aMTB RIDERS are people with physical and/or neurological disabilities that ride adaptive mountain bikes. Due to the wide variety of types of disabilities there are also a wide variety of aMTB bike types to accommodate the various rider types. Since most adaptive bikes are wider than a typical mountain bike, special trail construction techniques must be used to ensure a good experience for these riders. Here are a selection of organizations that provide a range of aMTB resources: (The US Forest Service and American Trails Organization also have general guidance on adaptive trail development.)

- ***Kootenay Adaptive Sport Association*** is a Canadian nonprofit organization that provides adaptive mountain bike programs, experiences, and rentals. Kootenay also offers a free aMTB trail standards document as well as aMTB instructor training in conjunction with the Bike Instructor Certification Program (BICP).
- ***Break the Boundary*** is an Australian nonprofit organization that provides nature-based off-road cycling and hiking opportunities for people living with a disability. Break the Boundary also has aMTB guidelines and signage templates available for sale.
- Jeremy McGhee with ***The UNPavement*** offers aMTB consulting services and has his own rating system to inform aMTB riders on the level of support needed to ride a trail.

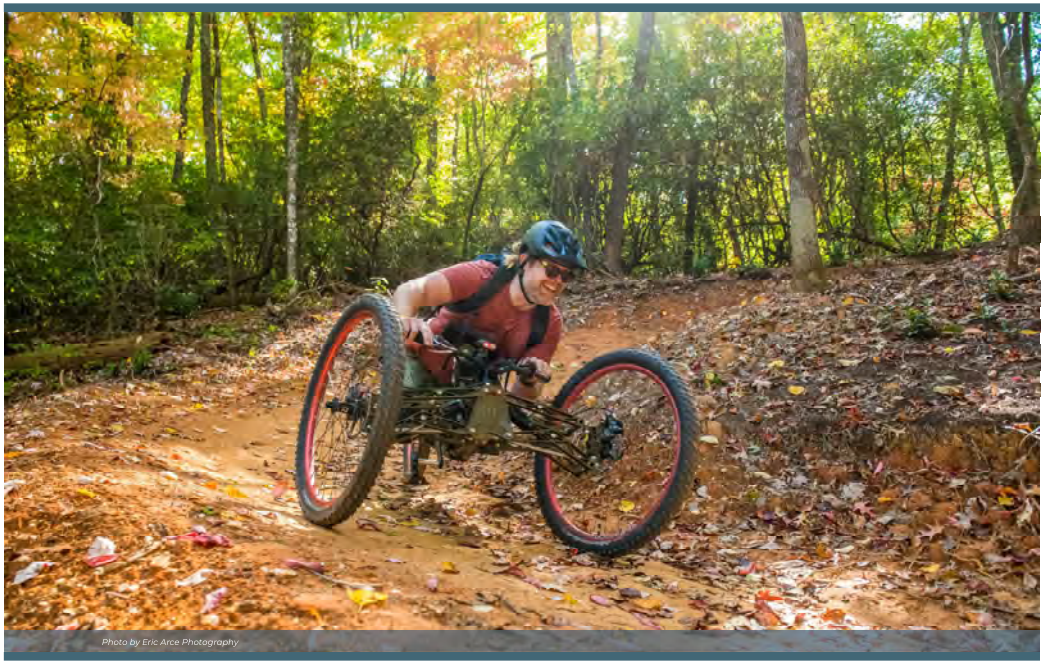


Photo by Eric Arce Photography

Chapter 5: Trail Types and Features

The trail types that riders seek out are in a constant state of change. Mountain biking is a progressive activity that encourages riders to creatively explore trail surfaces, the capabilities of their bike, and the sensations generated by the interplay between them. This results in steadily evolving trail experience goals from riders, and therefore, trail types have expanded and will most likely continue doing so in the future. The trail building industry may not all be on the same page in terms of types and terminology, so you may encounter variations from what you see below.

Before we get into the complex world of mountain bike trail types, we must first define singletrack. Singletrack is a narrow, natural surface trail ranging from 12 to 48 inches in width. Singletrack gets its name from its appearance as a single track in the woods, as opposed to a dirt road, which is wide enough for vehicle traffic.

Dirt roads are often referred to as doubletrack, jeep roads, fire roads, skid roads, or gravel roads. Before purpose-built mountain bike trails came into existence, dirt roads were commonly adopted as mountain bike trails to keep riders off of hiking trails and provide them a place to recreate in the woods. However, dirt roads do not provide the experiences that modern mountain bikers are seeking. Riding on a dirt road can feel like riding on a highway, whereas singletrack provides a more intimate experience that connects riders to the terrain. While there are mountain bike specialty trails that can be as wide as roads, these are typically reserved for high speed, downhill-only trails with large features.

Optimizing Trails for Bikes

Mountain bike singletrack trail falls into one of two general categories, bike-optimized or non-bike-optimized.

NON-BIKE-OPTIMIZED SINGLETRACK TRAILS

"Non-bike-optimized" refers to a classic style of trail that you would typically equate with those that were built by the Civilian Conservation Corps during the Great Depression. These types of trails are built with sustainable techniques, but the turns and tread slopes are built with the primary consideration of not trapping water on the trail rather than creating a dynamic experience for mountain bikers. As a result, surface tread is outsloped and turns are flat. These methods are great for encouraging water to move across the trail, but they are less than ideal for riders who are trying to maximize traction and avoid braking. Mountain bike tires tend to lose traction when turns are flat rather than cambered. To counter this, riders generally travel at a slower pace or are forced to brake more frequently and aggressively before turns on these types of trails. The slower speeds and frequent hard braking may not meet the experience goals that most mountain bikers seek. These types of trail are often referred to as "shared-use" or "hiking" trails by non-mountain bikers, and "classic," "legacy," or "old school" trails by mountain bikers.

BIKE-OPTIMIZED SINGLETRACK TRAILS

Bike-optimized singletrack refers to a trail that has been constructed to optimize the experience of a bike rider. While trail grade and distance are important elements to consider when optimizing a trail for bike riders, the primary elements we think of as bike-optimization are focused on tread manipulation and include the following:

Insloping

Insloped trail tread and turns aim to maintain a rider's momentum and speed. Insloping allows the rider to keep the bike perpendicular to the ground for maximum traction, minimizing the need for braking or slowing down. Insloped turns are often referred to as banked turns. Berm turns are a specialized form of insloped turns and, due to their uniqueness, are covered separately in this section.

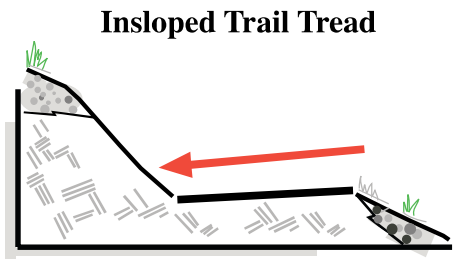


Illustration courtesy of IMBA

Rollers

Rollers are grade reversals that have been shaped and spaced to optimize a fluid riding experience. When properly designed and constructed, rollers allow a rider to maintain or increase speed simply by "pumping" the bike as opposed to pedaling. Pumping is a technique where riders use the terrain to maintain or increase speed without pedaling. The concept is very similar to elements and sensations you would see and feel on a roller coaster.

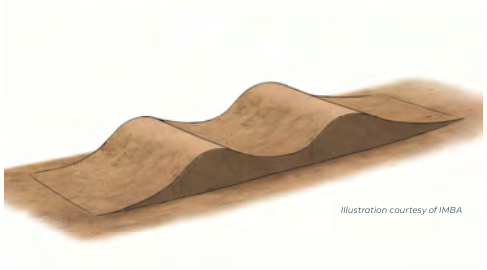
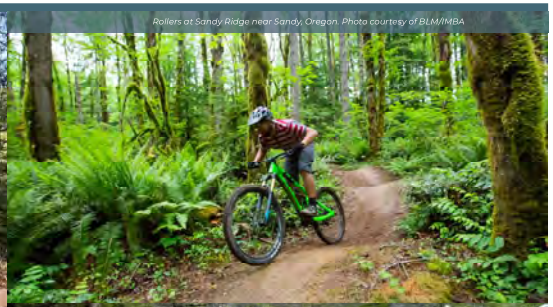


Illustration courtesy of IMBA

Insloped tread maximizes traction and flow. Photo by Hansi Johnson

Monster banked berm rollers (brollers!) pre-compaction at Giants Ridge in Biwabik, Minnesota Photo by Adam Buck, Pathfinder Trail Building



Rollers at Sandy Ridge near Sandy, Oregon. Photo courtesy of BLM/IMBA

Big roller line at Tioga Recreation Area in Cohasset, Minnesota. Photo by Ryan Taylor Visual

Berms (bike-optimized turns)

A berm is a specialized insloped turn that is built up and shaped like a bowl. They allow a rider to take a turn at higher speeds than if the turn were flat or just banked. Berms also require a larger/wider turning radius than standard hiking trails in order to provide a fluid experience for riders.

