Town of East Gwillimbury

Prepared for:
Town of East Gwillimbury

ACTIVE TRANSPORTATION AND TRAILS MASTER PLAN

Appendix A – Draft AT and Trail Design Guidelines

MMM GROUP

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TOWN OF EAST GWILLIMBURY AT AND TRAILS MASTER PLAN

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FOREWORD

The Planning and Design Guidelines set out in this report were assembled as part of the Town of East Gwillimbury Active Transportation and Trail Master Plan. They are intended to guide the Town and its partners in developing a Town-wide AT and trails network. These guidelines contain information regarding typical planning and design solutions for AT and trail facility planning, design and implementation. In addition, the implementation of the East Gwillimbury AT and Trails Master Plan should have regard to the existing Town of East Gwillimbury Parkland Design Standard Manual (2009).

The guidelines were developed through an iterative process that involved an extensive review of guidelines and best practices from other municipalities and jurisdictions as well as input from MMM Group and other sources. Public input was also used to review guidelines for specific features of the master plan.

The Planning and Design Guidelines provide the Town of East Gwillimbury with the tools necessary to design and implement an AT and trails network that responds to what residents and Town staff believe is needed to improve conditions for AT and trail use in East Gwillimbury and is based on engineering and planning best practices.

The guidelines described in this Appendix are intended to act as a general reference for AT and trail network planners, designers and the public and are not “standards”. Rather, they are a carefully selected set of currently accepted design practices in North America and should be treated as a reference that Town staff may consult during the development and construction of AT and trail facilities. Where appropriate, references are given to the most relevant detailed design standards and manuals, which include the details on currently accepted practices.

1.0 General Considerations

Careful consideration should be given to the physical, aesthetic and environmental requirements for each AT and trail type. In many instances physical design criteria related to operating space, design speed, alignment and clear zones are often governed by the needs of the fastest, most common user group on the majority of the trails, that being the cyclist. Therefore, many of the physical design criteria outlined in the following sections are recommended in relation to cycling. This is not to say that all trails or AT facilities need to be designed to meet the requirements for cyclists, however when multi-use trails are being designed it is prudent to use parameters for the cyclist. When considering single or specialty uses where part of the trail experience involves maneuvering through challenging conditions, such as BMX or freestyle biking, the parameters outlined below may not apply. In these instances designers should consult directly with the user group and/or design manuals that are specific for that use. **Table A.1** outlines minimum and preferred operating space for different uses.

Table A.1 Trail User Operating Space

Operating Condition by Trail User Type	Minimum (metres)	Preferred (metres)
One-way travel (one wheelchair user)	1.2	1.5
One- way travel (two pedestrians)	1.5	2.0
One way travel (one cyclist)	1.2 (in constrained locations)	1.5+
Two way travel (two cyclists)	3.0	3.0+
Two way travel (two wheelchair users)	3.0	3.0+

Trail user operating space is a measurement of the horizontal space that the user requires. In the case of cycling, the space includes room required for side to side body motion used to maintain balance and generate momentum. Horizontal clear distance is the space beside the trail bed that should be kept clear of protruding objects.

Vertical clear distance is the space above the head of the user while using the trail (i.e. walking or mounted on their bicycle etc). **Table A.2** provides minimum and preferred horizontal and vertical clear distance.

Table A.2 Horizontal and Vertical Clear Distance

Clearance Condition	Minimum (metres)	Preferred (metres)
Horizontal clearance to stationary objects	**0.5**	**1.0**
Vertical clearance to stationary objects	**2.5**	**3.0**

Slope refers to both the measured fall over a given distance and both the centerline (longitudinal slope) and perpendicular to the centerline (cross slope). Cross slope can be configured so that all runoff is directed to one side of the trail, or so that there is centre crown and runoff is shed to either side of the trail. **Table A.3** shows the preferred conditions for different longitudinal grade or slope.

Table A.3 Longitudinal and Cross Slope

Longitudinal Grade or Slope	
0 to 3%	**Preferred**
5%-10%	**Provide additional trail width where trail segments are greater than 100m in length** **Introduce level rest areas every 100 to 150m of horizontal distance; Consider design strategies such as switchbacks.** **Install signing to alert users of upcoming steep grades; Avoid grades over 5% for off road trails. Where steeper slopes are necessary "trail hardening" should be considered; Note: 12:1 (horizontal distance or run: vertical distance or rise), or 8.3% over a distance of 9.0m is the maximum permissible slope for meeting accessibility standards. Level landings or rest areas are should be provided at regular intervals where slope exceeds 5%.**
Greater than 10%	**Consider the use of structures such as steps, step and ramp combinations, stairways; Consider locating the trail elsewhere**
Cross Slope	
0.5 to 2%	**Minimal, acceptable on hard surfaced trails, may not provide adequate drainage on granular surfaced trails**
2 to 4%	**Preferred range for both hard and granular surfaced trails**
Greater than 4%	**Avoid wherever possible as excessive cross slopes can be difficult and potentially dangerous for some levels of physical ability and certain user groups as they can result in difficulty maintaining balance, especially among user groups with a high centre of gravity.**

Design speed is used to determine trail width, minimum curve radius, horizontal alignment and banking or super-elevation to ensure that trail users have adequate space and time to safely approach and navigate sharper curves along the trail. The design speed for recreational cyclists is generally considered adequate for all self propelled trail users including pedestrians and those using mobility devices such as wheelchairs. The average recreational cyclist can maintain speeds of 18 to 25 km/hr on some trails and most roads, while utilitarian and fitness-oriented cyclists usually travel at higher speeds (25 to 30 km/hr) on some trails and most roads. For granular surfaced off-road trails, a design speed in the area of 25 km/hr is usually adequate, whereas a minimum of 30 to 35 km/hr should be considered for hard surfaced trails. On descents with steeper grades, the design speed should be increased to 40 to 50 km/hr and consideration should be given to some additional trail width to increase manoeuvring space. Cautionary signing should be used to warn of upcoming steep grades and sharp curves.

Cycling is the critical user group when designing off-road trails for self-propelled users as they have the highest average travel speed. The minimum radius of a curve on an off-road cycling facility depends on the bicycle speed, super-elevation and coefficient of friction between the bicycle tires and the cycling facility surface. Refer to **Table A.4** for suggested outside radii for a range of design speeds and superelevation rates.

Table A.4 Trail Curve Radii

Design speed (km/hr)	Coefficient of Lateral Friction	Suggested radius (m) where superelevation = 0.02 m/m	Suggested radius (m) where superelevation = 0.05 m/m
25	0.30	15	14
30	0.28	24	21
35	0.27	33	30
40	0.25	47	42
45	0.23	64	57
50	0.22	82	73

Source: TAC, 1999

The upcoming revision to the AASHTO Guide for the Development of Bicycle Facilities will be recommending that the general design speed should be 22 km/hr (14 mph) for multi-use trails where cycling is the highest speed user group. Based on research, 22 km/hr represents the 85th percentile for speed. The slightly lower design speed will allow for slightly smaller curve radii and potentially less construction impact as compared to trails requiring larger radii.

Table A.5 Additional trail widening on outside of curve

Radius (m)	Additional widening (m)
0-7.5	1.2
7.5-15	0.9
15-22.5	0.6
22.5-30	0.3

When horizontal curves are sharp (i.e. a very small radius), cycling facility widening should be considered to compensate for the tendency of cyclists to track toward the outside of the curve. Roads are designed to accommodate vehicles that move at a significantly higher rate of speed than bicycles, therefore it is assumed that horizontal alignment of on-road routes will be ample to accommodate cyclists and other trail users.

Sight stopping distance is defined as the distance required to for the trail user to come to a full controlled stop upon spotting an obstacle. It is a function of the user's perception and reaction time. Once again stopping sight distances for off-road trails are typically governed by the distance required for cyclists since pedestrians and other trail users can typically stop more immediately than cyclists, regardless of the trail configuration.

On-road cycling facilities should typically be located on roads that provide for adequate sight lines to accommodate the minimum stopping distance required for motor vehicles. Minimum stopping sight distance is the least visible distance required by a driver to bring the vehicle to a stop before reaching an object in the vehicle's path. This is necessary so that a motorist can effectively make the decision on when to pass a cyclist or when to stop in the event the cyclist has fallen or is blocking part or all of a travel lane, or when a pedestrian is crossing the street.

Although all new roads should be designed in conformance with these minimum standards, it is recognized that many existing roads in the Town may not meet the requirements. For road designs in which there are a number of severe physical constraints due to topography, environmental or right-of-way constraints, roadway designers may need to compromise on one or more of the standards. If stopping sight distance is sub-standard, the driver may not see an object in time to come to a safe stop. However, the driver may be able to steer around the object or sufficiently reduce speed to minimize damage or injury. Additional signing to caution both motorists and cyclists should be considered in these situations. **While sub-standard design is to be avoided and is not advocated, if it is dictated by other constraints, the consequences should be clearly understood and based on good engineering judgment.**

As mentioned above, stopping sight distances for off-road trails should be governed by the distance required for cyclists since pedestrians can typically stop immediately while walking or jogging, regardless of the trail configuration. The minimum stopping sight distance for cyclists, both on-road and off-road, is the distance required to bring a bicycle to a full controlled stop upon spotting an obstacle. It is a function of the cyclist's perception and reaction time prior to braking, the initial speed of the bicycle, the coefficient of friction between the tires and the trail surface, and the braking of the bicycle.

The stopping sight distance is given by the formula:

$$S = 0.694V + V2 / 255 (f + G/100)$$

Where: S = stopping sight distance, m

V = speed (km/h)

f = coefficient of friction

G = grade, % (upgrade +, downgrade –)

Table A.6 illustrates minimum stopping sight distances for a range of speeds and grades for bicycles. It is based on 2.5 seconds of perception-reaction time and a coefficient of friction (f) of 0.25 that accounts for paved surfaces during wet weather plus typical braking characteristics of bicycles. The coefficient of friction for unpaved surfaces should be reduced to 50% of those for paved surfaces.

Table A.6 Minimum Sight Stopping Distances

Grade %	Design Speed (km/h)								
	10	15	20	25	30	35	40	45	50
Minimum Stopping Sight Distance (m)									
+12	8	13	18	-	-	-	-	-	-
+10	8	13	18	24	-	-	-	-	-
+8	8	13	19	25	32	-	-	-	-
+6	8	13	19	25	32	40	-	-	-
+4	8	13	19	26	33	41	49	-	-
+2	8	14	20	26	34	42	51	61	-
0	9	14	20	27	35	44	53	63	74
-2	9	14	21	28	36	45	55	66	77
-4	9	15	21	29	38	47	58	69	81
-6	9	15	22	30	39	50	61	73	86
-8	9	16	23	32	42	53	65	68	92
-10	10	16	24	34	44	56	70	84	100
-12	10	17	26	36	48	61	76	92	110

Source: Geometric Design Guide for Canadian Roads, TAC, 1999.

(TAC Table 3.4.5.1)

2.0 Accessibility

Approximately one in eight Canadians suffer from some type of physical disability. Mobility, agility, and pain-related disabilities are by far the most common types, each accounting for approximately 10% of reported disabilities nationally[1]. Disability increases with age: from 3.3% among children, to 9.9% among working-age adults (15 to 64), and 31.2% among seniors 65 to 74 years of age. Disability rates are highest among older seniors (75 and over), with fully 53.3% in this age group reporting a disability.

The Accessibility for Ontarians with Disabilities Act (ODA) states that "The people of Ontario support the right of persons of all ages with disabilities to enjoy equal opportunity and to participate fully in the life of the province[2]." Within the ODA, Bills 118 and proposed Bill 125 recognize the need to provide for accessibility standards,

1 Social Development Canada, 2004, p. 2

2 Ontarians with Disabilities Act, 2001

improve opportunities and facilitate the removal of barriers in order to enable persons with disabilities to fully participate in the life of the province[3].

As required by the AODA, the Minister of Community and Social Services appointed a Standards Development committee to develop a set of Accessibility Build Environment Standards. The document was developed and issued in July of 2010 by the committee and provides a definition of the built environment as well as accessibility standards for each. The definition includes buildings, site development, public ways and public parks, trails and playgrounds. As part of the standards developed, specific reference is made to paths and trails under section 11 (recreation elements and facilities) of the report. The rationale for the inclusion of these standards can be summarized in the following text:

"Opportunities for recreation, leisure and active participation should be available to all members of the community. Outdoor trails and pathways which offer a range of levels of difficulty will allow each individual to choose their preferred route based on their abilities and desired level of challenge.

The accessibility strategy commonly applied to natural environments is to provide appropriate accessibility for persons with disabilities, wherever practical, and to provide relevant information on the grade, cross-slope, width, surface, or length of the trail where it is not practical or appropriate to fully comply with the requirements."

More specifically, section 11 focuses on the overall accessibility of trails that are found in the natural environment. As will be outlined in the following sections, the development of trails and active transportation facilities is not a one size fits all approach. Trails facilities are to be developed to accommodate all users including those with a variety of needs and levels of ability. The strategy outlines necessary criteria for the development and design of trails to accommodate such user groups. The criteria that have been developed includes but are not limited to:

- Operational Experience;
- Width;
- Running Slope;
- Cross Slopes;
- Total Slope;
- Surface;
- Changes in Level; and
- Signage

When designing and implementing active transportation and trails facilities, the Town of East Gwillimbury should utilize the guidelines and requirements outlined in the strategy to ensure that the needs of all user groups are accommodated and satisfying the requirements of the AODA to the greatest extent possible, given the context of each trail's location, the surrounding environment and type of trail experience that is desired for that location.

Universal Trail Design is a concept that takes into consideration the abilities, needs, and interests of the widest range of possible users. In regards to trail design, it means planning and developing a range of facilities that can be experienced by a variety of users of all abilities.

3 Ontarians with Disabilities Act - Bill 118 and 125, 2001

Principles of universal trail design can be summarized as follows:

- Equitable use: provide opportunity for trail users to access, share and experience the same sections of trail rather than providing separate facilities;
- Flexibility in use: provide different options for trail users in order to accommodate a variety of experiences and allow choice;
- Simple, intuitive and perceptible information: whether conveying trail information through signage, maps or a web site, communicate using simple, straightforward forms and formats with easy to understand graphics and/or text;
- Tolerance for error: design trails and information systems so as to minimize exposure to hazards, and indicate to users any potential risks or challenges that may be encountered;
- Low physical effort: trails may provide for challenge but should not exceed the abilities of the intended users; where appropriate, rest areas should be provided; and
- Size and space for approach and use: trails and amenities should provide for easy access, comfort and ease in their usage.

Ontario's Best Trails – Draft (2006)[4] provides an in depth discussion of the application of Universal Design principles and their application.

Trails should be designed to be accessible to all levels of ability, where possible and practical. It must be recognized however, that not all trails throughout the system can be fully accessible. Steep slopes are one of the most significant barriers for those with physical disabilities. Designing trails to be within the threshold (5%) for universal access will not only overcome this significant barrier but it will help to reduce the potential for erosion of the trail surface. The following are some additional considerations for making existing and new trails accessible:

- Designers should consult the most current standards available in the Town of East Gwillimbury through the local Accessibility Advisory Committee/Department;
- Where the trail requires an accessibility solution that is above and beyond what is normally encountered, a representative of the local Accessibility/Advisory Committee/Department should be consulted early on in the process to determine if it is practical and desirable to design the specific trail to be fully accessibility;
- Where it has been determined that full accessibility is appropriate, the accessibility representative should be consulted during the detailed design process to ensure that the design is appropriate; and
- Work collaboratively with the local Accessibility/Advisory Committee/Department to consider developing signage/content to clearly indicate trail accessibility conditions, which allow users with mobility-assisted devices to make an informed decision about using a particular trail prior to travelling on it.

4 Trails for All Ontarians Collaborative (TAOC), 2006

3.0 Personal Security

To the extent possible, trails should be designed to allow users to feel comfortable, safe, and secure. Although personal safety can be an issue for all, women, seniors and children, are among the most vulnerable groups. Principles of Crime Prevention Through Environmental Design (CPTED) should be considered and applied to help address security issues concerning trail use, particularly in locations where trails are infrequently used, isolated or in areas where security problems have occurred in the past.

The four main underlying principles of CPTED are:

- Natural Access Control: deters access to a target and creates a perception of risk to the offender;
- Natural Surveillance: the placement of physical features and/or activities that provides for natural visibility or observation;
- Territorial Reinforcement: defines clear borders of controlled space from public to semi-private to private, so that users of an area develop a sense of proprietorship over it; and
- Maintenance: allows for the continued use of space for its intended purpose[5].

