CHAPTER 7 — DESIGN OF TRAILS

I. DESIGN STANDARDS

The objective of this chapter is to provide municipal guidelines for the design of trails. All trails shall be designed, located and signed to prevent incompatible use and to ensure safe, enjoyable, and year-round use. These design standards will protect the Municipality against liabilities. High volume trails are trails with more than 1000 users per day, per the FHWA (see Figures 7.1, 7.2, 7.3, and 7.4.)

The criteria for trail development and design include paving, alignment, stopping sight distance, intersections, grades, cross slopes, clearances, road separation, bicycle routes, widths, traffic control and signage, lighting, drainage, surfacing, and trail structure. Additionally, specific attention should be placed on the landscaping of trails including trees, shrubs, topsoil and seeding.

A. PAVING

Trails in road rights-of-way shall be paved, except those that are:

- identified as multi-use unpaved trails on a Plan map
- located in Girdwood that the Girdwood Board of Supervisors elects to waive
- in the Anchorage Bowl and Chugiak-Eagle River areas that the Planning and Zoning Commission elects to waive

B. ALIGNMENT

The significance of proper alignment, or design radii, varies with the use of the facility. For example, sidewalks and walkways are predominantly used for slow moving pedestrian traffic, however, bike and equestrian trails shall be designed to accommodate movement at greater speeds, volumes of users, and user types. Therefore, alignment concerns, such as sight distance and horizontal curve radii, are more critical on bike and equestrian trails (see Table 4).

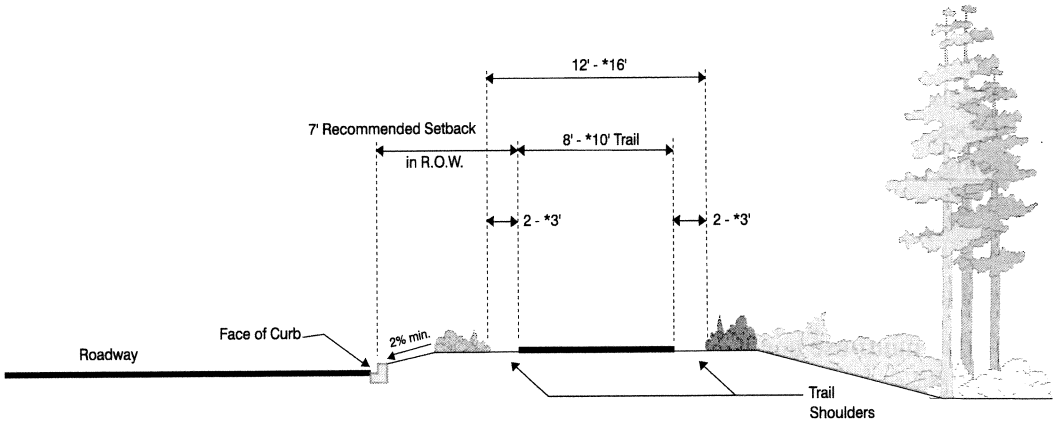
Table 7.1—Typical Design Radii

Activity	Design Radii
Walking, hiking, equestrians, jogging	N/A
Bicycles, rollerblading, x-co skiing, dog mushing (design speed = 20 mph)	95 feet
Snowmobiles (design speed = 40 mph)	565 feet

C. STOPPING SIGHT DISTANCE

The standard required stopping sight distance on flat surfaces shall be 125 feet for pedestrian or bicycle trails. This standard is the same as the adopted Oregon standard that is based on the speed of the fastest bicycle. This shall be increased, as necessary, to accommodate the factor of slope, in that speed is a factor of gravity acting on mass. Trails for equestrians may include shorter stopping distances, and dog mushers may require up to twice the stopping distance (250 feet). Snowmobile trails shall be designed with a stopping distance of 225 feet.

