







Bicycle Facility Selection Guide & Bicycle Facility Design: Guideline Tool Box for Intersections



Multi-use trail on Denison Street.

2.0 PROPOSED NETWORK

The core of the Cycling Master Plan is the proposed cycling route network. The vision for this network was initially established in the Town-Wide Bicycle System Study (1998), while the groundwork for its development was laid in Phase I. The approach for Phase II was to develop a detailed long-term network plan, including:

-  A thorough consideration of potential facility types;
-  A comprehensive review of existing conditions, major attractions, destinations and barriers to cycling;
-  A detailed investigation and evaluation of candidate routes; and
-  Comments on network amenities such as bicycle parking and other end-of-trip facilities.

Ultimately, a proposed cycling network, including short and long-term phasing was developed. This chapter describes the proposed network and facility types, and summarizes the steps taken to develop it.

2.1 Network Facility Types

This section identifies the different cycling facility types that are proposed to make up the Markham cycling network. For a more detailed discussion of network facility types, as well as network design elements, amenities, design parameters, signing and maintenance, refer to the Markham Cycling Master Plan Update Volume II: Planning & Design Guidelines, printed under separate cover. With regard to off-road trails in greenways and parks, refer to the Town of Markham Pathways and Trails Master Plan (2007).

2.1.1 Multi-use Trails

A multi-use trail or pathway is a facility that is completely separate from the travelled portion of a roadway, and may take the form of an in-boulevard trail in a public road right-of-way, or an off-road multi-use pathway within a greenway/abandoned rail corridor or through a park or Conservation Authority lands. These types of trails are typically designed to support the

widest range of users including pedestrians, cyclists, in-line skaters and skateboarders where trail surfaces permit such activities. Multi-use trails located in parks primarily serve recreational cyclists. These can include trails along valley lands, river and canal corridors, active or abandoned rail lines, hydro corridors and other linear routes that serve the needs of both recreational and utilitarian cyclists. Multi-use trails that form part of the proposed Town-wide network should include appropriate signing to inform users that this trail segment is also part of the Town-wide cycling system. **Figure 2-1** illustrates a typical multi-use boulevard trail adjacent to a road.

Multi-use trails that form part of the proposed Town-wide network should include appropriate signing to inform users that this trail segment is also part of the Town-wide cycling system.

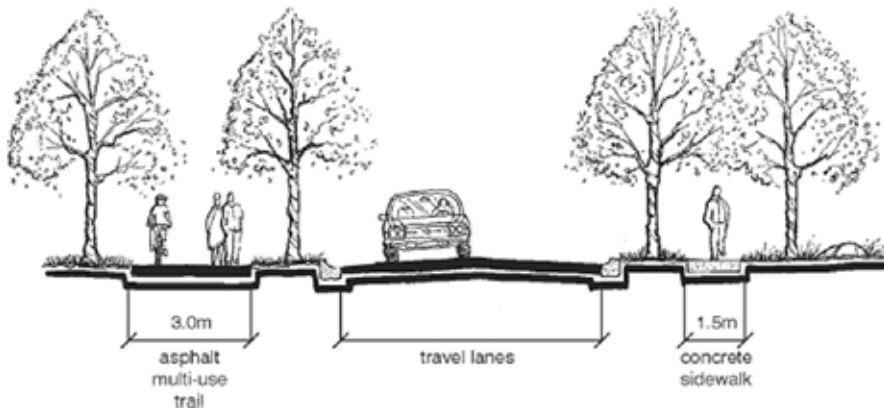


Figure 2-1: Multi-Use Boulevard Trail

2.1.2 Bike Lanes / Paved Shoulders

A paved shoulder/bike lane is a facility located in the travelled portion of the roadway, and is designed for one-way cyclist traffic. Bike lanes are typically located on urban streets. Where on-street parking is permitted, bike lanes are located to the left of, and adjacent to, parked vehicles along the curb. **Figure 2-2** shows a typical roadway cross-section incorporating bike lanes both with and without on-street parking. Paved shoulders are often used to accommodate cyclists on rural road cross-sections, as shown in **Figure 2-3**. Even when paved shoulders or bike lanes are provided, cyclists are not required to use them. Because a bicycle is considered a “vehicle” under the Highway Traffic Act, cyclists are legally permitted to travel with mixed traffic



A bike lane within the Town of Markham.



in a standard motor vehicle travel lane. Bike lanes and paved shoulder bikeways should normally be denoted by pavement markings and signage that identify the facility as part of the Town-wide cycling network.