Berm turn at Sandy Ridge in Sandy, Oregon. Photo courtesy of BLM/IMBA

Berm turn along the World Cup Downhill course on Snowshoe Mountain Resort, West Virginia Photo courtesy of IMBA

Rider entering a berm turn on Cook County Mountain Bike Trails in Minnesota. Photo by Bryan Hansel Photography

Technical Trail Features (TTFs)

TTFs refer to sections of trail that are purposefully constructed to challenge a rider's skill set. The calculated risk involved in riding TTFs also heightens the emotional experience of overcoming fear and conquering a challenge. TTFs can be constructed or naturally occuring and are typically made from either rock or wood, and include features such as rock gardens, drops, rock-overs (rocks you ride up and over), ledges, skinnies (narrower sections of trail that require focus and balance), and jumps, to name a few.

Constructed technical rock tread at Tioga Recreation Area in Cohasset, Minnesota Photo by Chris Guibert/Rock Solid

Technical rock garden section at Cuyuna Country State Recreation Area in Crosby, Minnesota Photo by Corey Lunsford

Technical trail section with progressive line choices of drops, rail-dawns, and rock gardens at Lake Leatherwood in Eureka Springs, Arkansas. Photo by Eli Glesmann/Rock Solid

Engineered trail feature made from steel and wood at Railyard Bike Park in Rogers, Arkansas Photo courtesy of OZ Trails

Bike-Optimized Trail Types

A trail type can refer to the entire length of a trail, or just for a section (segment) of a trail.

TRADITIONAL TRAILS: Traditional trails are associated primarily with a user's desire to travel longer distances, experience nature, and challenge their riding skills. As a result, traditional trails tend to be narrower (1- to 4-feet wide), have less manipulated tread, and have less frequent and more natural-looking features. Traditional trails are often referred to as cross-country or XC trails.

a. ***Trail user objectives*** **-** nature, escape, solitude, exercise, connectivity, challenge
b. ***Trail features*** **-** rock gardens, rock overs, ledges, drops, skinnies
c. ***Feature frequency*** **-** low (occasional, sporadic, opportunistic)
d. ***Trail direction***
    i. one-way or two-way
    ii. climbing and descending
e. ***Trail use*** **-** shared-use (hike, bike, trail run, etc.) or single-use (bike only)

Traditional bike-optimized singletrack trail at Mount Nebo State Park in Dardanelle, Arkansas and Northwoods Trails in Hot Springs, Arkansas. Photos courtesy of IMBA

Technical trail at Split Rock Wilds in Beaver Bay, Minnesota. Photo by Chris Guibert/Rock Solid

Lizard Tail technical trail at Mount Nebo State Park in Dardanelle, Arkansas. Photo by Eli Glesmann/Rock Solid

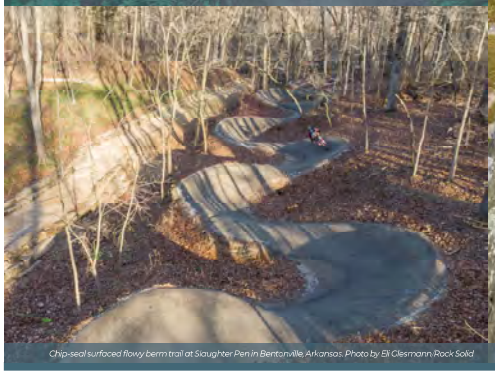
TECHNICAL TRAILS: Technical trails are those favored by riders wanting to be challenged by obstacles and changing or unpredictable tread characteristics. Technical trails can be narrow or wide depending on the types of technical features, but in general, technical trails tend to be more narrow (1- to 4-feet wide).

a. ***Trail user objectives*** **-** challenge, risk, fun, play/playfulness
b. ***Trail features*** **-** rock gardens, rock-overs, ledges, drops, skinnies
c. ***Feature frequency*** **-** high (technical features are frequent and prominent)
d. ***Trail direction***
    i. one-way or two-way
    ii. climbing and descending
e. ***Trail use*** **-** shared-use or single-use (bike only)

FLOWY TRAILS: Trails referred to as "flowy" most often refer to ones that riders seek to have a roller coaster-like experience, with lots of fluid up/down, left/right changes in direction via rollers and berms. Features are shaped and spaced to help riders maintain speed and momentum. Flowy trails are often slightly wider (2- to 6-feet wide) than traditional or technical trails to allow for more side-to-side play and wider landing areas for features that allow riders to get airborne. Rolling contour trail construction is the foundation from which flowy trails were born.

a. ***Trail user objectives*** **-** challenge, risk, fun, play/playfulness
b. ***Trail features*** **-** rollers, berms, jumps and drops
c. ***Feature frequency*** **-** high (features feel continuous with one feature starting as another is ending)
d. ***Trail direction***
   i. typically one-way descents, but since climbs can be designed to be flowy as well (versus a technical climb, for example), a two-way trail with flowy sections is possible as long as the descent sections do not create impossible climbing sections or unnecessary risk of high-speed collisions for riders traveling in the opposite direction
   ii. climbing and descending
e. ***Trail use*** **-** typically single-use (bike only), but shared-use is possible if similar precautions are taken as listed in the "trail direction" section above.

Flowy trail section at Sandy Ridge near Sandy, Oregon. Photo courtesy of BLM/IMBA

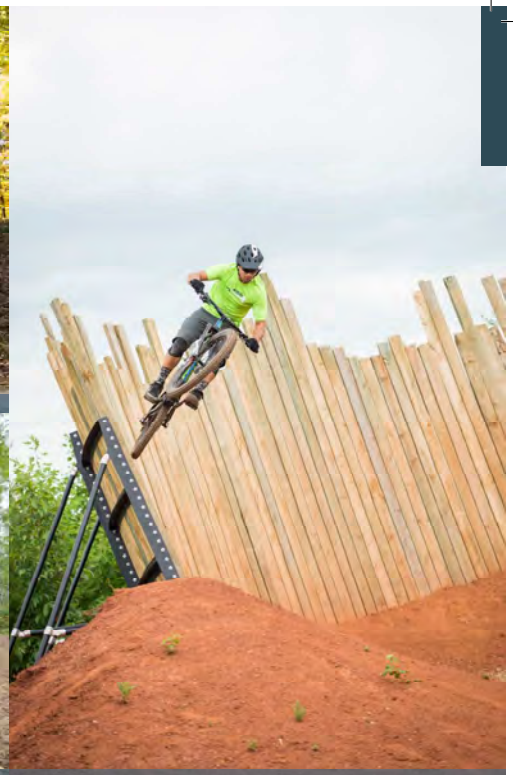


Chip-seal surfaced flowy berm trail at Slaughter Pen in Bentonville Arkansas. Photo by Eli Clesmann/Rock Solid

Tech-flow at Devil's Den State Park in Winslow, Arkansas. Photo by Chris Guibert/Rock Solid

Step-up jump at Northwoods Trails in Hot Springs, Arkansas. Photo courtesy of IMBA

Jump trails at Tioga Recreation Center in Cohasset, Minnesota. Photo by Chris Guibert/Rock Solid



Slopestyle trail with constructed features on Devil's Racetrack in Knoxville, Tennessee. Photo courtesy of IMBA

JUMP/SLOPESTYLE/FREERIDE TRAILS: Jump trails consist of intentionally spaced and shaped ramps intended to launch riders into the air, setting them up to flow from one jump into the next. Jump trails require a high degree of skill to design and construct properly. Grade, approach distance, takeoff speed, takeoff radius, jump distance, and landing radius are just a few of the critical elements for a jump trail to function properly. Slopestyle and freeride trails combine jumping with constructed (and natural) technical features such as drops and wall-rides, focusing on a mixture of jumping, executing tricks, and performing skilled maneuvers. These trail types tend to be wider (3- to 12-feet wide) than other trail types to allow for variances in landings.

a. ***Trail user objectives*** **-** challenge, risk, fun, variety, play/playfulness
b. ***Trail features*** **-** jumps, rollers, berms, drops, wall rides
c. ***Feature frequency*** **-** high (features feel continuous with one feature starting as another is ending, spaced to allow just enough time to set up for the next feature)
d. ***Trail direction*** **-** one-way, descending
e. ***Trail use*** **-** single-use (bike only). Due to higher speeds and riders "catching air" it is not recommended to allow foot traffic; when a rider is in the air it is impossible to slow down or change direction

GRAVITY TRAILS: Gravity trails are typically associated with ski resorts, chair lifts, and/or shuttle vans for gravity-based, one-way descending experiences that include technical and flowy features. Common industry terms are flow trail (rollers, berms, jumps), technical trail (steep, rocky, technical), and slopestyle trail (feature-rich with constructed wooden structures such as wall rides). Gravity trails can vary greatly in width (1- to 12-feet wide) depending on the trail type. The common theme is not having to pedal up the mountain.

a. ***Trail user objectives*** **-** challenge, risk, fun, variety
b. ***Trail features*** **-** rock gardens, rock-overs, ledges, drops, berms, skinnies, jumps, wooden structures
c. ***Feature frequency*** **-** high
d. ***Trail direction*** **-** one-way, descending
e. ***Trail use*** **-** single-use (bike only) – due to higher speeds and terrain that is not conducive to walking, it is not recommended to allow foot traffic

Lift-served downhill bike parks are the pinnacle of gravity riding - Giants Ridge in Biwabik, Minnesota. Photos by Chris Guibert/Rock Solid

Flowy gravity trail with big berms and jumpable features at Spirit Mountain in Duluth, Minnesota. Photo by Hansi Johnson

While it is fine to have an entire trail dedicated to one specific trail type, such as a flowy trail, for example, it is becoming more common for trails to be designed and built that bring flowy sections and technical sections together, combining to create a rich and diverse trail experience. This is especially true when space or resources are limited and it is not physically or financially possible to have different trails dedicated to every trail type.

