

CHAPTER 5 BUILDING TRAILS

5.1 Introduction

This section is a compendium of design guidelines based on best practices and covers a wide range of conditions that will typically be encountered during the construction of the Guelph Trail system. **Figures 5-1 through 5-24** (at end of this chapter) illustrate key design aspects of the various network components. Although they are generic in nature, critical dimensions and standards (where they exist) are noted. At the time each segment of the network becomes a priority for implementation, detailed design studies will be required so that the spirit and intent of the relevant details can be applied in response to site specific conditions.

5.2 Trail Types

5.2.1 Off-road Trails

Figure 5-1 through **5-7** illustrate the design aspects of off-road trails in the Guelph Trail system. The chart included in 5-1 provides recommendations for width and surface type for primary, secondary and tertiary trails in different locations, and 5-2 to 5-7 provide further detail. Preferred dimensions are noted but it must be recognized that some adjustments may be necessary to accommodate trails in certain locations.

Primary and Secondary Off-road Trails

Primary and Secondary trails accommodate the widest spectrum of users. They are wider, and may have an asphalt or granular surface (see discussion below for trail surfacing options). Though generally a granular surface, asphalt should be applied to secondary trails where; volumes of use are high, there are specific requests for asphalt by residents, and/or on slopes where erosion is a problem. The clearing width, clearance zone and sight line requirements are greater than those for tertiary trails.

Tertiary Off-road Trails

Tertiary trails are generally narrow and follow the topography quite closely. Typically 0.5m to 1.5m in width they usually have an earth, mown grass or wood chip surface. Some tertiary trails may be accessible by users with mobility-assisted devices where the conditions are conducive. On some slopes, it may be desirable to provide a hardened surface to reduce erosion and to help prevent trail widening.

Separated Trails

In some areas, where trail use is high and adequate space exists, it may be appropriate to provide physically separated trails for primary/secondary and tertiary trail uses, creating opportunities for both faster multiple uses as well as slower trail uses within the same corridor. Where this design treatment is appropriate, separation of the primary/secondary trail from the tertiary trail can be created by distance, grade, or vegetated buffers. Signs to identify permitted uses for each trail are necessary to ensure the integrity of the separated system. Although no locations are currently shown, these can be developed over time where/if necessary.

Boulevard Multi-Use Trails

A boulevard multi-use trail can be used to create links between off-road trails in areas where the characteristics of the boulevard are suitable. Because cyclists using boulevard trails are required to yield to other vehicles at driveways (whereas cyclists using the road have the right-of-way as they intersect private driveways and side streets), 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);
- Along corridors where there are limited commercial or residential driveway crossings. The following guideline thresholds have been applied in several other municipalities and are suggested for Guelph.

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

Table 5. Guidelines for Consideration of Boulevard Multi-use Trails.

Figure 5-8 provides an illustration of a typical Boulevard Multi-Use Trail. 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 minimum preferred setback is 3.0-4.5m from the curb. Where no trees are included and vehicle speed is 60km/hr or less, the preferred setback can be reduced to 2.0m;
- 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;
- 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 site lines at intersections with driveways and roadways;
- Centre yellow line on trail to separate directions of travel (optional) and to guide riders overtaking pedestrians and slower moving riders;
- Curb ramps at driveways and roadway intersections.

Boulevard Trails and New Road Construction

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 GTMP recommends a necessary 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).

Off-road Trail Surfacing Options

There are a number of options for off-road trail bases and surfaces, those considered appropriate for the Guelph Trail include:

- Asphalt and asphalt mixes;
- Concrete and Unit Pavers (certain applications only);
- Compacted granulars (Limestone screenings/stonedust A, B Gravel and Pit Run);
- Wood Chips and Bark Mulches;
- Earth, and
- Soil Cement.

Each material has specific characteristics, advantages, disadvantages and locations where they are appropriate (refer to chart on **Figure 5-1 and Figures 5-2 through 5-7**).

Asphalt and Asphalt Mixes

Asphalt is a very durable and flexible surface material that is costly to install relative to other trail surfaces, but requires very little maintenance until major repairs or replacements are required. Though the lifespan depends on the quality of the base and the initial installation, 15 years is a reasonable life expectancy. Asphalt trails can be easier to keep open during the winter months and in some cases are 'self-clearing' as radiant energy absorbed by the surface can melt snow and ice. Recently, asphalt mixes have been introduced that use recycled materials such as asphalt shingles and glass. These should be tested in Guelph. Patterned asphalt provides visual interest, but can be difficult for in-line skaters, scooters,

mobility-assisted devices and small-wheeled users to negotiate. Generally, patterned asphalt is not recommended. In specific situations (i.e. where urban design requires a textured surface) patterned asphalt or unit pavers may be appropriate over short distances. Where possible, shading of the trail with trees should be considered as this will help reduce radiant heat on the trails during summer months.