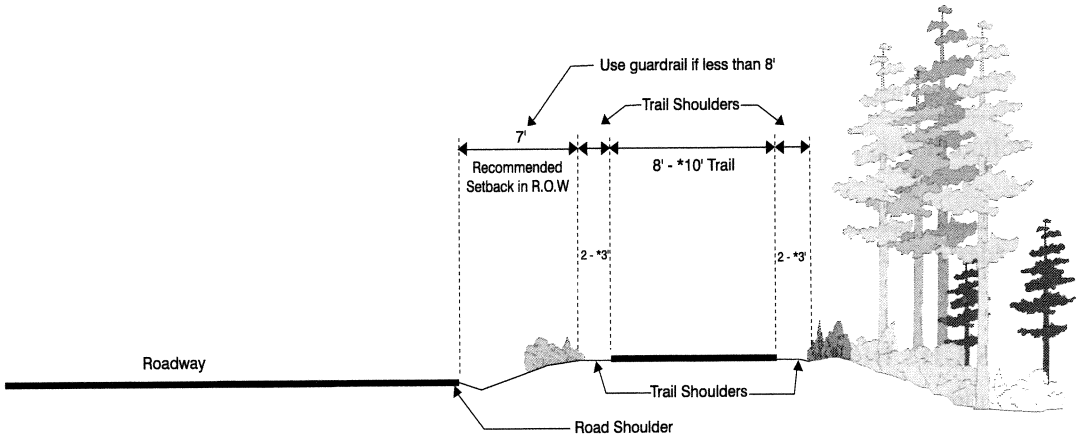
Standards for Paved Trails Along Roads with Curb and Gutter



*Use for high volume trails

Figure 7.1

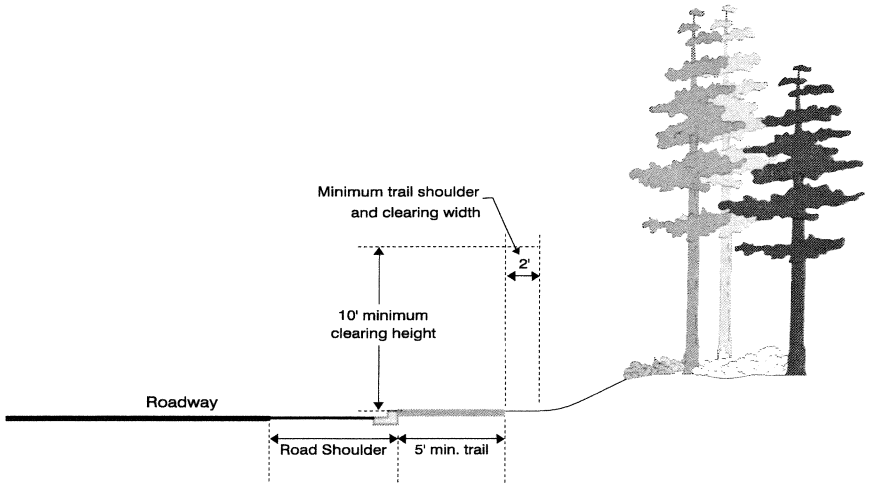
Standards for Paved Trails Along Roads without Curb and Gutter



*Use for high volume trails

Figure 7.2

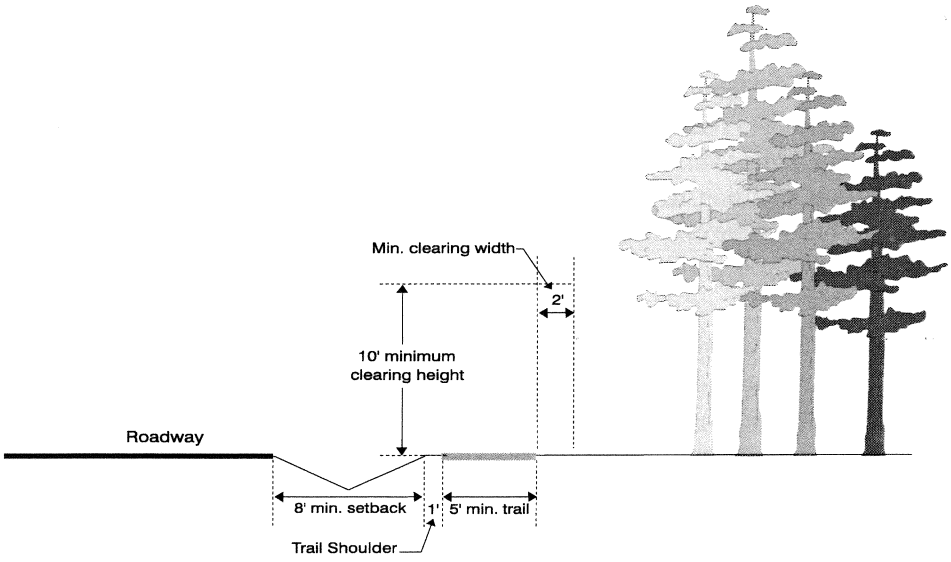
Standards for Unpaved Trails Along Roadway with Curb and Gutter



Note: These standards are to be used for equestrian trails.

