MOUNTAIN BIKING DESIGN GUIDELINE

This document provides general guidance in the layout and design of mountain biking trails and facilities in BSA Council camps. Biking programs offered at high adventure bases, because of their scale and customer profile, will vary in terms of scope, challenge and cost and are not addressed here. This document should be used in conjunction with it's companion piece, "Mountain Biking Program Guide"

OBJECTIVE: The objectives of the BSA Mountain Biking program are three fold:

1) To create a safe introduction to the sport. Note: Scouts should first be observed in a controlled environment to assure that they are competent to ride the trails. Additional training may be given at this time, if needed.
2) To provide a safe and fun environment where a Scout can sharpen the primary skills of the sport.
3) To support the mountain biking option of the cycling merit badge.

Biking can also be used to promote physical fitness and/or a means of transportation within camp.

A quality mountain bike (MTB) program should be rooted in education, stewardship, and skills progression. The program should provide learning opportunities for all riders, but remain challenging enough to build confidence and self-esteem at the same time. It is essential that participants are given the necessary resources to push their limits while minimizing the mental and physical risks. Challenge by choice should be respected and reinforced at every trail feature.

It is recommended that once the Scout has successfully mastered the fundamentals and has expressed an interest in highly challenging experiences, the activity be moved off site to a facility operated and maintained by professionals.

DEFINITIONS: To clarify what mountain biking is and what it is not, here are a few definitions:

Mountain Bike: Mountain Bike is a bicycle created for off-road cycling. Mountain bikes are typically ridden on mountain trails, fire roads, logging roads, and other unpaved environments.

Mountain bike construction differs from a typical bicycle in many ways. The most noticeable differences are the inclusion of suspension on the fork and possibly the frame, larger knobby tires, more durable heavy duty wheels, more powerful brakes, and lower gear ratios needed for steep grades with poor traction.

High end mountain bikes are built to handle demanding terrain and the obstacles that are found in it like logs, vertical drop offs, and smaller boulders.

BMX Bike - A BMX bike is an off-road sport bicycle used in a variety of different venues. BMX means bicycle motocross. The BMX "Class" bike is a strong, quick- handling, lightweight bike with a standard 20-inch (510 mm) or 24" (610 mm) -wheel.

BMX Racing - is a type of off-road bicycle racing. The format of BMX was derived from motocross racing. BMX bicycle races are sprint races on purpose-built off-road single-lap race tracks. The track usually consists of a starting gate for up to eight racers, and a groomed, serpentine, dirt race course made up of various jumps and rollers and a finish line. Typically, the track requires constant maintenance when in use. The course may be sloped or flat, about 15-foot (4.6 m) wide and has large banked corners to help the riders maintain speed. Other permutations include pump tracks, freestyle dirt jumping, freestyle urban/skate park riding or flat ground tricks.

Challenge by choice: Challenge by choice is a philosophy and strategy within the outdoor education industry in which participants are invited to challenge themselves and participate on their own terms. It's important to allow participants to choose what participation level they are comfortable with, set their own goals and measure their own success. It is the instructor's role to present the challenge, provide safety instruction for the activity, instruct the participant in the skills required to overcome the challenge, and to guide the participant in setting goals and levels of success. While an instructor should obviously encourage participants to push themselves physically and mentally, participants should never feel forced or coerced out of their comfort zone.

An important aspect of Challenge by choice is that the participant also has to feel that their choice will always be accepted by the group as a valid level of participation. This could also be known as participant buy-in. There are a number of ways to accomplish this, but one major tool in the outdoor education industry is the Full Value Contract. This is a term for a contract that the group comes up with together at the beginning of their experience to create a philosophy or culture for their own group dynamics. The instructor should help guide the participants in a proper direction, but it's important for the group to feel that they have created this contract together. This will aid in everyone sticking to the contract and all participants feeling comfortable within the group culture. In trail design this translates to adding "bail out" or "bypass" elements to challenging obstacles.

GENERAL GUIDELINES:

Bike Trails

Maintaining trails that are safe and environmentally sustainable can be expensive. Safe and sustainable trails are vital to the success of a quality MTB program. Trails should be meticulously planned and mostly sustainable with proper maintenance. Trails must be progressive in nature, starting at the easiest level and working towards more advanced skills.