Asphalt surfaces are suitable on trails designed for all uses and levels of experience. Because asphalt can be visually intrusive it is appropriate only for primary trails or in the case of secondary trails where trail hardening is required (i.e. steep slopes), and/or where there is a request for asphalt by neighbourhood residents.

Concrete and Unit Pavers

Concrete provides an extremely durable surface. However, less surface flexibility and very high installation cost make it appropriate only for special applications. Though concrete is used on sidewalks and urban settings such as plazas, it is generally not recommended for trails in park and open space settings. Even though expansion joints are included with concrete applications, cracking will occur over time and differential heaving often results in large cracks, steps, and pieces being displaced.

Like concrete, unit pavers are durable, but costly to install. They offer the advantage that they can be lifted and reset to combat settling and displacement that occurs over time. Like the patterned asphalt, the textured surface can be difficult for some users to negotiate. Unit pavers are generally not recommended, except where an urban design situation demands the colour and/or texture offered by this surface type.

In the case of the boulevard trail, many municipalities have shifted away from their practice of “concrete only” for sidewalks to allowing asphalt for boulevard trail applications. Though the life span is shorter than that of concrete, it is more conducive to multiple uses, especially for small wheel uses and mobility-assisted devices.

Granular Materials

Limestone Screenings (Stone Dust)

Limestone Screenings or stone dust is a granular material of fine particle size, which, when applied and compacted on a trail surface creates a smooth, fine granular surface that most users except in-line skaters can negotiate with confidence. Persons who use mobility-assisted devices do report however that the shards picked up by their wheels can injure their hands unless gloves are worn. Screenings are best used as a top course or as a trail hardening material on trails with a low to moderate erosion problem. They are not suitable as base material for wet trails or on soils with low stability and require more maintenance following heavy rainfall than hard surface treatments. Trail hardening with asphalt or asphalt mixes should be considered on long or steep slopes. They can be used on most tertiary trails with the exception of special purpose trails in natural and/environmentally sensitive areas where stone dust may be inappropriate from an ecological and aesthetic point of view.

Other Granulars

Other granulars (gravels) are best used as a base course but can also be useful for trail surfacing, trail hardening, repair and rehabilitation in certain locations. Crushed products are preferred over screened products as the angular surfaces tend to interlock, creating a more stable surface. Gravel drains well and provides good traction where used as a surface course. Over time the surface gradually ages and becomes covered with leaf litter and loses its “new” look, eventually taking on the appearance of a natural trail surface. In many tertiary trail applications, gravel can be mixed with the existing natural surface material to form a solid, stable trail bed.

The following are some selected gravel products along with some recommended applications for each:

- **'A' Gravel** contains fines (sand) and crushed stone up to about 20mm in diameter. It can be used as a surface course on tertiary trails in locations where the stability of the trail surface requires improvement or erosion is a problem.
- **'B' Gravel** contains fines (sand) and crushed stone or screened stone up to about 150mm (6") in diameter. It makes a good trail base material and suitable for trails in low, wet areas where boardwalks are not necessary. A surface course of a finer granular should be applied.
- **Pit Run** contains particles that vary widely in size and mix can vary from one load to another. It is less costly than screened or crushed materials but the particle size is can vary widely. Pit run can be used to create a solid base upon which a finer surface course can be applied.
- **Clear granulars** are useful for backfilling retaining structures and creating drainage features along and across the trail. They are not recommended for trail surfacing because the absence of granular fines prevents the compaction necessary for a stable surface.

Bark Mulch and Wood Chips

Mulches are good for walking and hiking trails, and are well suited to areas where tree roots are exposed. However, they tend to migrate under heavy foot traffic and regular maintenance is necessary to keep an adequate cover of wood chips in place. Mulches are very difficult if not impossible for most wheeled users with the exception of mountain bicycles, therefore the use of mulched surfaces is only appropriate in specialized locations. Where pedestrian uses only are permitted, the use of wood chips and mulches can help to discourage non-permitted users.

Earth Surface

The natural or earth surface a desirable and cost-effective trail for use on tertiary trails. Earthen surfaces blend visually with the surroundings and generally do not require additional material to be imported. Existing soil conditions will influence the decision to use earth surfaces or to import materials. Poorly drained and permanently wet soils generally do not make for good trail surfaces. In this situation, alternative trail surfacing such as granulars or boardwalks should be considered. Soil Cement is a mix of portland cement, water and parent materials from the trail bed. This is an excellent mix for repair of eroded sections of tertiary trails that receive high traffic, and trail repairs in remote areas as fewer materials (volume and weight) need to be imported. Because soil cements use existing parent materials, they look very natural and fit well with surroundings.

5.2.2. On-road Routes

One of the objectives of the GTMP is to develop a trail network that is off-road wherever possible. In some cases this will be impossible in the short, or even long term. In some areas of the city, particularly the older residential neighbourhoods, public open space is confined to road rights-of-way and centralized parks. Where public land (other than the road right-of-way) is not available and access agreements for trails on private lands are not feasible, it is necessary to provide connecting links using the road network. Where this is the case, pedestrians and other small-wheeled users (strollers, in-line skaters, users with mobility-assisted devices etc.) are expected to use the sidewalks, whereas cyclists are expected to use the road.