Trail Difficulty Levels

There are two primary factors that influence the difficulty level of a trail experience: grade and obstacles. The steeper the descending grades, the faster the descents. The steeper the climbing grades, the harder the climbs. The bigger the obstacles, the more challenging the trail. Thus, as trails get steeper and with larger obstacles, riders need to have progressively better bike handling skills and physical fitness.

The mountain bike industry has historically used the same difficulty rating signage as downhill ski resorts: A green circle for easy, blue square for intermediate, single black diamond for advanced, and double-black diamond for expert. This system is accepted as the industry standard and is widely used on maps and trail signs.

IMBA Trail Difficulty Rating System (I M B A)

	EASIEST WHITE CIRCLE	EASY GREEN CIRCLE	MORE DIFFICULT BLUE SQUARE	VERY DIFFICULT BLACK DIAMOND	EXTREMELY DIFFICULT DBL. BLACK DIAMOND
TRAIL WIDTH	72" (1,800 mm) or more	36" (900 mm) or more	24" (600 mm) or more	12" (300 mm) or more	6" (150 mm) or more
TREAD SURFACE	Hardened or surfaced	Firm and stable	Mostly stable with some variability	Widely variable	Widely variable and unpredictable
AVERAGE TRAIL GRADE	Less than 5%	5% or less	10% or less	15% or less	20% or more
MAXIMUM TRAIL GRADE	Max 10%	Max 15%	Max 15% or greater	Max 15% or greater	Max 15% or greater
NATURAL OBSTACLES AND TECHNICAL TRAIL FEATURES (TTF)	None	Unavoidable obstacles 2" (50 mm) tall or less Avoidable obstacles may be present Unavoidable bridges 36" (900 mm) or wider	Unavoidable obstacles 8" (200 mm) tall or less Avoidable obstacles may be present Unavoidable bridges 24" (600 mm) or wider TTF's 24" (600 mm) high or less, width of deck is greater than 1/2 the height	Unavoidable obstacles 15" (380 mm) tall or less Avoidable obstacles may be present May include loose rocks Unavoidable bridges 24" (600 mm) or wider TTF's 49" (1,200 mm) high or less, width of deck is less than 1/2 the height Short sections may exceed criteria	Unavoidable obstacles 15" (380 mm) tall or less Avoidable obstacles may be present May include loose rocks Unavoidable bridges 24" (600 mm) or narrower TTF's 49" (1,200 mm) high or greater, width of deck is unpredictable Many sections may exceed criteria

IMBA Trail Difficulty Rating System

Trail Rating Guidelines

The following trail rating guidelines are intended to help you better understand how to collect data and implement difficulty ratings on your trails.

RATE TECHNICAL CHALLENGE ONLY - Rate the technical challenge of the trails, not the physical exertion required for that trail. Instead, identify trail length, elevation change, and average grade, so that riders can assess the exertion required to that trail based on their own levels of fitness and skill.

COLLECT TRAIL MEASUREMENTS - Collect trail measurements such as trail width, trail length, average grade, maximum sustained grade, trail feature dimensions, and trail feature frequency.

EVALUATE DIFFICULTY RELATIVE TO LOCAL TRAILS - Rate trails relative to other trails in the region so that riders can reasonably expect some similarity in difficulty ratings levels of trails within the same region.

CONSIDER OTHER TRAIL QUALITIES - When assigning difficulty ratings, consider additional factors such as exposure (the steepness of the hillside on the downhill edge of the trail), corridor clearance, turn radius (tighter radius equals more challenge), natural obstacles, and constructed TTFs.

USE GOOD JUDGMENT - Rating a trail will involve a degree of subjective judgment. Combine quantitative, tangible data with subjective judgment to reach the final rating. Use professional and stakeholder feedback when feasible.

INCLUDE DIFFICULTY AND TRAIL MEASUREMENTS ON SIGNS AND MAPS - Providing the difficulty symbol, trail length, and average grade on signage provides valuable information to riders.

Criteria to Consider

The following trail rating criteria are intended to further aid your understanding and implementation of trail difficulty ratings.

TREAD WIDTH - the average width of the active tread of the trail

TREAD SURFACE - the material and stability of the tread surface that is a determining factor in the difficulty of the trail. Some descriptive terms include: firm, stable, variable, widely variable, loose, and unpredictable

TRAIL GRADE - measured using a clinometer (or software that can display grades on GPS tracks) and always referenced as a percentage.

- **Average grade** – Average grade is the steepness of the trail over its entire length, calculated by total elevation gain of the trail divided by total length of the trail and multiplied by 100 to calculate the percent grade.
- **Maximum sustained grade** – Maximum sustained grade is defined as the steepest section of trail sustained for more than 10 feet in length.
- **Average climbing and descending grades** – It is helpful to define climbing and descending grades separately from one another to accurately assess the level of physical exertion required on the climbs as compared to the level of speeds potentially obtained on the descents.

The average grade is very influential on how difficult a trail may or may not be. Average grade percentages depicted in the IMBA Trail Difficulty Rating System help to determine the appropriate skill-level category a trail falls into.

BEGINNER/EASY	**0%-5% Average Grade**
INTERMEDIATE/ MORE DIFFICULT	**5%-8% Average Grade**
ADVANCED/VERY DIFFICULT	**8%-12% Average Grade**
EXPERT/EXTREMELY DIFFICULT	**10%-15% Average Grade**

The difference between a 5% and 8% stretch of intermediate trail is significant. The physical exertion required to climb a sustained 8% grade is significantly more challenging than what is required to climb a sustained 5% grade. Similarly, potential descending speed on an 8% grade is significantly faster than a 5% grade.

For example, a one-way trail planned with 8% descents and 5% climbs will maximize speeds for the descending portions and minimize physical exertion on the climbs, creating a fast, flowy experience that focuses on speed and minimal exertion. Whereas a one-way trail planned with 5% descents and 8% climbs will reduce descending speeds and maximize physical exertion on the climbs, creating a more physically demanding trail experience with reduced descending speeds.

This is the type of knowledge an experienced trail planner will use to tailor the trail experience to match user objectives. It is also excellent foundational knowledge for a land manager to possess when providing oversight on trail development projects.

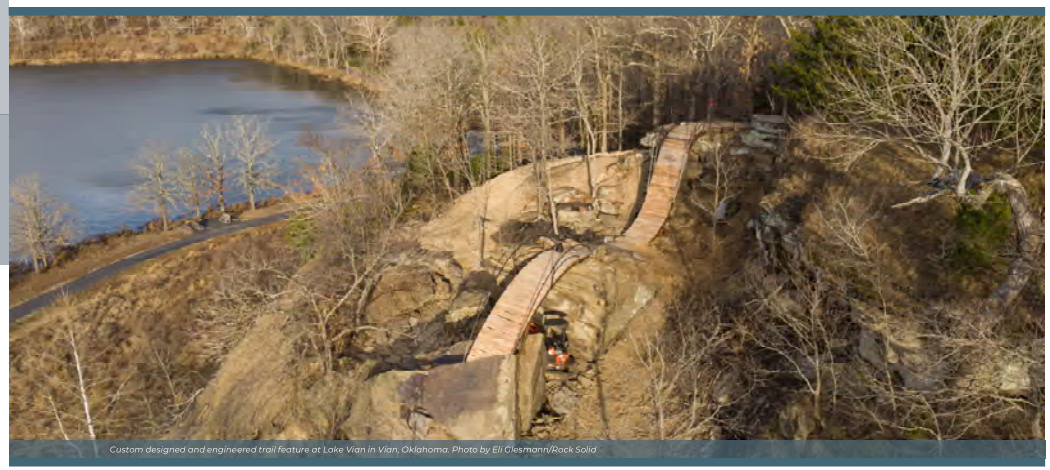
COMMON PITFALL:

Poor grade management

Trail grades not planned with the benefit of best practices and tools such as geographic information system (GIS) terrain analysis and clinometers can have a direct impact on rider speed, rider exertion, drainage, erosion, and other critical variables when planning trail corridors.