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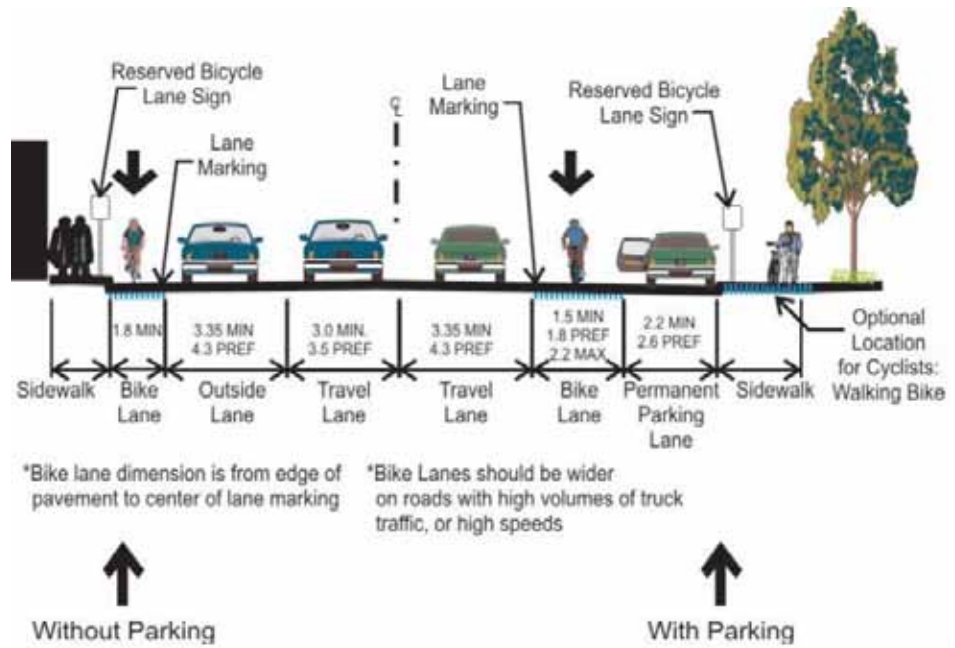


Figure 2-2: Bike Lanes With and Without On-Street Parking

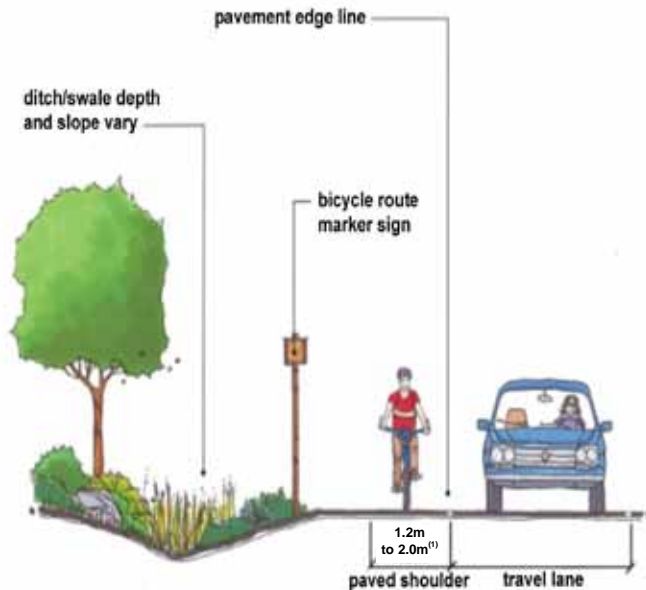


Figure 2-3: Typical Paved Shoulder Bikeway

⁽¹⁾ Shoulder width is dependent on speed limit, traffic volumes and percentage of truck traffic.

2.1.3 Signed-only Routes

A signed-only route is an on-road bicycle route denoted with bicycle route signage and normally requires no other physical changes to the roadway. Cyclists share the pavement and travel lane with motor vehicles, and there are no special lane designations. The purpose of designating a signed-only bicycle route is to promote a road for cycling because it is deemed to be well suited for cycling and/or because it provides an important connection to where cyclists want to travel.