Because there is legislation pertaining to the operation of bicycles on roadways and there is a well-established set of guidelines and standards for the development of on-road cycling facilities, a brief discussion of on-road cycling facilities is an important aspect of the GTMP. 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.

Figure 5-9 provides a summary of the standards for the most commonly encountered situations in developing on-road cycling facilities. Several options 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 standards can be applied, there are often situations where the proper design requires a bicycle system design specialist who is familiar with not only the standards, but also with innovative techniques that have been successfully applied elsewhere.

The following sections elaborate on the facility types illustrated on **Figure 5-9**. It is recommended that the City of Guelph staff refer to the most recent manuals available from TAC to fully appreciate the intricacies of on-road bicycle facility design.

Bicycle Lanes

Bike lanes are typically located on urban 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. Providing the physical space on the roadway is an excellent method of encouraging a higher percentage of the population to cycle on-road over the long term. In areas where on-road parking is present, continuing the bike lane as shown in **Figure 5-9** 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 and ramped curb (to allow users with mobility-assisted devices to reach the sidewalk) where feasible.

Paved Shoulder

Paved shoulders provide a space for cyclists on rural cross-section-roads (shoulders, no curb and gutter). Though not preferred, other users such as pedestrians and runners can use this on-road space where there is insufficient public space to develop an off-road connection. It has also been shown that paved shoulders also reduce erosion and long-term maintenance costs of the road, and reduce the potential for single vehicle run-off-the-road accidents.

Wide Curb or Shared-Use Lanes

Wide lanes are used on roads where vehicle speeds or traffic volumes are higher than those associated with signed routes (e.g. arterial and collector roads). Where necessary or desirable, the bicycle symbol and “shared use” can be painted on the road at regular intervals to inform road users to expect cyclists.

Signed Routes

Signed routes are typically found along roads where traffic volumes and vehicle speeds are low. Typical of quieter residential streets and other lower order roads, there is no need for a designated on-road space for cyclists. Other users are intended to use sidewalks. Signs located at changes in direction or at street corners 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.

5.2.3. Water Routes

Guelph is fortunate to have two heritage rivers within its boundaries, and like most other cities, is home to a number of canoe enthusiasts. Having water routes as a component of the trail system will provide the city with the opportunity to promote this asset. Several reaches of the Eramosa and Speed offer excellent flat water canoeing. The confluence of the Speed and Eramosa is in the heart of the city and is located at the proposed hub of Guelph's trail network. From this location, the Eramosa River is a flat, easy paddle upstream almost to Stone Road and downstream to the dam in Silvercreek Park. Other opportunities exist from Victoria Road downstream on the Speed to Riverside Park, and downstream of the Hanlon Expressway to Hespeler.

Few if any improvements are required to water routes in these sections. Because of their linear character and several informal access points, these sections of the Eramosa and Speed Rivers are a natural extension of the land-based trail system. Other sections such as the reaches of the Speed River between Riverside Park and its confluence with the Eramosa River contain shallower and/or faster water with obstructions that are not recommended for canoeists. If and when long-debated changes such as the removal of the weirs are made to the Eramosa in Silvercreek Park, this section may also be appropriate as a water route (depending on water depth and flow characteristics following weir removal). Users of the water routes should be educated about their rights and responsibilities regarding the use of the rivers. Section 5.3.4 and **Figure 5-10** provide some criteria for the creation of canoe launch points. Typical upgrades are minimal and include parking (which may be combined with existing parking in some locations), access to the river's edge and signage along the routes to draw attention to potential hazards.

5.3 Trail Access Points

The trail system in Guelph can be accessed at a number of locations throughout the city. The following sections provide the key features that should be incorporated into the design of major and minor trailheads, canoe launches, trail junctions and roadway crossings, and trail gateways.

5.3.1 Major Trailheads

Major staging 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. As illustrated in **Figure 5-11**, a well-designed trail staging area typically incorporates the following elements:

- Parking (the number of spaces required should relate to the anticipated level of use for the staging area and the design should provide the flexibility to increase the number of spaces if the demand exceeds the anticipated level);
- Trail access barriers (**Figure 5-12**);
- Parking areas should also include an appropriate number of accessible parking spaces according to Guelph Accessibility design standards;
- Easy access to and from the trail system;
- Ample room to load and unload equipment such as bicycles or canoes (space requirement will vary depending on permitted trail uses);
- Secure bicycle parking facilities;
- Waste receptacles;

- Lighting (may or may not be included, depending on location and site context);
- Signing (including trail directional signing and mapping/interpretive signing so that trail users can plan their journey);
- Drinking water/refreshments (vending machines as City health regulations do not support drinking fountains in parks) and washrooms (typically at major trailheads only);
- Seating and or picnic/informal activity space (more often associated with a major staging area that includes an open gathering space);
- A food concession and/or other entrepreneurial facilities (i.e. canoe rentals, bicycle rentals) may also be available, depending on the size and setting for the major staging area.