Figure 7.3

Standards for Unpaved Trails Along Roadway without Curb and Gutter



Note: These standards are to be used
for equestrian trails

Figure 7.4

D. INTERSECTIONS

Intersections shall be a horn configuration (at right angles) for almost all trail types. This shall be especially true where conflicting trail types intersect. Due to design constraints, it may not always be possible to have a 90-degree intersection. The American Association of State Highway and Transportation Officials (AASHTO) allows a 10 to 20 degree latitude, however, all intersections of dog sled trails with other user groups shall be at 90-degree intersections. Where trails of compatible activities merge, signing shall indicate the convergence of trails.

E. GRADES

The AASHTO standards for grades for paved bicycle trails is as follows: "Grades on bicycle trails should be kept to a minimum, especially on long inclines. Grades greater than 5 percent are undesirable because the ascents are different for many bicyclists to climb and the descents cause some bicyclists to exceed the speeds at which they are competent. Where terrain dictates, grades over 5 percent and less than 500 feet (150 m.) long are acceptable when a higher design speed is used and additional width is provided." Thus, a paved bicycle trail may not exceed a grade of 5 percent for over 500 feet. An unpaved trail is not subject to the same standards.

Trails dedicated to cross-country skiing, off-road vehicle, snowmobile, hiking, jogging, dog mushing, and equestrian use may have grades that exceed this standard. Grades for equestrian trails should not typically exceed 10 percent.

F. CROSS SLOPES

Cross slopes should be approximately 1 percent. Multi-use trails should never exceed 2 percent cross slope, in accordance with American with Disabilities Advisory Act Guidelines (ADAAG). Where driveways cross paved trails, the 2 percent maximum cross slope also applies. Trails dedicated to bicycles, ORV's, snowmobiles, or cross-country skiing could have steeper cross slopes (super elevation), if needed. This would enhance the ability of the trail to accommodate high-speed travel. Trails that are strictly recreational in nature may have steeper cross slopes (super elevation), if challenge levels for the area allows.

G. CLEARANCES

Horizontal and vertical clearances are important safety considerations. The greater the speed traveled on the trail, the greater the tendency for users to "shy" or steer away from nearby obstructions such as trees, fences, light poles, and retaining walls. This creates a safety hazard by moving the user toward the center of the facility and/or distracting attention from other users. Clearances should be 10 feet vertical for most trail users. Minimum tunnel and bridge clearances should be 12' x 12'. Bridge and tunnel clearances should be 12 feet where equestrian activity is permitted. Horizontal clearances shall be 2-3 feet for all trails measured from the paved edge of the trail.

There may be a 10-foot selective thinning zone along all trails, except for trails designated for cross-country skiing, equestrian, dog mushing use, or to interpretive use, and any trails where preservation of the existing flora is important. Selective thinning shall only include limbing of trees to the eight-foot height and removal of shrubs above three feet if they significantly restrict vision. There shall be no selective thinning within any 25-foot stream protection setback.

H. ROAD SEPARATION

When trails are located adjacent to a road of collector or greater status, consideration must be given to the need for horizontal and vertical separation between vehicles on the road and users on the trail. Separating these two uses provides time for each to react to potential conflicts before they occur. Trail separation from roadways also allows area for snow storage and drainage channels, separating trail users from splash back.

Trails shall have a 7-foot separation from the roadway, providing for safety. When distance must be reduced below 7-feet, specific waivers for Municipal projects must be granted by the Planning and Zoning Commission during the site plan review process. The federally approved ADOT&PF Pre-construction Manual guides the development of trails within State right-of-way.

The AASHTO standards state that when the distance between the edge of the roadway and the bicycle trail is less than 5 feet a suitable physical divider may be considered. Such dividers serve both to prevent bicyclists from making unwanted movements between the trail and the highway and to reinforce the concept that the bicycle path is an independent facility. Where used, the divider should be a minimum of 4.5 feet high in order to prevent bicyclists from toppling over it, and it should be designed so that it does not become an obstruction in itself.

