or ramps[30] in areas where riders normally dismount and mount can increase usage of trails, trailheads, or campgrounds. Many riders have difficulty getting on and off a horse or mule, especially young children, small or older riders. Many riders in this situation search out large rocks, stumps, or mounds to boost themselves. Such objects can be unstable or slippery. Therefore, designers should provide mounting blocks or ramps instead.

Riders of all abilities and ages can use mounting blocks. A mounting block resembles a short staircase that ends in midair. The rider climbs the stairs to reach the saddled animal standing at the elevated end. Mounting blocks may be made of wood, steel, concrete, plastic, fiberglass, or a combination of these materials. Structures that are more permanent, for example those

Equestrian Mounting Ramp

Photo Credit: PA Equine Council

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30   Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds, U.S. Forest Service: 2007

made of concrete or steel, are most suitable at trailheads or campgrounds that have easy access for construction equipment. Permanent structures also discourage theft. Structures made from wood, fiberglass, or plastic are easier to transport, install, and place along trails.

To meet accessibility requirements, the treads on mounting blocks should be at least 11 inches deep and 36 inches wide. Risers should be uniform and measure between 4 and 7 inches high. Mounting blocks commonly have an overall height of 16 to 28 inches. The need for handrails remains a source of debate. While handrails keep users from falling off platforms, they may catch the animal, rider, assistants, or equipment.

Riders usually mount from the left side of the animal, passing their right leg over the horse's back. Handrails on the right-hand side of the stair will interfere with the rider's leg movement. This makes a compelling case for leaving handrails off mounting blocks, or for installing handrails that stop before the top step. To meet the ADA/ABAAG requirements, handrails should have extensions, also called returns, at the top and bottom. In this case it is not appropriate to have handrail returns extending into the animal's space.

Complementary Publications

The U.S. Forest Service publication *Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds*[31]*, available **Here**,* is an excellent resource.

For additional information contact the Pennsylvania Equine Council's Trail Stewardship Program:

- Pennsylvania Equine Council
  Post Office Box 62
  Huntington Mills, PA 18622-0062
  (888) 304-0281
  info@pennsylvaniaequinecouncil.org
  www.pennsylvaniaequinecouncil.org

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31   Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds, U.S. Forest Service: 2007

Cross-Country Skiing Trails

Cross-country skiing routes provide naturally surfaced trails used during the winter season. The design and grooming of these trails provide for a variety of trail users including traditional or classic, skate, and backcountry skiers. Traditional or classic cross-country skiers use a kick or gliding motion, while skate-skiers use a unique skating motion to move forward along a trail.

General Considerations for Cross-Country Skiing Trails[32]
The following information defines the general preferences and motivations of cross-country skiers, and provides suggestions for the most effective design of these routes.

User Information
Cross-country skiing is attractive to people of all skill levels and abilities. This winter sport appeals to recreational, fitness, event, and backcountry skiers who enjoy skiing for its range of benefits. Although motivations for skiing differ for each individual, all users enjoy groomed trails whose design meets their specific needs.

Trail networks that offer convenience and diverse opportunities for all types of use prove attractive to dedicated skiers. Recreational and fitness skiers prefer a combination of traditional and skate-ski style trails that can accommodate varying skills and preferences. Event skiers prefer hilly, lighted trails that allow skilled users to participate in organized events and train throughout the year.

Cross-country ski trails generally serve as a part of a looped trail system which provides varying conditions and difficulty levels. While recreational skiers do not depend on the technical difficulty of a trail, highly skilled skiers seek out well-groomed trails that offer a mixture of difficulty and length. Trailheads and trail systems alike should offer amenities such as restrooms, warming areas, and drinking water to accommodate users.

Recreational/Family Skier User Characteristics
Trail Use Pattern
- Seeks out and travels to designated, groomed trails
- Often skis as a family, but you will commonly encounter couples and individual skiers
- Prefers looped configurations with varying conditions

Recreation Setting Preferences
- Prefers larger natural settings
- Attracted to convenience and diverse activity opportunities in the area to accommodate all family members
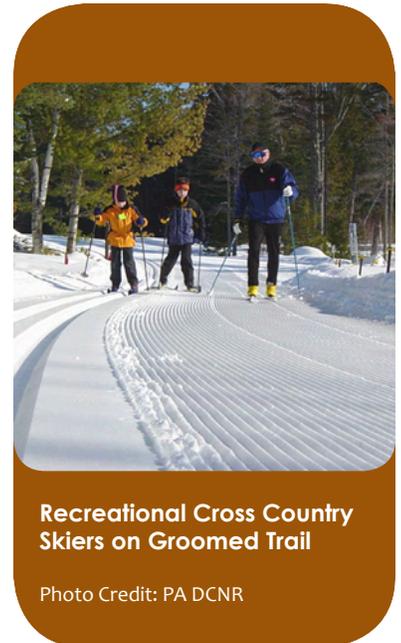
Recreational Cross Country Skiers on Groomed Trail

Photo Credit: PA DCNR

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32 Adapted from Trail Planning, Design, and Development Guidelines, Minnesota Department of Natural Resources: 2007