5.3.2 Minor Trailheads

Minor trailheads areas (**Figure 5-10**) are located throughout the city. Ideal locations include community parks and other key publicly owned properties. In some locations it may be possible to share parking and washrooms with other community facilities or other partners (e.g. School Board, Conservation Authority).

Typical amenities include:

- Parking for 3-5 cars;
- Trail access barriers (**Figure 5-12**);
- Ample room to load and unload equipment such as bicycles or canoes (space requirement will vary depending on permitted trail uses);
- Waste receptacles; and
- Signing (including trail directional signing and mapping/interpretive signing so that trail users can plan their journey);

5.3.3 Trail Access Barriers

Trail access barriers are intended to allow free flowing passage by permitted trail user groups, and prohibit access by non-permitted trail users groups. Access barriers also require some mechanism to allow their temporary removal for service vehicle access. There are many designs for trail access barriers in use by different trail organizations, some are more successful than others. In Guelph, trail access barriers can be generally grouped into three categories:

- Bollards;
- Offset Swing Gates;
- Single Swing Gates.

Bollards

The bollard is the least costly access barrier. In Guelph, older installations typically consist of fixed vertical wood posts (150mmx150mm pressure treated timber, or peeled cedar posts). More recent bollard installations consist of several fixed vertical metal posts beyond the limit of the trail bed, accompanied by removable metal posts spaced at regular intervals across the trail bed. An odd number of bollards (usually 1 or 3) are placed in the trail bed in order to create an even number of “lanes” for trail users to follow as they pass through the barrier. Older wood fixed bollards are not removable for service access or special events where large numbers of users may be on the trail at one time. Although the

newer removable metal bollard system provides this flexibility, Operations staff report that they are difficult to maintain as the metal sleeves placed below grade can be damaged by equipment and tend to become jammed with gravel and debris from the trail bed.

Offset Swing Gates

Similar to the single swing gate, except that barriers are paired and offset from one another. This type has been used in several locations throughout Guelph including Pine Ridge Estates and Riverside Park. Although they can be effective in limiting access by unauthorized users and can be easily opened by Operations staff, some groups including cyclists, cyclists pulling trailers and users with mobility-assisted devices can have difficulty negotiating the offset swing gate.

Single Swing Gates

This style of barrier has been recently tested in a few locations throughout the city. The results are very favourable. The single swing barrier combines the ease of opening for service vehicle access, with the ease of passage of the bollard. **Figure 5-12** provides a construction detail for the Single Swing Gate currently being used in several locations throughout the city. It also contains some suggested modifications to meet the needs of users visually impaired users.

The Single Swing Gate is recommended for future access barrier installations in the Guelph Trail system. Existing bollard systems should be replaced over time as part of the trail upgrading process. Existing double swing gates can remain in place provided that they are adequately spaced to allow free flowing passage by all permitted user groups.

Additional Treatments Beyond The Ends of Barriers

Based on site specific conditions, it may be necessary to provide additional landscape treatments beyond the ends of the access barrier to prevent permitted and prohibited users from bypassing the barrier altogether. Each access point should be evaluated to determine if additional treatments are necessary. Additional treatments can consist of plantings, boulders, fencing or extension of the barrier treatment depending on the setting.

5.3.4 Canoe Launches

Figure 5-10 also illustrates the basic requirements for canoe launches. Ideally, parking should be located as close as possible to the launch point so the portage distance can be minimized. In addition, the portage route between the parking area and launch ramp should be relatively straight with no obstructions. Bollards or swing gates are preferred over offset gates at these locations. A 3 to 4m wide launch area at the river's edge will provide adequate room for canoeists/kayakers to load and unload. Where necessary, this width can be reduced to 2m. Signing along the shoreline upstream and downstream of the launch point will help to direct users to the dedicated launch point, minimizing unnecessary damage to the shoreline in other areas.

5.3.5 Trail Junctions and Roadway Crossings

A junction is an intersection of two or more trails. Junctions are ideal locations for rest stops and wayfinding signage. Refer to **Figure 5-13**.

A significant challenge for municipalities implementing trail systems is how to accommodate crossings of roads. In the case of busy arterial and collector roads, ideal trail crossing designs can be:

- Grade separated;
- Occur at an existing signalized or stop-controlled intersection; or
- At a mid-block pedestrian signal/pedestrian half signal (e.g. Kortright Road at Preservation Park).

In the case of lower volume, lower speed roads the crossing can be much simpler. **Figures 5-14 through 5-17** illustrate the key aspects of trail crossings of roadways. **Figures 5-14 and 5-15** deal with mid-block trail crossings of minor roads and **Figures 5-16 and 5-17** relate to the crossing of collector and arterial roads.

Trail crossings of minor 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;
- Curb ramps (to current City of Guelph Accessibility standards) with tactile indicator (where appropriate) on both sides of the road;

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 will force trail users to slow and stop prior to crossing. Changes to the streetscape may also provide a traffic calming effect for vehicles. **Figure 5-14** provides an illustration of this concept.