Some specific design considerations that should be considered by the Town and surrounding local municipalities include:

- Good visibility by others by having routes pass through well-used public spaces;
- Provide the ability to find and obtain help: Signage that tells users where they are along the trail system;
- Provide "escape" routes from isolated areas at regular intervals;
- Maintain sight lines and sight distances that are appropriately open to allow good visibility by users;
- Provide trailhead parking in highly visible areas;
- Minimize routing close to features that create hiding places such as breaks in building facades, stairwells, dense shrubs and fences;
- Design underpasses and bridges so that users can see the end of the feature as well as the area beyond; and
- Signs near entrances to isolated areas can be used to inform users that the area is isolated and suggest alternative routes.

5 CPTED Ontario, 2002

4.0 Trail Lighting

Lighting on trails must be carefully considered in the Town of East Gwillimbury. Very few municipalities make the decision to light their entire trail system for a number of important reasons, including:

- The cost of initial installation can be prohibitive. Some general budget figures reported exceed $40,000 per kilometre not including power supply;
- Staff time and material cost to properly monitor, maintain lamp fixtures and replace broken and burned out bulbs on an ongoing basis;
- A tendency for vandals to target light bulbs;
- Energy consumption;
- Excessive light pollution, especially in residential rear yards and adjacent to natural areas (though this can be controlled with proper shielding);
- The potentially false sense of personal security created by lighting in the night-time environment; and
- Inability of the human eye to adapt to the high contrast resulting from brightly lit and dark shadowed areas adjacent one another.

Lighting the entire trail system is not recommended, however there may be some locations where attractions and facilities such as urban and waterfront promenades, major parks or heavily used routes to major destinations where lighting might extend the hours of use and enjoyment by the community and visitors. The decision to light or not to light should be made on a site specific basis, and where it has been determined that lighting is appropriate, the quality and intensity of lighting should be consistent with prevailing standards for the setting being considered.

5.0 AT and Trail Types

5.1 Multi-use Trails

Major or main off-road trails are designed to accommodate the widest spectrum of users. They are wider, and may have an asphalt or granular surface. Minor or secondary trails are generally narrow and follow the topography more closely than main trails. **Table A.7** provides recommended guidelines for trail width and surface treatments for Major and Minor trails according to location type throughout the Town of East Gwillimbury. Intended trail uses should be considered when selecting trail surface as some surfaces tend to exclude certain uses.

In areas where trail use is high and adequate space exists, it may be appropriate to provide physically separated trails within the same corridor to create opportunities for faster traveling users as well as slower travelling users. Where this design treatment is appropriate, separation of the major trail from the minor trail can be created by distance, grade, or planted buffers. Signs to identify permitted uses for each trail should be used to communicate intent and ensure the integrity of the separated system. Trails in utility corridors and abandoned rail corridors are prime opportunities to develop separated trails.

Table A.7 Suggested trail dimension and surface type according to location

Trail Location	Major /Main Trail Recommended/Preferred Guideline*	Minor /Secondary Trail Recommended/Preferred Guideline*
Urban Core Area	3.0-3.5 m wide, hard surface (asphalt, concrete, pavers) compatible with urban design objectives Note: some surface textures may be difficult for persons with wheelchairs and walkers to use. Consider application of a centerline marking on hard surface trails to articulate user positioning for bi-directional flow.	Not applicable
Major destination (i.e. Major parks, community centre, civic complex, urban rail trails, trails in utility corridors)	Minimum 2.4 m wide, paved with asphalt for park walkways primarily used by pedestrians (Parkland Design Standards Manual, 2009). 3.0-3.5 m wide, hard surfaced (typically asphalt), especially for routes/loops to accommodate small wheeled users and urban rail trails where they pass through core areas and major destinations. Use granular surface where warranted Consider width and turning radii of service access vehicles when designing trails in utility corridors Consider application of a centerline marking on hard surface trails to articulate user positioning for bi-directional flow.	2.4-3.0 m wide granular surface Hard surfaced only where requested by residents and warranted, or for maintenance concerns.
Minor parks, stormwater management areas with trails	2.4-3.0 m wide granular surfaced Hard surfaced when/where requested by residents and warranted, or for maintenance concerns.	2.4 m wide granular surface
Natural area buffers, rural areas, including rail trails in rural areas	2.4 m wide granular surface Consider trail hardening for maintenance concerns (only use asphalt or soil bonding agents). Avoid using asphalt around treed areas where excessive root damage may occur during installation and/or roots may cause premature heaving	1.5 m wide granular surface Trail hardening for maintenance concerns only-use soil bonding agents.

Table A.7 Suggested trail dimension and surface type according to location

Trail Location	Major /Main Trail	Minor /Secondary Trail
	Recommended/Preferred Guideline*	Recommended/Preferred Guideline*
Woodlots and conservation areas (urban and rural areas)	2.4 m wide granular surface	1.5-2.0 m wide woodchip surface May be granular or smooth earth surface where disabled access is desired.
Wetlands: includes treed swamps, marshes, shrub thickets/ meadow marshes, marshes (urban and rural areas)	2.0-2.4 m wide granular surface, boardwalk or other surface considered to be compatible with site conditions.	1.5 m boardwalk or other suitable elevated.

*** = Standards are to be achieved where possible. Some variation from standard width and surface type will be applied on a site by site basis when considering local environmental constraints and/or access needs for people using mobility devices.**

There are a number of options for trail surface materials, each with advantages and disadvantages related to cost, availability, ease of installation, lifespan and compatibility with various trail users groups. **Table A.8** provides a summary of the advantages and disadvantages of the most commonly used trail surfacing materials. There is no one trail surface material that is appropriate in all locations, and material selection during the design stage must be considered in the context of the anticipated users and location.

Table A.8 Comparison of Trail Surfacing Materials

Type	Advantages	Disadvantages
Concrete	Smooth surface, can be designed with a variety of textures and colours, providing flexibility for different urban design treatments; Long lasting, easy to maintain.	High cost to install; Requires expansion joints which can create discomfort for users with mobility aids; Must be installed by skilled trades' people; Is not flexible and cracking can lead to heaving and shifting, sometimes creating large step joints.
Unit Pavers	Relatively smooth surface, available in a variety of patterns and colours to meet urban design needs Long lasting, can be easily repaired by lifting and relaying.	High cost to install. Users with mobility aids may find textured surface difficult to negotiate. Must be installed by skilled trades' people.

Table A.8 Comparison of Trail Surfacing Materials

Type	Advantages	Disadvantages
Asphalt Granulars	Smooth surface, moulds well to surrounding grades, and is easily negotiated by a wide range of trail user groups. Relatively easy to install by skilled trades. Patterned and coloured surface treatments are available, however patterning in surface may be difficult for some user groups to negotiate.	Moderate-high cost to install. Must be installed by skilled trades' people. Has a lifespan of 15-20 years depending on the quality of the initial installation. Poor base preparation can lead to significant reduction in lifespan. Cracking and "alligatoring" occurs near the edges, grass and weeds can invade cracks and speed up deterioration. Must be appropriately disposed of after removal.
Granulars	Pit Run: Mixed granular material "straight from the pit" containing a range of particle sizes from sand to cobbles. Excellent for creating a strong sub base, relatively inexpensive	Not appropriate for trail surfacing.
	'B' Gravel: Similar characteristics to Pit Run with regulated particle size (more coarse than 'A' Gravel). Excellent for creating strong, stable and well drained sub bases and bases. Relatively inexpensive.	Not appropriate for trail surfacing.
	'A' Gravel: Similar characteristics to 'B' Gravel, with smaller maximum particle size. Excellent for trail bases, may be appropriate for trail surfacing of rail trails in rural areas and woodlots. Easy to spread and re-grade where surface deformities develop.	Subject to erosion on slopes. Some users have difficulty negotiating surface due to range in particle size and uneven sorting of particles that can take place over time with surface drainage.
	Clear stone: Crushed and washed granular, particles of uniform size, no sand or fine particles included. Excellent bedding for trail drainage structures and retaining wall backfilling, if properly levelled and compacted, makes an excellent base for asphalt trails.	Not appropriate for trail surfacing.

Table A.8 Comparison of Trail Surfacing Materials

Type	Advantages	Disadvantages
Granulars Cont'd	Stone fines (Screenings): Mixture of fine particles and small diameter crushed stone. Levels and compacts very well and creates a smooth surface that most trail users can negotiate easily. Easy to spread and regrade where surface deformities develop. Inexpensive and easy to work with. Widely used and accepted as the surface of choice.	Subject to erosion on slopes Wheelchair users have reported that stone shards picked up by wheels can be hard on hands. May not be suitable as a base for hard surfaced trails in some locations.
Mulches and Wood Chips	Bark or wood chips, particle size ranges from fine to course depending on product selected, soft under foot, very natural appearance that is aesthetically appropriate for woodlot and natural area settings. Some user groups have difficulty negotiating the softer surface, therefore this surface can be used to discourage some uses such as cycling. May be available at a very low cost depending on source, and easy to work with.	Breaks down over time, therefore requires "topping up". Source of material must be carefully researched to avoid unintentional importation of invasive species (plants and insects).
Earth/Natural Surface	Native soils existing in situ. Only cost is labour to clear and grub out vegetation and re-grade to create appropriate surface. Appropriate for trails in natural areas provided that desired grades can be achieved and that soil is stable (do not use avoid organic soils).	Subject to erosion on slopes. Different characteristics in different locations along the trail can lead to soft spots. Some user groups will have difficulty negotiating surface.
Soil Cement and Soil Binding Agents	Soil Cement = mixture of Portland Cement and native/parent trail material. When mixed and set it creates a stable surface that can be useful for "trail hardening" on slopes, particularly in natural settings. Soil Binding Agents = mix of granulars and polymers that create a solid, yet flexible surface that may be appropriate for "trail hardening" on slopes in natural areas.	Useful for specific locations only. Soil binding agents tend to be expensive and have been met with mixed success.

Table A.8 Comparison of Trail Surfacing Materials

Type	Advantages	Disadvantages
	Limits volume and weight of materials to be hauled into remote locations.	
Wood (i.e. bridges and boardwalks)	Attractive, natural, renewable material that creates a solid and level travel surface. Choose rough sawn materials for deck surfacing for added traction.	Requires skill to install, particularly with the substructure. Gradually decomposes over time, this can be accelerated in damp and shady locations, and where wood is in contact with soil. Expensive to install.

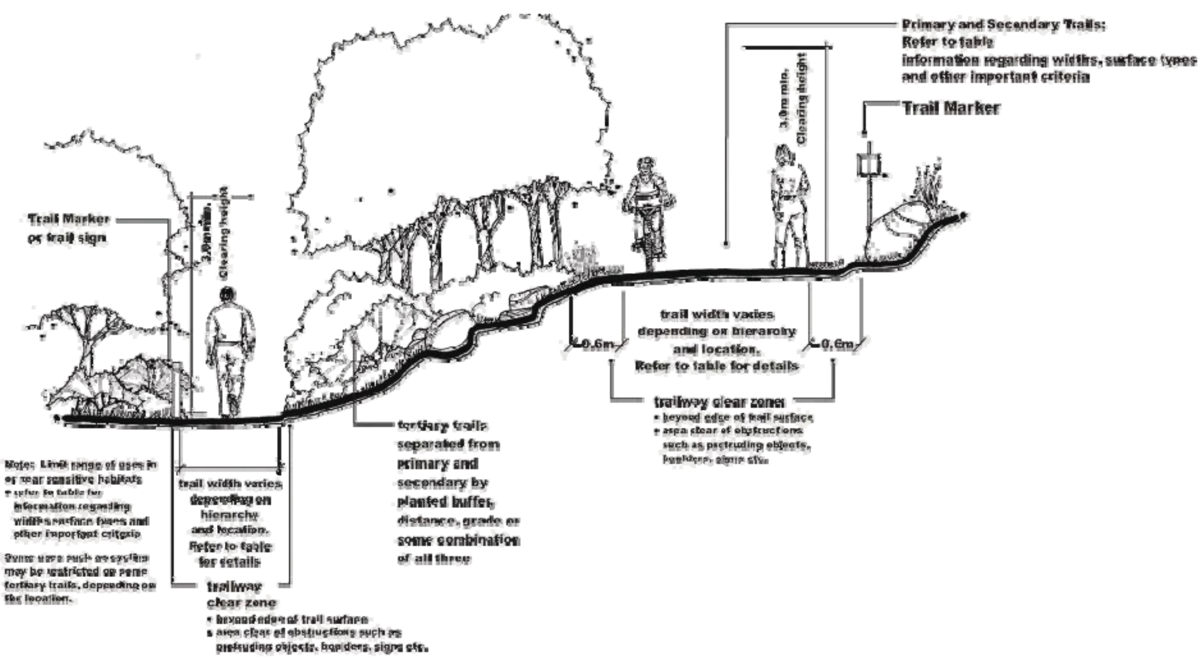


Figure A.12- Multi-Use Trail section

5.2 Footpaths / Hiking Trails

Footpaths and hiking trails are typically narrow single-track routes with a soft surface (earth or granular) and are intended for pedestrian use only unless otherwise noted. Existing and future footpaths and hiking trails should be built into the secondary system in open spaces and woodlots where feasible.

In valleys and open spaces, typical off-road trail designs include hiking and walking trails. Other possible variations include cross-country skiing, equestrian and cycling trails, however, these latter two would likely be located in rural areas and conservation lands. These are the main types of off-road trails in rural areas as defined by the Toronto and Region Conservation Authority, (TRCA) Trail Planning and Design Guidelines. **Figures A.13 to A.14** detail typical cross sections for hiking and walking off-road trail designs in rural areas.

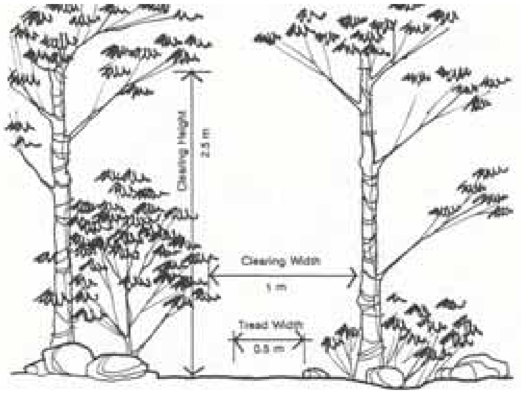


Figure A.13 Hiking Trail Cross Section
Source: TRCA, Trail Planning & Design Guidelines 1992

Guideline:

A.1 Hiking trails or footpaths should nave a natural terrain tread surface. The clearing height for a hiking trail should be at least 3.0 m. Desirable grades should be between 0 and 10% with a maximum sustained grade of 15%. Hiking trails should be at least 1 kilometre in length, with an optimum length of 5 to 10 kilometres

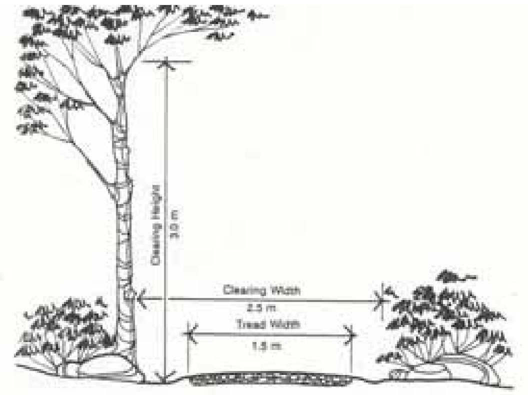


Figure A.14 Walking Trail Cross Section
Source: TRCA, Trail Planning & Design Guidelines 1992

Guideline:

A.2 Walking trails should have a clearing height of 3.0 m and should be made from compacted granular materials such as gravel and shale. Desirable grades should be between 0 and 3% with a maximum sustained grade of 5%. Generally, walking trails are less than two kilometres in length.

For more detailed information regarding off-road trail design in natural and conservation areas, refer to the "Toronto and Region Conservation Authority Trail Design Guidelines."

