Construction Standards for Multi-use Trail on Abandoned Rail Corridors

TRAIL OBJECTIVE:

To provide a consistently level, hazard free, compacted trail travel surface for multi-use purposes.

PRESENT CONDITIONS:

The present rail bed is affected by external factors. Removal of ties and rails has resulted in unauthorized use by motorized vehicles and recreational users, resulting in surface deterioration and drainage control problems within the corridor. The rail bed provides a well built and stable foundation for a trail. The existing rail bed/travel surface varies from less than 3 meters wide in problem areas, upwards to 5 meters wide in other sections. The existing stone ballast varies from being as deep as 0.5 meters, to being densely compacted at the soil surface. When properly graded and compacted, either situation still offers a superior base for a finished surface material.

BASIC TRAIL STANDARDS:

1. Trail Gradient
The change in the elevation level of the rail bed is generally called the slope. Slope is measured in the percentage change of the rise (vertical distance) in relation to the-run (horizontal distance) of a section of terrain.

Trail grades of slope should generally range up to 5%, a grade that presently exists on most sections of the abandoned lines. For most intended recreational activities, this gradient is acceptable. It should be noted that sections of the rail bed have disappeared and as such will require new construction in the corridor and in some case outside the corridor. A decision on the type of trail tread construction (out sloping, cut and fill, tread on fill) will have to be made, ensuring an adequate trail slope.

2. Surface (Rail Bed) Drainage
The surface of the rail bed will require reshaping for drainage. Small berms may have developed along much of the bed, in particularly along the edges of the travel surface. All outside berms, and irregularities/obstructions must be graded to provide a 3% cross slope either from the center outward (crowning), or in one direction (out sloping) to a normal drainage area. This is necessary to prevent pooling and channeling of water and to help avoid long term maintenance problems. A crowned slope may be preferable in wider areas. Where ballast depth is minimal, the material in the berms should be recovered and not graded off into ditches or watercourses. Other areas may have excess material that have the potential to be used in areas where material has been lost.

3. Tread Width

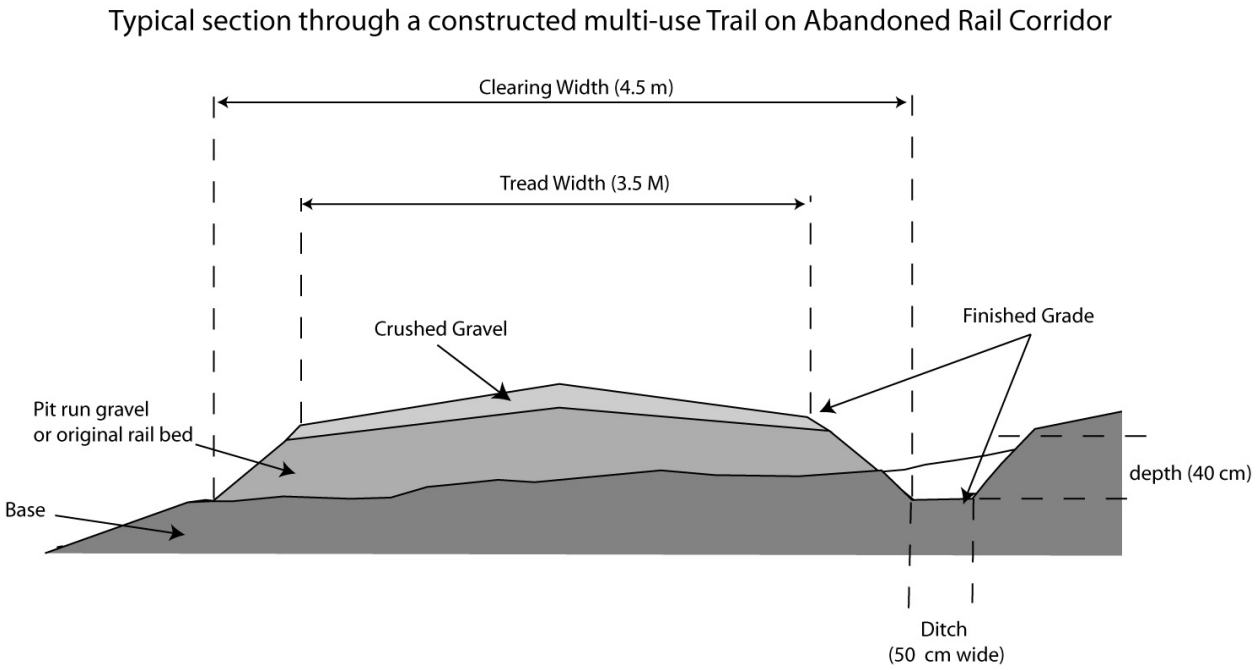
The tread is the portion of a trail on which recreational users travel ,and in the case of abandoned railways, it would include decked bridges. The existing, on average, rail bed width of 3.5 meters (12 ± feet) is a resource in itself, acting as a potential base from which a tread can be developed to accommodate multi-users in all seasons. (Figure 1) The rail bed consists of the ground (existing soil material), a sub-base, and a tread surface. The width of any proposed tread depends on the activity, the level of use, and whether traffic moves in one or two directions. To the sides of a developed tread are "shoulders", which help stabilize the tread from erosion, act as a safeguard from obstructions that would pose a safety problem, and aid in keeping vegetation from encroaching onto the travel way. For example, the tread width design standards for a two-way bikeway are 2.5 m, which can be accommodated within the present rail bed width, leaving 0.5 m shoulders on either side of the tread to act as a safeguard. Two-way snowmobile travel, on the other hand requires at least 3 m.