When a mid-block crossing is necessary, it should be designed to provide advance warning to both motorists and trail users of the upcoming crossing. The trail should be designed and signed to reduce speed (in the case of faster moving users) and stop. Grade changes on the trail in advance of the crossing combined with adequate sight distance, signing, textural surface contrast, tactile band where appropriate, and access barriers may also be considered.

Mid-block crossings of arterial or collector roads may warrant consideration of a mid-block pedestrian signal. **Figure 5-16** illustrates one example of a typical mid-block trail crossing. As part of an evaluation of potential locations for a Mid-block Pedestrian Signal, consideration must be given to:

- Proximity to the nearest signalized intersection. Traffic Services notes that 215m is the desired minimum);
- Potential concerns regarding coordination of nearby signals along the road corridor. Coordination issues may lead to the perception of long delays in triggering the signals to stop traffic; and
- Cost.

Consideration may also be given to changing the texture/colour/elevation of the roadway itself (in addition to the detail that is paid to the treatment of the trail approach) to provide drivers with a visual cue to exercise caution.

In some cases the preferred solution is to provide a median refuge for trail users. The refuge (**Figure 5-16**) provides users with a safe point in the middle of the roadway enabling them to negotiate the crossing of one direction of traffic at a time.

Mid-Block Crossing Warrant

If a trail crossing at a collector or arterial road is within the threshold distance to a signalized intersection, or a mid-block pedestrian signal, trail users should be directed to cross at this location. Once beyond

these threshold levels, trail users often ignore the protected crossing and attempt to cross at an unprotected point. **Figure 5-17** provides an illustration of this concept and provides some direction regarding the application of signage at the appropriate points to guide trail users to the intersection, and to warn sidewalk users that they may encounter cyclists on this portion of the sidewalk. Note that cyclists are expected (reinforced with signs) to dismount and walk their bicycles through the intersection per the Highway Traffic Act.

Although more conservative than the threshold identified by Traffic Services, the following guideline threshold distances for mid-block crossings have been used in other Ontario municipalities.

Road Class/Type	Threshold Distance to Nearest Signalized Intersection
2 Lane Collector Roadway:	No less than 60m from nearest protected crossing (traffic signal or mid block pedestrian signal)
4 Lane Collector or Arterial Roadway:	No less than 120m from nearest protected crossing (traffic signal or mid-block pedestrian signal)

Table 6. Guideline Threshold Distances: For Mid-block Trail Crossings that have been applied in other municipalities.

5.3.6 Trail Gateways

In most cases the trail gateway is articulated with a sign indicating to the trail user that they have entered into Guelph. This is the first opportunity to introduce the Guelph trail logo and character of the trail system as expressed through the design of the sign and the trail gateway. In cases where the trail gateway is located in a rural setting it may be limited to simply a sign. Where the trail gateway is in an urban setting, or in a prominent location (such as the Trans Canada Trail) a more elaborate treatment may be desirable and include a plaza setting with hard surfacing, kiosks, landscape treatments and furnishings.

5.4. Barrier Free Access

Where possible and practical, trails should be designed to be accessible to all levels of ability. It must be recognized however, that not all trails throughout the system can be fully accessible. The following should be considered during the development of new trails and when making improvements to existing trails:

- The most current accessibility standards published by the Guelph Accessibility Advisory Committee should be consulted;
- Where the trail requires an accessibility solution that is above and beyond what is normally encountered, a representative of the Guelph Accessibility Advisory Committee must be consulted during the design process. The first consultation should take place early on in the process to determine if it is practical and desirable to design the specific trail to meet standards for disabled access. Where it has been determined that full accessibility is appropriate, the representative should be consulted during the detailed design process to ensure that the design is appropriate;
- Where grades and/or site conditions make the construction of a structure necessary, the Guelph Accessibility Advisory Committee should be consulted regarding the location and design if necessary;

- Primary and secondary trails that provide connections to important destinations should be fully accessible;
- Work with the Guelph Accessibility Advisory Committee to develop signage/content to clearly indicate trail conditions from the point of view of accessibility. This will allow users with mobility-assisted devices to make an informed decision about using a particular trail prior to travelling on it (e.g. steep slopes, structures, cross slopes greater than 2%);
- Steep slopes are one of the most significant barriers for the disabled. Designing trails to be within the 8.3% threshold for disabled access will not only overcome this significant barrier but it will help to reduce the potential for erosion of the trail surface;
- Design guidelines are intended to have some flexibility in order to accommodate site conditions as well as take advantage of opportunities for trail users of all ability levels to experience the variety of environments through which the trail network travels. For example the creation of a barrier-free loop in Preservation Park could be an interesting asset for the trail system, but this would require a modification of the trail design standard for woodlots;
- Over time, curb cuts and tactile warning strips at mid-block trail crossings and at roadway intersections should be constructed/retrofitted to meet the most current disability standards. As noted in section 4.7 the number of curb crossings throughout network has been included. When budgeting for implementation, the construction and/or upgrading of curb cuts will need to be included. Opportunities to secure additional funding for increasing accessibility in parks and on trails should be sought wherever possible. (refer to section 4.7.2).

