




# GREAT STREETS

FOR KINGSTON



FINAL REPORT – DECEMBER 2012



## Acknowledgements

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## EXECUTIVE SUMMARY

### *Project Introduction*

‘Great Streets for Kingston’ is a guide developed by members of the School of Urban and Regional Planning (SURP-824) Project Course for the City of Kingston, to further support their progress towards ‘Complete’ and ‘Green’ streets. This report is firmly grounded in the need for a context-specific approach to designing streets (i.e., the public right of way). It provides an element-by-element breakdown of best practices which policymakers and practitioners can use to prioritize improvements based on different street types found throughout the city. This will make Kingston’s streets more accessible and attractive for all users and transportation modes, while being sensitive to important ecological processes, which contribute to the overall public realm.

Great Streets recognizes that the street network needs to be accessible and well-connected. This means streets that are accessible to all, regardless of age or ability. It also means that all transportation modes, particularly more sustainable and active forms such as cycling, walking, and transit are clearly allocated space in the public right of way, along with the private automobile. This is the ‘Complete Streets’ philosophy. While the travel throughout the city should be more sustainable, green infrastructure must also be incorporated into streets in order to counteract flooding events, smog, and water pollution. This is where ‘Green Streets’ principles meet ‘Complete Streets’ design to make for ‘Great Streets’ that foster both healthier environments and lifestyles.

### *Scope*

As places of on-going social, economic, and cultural activity, streets are more complex than is reflected in the traditional rural-urban dichotomy of street classification. A gradient of built form and function contributes to the different contexts of streets, as conceptualized by the Rural-Urban Transect (Figure 1).

**Figure 1:** The Rural-Urban Transect Source: Center for Applied Transect Studies. Retrieved from: [http://www.transect.org/rural\\_img.html](http://www.transect.org/rural_img.html)



In reviewing the seven transect zones, the scope of the study was determined to be those streets that fall under the T3 Sub-urban zone and T4 and T5 Urban zones, as these capture the bulk of the city’s streets. In Kingston, the T6 Urban Core streets such as the Princess Street corridor, Ontario Street, and the Market Square District have been subject to many studies as well as capital improvements, while suburban and urban areas have received comparatively less funding and research. The SD Special District zone, T1 Natural Zone and T2 Rural Zones have specialized needs different from streets typical of the Kingston urban area. For the zones falling

outside of the report scope, separate studies would be worthwhile.

Street Typology

The seven roadway types from Kingston’s Official Plan (2010) that have been further delineated based on their location in the suburban or urban area, are shown in Table 1. For the purposes of this report, suburban residential arterial roads are distinguished from suburban commercial arterial roads as commercial activity in the suburban area is often found along arterial roads where the needs of the pedestrian, cyclists, and motorists are quite different from residential streets.

In Kingston, urban streets were laid prior to their modern function. This means a wider right of way does not necessarily equate to a higher order street such as in new suburban developments. In many cases, local, collector, and arterial streets in the urban zone can have the same widths. A context-specific approach is therefore essential to the appropriate design of Great Street elements.

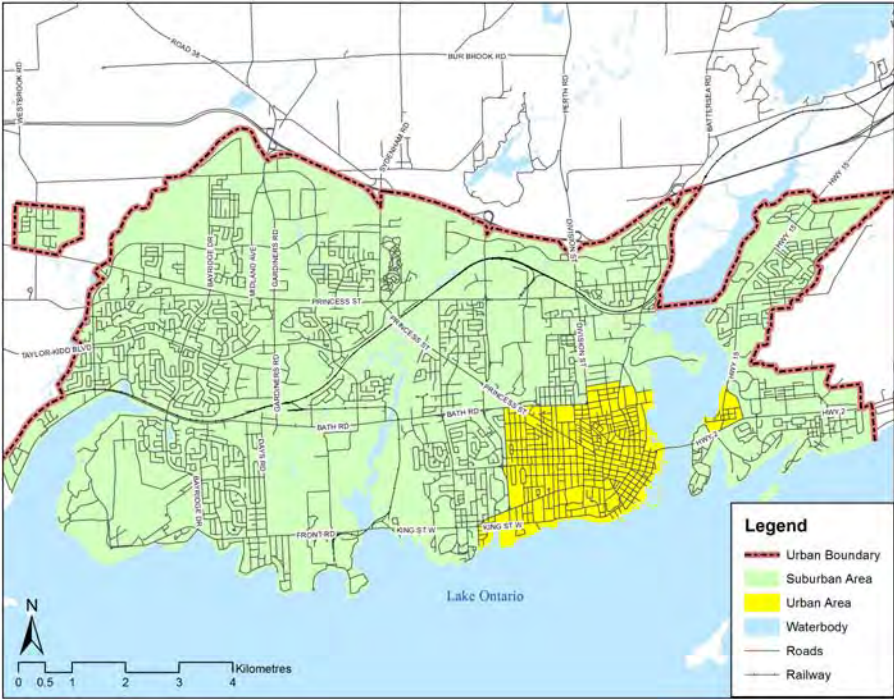
**Table 1:** Contextualization of Kingston streets by physical attributes and surrounding land uses, within the established hierarchy laid out in the City of Kingston’s Official Plan.

Suburban	Urban
Residential Local	Residential Local
Residential Collector	Residential Collector
Residential Arterial	Residential Arterial
Commercial Arterial	

Study Area

Kingston’s T3 and T4-T5 zones are identified within the urban boundary of the City (Figure 2). The more urban areas of the City are focused in the central core, East of Sir John A MacDonald Boulevard to the Great Cataraqui River and South of Concession street to Lake Ontario. Other urban areas within the City include Portsmouth Village and Barriefield Village.

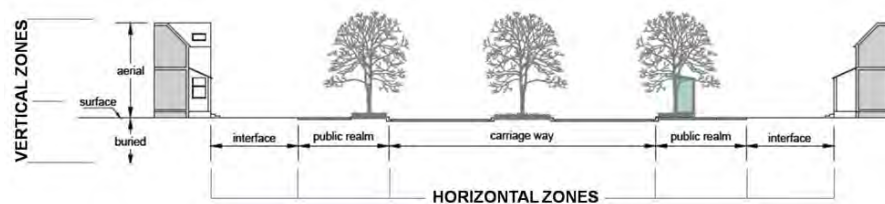
**Figure 2:** Suburban and Urban Areas Identified within Study Area.



### ***Right of Ways: The Backbone of Great Streets***

It is not the roads themselves, but the way in which they are used, planned and developed that make Great Streets. Thus, focusing efforts on the public right of way (ROW) is necessary for each street typology as the ROW defines the space that accommodates components of Great Streets, defined by both horizontal and vertical zones (see Figure 3).

**Figure 3: Cross section of the Vertical and Horizontal Zones within the Right of Way.**



### ***Travel Lanes***

Wider travel lanes encourage higher speeds and pose safety concerns to pedestrians and cyclists. Current design standards mandate a 3.5 m travel lane width or greater, which is wider than what is necessary for the safe, convenient and efficient circulation of motorized vehicles. In addition, widths for collector streets with 60 km/h speed limits are the same as widths for those with lower speeds. In Ontario in 2010, 75 per cent of pedestrian fatalities occurred on arterial roads, and 67 per cent occurred on streets with speed limits of 50 km/h or higher. Fatalities due to high travel speeds can be mitigated by the traffic calming effect of narrower roads. The effect of narrow roads has been recognized by the Institute of Transportation Engineers,

which advocates 3.05 m as an appropriate minimum travel lane width, while the Ontario Ministry of Municipal Affairs and Housing's (1995) Alternative Design Standards recommend a reduced lane width of 2.75 m for local roads. While 2.75 m would be optimal, current legislation requires a 3 m minimum width for local streets. Table 2 indicates recommended travel lanes widths for each street type.

**Table 2: Recommended travel lane widths for Kingston Streets.**

	Road Classification	Speed Limit (km/h)	Support Transit/Tractor trailers	No. of Lanes	Travel Lane Width (m)
Urban	Local	50	No	2	3
	Collector	50	Yes	2	3.35
	Arterial One Way Traffic	50	Yes	2	3.35
	Arterial Two Way Traffic	50	Yes	3	3.35
Suburban	Suburban Local	50	No	2	3
	Minor Collector	50	Yes	2	3
	Major Collector	60	Yes	2	3.35
	Residential Arterial	60	Yes	4	3.35
	Commercial Arterial	60	Yes	4 + turn lane	3.35
	Laneway	10	No	1	6

**Elements of Great Streets: The ‘Building Blocks’**

Seven key Great Street elements have been identified for the City of Kingston:

<b>NATURAL ENVIRONMENT</b>	1. Street Trees 2. Green Stormwater Infrastructure
<b>PEDESTRIAN REALM</b>	3. Pedestrian Safety and Accessibility 4. Pedestrian Amenities
<b>TRANSPORTATION</b>	5. Traffic Calming 6. Cycling 7. Transit

**The Natural Environment: Street Trees and Green Stormwater Infrastructure**

The urban forest is a key contributor to maintaining the hydrological cycle, mitigating the urban heat island effect, and reducing smog. Cities should foster urban vegetation and boulevard trees through green infrastructure, low impact development (LID) strategies, and by ensuring vegetation has an appropriate growing medium of good quality soil and sufficient size.

**Highlights of Recommendations:**

- Native species of trees are preferable, and columnar or vertically oval-shaped trees can work in narrow ROWs to minimize interference with utilities.

- Policies should be in place to prevent soil degradation and compaction from development, to help ensure tree and plant growth into maturity.
- Permeable surfaces of different kinds should be used where appropriate to reduce impervious surface area on ROWs.

**The Pedestrian Realm: Safety, Accessibility, and Comfort**

Great Streets guidelines can contribute to a lively pedestrian realm. A sense of security is necessary and is facilitated by pedestrian-scaled lighting. Sidewalks should line both sides of the street and widths warrant context-specific consideration based on expected activities, adjacent land uses, volume of pedestrian traffic, and the speed and volume of vehicular traffic in the travel lanes.



**Tree-lined streets with on-street parking in Washington, DC**  
Source: [http://www.flickr.com/photos/rob\\_good\\_speed/792610639/](http://www.flickr.com/photos/rob_good_speed/792610639/)

**Highlights of Recommendations:**

- Minimum combined sidewalk and boulevard widths (measured from curb edge to property line) of 3.7 m for arterials and collectors and 3 m for local streets.



- Prioritize sidewalk widening in areas of high volumes of pedestrian and vehicle traffic as well as those with street-level commercial activity.

### **Transportation: Cycling, Transit, and Traffic Calming**

This category calls for a democratic share of the road for different modes of travel. The presence of cycling infrastructure and transit amenities in the ROW contributes to traffic calming through friction, by reducing the perceived roadway width of motorists. At the same time this encourages transit riders and cyclists to use the appropriately placed facilities. To stimulate an increased share of the road for more sustainable forms of transportation, transit riders and cyclists need to find the experience safe, comfortable, and attractive.



**A clearly marked cycle track and bicycle facilities on a street in Haarlem, Netherlands**

Source: [www.urbancommuter.wordpress.com](http://www.urbancommuter.wordpress.com)



**Wide sidewalks with pedestrian lighting in Portland, Oregon**

Source: [http://raisethehammer.org/article/855/rth\\_does\\_northwest\\_part\\_2:\\_portland\\_oregon](http://raisethehammer.org/article/855/rth_does_northwest_part_2:_portland_oregon)

### ***Highlights of Recommendations:***

- Clearly separated bike lanes and cycle tracks.
- Visible bike racks to deter theft.

- Raise minimum standards for transit user comfort. Maximize on-street parking on urban streets over parking lots.

### ***Great Streets: Best Practices Examples and Local Opportunities***

There are many existing examples of Great Streets across North America. From Kitchener, ON to Charlotte, NC, they span different kinds of communities and different kinds of streets.



**A collector Street in Calgary, AB featuring a vegetated refuge median and clearly marked crosswalks.**

Source: <http://www.calgary.ca/Transportation/TP/Documents/CTP2010/2011-interim-complete-streets-guide.pdf>,



**An intersection in Boulder, CO featuring a cycle-track and bicycle signalization as well as a "green" street treatment.**

Source: <http://www.planning.org/planning/2005/may/complete.htm?print=tr>

Inspired by these best practices examples and the potential for Great Streets in Kingston, a local example of each street type was re-conceptualized into a Great Street using the key elements to illustrate how Great Streets principles would improve existing streets. These guidelines and Great Street designs can be found in the Great Streets Guidelines for Kingston section of this Report.

### Final Recommendations

Applying Great Streets elements appropriate for the different street types in Kingston requires consideration of existing physical infrastructure as well as the existing policy framework. In order to create Great Streets, it is essential for decision-makers, planners, engineers and Kingston citizens alike to change their way of thinking about the purpose, structure and function of their streets. The following are recommendations for transitioning from the status quo to Great Streets.

**Education and Engagement-** A crucial component for success is changing the perception that ROWs exist to serve only motorized vehicles. The elements and the techniques for their implementation aid in making ROWs equally accessible to all modes, needs, and users. The community at large must be engaged throughout the process of transitioning to Great Streets in order to ensure a smooth transition.

**Policy-** In order to move away from automobile-centric design, a more balanced approach to street planning is needed. The City should continue to lobby for changes to the Highway Traffic Act of Ontario in order to develop municipal bylaws that allow pedestrians the right-of-way at uncontrolled traffic intersections and at midblock crossings.

**Timing-** Phased implementation, through the prioritization of both elements and locations for implementation, can help with managing costs. Projects such as sidewalk widening and installation of accessible pedestrian signals at intersections

should work in conjunction with schedules for road or utility repairs to ensure efficiency and cost effectiveness.

**Challenges-** Given ROW width constraints, determining the trade-offs between different elements may be a challenge. Determining the prioritization of elements based on the needs of a street is key and can provide significant benefits including long-term cost efficiencies.

**Accessibility-** Finally, Great Street design must be approached with user accessibility for all ages and abilities in mind. Whether it is the design of a raised cycle track or placement of a planter in the ROW, the goal should be to enable those with any visual or mobility challenges to use the ROW with ease.

**Conclusion-** The culmination of research into Great Streets for the City of Kingston led to a toolkit from which policymakers and practitioners can consider improvements to a given street type. Additionally, this toolkit of techniques and guidelines can help inform an integrated policy emphasizing both 'Complete' and 'Green' streets philosophies to create Great Streets for Kingston. Adopting Great Street principles would move the City closer to achieving its social, environmental, and economic goals. More importantly, the citizens of Kingston would benefit from a safer, more accessible, and attractive public realm that supports important ecological processes throughout the city.