The cost will vary with the degree of difficulty. For example, trails that are very steep are subject to constant erosion and require care. Good design and trail construction will minimize maintenance costs and increase safety. Professional help or assistance from recognized biking organizations such as the International Mountain Biking Association (IMBA) or the Professional Trail Builders Association (PTBA) can prove invaluable.

Highly demanding types of terrain commonly involve challenging use of rocks, washouts, ruts, loose sand, loose gravel, roots, and steep grades (both inclines and declines). We do not recommend an advanced level of challenge within a camp environment. However, experienced

bikers may pursue that level of challenge at facilities operated and maintained by professionals or at our National High Adventure Bases. Because the degree of challenge in a BSA camp is less, the camp will be able to provide simpler equipment that is more affordable.

A great trail system will have trails meant for riding up at lower grades and trails meant for riding down at steeper grades. Generally, an average trail grade of 10% or less is most sustainable. Beyond this grade, the trail is easily eroded. This is site specific and fluctuates. Turning radii should be in the 6 to 8 foot range, and the path width should be 36” to 48”. All of this is dependent on a number of variables such as soil conditions and topography. When we talk about the maximum grade at any particular point, we mean short sections of steep grade followed by mellow grades. Even an intermediate blue trail may have very short, but very steep sections that create little cruxes to power through and provide a sense of accomplishment. A sustainable trail will have both gradient changes and turns to help slough off the water. For specific design parameters, IMBA has an excellent resource, “Trail Solutions” published by the IMBA, Boulder, CO. Frequently, maintenance roads, fire lanes and other such routes are incorporated into the trail system.

The IMBA uses a 5 tier trail difficulty rating system. White (easiest) and green (easy) difficulty levels are entirely appropriate for BSA properties. At the blue square level (difficult), the council should consider providing access to professionally managed and maintained trail systems. Black diamond (very difficult) and double black diamond (extremely difficult) are not recommended as a council operated camp activity due to the potential for injury.

Trail Difficulty Rating System

	Easiest White Circle	Easy Green Circle	More Difficult Blue Square	Very Difficult Black Diamond
	○	●	■	◆
Trail Width	72” or more	36” or more	24” or more	12” or more
Tread Surface	Hardened or Surfaced	Firm and Stable	Mostly stable with some variability	Widely variable
Average Trail Grade	Less than 5%	5% or less	10% or less	15% or less
Maximum Trail Grade	Max 10%	Max 15%	Max 15% or greater	Max 15% or greater
Natural Obstacles and Trail features (TTF)	None	Unavoidable Obstacles 2” tall 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 TFF’s 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 rocks Unavoidable bridges 24” or wider TFF’s 4’ high or less, width of deck is less than ½ the height Short Sections may exceed criteria

NOTE: IMBA provides for double black diamond riding, however, the BSA does not permit scouts to use double diamond trails.

Customized Protocols and Risk Management Plan

All quality mountain bike programs should have well planned and customized policies in place. The policies should address program operation, participant/staff ratios, facility and equipment care, safety, and more. An example document can be found in the Mountain Bike Program Document. All policies should be written specifically for the program objectives and capability level of the participants.

While considering the financial commitment and policies for your program, it is imperative to begin formulating a detailed Risk Management Plan. The BSA Field Book notes that managing risk requires planning, training, leadership, good judgment, and accepting responsibility. Incorporating those specific characteristics into a detailed plan will help identify potential hazards, improve overall safety, and limit liability associated with the program. There are many BSA Risk Management resources, but the International Mountain Bike Association (IMBA) provides detailed risk management guidance specifically for mountain bike programs. We strongly encourage you to utilize their expertise in this field, prior to operating your own program.

Financial Commitment:

Operating a mountain bike program is an involved process, but a rewarding way to help engage youth in the outdoors. Typically one of the first questions would be, “how much does a mountain bike program cost?” Entry level bikes can retail anywhere from $200-$400. The investment related to operating a fleet of 20 entry level mountain bikes (not including infrastructure/facilities/maintenance) can cost $6,000 - $11,000 for an entry level program fleet. This does not include staffing and operations and maintenance costs.

Alternatives would include renting bikes and equipment from a local bike shop. One council is known to buy year end “left overs” directly from the manufacturer at significant discount

Initial Costs 20 units **(2015)**	Low	High
Bikes	$3,800	$8,200
Helmets	$600	$800
Pads/ Gloves	$1,600	$2,000
Total	**$6,000**	**$11,000**

A financially sustainable program would involve purchasing/selling a specific number of bikes and ancillary equipment per year.