5.5 Trail Structures

To overcome some of the physical trail barriers throughout the city (rivers, highways, railroads etc.) it will be necessary to construct structures. Bridges, stairways, switchbacks and elevated trailbeds can be used to cross waterways and wetlands, and to negotiate steep slopes.

5.5.1. Bridges

Bridges are necessary for crossing rivers and streams. Where possible, the trail network should make use of existing bridges (pedestrian bridges and/or vehicular bridges where there is adequate space). In cases where this is not possible a new structure is proposed. Prefabricated steel truss bridges are a practical, cost effective solution for most situations. In some locations a wooden structure constructed on site may be more appropriate. 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.

5.5.2 Switchbacks

Pedestrian, motorized and some self-propelled users are capable of ascending grades of 30% or more. Some users are limited to grades of less than 10%. A Switchback (**Figure 5-18**) is one method of traversing a steep grade yet maintaining the ability for wheeled users to travel up and down the slope. When properly constructed, water is removed from the trailbed at regular intervals reducing its erosive power. They are constructed with turns of about 180 degrees and are used to decrease the grade of the trail. Typically they require extensive grading and are recommended only in locations where construction activity will not cause major disruption to the surrounding environment.

5.5.3 Stairways

For very steeply sloped areas where there is inadequate room to develop a switchback and/or other fully accessible solution, it may be necessary to construct a stairway. In these situations the site should be carefully studied so that the most suitable design can be developed. In addition, a representative of the Guelph Accessibility Advisory Committee should be informed of the decision as the use of a structure will limit access for users with mobility-assisted devices. 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;
- 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. Rough sawn Ontario White Cedar is long lasting and readily available;
- Incorporate barriers on either side of the upper and lower landing to prevent trail users from bypassing the stairs;
- Provide signs well in advance of the structure to inform users that may not be able to climb stairs.

5.5.4. Elevated Trailbeds

Where trails must pass through sensitive environments such as wet or boggy soils, areas with a proliferation of large roots that are either exposed or near the surface, a structure may be required to maintain the integrity of the trail and minimize environmental damage. If left unmitigated, users will walk around wet areas, creating a wider trail(s) through the surrounding vegetation.

Figure 5-19 provides details for turnpikes and boardwalks, two relatively simple yet effective methods for tertiary trails. The turnpike can be used along the trail in wet areas where a trail on grade will become rutted, or in a sensitive area where it is desirable to keep foot traffic away from surrounding vegetation. A 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. The following link provides some useful information (<http://www.fhwa.dot.gov/environment/fspubs/00232838/>).

Low profile boardwalks have been successfully implemented in the Hanlon Creek Conservation Area. Precast deck blocks used for the foundation of the boardwalk makes construction simple enough that volunteers can assist. Where the trail is in a high profile location, where it is necessary to provide a fully accessible trail, or where the trail surface must be greater than 60cm above the surrounding grade, a more sophisticated design and installation is necessary. This may include engineered footings or abutments, structural elements and railings. A professional who is familiar with applicable standards and legislation should be retained for these types of applications.

Figure 5-20 provides a conceptual detail for elevated trailbeds on a primary or secondary trail.

5.6 Trail Drainage

Dealing with surface runoff is one of the most significant and persistent maintenance challenges for trail managers. Erosion on sloped trails and where trail surface changes occur are two of the most common locations where trail erosion takes place. Collecting water and diverting it from the trail bed at regular intervals is the most effective way to reduce or prevent erosion.

5.6.1. On The Trail Bed

The greater the distance water is allowed to travel along the trailbed, the more significant the erosion tends to be. Until recently, waterbars and other similar structures placed in the trailbed were the preferred method of collecting and removing water. However, these can become ineffective if not maintained on a regular basis. Some user groups (e.g. cyclists and trail users with mobility-assisted devices) find them difficult or dangerous to pass over when the trail is wet.

The rolling grade dip (**Figure 5-21**) is a modification of the longitudinal slope of the trail at regular intervals. Because it is designed to be a gentle modification of the longitudinal slope rather than an abrupt interruption of the longitudinal slope as is the case with the waterbar, most trail users find them easier to negotiate. The rolling grade dip may be difficult for trail users with mobility-assisted devices, therefore advance signing will allow users to make a decision regarding their route prior to traveling along the trail. Though more commonly applied to granular surfaced trails, the rolling grade dip may also be used on hard surfaced trails where long, steep slopes are involved.