- Strong preference for well-groomed trails offering a mixture of difficulty and length, with places for children to practice
- Generally does not want all skate-skiing or too many fast skiers on trails
- Prefers a combination of traditional/classic and skate-ski styles to accommodate varying skills and preferences
- Prefers that skate-skiers and traditional/classic skiers be on different trails (not side-by-side) at least once in a while in order to have their own space
- Drinking water, restrooms, and warming areas at trailheads remain important
- May do multi-day trips and stay at local lodging facilities or resorts

Fitness Skier User Profile
Trail Use Pattern
- May go daily or several times per week; many use local trails routinely
- Primarily skis on local trails in a park or on a golf course that offers trails providing enough length and challenge

Recreation Setting Preferences
- Needs trail of varying difficulty and length, with looped systems preferred for training
- Should have well-groomed trails; groomed trails are a significant factor in trail selection
- Prefers a natural setting, but having ample trail distance is most important
- Prefers a combination of traditional/classic and skate-ski styles to accommodate varying skills and preference; many participate in both kinds of skiing
- Needs and highly supports lighted trails to enable training in the evening during the work week
- Drinking water, restrooms, and warming areas at trailheads remain important

Racer/Event Skier User Profile
Trail Use Pattern
- Uses trails as part of an organized event or competition
- Often falls into the fitness skier category on a day-to-day basis and commonly trains on local trails

Recreation Setting Preferences
- Prefers hilly terrain for good skiing and avoiding boredom during longer events
- Needs support facilities for rest, staging, and comfort
- Needs same trail facilities as fitness skiers for training, including lighted trails

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Cross-Country Ski General Speeds and Distances

Backcountry Skier
- 0.6 to 3.7 miles per hour
- 2.5 to 9.3 miles per hour

Recreational/Family Skier
- 1.8 to 6.2 miles per hour
- 2.5 to 6.2 miles

Fitness Skier
- 3.1 to 9.3 miles per hour
- 5 to 15.5 miles

Racer/Event Skier
- 6.2 to 12.4 miles per hour
- 3.1 to 31 miles

- 6-75 mile loops are good for events, as are linear courses of up to 30 miles

Backcountry Skier User Profile
Trail Use Pattern
- Prefers natural areas with extensive opportunity for skiing
- Does not need groomed trails
- May camp during winter as part of an outing

Recreation Setting Preferences
- Beginners need marked trails with maps and some level of basic maintenance
- Traditional/classic style is predominant
- Prefers looped system, but linear trails offer an acceptable alternative if shuttle service is available
- Length of trail can be less than 5 miles for a day outing and up to 50 miles for a winter camping trip
- Prefers remote settings free of motorized activity

Ungroomed Cross-Country Trail
Nescopeck State Park
Luzerne County

Photo Credit: PA DCNR

Cross-Country Skiing Classifications

Cross-country skiing trails accommodate trail users on a local, county, regional, and state level during the winter months. Local trail systems typically do not support skiing because of their need for specialized grooming. All trails accommodate traditional and skate-style skiers on groomed trails that vary in form. Backcountry skiers typically follow routes with little to no formal maintenance.

Traditional (Classic) Style – one track set/one direction:
Traditional cross-country trails are usually located in county, regional, and state parks. Total width is 6 to 8 feet.

Traditional (Classic) Style – two track set/one or two directions:
Two-way traditional style routes are the most common type of groomed trails in state parks. These trails receive routine maintenance, especially after snowfall over a few inches. Total width is 8 to 10 feet.

Skate Style – single width/one direction: These trails are typically located in county, regional, or state parks as connector trails from one loop to the next. Trails of this type are common in high use areas where users prefer the separation of skiing styles. Total width is 8 to 10 feet.

Skate Style – double width/one or two directions: This configuration is typically found in county, regional, and state parks. Trails of this type are common in high use areas where users prefer the separation of skiing styles. However, uses are often combined because of the increased mileage needed to accommodate separate uses. Total width is 14 to 16 feet.

Combination Traditional and Skate Style – one direction: One-directional use trails are typical in county, regional, and state parks and most popular among skiers. This type of trail helps avoid confusion and conflict, keeps overall tread width narrow, and accommodates high levels of use and a diversity of skier types. Total width is 12 to 14 feet.

Combination Traditional and Skate Style – two direction: This type of trail serves as a linear connector between loops or at trailheads with two-directional use. Total width is 16 to 20 feet.

Cross-Country Skiing Trail Layout Configurations : Cross-country ski trails should offer 5-10 mile looped trail systems of varying terrain consistent with the trail difficulty ratings shown in the following table. Internal connector trails and cutoffs allow different trail lengths and permit easy return access for skiers. Users prefer multiple, short loops ranging from ½ to 3 miles in length, to one long loop.

In addition to looped configurations, linear or point-to-point cross-country ski trails commonly occur with greenways and trail corridors located in developed areas. This approach allows nearby trail users to conveniently access cross-country skiing areas as a major advantage.