5.3 Boulevard Multi-use Trails

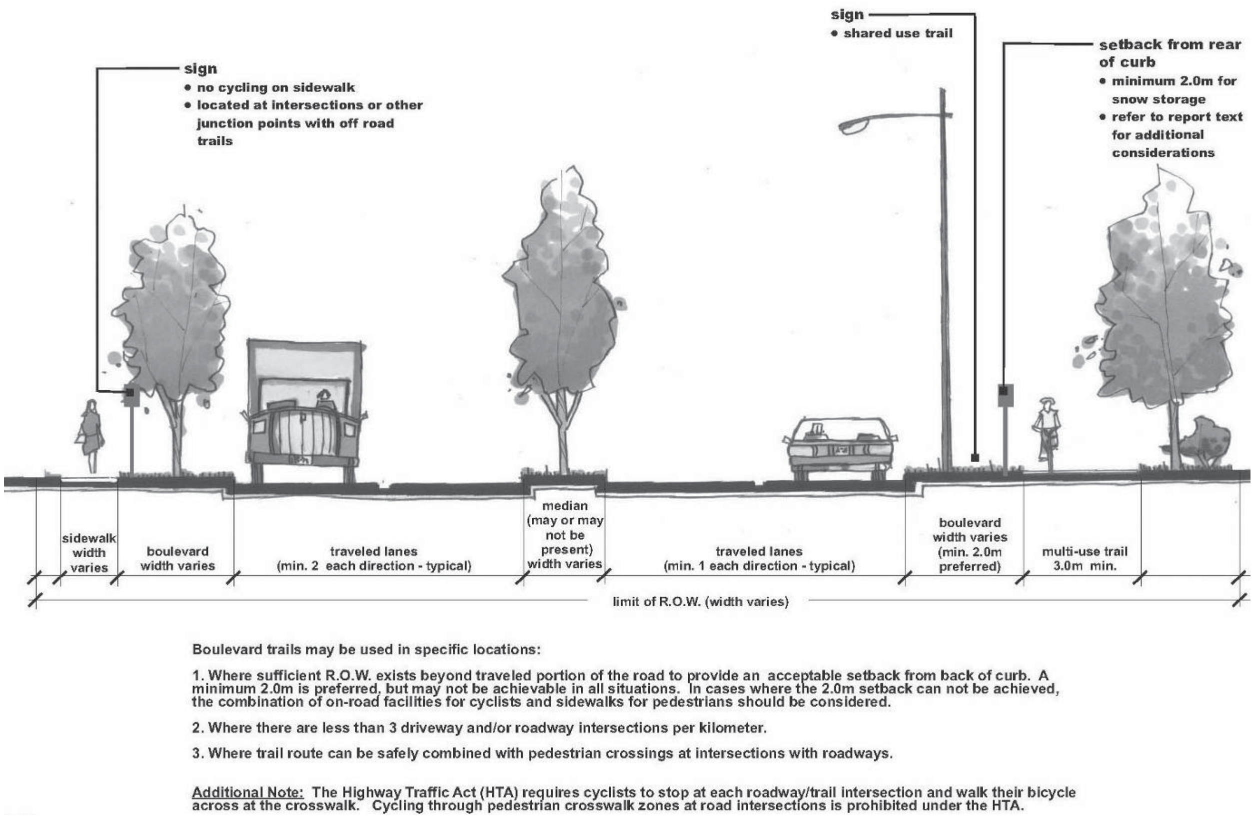


Figure A.15 - Boulevard Multi-use Trail

A boulevard multi-use trail can be used where the characteristics of the boulevard are suitable. Even though users of the boulevard multi-use trail have the right-of-way over vehicles as they leave the road and enter the driveway, every driveway is a potential conflict point. Intersecting roadways are a particular concern as motor vehicles making right hand turns may not be anticipating the speed at which some users of the boulevard multi-use trail may be traveling (i.e. cyclists). Therefore, the boulevard multi-use trail has limited application. The following are some general roadway characteristics where the application of a boulevard trail may be considered:

- Urban arterial, collector or rural roads where there is ample right of way between the edge of the road (curb for urban cross section and shoulder for rural cross section) and the limit of the right of way to maintain a minimum separation between the road and the trail;
- Routes that provide connections between important destinations or links between off-road trails where no parallel route(s) exist nearby;
- Routes that are intended to provide short connections between long off-road trail segments (i.e. 4 – 6 blocks or less where other alternatives are not available); and
- Along corridors where there are limited commercial or residential driveway crossings. The guideline thresholds outlined in **Table A.9** have been applied in several other municipalities and are suggested for the Town of East Gwillimbury.

Table A.9 Driveway crossings thresholds for Boulevard multi-use trails

Number of Driveway Crossings / Intersections Per km	Guideline Recommendation for Boulevard Multi-use Trail
0-3	**An ideal application for boulevard multi-use trail.**
4-10	**Consider applying on-road paved shoulders or bike lanes, where other conditions noted above can't be met.**
>10	**Boulevard trail not recommended. Pedestrian trail users should be directed to follow sidewalks, bicycle lanes should be installed on-road for cyclists.**

When implementing this facility type, the following design elements should be considered:

- A setback from the curb is required to provide space for snow storage, to provide an adequate clear zone from site furniture and utility poles and in some cases street tree plantings. Where street tree plantings are included, the preferred setback is 3.0-4.5 m from the curb. Where no trees are included and vehicle speed is 60 km/hr or less, the preferred setback can be reduced to 2.0 m;
- The setback should be achieved throughout the length of the route with the exception of intersections where the trail should cross with the formal pedestrian crossing;
- Signing in advance of, and at roadway intersections, to inform cyclists to stop, dismount and walk across intersections as required by the Highway Traffic Act, or a suitable crossing design to permit cyclists to legally ride through intersections after stopping but without dismounting;
- Stop or yield signs (decision on a site-by-site basis) at driveways, depending on the number of driveways and the distance between each;
- A treatment at road intersections (i.e. swing gate) to separate "lanes of traffic" in each direction. The treatment must be spaced adequately to allow for the passage of bicycles with trailers;
- Open sight lines at intersections with driveways and roadways;
- A centre yellow line on trail to separate directions of travel (for hard surfaced trails-optional) and to guide riders overtaking pedestrians and slower moving riders; and
- Curb ramps at driveways and roadway intersections.

When new roads are being built or existing roads are being reconstructed, the alignment of the centre line of the road within the right-of-way should be examined where the AT and Trail Master Plan recommends an off-road connection. For example, when a road is being reconstructed from a two lane rural to a three or four lane urban cross section and the potential for a boulevard trail has been identified, an offset road centreline within the road right-of-way can provide additional boulevard space on one side. This will provide more space for the development of the boulevard trail and/or increased separation distance between the road and the trail. Where boulevard trails are implemented on one or both sides of a road, it is reasonable to assume that they can perform the same function as the sidewalk, therefore it is not necessary to install both a trail and sidewalk on the same side of the road. The boulevard trail should be clearly signed (i.e. trail and shared use signage) so that users are aware that the segment is multi-use and not pedestrian only.

Where boulevard trails are provided as multi-use primary or secondary trail connections, some cyclists may still prefer to, and have the legal right to, ride on the road. The addition of bicycle lanes should be evaluated during the design stage for new roads and upgrading of existing roads even where boulevard trails are provided. Where it is not appropriate or feasible to include bicycle lanes, consideration should be given to providing a wide curb lane to accommodate cyclists, along with other improvements to make the street more bicycle friendly (e.g. bicycle friendly catch basin covers, share the road and bike route signage, sharrow symbols etc.). AASHTO notes the following problems associated with multi-use trail boulevard trails:

- Unless separated and set back from the road, they require one direction of cycling traffic to ride against motor vehicle traffic, contrary to normal rules of the road;
- When the path ends, cyclists going against traffic will tend to continue to travel on the wrong side of the street. Likewise, cyclists approaching a shared-use path often travel on the wrong side of the street in getting to the path. Wrong-way travel by cyclists is a major cause of cyclist / automobile collisions and should be discouraged at every opportunity;
- At intersections, motorists entering or crossing the roadway often will not notice cyclists approaching from their right, as they are not expecting contra-flow vehicles. Even cyclists coming from the left often go unnoticed, especially when sight distances are limited;
- Signs posted for roadway users are backwards for contra-flow cycling traffic; therefore these cyclists are unable to read the information without stopping and turning around;
- When the available right-of-way is too narrow to accommodate all roadway and shared-use path features, it may be prudent to consider a reduction of the existing or proposed widths of the various road (and trail) cross-sectional elements such as travel lane and shoulder widths, for example. However, any reduction to less than MTO, TAC, AASHTO or municipal approved design criteria should be supported by a documented engineering analysis;
- Many cyclists will use the roadway instead of the boulevard trail because they have found the roadway to be more convenient, better maintained, or perceive it to be safer. Some motorists who feel that in all cases cyclists should be on the trail may harass cyclists using the roadway;
- Although shared-use boulevard trails should be given the same priority through intersections as the parallel roadway, motorists falsely expect cyclists to stop or yield at all cross-streets and driveways. Efforts to require or encourage cyclists to stop or yield at each cross street and driveway, as required under the Highway Traffic Act, are frequently ignored by cyclists; and
- Stopped cross-street motor vehicle traffic exiting side streets or driveways may block the path crossing.

The application of boulevard trails as cycling facilities directly adjacent to a roadway is not recommended unless separated by a curb and clear zone.

5.4 Rails with Trails

There are active and inactive rail corridors in the Town of East Gwillimbury and some may be candidates for “rails with trails” or “trails in place of rail”. Rights-of-way for rail corridors are sometimes wide enough to safely accommodate a multi-use trail in addition to existing rail operations, while other existing rail corridors may be too narrow to have a trail and active rail line in the same corridor. This can be an issue if an abandoned rail corridor is developed as a trail and then a decision is made to re-introduce an active rail service in the future. A number of municipalities are now considering “rails with trails”, particularly for low volume, low speed rail lines and light rail transit corridors.

If a trail in an active rail corridor is planned, the trail should also be physically separated from the rail facility. This can be accomplished through the provision of planted berms where sufficient right-of-way exists. In locations with constrained rights-of-way, a barrier or fence is a more feasible way to safely separate trail users from active rail traffic. Crossings of the active line should be minimized and must be properly designed which will include an approval process with the rail agency.

The following figures illustrate some of the ways in which rails and trails can be developed in close proximity while achieving the necessary design, engineering and safety requirements.

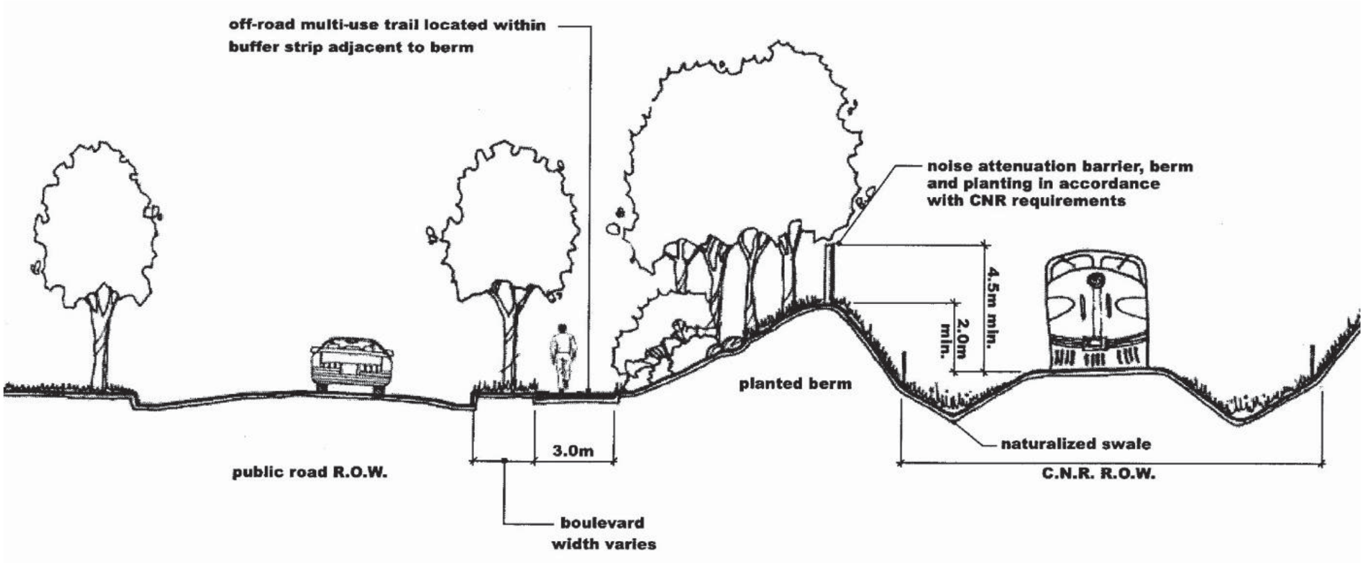


Figure A.16 - Typical cross-section of a cycling facility adjacent to a rail corridor separated by a planted berm

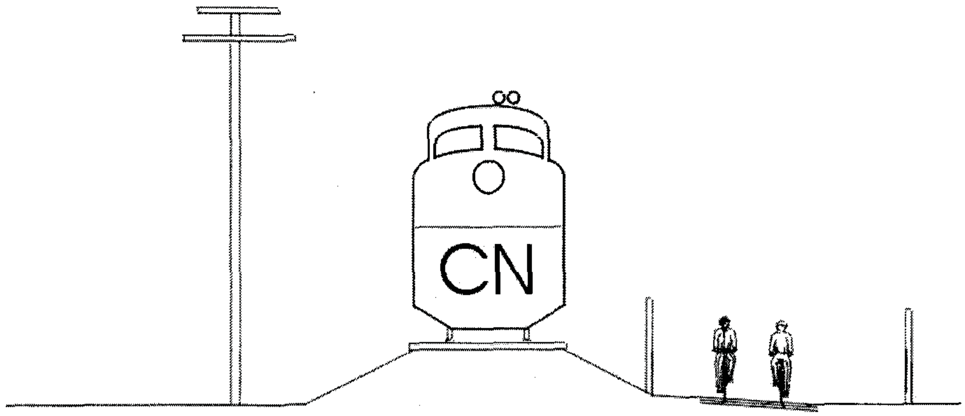


Figure A.17 - Typical cross-section of a cycling facility adjacent to a rail corridor separated by a fence.

5.5 On-road Routes

Bicycles are designated as a vehicle under the Highway Traffic Act (HTA) and as such are required to obey all of the same rules and regulations as automobiles when being operated on a public roadway. The Ministry of Transportation (MTO) and the Transportation Association of Canada (TAC) have developed standards for the design of on-road facilities and signing for on-road-bike system. The Town of East Gwillimbury will explore a number of options that exist for on-road cycling routes including bicycle lanes, paved shoulders, wide curb or shared lanes and signed routes. In addition to the commonly encountered situations to which relatively simple guidelines can be applied, there are often situations where the proper design requires a bicycle system design specialist who is familiar both the common guidelines, and innovative techniques, successfully applied elsewhere.

Conventional Bike Lanes

Bike lanes are typically located on urban cross-section roads (with curb and gutter) to create a physical space reserved for cyclists. In many municipalities, persons who use mobility-assisted devices also use this space. The diamond symbol and bicycle symbol painted on the pavement, in addition to roadside signs are useful on higher volume and higher traffic roadways. In areas where on-street parking is permitted, continuing the bike lane is the ideal method where space permits. Where road right-of-way widths are limited, where narrowing or removing traffic lanes is not feasible, and/or where the relocation or removal of parking is not an option, the bike lane must be properly terminated, which includes proper signage. The Bikeway Traffic Control Guidelines for Canada (Transportation Association of Canada 1998) should be consulted for additional details and specifications.

Bike lanes should be clearly identified on roadways through bicycle route signing, bicycle symbol pavement markings and bike lane signs. **Table A.10** summarizes the widths of bike lanes recommended for the Town of East Gwillimbury based on the requirements set out by the Ministry of Transportation (MTO), TAC and AADTs, posted and observed speeds, as well as commercial vehicle volumes (trucks / buses).

Table A.10 Recommended Bike Lane Widths

Classification	Minimum Width	Desired Width
Standard Bike Lane	**1.5 m**	**1.8 m**
Bike Lane Adjacent to On-Street Parking Aisle	**1.5 m**	**1.8 m**
Bike Lanes on Rural Roads with Posted Speed Limit between 60 - 80 km/h [(a)]	**1.5 m**	**2.0 m**
Bike Lanes in Constrained Right-of-way	**1.2 m**	**1.5 m**

(a) Note: On-road cycling facilities are not recommended on roadways with posted speed limits greater than 80 km/h.

Signed Routes

Signed routes are typically found along roads where traffic volumes and vehicle speeds are low. Typical on quieter residential streets (low volume and low speed), core urban areas (higher volume and low speed) and lower order rural roads (low volume and moderate speed), cyclists can share the road with motor vehicles and there is no need to create a designated space for cyclists. Signs located at intersections and at regular intervals in rural areas help trail users find their way. Along signed routes where the street is very narrow, “share the road” signs can also be erected to encourage cooperative behaviour between cyclists and motorists.

Paved Shoulder Bikeways

Paved shoulders provide a space for cyclists on rural cross-section roads (with shoulders, no curb and gutter). Pedestrians can use paved or granular shoulders where necessary (traveling in a direction facing traffic). Paved shoulders are typically recommended on rural cross section roads where traffic volume and speed are high. Poor sight lines and high truck volume are additional situations where paved shoulders should be considered.