Shoulders are to be equally divided on each side of the trail.

I. WIDTH OF TRAILS

The desired width of a trail is directly related to the volume and type of use it receives. Paved multi-use trails are typically 8-10 feet wide and unpaved trails should have a minimum width of five feet.

Because of increased speeds and joint use by bicyclists, walkers and joggers on paved trails, the minimum width is 8 feet. Two-foot wide "flat" shoulders are required on each side of the trail. Shoulders should slope away from the trail at 3-5 percent in order to maintain positive drainage. In some cases, high use, steep grades, and sharp turns may dictate larger widths. The designer shall carefully evaluate these locations to see if safety hazards exist that dictate the need for wider trails.

Where traffic volumes are expected to exceed 1,000 users per day (Transportation Planning for Livable Communities, Conference Proceedings, FHWA), the paved trail width should be 10-feet and an additional unpaved three foot shoulder shall be provided on each side of the trail. This will accommodate multiple use characteristics and users that travel at greatly differing speeds.

AASHTO standards state that, under certain conditions, it may be necessary or desirable to increase the width of a bicycle trail to 12 feet. Such conditions would include trails that receive substantial bicycle volume, have probable shared use by joggers and other pedestrians, are used by large maintenance vehicles, have steep grades, and where bicyclists will be likely to ride two abreast.

J. STRIPING AND SIGNAGE

The majority of trails are designed and constructed to minimize safety hazards. Therefore, signage and pavement markings are not significant concerns. However, the designer shall closely evaluate the proposed grades, sight distances, and types of intersections for potential safety hazards. Trails that experience as much as 1000 users per day or have restricted sight distance shall have a 3-inch yellow centerline. Trails that do not fully meet American Disabilities Advisory Act Guidelines (ADAAG) requirements should be signed to denote level of accessibility and challenge. Trails that do meet ADAAG requirements must also meet ADAAG sign requirements.

Trails shall be signed at the time of construction to indicate uses appropriate to the trail. Significant misunderstanding exists in the community over the compatibility of various uses on the many Anchorage trails. Signage is an important component in the resolution of many conflict issues, but is also a maintenance expense.

All trail signage placed in the right-of-way must conform to the Federal Manual on Uniform Traffic Control Devices and be approved by the Municipal or State Traffic Engineer.

K. LIGHTING

Most trails located adjacent to existing roads will have adequate illumination from existing streetlights. However, in the design process, the intensity and uniformity of lighting on the trail should be evaluated. Illumination on trails and in tunnels within the right-of-way shall be in accordance with the Municipality of Anchorage Department of Public Works Design Criteria Manual. Illumination on trails and in tunnels not located in the right-of-way shall be in accordance with the Department of Cultural and Recreational Services standards.

L. DRAINAGE

Trail designs shall give careful considerations to potential drainage impacts. Trails should be built above nearby roadways unless existing conditions prevent such placement. Particular attention shall be given to ponding along property lines and the possibility of trail fill blocking drainage. Trails should be designed so that no adverse drainage impacts result from construction. Trails should not be constructed by filling existing roadway ditches, which may result in water ponding on the roadway and trail and in deterioration of the road and trail.

M. SURFACING

Several conditions must be considered when evaluating the appropriate surface to accommodate a particular trail use. While Table 7.7 is a guide, consideration must be given to environmental conditions, environmental impacts, accessibility needs, and the desirable challenge levels of each trail. While off-road vehicles and equestrians may both use trails built of native material, the environmental impacts of each varies greatly. Gravel and native earth trails pose significant restrictions to the disabled.

Winter activities are generally compatible on any trail surface type, though other problems with compatibility may exist. Consideration must be given to snowpack in determining when particular activities are allowable. Packed trails, such as the Chester Creek Greenbelt Trail, can serve multiple winter uses when width allows. Trails groomed specifically for cross-country skiing are generally not compatible with other activities.