PA DCNR Cross-Country Trail Guidelines, Level of Difficulty, and Other Considerations[33]

Trail Type	Easiest (Interpretive)	More Difficult	Most Difficult
Clearing Height	10-12 feet	10 feet	8-10 feet
Clearing Width	18-24 inches outside of treadway	12-18 inches outside of treadway	12 inches outside of treadway
Treadway Width	One-way: 2-4 feet T wo-way: 5-6 feet	1 ½-4 feet	1-2 feet Typically not designed for two-way travel
Treadway Grade	Less than 8% Maximum: 15% up to 150 feet	Less than 10% Maximum: 20% up to 150 feet	Less than 15% Maximum: 20% up to 200 feet
Treadway Cross Slope	0-4%	0-4%	4-8%
Turning Radius	50-100 feet Gentle turns on downhill slopes. Avoid sharp turns. Never locate a turn at the base of a downhill run.	50-100 feet Incorporate more turns in trail layout. Avoid sharp turns. Never locate a turn at the base of a downhill run.	50-100' feet Incorporate more turns in trail layout. Never locate a turn at the base of a downhill run.
Sight Distance	50 feet on downhill runs, streams, and road crossings.	50 feet on downhill runs, streams, and road crossings.	50 feet on downhill runs, streams, and road crossings.

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33   Guidelines for Marking Recreational Trails, PA DCNR: 2008

10'-12'
Clearance

1'-2'
Shoulder
Width

5'-6'
Treadway
Width

1'-2'
Shoulder
Width
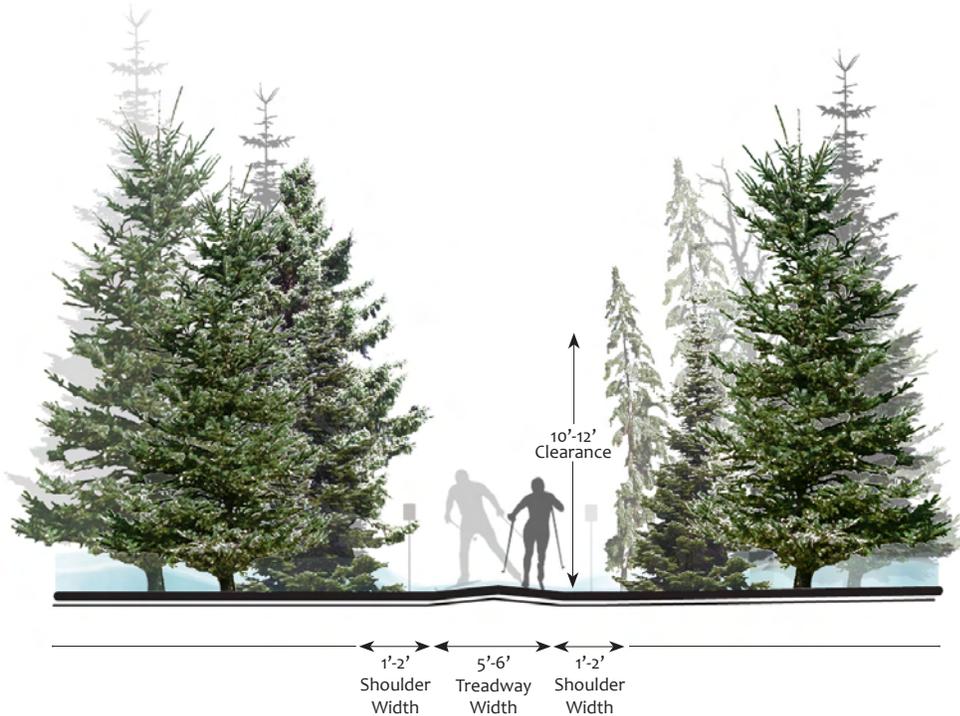
Two-Way Cross-Country Skiing Trail

Many multi-use trails that accommodate pedestrians, bicyclists, and equestrians during warmer months provide ideal opportunities for cross-country skiing throughout winter months. A minimum of 6 inches of snow on a trail offers excellent skiing opportunities with minimal to no damage of the trail or ski equipment. If the trail sees other winter use, cross-country skiers will often ski off to the side to avoid having their tracks trampled.

Trail Grades, Curves, and Sight Distances

Grade variations enhance the skier's experience, consistent with the desired difficulty level of a trail. Generally, 1/3 of a given trail provides uphill skiing, 1/3 should provide downhill skiing, and 1/3 should have a rolling grade.

Designers should consider downhill runs as an important feature in the design of cross-country ski trails. The longer and steeper the run, the straighter and longer the run-out area should be at the bottom of a hill. This allows skiers to dissipate speed to regain a sense of control. Where limited space exists, a rise in grade can offset a loss of run-out distance. Within clearance zones and on two-direction trails, the trail should be wide enough to separate various user types, as well as allow skiers to safely fall and slide several feet.

Since most skiers are not experts, avoid sharp bends at the base of hills. Long, gentle curves are the preferred design on downhill ski trails; however, in some situations where the design of a trail cannot avoid a curve at the end of a downhill, the design should incorporate a radius of 100 feet or more. This

also holds true for all other curves along the trail. In these situations, locate warning signs at least 100 feet before the beginning of the slope.

Forward sight distances are critical on steep downhill runs, and where trails cross waterways, motorized roadways, and other potential hazards. In these cases, incorporate level approaches with forward sight distances of at least 50 feet. On sharp curves and downhill sections, designers need to incorporate a sight distance of at least 100 feet.