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## 1.0 Introduction

### 1.1 Project Background

Streets are the conduits through which a city's social and economic activity passes year-round. We all use streets every day, in different ways and to achieve personal and community goals. However, streets have long emphasized, through culture and design, certain users and modes over others. Our partiality to the personal automobile has effectively made many of our right-of-ways (ROWs) into highways with differing speed limits. On the other hand, an ever-growing body of literature points to the social, economic and environmental pitfalls of our focus and reliance on this mode of transportation. 'Great Streets' combines the concepts of both, 'Complete' and 'Green Streets' and presents a refreshing approach to ROWs that takes all users, modes and community goals into consideration.

The purpose of this report is to present the City of Kingston with a guide to 'Complete' and 'Green Streets' to inform future policy on the City's public right of ways. Strategies from elsewhere in Canada, the United States and Europe were reviewed to learn from the experiences of other cities and provide a snapshot of current best practices. To facilitate this research and understand the requirements of Kingston's current policy and practice, key interviews were held with City of Kingston employees from a variety of departments including Planning, Engineering, Transit, Parks, Utilities Kingston and KFLA Public Health. This research culminated in an element-by-element breakdown of current best practices, which was then applied to the street typology

developed within the report. The result is a street design toolbox to help policymakers and practitioners prioritize user needs depending on the type of street and its objectives (e.g. a commercial arterial versus a residential arterial). The toolbox is then used to showcase several case studies from Kingston and how a 'Complete' and 'Green Streets' policy could improve all streets and further the City's broader social, economic and environmental goals. 'Complete' and 'Green Streets' make for **'Great Streets'**.

### 1.2 What are Great Streets?

'Great Streets'<sup>1</sup> are designed to accommodate all users and modes within a well-connected accessible community. With an improved human environment supportive of natural processes, 'Great Streets' are designed to improve the very backbone of cities. Drawing from 'Complete Streets' and 'Green Streets' philosophies and design principles, 'Great Streets' enables the creation of ROWs that encourage efficiency of travel, the development of vibrant communities, they promote intensification as well as health-conscious and environmentally-friendly lifestyles.<sup>2</sup>

'Complete Streets' benefit all users of a roadway in the order of walking, cycling, transit, and automobile.<sup>3</sup> Providing capacity for alternatives to automobiles encourages travel demand growth to be absorbed by more desirable modes.<sup>4</sup> A 'Complete Streets' philosophy acknowledges that too much emphasis has been placed on accommodating automobiles. In addition to promoting alternative modes, the roadways are configured more attractively and "function in the context of surrounding land uses".<sup>5</sup> 'Complete Streets' informs trade-off

discussions when ROWs cannot accommodate every mode to the highest standard.<sup>6</sup>

Green Streets are a way of using the public ROW to aid important environmental processes. 'Green Streets' help to "reduce stormwater flow, improve water quality, reduce the urban heating, enhance[d] pedestrian safety, reduce carbon footprints, and beautify neighbourhoods."<sup>7</sup>

### 1.3 Why Great Streets?

'Great Streets' afford a variety of social, economic, environmental and health benefits. With a more inclusive, accessible and multi-modal street network, the propensity to socialize is increased, as many users are no longer confined to their single-occupancy automobile. The provision of amenities that can be accessed without automobiles will also allow residents to age in place, creating a stronger, multi-generational community structure. Pedestrian safety will be improved, especially through the design of safer, more accessible arterials and collector roads where speeds tend to exceed 50 km/h. According to the Office of the Chief Coroner for Ontario, in 2010 75% of pedestrian fatalities occurred on arterial roads and 67% of fatalities occurred on streets with a posted speed limit of 50 km/h or higher. The Coroner's report recommends a 'Complete Streets' approach to both new community development and the retrofitting of existing communities in Ontario.<sup>8</sup> Business owners will benefit as all community members will have greater and safer access to the downtown and other key commercial areas.

With a greater emphasis on transit and active modes, the

loss of productive hours due to congestion will be reduced. Low-impact development, which uses micro-scale techniques to manage precipitation as close to where it hits the ground as possible,<sup>9</sup> offers benefits such as enhanced property values and re-development potential, greater marketability, improved wildlife habitat, thermal pollution reduction, energy savings, smog reduction, enhanced wetlands protection, and decreased flooding.<sup>10,11</sup> By encouraging active modes of transportation or combined with other modes (e.g. walking to transit), community health will benefit, which can help to reduce healthcare costs and the risk of obesity, cardiovascular disease, type II diabetes and certain types of cancer.<sup>12</sup> The reduced use of motor vehicles can also reduce the incidence of respiratory, cardiovascular and other diseases associated with air pollution.<sup>13</sup>

Compared to active transportation modes and public transit, personal motor vehicles induce land-intensive development and reduce green space capacity.<sup>14</sup> Green space provides air filtering, cooling, shade and other climate control functions that help to reduce the urban 'heat island' effect<sup>15</sup> and contribute to increased life expectancy<sup>16</sup> and improved mental health.<sup>17</sup> In terms of handling precipitation, managing grey water through green storm water management techniques will provide infrastructure savings and make sewer systems more efficient.<sup>18</sup>

In reviewing City of Kingston policy documents, it is apparent that the goals of Great Streets align with many of the City's goals. The Official Plan (OP) sections on Sustainable Development and Transportation (Sections 2 and 4) identify goals and policies that are part of the Great Streets



approach.<sup>19</sup> These sections call for limiting the reliance on private automobiles and the promotion of active modes and transit. These goals are echoed in the Transportation Master Plan (TMP), which calls for a transportation system that is safe, convenient, efficient, affordable, and energy-conserving.<sup>20</sup> The OP Sections 2 and 4 further point out the need to reduce energy consumption and limit the need for undue extension of infrastructure. It is the City's policy to promote the use of innovative energy systems that reduce urban heat, greenhouse gases (GHG) and stormwater flows. These infrastructure goals and policies are further addressed in Utilities Kingston's Sewage Infrastructure Master Plan (SIMP) that recommends the adoption of policies and procedures to improve storm water management.<sup>21</sup> The Integrated Community Sustainability Plan (ICSP), which outlines Kingston's vision to be Canada's most sustainable city, encourages developing and servicing land in a way that promotes transit and non-motorized modes.<sup>22</sup> The importance of building and maintaining ROWs to achieve the City's goals can also be understood in a fiscal sense. For example, roughly one third of the \$47 million 2012 capital budget is dedicated to transportation services and just under \$25 million of the 2012 operating budget is apportioned to transportation services and public works, much of which goes into the construction, maintenance and use of streets.<sup>23, 24</sup> It is therefore abundantly clear that a Great Streets approach to ROWs is attuned to the existing goals and policies laid out in key city documents and would produce a variety of economic, social, environmental and health benefits.

## 1.4 Report Structure

This report is divided into seven chapters. In Chapter 2, a conceptualization of the different street types is presented and further analyzed to align with the Kingston context. The classification of Kingston streets as outlined in the City of Kingston's Official Plan is also highlighted in this chapter. Chapter 3 defines the right of way (ROW) within each street typology and their respective zones in relation to the City of Kingston's road classifications. The current travel lane widths within the City are discussed and new travel lane widths are proposed. Chapter 4 discusses each of the elements that should be present on Great Streets. A definition and further analysis of each individual element is also presented in this chapter. Chapter 5 contains photographs of Great Streets from elsewhere in Ontario, Canada, the U.S. and Sweden, and highlights some of the factors that make these streets 'Great'. Chapter 6 introduces the proposed cross-sectional and plan-view designs for each street typology accompanied by 'before' and 'after' renderings of select streets in Kingston. Finally, Chapter 7 contains the conclusions drawn from this study and final recommendations for the City.

*"If you create a city that's good  
for an 8 year old and good for an  
80 year old, you will create a  
successful city for everyone."*  
-Gil Penalosa  
8-80cities.org

### Notes

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## 2.0 Contextualizing Streets

Municipalities across North America have traditionally classified the physical character of the areas within their boundaries as urban or rural. However, this dichotomy does not take into account the gradient of built forms that span these two extremes.<sup>1</sup> Post-WWII development created the suburban built form which is often not reflected in municipal planning policies.

### 2.1 Transect Zones

A transect system organizes areas into seven zones based on their physical characteristics, and was developed at the close of the twentieth century as a means of contextualizing the variety of physical environments that form a municipality (see figure 2-1). A transect can help remedy “one size fits all” policies and move municipalities towards a more context-sensitive approach to planning and development.<sup>2</sup>

Transect zones are based on the physical attributes and land uses that characterize different types of streets, as described below.

*T1 Natural Zone:* Natural lands that are in a wilderness condition.

*T2 Rural Zone:* Sparsely populated lands that are in an open or cultivated state.

*T3 Sub-Urban Zone:* Lower density areas with deep setbacks.

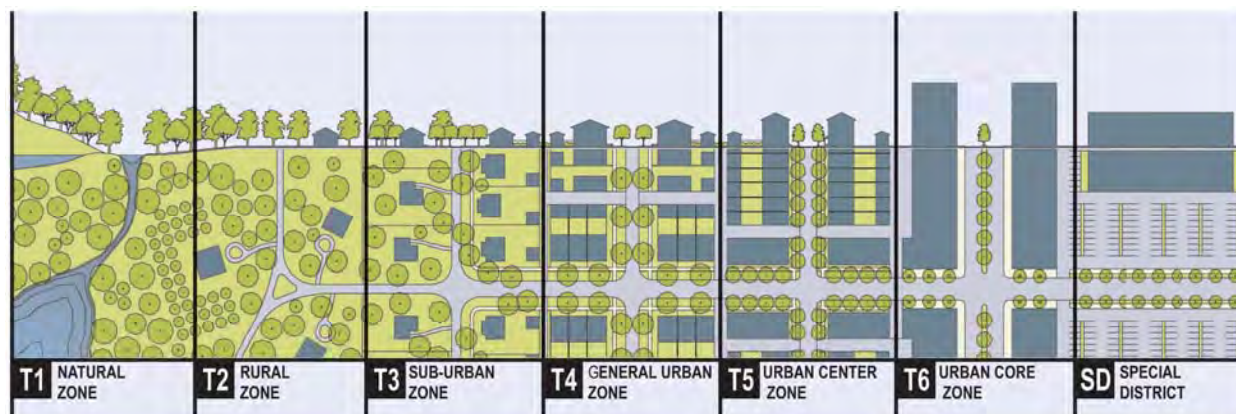
*T4 General Urban Zone:* Areas with predominately residential uses with shallower setbacks that include a variety of housing types as well as some commercial uses.

*T5 Urban Center Zone:* Higher density areas with mixed use buildings, row houses and apartments.

*T6 Urban Core Zone:* Highest density zone with a variety of land uses including civic buildings.

*SD Special District:* Areas whose physical disposition does not conform with the other six areas, for example, employment lands.

**Figure 2-1:** The Rural-Urban Transect  
Source: Center for Applied Transect Studies.  
Retrieved from: [http://www.transect.org/rural\\_img.html](http://www.transect.org/rural_img.html)



2.2 Contextualizing Kingston Streets

2.2.1 Identifying the Scope of ‘Great Streets’ Guidelines and Recommendations

Kingston contains all of the aforementioned transect zones. This report will focus on providing guidelines and best practices recommendations for creating Great Streets within T3 sub-urban zones and T4 and T5 urban zones. The T4 and T5 zones will be combined into a single “urban” zone for the purposes of this report. Streets within the City of Kingston have been contextualized as either urban or suburban (see map 2-1). Further research at a later date may expand these guidelines to separate the two zones as well as create guidelines for T2 rural zones and SD special district zones.

The primary districts within Kingston that would fall into the T6 urban core zone are the Princess Street corridor (from Bath Road to Ontario Street), Ontario Street and the Market Square District. These predominantly commercial urban areas have already benefited from extensive study and, in many cases, infusion of capital for improvements. These districts have been excluded from this report because there

**Table 2-1:** Contextualization of Kingston streets by physical attributes and surrounding land uses, within the established hierarchy laid out in the City of Kingston’s Official Plan.

Suburban	Urban
Residential Local	Residential Local
Residential Collector	Residential Collector
Residential Arterial	Residential Arterial
Commercial Arterial	

is, arguably, greater benefit in focusing on the suburban and urban zones that have received less attention in terms of funding and research.

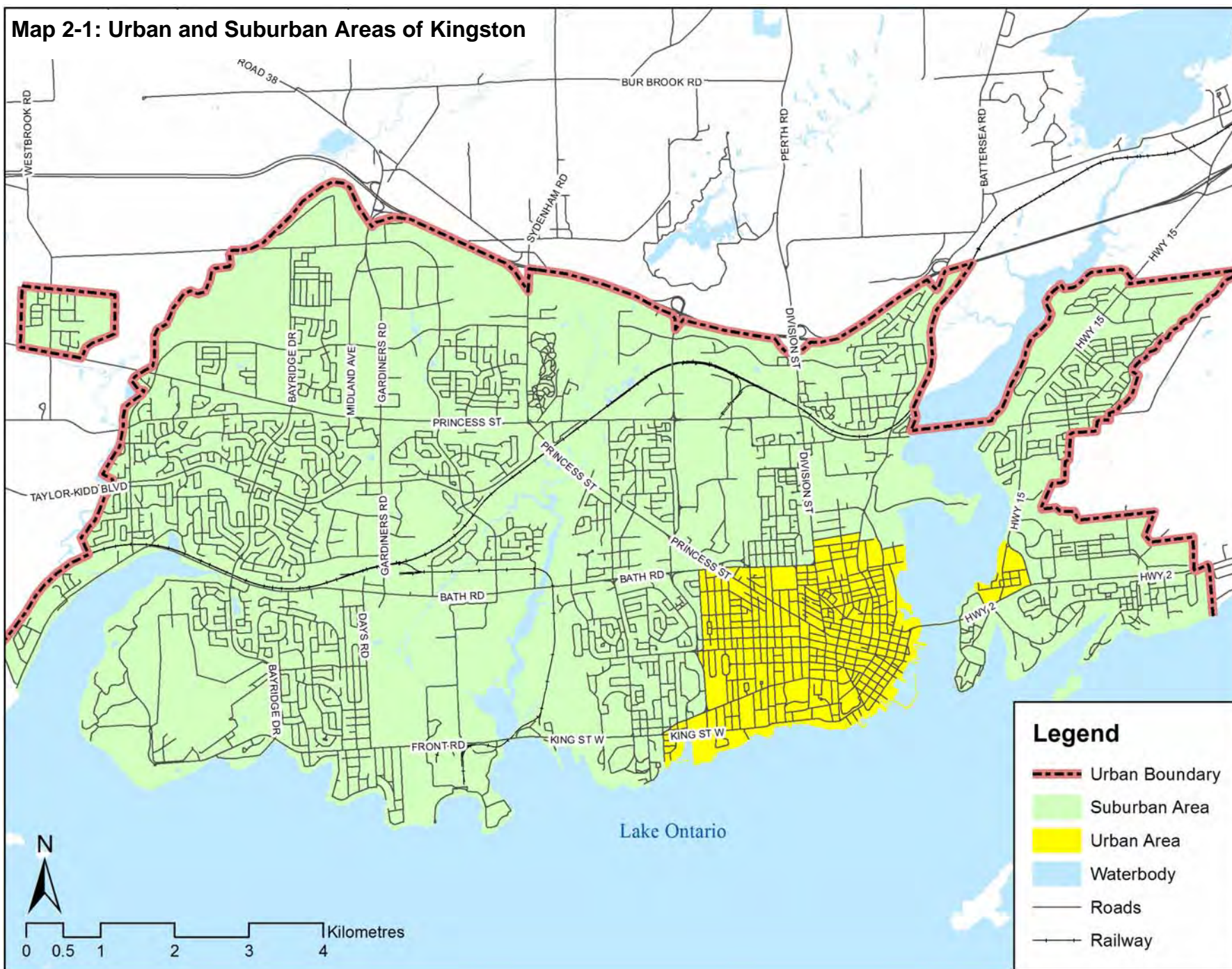
2.2.2 Classification of Kingston Streets in the Official Plan

Roadways in the City of Kingston are currently classified in a hierarchical manner in the Official Plan as Arterial Roads, Collector Roads or Local Roads.<sup>31</sup> Table 2-1 summarizes this classification, while maps 2-2, 2-3 and 2-4 locate the different categories of roadways within Kingston. While commercial streets in the urban areas of the City have undergone extensive study, roadways with commercial activity in suburban areas have not been well-studied. In suburban areas, most commercial activity takes place on arterials. The needs of pedestrians, cyclists and motorists are fundamentally different for these types of streets compared to their residential counterparts. So it is useful for the purposes of this report to separate suburban arterial roads into residential and commercial arterial roads.