N. TRAIL STRUCTURE

Required trail structure is related to surface material. All trails with paved surface shall be engineered in accordance with Municipal and State criteria for roadway structural fill. Surfaces must be able to hold up under snow removal practices and wear from maintenance equipment. The impacts of each use shall be considered when determining trail structure. For example, while equestrians prefer a native surface material, locating an equestrian trail in wetland conditions may require an engineered gravel structural section. Proper planning and design should attempt to locate trails such that expensive engineering solutions are not needed for their construction.

Table 7.2 — Compatibility of Surface Type To Summer Trail Use

	Paved	RAP	Gravel	Natural
Biking (Mountain)	X	X	X	X
Biking (Non-Mt.)	X	X		
Dog Walking	X	X	X	X
Equestrian		+	X	X
Hiking		X	X	X
Interpretive	X	X	X	X
Jogging/Running	X	X	X	X
Motorized Vehicles			X	X
Natural				X
Roller Skiing	X			
Rollerblading	X			
Walking	X	X	X	X

Key: RAP = recycled asphalt pavement
x = compatible
+ = may be compatible if not oiled or compacted

II. DESIGN FOR MAINTENANCE

Trails and walkways paralleling roadways should be physically separated by a combination of distance, barrier, or elevation in order to reduce maintenance problems. Where the recommended horizontal distance cannot be achieved, a physical barrier should be placed between the trail and roadway so as to protect trail users from errant vehicles, protect the trail from road splash, and reduce the amount of dirt and debris that comes onto the trail. The trail should be constructed at a higher elevation than the roadway in order to prevent runoff onto the trail, to allow the trail to drain into the street gutters, and to increase the safety and enjoyable use of the trail.

Trail shoulders should be constructed of a porous material that will not wash or be scattered onto hard surfaced trails. These shoulders should be maintained for walking or running and should not be allowed to settle below the elevation of the trail surface, which could cause bicycle tires to drop off the edge or a pedestrian to be injured.

All utilities, traffic control pedestals, hydrants, signs, and utility poles should be placed between the back of the curb and the trail. In no instance should they be placed within 18 inches of the edge of a trail.

III. DESIGN OF SPECIFIC KINDS OF TRAILS

A. TRAILS FOR EQUESTRIAN USES

The design of an equestrian trail should be based upon a careful evaluation of the location of the planned trail. It should include provisions for protection of the adjoining resources, as well as the safety and enjoyment of the users, and consideration should be given to the volume and type of traffic, and economies of construction. The design should incorporate features that mitigate adverse impacts upon the environment and result in a trail of high quality that is permanent and inexpensive to maintain.

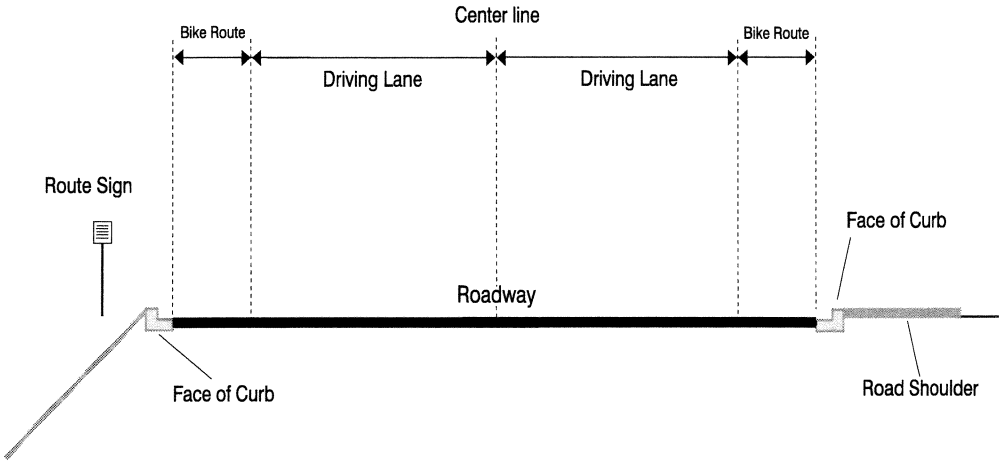
B. COMMUTER BICYCLE ROUTES (On-Street Facilities)

The design of on-street bike routes is determined by the speed and volume of cars, as well as the type of user, whether it be a local user (typically a less adept cyclist) or a commuter (those comfortable traveling alongside moving vehicular traffic). Designers shall determine the design criteria for the route based upon the Design Criteria Manual. The first step in design is to determine whether the street has a curb and gutter (see Figure 7.5).