Trail Alignment and Preparation

Trail Alignment
The tread of a cross-country skiing trail refers to the underlying trail beneath the compacted and groomed snow. Proper off-season evaluation of trail alignments, tread surface preparation, and trail maintenance should occur to ensure the quality of a trail. Locate trails in areas where snow will remain the longest and offer the most stable skiing. Important consideration in determining the location of a cross country skiing trail include: sun and wind intensity, solar orientation, location, and overall trail tread. By designing with these factors in mind, trail designers can locate trails geographically to maximize their use throughout the season.

Cross-country ski trails are usually well suited for hardwood and coniferous forests. Hardwood forests offer an excellent setting for these trails because the sun's intensity is lower and the air temperature remains colder than in wide-open flat areas. Incorporating changes in topography offers designers another effective strategy to reduce the extent of sunlight on the trail. Use this strategy along the base of north-facing slopes where the sun is less intense. Also, avoid locating skiing trails at the base of south facing slopes where the sun is most intense.

Before permanently establishing a trail, the designer should conduct field tests of a trail's alignment, snow displacement patterns, and seasonal wind effects. Even relatively minor shifts in the location of a skiing trail can make a dramatic difference in the impact natural elements will have on it.

Avoid wetland areas and water bodies when aligning cross-country ski trails to minimize ecological impacts, surface quality issues, and safety issues. Do not place ski trails on lakes for safety.

Trail Cross Grades
The optimal skiing trail cross-section has a consistent, even grade with a 0 to 2 percent cross-slope. Avoid abrupt changes in grade along a trail to make the route more enjoyable and easier to maintain.

Tread Surface Conditions

The tread surface of a trail is important to consider for overall preparation and grooming maintenance. A level, smooth trail with a short grass cover of 3 to 4 inches across the entire width of the trail offers ideal conditions. This type of tread prevents off-season foot traffic and erosion from creating an uneven tread surface and holds snow better than bare ground or pavement.

Routine mowing maintains the tread surface, as well as reduces the need for brush trimming and controls the growth of woody plants. In protected or environmentally sensitive areas, employ a two-step approach to mowing as the preferred method. The first mowing should occur in late September to cut grass to the desired length and the second mowing should occur a few weeks later to mulch debris left from the first pass. Remove logs, rocks, and other woody debris from the trail shortly before the season begins.

If grass cannot be maintained, wood chips offer the next best alternative. Other surfaces such as bare ground and aggregate surfacing have certain limitations. Asphalt and concrete are the least desirable surfaces since asphalt absorbs more sun energy, loses snow earlier, and is hard on ski equipment when snow cover is thin.

Tread drainage and erosion are important design considerations evaluating overall trail quality and the dual use of ski trails. To prevent erosion the design should stabilize the trail with ground cover during the off-season.

Cross-Country Skiing
Black Moshannon State Park
Centre County

Photo Credit: PA DCNR

## Cross-Country Ski Trail Amenities

Lighted Cross-Country Ski Trails

When trails are lighted they are typically designed as 3 mile loops. By lighting a previously unlit trail, skiers have the opportunity to use the trails for longer periods throughout the day. While it may seem reasonable to light a loop of the recommended length, anything more or less should take into account the added costs for development and maintenance, as well as provide justification through user counts and satisfaction surveys. Consideration should be given to exploring solar lighting options to reduce utility costs.

Trailhead Facilities and Signage

In larger park settings, the main trailhead is commonly located adjacent to a visitor center. On the local level trailheads usually consist of simple amenities such as a plowed parking area, trail shelter, warming area, portable restroom, and self-registration station.

The signage for cross-country ski trails should be generally consistent with the signage recommendations contained in Chapter 3. It is important to include maps, trail distance, level of difficulty, and warning signs on all cross-country ski trails.

Best Practice Examples

The following represent the use of best practices in the development of cross-country ski trails and amenities. We encourage you to research and visit these locations before planning, designing, and constructing your trail.

- Parker Dam State Park, Clearfield County: Grooms and sets track on five miles of ski trails, provides cross-country skiing programming and classes, provides equipment, and guides learners on the trails.

- Bald Eagle State Park, Centre County: Some park trails and open areas are suitable for cross-country skiing. About seven miles of ungroomed trails are available with proper snow conditions.

- Chapman State Park, Warren County: The 4.4 miles of ski trails connect with numerous trails in the adjoining national forest and state game land. There is a warming hut.

- Clear Creek State Park, Jefferson County: A three-mile cross-country ski trail uses portions of Truby, Sawmill, Clear Creek and Ox Shoe trails to make a loop.

- Little Pine State Park, Lycoming County: The five-mile Lake Shore Trail follows level terrain and parallels the lake and headwaters and then returns to the starting location. Motor vehicles and snowmobiles are prohibited in this area.

- Ole Bull State Park, Potter County: Cross-country skiing and snowshoes are allowed throughout the park.

- S. B. Elliott State Park, Clearfield County: There are more than four miles of easy to moderate roads and trails.

- Sizerville State Park, Cameron and Potter Counties: Park trails provide access to many miles of trails on adjacent state forest land. The average yearly snowfall is 60-70 inches. The park provides parking and restrooms.