Trail Features

Bike-specific trail features are what truly make a trail experience unique and specific to mountain biking. This distinction can not be overstated enough. Bike-specific trail features are essential to creating a high-quality mountain bike trail experience.



Custom designed and engineered trail feature at Lake Vian in Vian, Oklahoma. Photo by Eli Olesmann/Rock Solid

Hiking trails, shared-use trails, and mountain biking trails are all constructed with similar techniques in an attempt to minimize erosion and make the trails physically sustainable. However, trails designed and constructed to optimize the experience for mountain bikers pay great attention to detail in how grades are utilized, where grade reversals are located and how they are spaced/shaped, with extensive focus on how riders will interact with the trail tread. In addition to the typical sustainable trail building techniques, a trail planner has to constantly think about overall rider speeds, as well as the riders' speeds when entering and exiting trail features, to craft the experience intended for the level of skill indicated on that specific trail. Execution of this level of trail planning requires a high degree of understanding of the physics of riding and the interaction of the rider and bicycle with the terrain and features.

The analogy of a roller coaster is highly relevant in terms of mountain bike trail design. A rider is routinely transitioning from one trail feature to the next, much like a passenger on a roller coaster, so spacing and timing are critical. Though roller coasters are associated with flow, there is also an anti-flow style of constructing trail features that intends to make it difficult to time and transition from one feature to the next. While this may sound counter-intuitive to the non-rider, this kind of anti-flow creates a unique style of riding that can be as rewarding as it is challenging. Understanding these concepts becomes especially critical for trail features such as jumps and drops, which require a rider's wheels to leave the ground.

Extensive rock armoring at Cacapon State Park in West Virginia. Photo by Daddio/IMBA

The term "trail feature" can apply to any type of obstacle or element on the trail that the rider has to respond to or interact with, whether it is made of dirt, wood, rock, or steel. While the types of bike-specific trail features are only limited by available materials, budget, and imagination, the following 10 types are most commonly utilized. Understanding each of these will help ease communication between riders in your community and professional mountain bike trail building contractors.

ROCK GARDEN

A rock garden refers to a section of trail that has rocks embedded in the tread. Rock gardens vary from beginner- to expert-difficulty ratings. A rock garden can be on flat trail, descending trail, climbing trail, or a combination of the three. Rock gardens can exist naturally within a trail, or they can be constructed by trail builders by gathering and placing rocks to create the feature. The "rugosity" of the rock garden, the difference in height from one rock to the next, determines how difficult the rock garden is to navigate. With less height difference between rocks, the rock garden feels smoother and easier to ride, while more height variation presents more difficulty and challenge to the rider.

Riders navigating a constructed rock garden in Deep Creek State Park, Maryland. Photo by Daddio/IMBA

Climbing a constructed rock garden in Copper Harbor, Michigan. Photos by Chris Guibert/Rock Solid

Descending rock garden at Giants Ridge in Biwabik, Minnesota. Photo by Chris Guibert/Rock Solid

Elaborately constructed rock garden segment at Devil's Den State Park in Winslow, Arkansas. Photo by Chris Guibert/Rock Solid

ROCK SLAB

Rock slabs are large slabs of rock. They can be smooth or textured, flat or undulating. Rock slabs vary from beginner- to expert-levels of difficulty. A rock slab can be on a flat trail, descending trail, climbing trail, or a combination of the three. Rock slab features tend to exist naturally, with the trail routed to the rock slab. If a rock slab is steep enough, it would also be considered a roll down feature.

ROCK-OVER

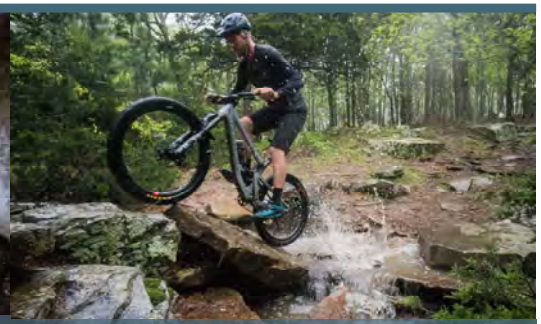
Rock-overs are large rocks that require the rider to ride up and over them. A rock-over can vary from beginner- to expert-level of difficulty. These can be found in nature and ridden as is, though they will often require an approach trail built or routed onto or off the feature. They can also be constructed by moving large rocks into place. A rock-over can be on a flat trail, descending trail, or climbing trail.

Natural rock slab features tend to offer many different line choices. Above: Old Forge, New York. Photo by Kyle Lieberman Photography

Natural rock slab riding at Lunch Loops in Grand Junction, Colorado. Photo courtesy of BLM/IMBA

Natural rock slab used for a steep, technical fall-line descent at Hartman Rocks in Gunnison, Colorado. Photo courtesy of BLM/IMBA

Riding down the backside of a rock-over feature at Sandy Ridge in Sandy, Oregon Photo courtesy of BLM/IMBA



Riding up a rock-over feature at Mount Nebo State Park in Dardanelle, Arkansas. Photo by Eli Gleismann/Rock Solid

Riding a rock-over feature in Cuyuna, Minnesota. Photo by Hansi Johnson

Rock-over feature at La Larr Ba Guawa Park at Harcourt in Central Victoria, Australia. Photo by Dirt Art

ROLL-DOWN

A roll-down is a feature that is steep enough and long enough to make it hard to brake or limit speed while descending; a rider controls their speed management after they exit the feature. A roll-down tests a rider's balance on the bike, requires proper body positioning, timing, and braking skills. Roll-downs can be made out of dirt, trees, lumber, rock, and even metal-framed structures, but trail builders often take advantage of large, steep rock slabs for naturally occurring roll-downs. Roll-downs can vary from beginner- to expert-level of difficulty. A roll-down is a descending feature, but is not limited to descending trails and can appear on a variety of trail types.

Naturally occurring rock roll-down feature with an alternate, easier line to the side on Double Barrel trail at Wheelerville Trails in Caroga Lake, New York. Photo by Kyle Lieberman Photography

Steep rock roll-down at Split Rock Wilds in Beaver Bay, Minnesota Photo by Chris Guibert/Rock Solid

Custom designed and engineered roll-down trail feature in Vian, Oklahoma. Photo by Eli Glesmann/Rock Solid

SKINNY

A "skinny" is a narrow section of trail that requires increased skill and balance to navigate. Skinnies are commonly constructed out of downed trees, lumber, rock, and even metal-framed structures, and can vary from beginner- to expert-level of difficulty. Skinnies can be on flat trail, descending trail, climbing trail, or a combination of the three.

Wooden skinnies in Bentonville, Arkansas. Photos by Eli Glesmann/Rock Solid

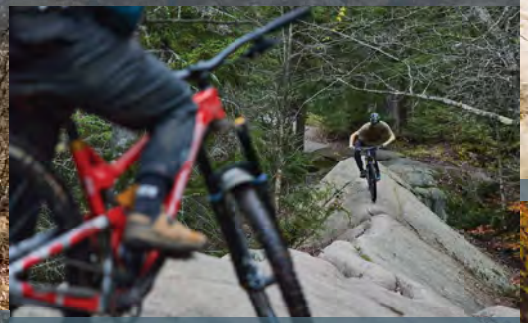
Wooden skinnies in Rogers, Arkansas. Photos by Eli Glesmann/Rock Solid

Wooden skinny(ish) with roll-down at Pine Valley Park in Cloquet, Minnesota. Photo by Hansi Johnson

Chainsaw-milled wooden skinny alternate line at Blackhawk Ski Area in Madison, Wisconsin Photo by Chad Landowski/TractionTrailworx

Wooden skinny with alternate riding lines at Fitzgerald Mountain in Springdale, Arkansas. Photo by Erik Nelson/Rock Solid

Steel fabricated skinny on Chunky Trail at Centennial Park in Fayetteville, Arkansas Photo by Eli Gliesmann/Rock Solid



Naturally occurring rock skinny in Old Forge, New York. Photo by Kyle Lieberman Photography

Rock skinny as an optional feature at Slaughter Pen in Bentonville, Arkansas. Photo by Chrisman/IMBA

LEDGE

In mountain biking terms, a ledge is a vertical face that a rider must either ride up or down. For example, a street curb in a parking lot is technically considered a ledge because it has a vertical face and a rider could ride down it or up it. Riding up a ledge requires a rider to be able to perform a front wheel lift technique. Ledges can vary from beginner- to expert-level of difficulty. Ledges can appear naturally or they can be constructed. For added challenge and interest, multiple ledges can appear one after the other. With enough speed and skill, a rider can ride off a ledge and execute a drop maneuver. Ledges can be made out of dirt, wood, rock, or metal-framed structures. Ledges can be on flat trail, descending trail, climbing trail, or a combination of all three.

