

## **CHAPTER 4: Trail Design**

## I. Applicability of Design Standards

### 1. State Trust Lands

The majority of the trails in “A Trail Runs Through It” system will be located on the Montana Department of Natural Resources School Trust Lands. These trails will be primarily multi-use trails with a natural surface. The design guidelines in this chapter apply to these trails.



*Trail in Spencer Mountain subarea*

### 2. United States Forest Service

A portion of the trail system will include trails on the Flathead National Forest. Specifically, this will include a link from the summit of Big Mountain Resort following Taylor Creek Road to connect with the trail system in the Swift Creek subarea. This trail and any future trails on Forest Service Land must follow the design standards and specifications of the United States Forest Service.

### 3. Public Right-of-Way

This Master Plan describes a trail system that links with proposed bike paths in the City of Whitefish and along US 93. These are off-road paved bicycle trails that generally follow standards established by the American Association of State Highway and Transportation Officials. (AASHTO). Additionally, there may be some linkages to designated bike routes along county and city roads. On these routes, bicycles share the roadway with vehicles and there may be signage alerting motorists to bicycle traffic. Whichever local government has jurisdiction of the road will designate the bicycle route and determine the standards for these roadways.



*Fish Trails in Whitefish*

### 4. Private Property

Trails that cross private property through an easement for the “A Trail Runs Through It” project would follow the same design standards as the trails on State Trust Lands unless the easement provided otherwise. The trail system may also connect to privately operated trails such as the mountain bike network at Big Mountain Resort. The property owner will establish the design standards for these trails.

## II. Difficulty Levels

The physical design of the trail will vary depending on the natural features, volume of traffic on the trail and the types of activity. Heavily congested areas will be designed for ease of use until the trail users have an opportunity to disperse. Trails that are in more remote areas can be more challenging. Additionally, trails that are attractive for a wide range of users will have a wider and more even grade to avoid conflicts.

The International Mountain Bicycling Association (IBMA) has a rating system that is adapted from the difficulty rating system used at ski resorts. Although the ratings are developed for mountain bike trails, they are also useful for other activities such as hiking and horse back riding. The system focuses on technical challenge, not physical exertion. The following trail features determine technical challenge:

- Trail width
- Tread surface
- Average trail grade
- Natural obstacles and technical trail features

The IBMA has five ratings from Easiest (paved trails) to Extremely Difficult (the equivalent of a double black diamond at a ski resort). The design guidelines for “A Trail Runs Through It” will be for natural surface trails using the three IBMA middle rankings for level of difficulty. (“Easy,” “Moderate,” and “Difficult”). Guidelines for classifying different segments of the trail include:

- Trail segments near trailheads should be “Easy”
- High activity corridors should be “Easy”
- The overall difficulty level for the remainder of the main corridor should be “Moderate”
- Depending on natural features, there may be short segments that would be either “Easy” or “Difficult”.
- Chapter 3 generally describes the difficulty level for each subarea of the trail
- Some secondary trails or spurs may be specifically designated for family, seniors, or disabled populations and designed as “Easy”
- Some secondary trails or spurs may be specifically designated as challenging and be designed as “Difficult”

### *Survey Responses*

*83% agreed the trail should be a natural surface.*

*78% agreed some segments of the trail should be family friendly.*

*77% agreed some segments of the trail should be strenuous /challenging.*

*63% agreed some segments of the trail should accommodate disabled users.*

*71% said it was very important to post trail rules at trailheads.*

*76% agreed the trail should accommodate mountain biking.*

Table 1: Trail Difficulty Rating System

	<b>EASY</b>	<b>MODERATE</b>	<b>DIFFICULT</b>
<b>Trail Width</b>	72 inches or more	36 inches or more	12 inches or more
<b>Tread Surface</b>	Firm and stable	Mostly stable with some variability	Widely variable
<b>Average Trail Grade</b>	5% or less	10% or less	20% or less
<b>Maximum Trail Grade</b>	15%	Max 15% or greater	Max 15% or greater
<b>Natural Obstacles and Technical Trail Features (TTF)</b>	Unavoidable obstacles 2” or less Avoidable obstacles may be present Unavoidable bridges 36” or wider	Unavoidable obstacles 8” tall or less Avoidable obstacles may be present Unavoidable bridges 24” or wider TTF 2” high or less, width of deck is greater than ½ the height	Unavoidable obstacles 15” tall or less Avoidable obstacles may be present May include loose rock Unavoidable bridges 24” or wider TTF 4” high or less, width of deck is less than ½ the height Short sections may exceed criteria