Snowshoeing and Winter Hiking Trails

The development of naturally surfaced trails for winter use allows routes to accommodate the sport of snowshoeing and winter hiking. The amount of snow, as well as the level of grooming on a trail depends on the type of user group that uses the trail throughout the winter season.

General Considerations for Snowshoeing Trails[34]

The following information defines the general preferences and motivations of both snowshoers and winter hikers, as well as how the design of each type of route can best accommodate its use.

User Information

Snowshoers and winter hikers enjoy being outdoors during the winter season. Winter hiking trails, used for alternative uses during the summer months, can accommodate trail users seeking multiple experiences.

A large percentage of natural trail users seek to escape from motorized activity and value experiencing nature. Winter hikers usually seek groomed trails of varying difficulty that provide observation points for users to rest, observe, and socialize. Snowshoers like trails that vary in skill and difficulty levels whether they are groomed or not.

Given the limited demand, designers can typically accommodate both uses on the same trail. With deeper snow, snowshoers tend to frequent the trail most often. Conversely, hikers tend to use trails when the snow is less than a foot deep on unpacked trails. Since both user groups prefer a trail with varying snow conditions, it usually allows users to enjoy the trail without disturbing others.
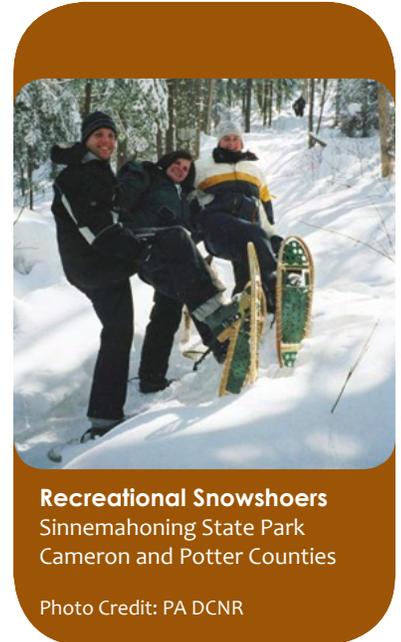
Recreational Snowshoers
Sinnemahoning State Park
Cameron and Potter Counties

Photo Credit: PA DCNR

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34   Adapted from Trail Planning, Design, and Development Guidelines, Minnesota Department of Natural Resources: 2007

Snowshoe and Winter Hike General Speeds and Distances

Snowshoer/Winter Hiker
- 2-4 miles per hour
- 3-5 miles

Snowshoer User Profile

Trail Use Pattern
- Uses trails whether groomed or ungroomed, depending on personal preference and type of snowshoe
- Frequently leaves the established trail
- May walk along groomed ski trails

Recreation Setting Preferences
- Needs unplowed, ungroomed surfaces, although some prefer to follow a groomed trail
- Prefers natural areas
- Snowshoers interested in exercise seek a trail with hills and adequate length

Winter Hiker

Trail Use Pattern
- Seeks out trails for a desired experience, whether near home or some travel distance
- Prefers looped systems over out-and-back trails to vary the experience
- Prefers groomed or plowed trails for ease of walking
- Will seek out trails of varying difficulty
- Likes to stop along the trail to rest, observe, and socialize if hiking in a group
- Expects trail to be of varying difficulty consistent with landscape characteristics

Recreation Setting Preferences
- Large percentage seeks escape from motorized activity, and values experiencing nature
- Natural setting is important to all, with wooded, rolling terrain with wildlife viewing opportunities commonly preferred
- Trail difficulty is an important determinant in trail selection
- Access to the trail serves as a major predictor of use levels
- Length preferences vary widely with skills and individual user preference
- Minimum preferred width should be 18"

Snowshoeing Trail Layout Configurations

Although snowshoeing and winter hiking have grown in popularity over the years, the demand for specialized trails remains small. As a result, the layouts for snowshoeing and winter hiking trails generally remain consistent with cross-country skiing trails. A looped trail system of 3 to 5 miles offers the most desirable design for this type of trail layout in most park settings.
If snowshoers have permission to use cross-country ski trails, trail managers commonly limit access to specific areas of a trail route. Trail blazes often define a route in order to guide trail users and keep them in a specific area and trail managers may relocate the blazes throughout the season.

Snowshoeing Trail Guidelines and Considerations

Slope Considerations for Snowshoeing Trails[35]

Aspect	Easy	Intermediate	Expert/Advanced
Corridor Clearance (Horizontal)	6-8 feet	6-8 feet	6-8 feet
Corridor Clearance (Vertical)	10 feet	10 feet	10 feet
Average Trail Grade	4%-10%	6%-12%	>12% (most challenging loops)
Maximum Hill Grade	10%-12%	12%-18%	>18%, with 40% max. for short distance

Snowshoeing
Sinnemahoning State Park
Cameron and Potter Counties

Photo Credit: PA DCNR

The design and grooming standards for snowshoeing and winter hiking trails are generally consistent with those defined for cross-country ski trails. To accommodate users for both trail types, trail grades should be consistent with easy or intermediate cross-country ski trail difficulty levels. Determine trail widths by the type and level of use the trail will receive. To accommodate one or two-way snowshoeing and/or winter hiking, the tread should be 6 to 8 feet wide.