It is also important to determine the type of user anticipated on a route. Routes that serve only as major transportation routes, such as "C" Street north of 36th Avenue, should be considered as serving "commuter" traffic. Routes that are anticipated to include use by a numbers of novices, children, or people not comfortable riding in traffic situations should be considered as serving "local" users. The designer should design to the most restrictive criteria dependent on the anticipated user.

Design of bike routes must consider the relationship of the bike route with transit facilities. Where the bike route crosses a transit pull-out, there is a possibility of conflicts between the bicycle rider and the transit vehicle while pulling into and out of the pull-out. Where buses and bikes must share the same travel lane or pull-out, there is a possibility that the bus driver may not be able to see bicyclists coming upon the bus. Bus turnouts should be striped 250 feet before the turnout to remind the bicyclists that transit shares the lane.

Standards for Bicycle Routes



1. These routes use part of the roadway with signing and striping to alert motorists of bicycle activities.
2. Bikes are legal road vehicles.
3. No parking is allowed in the bike route.

Figure 7.5

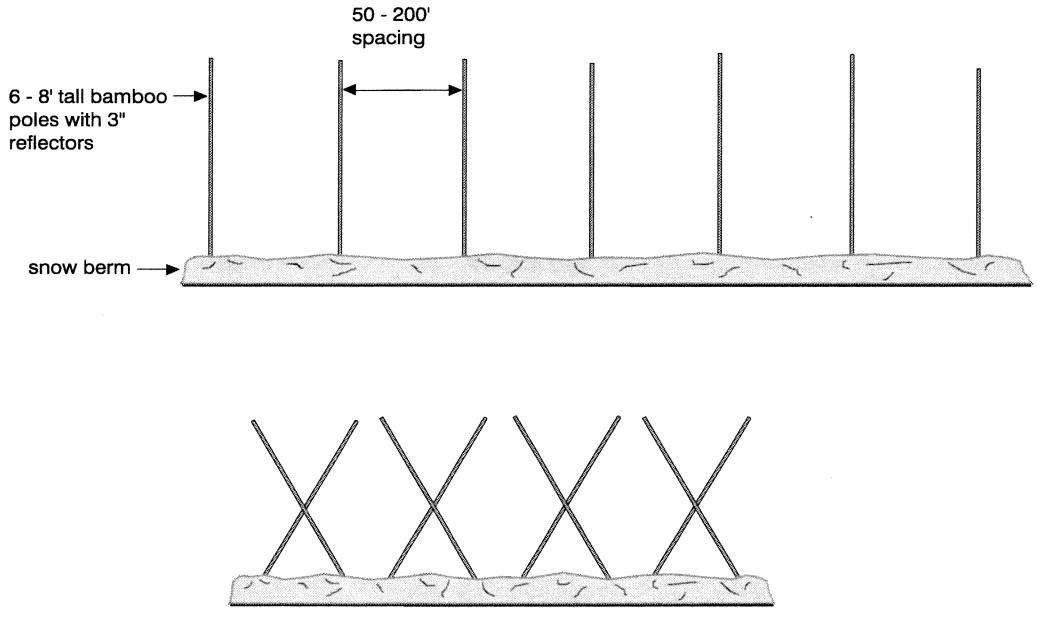
Under no circumstance shall a bike route be provided on the same side of the street as on-street parking. Also, under no circumstance shall a bike route be located on-street such that a user is traveling in a direction opposite to the travel of the adjacent vehicular lane.

In most cases, the streets that require separated bike routes already use all the available right-of-way for the street section itself. Therefore, the costs of additional acquisition and impact on adjacent properties to create bike routes can be substantial. The design of these routes shall carefully balance funding limitations with safety needs. When trail construction is associated with construction of a collector or greater status street, assistance in determining appropriate design should be provided in the review process. The street and highway designs are reviewed and approved by the Planning and Zoning Commission because these streets are classified as "public facilities." The designer should be prepared to present the pros and cons of various design options to the Commission.

C. SNOWMOBILE TRAILS

Snowmobile corridors may need to be indicated in areas where the trail is at a distance from the snowmobile area. Bamboo can be used to signify open and closed areas. (See Figure 7.6 and 7.7).