Notes

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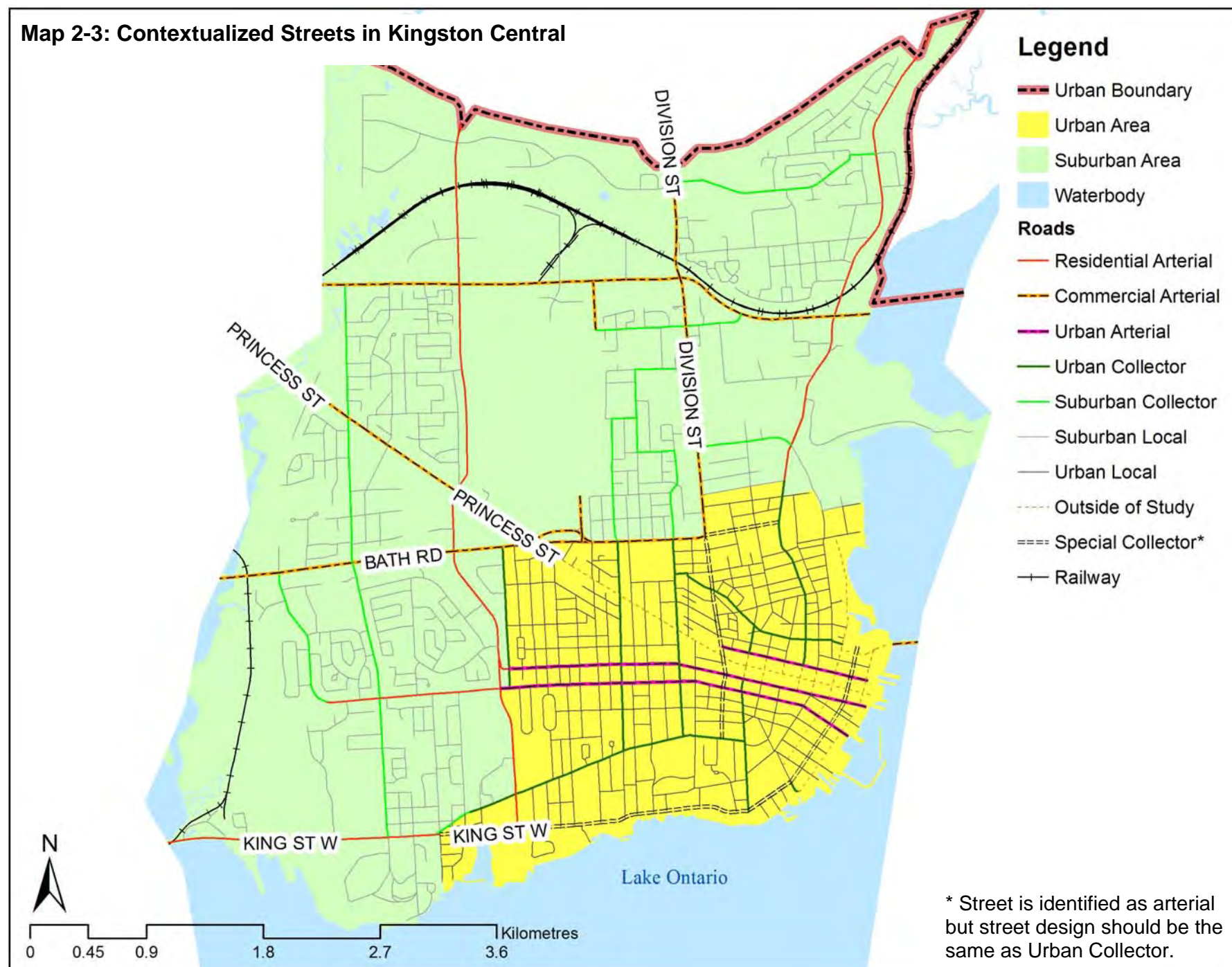


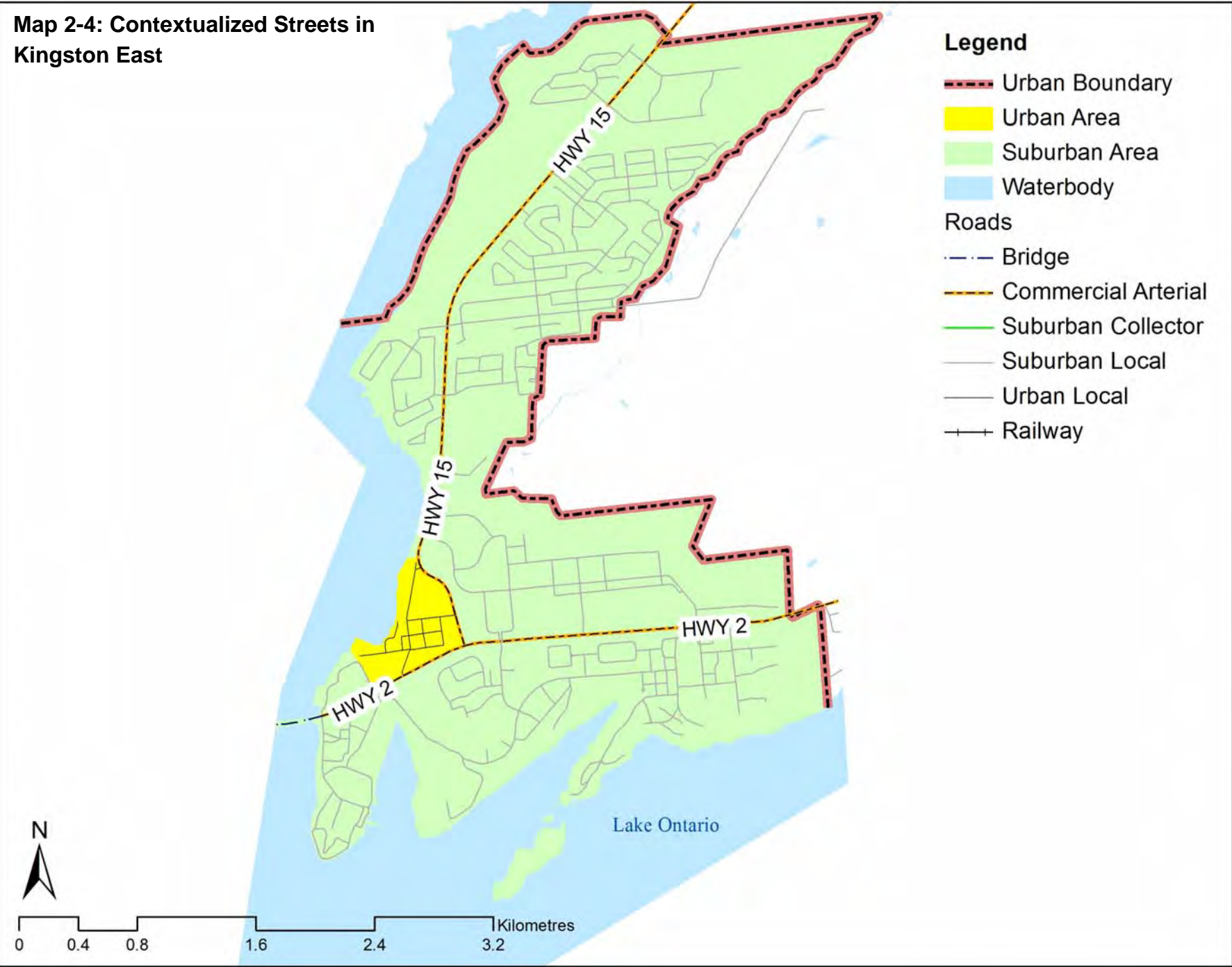
Map 2-2: Contextualized Streets in Kingston West





Map 2-3: Contextualized Streets in Kingston Central







### 3.0 The Backbone of Great Streets

#### 3.1 The Public Right of Way

The right of way (ROW) width defines the spatial extent within which the elements of 'Great Streets' exist. The ROW contains both horizontal and vertical zones which must be considered in the creation of Great Streets (Figure 3-1.).<sup>1</sup>

##### Horizontal Zones:

**Interface Zone:** mostly consisting of private property, this area frames 'Great Streets' and should provide for pedestrian-oriented land uses.

**Public Realm:** contains travel lanes for pedestrians and cyclists as well as the boulevard which contains green infrastructure, amenities for public transit as well as street furniture and public amenities.

**Carriage Way:** contains travel lanes for vehicles and in some circumstances for bicycles as well. Also contains space for parked cars and, where appropriate, carriage way features such as medians, bulb-outs and the green infrastructure that can be contained within them.

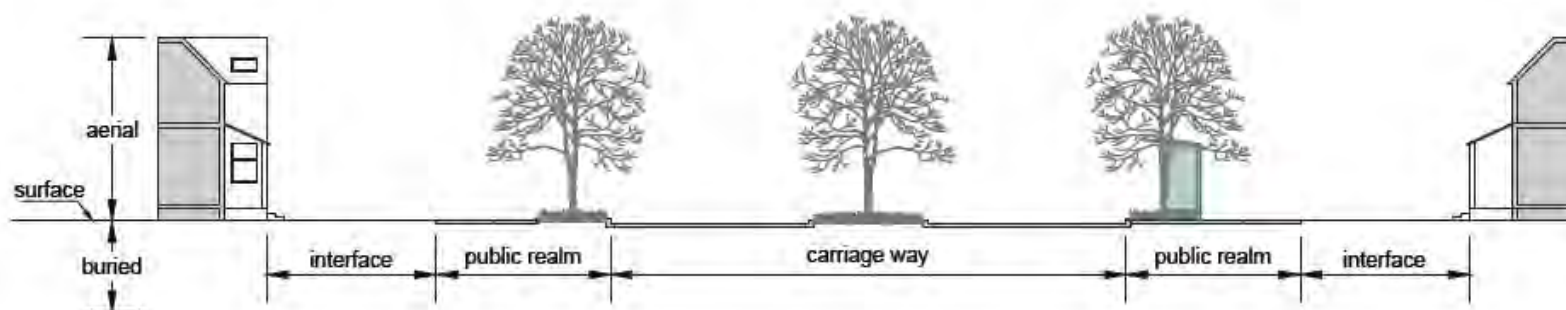
##### Vertical Zones:

**Aerial:** includes street lights, traffic signals, signs, and the tree canopy.

**Surface:** contains the horizontal zones that make for Great Streets.

**Buried:** includes tree and utility trenches, stormwater and sewer features.

**Figure 3-1: Cross section of the Vertical and Horizontal Zones within the Public Right of Way.**



3.1.1 Kingston New Development Right of Way Standards

In Kingston, ROW widths for new development are outlined in the City’s *Subdivision Development Guidelines & Technical Standards* (see Table 3-1).<sup>2</sup>

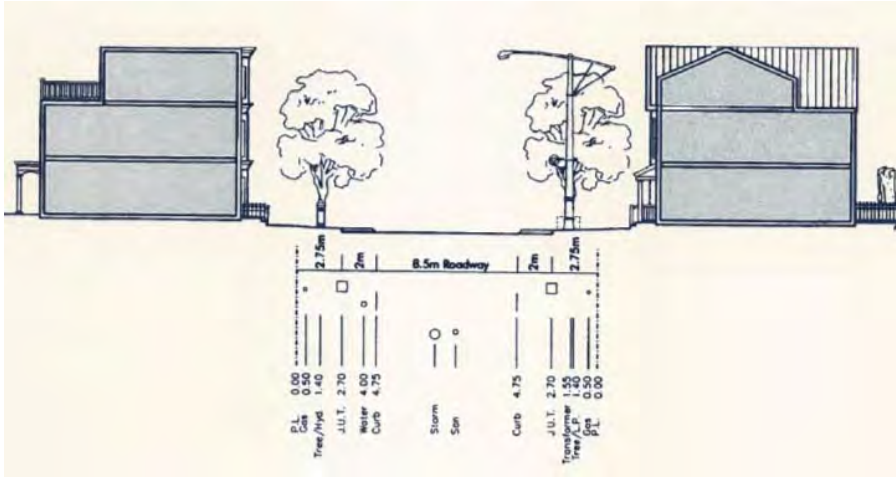
**Table 3-1: Right of way standards for new subdivisions.**  
Source: Kingston, City of (2012). Subdivision Development Guidelines & Technical Standards. Kingston, Ontario

Road Classification (Vehicles per day)	No. of Lanes	Minimum Right of Way Width (m)	Minimum Pavement Width (m)
Local (under 1,000)	2	18	8.5
Collector (minor) (1,000 to 5,000)	2	20	9
Collector (Major) (5,000 to 8,000)	2	22	10
Arterial (Minor) (8,000 to 15,000)	2	26	12
Arterial (Major) (Greater than 15,000)	4	36	18

3.1.2 The Right of Way: Challenges

The City of Kingston is presently facing challenges with implementing an 18m ROW. These challenges, within the buried zone, include providing for the necessary utility services to fit within the ROW as well as operational issues such as snow storage capabilities of streets with a decreased width.