Trail Treads

Maintain packed trails for hiking and snowshoeing once a week or after a significant snowfall. This rate is far less than cross-country ski trails since snowshoes and foot traffic easily accommodate loose or uncompacted snow on a trail. Most often, these trails are located on existing summer-use natural surface trail corridors.

While hikers usually prefer a groomed trail system, snowshoers are more tolerant of ungroomed and uneven surfaces. For ungroomed snowshoeing trails, trail managers typically use tree markers and trail blazes to mark the route. For cross-country travel, maps and directional signs typically highlight specific areas designated for snowshoeing.

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35   Trail Planning, Design, and Development Guidelines, Minnesota Department of Natural Resources: 2007

Difficulty Rating System for Snowshoeing Trails

Difficulty Standards for Snowshoeing Trails[36]

Aspect	Easy	Intermediate	Expert/Advanced
Length	1 ½-3 miles	3-10 miles	3-20 miles
Average Trail Grade	4-10%	6-12%	>12% (most challenging loops)
Maximum Hill Grade	10-12%	12-18%	>18%, with 40% max. practical
Character of Trail	Wide trails with ample run-out on hills, nice rolling terrain with easy grade changes.	Introduction to steeper, longer, and more frequent hill climbs, but with ample run-out on hills still important; steepest hills are relatively short; intermediate trails should be combined with easy trails to provide user with diversity and opportunity to work on various skills and endurance	More frequent, steeper, and longer hills with less recovery time in between; run-out area on hills is more constricted, but still safe for skill level; expert trails should be combined with intermediate and easy trails to provide user with diversity and opportunity to work on various skills and endurance; upper end hill grades should be shorter than 50 yards

Butler Freeport Trail
Butler County

Photo Credit:
Butler Freeport Community Trail

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36   *Ibid*

Accessible Trails

As noted in Chapter 1, designers should integrate universal design strategies into the design process whenever possible. Newly constructed trails should address these issues during the planning process to eliminate changes in a design during and after construction.

Every aspect of a trail experience should include accessible built facilities, amenities, trailheads, and trail corridors to ensure a trail's versatility. Moreover, a trail's environment and benefits should be enjoyable and appeal to those with and without disabilities.

Access Routes

Accessible routes are governed by the Department of Justice regulations titled the *2010 ADA Standards for Accessible Design*[37] (ADAADS), available *Here*. Accessible routes are exterior pathways, including sidewalks, with a prepared surface intended for pedestrian use.

In the trail environment accessible routes are typically associated with building environments such as comfort stations and nature centers.

ADAADS requires at least one accessible route within the site from accessible parking spaces and accessible passenger loading zones; public streets and sidewalks; and public transportation stops to the accessible building or facility entrance they serve.

Accessible routes should meet the following requirements:

- Floor or Ground Surface: Floor or ground surfaces should be stable, firm, and slip resistant. Openings in floor or ground surfaces should not allow passage of a sphere more than 1/2 inch diameter.
- Vertical Changes in Elevation: Changes in level of 1/4 inch high maximum should be permitted to be vertical.
  Beveled: Changes in level between 1/4 inch high minimum and 1/2 inch high maximum should be beveled with a slope not steeper than 1:2.
  Ramps: Changes in level greater than 1/2 inch high should be ramped.
- Protrusion Limits: Objects with leading edges more than 27 inches and not more than 80 inches above the finish floor or ground should protrude 4 inches maximum horizontally into the circulation path.
- Vertical Clearance: Vertical clearance should be 80 inches high minimum.
- Slope: The running slope of walking surfaces should not be steeper than 5 percent. The cross slope of walking surfaces should not be steeper than 2 percent.
- Clear Width: The clear width of walking surfaces should be 36 inches minimum.
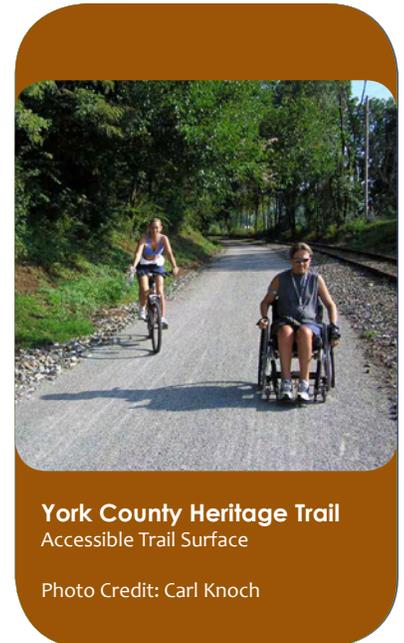
York County Heritage Trail
Accessible Trail Surface

Photo Credit: Carl Knoch

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37   2010 ADA Standards for Accessible Design, U.S. Department of Justice, 2010

Accessible Route to Picnic Shelter
Ernst Trail, Cawford County

Photo Credit: Pashek Associates

- Clear Width at Turn: Where the accessible route makes a 180 degree turn around an element which is less than 48 inches wide, clear width should be 42 inches minimum approaching the turn, 48 inches minimum at the turn and 42 inches minimum leaving the turn.
- Passing Spaces: An accessible route with a clear width less than 60 inches should provide passing spaces at intervals of maximum. Passing spaces should be either: a space 60 inches minimum by 60 inches minimum; or, an intersection of two walking surfaces providing a T-shaped space complying with 304.3.2 where the base and arms of the T-shaped space extend 48 inches minimum beyond the intersection.