A wide curb lane is often used in urban areas on multi-lane roads, on roads where traffic volumes exceed the suggested thresholds for a signed-only route, and on roads where a bike lane is not feasible. In rural areas, an edge line and paved shoulder is preferred. Edge lines located less than 1.2 m from the edge of pavement are not recommended on urban roads with curbs due to the risk of cyclists striking the curb and “bouncing” back into the motor vehicle travel lane. Existing urban cross-section roads with edge lines less than 1.2 m from

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IB-23
450 mm x 450 mm

Bicycle Route Marker sign TAC, Bikeway Traffic Control Guidelines, 1998



Signed-only route on Willowdale Boulevard.

Signed-only cycling routes can be located on roads with standard or wide curb lane widths.



The majority of new cycling routes will involve some form of retrofitting existing roads.

the face of curb should not be signed or marked as bike lanes. Should a cycling route be preferred on this type of road, consideration should be given to providing a signed-only route.

Signed-only cycling routes can be located on roads with standard or wide curb lane widths. In either situation, the travel lane is still shared by motorists and cyclists. A typical signed-only route with a wide shared curb lane is shown in **Figure 2-4**.

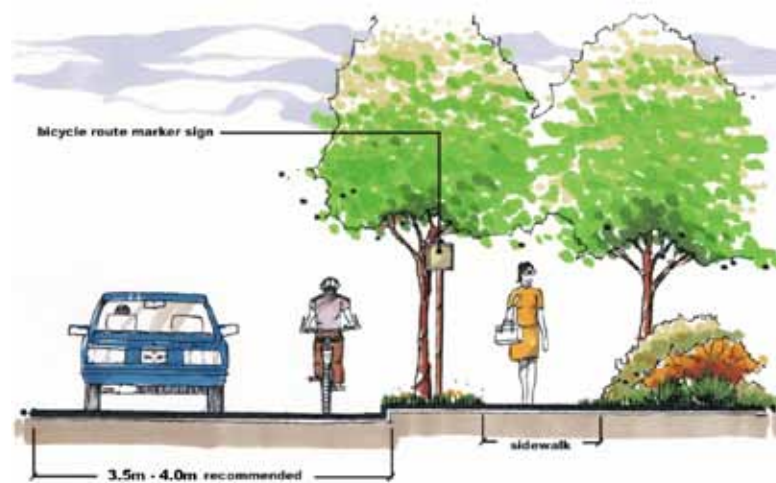


Figure 2-4: Signed-only Route (wide curb lane)

2.1.4 Retrofitting Roads

The successful implementation of the Markham Cycling Master Plan will require balancing the desire to implement the preferred facility type with real physical and environmental constraints. The limited financial resources available from both the Town and Regional levels of government may also constrain the ability of the Town to construct the recommended design.

The majority of new cycling routes recommended in the Town of Markham Cycling Plan will involve some form of retrofitting of existing Regional and local roads, or waiting until certain roads are widened, resurfaced or reconstructed in the future. Although the preferred design should always be

assumed for planning purposes and for determining rights-of-way policy for new roads, it is important to establish thresholds for applying minimum cycling facility design standards or guidelines. The recommended guidelines for retrofitting Town and Regional roads having urban or rural cross-sections are included under separate cover in Volume II: Planning & Design Guidelines.

2.2 Network Development Approach

The approach to developing the recommended cycling network began with an inventory of existing conditions, which included a review of the initiatives proposed and implemented in Phase I. Major attractions and destinations were identified, as were significant barriers to cycling, and their integration with the proposed network. The primary steps in network development were the identification, investigation, evaluation and refinement of candidate routes, ultimately defining the Town-wide cycling network for Markham. Each of these steps is discussed in the following sections.

2.2.1 Review and Update Inventory of Existing Conditions

The starting point for developing the network plan involved preparing an inventory of existing and previously proposed but never implemented cycling facilities in the Town of Markham. This was crucial in order to understand where and what types of cycling facilities currently exist in the Town. This exercise was largely completed as part of Phase I of the study, however a thorough review and update was required to ensure the latest information was incorporated into the Phase II network, as documented in this Master Plan Report.

Information on existing or previously planned cycling facilities was compiled and digitally mapped to establish an existing base condition for the study. This information was based on data collected from the Phase I study, observations made during field reviews, and information provided by the Town of Markham, Region of York, Toronto Region Conservation Authority, Rouge Park and other sources. Inputs to the inventory also included the Town's Geographic Information System (GIS) database and up-to-date (2005) aerial photography.



Main Street Unionville



Amber Glen Park.