Paved shoulder bikeways (a paved shoulder on a road signed for cycling) may form part of the main and secondary/local community systems in rural areas. Where funding is limited, adding or improving shoulders on uphill sections will give slow moving cyclists needed manoeuvring space and will decrease conflicts with faster moving motor vehicle traffic[6]. On rural roads, a marked edge line is typically used to designate a paved shoulder

6 Bikeway Traffic Control Guidelines for Canada, Transportation Association of Canada (TAC), (1999)

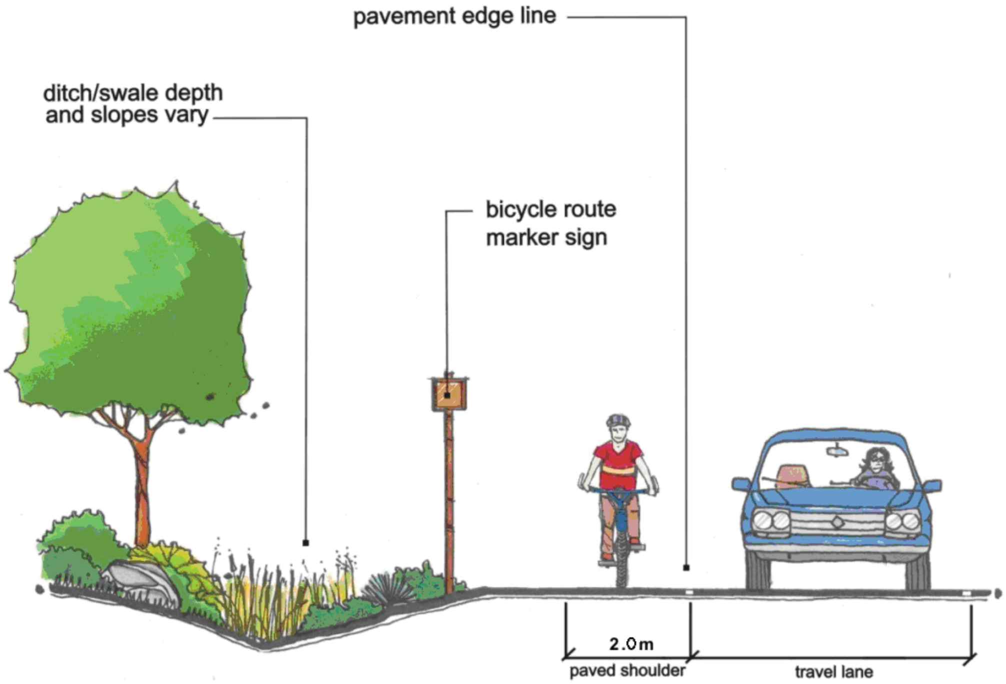


Figure A.18 - Typical Paved Shoulder Bikeway

It is recommended that paved shoulder cycling routes on roads having a posted speed limit up to and equal to 60 km/h should have a preferred design width of 1.5 m. On roads with a high percentage of commercial traffic above 60 km/h and less than 80 km/h, a design width of 2.0 m is preferred. However, in constrained areas, shoulder cycling routes with a design width of 1.5 m may be used if adjacent to a granular surface. That said, since a bicycle is defined as a vehicle, cyclists have the right to continue to use rural roads regardless of the posted limit, traffic volume or availability of a paved shoulder. If the preferred design width of 2.0 m for a paved shoulder cannot be achieved, any additional paved shoulder width is better than none at all. Paved shoulders on rural roads should not be denoted as reserved bicycle lanes but only as signed only bicycle routes since they must still be available as a refuge for disabled vehicles.

There may be segments of proposed cycling routes on roads with rural cross-sections (no curb) where it is difficult to accommodate even a minimum 1.2 m paved shoulder. In these cases, edge lines (pavement markings) may be provided to mark the vehicle lane width and to delineate as much additional shoulder width as possible for cyclists to use. This approach, however, is not recommended for urban roads with curbs due to the risk of cyclists striking the curb and “bouncing” back into the motor vehicle travel lane, potentially colliding with a motor vehicle. Should edge lines be applied to a rural cross section road in an urban area primarily to support cycling, they should be a minimum of 1.2 m in width. If a rural road is upgraded to an urban section (with curbs) the paved shoulders should be converted into bike lanes. The following is an example of policy that has been developed within Canada, in support of the implementation of paved shoulders.

Grey County developed and approved in 2009, a county-wide policy outlining guidelines for the provision of paved shoulders. The policy was developed after a fiscal analysis / comparison was done regarding the implementation of paved versus gravel shoulders on rural county roads which concluded that paved shoulders prove to be more efficient. The initial cost for the implementation of a paved shoulder is outweighed by the decrease in lifecycle costs. In addition, further analysis has found that by introducing a paved shoulder there is a decrease in auto accidents and collisions as well as additional supports to non-motorized traffic including pedestrians and cyclists. Grey County has now made it a priority to implement Paved Shoulders of 1.2 to 2.0 m for newly constructed roads and spot improvement projects[7].

Signed Only Bicycle Routes on Wide Curb Lanes

Signed only bicycle routes within wide curb lanes are similar to signed only bicycle routes, with the exception that the travel lane shared by motorists and cyclists is wider than a standard motor vehicle travel lane (e.g. greater than 3.5 metres). Wide curb lanes (also referred to as shared use lanes) should have sufficient width to allow motorists to pass cyclists without encroaching on an adjacent travel lane (if one exists). Wide curb lanes should be encouraged for all road classifications to provide cycling friendly streets, whether they are designated as part of the cycling network or not.

Research indicates that as lane widths begin to exceed 4.0 m this tends to increase confusion and improper lane use by motor vehicles in congested urban environments, and may encourage unsafe passing manoeuvres in rural environments. Therefore the recommended wide curb lane width for roads that are proposed for designation as on-road cycling routes is 3.5 m to 4.0 m.

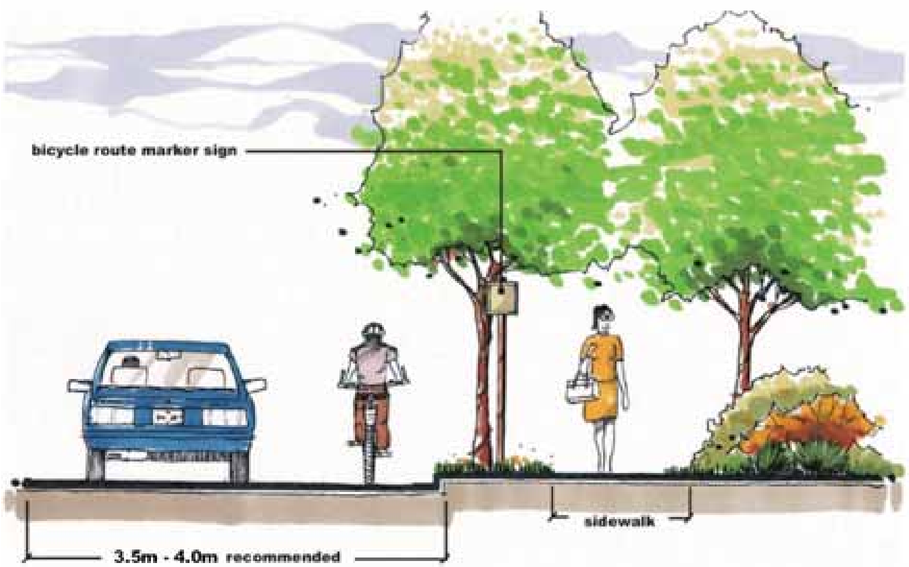
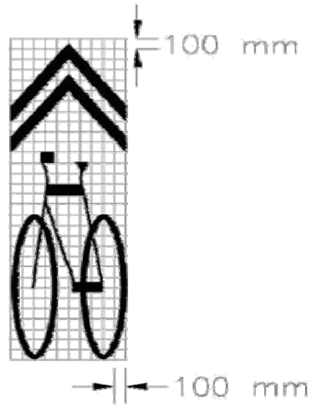


Figure A.19 - Signed-Only Cycling Route along a Wide Curb Lane

7 Source: Paved Shoulder Policy, Grey County, TAPSR-018-09

Shared Use Lane Markings

Where necessary or desirable, the shared use arrow or "Sharrow" can be painted on the road at regular intervals to inform road users to expect cyclists, and to assist the cyclist in understanding the preferred location to travel.



Shared Use Lane Marking (Bicycle with Chevron)[8]

Roads that are presently not suitable for on-road cycling facilities (i.e. too narrow, AADT'S too high or in poor condition) but are recommended for implementation in the future should be upgraded to at least minimum standards before being signed as part of the cycling network.

TAC's Guidelines for the Design and Application of Bikeway Pavement Markings provides guidance on the application of shared use lane markings, including the following recommendations (refer to the TAC Guidelines for detailed recommendations):

- Place immediately after an intersection and 10 m before the end of a block.
- Space longitudinally at intervals of 75 m (this spacing may be increased or decreased as needed to have evenly spaced markings within a block).
- This marking may be used on roadways with lanes that are wide enough for side-by-side bicycle and vehicle operation but not wide enough for a standard bicycle lane. These markings should be used on roadways with posted vehicle speeds of 60 km/h or less.
- On roadways without on-street parking, place so that the centre of the marking is 1.0 m but a minimum of 0.75 m from the edge of pavement or edge of curb.

The use of this marking should be considered primarily on routes with high cyclist volumes and/or with less than average sight lines because of road grades. Bicycle route signing should also be applied along the cycling route.

Bicycle Priority Streets or Bikeway Boulevards

In some areas, particularly urban residential neighbourhoods, traffic calming techniques such as through travel restrictions for cars, traffic circles and reduction in the number of stops signs can be used to create "bicycle priority streets" which allow the cyclist to travel more efficiently by not having to break momentum and stop at frequently placed four way stops.

8 Source: TAC Guidelines for the Design and Application of Bikeway Pavement Markings – Figure 3.1 (2007)

Figure A.20 - Example of a Bikeway Boulevard with Neighbourhood Traffic Circle

(Photo credit: Bicycle Transportation Alliance, Portland, 2008)

Cycle Tracks

One alternative to standard on-road bike lanes now being considered by a number of municipalities in North America, most notably New York County, is separated bike lanes. The concept is based on on-street bikeways and bikeway boulevards popular in some European countries, especially the Netherlands. The facility is located on the road surface and not above the curb in the boulevard, and is typically unidirectional (although they can be bidirectional).

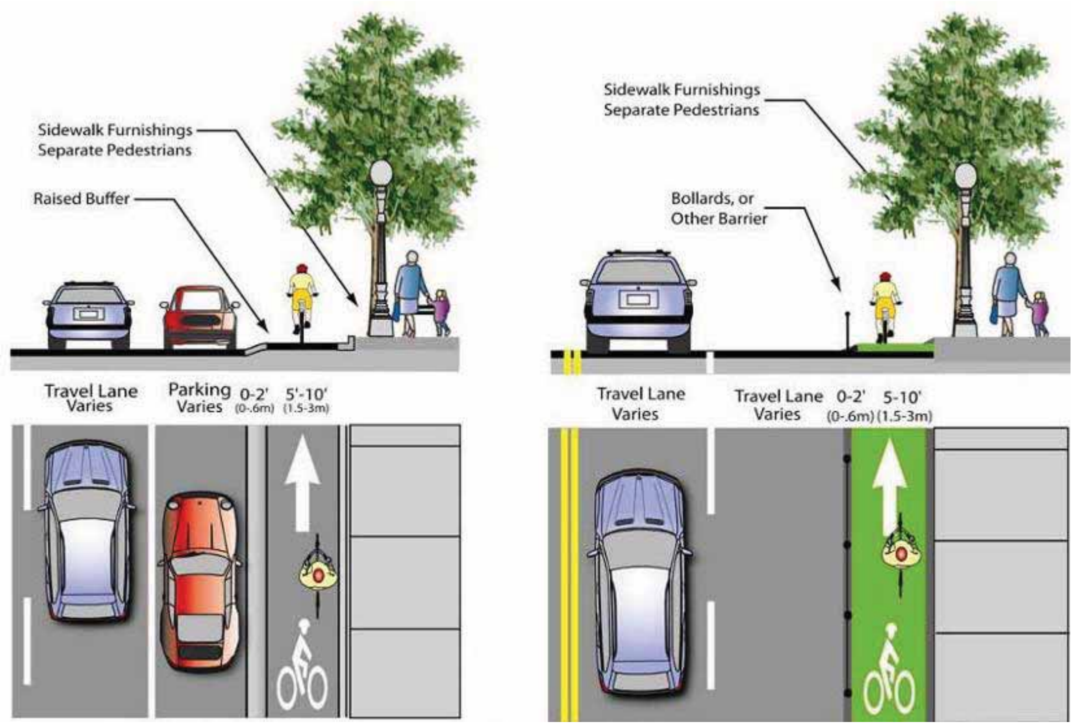


Figure A.21 - Typical Cycle Track With or Without On-Street Parking

One of the challenges with standard bike lanes in urban areas, especially where on-street parking is provided is that cyclists often find themselves “sandwiched” between parked cars and moving motor vehicles, including trucks and buses in the adjacent travel lane. The opportunity for conflict is higher in this condition as motor vehicles cross the bike lane to park or exit parking. Cyclists are also at increased risk from motorists in parked or stopped vehicles who open the vehicle door into the bike lane at the same time a cyclist is approaching (known as “dooring”). Delivery trucks, buses and taxis can also be found blocking the bike lane from time to time forcing the cyclist to divert into the adjacent general purpose travel lane or wait for the vehicle to move on.

In an effort to reduce these types of conditions, reduce the risk to cyclists and encourage more people to cycle, the bike lanes are combined into a bikeway separated by a buffer that may consist of a 0.5 to 1.0 m hatched pavement marking and / or ideally a physical barrier. On streets where full time parking is permitted, the parking lane may be shifted away from the curb and the bikeway inserted between the curb and the parking lane, with the latter separated from the bikeway by a raised planted median.

Figure A.22 - Example of a Raised Bicycle Lane on Ayres Road in Eugene, Oregon[9]

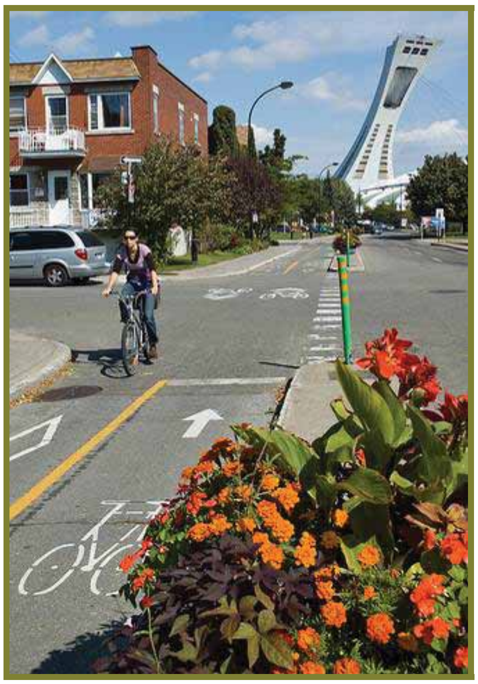


Figure A.23 - Example of a Two-way Cycle Track in Montreal, Quebec[10]

Although separated bike lanes (on-street bikeways) have many advantages, they also have some challenges. Intersection crossings may require special treatments, such as traffic control and/or traffic calming facilities. Pedestrians may use the bikeway as an extension of the sidewalk in busy commercial areas and when on-street parking is present, a motorist’s ability to see cyclists may be compromised. In addition, motor vehicles will need to yield to bicycle traffic, particularly right-turning vehicles at intersections. [11] The cost to implement the facility, educate users and maintain it, including snow clearing in winter months, are also areas that need further investigation.

9 (Source: “Cycle Tracks: Lessons Learned”, Alta Planning + Design, 2008)

10 (Source: Flickr)

11 Innovative Bicycle Treatments, An Informational Report, Jumana Nabti, Mathew Ridgway and the ITE Pedestrian and Bicycle Council, Institute of Transportation Engineers, May, 2002.

5.6 Evaluating Existing Roadways

Trail planners and designers and/or other concerned bodies should conduct an inventory of the existing conditions found along sections of a roadway right-of-way before they determine which routing and design options are most appropriate. The following factors **(Table A.11)** for evaluating existing roadways can serve as a useful checklist to assist in that decision-making process and not all factors will apply in all locations. Although there is no formula or calculation that can be applied to come up with the definitive answer, the group of factors is arranged, generally, in descending order of importance. Sound "engineering judgment" should also be applied when deciding on the most appropriate facility type.