5.6.2. Below the Trail Bed

Where surface water must cross the trailbed, culverts and drain tiles are a simple and cost effective technique. In the case of tertiary trails where there is a small amount of surface water flowing on a regular or intermittent basis, the cobble drain (**Figure 5-22**) is a low-tech solution that can often be built with materials found on site during trail construction. Stones ranging in diameter from 50-100 mm in diameter are partially buried into the grade to create a protected channel allowing surface water pass from one side of the trail to the other. Note that this type of drain is not appropriate for trails where wheeled users other than mountain bikes are expected.

Methods such as bridging are necessary for small streams and creeks as protection of fish habitat is an important concern that needs to be addressed through consultation with the Grand River Conservation Authority.

5.7 Trail Signing

Signage is a critical element of the trail network and serves many important functions including:

- Providing instruction regarding traffic operations (for both motorists and trail users);
- Providing information regarding safety while traveling (e.g. rate of travel, upcoming hazards, junctions and crossings);
- Advertising the network (provide landmarks), to attract new users;
- Guiding trail users (new and repeat) throughout the network;

- Providing information about the routes and accessory facilities; trail-related events, accessory facilities;
- Informing users of their responsibilities while on the network; and
- Providing interpretation of local historical, cultural, natural and other resources.

Good signing systems have common characteristics. These include:

- Clearly, concisely and consistently communicate information related to identification, direction, regulation and operation of the trail;
- Inform but not distract trail users and detract from the visual quality of overall trail experience;
- Design in scale with the space, and visually integrate with the landscape, avoid visual clutter in the landscape;
- Reflect a sense of quality and community;
- Durability and vandal resistance; and
- Are long-lasting aesthetically.

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:

- Orientation signs, which are typically located at key destination points and major network junctions. They provide orientation to the network through mapping, other appropriate network information as well as any rules and regulations (similar in nature to shelters displaying transit routes). Where network nodes are visible from a distance, the size, shape and colouring of this sign can be used as a network “identifier” or landmark. In some municipalities, orientation signing has also been used as an opportunity to sell advertising space. This not only provides information about local services that may be of interest to trail users, but it may also help to offset the cost of signs and/or trail;
- Regulatory signs, which are required throughout the network. Where traffic control signs are needed (stop, yield, curve ahead etc.), it is recommended that recognizable traffic control signs be used;
- Route marker signs, which should be located at regular intervals throughout the network and at intersections. The purpose of route marker signs is to provide a simple visual message to users that they are on an approved network route.

Figure 5-23 provides details for a signing family for the Guelph trail system and includes the:

- Major trailhead sign (Type A) which is typically located at staging areas and major trail nodes. This provides orientation to the trail system through mapping and interpretive information. Larger in size, trailhead signs are visible from a distance. Where staging areas are visible from the roadway, this type of signing can be used as a trail “identifier” for passing motorists and visitors to the city;
- Minor trailhead sign (Type B) which is typically located at minor trailheads and staging areas. Smaller in size and stature than major trailhead signs, they contain key messages such as a location map showing the trail, landmarks and the current location on the trail, permitted uses, rules of the trail, emergency contact and may provide an introduction to key points of interpretive interest;
- Trail Directional sign (Type C) which should be located at trail intersections to cue trail users for destinations and in some cases, distances to destinations;

- Trail Marker sign (Type D), which should be located at regular intervals (i.e. 500m-1000m) along the trail. The purpose of trail marker signs is to provide a simple visual message to users that they are still on the designated route. Providing distance from the main starting point provides users with a sense of how far they have traveled and how far they have yet to go to reach their destination;
- Interpretive sign (Type E), which should be located at key trail features having a story to be told. These features may be cultural, historical, or natural. Interpretive signs should be highly graphic and easy to read. They should be sited with care (i.e. where possible in visible or high traffic locations) to avoid vandalism;
- Trail “Rules” sign, which should be posted at every public access point to clearly articulate which trail uses are permitted, regulations and laws that apply, as well as trail etiquette, safety and emergency information. Reminder signs may be needed at some locations such as “ Please stay on the trail”. At trailheads, this information can be incorporated into trailhead signs. In other areas, this information can be integrated with access barriers;
- Regulatory Signs which are required throughout the system. Where traffic control signs are needed (stop, yield, curve ahead etc.), it is recommended that recognizable traffic control signs be used (see the Ministry of Transportation for Ontario’s (MTO) *Manual of Uniform Traffic Control Devices*, 1996).

Considerations for Sign Design

When designing sign structures and graphic panels, a number of criteria should be considered:

- Limit the number of messages on signs to avoid graphic overload. This includes both graphic images and printed information;
- Use universal symbols where possible. Universal symbols are readily recognizable and can help to overcome language barriers and some disabilities. Symbols can replace written words and simplify signage;
- Consolidate signage where possible to avoid sign clutter;
- Use durable materials and construction methods that resist the elements including rain, snow, ice and ultraviolet radiation;
- They should be placed so that users can easily approach the sign and get close enough to easily read the information being conveyed. This should include consideration for a clear zone allowing easy access for persons using mobility-assisted devices;
- Select vandal resistant materials, finishes, fasteners, construction and assembly methods and locations to discourage vandalism;
- Design signs to be visible and readable for all trail users. Sign size, colour, level of information (text and graphics) must be considered. Achieving the balance between too much information and not enough information can be difficult. Graphics and internationally recognized symbols can be used to replace text and 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;
- Signs must be functional, but also need to be well designed aesthetically. Signs are part of the trail user experience and the quality sends a message to trail user about the quality and management of the trail system.