Mount Joy GO Station



Angus Glen Community Centre and Library









Figure 2-5 identifies the inventory of existing cycling facilities and major pathways in the Town of Markham.

2.2.2 Identify Major Attractions and Destinations

A fundamental element of the cycling network is the incorporation of key locations that will be connected by proposed routes. Major cycling destinations and other attractions were identified based on available reference information, including town maps and field reviews.

Figure 2-5 identifies the locations of these attractions and destinations, including: key recreational, commuter and utilitarian destinations; natural areas, such as parks and conservation areas, public lands, and prominent vistas; major commercial and employment centres; educational institutions; and municipal buildings and civic centres including libraries and recreational facilities.

Some of the major destinations and attractions highlighted by the study team and the Town’s Cycling and Pedestrian Advisory Committee in the Town of Markham include:

-  Unionville, Centennial, Markham and Mount Joy GO Stations;
-  Natural areas such as the Rouge River valley south of 16th Avenue, and Milne Dam Conservation Park;
-  Business parks throughout the Town;
-  Major new developments such as Cathedraltown and Markham Centre;
-  Municipal buildings such as the Markham Civic Centre and various community centres throughout the Town;
-  Commercial centres such as Markville Mall;
-  Heritage areas such as Main Street Unionville and Main Street Markham; and
-  Numerous high schools and elementary schools.

This information was used in association with other route selection criteria to identify potential cycling routes that could be created or expanded to form part of the Town-wide network. It was also used to assist in identifying deficiencies in the existing cycling network, and to identify where improved bikeway access might be warranted.

2.2.3 Barriers to Cycling

When developing the bikeway network, it was important to understand the nature of perceived or real barriers to cycling in Markham. Barriers to cycling that exist in the Town include both primary and secondary barriers, as shown on Figure 2-5.

Major physical barriers to cycling – such as highways, railways, wetlands and ravines – are classified as primary barriers. In the absence of appropriately located and properly designed crossings, these barriers represent significant obstacles to cyclists that are often impassable. In Markham these include Highway 407, Highway 404, CP, CN and GO railway lines, and the Rouge River.

Secondary barriers, while not necessarily physical barriers to cycling, are those that might deter less-experienced cyclists from taking a certain route. Secondary barriers include cycling along narrow or busy regional arterial roads, the lack of designated on-road cycling facilities, narrow bridge underpasses and trails with difficult terrain.

The purpose of identifying these primary and secondary barriers was to consider their impact in the development of candidate cycling routes and the ultimate cycling network. By providing crossings of primary barriers at relatively even spacing across the Town, the impact of these barriers can be mitigated. Secondary barriers were addressed by providing an equitable distribution of facility types throughout the Town so that no particular areas were, for example, served exclusively with signed-only on-road routes.



Major highways and some highway crossings are barriers.

When developing the bikeway network, it was important to understand the nature of perceived or real barriers to cycling in Markham.










Proposed cycling routes should be evaluated based on a set of guiding principles.




The cycling network should be integrated with other modes of transportation, particularly public transit.

2.2.4 Candidate Route Investigation and Evaluation

The route selection process for developing the Markham Cycling Network was based on a set of qualitative and quantitative criteria.

The following is the list of guiding principles used to evaluate the existing network and recommend new routes:

-  **Safe:** The system should be designed to minimize risk to users.
-  **Connected:** All cycling routes should be connected to form an overall cycling network, and should be accessible from local communities within Markham. The cycling network should connect key destinations and nodes, existing and proposed cycling facilities, and gateways to and from neighbouring municipalities.
-  **Convenient:** The network should include a variety of route types, appeal to all cycling abilities and interests, and provide links to popular destinations. Support services and facilities such as bicycle parking should be available along cycling routes and at destinations. Routes should be selected that provide opportunities to develop supporting facilities.
-  **Attractive:** Cycling routes should take advantage of attractive and scenic areas, views and vistas.
-  **Economically feasible:** The financial impacts of including a particular route in the network must be reasonable given the limited resources and funding available.
-  **Integrated:** The cycling network should be integrated with other modes of transportation, particularly public transit. Routes should be selected to provide access to transit nodes.
-  **Distributed:** The density of the proposed network will be higher in the urban areas of the Town. In urban areas, network facilities should be no more than a five-minute bike ride or 1 to 2 kilometres from the next nearest facility that serves as part of the Town-wide network. In rural areas, network facilities should form a grid of north-south and east-west facilities typically no more than a 5 to 10 minute bike ride, or 2 to 5 kilometres apart.