Table A.11: Factors and considerations useful in evaluating roadways for potential multi-use trails and bicycle routes

Primary Factors	Considerations	Secondary Factors	Considerations
1. Location	• Rural roadway right-of-way • Urban roadway right-of-way • Not within a public roadway right-of-way	1. Length of the section	• Less than 50 m • 50 m to 5.0 km • Greater than 5.0 km
2. Function	• Provincial highway • Arterial road • Collector road • Local road • Residential street • Park road • Semi-public road • Parking lot	2. Pedestrian facilities and amenities	• Curbs, sidewalks • Boulevards, trees, benches (for each side of road), • Transit stops and shelters
3. Posted and observed motor vehicle operating speed	• Less than or equal to 60 km/hr • Greater than 60 km/hr	3. Turning potential and crossing opportunities	• Traffic lights, crosswalks, number of lanes, traffic sensors, medians, centre refuges, curbs, crossing interval, turning lanes
4. Traffic volume (per lane)	• Less than 1,000 AADT (Annual Average Daily Traffic) • 1,000 to 3,000 AADT • Greater than 3,000 AADT	4. Driveways - number of commercial or residential	• Number of crossings per km
5. Traffic mix - trucks, buses, streetcars, RVs	• Less than 6% of AADT • 6% to 12%of AADT • More than 12% of AADT	5. Topography	• Slopes less than or equal to 5% • Slopes greater than 5%

Table A.11: Factors and considerations useful in evaluating roadways for potential multi-use trails and bicycle routes

Primary Factors	Considerations	Secondary Factors	Considerations
6. On-street parking	• **One side of the roadway** • **Both sides of the roadway**	**6. Scenic interest**	• **Proximity or relationship to natural areas, scenic views and vistas, points of interest**
7. Intersections	• **Number and complexity**	**7. Sidewalk or trail obstructions**	• **Constrictions due to walls, utility poles, etc.**
8. Sight lines / visual environment	• **Road bends, hills, pedestrian activity and crossings, tight urban scale, road signs, utility poles, shrubbery, walls, night lighting**	**8. Opportunities for regeneration**	• **Naturalized plantings, wildlife habitat**
9. Roadway width and surface conditions	• **Number of lanes, width of lanes, pavement type, edge condition, railway crossings, sewer grates**	**9. Access to public transit**	• **Interregional Transit** • **Municipal transit**
10. Cost of recommended improvements	• **High** • **Medium** • **Low**	**10. User security**	• **Lighting, emergency telephones, “remoteness”**
Primary factors should be used to establish the basic form and “minimum recommended” or “preferred” width of the proposed route.		**Secondary factors are less important on their own but in combination with one another may increase or decrease the level of improvement required, and should be considered in detailed design.**	

5.7 Pedestrian Facilities

A sidewalk is located within the road right-of-way but separate from the travelled portion of the roadway. Sidewalks are typically made of concrete, are a minimum width of 1.5 m and are designed primarily for pedestrians. Existing and future pedestrian sidewalks should be incorporated into the spine and neighbourhood systems in urban areas for all system segments proposed within road rights-of-way. Sidewalks are preferred on both sides of all streets in the urban areas that are designated Active Transportation routes (for both new street construction and retrofitting of existing streets).

Where this can not be achieved a sidewalks should be provided on at least one side for all streets other than culs-de-sac and laneways. In these situations where traffic volume is extremely low, pedestrians can safely share the street with motor vehicles. Once sidewalks are constructed within the public right-of-way, the Town assumes responsibility for all future repair, reconstruction, maintenance, and operation during the life of the asset. Therefore, it is important that long-term financial liability be recognized when the Town decides when and where sidewalks are required.

Pedestrian walkways should be provided within parks to provide connectivity with municipal sidewalks, roadways, and open space linkages. This will provide greater accessibility for residents to local amenities. As per the Parkland Design Standards Manual (2009), walkways shall be minimum 2.4 m wide for pedestrian use and minimum 3.0 m wide for primary route areas where access by park maintenance service vehicles is required.

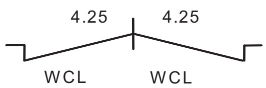
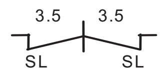
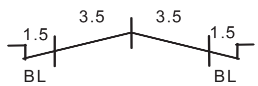
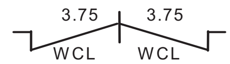
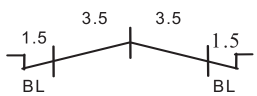
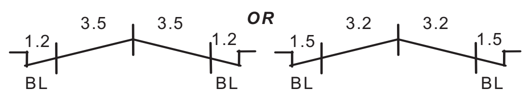
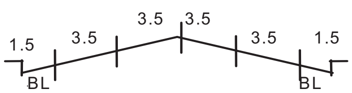
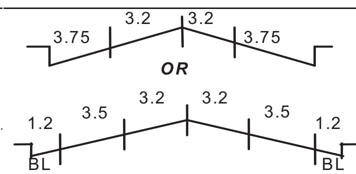
A “buffer” zone should also be provided between the sidewalk and roadway where applicable to separate pedestrians from the road. Buffer zones may vary depending on the nature of the area they serve. In older and established neighbourhoods, the cost of installing sidewalks and opposition by residents may be significant challenges encountered in the decision to add sidewalks or not in these neighbourhoods.

6.0 Network Design Features

6.1 Retrofitting Roads

Some of the new cycling routes recommended in the Master Plan will involve retrofitting existing arterial and local roads. Narrow rights-of-way, roadway platform and pavement widths as well as other geometric issues related to roadway design and drainage will impact both the feasibility and cost of implementing the recommended facility type and respective preferred design. It is suggested that the Town consider minimum thresholds for applying appropriate design guidelines. **Tables A.24 and A.25** outline a set of recommended guidelines for retrofitting roads in the Town of East Gwillimbury to accommodate cycling facilities in both ideal and constrained conditions. On higher volume / speed roadways consideration should be given to “buffered” bike lanes or cycle tracks in place of bike lanes where possible. Where the curb to curb width of a road is not wide enough to accommodate bike lanes, a cycle track pushed into the boulevard may be an option (see Figure A.8).

Table A.24 Retrofitting Urban Roads for Cycling Facilities

<table>
<tr><th></th><th>Road Configuration and Characteristics</th><th>Preferred Solution</th><th>Minimum or Interim Solution (Constrained Projects)</th></tr>
<tr><td>a)</td><td>2 Lane Urban
≤ 3,000 AADT / Lane
≤ 60 km/h
≤ 6% Trucks</td><td>
</td><td>
</td></tr>
<tr><td>b)</td><td>2 Lane Urban
> 3,000 AADT / Lane
≤ 60 km/h
6% ≤ 12% Trucks</td><td>
</td><td>
</td></tr>
<tr><td>c)</td><td>2 Lane Urban
> 3,000 AADT / Lane
> 60 km/h
> 12% Trucks</td><td>
</td><td>
</td></tr>
<tr><td>d)</td><td>4+ Lane Urban
≤ 10,000 AADT / Lane
≤ 60 km
≤ 12% Trucks</td><td>
</td><td>
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<tr><td>e)</td><td>4+ Lane Urban
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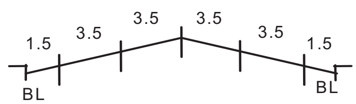
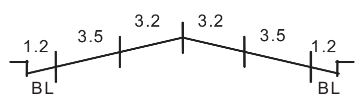
≤ 60 km/h
> 12% Trucks</td><td>
</td><td>
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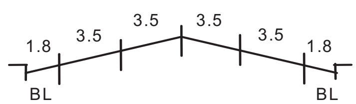
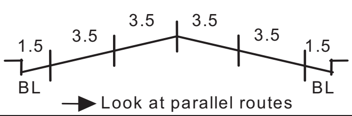
> 60 km/h
> 12% Trucks</td><td>
</td><td>
</td></tr>
</table>

BL = Bike Lane WCL = Wide Curb Lane SL = Shared Lane 3.5 = Vehicle Travel Lane Width (metres)

BL = Bike Lane measured to face of curb (includes gutter)

NOTES:

1. Motor vehicle travel lane widths can vary (e.g. 3.25 m to 4.25 m). If a travel lane is less than 3.25 m the adjacent bike lane should typically be a minimum of 1.5 m unless it is an interim condition. That said, good engineering judgement must be applied at all times.
2. **The values indicated in these tables are suggested thresholds and are not meant to be prescriptive. Rather, these thresholds are meant to serve as a guide to assist bikeway planners and designers in the decision-making process when attempting to retrofit existing roads for cycling facilities.** A decision to select one cycling facility type over another will also be influenced by other factors. These may include the type and density of adjacent land uses, driveway frequency, collision information, municipal streetscape and / or urban design planning objectives for a particular road or road segment, and local community preferences.

Sources:

- Ministry of Transportation of Ontario (MTO), Ontario Bikeways Planning and Design Guidelines (1996);
- Transportation Association of Canada (TAC), Geometric Design Guide for Canadian Roads (1999);
- United States Department of Transportation - Federal Highway Administration, Selecting Roadway Design Treatments to Accommodate Bicycles (FHWA-RD-92-073);
- University of North Carolina, Highway Safety Research Center and Pedestrian and Bicycle Information Centre, Bicycle Facility Selection: A Comparison of Approaches;
- American Association of State Highway and Transportation Officials, Guide for the Development of Bicycle Facilities, (1999);

Table A.25 Retrofitting Rural Roads for Cycling Facilities

	Road Configuration and Characteristics	Preferred Solution	Minimum or Interim Solution (Constrained Projects)
a)	2 Lane Rural ≤ 3,000 AADT / Lane ≤ 80 km/h ≤ 6% Trucks Good Sight Lines	1.5 / 3.5 / 3.5 / 1.5 PSL PSL	≥ 1.2 / 3.5 / 3.5 / ≥ 1.2 PSL PSL OR ≥ 0.5 / 3.5 / 3.5 / ≥ 0.5 SL SL Edge line Edge line
b)	2 Lane Rural > 3,000 AADT / Lane ≤ 80 km/h 6% ≤ 12% Trucks Good Sight Lines	2.0 / 3.5 / 3.5 / 2.0 PSL PSL	1.5 / 3.5 / 3.5 / 1.5 PSL PSL
c)	2 Lane Rural > 10,000 AADT / Lane ≤ 80 km/h > 12% Trucks Good Sight Lines	2.5 / 3.5 / 3.5 / 2.5 PSL PSL	2.0 / 3.5 / 3.5 / 2.0 PSL PSL → Look at parallel routes
d)	4 Lane Rural ≤ 10,000 AADT / Lane ≤ 80 km/h ≤ 12% Trucks Good Sight Lines	2.0 / 3.5 / 3.5 / 3.5 / 3.5 / 2.0 PSL PSL	1.5 / 3.5 / 3.5 / 3.5 / 3.5 / 1.5 PSL PSL
e)	4 Lane Rural > 10,000 AADT / Lane ≤ 80 km/h ≥ 12% Trucks Good Sight Lines	2.5 / 3.5 / 3.5 / 3.5 / 3.5 / 2.5 PSL PSL	2.0 / 3.5 / 3.5 / 3.5 / 3.5 / 2.0 PSL PSL → Look at parallel routes

PSL = Paved Shoulder Lane   SL = Shared Lane   3.5 = Vehicle Travel Lane Width (metres)

NOTES:

1. On roads with poor sight lines, preferred guidelines should always apply. Consideration should also be given to an additional clearance width of 0.5 m in the paved shoulder.
2. Assumes paved shoulders have an adjacent granular shoulder, which is typically 0.5 m or more in width.
3. **The values indicated in these tables are suggested thresholds and are not meant to be prescriptive. Rather, these thresholds are meant to serve as a guide to assist bikeway planners and designers in the decision-making process when attempting to retrofit existing roads for cycling facilities.** A decision to select one cycling facility type over another will also be influenced by other factors. These may include the type and density of adjacent land uses, driveway frequency, collision information, municipal streetscape and/or urban design planning objectives for a particular road or road segment, and local community preferences.

Sources:

- Ministry of Transportation of Ontario (MTO), Ontario Bikeways Planning and Design Guidelines (1996);
- Transportation Association of Canada (TAC), Geometric Design Guide for Canadian Roads (1999);
- United States Department of Transportation - Federal Highway Administration, Selecting Roadway Design Treatments to Accommodate Bicycles (FHWA-RD-92-073);
- University of North Carolina, Highway Safety Research Center and Pedestrian and Bicycle Information Centre, Bicycle Facility Selection: A Comparison of Approaches;
- American Association of State Highway and Transportation Officials, Guide for the Development of Bicycle Facilities, (1999);

6.2 Trail Crossings

A significant challenge when implementing a trail system is how to accommodate trail users when crossing roads. In the case of highways, arterial and busier collector roads, options generally include:

- Grade separated crossings (bridges and underpasses including both shared and pedestrian/trail only facilities);
- When considering acceptable threshold distances for mid-block crossings use the following:
  - two Lane Roadway: 60 metres from nearest protected crossing
  - four to six Lane Roadway: 120 metres from nearest protected crossing
- Directing users to cross at an existing signalized or stop-controlled intersection;
- Utilizing a mid-block pedestrian signal or Intersection Pedestrian Signal (IPS); and
- At a mid block location with a pedestrian island or refuge.

Multi-use Trail Crossings at Intersections

TAC's Guidelines for the Design and Application of Bikeway Pavement Markings provide recommended treatments for locations where multi-use trails cross roadway intersections. There are two different applications to consider: where pedestrians and cyclists will mix and where only a cyclist will cross. It should be noted that this TAC recommendation was recently approved for application in the County of Mississauga in a letter from the Ontario Ministry of Transportation.

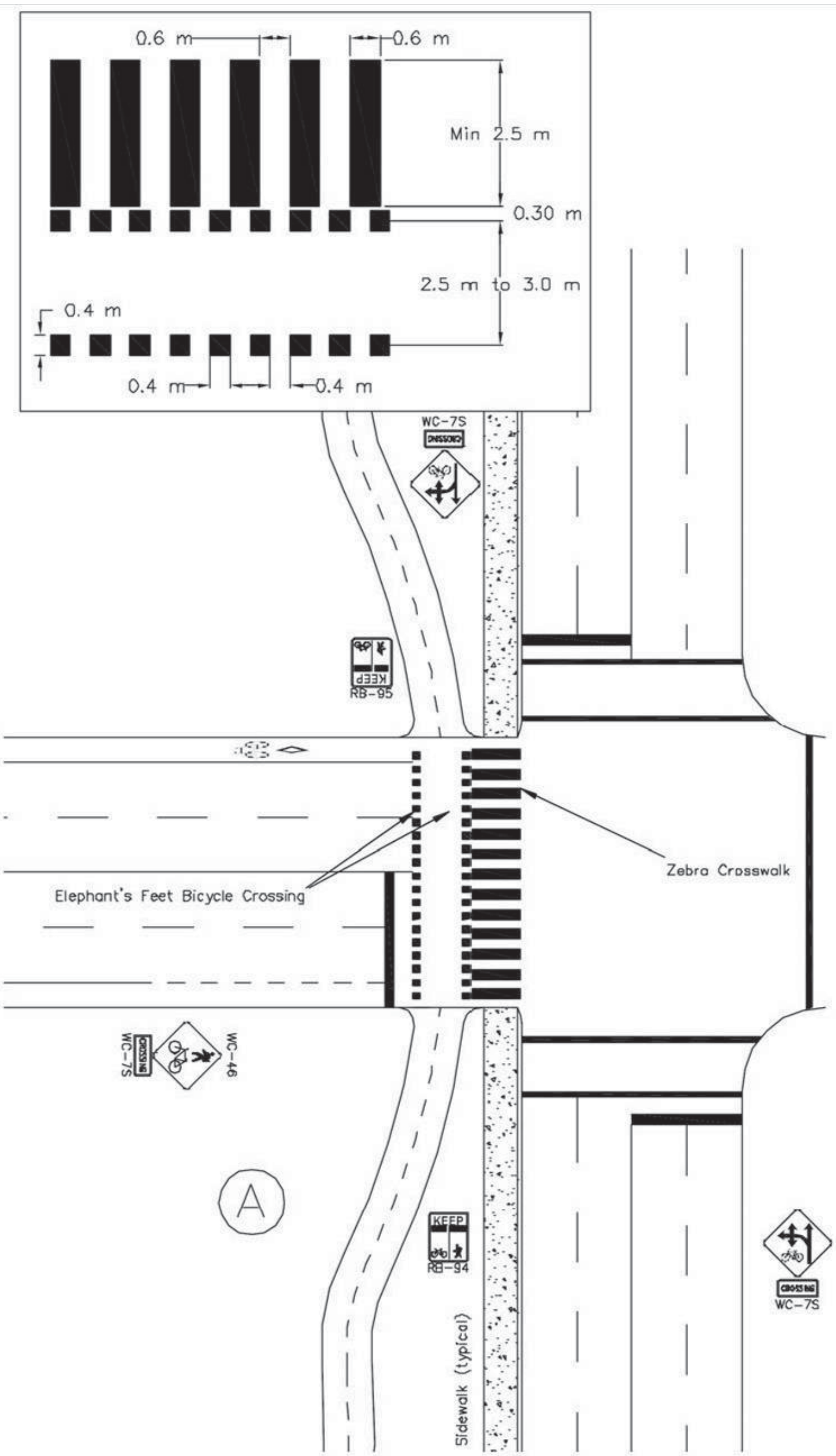


Figure A.26 - Multi-use Trail Crossing of Intersection – Pedestrians and Cyclists

Source: TAC Guidelines for the Design and Application of Bikeway Pavement Markings – Page 40 (2007)

6.3 Minor and Major Roads

Trail crossings of minor and major roads should include the following:

- Creation and maintenance of an open sight triangle at each crossing point;
- Trail access barriers;
- Signing along the roadway in advance of the crossing point to alert motorists to the trail crossing;
- Signing along the trail to alert trail users of the upcoming roadway crossing;
- Alignment of the crossing point to achieve as close to possible a perpendicular crossing of the roadway, to minimize the time that trail users are in the traveled portion of the roadway; and
- Curb ramps on both sides of the road.
- Consider mid-block curb extensions to reduce the distance pedestrians must travel to cross a road and make the crossing more visible to motorists.