Rock ledge roll-down at Lake Pueblo State Park, Colorado. Photo by Evan Green

Series of small rock ledges at Split Rock Wilds in Beaver Bay, Minnesota. Photo by Chris Guibert/Rock Solid

Riding down a rock ledge on the Duluth Traverse in Duluth, Minnesota Photo by Hansi Johnson

Riding up a large rock ledge at Tioga Recreation Area in Cohasset, Minnesota. Photo by Chris Guibert/Rock Solid

DROP

A drop is a ledge that is too tall for a rider to roll down, forcing the rider to execute a skill maneuver known as the same name, a "drop." With enough speed and the proper technique, a rider can ride off of a drop so that both wheels are in the air briefly before landing back on the ground. Whenever both of a rider's wheels leave the ground, the level of risk goes up significantly. However, effectively executing a drop results in increased adrenaline and excitement, which can add an overall sense of fun and feeling of accomplishment. A drop can vary from beginner- to expert-level of difficulty and be made out of dirt, rock, wood, engineered materials, metal, or any combination of these. Due to the momentum required to ride a drop, these features are typically only built on flat or descending trail.

Buck Wylde jump trail with drops at Detroit Mountain Recreation Area in Detroit Lakes, Minnesota. Photo by Adam Buck/Pathfinder Trail Building

Large wooden drop at Cuyuna Country State Recreation Area in Cuyuna, Minnesota Photo by Chad Landowski/Traction Trailworx

Rock drop at Split Rock Wilds in Beaver Bay, Minnesota. Photo by Paul Vincent Photography

Large rock drop with alternate go-around at Devil's Den State Park in Winslow, Arkansas. Photos by Eli Giesmann/Rock Solid

ROLLER/PUMP SECTION

A roller refers to trail tread that has been shaped into a mound that a rider will roll up and over. A roller can vary from beginner- to expert-level of difficulty depending on the size, shape, and rider speed coming into the roller. Multiple rollers back-to-back create a pump section (also called a rhythm section) that a rider can "pump" through without pedaling and still maintain, or even gain speed. The size, spacing, and approach speeds are critical for a pump section to be fun and effective. A roller can be made out of dirt, wood, rock, or metal-framed structures. A roller can be on flat trail, descending trail, climbing trail, or a combination of all three. A roller can be in a straight line or banked to help a rider change direction.

Roller section on Mama Bear chip-seal pump trail in Bentonville, Arkansas Photos by Chris Guibert/Rock Solid

Roller section on Mama Bear chip-seal pump trail in Bentonville, Arkansas. Photos by Chris Guibert/Rock Solid

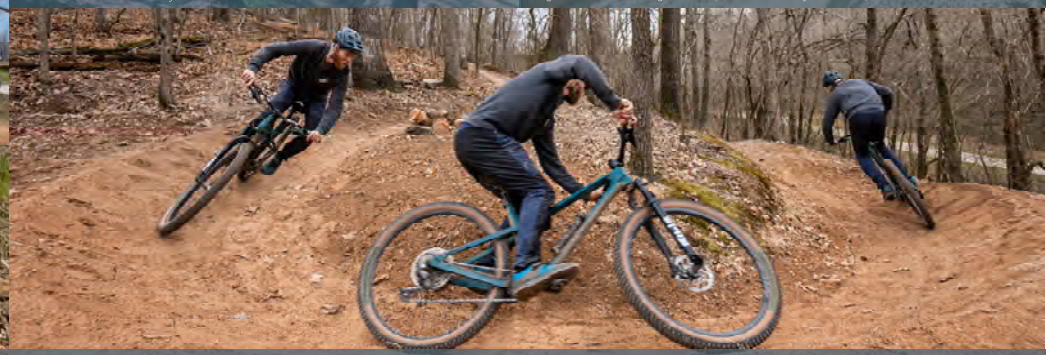
BERM

A berm is a banked turn designed to help a rider change direction while maintaining speed and maximizing traction. A berm can vary from beginner- to expert-level of difficulty depending on the size, shape, and turn radius, and is also affected by the speed in which the rider takes the berm. The smaller the turn radius, the tighter and more difficult the berm. A berm can be made out of dirt, wood, rock, or metal-framed structures. A berm can be on flat trail, descending trail, and/or a climbing trail.

Large dirt berm at Centennial Park in Fayetteville, Arkansas. Photo by Eli Glesmann/Rock Solid

Large wooden berm at Detroit Mountain Recreation Area in Detroit Lakes, Minnesota Photo courtesy of Detroit Mountain Recreation Area

Large dirt berm at Giants Ridge in Biwabik, Minnesota. Photo by Chris Guibert/Rock Solid



Berm entry, apex, and exit at Lake Atlanta in Rogers, Arkansas. Photo by Eli Glesmann/Rock Solid

JUMP

A jump is a feature designed to send a rider upward into the air. A jump consists of a take-off, a landing, and the space between the two. Designing and building jumps requires a high degree of skill and experience, especially with the increased risk of riding a jump. A jump section refers to a section of trail having multiple jumps in a row, which adds challenge and fun. A jump can vary from beginner to expert difficulty and can be made out of dirt, wood, rock, or metal-framed structures.

Jumps with optional, easier go-arounds at Giants Ridge in Biwabik, Minnesota. Photo courtesy of Rock Solid

Jump trail at Giants Ridge in Biwabik, Minnesota. Photo by Chris Guibert/Rock Solid

Rock jump alt-line at Iron Hills Trails in Cedar City, Utah. Photo courtesy of IMBA

Common jump types:

1. Table-Top Jump

A table-top jump has trail tread connecting the top of the take-off to the top of the landing so that if a rider does not clear the jump, they land on the tread between the two.

Typical table-top jump. Photo by Eli Glesmann/Rock Solid

2. Step-Up Jump

A step-up jump refers to a jump where the landing is higher than the take-off. Step-up jumps are typically easier to learn on since the rider will not be as high off the ground or in the air for as long as on a normal jump.

Step-up jump at Northwoods Trails in Hot Springs, Arkansas. Photo courtesy of IMBA

Rock step-up jump at Split Rock Wilds in Beaver Bay, Minnesota. Photo by Chris Guibert/Rock Solid

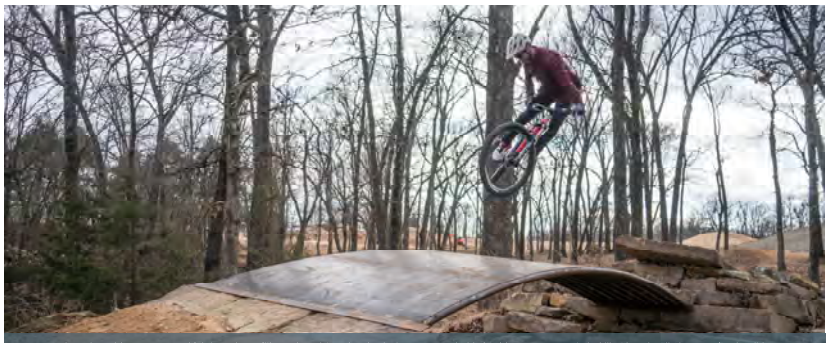
3. Step-Down Jump

A step-down jump refers to a jump where the landing is lower than the take-off. Step-down jumps can be more challenging to learn on since the rider can be in the air longer than they would for a table-top or step-up jump.

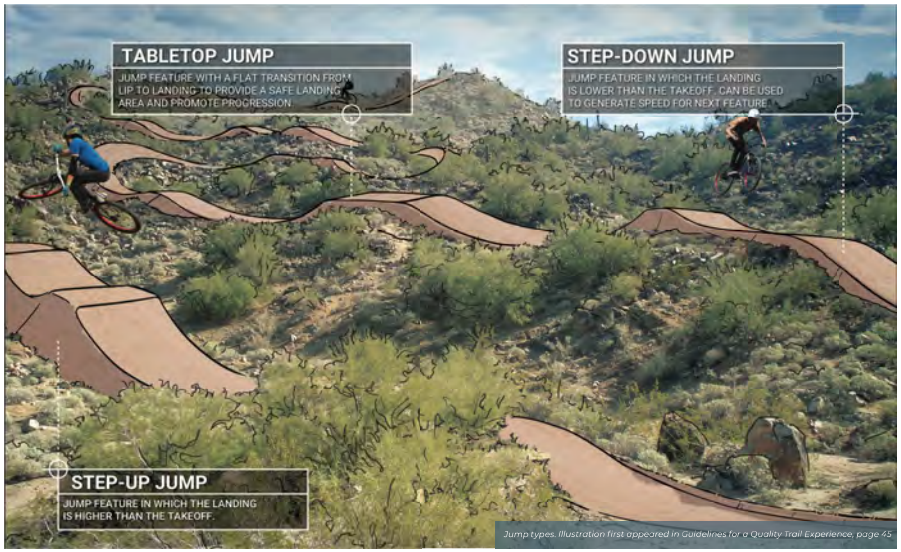
4. Gap Jump

A gap jump has no trail tread connecting the top of the take-off to the top of the landing. This creates a high degree of consequence for not clearing the jump, usually resulting in a rider having to ditch or bail off of their bike while in the air. Since riders can not gradually work their way up to clearing gap jumps and consequences are big, constructing and maintaining these types of jumps requires extreme care by builders, those who maintain the jumps, and land managers due to the increased potential for injury and additional liability.