Americans with Disabilities Act Standards for Accessible Trails
Currently, there are no accessibility standards under the Americans with Disabilities Act that apply to trails. In Chapter 10 of the *ADAADS*[38] recreation facilities are addressed, but trails are not included in those recreation facilities. The U.S. Access Board (creator of the accessibility standards) defines a trail as:

> *"A pedestrian route developed primarily for outdoor recreational purposes. A pedestrian route developed primarily to connect elements, spaces, or facilities within a site is not a trail."* In other words a trail is constructed for the primary purpose of hiking. A "trail" is not shared use pathway, or the route that connects facilities in a campground or other area.

In 2009 the Federal Access Board released the *Draft Final Accessibility Guidelines for Outdoor Developed Areas*[39] (ODAAG), available **HERE**. This document proposes accessible design requirements for outdoor recreation access routes and accessible trails located on federal lands, including the U.S. Forest Service, National Park Service, Fish and Wildlife Service, Bureau of Land Management, Bureau of Reclamation, and Army Corps of Engineers. These guidelines are also proposed for non-federal entities that construct or alter facilities on federal lands on behalf of the federal government.

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38   Ibid
39   Draft Final Accessibility Guidelines for Outdoor Developed Areas, U.S. Access Board: 2009

The following table summarizes the proposed accessibly requirements for trails on federal lands.

Technical Provisions for Trails[40]

Aspect	Trail
Surface	Firm and Stable *Exception**
Maximum Running Slope	1: 20 (for any distance) 1: 12 (for max 200 ft) 1: 10 (for max 30 ft) 1: 8 (for max 10 ft) *Exception: 1: 7 (for 5 ft max for open drainage structures)* *Exception**
Maximum Cross Slope	1:20 *Exception: 1: 10 (at the bottom of an open drain where clear tread width is a min of 42 inches)*
Minimum Clear Tread Width	36 inches for any distance *Exception: 32 inches when * applies.*
Edge Protection	Where provided, 3 inches minimum height
Tread Obstacles	2 inches high max *Exception: 3 inches max (where running and cross slopes are 1: 20 or less) Exception**
Passing Space	Every 200 feet where clear tread width is less than 60 inches, a minimum 60 X 60 inch space, or a t-shaped intersection of two walking surfaces with arms and stem extending min of 48 inches. *Exception: every 300 feet where * applies.*
Resting Intervals	60 inches min length, width at least as wide as the widest portion of the trail segment leading to the resting interval and a maximum slope of 1: 20. *Exception**

French Creek State Park
Accessible Trail

Photo Credit: PA DCNR

* Refer to the discussion on Conditions for Departure on the following page.

The U.S. Access Board has been working for many years to develop the *ODAAG* for campgrounds, picnic area, overlooks, and the outdoor recreation access routes that connect them, connect the facilities within those areas and for trails.

Once finalized and published in the Federal Register they will only apply to federal agencies, under the Architectural Barriers Act. They will not apply to those under ADA (state and local government and private businesses and organizations that are open to the public). Sometime in future years the same *ODAAG* guidelines will likely move forward and be adopted under the ADA.

The *ODAAG* is a good "best practice" - keeping in mind its goal is to maximize accessibility without changing the setting.

40   Ibid

ODAAG is very similar to the US Forest Service accessibility guidelines that are legally required to be used on National Forest System lands. These guidelines include the *Forest Service Outdoor Recreation Accessibility Guidelines*[41] (FSORAG), available **Here**, and the *Forest Service Trail Accessibility Guidelines*[42] (FSTAG), available **Here**. Further, the FHWA Recreational Trails program strongly supports integrating accessibility into new trails. For more information visit **Here**. The trail accessibility guidelines only apply to trails that meet all three of the following criteria:

1. New (no trail there before) or altered (there is a change in the purpose for which the trail was originally designed and built)

   and

2. It has a Federal Trails Data Standard of Hiker/Pedestrian (it is being constructed around the parameters for pedestrian hiking)

   and

3. It connects directly to the trailhead or to a trail that currently substantially meets the trail accessibility guidelines.

Only if the trail meets all three of the above criteria do the trail accessibility guidelines apply.

Conditions for Departure and Exceptions from the Draft Final Accessibility Guidelines for Outdoor Developed Areas[43]

Compliance will not always result in facilities accessible to all persons with disabilities. Therefore the guidelines recognize this by providing four conditions for departures from the required technical provisions. The Access Board permits departures from certain technical provisions where at least one of four conditions is present for trails, picnic and camping facilities, and beaches.

The four conditions that permit departures from specific technical provisions include:

1. Where compliance would cause substantial harm to cultural, historic, religious, or significant natural features or characteristics.