In some locations signing on the trail may not be enough to get trail users to stop before crossing the road. Under these circumstances or in situations where the sightlines for motorists are reduced and/or where there is a tendency for motorists to travel faster than desirable, the addition of other elements into the trail crossing may be necessary. Changing the trail alignment may help to get trail users to slow and stop prior to crossing. Changes to the streetscape may also provide a cue and traffic calming effect for vehicles. The following is an illustration of elements of a typical trail crossing.

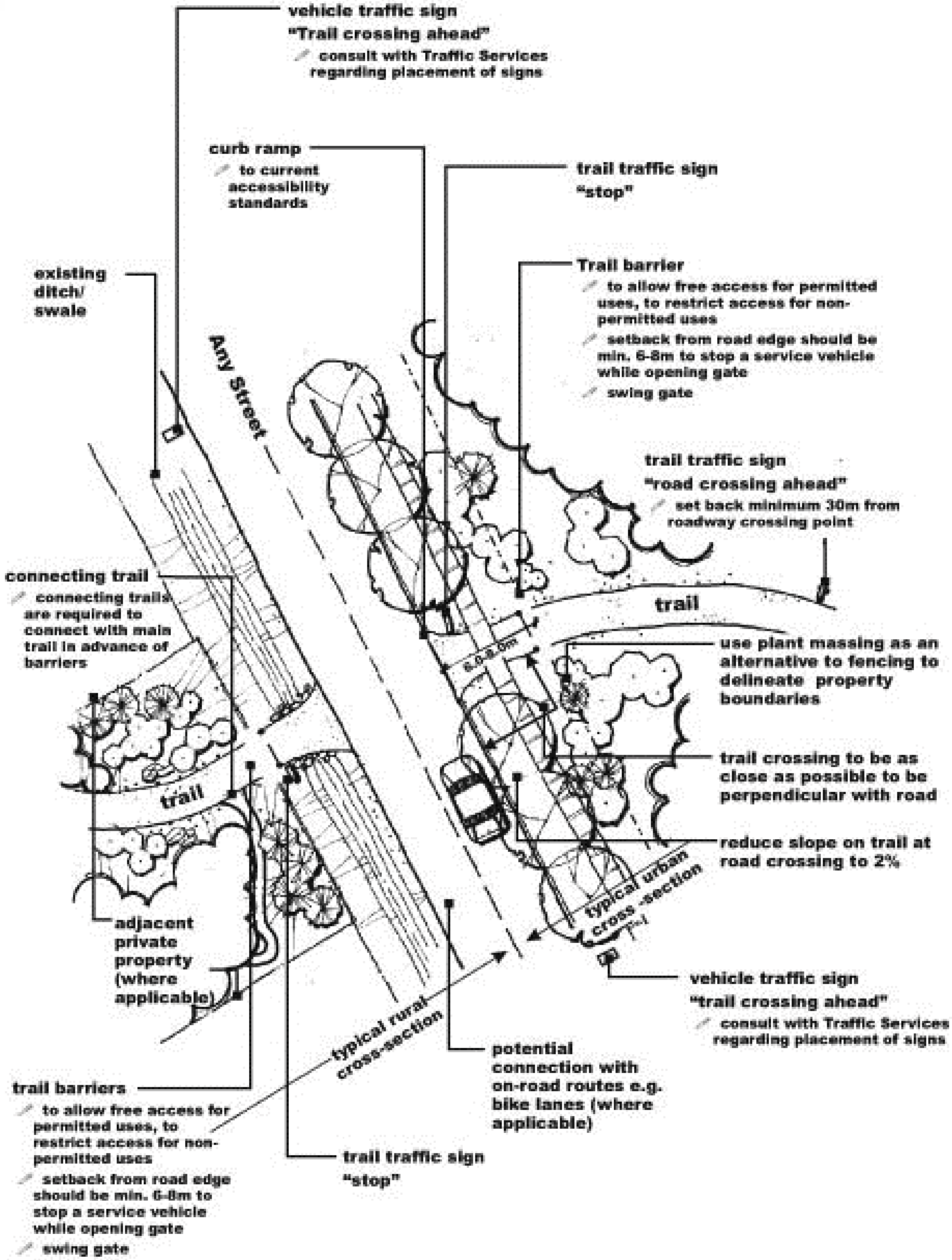


Figure A.27 - Typical Trail Crossing

6.4 Railway Crossings

Currently, in order to establish a pathway crossing of an active rail line, proponents must submit their request directly to the railroad company. Submissions need to identify the crossing location and its basic design. Designs should be consistent with Draft RTD-10, Road/Railway Grade Crossings: Technical Standards and Inspection, Testing and Maintenance Requirements (2002) available from Transport Canada. In the event that an agreement cannot be reached on some aspect of the crossing, then an application may be submitted to the Canadian Transportation Agency, who will mediate a resolution between the parties. Contact information is below.

Canadian Transportation Agency
Ottawa, ON K1A 0N9

Telephone: 1-888-222-2592

It is recommended that appropriate traffic control devices, such as pavement markings, signage and lift gates, be installed at the intersections of railway tracks and network routes. These should be designed and installed in accordance with the Bikeway Traffic Control Guidelines (TAC 1997) and the Manual of Uniform Traffic Control Devices for Canada (TAC 1998).

Careful consideration should be given to the design of at-grade crossings of railways. Furthermore, it is recommended that crossings be designed as close to right angles as possible. In many situations this may require widening of a network segment in advance of the crossing, thereby allowing cyclists to reduce their speed and position them for crossing at right angles.

Rubber track guards are also recommended to improve friction between bike tires and the pavement, and also to narrow the rail gaps. Clearly visible signage should also be displayed to forewarn pedestrians, including those using mobility devices, of an approaching railway crossing, and possible tripping hazards when walking or running over them. Pavement crossing surfaces should also be paved, and inspected regularly during road inspections for signs of deterioration around the tracks. Pavement deterioration adjacent to railway tracks can be a potential hazard, especially to those in wheelchairs since tires could get caught in the rails.

While these examples illustrate bicycle lanes, similar applications could be made using sidewalks or multi-use trails.

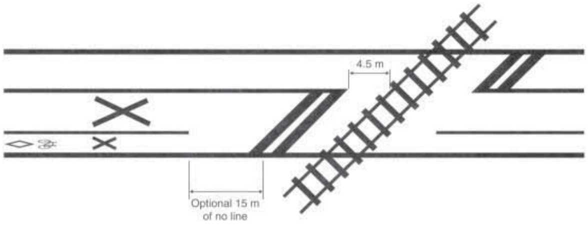


Figure A.28 - Skewed Railroad Crossing with Restricted Right-of-Way Width

(TAC Guidelines)

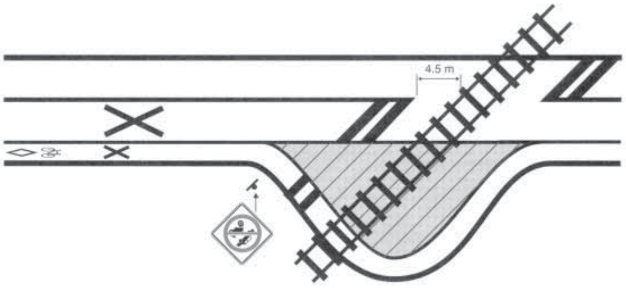


Figure A.29 - Skewed Railroad Crossing with Unrestricted Right-of-Way Width

(TAC Guidelines)

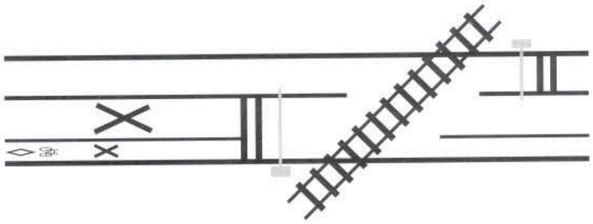


Figure A.30 - Skewed Railroad Crossing with Restricted Right-of-Way Width and Gate Control

(TAC Guidelines)

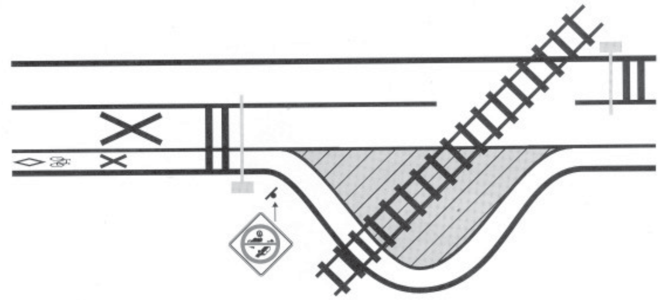


Figure A.31 - Skewed Railroad Crossing with Unrestricted Right-of-Way Width and Gate Control

(TAC Guidelines)

6.5 Gates and Barriers

Access barriers are intended to allow free flowing passage by permitted trail user groups, and prohibit access by others. Barriers typically require some mechanism to allow access by service vehicles and emergency access. There are many designs for trail access barriers which include but are not limited to bollards, single swing gates and offset swing gates.

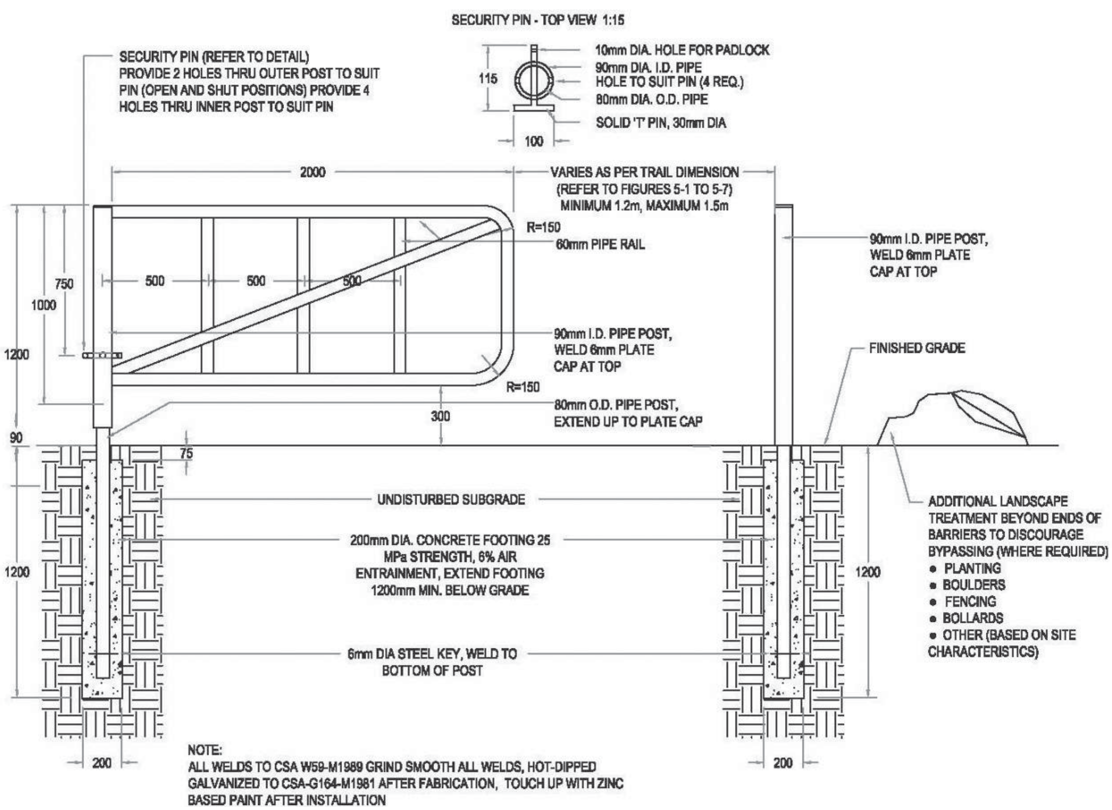


Figure A.32 - Light Duty Trail Barrier – City of Guelph

Bollards

The bollard is the simplest and least costly barrier, and can range from permanent, direct buried wood or metal posts, to more intricately designed cast metal units that are removable by maintenance staff. An odd number of bollards (usually one or three) are placed in the in order to create an even number of "lanes" for trail users to follow as they pass through the barrier. Although the removable bollard system provides flexibility to allow service vehicle access, they can be difficult to maintain as the metal sleeves placed below grade can be damaged by equipment and can become jammed with gravel and debris from the.

Example of a Trail Crossing Bollards, Windsor, ON

Swing Gates

The single swing gate combines the ease of opening for service vehicle access, with the ease of passage of the bollard. Gates also provide a surface/support for mounting signage. The offset swing gate is similar to the single swing gate, except that barriers are paired and offset from one another. Cyclists and wheelchair users can have difficulty negotiating the offset swing gate if the spacing between the gates is not adequate.

In urban areas the single swing gate is recommended for most applications. In some locations bollards may be sufficient. In rural locations a more robust single swing gate should be used.

Example of a light duty swing gate barrier, Waterloo, ON

6.6 Bridges and Underpasses

Bridges

Where possible, the trail network should make use of existing bridges, including pedestrian bridges, vehicular bridges and abandoned railway bridges in appropriate locations. In cases where this is not possible, a new structure will be needed and the type and design of a structure needs to be assessed on an individual basis. The following are some general considerations:

- In most situations the prefabricated steel truss bridge is a practical, cost effective solution;
- In locations where crossing distances are short, a wooden structure constructed on site may be suitable;
- Railings should be added if the height of the bridge deck exceeds 60 cm above the surrounding grade, and should be designed with a "rub rail" to prevent bicycle pedals and handlebars from becoming entangled in the pickets;
- When considering barrier free access to bridges, an appropriate hardened surface should be employed on the trail approaches and bridge decking should be spaced sufficiently close to allow easy passage by a person using a mobility-assisted device; and

A Pedestrian Trail Bridge, Brampton ON

- Decking running perpendicular to the path of travel is preferred over decking running parallel, as the latter is more difficult for use by wheelchairs, strollers and narrow tired bicycles.
- Bridges should be 0.6 m wider (0.3 m wider on each side) than the trails they are serving, to provide adequate side clearance for the railings. They should be wide enough and strong enough to support maintenance vehicles where required.
- An immovable bollard located at the centre of each approach can be used to prevent heavy vehicles from crossing a light duty bridge.
- The bridge travel surface should be a non-slip material. Untreated wood or flat metal surfaces become slippery when wet or icy. Bridge slats made of self-weathering steel with raised dimples for traction have been used successfully. Open metal grating, on the other hand, is noisy and provides a less desirable riding surface for cyclists.