Expert-level gap jump at Centennial Park in Fayetteville, Arkansas. Photo by Eli Glesmann/Rock Solid



Same gap jump but with a custom steel fabricated gap-fill to reduce risk and make the jump more suitable for riders to progress their skills. Photo by Eli Glesmann/Rock Solid



Jump types. Illustration first appeared in Guidelines for a Quality Trail Experience, page 45

DUTY OF CARE FOR TECHNICAL FEATURES WITH HIGH RISK OF INJURY

Scott Chapin, Bicycle Industry Risk Specialist, Marsh & McLennan Agency LLC

"There really isn't any actuarial data specific to various types of features, including gap jumps. However, the more technical the feature the more apt someone is to get hurt which could potentially lead to a lawsuit. You have to think about how a plaintiff attorney would argue about a feature in court. Gap jumps, for example, are easier for a plaintiff attorney to come up with arguments about how the approach was too short, the approach speed was too slow, the landing radius and length were too short, or a myriad of other findings. Plaintiff attorneys are known for hiring expert witnesses to perform these kinds of calculations and create visuals to support their findings, so great care should be taken when selecting a contractor responsible for designing and building technical features that introduce high risk of injury."

A rider enjoys a jump in the snow at Tioga Recreation Area in Cohasset, Minnesota. Photo by Wesguy Images

ROOTS

Natural, exposed tree roots that riders must ride over as part of the trail should not be planned as trail features. Repeatedly riding over tree roots can cause stress to the tree and possibly kill it. Exposed tree roots are usually the result of erosion caused by excessive use, weather events, improper trail design, poor trail construction, or soft soils. If tree roots become exposed they are at risk of constant damage by traffic, leaving the tree in a compromised state. It is recommended to either reroute a section of trail riddled by tree roots, or use a variety of techniques to raise the tread above roots, such as rock armoring or bridging.

While there are other types of specialty features, rock gardens, rock slabs, rock-overs, roll-downs, skinnies, ledges, drops, roller/pump sections, berms, and jumps of all sorts account for the vast majority of feature types desired by riders. Combining different types of features on one trail can create a diverse and unique experience for a rider. It is important to always be mindful of the desired trail user objectives and varying difficulty levels when adding features to a trail.

Photo by Eli Griesmann/Rock Solid

SPACING AND FREQUENCY

How far apart should features be spaced? And how frequently should features appear on a trail, even if they are spaced far enough apart for a rider to "recover" in-between features? These questions are partly answered by understanding the trail user objectives and difficulty levels. If play is an important trail user objective, then the trail should typically include more features. Spacing and frequency will vary depending on the desired experience, terrain, difficulty level, and budget. In general, features can be more frequent with less time to react between features as the degree of difficulty increases for a trail. The opposite is true for a trail with a lower degree of difficulty, which may have less frequent features and more time to react between features. Budget plays a role, too. Even though you may desire a feature-packed trail, features are far more time-consuming to build than normal bench-cut trail, so balancing feature types and how many with the project budget early in the trail planning phase can help set realistic expectations for everyone involved.

Illustration showing desired feature frequency. Illustration first appeared in Guidelines for a Quality Trail Experience, page 44

MANDATORY VS. OPTIONAL (ALT-LINES)

If there is an easier route available to riders around any certain feature, then the feature is considered to be optional. Optional lines are also referred to as "alt-lines," short for alternate lines. If there is no easier route around a feature, then the feature is considered to be mandatory. Having optional features allows riders to be able to pick and choose which features they ride without having to disrupt the flow of the trail. This also increases the number of ways a rider can choose to experience a trail, and lets riders of varying skill levels to more easily ride together on the same trail. Optional features also allow riders to improve their bike handling skills because they let riders pick and choose which features they will attempt during a ride.

If a mandatory feature is too challenging for a rider, the rider is forced to stop, dismount their bike and navigate over the feature on foot, disrupting the flow and experience of the ride. It is important to consider what is an appropriate skill-level advancement for optional lines on a trail segment. For example, it is appropriate to have an intermediate alt-line on a beginner trail, but it is not recommended to have an expert alt-line on a beginner trail.

Example of an optional line on the Captain Ahab trail in Moab, Utah. Illustration first appeared in Guidelines for a Quality Trail Experience, page 50

Optional lines: a rollable jump on the right with an easier go-around on the left. Photo by Eli Glesmann/Rock Solid

Alternate lines for multiple skill levels with a mix of rock and wood trail features in Munising, Michigan Photo by Chad Landowski/Traction Trailworx

Large rock slab with an easier go-around at Hartman Rocks in Gunnison, Colorado. Photo courtesy of BLM/IMBA

Skilled planners and builders look for creative ways to route trails to utilize alt-lines provided by Mother Nature. Split Rock Wilds in Beaver Bay, Minnesota Photo by Chris Guibert/Rock Solid

TRAIL FILTER

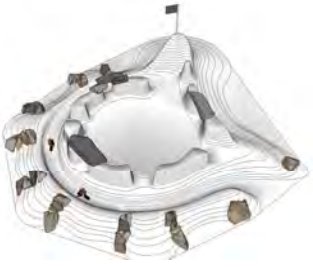
A mandatory feature placed at the entrance of a trail to set the expectation for the level of skill required for that trail is called a "trail filter." A key goal of the filter is to discourage riders from entering a trail beyond their ability. A trail filter is typically built at the highest skill level required for that trail, and ideally of a feature type that is common for that trail experience.

Filter feature at Sandy Ridge, Oregon. Illustration first appeared in Guidelines for a Quality Trail Experience, page 38

TRAIL HUB

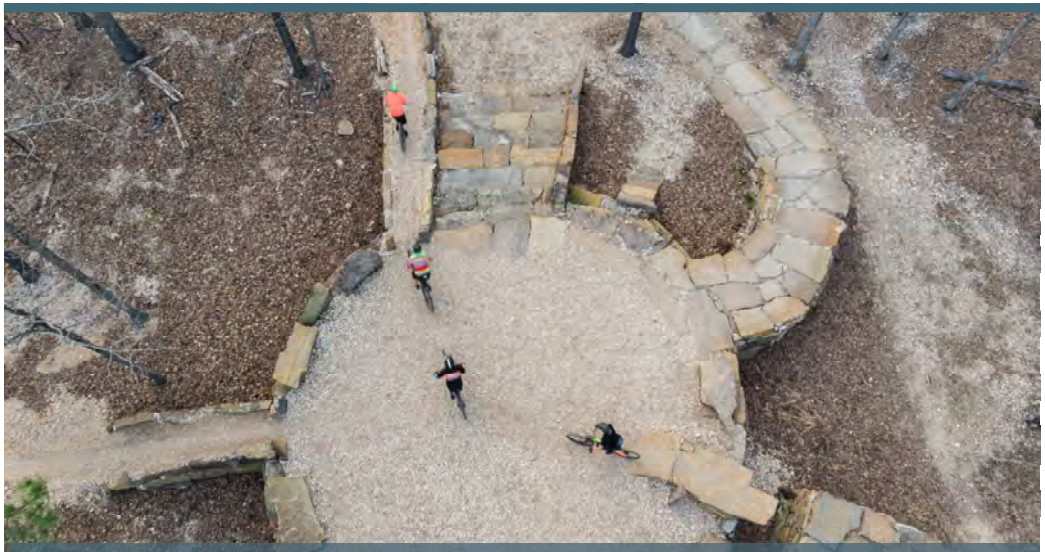
While not technically a trail feature, a "trail hub" is where multiple trails split off from one another or come together, providing an opportunity for riders to gather and wait while the rest of their group arrives. A trail hub is an ideal place to incorporate trail filters and optional lines to help riders select an experience appropriate to their skill levels and desires.