Alternative design guidelines produced in 1995 by the Ministry of Municipal Affairs and Housing (then separate Ministries) indicated how servicing challenges to an 18 m ROW may be met.<sup>3</sup> Gas lines are placed on either side of the ROW within the boulevard, along with the utility trench and water lines, as show in Figure 3-2. The storm and sanitary pipes are placed along either side of the centreline of the ROW. Another solution to the placement of utilities in narrower ROW is the use of rear laneways. In this way utility services can be split between the street ROW and the rear laneways. However, Kingston faces unique challenges due to the high costs of excavating the shallow limestone underlying much of the City. There are ongoing studies to meet those challenges.



**Figure 3-2: Proposed solution to servicing 18 m right of way.** Source: Ministry of Municipal Affairs and Ministry of Housing (1995). Making Choices: Alternative Design Guidelines. Toronto, Queen’s Printer for Ontario.

Another challenge is the practice of reversing residential frontage on arterial and major collector streets. Rear laneways can act as a solution to the problem of reverse frontage lots. Currently, residential access (i.e., driveways) onto major collector streets and arterial roads is not permitted. Through the use of laneways, residential uses could front on to major collector and arterial streets while their vehicular access would be provided through rear laneways. This would provide for safe pedestrian and vehicle access from both sides of the property. While the positioning of laneway garages across the entire width of the lot poses access challenges to emergency response vehicles, these challenges can be addressed during the site plan phase of development.

In an urban context, challenges exist due to the variety of ROW widths and the way in which streets are utilized. Streets in the urban core were often laid out prior to the determination of their modern function. Streets with a wider ROW do not necessarily function as a higher order street as they would in a suburban context; in many cases local, collector and arterial streets all share the same ROW width. Designing streets with a contextual approach addresses the functions of these streets, implementing measures to reduce speeds on local streets and providing for greater vehicle access on collector and arterial streets.

### 3.1.3 Contextualized Right of Way Guidelines for Kingston

City of Kingston street data and City staff were consulted to provide the predominant urban and suburban ROW widths for the various categories of streets within the City. Table 3-2 illustrates the result of contextualizing Kingston street ROW widths and their transportation function.

**Table 3-2: Contextualized street classifications and ROW widths for City of Kingston streets.**

	Road Classification	No. of Lanes	Right of Way Width (m)
Urban	Narrow Local 1	2	12.2
	Narrow Local 2	2	15.25
	Wide Local	2	20.12
	Collector	2	20.12
	Arterial- One Way Traffic	2	20.12
	Arterial- Two Way Traffic	3	20.12
Suburban	Narrow Local	2	18
	Wide Local	2	20
	Residential Minor Collector	2	20
	Residential Major Collector/Minor Arterial	2	26
	Narrow Residential Major Arterial	4	30.5
	Wide Major Residential Arterial	4	36
	Commercial Arterial	4	30.5
	Laneways	1	6

3.2 Travel Lanes

The width of travel lanes are an important consideration for the creation of Great Streets. Travel lanes provide for the movement of automobiles, transit and cyclists, and the transportation of goods. Wider traffic lanes act as a barrier to safe pedestrian crossing and encourage higher speeds. The determination of appropriate lane widths must strike a balance between the surrounding uses and context of the street, the volume of traffic, the safety of pedestrians and cyclists, and the requirements of emergency vehicles as well as those of maintenance and utility vehicles.

3.2.1 Kingston Travel Lane Design Standards

Travel lanes in the City of Kingston are designed according to the *Geometric Design Guide for Canadian Roads*.<sup>4</sup> The guidelines are based on traffic volumes and speeds of the different types of roads (Table 3-3). These guidelines are utilized as a starting point to determine appropriate travel lane widths. However, the fallback position for all travel lanes is often 3.5 m. In some cases, when there is a constricted ROW, the City has utilized narrower travel lanes.

**Table 3-3: Transportation Association of Canada travel lane width guidelines.** Adapted from: Transportation Association of Canada (1999) *Geometric Design Guide for Canadian Roads*. Ottawa.

Road Classification	Design Speed (km/h)	Min. Travel Lane Width (m)	Max. Travel Lane Width (m)
Local	30 – 40	3	3.7
Collector (minor)	50 – 60	3.3	3.7
Collector (Major)	50 – 60	3.5	3.7
Arterial (Minor)	80	3.5	3.7
Arterial (Major)	80	3.7	3.7

3.2.2 Disadvantage of Traditional Travel Lane Standards

When considering the types of streets in Kingston there are disadvantages to utilizing these guidelines:

- A large discrepancy between minimum and maximum travel lane widths within the local street category.
- There is no differentiation in travel lane widths for collector streets with speeds of 60 km/h and those with lower speeds.
- Arterial roads are designed for speeds above 80 km/h; there are no design guidelines for lower speed arterials.

3.2.3 Alternative Travel Lane Design Standards

Other guidelines exist for the design of travel lanes that address some of these shortcomings. The Institute of Transportation Engineers<sup>5</sup> (ITE) advocates that road widths for collector and arterial streets should be based on the use of the street as well as the desired speed of automobile traffic (Table 3-4). Furthermore, it is suggested by the ITE that travel lane widths for one-way collector and arterial streets can be further narrowed from conventional widths to reduce speed naturally.

When designing travel lane widths it is imperative that the needs of transit, tractor trailers and emergency vehicles be taken into consideration. Buses and tractor trailers require

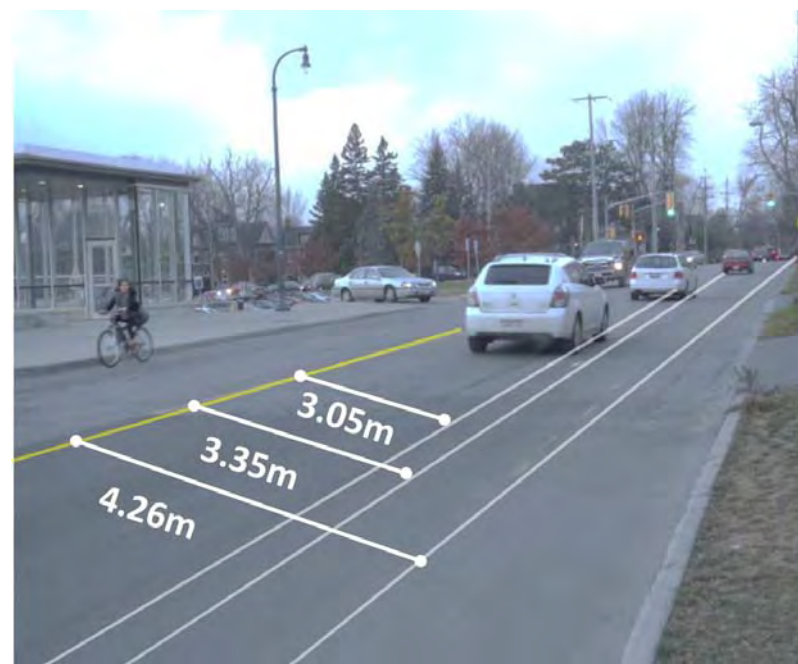
street widths of 3.35 metres (11 ft) when traveling in areas with speed limits of 60 km/h or less. It is important to note that these guidelines are created for streets with speeds of 30 and 35 mph (48.28 and 56.33 km/h). These speeds do not necessarily translate into a Canadian context. Further research needs to be performed to understand if these widths are appropriate for speed limits of 50 and 60 km/h.

**Table 3-4: Institute of Transportation Engineers recommended travel lane width guidelines for arterial and collector roads.** Adapted from: Institute of Transportation Engineers (2010). *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach*. Washington DC

Road Classification	Design Speed (km/h)	Minimum Travel Lane Width (m)	Maximum Travel Lane Width (m)
Lower Speed Collector	48.28 (30 mph)	3.05 (10 ft)	3.05 (10 ft)
Higher speed Collector	56.33 (35 mph)	3.05 (10 ft)	3.35 (11 ft)
Lower Speed Arterial	48.28 (30 mph)	3.05 (10 ft)	3.35 (11 ft)
Higher Speed Arterial	56.33 (35 mph)	3.05 (10 ft)	3.65 (12 ft)

Alternative guidelines for local streets have been proposed by the Ministries of Municipal Affairs and Housing in their *Alternative Design Standards*.<sup>6</sup> These guidelines suggest an appropriate travel lane width for local roads to be 2.75 metres. However, the requirements of emergency vehicles must be taken into consideration when designing local roads. The Ontario Building Code requires that emergency vehicles have a minimum clearing of 6 m for the total travel lane width.<sup>7</sup> The City of Waterloo Transportation Master Plan calls for similar standards advocating for a travel lane width of

between 3 m and 3.3 m for local and minor collector streets.<sup>8</sup> While a travel lane width of 2.75 m may be optimal, until such time as legislation allows, travel lane widths must remain at 3 m for local streets. Figure 3-2 showcases the result of utilizing narrower lanes on a Kingston street and highlights the amount of space that can be gained within the pedestrian realm by doing so.



**Figure 3-3: Narrower lane widths on Union Street.**



### 3.2.4 Contextualized Travel Lane Guidelines for Kingston

Table 3-5 illustrates the result of implementing the aforementioned narrower travel lane widths with the contextualized Kingston street types proposed in the previous chapter.

**Table 3-5: Recommended travel lane widths for Kingston Streets.**

	Road Classification	Speed Limit (km/h)	Support Transit/Tractor trailers	No. of Lanes	Travel Lane Width (m)
Urban	Local	50	No	2	3
	Collector	50	Yes	2	3.35
	Arterial One Way Traffic	50	Yes	2	3.35
	Arterial Two Way Traffic	50	Yes	3	3.35
Suburban	Suburban Local	50	No	2	3
	Minor Collector	50	Yes	2	3
	Major Collector	60	Yes	2	3.35
	Residential Arterial	60	Yes	4	3.35
	Commercial Arterial	60	Yes	4	3.35
	Laneway	10	No	1	6

### Notes

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## 4.0 The Building Blocks of ‘Great Streets’

The following chapter discusses the various elements that make for Great Streets. The fundamentals of each element grouping are presented; existing conditions and policies in Kingston are reviewed; best practices are considered; and recommendations for the Kingston context are proposed. The chapter is separated based on element groupings as follows:

- 4.1 Green Stormwater Infrastructure
- 4.2 Street Trees
- 4.3 Pedestrian Safety and Accessibility
- 4.4 Pedestrian-scale Lighting and Street Furniture
- 4.5 Traffic Calming
- 4.6 Cycling
- 4.7 Transit

### 4.1 Green Stormwater Infrastructure

#### 4.1.1 Fundamentals of Green Stormwater Infrastructure

Green infrastructure specific to stormwater management is referred to as ‘green stormwater infrastructure’. Green infrastructure includes both natural vegetation and vegetative technologies that provide many health benefits for society<sup>1</sup> and can also be referred to as low-impact development (LID). The idea is to employ small, decentralized stormwater treatments to capture runoff before it enters the underground sewer pipes.<sup>2</sup> It is important to capture rain as close to the source as possible in order to reduce contaminants picked up as runoff<sup>3,4</sup>, as

well as to minimize the amount of impervious cover and maximize the pervious surface to reduce runoff and prevent flooding.<sup>5</sup>

The aim of green stormwater infrastructure then is to use vegetation to capture rain before it has a chance to become runoff. This means rainfall needs to be able to infiltrate into the subsurface, which requires reducing the impervious surface, and increasing the pervious surface, which also requires a couple of soil conditions<sup>6</sup>:

- Non-compacted, porous soil to ensure water infiltration.
- High organic content, good quality soil to ensure plant survival.

Green stormwater management techniques can be classified by the following functions:

##### 4.1.1.1 Bioretention / Biofiltration<sup>7</sup>

Bioretention and biofiltration involve the use of planted depressions designed to collect and absorb stormwater runoff from nearby paved surfaces by combining engineered stormwater control and treatment with aesthetic landscaping. Depending on soil conditions, they can be designed to remove pollutants from stormwater using biological processes, and slow the movement of stormwater through the landscape into the soils below.



**Swale on SE Clay and 12<sup>th</sup> Street, Portland, Oregon.** Source:<http://mediaprojectionline.org/heavyweather/green.html>



**Infill planter in Philadelphia**  
Source: Marissa Huber (<http://www.flickr.com/photos/marissandrew/3652378546/>)



**Planter box in Perth, ON.** Source: Diana Chang

***Vegetated Swale<sup>8</sup>***- A vegetated swale is a broad, shallow channel with dense vegetation covering the side slopes and bottom. Where soils do not drain well, swales are typically lined and convey runoff elsewhere. As the runoff flows along the length of the swale, the vegetation slows it down, allowing it to infiltrate into the ground.

Vegetated swales are highly customizable to treating street runoff because of their linear nature. They can be installed in median strips and curb extensions by excavation and retrofit.

Swale bottoms should be relatively flat so that flow across the swale is even. Swales should have shallow side slopes and depth to avoid safety risks and prevent erosion. Widths can be 1.5 to 3.4 m, or as narrow as 0.91 m.<sup>9,10</sup>

***Planters***- Landscaping installed wherever space and site conditions allow. Planters contribute to capturing runoff in order to prevent overflow. Examples of typical placement include on curb extensions and in medians. Planters are typically lined with permeable fabric, gravel, and soil and filled with vegetation, including street trees. There are generally two types of planters:

**Underground planters**, which are connected to the subsurface soil. Soil in these types of planters should be lower in elevation than the sidewalk to receive runoff.

**Above ground planters**, which are held in boxes or containers. These can be used when subsurface constraints such as utilities or poor soil quality exist.

**Planting Strips-** Planting strips in the boulevard alongside the road can detain, cleanse, and infiltrate stormwater using trees and understory landscaping.

As they can be effective even in small installations, bioretention planters are appropriate in constrained locations where other stormwater facilities are not possible. Landscaping may be included in medians greater than 1.2m in width, including curbs. A 0.61m wide path clear of plantings is recommended for maintenance workers where possible. Low maintenance, drought tolerant species are encouraged.