-  **Diverse:** The cycling network should provide a diverse on and off-road cycling experience.
-  **Visible:** The cycling network should be a visible component of the transportation system.
-  **Bicycle-Friendly:** The fact that cyclists have the right to use most municipal and provincial roadways leads to an important principle of roadway design that “every road is a cycling road”. The Town of Markham should therefore adopt bicycle-friendly guidelines for all streets, whether a road is designated as part of the cycling network or not.

Each candidate route was evaluated through a four-step process:

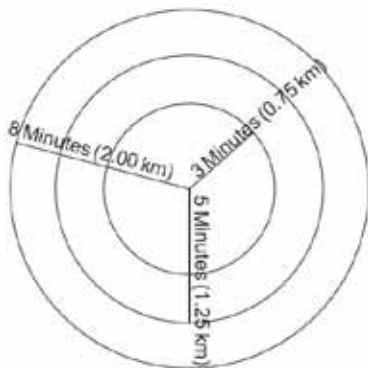
1. Travel all or segments of each candidate route (ground-proof) by cycling it, or by driving it in a motor vehicle;
2. Assess each route using the selection criteria identified above, as well as the results of the ground-proofing combined with the technical expertise of the study team plus the public input;
3. Accept or reject each candidate route based on Steps 1 and 2; and
4. Determine an appropriate cycling facility type for each accepted route based on the results of Steps 1 through 3.

In summary, route selection was generally based on the experience of the team, input from the Cycling and Pedestrian Advisory Committee as well as the public, subjective decisions made in the field regarding the application of the route selection criteria, as well as quantitative information such as traffic volumes, road and right-of-way widths, and distance from key destinations and the nearest proposed route. Potential routes were screened using this approach, and those routes that were less desirable compared to a parallel route were eliminated from further consideration.

Once this plan begins to be implemented, more detailed feasibility studies may conclude that a recommended route is not feasible (see Chapter 4.0). In such cases, parallel routes should be re-assessed.

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A travelling distance/ time circle was used to ensure that all residents will be within a five-minute bike ride from the network.

When completed, the Markham Cycling Network will consist of approximately 390 km of on and off-road cycling routes.

2.3 Proposed Bikeway Network

Based on a thorough review of existing conditions, consideration of input from the public and CPAC, plus candidate route development and evaluation, a proposed Town-wide cycling network was developed as shown in **Figure 2-6**. It represents a grid of north-south and east-west routes spaced approximately 1 to 2 kilometres apart (where practical), with additional routes integrated into the local street networks of communities, business parks and other urban areas. The spacing should ensure that all residents will be within a five-minute bike ride from the network. It provides linkages to the major attractions and destinations within Markham, incorporates crossings of major barriers to cycling, includes a variety of facility types, and connects to gateways of existing or proposed bike networks in adjacent municipalities.

Table 2-1 summarizes the number of kilometres of existing and new on and off-road pedestrian and/or cycling routes proposed for implementation in both Stage 1 (2007 – 2012) and Stage 2 (2013 – 2022) by facility type. **When completed, the Markham Cycling Network will consist of approximately 390 km of on and off-road cycling routes, consisting of 102 km completed as part of Phase I (includes existing) and 288 km proposed as part of Phase II.**

Table 2-1: Proposed Length of Cycling Network by Facility Type (Phase II)

Facility	Jurisdiction	Distance (km)		
		Short Term (2007-2012)	Long Term (2013-2022)	Ultimate (2007-2022)
Signed Bike Routes	Town of Markham	57.13	4.26	61.39
	Region of York	7.53	0.00	7.53
	Total	64.66	4.26	68.92
Bike Lanes	Town of Markham	9.45	38.74	48.19
	Region of York	19.83	25.23	45.06
	Total	29.28	63.97	93.25
Paved Shoulder Bikeways	Town of Markham	1.99	16.75	18.74
	Region of York	11.11	25.75	36.87
	Total	13.11	42.50	55.61
Multi - Use Trails	Town of Markham	5.48	7.09	12.56
	Region of York	10.58	20.44	31.02
	Total	16.06	27.53	43.59
Multi - Use Trails ¹	Other	0.00	26.94	26.94
Total		123.10	165.21	288.31

¹ Located in parks and / or hydro corridors



*Example of bicycle parking
in the boulevard of a
roadway*



*Bike parking at the
Town of Markham.*








2.4 Network Amenities

The provision for network amenities is a key element of cycling network design. Developing and maintaining a comprehensive network of on and off-road cycling facilities does not automatically imply that the public will use the network. The network has to be promoted, cyclists need to feel comfortable using it, and there should be adequate trip-end facilities at strategic locations.