Underpasses

Often an underpass is the only way to cross significant barriers such as elevated railways and multi-lane highways. Underpasses should be designed wide enough to accommodate all trail users. The following are some general considerations:

- The minimum recommended underpass width for a multi-use trail is 3.6 m. Where the structure exceeds 18 m in length, in high traffic and/or urban areas the width should be increased to 4.2 or greater;
- For shorter length underpasses, a vertical clearance of 2.5 m is usually sufficient recommended;
- For longer structures a vertical clearance of 3.0 m should be considered. If service and/or emergency vehicles are to be accommodated within the underpass, an increase in vertical clearance may also need to be provided;
- Underpasses should be well lit with special consideration made to security, maintenance and drainage. Approaches and exits should be clear and open to provide unrestricted views into and beyond the end of the structure wherever possible;
- Abutments should be appropriately painted with hazard markings;
- Offensive graffiti and debris should also be removed promptly and regularly; and
- Ideally, the transition between the trail and underpass crossing should be level and provide for accessibility. In the case where an underpass crosses beneath ground-level travel ways, ramps should ideally be.

6.7 Elevated Trail Beds and Boardwalks

Where trails pass through sensitive environments such as marshes, swamps, or woodlands with a large number of exposed roots, an elevated trail bed or boardwalk is usually required to minimize negative impacts on the natural feature. If these areas are left untreated, trail users tend to walk around obstacles such as wet spots, gradually creating a wider, often braided trail through the surrounding vegetation.

The figure below illustrates the turnpike and low profile boardwalk, two relatively simple yet effective methods for secondary and special use (i.e. hiking only) trails. The turnpike is a low tech, low cost method that works very well in areas where organic soils are encountered. Various geosynthetic products have also been successfully used to overcome difficult soil conditions. The United States Department of Agriculture (Forest Service) has evaluated many products and design applications in the construction of trails in heavily used parks and on backcountry trails[12].

Low Profile Boardwalk, Guelph, ON

Low profile boardwalks have been successfully employed by trail managers across Ontario. A good example can be found in the Hanlon Creek Conservation Area in Guelph.

6.8 Switchbacks and Stairs

Pedestrian, motorized and some self-propelled users are capable of ascending grades of 30% or more whereas some users are limited to grades of less than 10%. For example, a slope of 5% is the threshold for a fully accessible facility. Once trail slopes exceed this threshold and slopes are long (i.e. more than 30 m) it is important to consider alternative methods of ascending slopes. Two alternatives to consider are switchbacks and stairs.

Where construction is feasible, switchbacks are generally preferred because they allow wheeled users such as cyclists to maintain their momentum, and there is less temptation to create shortcuts, as might be the case where stairways are used. Switchbacks are constructed with turns of about 180 degrees and are used to decrease the grade of the trail. A properly constructed switchback also provides outlets for runoff at regular intervals, thus reducing the potential for erosion. Switchbacks typically require extensive grading and are more suited to open locations where construction activity will not cause major disruption to the surrounding environment. Switchbacks can be difficult to implement in wooded areas without significant impacts to surrounding trees.

12 (http://www.fhwa.dot.gov/environment/fspubs/00232838/)

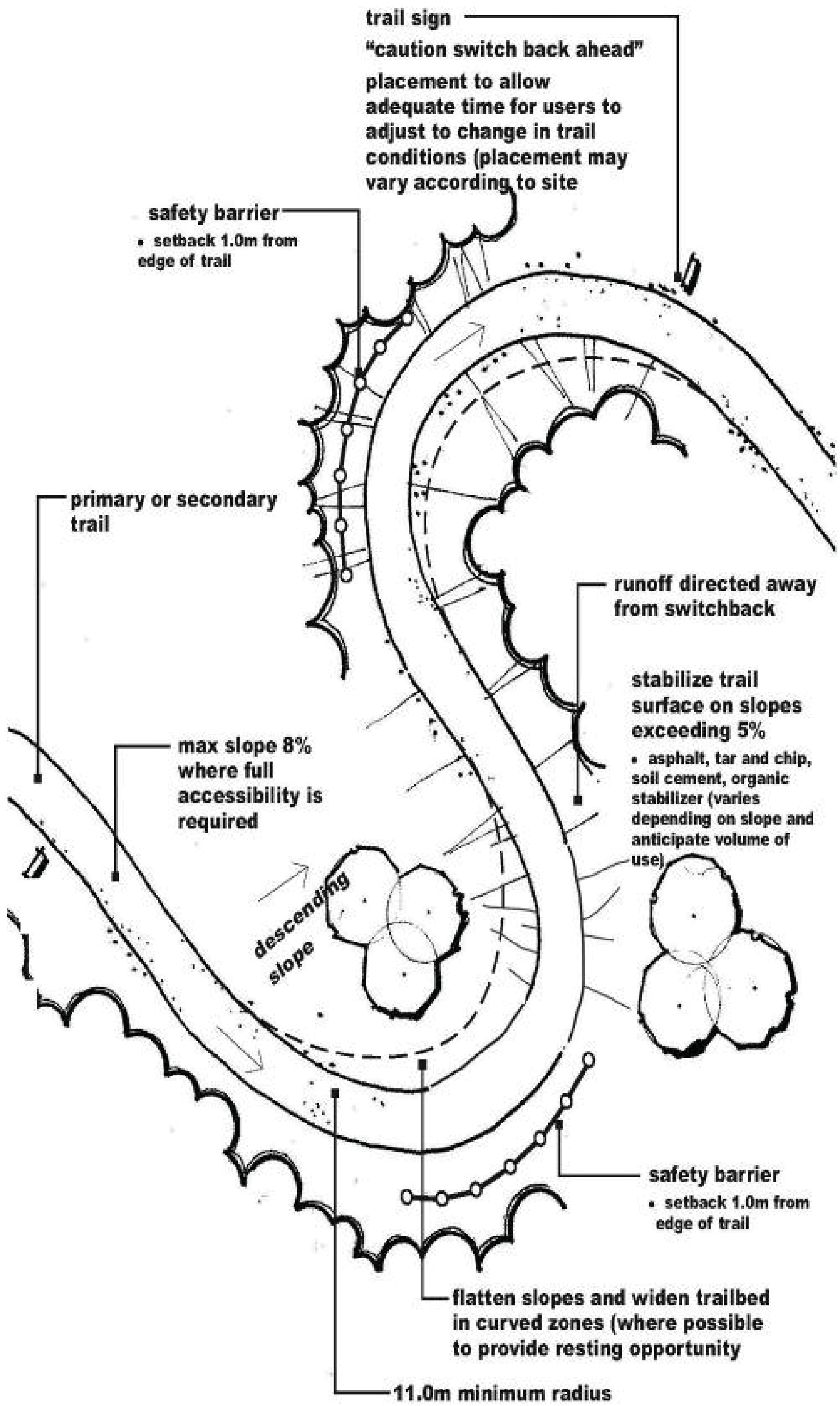
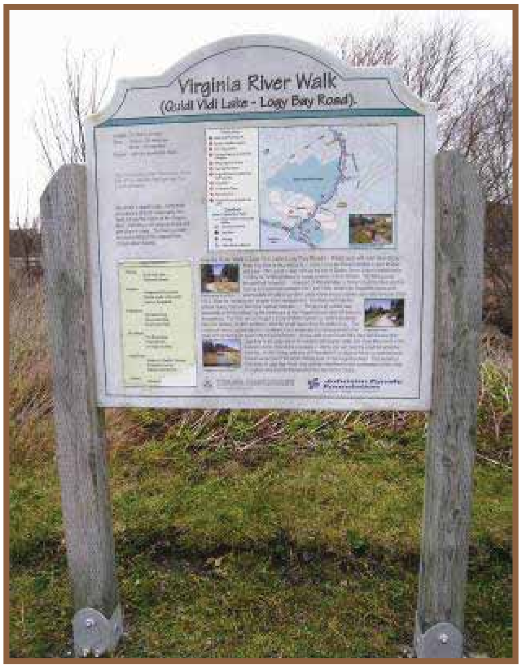


Figure A.33 – Example of a Switchback

When slopes exceed 15%, or where there is inadequate room to develop a switchback or another accessible solution, a stairway system should be considered. The following are some considerations for stairway design:

- Provide a gutter integrated into the stairway for cyclists to push their bicycles up and down (where appropriate to have bicycles);
- Develop a series of short stair sections with regularly spaced landings rather than one long run of stairs;
- For long slopes, provide landings at regular intervals (e.g. every 8-16 risers) and an enlarged landing at the mid-way point complete with benches to allow users the opportunity to rest;
- On treed slopes, lay the stairway out so that the minimum number of trees will be compromised or removed;
- Use slip resistant surfacing materials, especially in shady locations.
- Incorporate barriers on either side of the upper and lower landing to prevent trail users from bypassing the stairs; and
- Provide signs well in advance of the structure to inform users that may not be able to climb stairs.



7.0 Signage

The local identity of the Town of East Gwillimbury has evolved over time, in some cases the result of the architecture, landscape, land use, cultural history and residents. Trail themes can add a local flavour to individual trails or loops, creating an overall unique quality to the trail network. It also provides an additional opportunity and incentive for neighbourhood associations and interest groups to become unified as partners in developing and maintaining the trails throughout the entire municipality.

Other jurisdictions have taken this approach using a variety of methods including:

- Adding a distinct trail name or additional logo plate while maintaining other common design elements of the signs;
- Creating neighbourhood/district gateway nodes in key locations where the edges of neighbourhoods are considered to be; and
- Creating distinct interpretive themes for different neighbourhoods.

Signage is a critical element of the trail network and serves many important functions. The following are common characteristics of a good signing system:

- Clearly, concisely and consistently communicate information related to identification, direction, regulation and operation of the trail;
- Informing, but not distracting, trail users and detracting from the visual quality of overall trail experience;

- Graphics and internationally recognized symbols instead of excessive text to overcome language barriers;
- Visibility at night through the use of reflective materials should also be considered in locations where low light and night use is anticipated;
- A design that is timeless, in-scale and visually integrated with the landscape without creating unnecessary clutter; and
- High quality, durable (including resistance to ultraviolet radiation), vandal resistant quality materials and finishes.

While all elements of the bicycle network and most elements of the off-road trail network should be signed, it is not feasible to sign every part of the pedestrian system. Therefore, only the primary (spine) system and key secondary (neighbourhood) system links should be signed.

7.1 Sign Types

The design and construction of the network should incorporate a hierarchy of signs each with a different purpose and message. This hierarchy is organized into a “family” of signs with unifying design and graphic elements, materials and construction techniques. The unified system becomes immediately recognizable by the trail user and can become a branding element. Consistent with this approach is the correct use of signage, which in-turn reinforces the trail’s identity.

Generally the family of signs includes:

Information Signs

Information signs provide general information about the use and identity of the network, as well as adjacent features. Information signs can be in the form of words, symbols or maps and should be placed at trailheads, access points and gateways. The preferred (as opposed to the regulated) use of the system is communicated through “use symbols” where the separation of trail users has been accommodated.

Way-finding Signs

Way-finding signs may include the network logo or “brand” and communicate other information to users such as directional arrows and distances in kilometres to major attractions and settlement areas. Way-finding signs should be mounted on standard sign poles and be located on all legs of an intersection or off-road trail junction, as well as at gateways.

Interpretive Signs

Interpretative signs provide specific information about points of ecological, historical, cultural and general interest, as well as current land uses along the network. They represent a broad range of possible sign formats and applications, depending on the interpretative program and complexity of information to be communicated. In order to maximize the ease of understanding, signage for pedestrian and cycling network should be consistent.

Bicycle Route and Pedestrian System Designation Signs

Bicycle route and pedestrian system designation signs should be used to "brand" or identify routes that constitute the network. Designation signs may be mounted alone or with other signs at logical, highly visible locations on both on-road and off-road network route segments. The bicycle route sign, shown in is commonly used for this purpose.

Figure A.34 - Bicycle Route Marker Sign

Source: TAC Bikeway Traffic Control Guidelines, 1998

Regulatory Signs

Regulatory signs are intended to control particular aspects of travel and use along the road or off-road network. Signs restricting or requiring specific behaviour is not legally enforceable unless it is associated with a provincial law or municipal by-law. Where applicable, it is recommended that authorities discreetly include the by-law number on signs to reinforce their regulatory function. The graphic to the right illustrates a reserved bicycle lane sign and a bicycle lane ends sign, which are currently used regulatory signs.

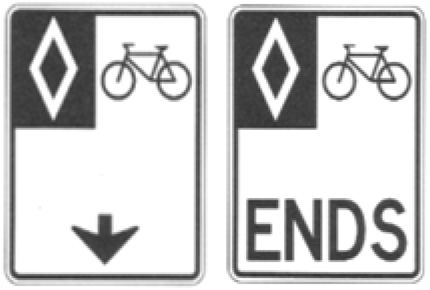


Figure A.35 - Reserved Bicycle Lane and Reserved Bicycle Lane Ends Signs

Source: TAC Bikeway Traffic Control Guidelines, 1998

Warning Signs

Warning signs are used to highlight bicycle route conditions that may pose a potential safety or convenience concern to network users. Examples are steep slopes, share the road, railway crossings and pavement changes. These signs are diamond in shape, with a black legend on a yellow background. These signs are more applicable to cycling routes and multi-use trails than pedestrian systems.

Figure A.36 - Examples of Warning Signs

Source: TAC Bikeway Traffic Control Guidelines, 1998

7.2 Trailheads and Gateways

Major trailheads areas are generally proposed for important community destinations such as community centres. Because of their high visibility and proximity to other recreation facilities, they help to raise the profile of the trail system. A well-designed trail staging area typically incorporates the following elements:

- Regular and accessible (handicapped) parking with an appropriate number of spaces in relation to the anticipated level of use of the nearby trail, with the flexibility to increase the number of spaces where warranted by future demand;
- Trail access barriers;

- Easy access to and from the trail;
- Ample room to load and unload equipment;
- Secure bicycle parking facilities;
- Waste receptacles and washrooms;
- Signing and appropriate lighting;
- Seating and or picnic/informal activity space; and
- A food concession and/or other entrepreneurial facilities (i.e. bicycle rentals) may also be available, depending on the size and setting.

Post and Ring Bicycle Parking Facility, Toronto, ON

A trail gateway is articulated with a sign indicating to the trail user that they have entered the Town of East Gwillimbury. This is the first opportunity to introduce the Town of East Gwillimbury trail logo and character of the trail system as expressed through the design of the sign and the trail gateway.

8.0 Trail Features

8.1 Seating and Rest Areas

Seating provides the opportunity to pause along the trail at points of interest or just to rest. Young children, older adults and those with disabilities will need to rest more frequently than others. Benches are the most common form of seating, but walls of appropriate height and width, large flat boulders, and sawn logs are some alternatives depending on the trail setting. Where seating/rest areas are planned, the design should consider a 1 m wide level area with a curb or other appropriate wheel stop for mobility-assisted devices. For heavily used trails it is reasonable to provide some form of seating at approximately 500 m intervals.

8.2 Washrooms and Waste Receptacles

Washrooms must be provided along the trail. Typically, they are located at major trailheads and where possible make use of existing facilities (i.e. at community centres and in major parks). As trail use continues to increase, and as the network becomes denser, it may be necessary to provide additional facilities. Where this is necessary, they must be placed where they can be easily accessed for maintenance and surveillance.

Waste receptacles are an absolute necessity throughout the trail network. Generally they should be located at regular intervals and in locations where they can be easily serviced. Mid block crossing points, staging areas, trail nodes and in association with other site amenities such as benches and interpretive signs are ideal locations. They must be monitored and emptied on a regular basis to prevent unsightly overflow.

8.3 Bicycle Parking

Adequate bicycle parking facilities at key locations throughout the network will allow trail users to confidently secure their bicycles while pausing along the trail, enjoying nearby attractions, reaching their destination, or taking a trail journey on foot. Key locations include trailheads, major trail nodes and lookouts. Proper bicycle parking facilities should be considered where multi-use trails intersect with pedestrian-only trails. The provision of bicycle parking facilities in these locations along with signing explaining the reasons for restricting bicycle use will help to discourage cycling on unsuitable trails, reinforce trail etiquette and encourage the proper use of the trail system.

Racks, whether as single units or grouped together, should be securely fastened to a mounting surface to prevent the theft of a bicycle attached to a rack. Another alternative is to create a bicycle rack that is large enough that it cannot be easily lifted or moved from its position with bicycles attached. Bicycle racks should be placed as close as possible to the trail facility that it serves, but not in a location where they would inhibit trail user flow.

Bicycle racks are made up of four main components: the rack element, the rack, the rack area and the rack area site. These components are described in greater detail in the following sections.

Bicycle Rack Element

The bicycle rack element is the portion of a bike rack that supports the bicycle. Bicycle rack elements can be joined on any common base or arranged in a regular array and fastened to a common mounting surface. The racks may be used to accommodate a varying number of bicycles securely in a particular location. Various types of available bicycle rack designs include the "Ribbon" rack, the "Ring" rack, the "Ring and Post" rack and the "Swerve" rack.