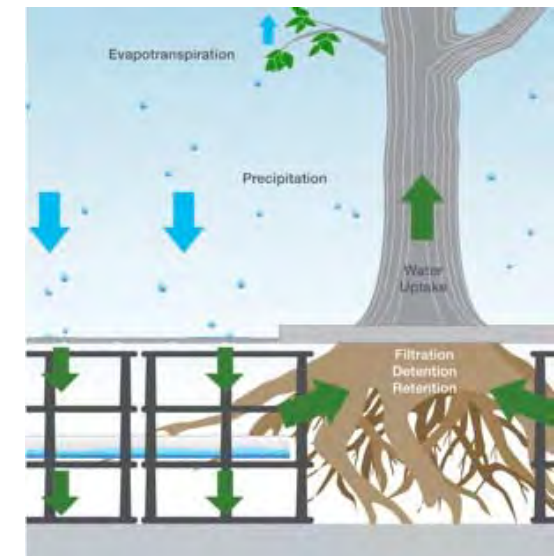
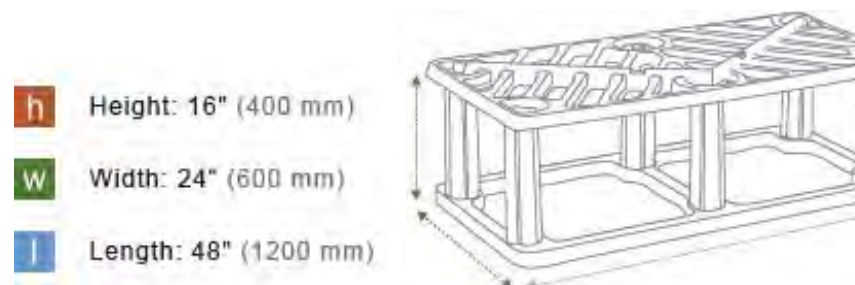
**Planting strip in Seattle, WA and median planting strip in Indianapolis, IN.**

Source: Wendi (<http://beaconhill.seattle.wa.us/2011/05/page/2/>) and Indianapolis Public Works (<http://www.indy.gov/eGov/City/DPW/SustainIndy/RRR/Recycle/Pages/Adopt-A-Median.aspx>)

#### 4.1.1.2 Infiltration

This is the process by which water moves through the soil. It is vital for ensuring the health and longevity of plants in the bioretention system, as well as for preventing runoff and reducing flooding events.

**Silva Cells<sup>11</sup>**- Silva cells are underground structures composed of a frame to support large tree growth. Given their ability to be stacked both laterally and up to three levels high, they can be fitted into many types of spaces to create a maximum containment area for lightly compacted loam soil. Each unit is about 92% void space, making it easy to accommodate utilities.



**How a silva cell works with the hydrological cycle (above) and typical dimensions of a single cell (left).**

Source: Deep Root ([www.deeprroot.com](http://www.deeprroot.com))





**Permeable pavement, with silva cell installed underneath allows water to infiltrate to the root system, Syracuse, NY.**

Source: DeepRoot ([www.deeproot.com](http://www.deeproot.com))



**Porous Pavement installed at the City of Kingston Water Conservation Garden.** Source: Project Team

***Permeable pavements***<sup>12</sup> - Permeable pavements come in a variety of textures and colours, so they are best applied on special areas on the street that need distinction, such as bike lanes, on-street parking, or any other areas that could make use of markings to divide and separate spaces. Permeable pavement can also be as simple as having gaps between pavement sections to allow water to pass through.

### **Special Types:**

**Unit / interlocking concrete pavers:** Usually form interlocking patterns, placed within a rigid frame on top of a sand bed or an under drain system. Typically made of pre-cast concrete, brick, stone, or cobbles. Some pavers also have small voids in the pavement surface to increase permeability.

**Porous pavement:** Also referred to as 'structural soil,' porous pavement is specifically engineered to allow water to infiltrate the soil. For cost considerations and less maintenance, a small strip at the end of a driveway, for instance, can be effective. Soils underneath should drain well, and the slope should be less than 10%. Requires cleaning or vacuuming the surface once or twice a year to maintain porosity. Properly installed pervious paving systems can last greater than 20 years.

The gaps between pavers may require occasional weeding or scorching and sand or gravel replenishment. As pervious pavers are easily lifted and reset, they are easy to repair or replace.

### **4.1.1.3 Conveyance**

Conveyance measures direct stormwater runoff. For roadways, manipulations to the curbsides runoff to water vegetated areas.



**Covered Channels<sup>13</sup>**- Channels are concrete or stone-lined pathways used to carry rainwater runoff along the surface to other LID features or the sewer system. Channels reduce the need for buried storm drains and carry surface water where underground utility infrastructure prohibits the installation of additional storm drain pipes. Aesthetic, artistic, and educational features can be added to a design. Covered channels are generally recommended in order to maintain public accessibility.

Channels are usually deeper than 15cm with hard vertical sides. A minimum slope of at least 0.5% should be maintained, and the maximum slope in absence of structural controls should not exceed 6%. (Where steeper slopes are present, terraces or check dams should be incorporated into the channel design).

**Curb Cuts-** are strategically placed gaps along a curb to allow runoff to move into a planter or swale. They convey stormwater runoff into the landscaped area, watering the vegetation. The use of curb cuts to direct water onto vegetation allows for infiltration into the soil rather than into stormwater sewers.

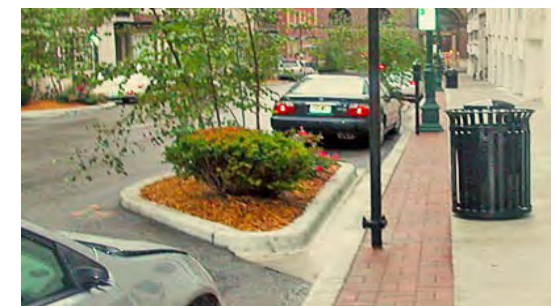
**Curb extensions / bulb-outs-** are extensions of the raised sidewalk that can be used to provide space for green stormwater infrastructure such as planters and street trees and can be interspersed in the parking lane.



**Covered channel diverts street runoff into planter on King Street in Kitchener, ON.** Source: Metrolinx (<http://www.metrolinx.com/mobilityhubs/images/mhg/Fig6-10.jpg>)



**Curb cuts can direct roadway runoff into bioretention features.** Source: Southeast Michigan Council of Governments (<http://www.semcog.org>)



**Planters on small curb extensions within the parking lane.** Source: San Francisco Better Streets

### 4.1.1.4 Implementation of Green Stormwater Infrastructure

The best time to incorporate green stormwater infrastructure is at the earliest stage of development, however, implementation can occur during<sup>14</sup>:

- Design of new construction
- Reconstruction projects
- Maintenance activities
- As part of a community redesign process

Green stormwater techniques such as planters and swales can be installed in traffic circles, curb extensions, medians, bike lanes, interspersed in the parking lane and other spaces in the right of way.<sup>15</sup>

### 4.1.2 Existing Green Stormwater Infrastructure Policy and Conditions in Kingston

In keeping with Kingston's Official Plan statement on Stormwater Management (section 4.3)<sup>16</sup> to reduce the amount of surface runoff and maintain water quality, green stormwater infrastructure should be incorporated in achieving these goals as it promotes the capture of stormwater at the source in more ecologically sound ways. Green stormwater infrastructure is a long-term strategy that has the added benefit of avoiding common problems with conventional infrastructure, such as repairs to cracked or broken underground pipes and the associated risk of water contamination, while alleviating the existing sewer system.

Green stormwater infrastructure also contributes to Sustainable Kingston's water goals of minimizing pollutants collected by stormwater runoff as identified in the Sustainable Kingston Plan.<sup>17</sup> Indeed, the City is already benefiting from its existing green infrastructure, along with water conservation measures such as the Rain Barrel program, and other test pilots of roadway LID and silvacells. Green stormwater infrastructure should be considered in future studies, planning and policy as Kingston continues to move in the direction of city planning for sustainability.

### 4.1.3 Green Stormwater Infrastructure Best Practices for Great Streets

Green stormwater best management practices occur when a combination of techniques are employed (Figures 4-1 and 4-2). For instance, when used with street trees, both the urban environment and ecosystem service benefits are maximized. This is also more cost effective since the soil requirements for both can be shared.



Source: (above) EPA Office of Water, <http://www.sfbetterstreets.org>;  
(right) Friends of Five Creeks, <http://bluegreenbldg.org>

**Figures 4-1 and 4-2: Green stormwater infrastructure being used effectively with street trees in Seattle, WA (Left) and El Cerrito, CA (Below).**



#### 4.1.3.1 Case Studies – Green Stormwater Infrastructure Examples from Other Municipalities

**Ann Arbor, Michigan<sup>18</sup>**- The reconstruction of East Street saw the reduction of 26 feet of asphalt to 18 feet. The difference was made up with the addition of two 3.5-foot concrete porous paver strips to capture all road runoff, along with some rooftop and sidewalk runoff. Bioswales were also implemented along the street.



Source: [http://www.semcog.org/uploaded/files/Programs\\_and\\_Projects/Water/Stormwater/LID/LID\\_Manual\\_chapter8.pdf](http://www.semcog.org/uploaded/files/Programs_and_Projects/Water/Stormwater/LID/LID_Manual_chapter8.pdf)

**Edmonston, Maryland<sup>19</sup>**- The Town of Edmonston, MD (pop. <1500) has 'greened' their main street, which was particularly vulnerable to flooding. The green stormwater system is designed to capture the first 1.33 inches of rain during storms, or about 90% of all rain events in a typical year. Techniques include bioretention cells, curb extensions, and permeable pavement for their bike lanes. Education and public engagement were important for redesigning this street.



Source: <http://edmonstonmd.gov/images/SP32-20100719-222808.jpg>

**Rhode Island<sup>20</sup>**- Rhode Island has developed an online repository tool that showcases various green techniques that have been installed across the state. The online mapping tool allows the user to select a technique, such as a bioswale, permeable pavement, 'Green Street,' or any combination to see where they have been employed (see RI Rhode Island Stormwater Solutions Low Impact Development (LID) Inventory: [http://www.ristormwatersolutions.org/SW\\_ri\\_lidtour.html](http://www.ristormwatersolutions.org/SW_ri_lidtour.html)).

### 4.1.4 Green Stormwater Infrastructure ‘Great Streets’ Recommendations for Kingston

- Consider incorporating green stormwater techniques as early in the new or re-development stage as possible for easier, cost effective implementation.
- Locate utilities (telephone, cable, electricity, natural gas) in shared trenches and/or beneath the sidewalk rather than beneath a landscaped boulevard. This further reduces ROW requirements, but may increase future utility company costs unless the lines are placed in a conduit that can be accessed without requiring excavation and reconstruction of the sidewalk.<sup>21</sup>
- Disconnect the impervious cover as much as possible. Avoid having single slabs of impervious cover and break the area up with vegetation and pervious pavement wherever possible.
- Mandate good quality soil.
- Provide education for community buy-in and awareness.
- Maximize the tree canopy cover over impervious surfaces.
- Set Alternative Development Standards.
- Implement policies for maximum runoff and employ incentives to achieve this goal.
- Avoid frequent mowing or cutting of vegetation, as they are more effective when lush.

**Table 4-1: Best Practices toolkit for implementing Green Infrastructure.** ✓ = This feature is suitable for this road type x = This feature is not recommended or not necessary for this road type.

		Urban			Suburban			
		Arterial	Collector	Local	Residential Arterial	Commercial Arterial	Collector	Local
Bioretention/ Biofiltration	Planters	✓	✓	✓	✓	✓	✓	✓
	Vegetated Swale	x	x	x	✓	✓	✓	✓
	Planting Strip	x	x	x	✓	x	x	x
Infiltration	Silva Cells	✓	✓	✓	x	x	x	x
	Permeable Pavement	✓	✓	✓	x	✓	x	x
Conveyance	Curb Cuts	x	x	x	✓	✓	x	x
	Channels	✓	✓	✓	x	x	x	x



### 4.2 Street Trees

#### 4.2.1 Fundamentals of Street Trees

Ideally, street trees and vegetation should be considered as a default street feature due to the benefits they provide, rather than a luxury item to be included in a city's streetscape.<sup>22</sup> Urban trees and their root systems are relied upon to absorb stormwater as an important part of modern stormwater management techniques. The techniques being promoted include reducing the impervious surfaces associated with streets by planting more trees, and creating centre medians to filter runoff. By helping to reduce impervious surfaces and managing runoff, street trees are an essential component of designing Great Streets.<sup>23</sup> Trees also complement our built urban areas by giving the streets a sense of scale and helping to define street and pedestrian spaces, especially where buildings are set back from the street.<sup>24</sup>

Street trees aid in the cooling of urban environments and reduce the heat island effect through the processes of shading and evapotranspiration. The heat island effect occurs when surfaces that were once permeable and moist are made impermeable and dry through paving, causing urban regions to become warmer thereby forming an "island" of higher temperature.<sup>25</sup>

Tree leaves lower the amount of solar radiation that reaches the area below the tree's canopy, providing shade and reduce temperatures. Shading reduces surface temperature below the tree while the cooler surfaces

reduce the amount of heat transmitted into the atmosphere, thereby reducing the heat island effect.<sup>26</sup> Trees absorb water through their roots which then evaporates from the leaf surfaces through transpiration. Evaporation also occurs from the soil around trees which intercept rainfall on leaves and surrounding surfaces. The two processes together are known as evapotranspiration, which helps in cooling surfaces and mitigating the heat island effect.<sup>27</sup>

In addition to these benefits, the presence of street trees and vegetation also promotes reduced vehicle speeds in urban areas, a safer walking environment, greater pedestrian traffic in commercial areas, increased security, improved air quality, a reduced need for drainage infrastructure and improved aesthetics.<sup>28</sup>

#### 4.2.2 Existing Street Trees Policies and Conditions in Kingston

The City's *Subdivision Development Guidelines and Technical Standards* require developers of new subdivisions plant trees as per a 'street tree planting plan.' This plan must be prepared by a certified landscape architect and submitted along with the first engineering submission.<sup>29</sup> In new subdivisions, trees should be located at equal distances from the curb on both sides of the street to provide a balanced, canopied streetscape. They should be planted in the public right of way (ROW) so that the stock is included in the City's forestry data bank (see Table 4-2).<sup>30</sup> The guidelines further stipulate the distances that should be maintained between street trees and other street features, including utilities (see Table 4-3).<sup>31</sup>

**Table 4-2: Recommended tree spacing and location.** Source: City of Kingston Subdivision development guidelines and technical standards

Residential Dwelling Type	Lot Frontage	Spacing	Front Yard Depth	Location
Single Family Dwelling	9m or greater	1 tree per lot	>6 meters <6 meters	Within the public ROW, respecting service separation requirements and a minimum of 7.5 meters from the foundation of any house.
Single Family Dwelling	<9m	1 tree every second lot	As Above	As above.
Duplex/semi detached dwelling	9 m or greater	1 tree per lot	As Above	As above.
Duplex/semi detached dwelling	<9m	1 tree per lot	As Above	As above.
Triplex dwelling	9m or greater	1 tree per lot	As Above	As above.
Town houses	<7m	1 tree every third lot	As Above	As above.
Apartment building	>30m	Trees 8m on centre	6m or greater <6m	Within the public ROW, respecting service separation requirements and a minimum of 7.5 meters any foundation walls.
Corner Lots Exterior side yards	Lot depth	2-3 trees equally spaced between sight triangles on properties	Lot depth 30m or greater (60m block length)	Between property line and curb, depending on servicing trench and sidewalk location.