Snowmobile Trails - Profile View



NOTE: Bamboo poles are to be used when the snowmobile trail traverses an otherwise closed area or where the route of travel is not readily apparent.

Not to scale - Illustrative only

Figure 7.6

Snowmobile Trails - Cross Section

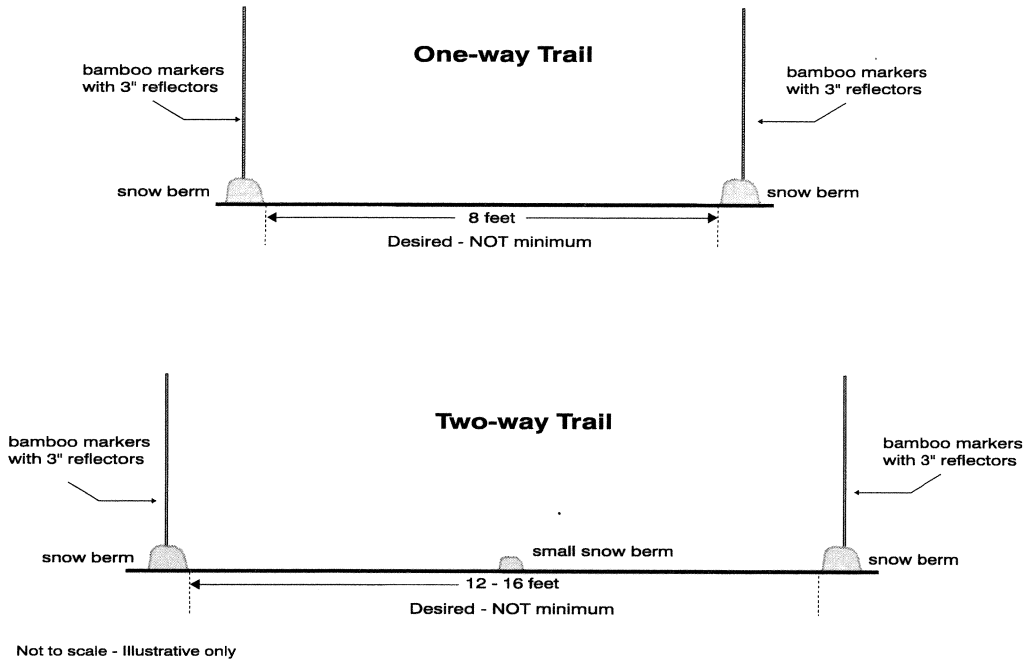


Figure 7.7

IV. REGULATORY AUTHORITY

The following are other sources that should be consulted when designing trails:

TITLE 21

- AMC 21.05.030 identifies the Anchorage Trails Plan as an element of the Comprehensive Plan. It is a guide for the construction of a trail and walkway network within the Municipality of Anchorage.
- AMC 21.080.030 gives the Platting Authority direction to require walkway dedication as part of subdivisions. This may be done when walkways or trails are necessary for adequate pedestrian circulation or safety.
- AMC 21.80.060 directs the Platting Authority to require trail dedication when the trail is designated on an adopted municipal plan and cannot be located in an existing dedicated easement or right-of-way.
- AMC 21 85.090 establishes sidewalk needs for land development based on the Average Daily Traffic (ADT).
- AMC 21.85.100 requires walkways and trails that are not part of required trail dedications to be improved in accordance with AMC 21.85 Table E.
- AMC 21.85.Table E establishes minimum widths and surfaces for trails and

OTHER SOURCES

In addition to Title 21, designers of sidewalks, walkways, trails and routes should be familiar with the following:

- Department of Public Works Design Criteria Manual. This document provides engineering criteria for non-motorized trails within a road right-of-way.
- Guide for Development of New Bicycle Facilities, August, 1991 American Association of State Highway and Transportation Officials. This document establishes criteria for design of bicycle facilities and serves as one of the guiding documents for all construction funded by the Federal Highway Administration.
- ADA Accessibility Guidelines for Buildings and Facilities, Appendix A to 28 CFR Part 36 provides standards for accessibility. Section 14 contains the most important information for purposes of trail construction.
- Alaska Department of Transportation and Public Facilities, Preconstruction Manual, Chapter 11, Design, Special design elements.