2.4.1 Bicycle Parking

Cyclists seek parking in locations that are frequented by pedestrians, visible from neighbouring buildings, or that offer some other form of security from theft and vandalism.

Improving the supply and security of parking facilities for cyclists will have a significant impact on the attractiveness of cycling as a transportation mode. In addition, bicycle parking facilities are much more efficient in their use of space than automobile parking lots. Generally, optimum bicycle parking facilities should:

-  Enable the bicycle to be securely locked to the device without damaging the bicycle or adjacent bicycles;
-  Be placed along commercial arterials, employment centres and other destinations where cyclists are expected to frequent;
-  Be placed in public view, where they can be seen by passers-by, station attendants and fellow workers for deterring theft and vandalism;
-  Be easily accessible from the road or cycling network;
-  Be sheltered from inclement weather, where possible;
-  Present no hazard to pedestrians; and
-  Be easy to use without detailed instructions.

Bicycle parking systems can generally be grouped into three categories:

-  **High Security:** These facilities may be a protected parking area with a surveillance system or a key-access bicycle locker. They are recommended for long-term parking (work, school, transit stations, etc) and in low-visibility locations where there is little pedestrian traffic.
-  **Medium-High Security:** This type of system permits the bicycle frame and both wheels to be locked together without requiring the cyclist to remove one of the wheels from the bicycle frame. This type of facility is appropriate for office buildings, stores, educational institutions and public buildings.
-  **Medium Security:** These types of racks permit the frame and one wheel to be secured with a lock. Bicycle parking devices of this type are typically low in cost and tend to require less space per unit. They are suitable for short-term parking in busy locations.

2.4.2 Bicycle-Friendly Catchbasin Covers

All on-road cycling facilities of the proposed cycling network in urban areas with curbs, gutters and storm drains should be made bicycle friendly through the provision of bicycle friendly catchbasin covers. These covers minimize the potential for the trapping of bicycle wheels as cyclists ride over them.

2.4.3 Rest and Staging Areas

Rest areas should be provided along off-road and rural cycling network systems. Areas where cyclists tend to stop, such as interpretative stations, lookouts, restaurants, museums and other attractions or services, are logical locations for rest areas. Ideally, there should be a rest area every 5 kilometres on a recreational trail. Typical furnishings to be considered include benches or tables, washrooms, drinking fountains, trashcans, information signing complete with mapping, plus bicycle parking facilities. Additional services may include an air pump, shelter and telephones.



Bicycle lockers provided added security and peace-of-mind for bicycle storage.



Bicycle-friendly catchbasin cover.



Showers and change facilities promote the use of the cycling network.

The development of end-of-trip facilities can strengthen the outreach of the Markham Cycling Master Plan by encouraging more residents to use cycling as a preferred mode of travel.

Staging areas should be incorporated into key gateways and park areas. This will provide for access to the cycling system. Potential amenities at staging areas may include picnic facilities and automobile parking. The number of parking spaces required should be determined on a site-specific basis, and should account for factors such as supply and demand of automobile parking elsewhere throughout the network.

2.4.4 Showers and Lockers (End-of-trip facilities)

The installation of showers and lockers at workplaces and educational institutions helps to promote the use of the cycling network for utilitarian purposes. Lockers can be used to store personal belongings such as cycling accessories, in-line skates or a change of clothing. Businesses or institutions with more than 20 employees commuting by bicycle or in-line skates should be encouraged to offer these facilities. It is recommended that consideration be given to promoting and implementing cycling supportive facilities. The development of end-of-trip facilities can strengthen the outreach of the Markham Cycling Master Plan by encouraging more residents to use cycling as a preferred mode of travel.

The proposed cycling network is the core of the Cycling Master Plan. Network amenities complement the network and make cycling more attractive to Markham residents, but these alone will not achieve the goals of the Cycling Master Plan. A comprehensive outreach strategy should be adopted to integrate the various elements of the Plan, and this topic is discussed in detail in Chapter 3.0.