Source: International Mountain Bicycling Association, Trail Solutions – IBMA’s Guide to Building Sweet Single-Track

### III. Construction Standards

#### 1. Benefits of Proper Construction

Trail construction activities include clearing, grading, installing drainage improvements, speed control features, and building trail structures. Common trail features that need to be constructed include climbing turns, switchbacks, culverts, bridges, boardwalks, crossings, rock walls, retaining walls and signs. Proper trail design and construction techniques have many benefits such as:

- Lowering maintenance costs
- Lessening impact on the environment
- Resisting erosion
- Improving water quality
- Reducing negative impacts on wildlife
- Blending in with surrounding area
- Creating an enjoyable and safe experience for trail users
- Keeping trail users on trail and away from sensitive areas
- Controlling the speed of bicycles
- Providing appropriate clearance for bicyclists and equestrians
- Reducing conflicts between user groups

#### 2. Construction Standards

There are a number of excellent resources to guide the trail manager on trail layout and construction. Following are some of the more commonly used books:

- 1) International Mountain Bicycling Association, Trail Solutions, IMBA's Guide to Building Sweet Singletrack, 2004, [www.imba.com](http://www.imba.com), ISBN 0-9755023-0-1
- 2) USDA, Forest Service, Standard Specifications for Construction of Trails, EM-7720-102
- 3) Student Conservation Association, Lightly on the Land: The SCA Trail Building And Maintenance Manual, ISBN 0-89886-491-7

### 3. Unauthorized Trails

Currently, there are numerous trails throughout the State Trust Lands that various user groups have constructed without permission or adherence to any standards. Many of these trails are poorly constructed and can create numerous problems including:

- Erosion
- Weed management problems
- Intrusion on sensitive wildlife areas
- Interference with forestry operations
- Unsafe structures
- Higher costs to maintain overall trail system
- Litter and vandalism



*Unauthorized bike jump in Spencer Mountain subarea*

As part of the trail management agreement, these unauthorized trails will be evaluated to determine if they should be included in the trail system, rerouted or vacated. Some guidelines for making this determination are:

- Trails should reflect the guiding principles in the appendix
- Trails should generally follow the design standards in this section
- Trails should have minimal environmental impact
- Trails should require reasonable reconstruction to bring them up to accepted standards

### 4. Configuring Loop Trails

A consideration in evaluating secondary trails and spur trails from the main corridor will be creating loops. Trail systems with loops let visitors enjoy trails of varying distances, difficulty and ecosystems all in one outing. Providing loops disperses people and reduces user conflicts. A combination of small and large loops provides the maximum opportunity for users to enjoy the trail network.

A stacked loop system consists of a core loop that is close to the trail head and designed for heavier uses. Loops that branch from the trailhead may get narrower and more challenging the more remote they are from the trailhead. Loops may also branch from point-to-point trails.

## IV. Conceptual Elements

Beyond construction standards, there are certain aspects of trails that make them interesting and give them a distinctive feel. Terms found in the public comment section of the survey included “meander,” “sense of discovery,” “vistas,” “overlooks,” and “geological features” to describe desirable trail characteristics. The following summary from the book, Natural Surface Trails by Design, (natureshape.com) provides an overview of these conceptual elements of trail design.

### 1. Physical Elements

A well designed trail will have a combination of all of these physical elements:

#### a) Natural Shapes

Natural shapes get their character by being unpredictable. A natural shaped trail will have a variety of curved, winding, irregular, and sometimes straight segments. The trail follows the natural contours, outcroppings and paths that are suggested by the land.

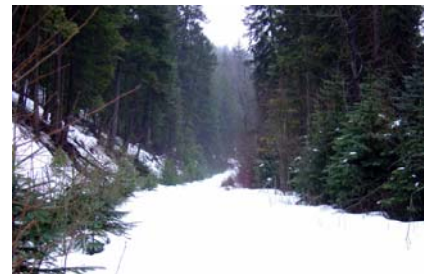
#### b) Anchors

Anchors are any distinct vertical features in the visible area. Anchors give a trail a visible reason to be “here” instead of “there.” The trail users are drawn to points of contrasts such as size, distance, and distinctiveness. Rocks, trees, cliffs, and water features can all be anchors. Anchors can be natural or constructed.