Tread width can therefore be defined as the horizontal dimension across the trail which provides adequate space for comfortable and safe movement. It includes the standard width of the tread that reflects the selected recreational activity, plus consideration for shoulders. The existing, on average, rail bed width of 3.5 m is therefore recommended as a standard tread width.

Table 1. Desired tread with for common activities on abandoned rail corridors.

Activity	Tread Width
Walking or front country hiking	1.2 m – 1.5m
Bicycling (touring/commuting)	1.5 –1.8 m (one-way) 2.4 – 3.0 m (two-way)
Horseback riding	4 m (one-way)
Classic X-country Skiing	1.2 m – 1.8 m (one-way) 2.1 m – 2.4 m (two-way)
Skate X-country Skiing	3.3 m (one-way) 3.9 m (two-way)
Snowmobile	2.4 – 3.0 m (one-way) 3.0 – 4.3 m (two-way)
Trans Canada Trail	3.0 m optimum (1.0 m minimum)

Figure . 1 typical Section through a constructed multi-use trail on Abandoned Rail corridor



Specifications :

Ditches- invert to grade	38 - 40 cm
Side and back slopes	2 to 1 max. slope
Gravel Depth	
Base	pit run to finish grade or profile original bed
Surface	NSDoT Class A (heavy fines) 15 cm thick (compacted)
Trail Crown	7 - 8 cm stone dust (heavy fines)
Clearing Height	3 m (minimum)

4. Right-of-Way

The right-of-way (ROW) is described as the area to the sides (clearing width), above (clearing height), and along the tread (site visibility) that is cleared for easy and safe movement of the trail user. Think of the right-of-way as the length, width, and height that creates a " tunnel" through which you can walk. (Figure 2) The right-of-wav dimensions are also affected by the trail activity and whether there is one or two-way traffic. A narrow ROW is acceptable for biking, while a wider ROW is required for snowmobiling. (See Table 2.)

Clearing width is the dimension measured across the trail from which all encroaching vegetation, rocks, and stumps are removed so as not to obstruct movement along the trail and to provide adequate room for the provision of drainage if required. All vegetation that impedes movement along the trail should be cleared. Clearing involves removing obstructions, and pruning and cutting trees. The presence or absence of motorized use will affect the clearing width. When non-motorized use of the trail is proposed it may be desirable to maintain specific trees near the edge of the trail, in order to break up long monotonous vistas and add interest to the trail. Where two-way motorized use is to occur, the 3.5 m trail tread width must not be compromised. Brush needs

to be cleared an additional 0.5 m in width on either side of the tread to remove encroaching vegetation or overhanging branches. Therefore the minimum standard clearing width for motorized use on an abandoned rail line corridor will be 4.5 m wide, assuming the absence of ditching. In areas that need ditching, a 2 to 1 back slope is required, which will mean a greater clearing width. The requirement for ditching should be predetermined prior to any right-of-way clearing authorization.

Clearing height is the vertical dimension which must be cleared of all branches that would otherwise obstruct movement along the trail. Height of clearing will vary with different activities, but generally 3 m is recommended to ensure unobstructed headroom. Special attention should be paid to winter uses to allow for both snow depth and sagging snow covered branches, meaning a higher clearing height.