5.8 Trail Themes

Guelph is made up of neighbourhoods, some with a very strong identity. These have evolved over time, in some cases the result of the architecture, landscape, land use, cultural history and residents. Themeing adds a neighbourhood flavour to individual trails or loops, and creates an overall unique quality to the Guelph 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 city.

Several other municipalities 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;
- Creating distinct interpretive themes for different neighbourhoods.

As part of the first phase of implementation, a feasibility analysis should be conducted to evaluate the potential addition of a heritage and theme component or “layer” to the GTMP route network.

5.9 Trail Amenities

5.9.1 Washrooms, Waste Receptacles and Seating

In addition to signing, basic trail amenities such as washrooms, waste receptacles and seating are an integral part of the system.

Washrooms must be provided along the trail. Typically, they are located at major trailheads and generally 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. Many trail groups have tested portable and temporary washrooms throughout their systems prior to installing permanent facilities (i.e. portable toilets or small buildings with concrete holding tanks), allowing them the opportunity to determine the most appropriate location for permanent washroom facilities. By consulting with business owners (particularly food service) in various parts of the city it may be appropriate to direct trail users to food/refreshments and washrooms.

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. For Guelph’s trail system this should include an evaluation of the current metal barrel and post system as well as strategies for controlling dumping of household trash in park receptacles. Several municipalities are reporting good success with below ground trash receptacles in heavily used areas. These have a larger capacity, are “out of sight” and may result in fewer odours as trash is stored at cooler temperatures.

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. As a guideline it is reasonable to provide some form of seating about every 500m along the trail. 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 incorporate a 1m wide level area with a curb or other appropriate wheel stop for mobility-assisted devices. Staging areas, trail nodes and heavily used trails typically require a higher density of seating opportunities.

5.9.2 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.

The design of bicycle parking units varies widely. Ribbon and Post and Ring styles are appropriate for the Guelph trail system. The Ribbon style allows the bicycle and wheels to be locked together without having to remove quick-release wheels, and provide parking for multiple bicycles with one installation. The post and ring style rack takes up less space, is less expensive per unit, but can only accommodate 2 bikes per unit. They require quick-release wheels to be removed and locked along with the frame of the bike. Currently, they range in price from \$250.00 to \$1000.00 each, depending on style and capacity. Preferred units are easy to use without written or pictorial instructions, support the frame of the bike, not the wheel alone, and can accommodate recumbent bicycles and/or hand-propelled bicycles. They also allow one wheel to be locked with the bike and/or two bikes to be locked together. **Low profile** racks that support the bicycle by the front wheel are **not recommended** as they can result in bending of rims and other damage caused by the bicycle falling over.

5.9.3 Lighting

There is often great debate about whether or not trails should be lit. Very few municipalities light their entire trail systems. The main reasons for this decision include:

- Cost
 - i. the high cost to install the underground power supply and the initial installation of the fixtures (budget \$2000.00 per fixture, \$40,000 per kilometer not including power supply);
 - ii. the cost to monitor, maintain lamp fixtures and replace broken and burned out bulbs on an ongoing basis;
 - iii. a tendency for vandals to target light bulbs;
 - iv. energy consumption;
- Excessive light pollution, especially in residential rear yards and adjacent to natural areas;
- Effects on wildlife including potential negative effects on flora and fauna from light in wooded areas;
- Safety
 - i. a false perception of personal safety created by a lit nighttime area;

- ii. inability of the human eye to adapt to the high contrast resulting from brightly lit and dark shadowed areas side by side.

Lighting of Guelph's trails is generally not recommended, except for locations where it is an important part of the urban design. For example, it is appropriate that the Alf Hales trail adjacent to the River Run Centre be lit as lighting is an important aspect of the design of the space, the area is often programmed for nighttime activity and it is relatively easy to patrol from nearby roads and buildings. Where lighting is necessary, quality and intensity of lighting should be consistent with appropriate standards.

5.10 Trail Closures

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 (e.g. for construction) 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. (Refer to section 6.4.2 for monitoring and maintenance recommendations). Signing and temporary barricades, notification in community newspapers and on the City's 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. **Figure 5-24** provides an illustration of 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;
- Scarifying the surface of the trail to be closed and covering it with forest litter (leaves, branches, and limbs) in a naturalistic manner across the old trailbed. This gives the message that the trail is closed, helps to reduce erosion, and supplies nutrients to plants during establishment;
- Placement of a detector object at the beginning of the closure area so that the closure can be detected by visually impaired users;
- Erecting signage describing the closure to inform users of the conditions; and
- Consideration for additional methods to inform users of closures such as public service announcements through local radio stations and newspapers.