#### c) Edges

Common types of edges are the edge between meadow and forest, land and water, valley wall and valley floor, cliffs, and edges between distinctly different vegetation areas or ecosystems with a vertical element. Different edge treatments such as having the trail parallel the edge, angle across the edge, or go back and forth across an edge, make the trail interesting.

*The trail meanders through the woods*



*The trees on the left create a distinct edge*



#### d) Gateways

Gateways occur where the trail is clearly constrained on two or three sides: left, right, and/or above. The more the trail feels like it squeezes through, the stronger the gateway. Gateways create a sense of passage and distance. A gateway near the parking area helps users adjust from the “car world” to the “trail world.”

## 2. Experiential Elements

#### a) Safety

Perception of safety depends on the individual’s abilities and comfort levels regarding certain risks. Varying trail segments will represent different challenges but overall, the trail should incorporate the following features to enhance the feeling of safety:

- Sufficiently stable and comfortable tread (stability, smoothness, and traction) for one’s ability
- Sufficient clearance around obstacles and edges
- Comfortable buffer or protection from danger (wildlife, steep drop-offs, site hazards ...)
- Clearly marked trails and thorough maps
- Reduced user conflicts
- Safely constructed features

#### b) Efficiency

Visitors and stock want to feel that the trail isn’t wasting their time and effort. Efficiency influences user’s willingness to stay on the trail instead of taking shortcuts or avoiding unsatisfactory sections. Problems that occur when trails are not efficient include:

- Avoiding excessively muddy, wet, rocky, or difficult main tread by forming parallel treads
- Bypassing tread structures such as waterbars or inconveniently spaced steps
- Shortcutting switchbacks
- Speeding
- Cutting corners on broad curves
- Traversing meadows and open space

*There should be a buffer between the trail and the railroad tracks*



## c) Playfulness

Playfulness is the main difference between trails and roads. Playfulness has natural shapes, uneven tread, and incorporates site elements. Aspects of playfulness include:

- Anticipation, excitement, curiosity, surprise
- Peacefulness (especially after more energetic trail sections)
- Quirkiness
- Natural shapes
- Variety and contrasts in feelings and physical sensations
- Desire for dramatic spaces
- Appropriate timing, rhythm, and flow between sensations



*Mountain views can create a dramatic experience on the trail*

## d) Harmony

Harmony occurs when everything - the site, tread, trail structures, trail usage, and movement - all work together. Low harmony invites abuse and degradation, while harmonious trails engender a sense of stewardship. Some elements of harmony include:

- The trail and its features seem part of the site
- The trail and tread support movement and modality with the desired speed and challenge
- The trail is not too wide or too narrow for the desired experience
- The trail and its structures have blended over time into the site through weathering, vegetation growth
- Peacefulness – Change happens slowly to accommodate and adapt to natural forces
- Spacing between attractive sensations
- Natural materials echo the site whenever feasible
- Manufactured materials are only visible when necessary
- Harmonious trails have natural shapes and do not have an engineered feel

## V. Signage

Although trail users ranked signage as the most important amenity on the trail, it is important that signs be located and designed appropriately so they don't intrude on the outdoor experience. High use areas generally require more signage while fewer signs are necessary in the remote areas. Following are the types of signage that will be useful on the trail system.

- Trailhead Kiosks – Map and description of trail length and relative difficulty. Also include trail rules, trail etiquette, emergency contact information or volunteer opportunities. Information about weeds, wildlife, travel restrictions, hunting and fishing is also be useful.
- Directional Signs – Navigational aids such as trail name and length of the route should be posted repeatedly along the route but not overused.
- Warning Signs – Signs to caution trail users of upcoming hazards should be placed close to the trail and should be easy to see. Use signs for big drop-offs, narrow bridges, wildlife habitat or other elements of increased risk.
- Difficulty-Level Signs – Post at the main trailhead, access point, intersection, or where there is a change in difficulty levels.
- Regulatory signs – Delineate rules such as user group restrictions, seasonal closure and other restrictions.
- Educational Signs – Use to interpret natural or cultural points of interest along the way. Placed roughly four feet away from main tread so they don't interfere with the trail when users stop to read the signs.

Most of the resources for construction standards also have guidelines and design standards for signs. Additional references from the Forest Service are:

- Forest Service Sign and Poster Guidelines for the Forest Service, Engineering Management (EM) Series publication (EM-7100-15)
- Forest Service, “Sign Installation Guide”, 9771-2813-MTDC



*Kiosk with map in Beaver Lakes subarea*



*Regulatory sign in Happy Valley subarea*