Site visibility is an important factor when determining the amount of vegetative clearing material to cut., Where *motorized use of the rail bed* is to occur, visibility is required on inside curves to provide a *horizontal sight distance of 120 m (400 ft.).* This means the removal of trees, limbs, and woody brush growing within the trail right of way and above the trail surface to improve sight lines. It may be desirable to replace this vegetative clearing with natural, low, native, shrubs and wildflowers. Where *cycling and pedestrian traffic* are the dominant activities, the *horizontal sight distance required is* 45 *m (150 ft.)*.

Figure 2. Right of way

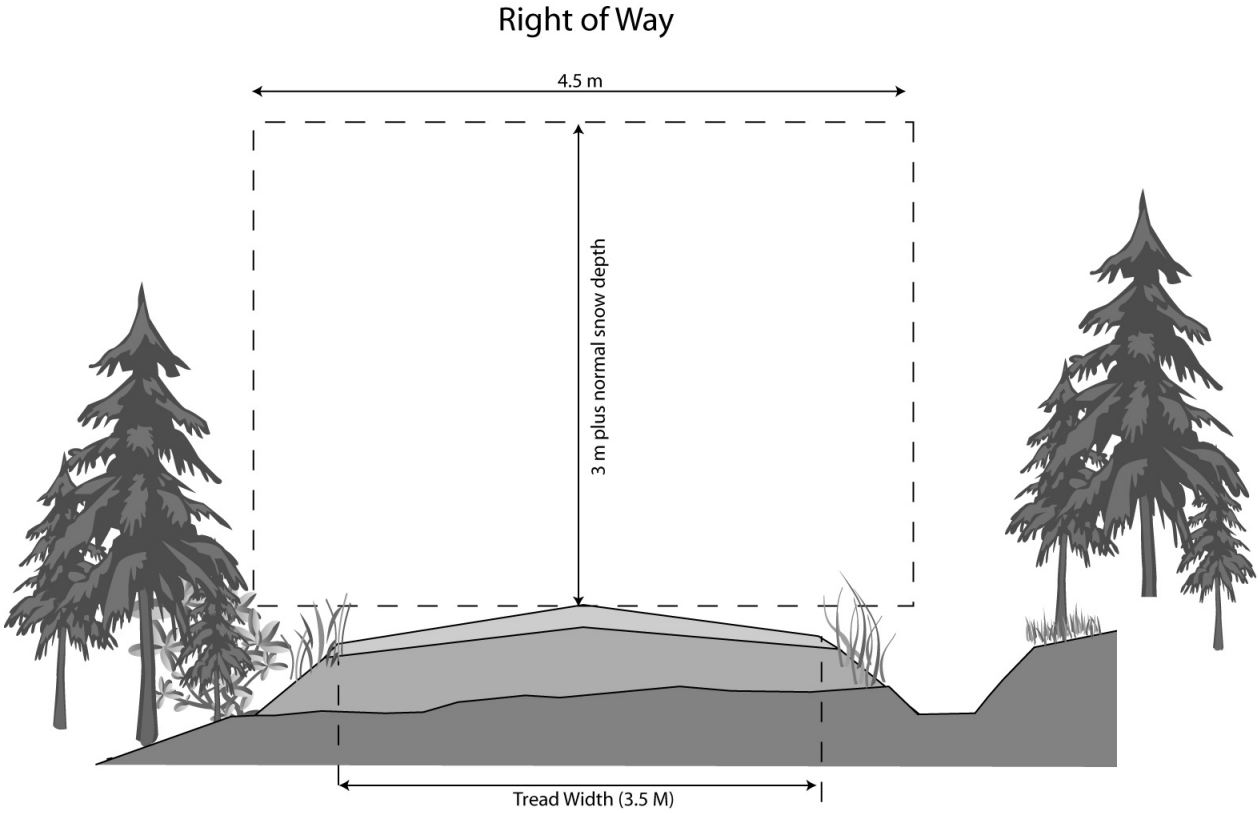


Table 2 . Right-of -way dimensions for common activities on abandoned rail corridors.