Trail hub at HandCut Hollow in Bentonville, Arkansas. Photo by Eli Glesmann/Rock Solid



TRAIL HUB "CASTLE" - SCHEMATIC DESIGN CONCEPT #1 3D
NOT TO SCALE

Castle hub/start hill original concept, in-progress, and complete at Slaughter Pen in Bentonville, Arkansas. Photos by Eli Glesmann/Rock Solid. 3D concept image by Derek Lehecka/Rock Solid

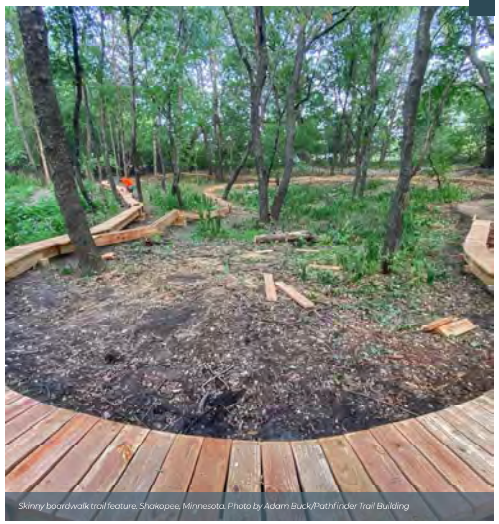


Start hub with trail filters, optional lines of varying difficulty, and rock benches at Lake Leatherwood DH in Eureka Springs, Arkansas. Photo by Eli Glesmann/Rock Solid

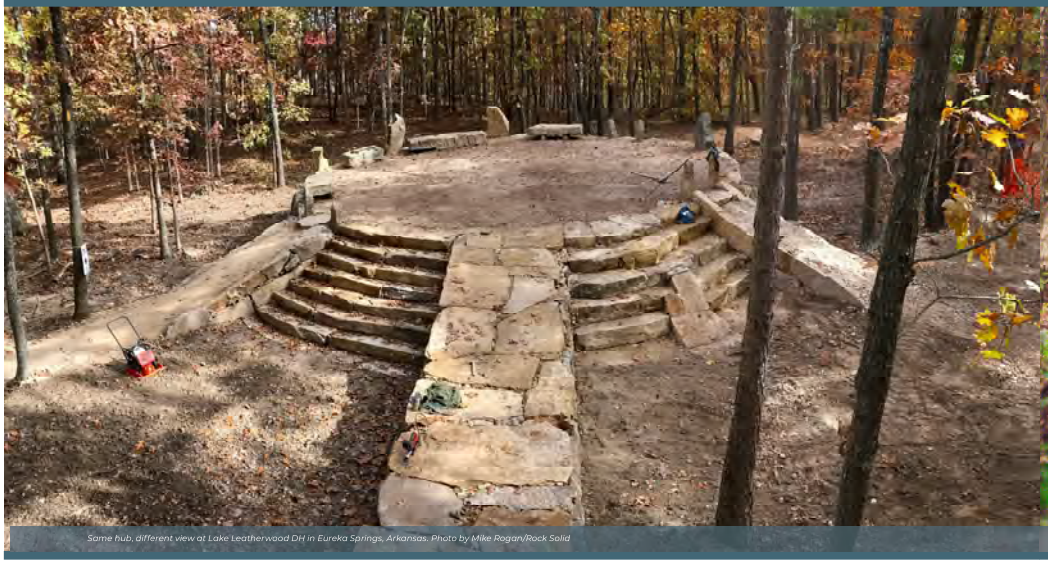
BOARDWALKS

Elevated wooden pathways used to traverse terrain or soil that is not ideal for natural surface trail construction, such as sandy or marshy ground, are referred to as boardwalks. The most common materials for boardwalks have historically been raw or finished lumber. Since lumber decays and rots over time, more permanent materials such as synthetic lumber alternatives, steel, and rock, have become very popular to reduce long-term maintenance and replacement costs.

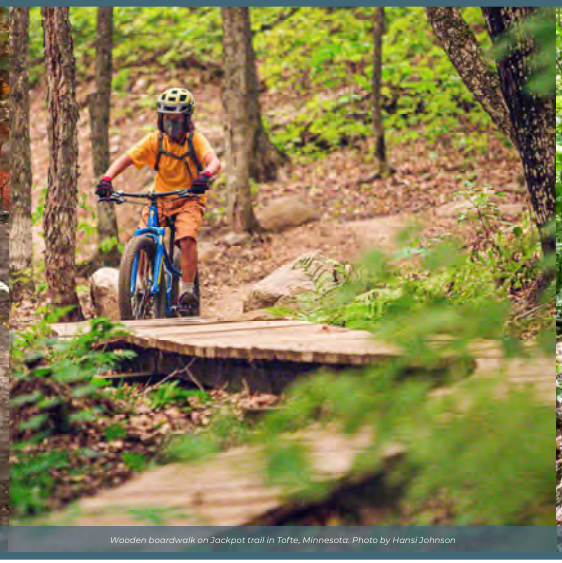
Just like with tread construction, boardwalks can be bike-optimized or non-bike-optimized. While it is possible to ride non-bike-optimized boardwalks, it is far more fun and rewarding to ride a boardwalk that incorporates bike-optimization elements such as canted and rolling surfaces to create the left/right and up/down experiences that riders crave. A boardwalk that has been bike-optimized may start to look more like a trail feature than a boardwalk—it is a blurred line that mountain bikers enjoy.



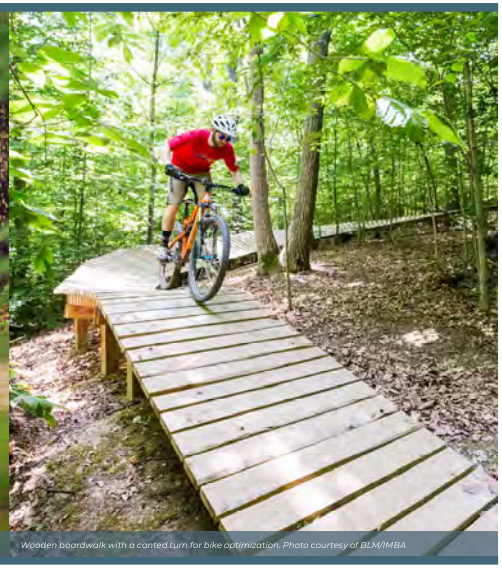
Skinny boardwalk trail feature, Shakopee, Minnesota. Photo by Adam Buck/Pathfinder Trail Building



Same hub, different view at Lake Leatherwood DH in Eureka Springs, Arkansas. Photo by Mike Rogan/Rock Solid



Wooden boardwalk on Jackpot trail in Tofte, Minnesota. Photo by Hansi Johnson



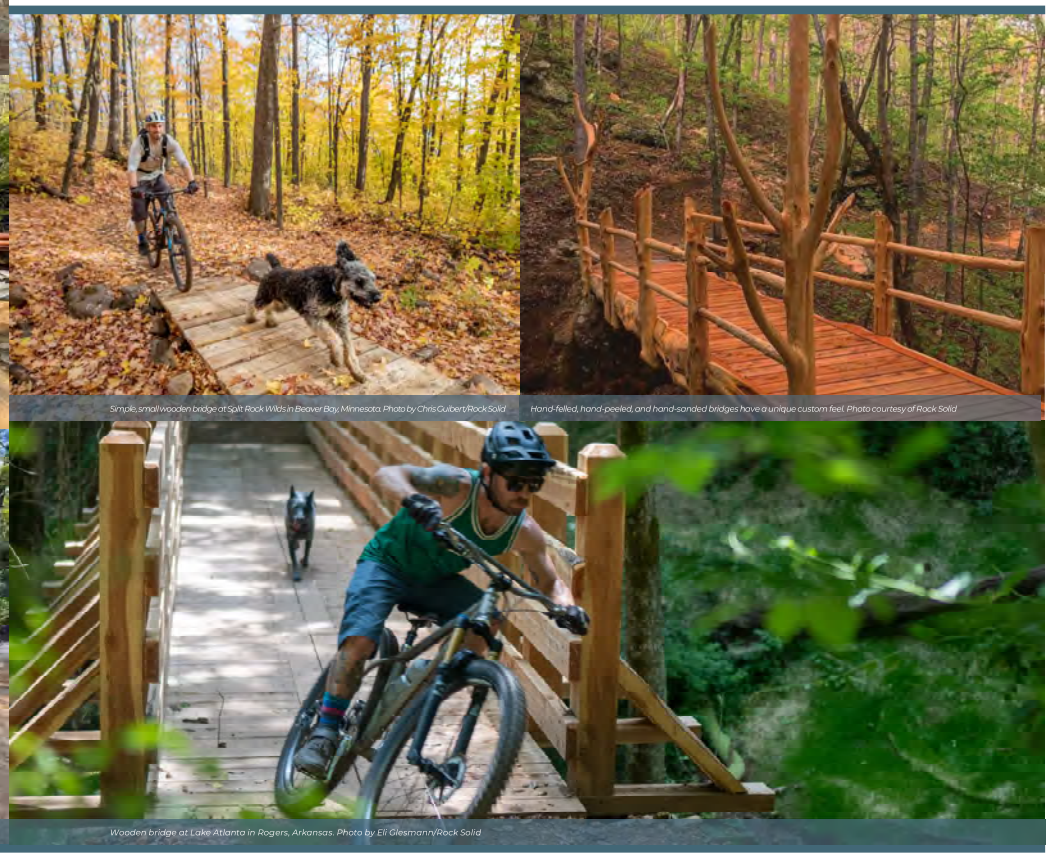
Wooden boardwalk with a canted turn for bike optimization. Photo courtesy of BLM/IMBA

Custom steel-frame boardwalk with wooden decking at Giants Ridge in Biwabik, Minnesota. Photos by Adam Buck/Pathfinder Trail Building

BRIDGES

Bridges can be as simple as a small, ten-foot structure meant for crossing a stream, or they can be wildly elaborate. Sometimes the most unique or breathtaking areas of a property can be extremely challenging or impossible to access with traditional trail construction methods. Incorporating a well-designed, creative solution to an access challenge can help to showcase the unique terrain while being both functional and visually appealing on its own.