Maintenance Considerations:

Maintenance will fall into two categories; trail maintenance and equipment maintenance.

Trail maintenance is important for both environmental sustainability and for safety. Research by the IMBA shows that the most effective way to minimize the environmental effects of trail recreation is through good design. Although it is a natural process, trail erosion is the biggest threat to safety and environmental sustainability. The process is accelerated by the combination of trail users, water and gravity.

Equipment maintenance will be inevitable but can be mitigated through the selection of simple, sturdy bikes. When deciding on the model of bike to use, camps need to look at maintenance, expected longevity, ease to ride, and trails that they will be ridden on. One or two gears may be necessary to successfully traverse even the easiest terrain. Keep in mind though, the more complex the machine, the more expensive it will be to acquire and maintain. A successful program will have a “repair shop” and staff or volunteers who are trained in maintaining bikes.

Depending on the caliber of the fleet, maintenance requirements can potentially consume a large amount of time and money. A rough parts estimate for a 20 bike fleet could range from $1,000-$3,000 per year. This doesn’t account for the service time/cost involved with maintaining the fleet, which can be done by a local bike shop or a qualified staff member. Depending on the caliber of your staff, the fleet should be inspected by a bike shop professional at least once a year. Based on a 4 year rotation/depreciation of entry level bikes, the total annual cost associated with purchasing bikes, parts, and providing quality service could cost anywhere from $6,000-$9,000 per year.

Local bike shops and bike clubs are a good starting place for volunteer assistance in trail design and equipment and trail maintenance. It is part of the IMBA ethic to seek partnerships, so explore this aspect thoroughly when contemplating the creation of a bike program.

Storage/Maintenance Facility

The size of your bike fleet should be determined by the number of participants you expect to serve. It is important to have a dry, organized, and efficient place to store, locate and inspect/ repair the bikes.

Space in this facility should be designated for a service/maintenance area that is outfitted with professional bike tools . Keeping the proper tools organized will look professional, improve efficiency, and improve the staff’s ability to service the fleet. Having a couple of bike vises is a good idea.

If there is not enough inside space for the service area, consider using a storage area near a roofed outdoor workspace. This will enable your staff to effectively maintain bikes during inclement weather and focus on program quality/safety when skies are clear. It is helpful when the storage area enables the staff to distribute bikes directly from the storage area to the participants, as opposed to removing the bikes from storage and staging them for riding in a different location.

Signage

If you decide to utilize trails on BSA property, it is imperative that you build proper signage into your trail network. Signage is important to limit liability for riders that might “stumble” onto the trail network without proper supervision and to help beginners reduce risk associated with more difficult terrain. For more information on creating effective signage, refer to the IMBA book Managing Mountain Biking in the resources section at the end.

Land Use Agreements & Strategic Partnerships

Another option for mountain bike programs is to utilize existing mountain bike trails within your local community. Using an existing trail system has many advantages, but may require additional land manager permission. Private land use agreements are often less cumbersome than state and federal agreements. If an existing trail system is available for use on public lands, it is imperative to find out whether or not permits are required for non-profit programming.

If building new trails on Council property is not an option and there are no existing trails in the area, consider pursuing strategic partnerships with local land managers like the United States Forestry Service, National Park Service, or Bureau of Land Management to create multi-use trails with mountain biking in mind. Permits are often issued in exchange for conservation work to maintain or build trail. This work helps federal/state agencies achieve their annual goals or "targets." Proper use and care of partnering properties has the potential to grow into something larger than a simple land use agreement.

In addition to working with private/public landowners, it is essential to develop working relationships with local MTB advocacy groups, trail clubs, and IMBA chapters that can provide guidance for work on BSA properties and offsite trails. These clubs can be great resources for trail building, program development, or community service opportunities. It is important for participants in a MTB program to understand the partnership component, commitment, and hard work that goes into riding great mountain bike trails.

RELATED DOCUMENTS AND WEB SITES:

- Mountain Biking Program Guide
- Guide to Safe Scouting
- Cycling merit badge pamphlet
- "Trail Solutions" IMBA, Boulder, CO
- "Managing Mountain Biking" IMBA , Boulder, CO

- http://www.uci.ch/mountain-bike/about/
- https://www.imba.com/resources/trail-building/designing-and-building-sustainable-trails
- http://www.singletracks.com/mountain-bike/club.php