Activity	Right of Way (Clearing Width)	
	Optimum	Dense vegetation
Walking or front country hiking	2.4 m – 3.0 m	2.1 –2.7 m
Bicycling (touring/commuting)	2.4 –3.6 m m	2.1 m (one-way) 3.6 m (two-way)
Horseback riding	4 m (one-way)	3.6 - 4.9 m
Classic X-country Skiing	3.6 m	3.3 m (one-way) 4.3 m (two-way)
Skate X-country Skiing	3.6 m	4.3 m (one-way) 4. 9 m (two-way)
Snowmobile	2.4 – 3.0 m (one-way) 3.0 – 4.3 m (two-way)	3.7 m – 4.3
Trans Canada Trail	3.0 m	-

5. Trail Base and Tread Surfaces

The three most important factors to consider when providing a base and tread surface are firmness, evenness and dryness. A trail can start from grading the existing base *material to create a travel surface, then adding compacted gravel and/or stone dust to a predetermined tread width, and applying a layer of asphalt/chips if a hard surface is required* (e.g. possibly on some heavily used urban trails). The selection of any of these three tread surfaces will be determined by user groups and their needs, and available funding sources.

A firmer tread and even grades are generally required on a section of trail traveled by bicycles or those with mobility problems. Stone dust is recommended for recreational bikeway for a number of reasons. The low cost and low maintenance requirements make it attractive. The advantage to the cyclist include: good riding quality in wet conditions, leaves do not make the surface slippery, and riders can usually hear other approaching riders due the sound created by riding on stone dust. On surfaces traveled by motorized vehicles, firmness and wear-resistance are an important maintenance consideration.

6. Trail Base and Tread Specifications

The trail base and tread surface on the bed can have three levels of preparation that reflect user groups and their needs. Bicycling is the one non-motorized activity that lends itself to the linear aspect of abandoned railway corridors. This activity requires specific design elements and standards in order to use the trail. If facilities, surfaces and bridges are designed with the cyclist in mind, it would make it is easier to accommodate many other activities. A minimum standard level can be developed to provide a smooth, well drained, hazard-free compacted trail travel surface to accomplish this mandate, *while* recognizing that other more expensive options exist.

The various levels of trail tread (travel) surfaces are as follows:

Level 1.

1. The surface of the existing rail bed will be shaped to a 3 % *cross slope* or crown without overly disturbing the tread base and bringing enough fines to the surface to permit binding when compacted. *Grade the berm material* from the edge of the travel surface towards the center of the bed where needed, to a *tread surface width of* 3.5 *m.*

2. Where ballast or base material is insufficient to allow for grading or compaction, add a 15 cm single layer of class "A" (3/4 inch crushed gravel) or a fine pit run base to a width of 3.5 m , which is the minimum tread surface width to accommodate all recreational activities. In areas where there is a thick layer of clean stone ballast, this same treatment is required to provide a consistently smooth, hazard free, compacted trail travel surface.

Level 2

1. Upon completion of Level 1, *add some dust* on top of the compacted trail tread surface base to create *a layer 10 cm in depth after compaction,* and 2.5 *m wide,* which is the minimum tread travel surface width for non-motorized multi-use recreational activities.

2. Roll the trail tread surface base to achieve compaction.

Level 3

In cases where a more stable surface is required *a 5 cm (2 in.) minimum layer of asphalt or layer of chip seal to a width of* 2.5 *m,* may replace stone dust in Level 2.

7. Bridges
A structural assessment of all bridges should be done before additions and repairs are made for trail use. The repairs and additions should be to design standards that provides for safe access across the structure and reflect the intended or permitted uses.

Bridge structures are of differing types of construction, using steel, concrete, and creosoted wood in different combinations. As a general rule, a bridge structure will ***require decking and handrails if the structure is over* 1.2 *m above ground or water level.*** Decking should be a non-slip surface, usually pressure treated lumber, and laid perpendicular to the direction of traffic. If railings are not required, curbs on both sides or the deck should be installed to a maximum height of 15 cm (0.5 ft.) .

Some structures may need to accommodate traffic in the form of snowmobiles, groomers, graders, emergency and service vehicles. For this reason, the size of decking material will vary. The width of decking should be dictated by the width of the widest planned use.

Railings should be built to C.S.A. standards and/or in accordance with local building codes. *Railing heights* should be placed *between 107 cm* (3.5 ft.) *and* 137 *cm* (4.5 ft.), *above the deck surface,* to accommodate a variety of trail activities. Where safety is a prime concern, there should be at least two parallel bars that occur below the top rail. These should be no further apart than 30 cm. Additional security may be had with the application or a structural screen to the railing.

8. Barriers
Barriers are used to control the access to a trail and conditions along a trail such as bridges, roads, and prohibited areas. Barriers are used to impede users from dangerous situations, protect sensitive environment, restrict vehicles, and prohibit activities. Regulatory signs which give operational requirements, restrictions, warnings or traffic control are posted along side or proceeding the barrier. *Suitable barriers* associated with multi-use trails on abandoned rail corridors *range from gates, bollards, railings and fences.* Materials suitable for this type or construction are generally timber, logs, metal tubing and rock.