While bridges can be a great solution, they can present challenges for getting materials to a build location, especially for remote trail systems without nearby road access. In addition, if wood is used, bridges will require regular inspections and require repairs over time as wood decays. When feasible, armoring a crossing at grade can avoid these issues, especially if native rock or stone is available near the build site.



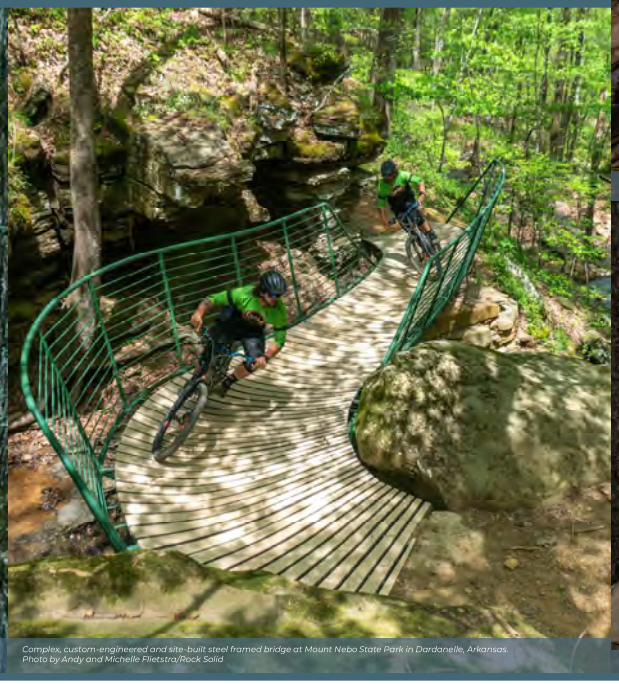
Simple, small wooden bridge at Split Rock Wilds in Beaver Bay, Minnesota. Photo by Chris Guibert/Rock Solid

Hand-felled, hand-peeled, and hand-sanded bridges have a unique custom feel. Photo courtesy of Rock Solid

Wooden bridge at Lake Atlanta in Rogers, Arkansas. Photo by Eli Glesmann/Rock Solid

Steel-framed bridge with wooden decking at Headstart to Slaughter Pen in Bentonville, Arkansas. Photos by Eli Glesmann/Rock Solid

Prefabricated steel bridge at Devil's Den State Park in Winslow, Arkansas. Photo by Andy Filetstra/Rock Solid

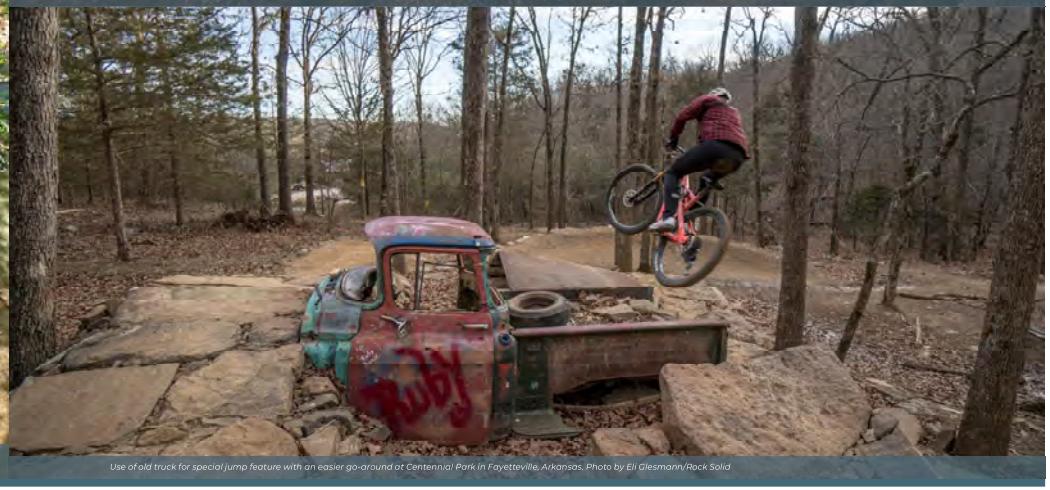


Complex, custom-engineered and site-built steel framed bridge at Mount Nebo State Park in Dardanelle, Arkansas. Photo by Andy and Michelle Filetstra/Rock Solid

SPECIAL FEATURES

Special features can be virtually anything. (See photos.). Budget and imagination may be your only limitations.

One-of-a-kind trail feature custom-designed and engineered to connect a cliff wall to a large rock "lily-pad" at Lake Vian in Vian, Oklahoma. Photo by Eli Glesmann/Rock Solid



Use of old truck for special jump feature with an easier go-around at Centennial Park in Fayetteville, Arkansas. Photo by Eli Glesmann/Rock Solid

Over-under trail section at Centennial Park in Fayetteville, Arkansas. Photo by Eli Glesmann/Rock Solid

COMMON PITFALL:

Poor understanding of mountain bike trail offerings

A poor understanding of mountain bike jargon, trail types, and trail features can result in trails getting built that do not meet the needs or wants of the community. A basic understanding of these elements (or having someone who does understand them involved in the project) is vital to ensure that the vision and goals of the community align with what gets planned and built.

Chapter 6: The Importance of Trail Signage

The development of a mountain bike trail network requires the development of a comprehensive system of signs. Signs are the most important communication tool between land managers and trail users. A well-implemented and maintained signage system enhances the user experience by helping visitors navigate the trail network and provides information about the area. Signage also plays a critical role in managing risk and deploying emergency services.

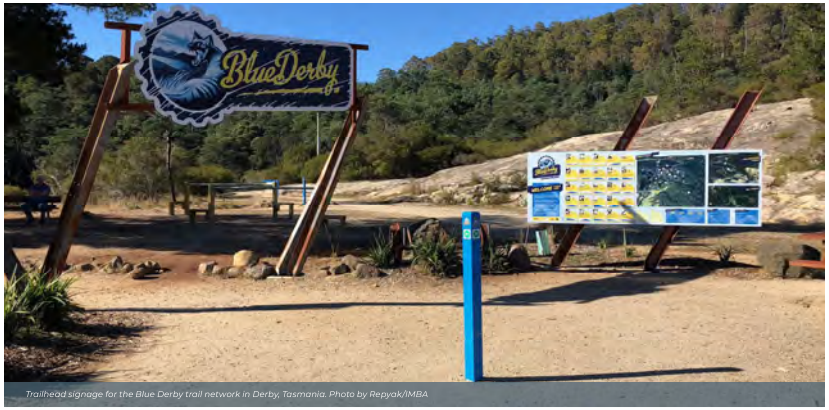
Signage for trails should be simple, uncluttered, and obvious, and there should be a sign at every major intersection to help users stay on track. Signs should meet the needs of all users, from the daily trail user to someone who is experiencing the trails for the first time. In order to serve the variety of visitors, sign placement should be strategic and frequent, although, too much signage can be unsightly among a natural outdoor experience. Balancing competing interests is key to developing a successful signage program.

Sign Types

A variety of signs can be created to help users identify trails and their locations, select routes, remain confident in their trail choices, find destinations and key points of interest, and understand regulations and allowed uses. Signage can also be interpretative, helping visitors learn about responsible recreation, trail etiquette, and resource protection, as well as how to reduce risk and hazards.

Informational Signs

Usually positioned at the trailhead and at major intersections, informational signs provide details such as trail length and difficulty. These include signs that identify a trailhead from a road, informational signs at a trailhead kiosk, trail intersection signs, waymarks, and signs that provide information about difficulty ratings, and trail lengths, and/or elevation gain and loss.



Trailhead signage for the Blue Derby trail network in Derby, Tasmania. Photo by Repyak/IMBA