**Table 4-3: Recommended separation distances between street trees and other street features.** Source: City of Kingston Subdivision Development Guidelines and Technical Standards

Street feature	Distance
Street lights	3.0 metres
Sidewalks	0.5 metres
Curbs	1.5 metres to back of curb
Driveways	1.25 metres
Other Trees	8.0 metres
Electric transformers	3.0 metres from the access hatch side
Hydrants	1.5 metres
Water/sewer lines	2.0 metres
Hydro lines	1.0 metre from line or as required by Hydro One or Utilities Kingston

The trees listed in Table 4-4 are recommended by the City of Kingston for planting as street shade trees. A total of five different species are to be selected from the list for a street. The trees are to be planted so that no two species of the same type are side by side unless otherwise approved by City staff as stated in the Tree Conservation By-law.<sup>32</sup> The trees listed in Table 4-5 are recommended for small lots, cul-de-sacs or where servicing limits space. The trees should be single leader trees and not multi-stem stock.<sup>33</sup>

**Table 4-4: Recommended street shade trees by City of Kingston**  
Source: City of Kingston Subdivision Development Guidelines and Technical Standards

Common name	Latin name
Freeman Maple	<i>Acer x freeman</i>
Emerald Queen Maple	<i>Acer plantanoides</i> (Emerald Queen)
Parkway Maple	<i>Acer plantanoides</i> (Parkway)
Red Maple	<i>Acer rubrum</i> var. Morgan/Red Sunset
Hackberry	<i>Celtis occidentalis</i>
Ash	<i>Fraxinus</i> var: White/Marshall's Seedless/Summit/Green
Honey Locust	<i>Gleditsia triacanthos</i> var. Shademaster/Skyline
Maidenhair (male only)	<i>Ginkgo biloba</i>
Red Oak	<i>Quercus rubur</i>
Linden	<i>Tilia var cordata</i> var. Glenleven/ Euchlora (Crimean)

**Table 4-5: Recommended street trees for small lots and cul-de-sacs.** Source: City of Kingston Subdivision development guidelines and technical standards

Common name	Latin name
Katsura Tree	<i>Ceridiphyllum japonicum</i>
Amur Cork tree	<i>Phellodendron amurense</i>
Ornamental Pears/Bradford, Redspire	<i>Pyrus calleryana</i>
Ivory Silk Tree	<i>Syringa amurensis japonica</i> (Ivory Silk)
Serviceberry	<i>Amelanchier Canadensis</i>
Amur Maple	<i>Acer ginnala</i>
Thornless Cockspur Hawthorn	<i>Craetaegus crusgalli</i> 'inermis'

#### 4.2.3 Street Trees Best Practices for 'Great Streets'

According to Steve Nix, a professional forester with 26 years of experience at the Alabama Forestry Commission in USA, the best street trees to plant on streets and sidewalks are trees that are most adaptable to the urban environment. These trees tolerate compacted, infertile soils and the general environment in cities. These trees are referenced below and some of them have been chosen as 'Urban Tree of the Year' by The Society of Municipal Arborists (SMA).<sup>34</sup>

- European Hornbeam (*Carpinus betulus* Fastigiata) is ideal for use as a hedge, screen or windbreaker.
- Hedge Maples (*Acer campestre* Queen Elizabeth) are excellent for residential areas and downtown urban areas due to their small stature and vigorous growth. They are easily adaptable to urban conditions with low pest and disease issues.
- Littleleaf Linden (*Tilia cordata*) is suitable for areas where adequate root space is available. Also has a predictably symmetrical shape and a prolific bloomer.
- Maidenhair (*Ginkgo*) thrives in a wide range of soil and is very tolerant of the stress of urban areas. The male cultivar of *Ginkgo* is excellent for tree planting as it is practically pest free, resistant to storm damage and can be easily transplanted.
- Thornless Honeylocusts (*Gleditsia tricanthos* var inermis shademaster) are excellent fast growing street trees. The tiny leaflets turn golden yellow in fall before dropping and are so small they vanish easily without extensive racking.
- Drake Chinese lacebark Elm (*Ulmus parvifolia*) is an excellent fast growing tree and often evergreen. It is extremely tolerant of urban stress and very resistant to Dutch elm disease. It thrives in drought conditions, adapts to alkaline soil and is relatively free of pests and diseases.



4.2.4 Street Trees ‘Great Streets’ Recommendations for Kingston

- Street tree planting should be tailored to the appropriate context and setting. For instance, bare root stocks work in green spaces but not on streetscapes because inadequate soil on streetscapes can cause bare roots to dry out and die if left exposed for any period of time.
- Tree sizes should be appropriate for the planting location. For example, street trees should be larger on collectors and arterials because they undergo more stress after planting.
- Trees with wider roots should be planted on wider ROWs.
- The City should ensure that there is at least one tree on every lot.<sup>35</sup>
- Soil and moisture improvement practices for trees such as the use of permeable pavement should be implemented as conditions permit.
- Fall planting should be adopted as opposed to planting in the spring because cool temperatures and adequate rainfall make fall a good time to plant. Also the soil may be warmer and less damp than in the spring.
- Root guards should be installed in tree pits to inhibit the growth of roots in the direction of the adjacent utilities.<sup>36</sup>
- The distance between trees and utilities should be maximized to avoid interference.

- In a narrow ROW, columnar or vertically oval-shaped trees should be considered to avoid interference with utilities, street lights and poles (see Figure 4-3).<sup>37</sup>

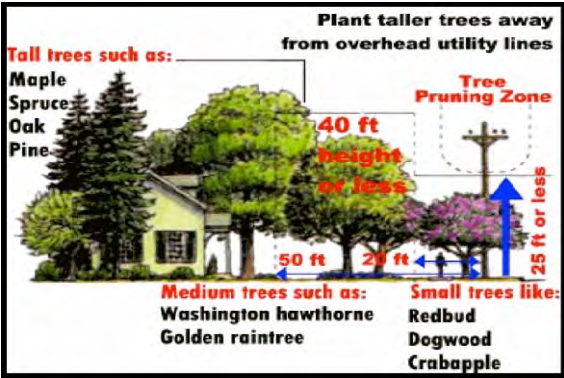


Figure 4-3: Trees and power line distances. Source: <http://www.bulldcityrising.com/2007/07/attack-of-the-m.html>

The City currently has a wide variety of street trees on different types of streets; however, there are often conflicts with other amenities that also need to be accommodated within the City’s ROWs. Table 4-6 below lists trees that are recommended for planting on urban and suburban streets.

Table 4-6: Recommended trees for Urban and Suburban Streets.

Sources: [http://www.gutenberg.org/catalog/world/readfile?fk\\_files=1502743&pageno=1](http://www.gutenberg.org/catalog/world/readfile?fk_files=1502743&pageno=1) and [http://forestry.about.com/od/urbanforestry/tp/street\\_trees.htm](http://forestry.about.com/od/urbanforestry/tp/street_trees.htm)

RECOMMENDED TREES FOR URBAN STREETS	RECOMMENDED TREES FOR SUBURBAN STREETS
Norway Maple American Elm (ideal for wide streets) Red Oak European Hornbeam Thornless Honeylocust Maidenhair	Hedge Maple (ideal for residential areas) Maidenhair (ideal for narrow streets) Pin Oak (best-suited for suburban streets)

### 4.3 Pedestrian Safety and Accessibility

#### 4.3.1 Fundamentals of Pedestrian Safety and Accessibility

##### *Sidewalk Widths and Accessibility*

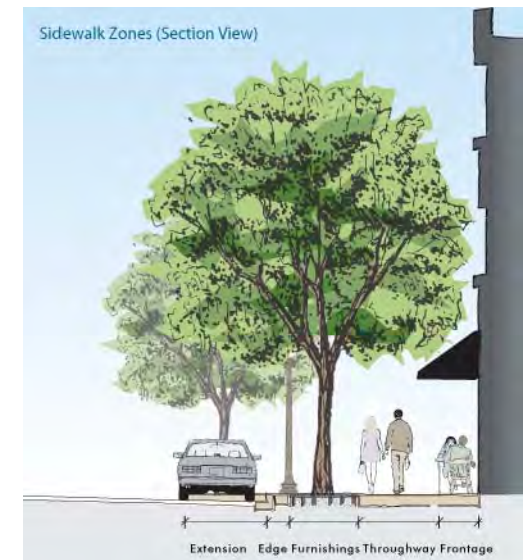
Sidewalks allow for the movement of people and are an important social space where people interact. Sidewalks must be wide enough to accommodate movement as well

as other functions related to the land uses located along the ROW.

Sidewalks on Great Streets should enable active public space and accessible pedestrian travel. Amenities such as landscaping, lighting, seating, and merchandise displays can contribute to vibrant street life, but they must be properly organized to ensure safe and accessible travel using sidewalk zones.<sup>38</sup> The *San Francisco Better Streets Plan* organizes the sidewalk into the following five zones, from property line to curb<sup>39</sup> (see Figure 4-4):

- **Frontage Zone:** The area adjacent to the property line where transitions between the public sidewalk and the space within buildings occur.
- **Throughway Zone:** The portion of the sidewalk for pedestrian travel along the street.
- **Furnishing Zone:** The portion of the sidewalk used for street trees, landscaping, transit stops, street lights, and site furnishings.
- **Edge Zone:** The area used by people getting in and out of vehicles parked at the curbside.
- **Extension Zone:** The area where pedestrian space may be extended into the parking lane, via features such as bulb-outs with mid-block plazas.

The optimal sidewalk width varies with the expected pedestrian activities, character of adjacent land uses and speed and volume of vehicular traffic in the ROW. Appropriate widths for each sidewalk zone vary based on numerous conditions, such as overall sidewalk width, pedestrian volumes, adjacent land uses, presence of driveways, and so on.<sup>40</sup> The *San Francisco Better Streets Plan* recommends that new streets that are part of major development or redevelopment plans should strive to



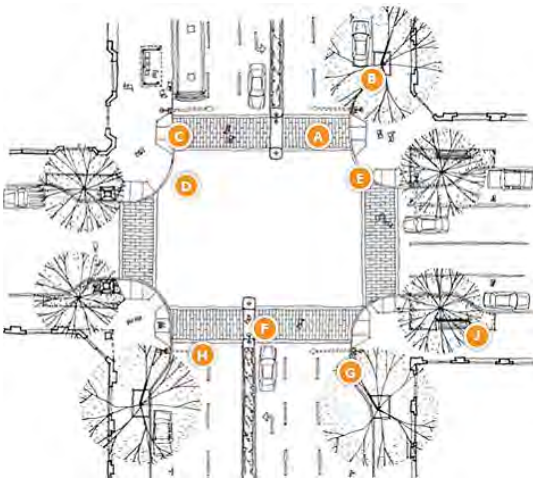
**Figure 4-4: Section view of a sidewalk organized into the five zones.**

Source: San Francisco Better Streets Plan (2011)

The optimal sidewalk width varies with the expected pedestrian activities, character of adjacent land uses and speed and volume of vehicular traffic in the ROW. Appropriate widths for each sidewalk zone vary based on numerous conditions, such as overall sidewalk width, pedestrian volumes, adjacent land uses, presence of driveways, and so on.<sup>41</sup> The *San Francisco Better Streets Plan* recommends that new streets that are part of major development or redevelopment plans should strive to exceed the minimum recommended widths, while acknowledging that in the case of existing streets, streetscape improvements may be constrained by the total available ROW as well as competing uses such as bicycle or transit lanes. The minimum recommended sidewalk/boulevard width for most types of streets is 12 feet or 3.7 metres.<sup>42</sup> For storing ploughed snow in the winter, the sidewalk needs to either be 0.5 metres wider if it is right at the curb, or be set a minimum of 1.2-2 metres away from the curb. In the summer, the extra space will be utilized by the larger volume of pedestrians using the sidewalks.

### ***Pedestrian Crosswalks and Accessibility***

Intersections and pedestrian crosswalks must be designed to ensure maximum pedestrian comfort and safety, and to minimize the distance, time and risk of exposure to collisions with traffic. Providing a pedestrian-friendly public realm that emphasizes safety can encourage people to walk to their destinations more often, even on high-traffic streets. Ideally, pedestrian-friendly intersections should include the following features (see Figure 4-5)<sup>43,44,45</sup>:



**Figure 4-5: Essential features in designing pedestrian-friendly intersections** Source: San Francisco Better Streets Plan (2011)

- ***Well-marked, visible crosswalks (A)*** to draw the attention of drivers. Raised or coloured crosswalks may be appropriate in some high pedestrian-traffic locations.
- ***Restricted parking at street corners (B)*** to maximize visibility for both pedestrians and drivers.
- ***Tight curb radii (D) and curb extensions (E)*** to slow turning traffic, increase visibility, and reduce pedestrian crossing distance.
- ***Accessible pedestrian signals (C)*** and features such as *curb ramps* to provide a safe and comfortable environment to all pedestrians.
- Where possible, ***median refuges (F)*** should be provided up to the crosswalk for pedestrians who may not be able to cross the entire roadway in one stretch.
- Intersections should have ***pedestrian lighting (G)*** at night to improve visibility for all users.
- ***Streetscape amenities (H)*** such as furniture, trees and landscaping can help to enhance the quality of the public realm of the intersection.