The abandoned rail corridor trails will support multiple-use, which can exclude other uses, and the well-designed barricade is primarily used to restrict access of specific types of unauthorized vehicles.

Barriers are required on both sides of intersections of the trail with public road crossings. They should be located 7.6 m (25 ft.) from the edge of the road right-of- way.

Barrier design must permit passage by pedestrians, bicycles and other "authorized" trail users, as well as be adaptable to permit periodic or emergency access by service vehicles.

1. ***Gate*** design is extremely flexible and often used in controlling access to any trail. Gates should be low revel, clearly marked and sympathetic to the environment, preferably timber or metal. Gates can be open like swinging doors, or a sliding

door, or can be off-set such as in a Texas style gate, providing an adequate opening width of 90 cm (3 ft.) (minimum) for it to be fully wheelchair accessible. Where snowmobiling is permitted, gates can be locked "open" for the snow season.

2. ***Bollards*** are posts installed in the ground, at close distances apart, to block the passage of road and off-road vehicles. Where it is required that service or emergency vehicles have access to trails, a collapsible or knock down or pullout bollard is a suitable alternative. In a natural situation timber bollards are preferred, metal is suited to urban environments. A bollard is 90 cm (3 ft.) high off the ground and the number of posts is optional. Spacing should be at least 90 cm (3 ft.) to allow for wheelchairs to pass through.

3. ***Railings and fences*** guard users from dangerous conditions, ora protected area, and keep users from trespassing on private lands. Fences can be made of timber, rock, smooth wire and posts or wood pieces. The C.S.A. building code standard for *a fence height is 107* cm (3.5 ft.) and should be a minimum guideline.

9. Signs

Signs are important elements that enhance the trail experience and provides guidance to the user for the safe use of the trail. Signs provide four major functions.

1. *Identification signs* note trails, buildings and associated facilities,
2. *Regulatory signs* note rules and regulations and include standard signs such as STOP, YIELD, DO NOT ENTER, BARRICADE AHEAD, etc.,
3. *Directional markers* point the way and,
4. *Informational/ interpretive* signs provide specific information about the trail, related facilities, trail sponsors, or tell a story about a point of interest along the trail.

In past *lease agreements,* DNR has had to approve the comments of all signs and notices before they are posted on leased Crown Trail Reserves, i.e. the abandoned rail corridors. All trail groups have been *responsible for posting signs at the usual points of access to the trail,* indicating that the land is a trail. As well, the trail groups where responsible for *posting signs at all road crossings, and at any other hazards to warn trail users.*

Upon *designation* of the trail reserve *as a provincial trail,* under the Trails Act, trail groups have had to *erect and place signs indicating the lands are a trail and signs advising of any restrictions or prohibitions*

All signs should face anticipated direction of traffic, be unobstructed by vegetation, and be easy to read and understand. The colour and scale must be in keeping with site conditions and the mounting height should fit the specific users.

The *"Trails Manual"* has an excellent section on signage that can be used to formulate a sign system that helps to identify all the necessary signs required along a specific trail from design and fabrication to installation and maintenance.

10. Trail Facilities

Trail facilities associated with the development of multi-use trails on Crown owned abandoned rail corridors should include the development of "primary entry points" or trail heads. Entry and exit points must accommodate all user groups and have parking facilities with signs and mapping to inform the trail user. Parking capacity should be decided in accordance with the overall trail management plan. In many cases, small parking areas (4-6 vehicles) are most appropriate. Trails used by snowmobiler groups may require additional parking and turning space. Parking on the shoulder of the road should be discouraged. In selecting a possible trail head, existing Crown lands/park reserves or other areas suitable for parking should be considered. Trail parking and the trail should be on the same side of the collector or arterial road.

Any road or driveway exiting from a public roadway must be designed and constructed according to the guidelines and specifications of the agency that manages the road or street. The trail developer must usually submit a detailed layout showing location, grades, drainage patterns and property boundaries. For more derailed guidelines on access roads refer to Specifications for Subdivision Roads in Urban and Rural Areas, available through the Nova Scotia Department of Transportation. Amenities associated at the trail head parking area can include potable water, picnicking, shelters, bicycle racks and information signs.

Secondary areas should be developed at intervals along the railway, especially near points of interest, to provide for sanitary needs and a restful respite from the physical demands of trail usage.