   Example: A significant natural feature such as a large rock, outcrop, tree, or water feature may interfere with trail construction or be altered to the extent that the trail could not be made accessible. This includes areas protected under federal or state laws, such as areas

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41   Forest Service Outdoor Recreation Accessibility Guidelines, US Forest Service: 2006
42   Forest Service Trail Accessibility Guidelines, US Forest Service: 2006
43   Draft Final Accessibility Guidelines for Outdoor Developed Areas, US Access Board: 2009

with threatened or endangered species or designated wetlands that could be threatened or destroyed by full compliance with the technical provisions. It also includes areas where compliance would, directly or indirectly, harm natural habitat or vegetation.

2. Where compliance would substantially alter the nature of the setting, the purpose of the facility, or portion of the facility.

Examples: A trail intended to offer a rugged experience such as a cross-country training trail with a steep grade or a challenge course with abrupt and severe changes in level. If these types of trails are constructed to comply with the technical provisions for accessible trails, they cannot provide the intended and desired level of challenge and difficulty for users.

Trails that traverse over boulders and rocky outcrops are another example. The purpose of such a trail is to provide people with the opportunity to climb the rocks. To remove the obstacles along the way or reroute the trail around the rocks would destroy the purpose of the trail. The "nature of the setting" may also be compromised by actions such as widening for the construction of imported surfaces on a remote trail or removing ground vegetation in meadows or alpine areas.

3. Where compliance would require construction methods or materials that are prohibited by federal, state, or local regulations or statutes.

Example: Federally designated and some state-designated Wilderness Areas prohibit use of mechanized equipment. Imported materials may be prohibited in order to maintain the integrity of the natural ecosystem. For traditional, historic, or other reasons, many trails are built using only the native soil for surfacing and may not be firm or stable. Some constructed water crossings, which would be needed to provide accessibility, are not permitted under certain laws or regulations.

4. Where compliance would not be feasible due to terrain or prevailing construction practices.

Example: Complying with the technical provisions, particularly running slope, in areas of steep terrain may need extensive cuts or fills that would be difficult to construct and maintain, or cause drainage and erosion problems. Also, in order to construct a trail on some steep slopes the trail may become significantly longer, causing a much greater impact on the environment. Certain soils are highly susceptible to erosion. Other soils expand and contract with water content. If compliance requires techniques that conflict with natural

drainage or existing soil, the trail would be difficult if not impossible to maintain.

This condition may also apply where construction methods for particularly difficult terrain or an obstacle would require the use of equipment other than that typically used throughout the length of the trail. One example is requiring the use of a bulldozer to remove a rock outcropping when hand tools are otherwise used.

These conditions for departure do not provide an overall exemption of the entire trail. When the condition for departure no longer exists, the technical provisions are applicable.

These conditions for departures are consistent with the conditions for departure specified in ADAAG and the ADA as well. Example: It may be impracticable in new construction to follow ADAAG where soil and terrain pose obstacles that cannot be remedied. Compliance with the provision for a firm and stable surface might conflict with the prevailing construction practices by requiring the use of a new surfacing material. If the prevailing construction practices do not include importing new surface material and the natural surface material is not firm and stable, the trail may not comply with that specific provision.

The term "not feasible" specifies what is "reasonably do-able." It does not refer to the feasibility or possibility of full compliance with the technical provisions. For example, it may be feasible to provide a trail with a 1:20 slope or less up a 1,500 foot tall mountain using heavy construction equipment, but the trail would be at least 5.8 miles long, rather than 2 miles long under a traditional backcountry layout. Further, although feasible, the longer route may cause inappropriate environmental and visual impacts. The intent of this conditional departure is to recognize that the effort and resources needed to comply would be disproportionately high relative to the level of access created. Although technically feasible, the effort and resources needed are not "reasonable." Therefore, this can be classified as an acceptable condition for departure.

Further, trail construction practices vary greatly, from the use of volunteer labor and hand tools, to professional construction with mechanized equipment. For alterations to an existing trail, the prevailing construction practices are defined as the methods typically used for construction or maintenance of the trail. For new trails, the land manager determines the construction practices employed on each trail. However, this choice of construction practice is primarily determined by the available resources (e.g. machinery, skilled operators, finances) and the environmental conditions (e.g., soil type and depth, vegetation, natural slope). The intent of this conditional departure is to ensure that compliance with the technical provisions does not require the use of construction practices that are beyond

the skills and resources of the trail building organization. It is not intended to automatically exempt an organization from the technical provisions simply because of a particular construction practice, (e.g. the use of hand tools or to suggest that hand tools should be used to avoid compliance) when more expedient methods and resources are available.

An accessible trail meets the technical provisions included within the guidelines. A trail is also accessible where one of the exceptions within the technical provisions addresses a specific condition. This is limited to certain exceptions and does not include those that allow for departure from the entire provision.

ODAAG[44] recommends that when specifying new signs at trailheads and on newly constructed or altered trails, designers include signs that provide the following information related to each trail:

1. Length of the trail or trail segment
2. Surface type
3. Typical and minimum tread width
4. Typical and maximum running slope and
5. Typical and maximum cross slope

These signs allow users to determine whether a particular trail is accessible to them at any given time given their abilities.

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44   Draft Final Accessibility Guidelines for Outdoor Developed Areas, U.S. Access Board: 2009

Tiadaghton Hike
Lycoming County

Photo Credit: PA DCNR