### 4.3.2 Existing Pedestrian Safety and Accessibility Policy and Conditions in Kingston

#### ***Sidewalk Widths***

Currently, the minimum sidewalk width requirement in Kingston is 1.5 metres or approximately 5 feet, which is the minimum recommended Pedestrian Access Route (PAR) or *walk zone* width for only very low pedestrian traffic areas.<sup>46</sup> According to Section 4.6.4 of the Official Plan (OP) and the Subdivision Development Guidelines and Technical Standards, newly constructed and re-constructed urban arterials and collectors must have sidewalks provided on both sides of the street, and local streets must have sidewalks on at least one side of the street. These sidewalks must directly connect neighbourhood interiors to transit and also provide connections to commercial areas to encourage pedestrian traffic in these areas (Section 4.6.5). The OP prioritizes connections between schools, recreational facilities, shopping areas, and areas of employment (Section 4.6.8). Additionally, Section 4.6.6 states that the City supports wide sidewalks with a range of amenities, trees, and transit stops where necessary, and street-front retail and personal service shops adjacent to the sidewalk in commercial areas (Section 4.6.7).

#### ***Pedestrian Crosswalks***

According to Section 4.6.3 of the OP, new development and redevelopment in settled areas of Kingston must have facilities such as pedestrian signals, sidewalks, crosswalks, and curb ramps that provide a safe and convenient

environment for pedestrians. These projects also have to include facilities that provide enhanced access to those with limited mobility.

According to the Pedestrian Crossing Guidelines, the provisions of the Highway Traffic Act of Ontario mean that the City cannot develop municipal bylaws that allow pedestrians the right of way (ROW) at uncontrolled traffic intersections. As a result, it may even be dangerous to install pedestrian crosswalks at uncontrolled intersections because pedestrians may mistakenly believe that they have the ROW. Consequently, the Pedestrian Crossing Guidelines state that *“the City will not support the installation of signed and marked crosswalks at locations where vehicles are not controlled by any of the following: traffic signals, intersection pedestrian signals, mid-block pedestrian signals, pedestrian crossovers, stop signs or school crossing guards with the exception of at Courtesy Crossings where specialized markings and signage may be installed”* (p. 3).

The City has installed Courtesy Crossings at select uncontrolled intersections, although pedestrians are still advised through signage to exercise caution as vehicles are not required to yield at these crossings. These have proven effective at increasing the percentage of drivers yielding to pedestrians at these crossings. Pedestrian Crossovers and Intersection Pedestrian Signals are not recommended for installation in Kingston, according to the current policy, due to confusion among drivers and pedestrians regarding their proper use. Mid-block Pedestrian Signals are used since they give pedestrians the ROW and are well-understood by both drivers and pedestrians.



Accessibility

Section 8.2 of the OP addresses the issue of providing barrier-free access and safety through the review of Public Works construction (such as sidewalks) by “providing adequate walkway widths, visually permeable materials and structures, and landscaping elements that do not obstruct sightlines in the design of streetscapes”. Within the City’s provincially mandated Accessibility Plan (2012), the Transportation Accessibility Standard “addresses barriers to accessibility for persons with disabilities in the delivery of public and private transportation services. Public and private transportation services refer to modes of passenger transportation within provincial and municipal jurisdiction (such as municipal transit and taxis)”. Under this plan, sidewalk ramps will be installed as part of all new construction and reconstruction projects, and additional warranted sidewalks will be installed where none currently exist. Winter snow removal will also be a priority to ensure accessible sidewalks, and the Step Safe Program will continue to operate.

In addition, the City’s Facility Accessibility Design Standards (FADS) also provide design standards for curb ramps that take into consideration not only those using wheelchairs and other devices, but also the needs of the visually impaired.

4.3.3 Pedestrian Safety and Accessibility Best Practices for ‘Great Streets’

Sidewalk Widths

The City of Burlington’s Downtown Urban Design Guidelines call for sidewalks to be widened to a minimum of 4-5 metres, or 13.1-16.4 feet, wherever possible in the downtown area. This allows for a variety of sidewalk amenities as well as a comfortable walk zone or PAR. These guidelines also suggest that in some cases, sidewalk width can be increased by providing developers additional sidewalk amenities in return for increased setbacks that contribute to a large public ROW. Sidewalk widths are measured from property line to the edge of the curb and include the width of the curb.

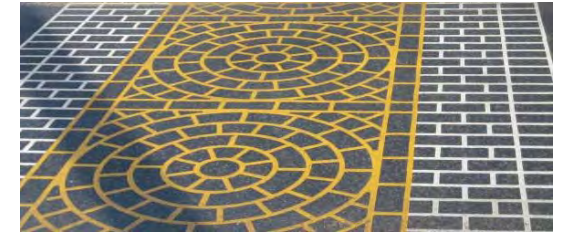
Table 4-7: Minimum recommended and ideal sidewalk widths for different street types

	Street Type	Minimum Recommended Width	Ideal Width
Urban	Local	≥9 ft or 3 m <sup>47,48</sup>	12 feet or 3.7 m <sup>49</sup>
	Collector	≥12 ft or 3.7 m <sup>50</sup>	15 ft or 4.6 m <sup>51</sup>
	Arterial	≥12 ft or 3.7 m <sup>52,53</sup>	13-16 ft or 4-5 m <sup>54,55</sup>
Suburban	Local	≥9 ft or 3 m <sup>56,57</sup>	≥10 ft or 3 m <sup>58</sup>
	Collector	≥12 ft or 3.7 m <sup>59,60</sup>	≥12 ft or 3.7 m <sup>61,62</sup>
	Residential Arterial	≥12 ft or 3.7 m <sup>63,64</sup>	≥12 ft or 3.7 m <sup>65,66</sup>
	Commercial Arterial	≥12 ft or 3.7 m <sup>67,68</sup>	13-16 ft or 4-5 m <sup>69,70</sup>

### Pedestrian Crosswalks

- **Well-marked and strategically placed Courtesy Crossings-** can encourage drivers to stop for pedestrians on two-lane streets with relatively high pedestrian and traffic volumes and no other traffic controls within 200 metres. Highly durable and visible materials should be used for Courtesy Crossing markings. Kingston has already piloted the use of DuraTherm, an asphalt-based, inlaid thermoplastic material that provides a wide range of colour and pattern choices at the Courtesy Crossing on King Street. This material should continue to be used for all crosswalk markings as paint fades within a year.<sup>71</sup>
- **Use of longitudinal crosswalk markings-** increases driver visibility of crossings significantly, leading to increased yielding by drivers and channelization of pedestrians.
- **Medians or refuge islands-** are one of the safest and most adaptable engineering improvements to pedestrian crossings. They are most often used when traffic speeds and volume are high, when streets are wide, and when sightlines are poor.<sup>72</sup> Compared to signal controlled crossing, crossing islands are less expensive to install and maintain, lead to shorter waiting times to cross, allow for mid-block crossings, and have been shown to reduce crashes by up to 40 per cent.<sup>73</sup>
- **Curb extensions should-** only be used on streets with on-street parking, avoiding streets used by buses or other large vehicles whose turning movement may be significantly hindered<sup>74</sup> Specific priority areas for curb extensions include<sup>75</sup>:
  - New streets.
  - Streets with high pedestrian volumes and/or high traffic volumes and speeds.
  - Wide streets with long crossing times.
  - Streets with a history of pedestrian safety concerns.
  - Locations where neighborhood streets intersect with busier thoroughways.
  - Transit priority streets where shortening crossing cycles would improve transit flow.

Lower priority areas for curb extensions include streets with lower pedestrian and traffic volumes and lower speeds, such as local streets and alleys.<sup>76</sup>



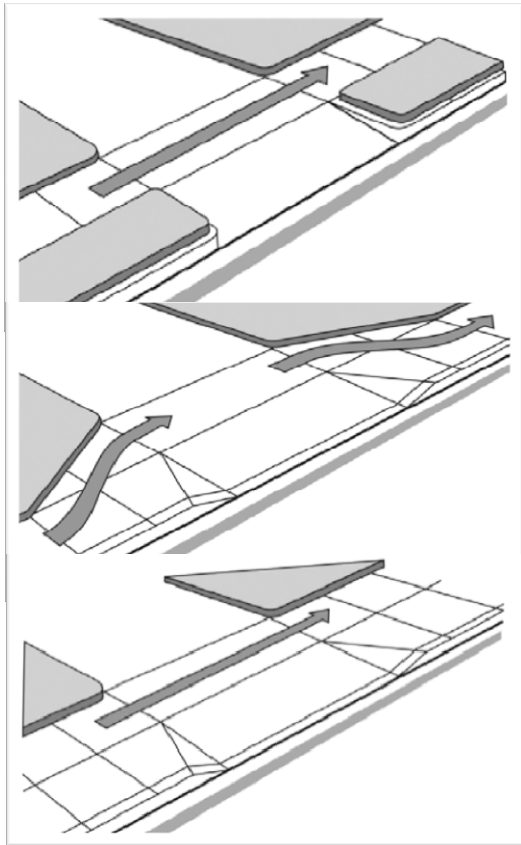
**Clearly marked Courtesy Crossing on King Street in Kingston, ON, using long-lasting DuraTherm.** Source: The City of Kingston



**Curb extension in Surrey, BC.** Source: The City of Surrey.



**Accessible curb ramp in Edmonton, AB, with detectable grid-lined surface to aid those with limited visibility**  
Source: The City of Edmonton



**Accessible designs for driveway crossings on sidewalks** Source: ITE

### **Accessibility**

**Accessible pedestrian signals (APS)-** provide information in non-visual format such as audible tones, verbal messages, and/or vibrating surfaces. San Francisco's observations have shown that APS benefits all pedestrians by providing audible and vibro-tactile cues. APS should be provided at all new signalized intersections.<sup>77</sup> Locations that may need APS include those with<sup>78</sup>:

- Vehicular and/or pedestrian actuation.
- Very wide crossings.
- Crossings of major streets where minor streets have minimal or intermittent traffic (APS may be needed for crossing the major street).
- T-shaped intersections.
- Non-perpendicular or skewed pedestrian crossings.
- Low volumes of through vehicles.
- High volumes of turning vehicles.
- Split phase signal timing.
- Exclusive pedestrian phasing, especially where right-turn-on-red is permitted.
- Leading pedestrian intervals.

**Curb ramps-** provide pedestrian access between the sidewalk and roadway for people using wheelchairs, strollers, walkers, crutches, handcarts, bicycles, and pedestrians who have trouble stepping up and down high curbs. Curb ramps are crucial to a full transit network and to pedestrian safety. Without curb ramps in place, people with mobility disabilities are often forced to travel in the street with traffic in order to move around the city.<sup>79</sup> On new streets, stormwater drainage inlets should be placed on the uphill side of curb ramps to prevent standing water at curb ramp landings.<sup>80</sup> Where driveways cross the sidewalk, they must be at the same level so as to allow smooth movement for those using mobility devices.<sup>81</sup>

#### 4.3.4 Pedestrian Safety and Accessibility ‘Great Streets’ Recommendations for Kingston

##### ***Sidewalk Widths***

The City of Kingston should strive to meet the minimum recommended sidewalk widths as laid out in Table 4-4 on all existing streets within ROW constraints and attempt to meet the ideal sidewalk widths on new streets. In order to make best use of available resources, the City will need to prioritize areas for sidewalk widening. Areas that are not very urbanized should be low priority for sidewalk widening efforts. Priority areas for sidewalk widening include areas with<sup>82,83</sup>.

- High volume of pedestrian traffic (e.g. downtown, streets around Queen’s University, transit nodes).
- High volume and speed of vehicle traffic (e.g. Taylor-Kidd Boulevard).
- Transit stops.
- Street level commercial activity (for example, Ontario Street).
- Tall buildings which require wider streets to minimize shadows.
- Street amenities such as benches or pedestrian lighting, and landscaping.
- Ceremonial or civic significance.

##### ***Pedestrian Crosswalks***

- *Well-marked and strategically placed Courtesy Crossings* should be installed on two-lane streets with relatively high pedestrian and traffic volumes and no other traffic controls within 200 metres. *Highly durable and visible materials* should be used for Courtesy Crossing markings.
- *Medians or refuge islands* should be used when traffic speeds and volume are high, when streets are wide, and when sightlines are poor. An example of a Kingston street where medians or crossing islands would vastly improve safety and comfort is on Taylor-Kidd Boulevard where all the above conditions hold true.
- *Curb extensions* should only be used on streets with on-street parking, avoiding streets used by buses or other large vehicles whose turning movement may be hindered.<sup>84</sup>

##### ***Accessibility***

- Accessible pedestrian signals (APS) should be provided at all new signalized intersections.
- Curb ramps with detectable grid-lined surfaces or raised crosswalks flush with the sidewalk should be provided on all sidewalk corners to promote accessible crossing.
- Where driveways cross sidewalks, they must be level with the sidewalk, at least in the walk zone, to enable smooth movement for mobility devices.



#### 4.4.4 Pedestrian Safety and Accessibility 'Great Streets' Recommendations for Kingston

**Table 4-8: Best Practices toolkit for implementing pedestrian safety and accessibility measures.** ✓ = This feature is suitable for this road type; x = This feature is not recommended or not necessary for this road type.

	Urban			Suburban			
	Arterial	Collector	Local	Residential Arterial	Commercial Arterial	Collector	Local
Wide sidewalks	✓	✓	✓	✓	✓	✓	x
Well- marked, visible courtesy crossings	x	✓	x	x	x	✓	x
Curb extensions	x	x	✓	x	x	x	✓
Accessible pedestrian signals	✓	✓	x	✓	✓	✓	x
Medians	✓	✓	x	✓	✓	✓	x

## 4.4 Pedestrian-Scale Lighting and Street Furniture

### 4.4.1 Fundamentals of Pedestrian-Scale Lighting and Street Furniture

#### ***Pedestrian-scale Lighting***

A pedestrian-friendly environment is a key component of Great Streets. Pedestrian-scale lighting improves not only the safety of pedestrians along streets and pathways, it also invites pedestrians to the street. The *San Francisco Better Streets Plan*<sup>85</sup> notes “quality street lighting helps define a positive urban character and supports night time activities. The quality of visual information is critical for both traffic safety and pedestrian safety and security.” Pedestrian-scale lighting can be utilized along many streets to create safer and more active streets. Although pedestrian-scale lighting can be placed on almost all streets priority should be given as follows<sup>86</sup>:

- Streets with high pedestrian volumes.
- Key civic, downtown, and commercial streets.
- Streets with concerns about pedestrian safety and security, such as at freeway underpasses.
- Small streets such as alleys and pedestrian pathways.

Every municipality has lighting illuminations that are acceptable for pedestrian standards. In general, providing sidewalks with a minimum luminance of 0.5 fc (5.38 Lux) allows pedestrians to detect obstacles, stay visually

oriented, and recognize faces from a distance of 13 feet, a minimum distance that brings comfort with regard to normal social contact.<sup>87</sup> The illuminations standards may vary; therefore it is important to understand the requirements for pedestrian-scale lighting individually by municipality. The *San Francisco Better Streets Plan* and the City of Ottawa have developed recommended light level standards for pedestrian-scale lighting (see Table 4-9 and Table 4-10).