11. Maintenance

Trail lands shall be kept in a clean and tidy condition. This means that any damage to the trail or activities that pose a problem to adjacent or nearby properties is the responsibility of the trail group who agrees to these conditions. The trail group is also responsible for keeping the designated trail right-of-way free and clear of brush and trees, and the trail travel surface level, hazard free and compacted. All signs erected by the trail group shall be kept in good repair and replaced if damaged or stolen, to ensure the safety of all trail users.

D. STANDARDS (in Brief)

Right-of-Way Corridor: (30 m (99 ft.))

- The right-of-way is described as the limits of the natural trail corridor environment.
- Recommend a 30 m (99 foot) right-of-way.

Clearing Width: (4.5 m (no ditches))

The clearing limits across the trail from which all vegetation, rocks or other obstructions are removed so as not to impede movement along the trail.

Clearing Height: (3.0 m)

The vertical dimension which must be cleared of all branches that would otherwise obstruct movement along the trail.

Tread Width: (3.5 m)

The horizontal dimension across the trail which provides adequate space for comfortable and safe movement, containing a level, hazard free, compacted trail travel surface for multi-use purposes.

Tread Surface:

- Existing rail bed surface; compacted 3/4" crushed gravel; crusher stone dust; asphalt/chip seal.

- The three most important factors to consider when providing a special tread surface are firmness, evenness and dryness. Surfaces will rampage depending on user group and their needs.

- The various levels of trail tread surfaces are as follows:

  Level 1 (Motorized)

  - The surface of the new trail bed will be shaped to a 3% cross slope or crowned to a width of 3.5 meters.

  - Add a 150 mm. Single layer of class "A" (3/4 inch crushed gravel) or a fine pit run base to a width of 3.5 meters,' which is the minimum tread surface width to accommodate all recreational activities.

  - Roll the trail tread surface base to achieve compaction.

  Level 2 (Non-motorized)

  - Upon completion of Level 1, add some dust on top of the compacted trail tread surface base to create a layer 10 cm in depth after compaction, and 2.5 m wide, which is the minimum tread travel surface width for non-motorized multi-use recreational activities.

  - Roll the trail tread surface base to achieve compaction.

Tread Width (2.5 to 3.5 m)

- The traveled portion of the trail right-of-way typically sloped or crowned to shed water and providing a consistently level, hazard free, compacted trail travel surface for multi-use purposes.

Trail Gradient: Range 5%

- Trail grades of slope up to 5% along the trail length or the rise (vertical distance) in relation to the run(horizontal distance) on any section of trail.

- Whereas the trail bed will require new construction in the re-aligned corridor, a decision on the type of construction (out sloping, cut and fill, tread on fill) is critical to ensure an adequate trail slope.

- A center line profile of the new alignment is essential in making decisions on the type of construction, and solutions to any drainage problems.

Trail Drainage

- All culverts and drainage problems are the responsibility of proponent and should include provisions of methods to manage excessive water run-off (ditch, dip, culvert, french drain etc.).

- The construction of any trail bed side ditches, off take ditches, catch water ditches, and inlet and outlet ditches to drainage structures is the responsibility of the proponent and should be inspected by DNR engineer.

- Corrugated metal pipe shall be placed where required in sufficient number and size to handle anticipated flows created by the 25 year storm, and shall conform to C.S.A. Standard, galvanized or plastic. Minimum diameter shall be 40 cm (16 in.)

- Sub-grade shall be shaped to fit the bottom of the pipe. Backfill within 50 cm (~20 in.) of the pipe shall not contain any stones larger than 15 cm (6 in.) in any direction.

- All pipe ends shall be rip-rapped with durable stone to a minimum of 30 cm (12 in.) above the top of the pipe.

- The surface of the trail bed will require shaping for drainage, and must be graded to provide a 3% cross slope either from the center outward (crowning), or in one direction (out slopping) to a normal drainage area.

Tread Bridges:

- Design should provide for the abilities of all probable users.
- A bridge structure will require railings if over 1.2 m above the ground surface.
- Decking should be non-slip surface, usually pressure treated lumber, and laid perpendicular to the direction of traffic.
- There should be at least two parallel bars that occur below the top rail, no further
- apart than 30 cm (12 in.). .
- Railing heights generally placed between 107 cm (42 in.) and 137 cm (54") above the deck surface.

Trail Barriers:

- used to protect the trail, the user, or the natural environment.
- Range from gates, boulders, railings,. fences, and natural/planted vegetative (green) barriers.