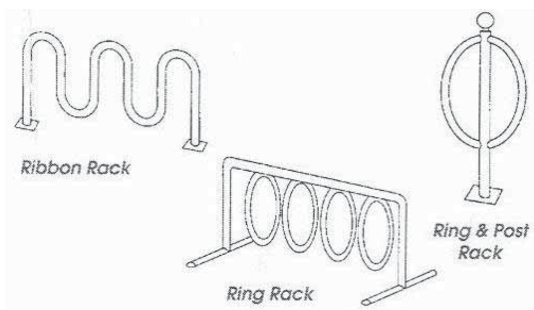


Figure A.37 - Various Bicycle Rack Designs

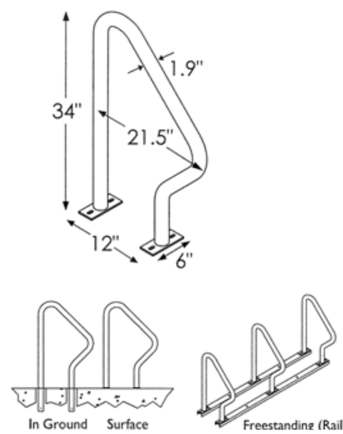


Figure A.38 - Swerve Rack Design

The rack element should:

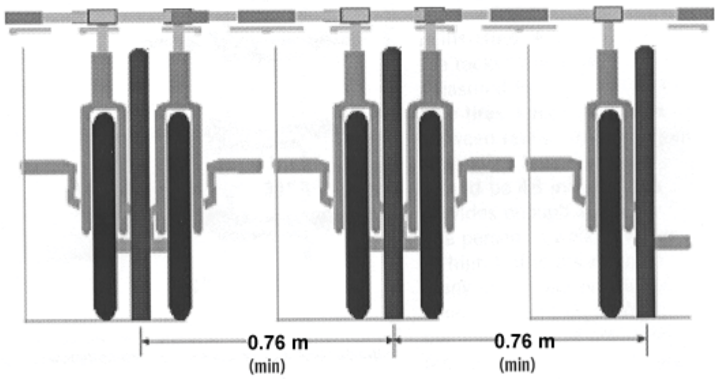
- Support the bicycle upright by its frame in two places;
- Prevent the wheel of the bicycle from tipping over;
- Enable the frame and one or both wheels to be secured;
- Support bicycles without a diamond-shaped frame with a horizontal top tube;
- Allow front-in parking: a U-lock should be able to lock the front wheel and the down tube of an upright bicycle; and
- Allow back-in parking: a U-lock should be able to lock the rear wheel and seat tube of the bicycle.

Bicycle racks should not only allow for a secure lock between the bicycle and the rack, but should also provide support for the bicycle frame itself.

The rack element should also be designed to resist being cut or detached by common hand tools such as bolt and pipe cutters, wrenches and pry bars which can easily be concealed in backpacks.

Bicycle Rack

Bicycle racks should consist of a grouping of the rack elements either by attaching them to a single frame or allowing them to remain as single elements mounted in close proximity to one another. Racks, whether as single units or grouped together, should be securely fastened to a mounting surface to prevent the theft of a bicycle attached to a rack. Another alternative is to create a bicycle rack that is so large that it cannot be easily lifted or moved from its position with bicycles attached.



A rack is one or more rack elements joined on a common base
or arranged in a regular array and fastened to a common mounting surface.

Figure A.39 - Bicycle Rack

Revised Figure from Bicycle Parking Guidelines: The Association of Pedestrian and Bicycle Professionals (APBP), www.apbp.org

Easy and independent bike access should be provided to the bicycle rack. Inverted "U" rack elements should be mounted in a row and placed on 750 mm (approximately 30") centres to allow enough room for two bicycles to be secured to each rack element. Bicycle racks should be arranged in a way so that is quick, easy and convenient for a cyclist to lock and unlock their bicycle to or from a rack.

Bicycle Rack Area

The rack area is essentially the "bicycle parking lot" and refers to the area where more than one bicycle rack is installed. Bicycle racks are separated by aisles, much like a typical motor vehicle parking lot. The recommended minimum width between aisles should be 1.2 m to provide enough space for one person to walk with one bicycle. Aisle widths of 1.8 m are recommended in high traffic areas where many users may retrieve their bicycle at the same time, such as after a school class. A 1.8 m depth should be provided for each row of parked bicycles since conventional bicycles are just less than 1.8 m long and can be accommodated in that space.

Large bicycle rack areas with a high turnover rate of arriving and departing cyclists should have more than one entrance to help facilitate user flow. If possible, the rack area should be sheltered to protect the bicycles from the elements by placing awnings and overhangs above the rack area.

Bicycle Rack Area Site

Bicycle racks should be placed as close as possible to the entrance that it serves, but not in a location where they would inhibit, pedestrian flow in and out of the building. Rack areas should be no more than 15 m from an entrance, and should be clearly visible along a major building approach line. Bicycle rack areas that are hard to find or that are located far from a building entrance are generally perceived as vulnerable to vandalism and will generally not be used by cyclists. To encourage use of a bicycle rack by cyclists, the rack site should be clearly visible and well lit.

Multiple buildings in an area should not be served by one distant bike rack. Rather, smaller bike racks should be placed in a convenient location at each building, but not in a manner that would obstruct utility access openings, garbage disposal bins, doorways or other building access points.

Bicycle racks can be placed on concrete, asphalt or brick surfaces. Bicycle racks should be securely fastened to the surface to prevent shifting or removal. If they cannot be fastened to the surface, then they should be large and heavy enough so that they cannot be easily moved.

Bicycle racks placed on grass surfaces cannot be secured to the ground, therefore they should also be heavy enough so that they cannot be moved. To avoid excessive bicycle riding on the grass, bicycle racks should only be placed on grass surfaces located within close proximity to a paved cycling route, such as on off-road multi-use trail, or an on-road route. Bicycle racks on grass surfaces should be considered temporary, and every effort should be made to relocate them to a permanent, hard surface area or a concrete pad can be paved in an approved area to accommodate bicycle parking.

Bicycle racks should not be placed within bus loading areas, taxi zones, goods delivery zones and emergency vehicle zones. In addition, it should be placed at least 4.0 m away from a fire hydrant, 2.5 m from a driveway or access lane and 10.0 m from an intersection.

Generally bicycle parking devices/facilities should:

- Enable the bicycle to be securely locked to the device without damaging the bicycle, and be easy to use without the need for detailed instructions;
- Be placed along key trail routes, connections and other destinations where cyclists are expected;
- Be placed in public view where possible, where they can be viewed by passers-by, trail attendants, fellow workers, etc.;
- Present no hazard to pedestrians;
- Be easily accessible from the road or trail;
- Be arranged so that parking manoeuvres will not damage adjacent bicycles;
- Be as close as possible to the cyclist’s destination;
- Be sheltered from inclement weather, where possible and practical; and
- Be located in areas that are optimal for deterring theft and vandalism.

8.4 Trails in Natural Areas and Environmental Buffers

Trail users often seek natural areas to find relief from the urban environment. In many cases, trails are compatible with natural areas, in some cases they are not. Where trails are appropriate, it is important that they are sited and designed appropriately and that the area be monitored for the effects of inappropriate use and/or overuse. If trails are not carefully planned, designed, constructed and maintained in these areas, people will create their own trail routes sometimes in sensitive locations where it would be preferable not to have trails at all. Proper planning, design and construction of trails, coupled with public education can go a long way to achieving the balance between use and protection.

Change in natural systems is inevitable, especially where there are significant changes in the character of lands surrounding the natural area. Managing change is the key and this involves deciding what an acceptable limit of change should be, and having a plan in place should the change exceed the acceptable limit. Using background ecological data such as the Ecological Land Classification (ELC) system, a natural area can be divided into different zones based on sensitivity to disturbance. Using sensitivity mapping, decisions can be made regarding trail closures, rerouting, design strategies as well as a definition of indicators of disturbance over and above an acceptable threshold. Critical wildlife habitat may also be used in delineating management zones. Consultation with the local Conservation Authority and local branch of the Ministry of Natural Resources is recommended for issues regarding vegetation communities and critical wildlife habitat.

In some cases, trails (and people) should not be in natural areas. Vegetation communities that are highly sensitive to disturbance and narrow and constrained wildlife corridors are two examples where trails may not be appropriate. In these cases, it is advisable to provide alternative trail routes and information (e.g. signing, public information campaigns, etc.) explaining the management decision to exclude trails from the area. When designing trails through sensitive natural heritage features the following general considerations should include:

- Route or reroute to avoid the most sensitive and/or critical habitats;
- Interpret sensitive species away from their location;
- Balance the effect of alternatives;
- Use previously disturbed areas where possible and appropriate;
- Maintain natural process;
- Limit accessibility;
- Incorporate habitat enhancements; and
- Complement and highlight natural features.

Where trail routes are being proposed within environmental buffers surrounding natural sensitive heritage features, the conditions in the buffer (width, slope, etc.) are sufficient to support the development of a trail such that the intended function of the buffer is not compromised.

8.5 Utility Corridors and Trails

Pipeline and hydro corridors, municipal water, storm and sanitary sewer lines are examples of linear corridors that provide excellent opportunities for trail development and should be considered for the development of trails in the Town of East Gwillimbury. Utility lines in urban areas often have a substantial easement, and in many cases are used informally for trail access as they tend to provide direct connections to a variety of destinations over and long distance. In rural areas the ability to provide trails in utility corridors is usually more limited as the easement may be much narrower and in the case of hydro corridors, may be limited to an area around the base of the towers

As previously discussed, abandoned railways are a valuable asset and present an opportunity for trail development. In addition, they may provide linear corridors for future transportation links (roads, future rail, light rail and transit). As well, easements can be leased to utility companies for underground transmission lines thus helping to offset the cost of owning, operating and maintaining a multi-use trail on the abandoned rail bed.

8.6 Creating New Trails in Established Neighbourhoods

There is no question that it can be challenging to implement trails in established neighbourhoods, even if the intent to do so has been clearly documented in strategic plans like the East Gwillimbury Active Transportation and Trails Master Plan. It is sometimes difficult to obtain public opinion related to specific trail segments at the strategic planning stage and it is not until a project reaches the implementation stage that residents who perceive themselves as being directly affected become more involved and vocal. Real and perceived concerns over increased traffic/access to their rear yards, invasion of privacy, the increased potential for vandalism and theft are often cited as key concerns. One way to overcome this challenge is to engage residents in an open, iterative consultation process in the earliest possible stages of the project.

8.7 Trail Closures and Rehabilitations

From time to time it will be necessary to temporarily close sections of trails or entire routes to public access. Situations such as inundation by water, culvert washout or general trail construction are typical reasons for temporary trail closures. As these situations arise, users must be informed well in advance of the closure. If the closure is planned, advance notices should be placed at all access points for the affected section(s). In the event of an emergency closure, notices must be placed at these locations immediately following the discovery of the problem. Signing and temporary barricades, notification in community newspapers, on local radio stations and the Town of East Gwillimbury website are possible methods of informing users of about temporary trail closures.

Permanent trail closures may be required at some point in the life cycle of the trail, especially in the case of trails in woodlots and other natural settings. It is important when closing a trail to rehabilitate the landscape to match the surrounding conditions, inform trail users that it has been closed, and to provide reasons for the closure. The figure on the following page illustrates a typical permanent trail closure and rehabilitation in a naturalized setting.

Depending on the location, appropriate rehabilitation measures in natural/naturalized settings may include:

- Slope stabilization, using engineered material and methods for severely eroded slopes;
- Terracing, using locally collected low-tech materials for eroded slopes of moderate and low severity;
- Live staking using locally collected cuttings from appropriate species;

- Plantings with appropriate native species (may include plants salvaged from nearby sites that will be cleared for development, roadway widening etc.);
- The application of erosion blankets and mulches;
- Seeding with mixes that are appropriate for the site in which they are to be applied;
- Scarification of the surface of the trail to be closed and covering it with forest litter (leaves, branches, and limbs) in a naturalistic manner which can help to reinforce the message that the trail is closed, reduce erosion, and supply nutrients to plants during establishment;
- Placement of a detector object at the beginning of the closure area so that the closure can detected by visually impaired users; and
- Erecting signage describing the closure to inform users of the conditions and “Water Me” signs for newly planted trees.

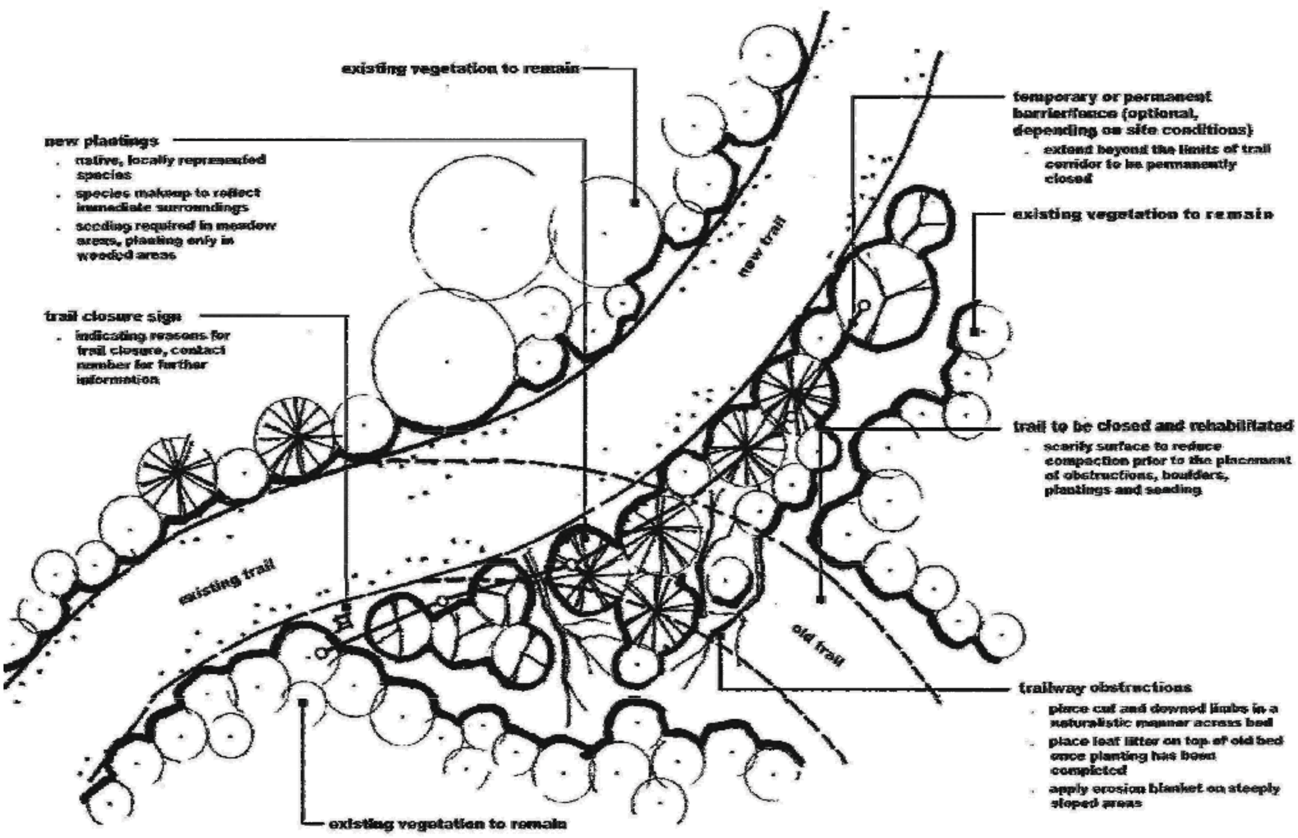


Figure A.40 - Typical Permanent Trail Closure and Rehabilitation in a Naturalized Setting

9.0 Guideline Application

The application of these guidelines in the development, implementation, and operation of individual sites will require specific consideration of a number of factors including public safety, local and/or provincial jurisdiction requirements, building codes and by-laws.

Where existing on and off-road trails and facilities are to be incorporated as part of the Town of East Gwillimbury on and off-road trail and active transportation system but do not meet the minimum recommended conditions described in these Guidelines, the following approach should be considered:

1. Examine the trail or route to identify any design issues, or areas that may be seen as a potential risk to trail users.

2. Assess whether the trail is reasonably capable of handling anticipated levels of use.

3. Set up a monitoring program to identify emerging problems.

4. If necessary, establish an upgrading program to addresses areas of risk and/or emerging problems, as this helps to create awareness and appreciation towards the issue(s), and determines ways in which they can be resolved so that at least the minimum recommended guidelines can be achieved over time.