**Table 4-9: Light Level Recommended Standards<sup>88</sup>**

Streetscape Type	Light Level
Commercial	10.8 lux
Residential	3.2 – 4.3 lux
Mixed-Use	5.4 lux

**Table 4-10: Light Level Standards, City of Ottawa<sup>89</sup>**

Roadway Classification	Illuminance Levels
Arterial	10.0 lux
Major Collector	5.0 lux
Collector	3.0 lux
Local	2.0 lux

#### ***Street Furniture***

Aside from pedestrian-scale lighting, street furniture and amenities add important functional uses to streets that encourage walking and other active transportation modes. Street furniture includes signage, benches, trashcans, public art, bollards, and banners. According to the *San Francisco Better Streets Plan* “street furnishings provide important amenities for pedestrians by adding functionality and vitality to the pedestrian realm. They announce that pedestrians are welcome and that the street is a

comfortable place to be. These amenities provide a functional service to the pedestrian and provide visual detail and interest”.<sup>90</sup> Street furniture can thus create more complete streets by making streets more inviting and functional.

### 4.4.2 Existing Pedestrian-Scale Lighting and Street Furniture Policy and Conditions in Kingston

#### *Pedestrian-scale Lighting*

In 2010, the City of Kingston established a set of urban design guidelines that establish specific standards that should be met in regards to pedestrian-scaled lighting. These are only a set of guidelines and are therefore not mandatory. The plan states: “Downcast, pedestrian-scaled lighting enhances safety and visibility on streets. In key areas, lighting can be used to accent special features, such as buildings heritage properties, landscaping, signage, etc”.<sup>91</sup> More specifically, the Kingston Design Guidelines (2010) suggest the following standards for pedestrian-scale lighting<sup>92</sup>:

- The design and location of lighting should consider sustainability and the impacts of light pollution, including energy efficiency, directional lighting that reduces wasted energy, induction lighting, solar power, and street reflectors and sensors.
- Downcast pedestrian-scale lighting should be provided in high traffic pedestrian areas.
- All lighting should be located within the Street Furniture and Landscape Zone.

- Consideration should be given to providing additional pedestrian-scale lighting in areas with high volumes of pedestrian activity, such as key intersections, transit stops, trail crossings, and mid-block connections.

#### *Street Furniture*

The City of Kingston’s Design Guidelines (2010) also include a section on street furnishing, which states, “Street furniture is an essential component of a pedestrian- supportive streetscape, offering opportunities for rest, social interaction, and casual surveillance”.<sup>93</sup> Every street furniture element should add its own unique functionality to a given street with the sole intent of creating more functional streets for pedestrians. Kingston’s Design Guidelines include the following standards in regards to street furniture<sup>94</sup>:

- Street furnishings should be developed within an overall concept and should provide a consistent and unified streetscape appearance that is appropriate for the area context.
- Street furnishings should be placed in a coordinated manner that does not obstruct pedestrian or vehicular circulation.
- Street furniture should be placed so as not to impact sidewalk maintenance, particularly snow removal. Specifically, the provision of street furniture should not result in a requirement for hand shovelling in order to provide proper sidewalk access.

### 4.4.3 Pedestrian Safety and Accessibility Best Practices for 'Great Streets'

#### *Pedestrian-scale Lighting*

General guidelines state that pedestrian-scale lighting should be placed on the sidewalk within close proximity to the furnished zone. The adjacent image illustrates a good example of street lighting on an urban collector in Ancaster (Hamilton), Ontario. The street redesign that occurred in 2012 added full bike lanes, wider sidewalks, and street furnishings.



Source: Ancaster Heritage Village, 2012;

Pedestrian lighting poles will normally align with streetlights, however, in special circumstances where the sidewalks are wide, it is acceptable to place separate pedestrian-scale lighting away from the curbside.<sup>95</sup> Moreover, combined street lighting can be both cost effective and efficient with minimal additional requirements. For example, the adjacent image from Surrey, BC illustrates multi-purpose light posts that function as both street lighting and pedestrian-scale lighting.



Source: City of Surrey, 2012. Street Lights; <http://www.surrey.ca/city-services/>



### Street Furniture



**Redesign of King Street in Kitchener** included wider sidewalks that allowed for pedestrian lighting, bollards, benches, trash receptacles, and banners. Source: World Landscape Architecture, 2012, <http://worldlandscapearchitect.com/king-street-revitalization-kitchener-canada-ibi-group/>



**Ancaster (Hamilton), Ontario.** The street design shows that the simple use of bollards, benches and trashcans can add to the functionality of the space for pedestrians. Source: Ancaster Heritage Village, 2012; <http://www.ancasterheritagevillage.com>

Street furniture should be prioritized on streets with the highest pedestrian activity for maximum utilization. In addition, street furnishings are important in places where pedestrians remain for longer periods of time. This is primarily characteristic of downtown streets but can also be the case on local and collector streets depending on the city.

Street furniture well-placed along streets with high pedestrian volumes. Each example illustrates the differing street furniture elements used depending on street type and location. Residential neighbourhoods can also utilize street furnishings to create more enjoyable and inviting public spaces for residents. Although most street furnishings are placed to work in conjunction with each other, certain elements are only appropriate for specific streets.



**Niagara Region,** has recently completed a Complete Streets discussion paper. The image highlights important street amenities including pedestrian-scaled lighting, benches and trashcans. Source: Niagara Region, 2012: Complete Streets for Niagara, Discussion Paper

**Table 4-11: Best Practices toolkit for implementing Pedestrian-Scale Lighting and Street Furniture amenities.** ✓✓ = This feature is suitable for this road type; ✓ = This feature could be incorporated, under certain circumstances; x = This feature is not recommended or not necessary for this road type.

	Urban			Suburban			
	Arterial	Collector	Local	Residential Arterial	Commercial Arterial	Collector	Local
Pedestrian-Scaled Lighting*	✓✓	✓✓	✓	✓	✓✓	✓✓	✓
Benches	✓✓	✓✓	x	✓	✓✓	✓✓	x
Bicycle Racks***	✓✓	✓✓	x	✓✓	✓✓	✓✓	x
Trashcans	✓✓	✓✓	x	✓✓	✓✓	✓✓	x
Bollards****	✓	✓✓	x	✓	✓✓	✓✓	x

\* Pedestrian-scale lighting can be used on all street types. However, it should be prioritized on streets with high levels of pedestrian traffic. It should also be placed in conjunction with street furnishings.

\*\* Pedestrian lighting can be placed on all types of suburban streets depending on pedestrian volume. It is especially important to locate lighting around bus stops and connection routes.

\*\*\* Bicycle racks need to be accessible and located close to the trip destination.

\*\*\*\* Bollards should be prioritized on streets with high pedestrian volumes where transition between vehicle traffic and pedestrian walkways are not clearly distinguishable.

### 4.5 Traffic Calming

#### 4.5.1 Fundamentals of Traffic Calming

While a primary objective of Great Streets is to encourage the use of active transportation modes and transit, personal automobiles and their place in the right of way cannot be ignored. According to the Kingston Transportation Master Plan, the vast majority of peak-hour trips are made by automobile.<sup>96</sup> In order to successfully promote active modes and transit as alternatives to the automobile, care must be taken to design Kingston streets in a way that provides a safe, convenient and efficient right of way for all modes.

The Institute of Transportation Engineers (ITE) defines traffic calming as the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver

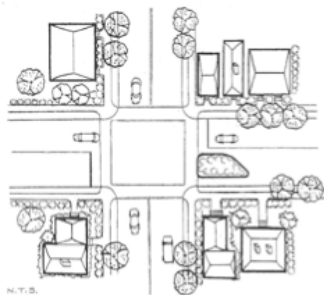
behaviour and improve conditions for non-motorized street users.<sup>97</sup> The concept of the differing needs of different streets is central to effective traffic calming. Not all streets need to be calmed and not all streets ought to be calmed, but many streets could be improved using one or a variety of calming techniques.

Calming measures are generally divided into three categories: horizontal deflections, vertical deflections, and obstructions. Horizontal deflections are those that force the driver to navigate through or around a feature. Vertical deflections create a change in roadway height that forces drivers to slow down in order to navigate the roadway without disruption. Obstructions are used to prevent particular movements and to discourage or eliminate short-cutting (or cut-through traffic). The following section describes measures under each category.<sup>98,99</sup>

##### 4.5.1.1 Obstructions

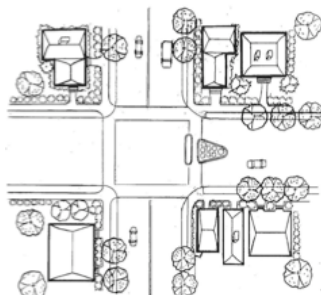
###### ***Directional Closure-***

Use(s): Reduce cut-through traffic; create one-way for automobiles/transit but not for other modes



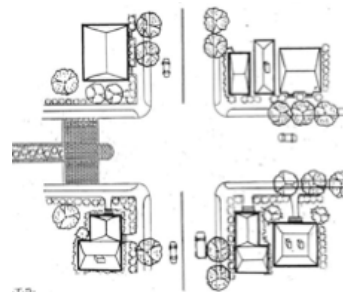
###### ***Right-in, Right-out Island***

Use(s): Channelization; reduce cut-through traffic



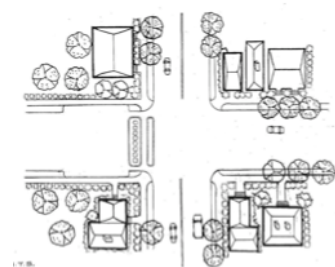
###### ***Narrowing/Gateway***

Use(s): Entrance to community; add friction to right-of-way causing drivers to sense a need to slow



###### ***Full Closure***

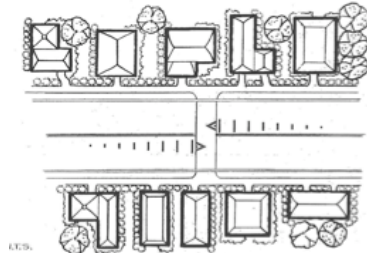
Use(s): Change traffic patterns; eliminate high volumes of through-traffic



### 4.5.1.2 Vertical Deflections

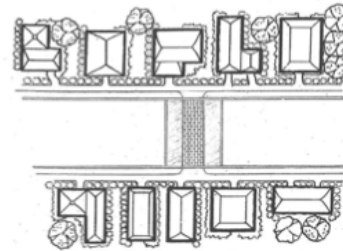
#### **Speed Hump/Cushion**

Use(s): Reduce speeds and volumes on residential streets



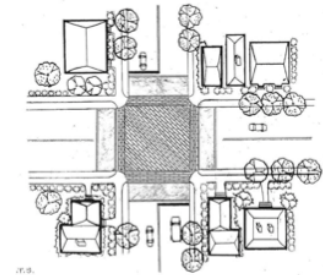
#### **Raised Crosswalk**

Use(s): Reduce speeds; decrease mid-block conflicts between vehicles and pedestrians



#### **Raised Intersection**

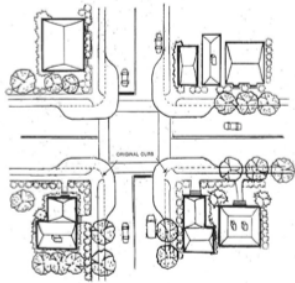
Use(s): Reduce speeds; decrease conflicts between vehicles and pedestrians at intersections



### 4.5.1.3 Horizontal Deflections

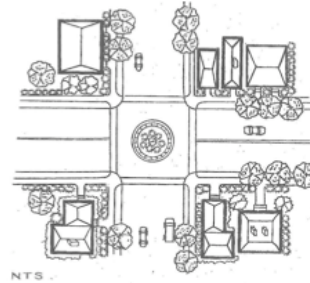
#### **Curb Extensions/Bulb-outs**

Use(s): Reduce crossing distance for pedestrians; slow turning traffic



#### **Traffic Circle**

Use(s): Slows vehicles entering intersections; appropriate when pedestrian volume and left-turning volumes are low



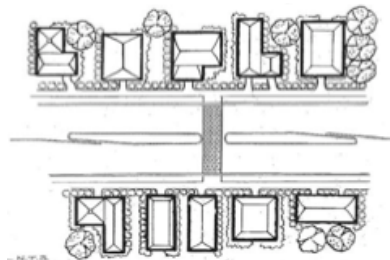
#### **Roundabout**

Use(s): Slows vehicles entering intersections; better for larger intersections



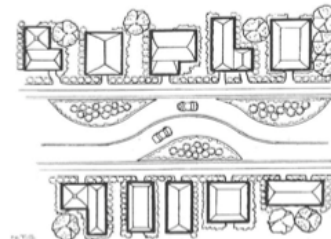
#### **Raised Median Island**

Use(s): Reduce pedestrian crossing distance; prevent passing movements



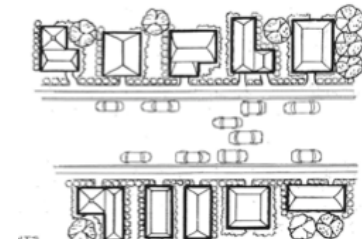
#### **Chicane**

Use(s): Slow motorists by forcing a weaving motion; reduce traffic volumes and speeds



#### **On-Street Parking**

Use(s): Reduce speeds by reducing width of street; 2.1m-wide spots for long-term; 2.5m-wide spots with heavy in-and-out





### 4.5.2 Existing Traffic Calming Policy and Conditions in Kingston

Both Kingston's Official Plan (OP) and the Transportation Master Plan (TMP) acknowledge the need to control traffic movements and operations in the city through design features.<sup>100,101</sup> The TMP further identifies traffic calming as a key component of network traffic management; however, it is Kingston's Traffic Calming Policy (2007) that specifically directs the implementation of traffic calming.<sup>102</sup> This policy outlines the criteria a street must meet to be eligible for traffic calming measures as well as the ranking system used to prioritize calming projects. The policy also provides a step-by-step process for community involvement and implementation. Kingston's policy dictates that traffic calming is only to be used on local and arterial streets and presents a familiar list of horizontal and vertical measures. Kingston's Traffic Calming Policy is similar to calming policies of other Canadian cities, likely due to their shared use of the *Canadian Guide to Neighbourhood Traffic Calming* by the Transportation Association of Canada (TAC) and the ITE.<sup>103</sup>

Traffic calming designs, whether intentional or not, have been used in Kingston since at least 1965, when the major Princess/Bath/Concession intersection west of downtown Kingston was still a roundabout (Figure 4-6 Princess Roundabout). Some projects have been more successful than others and each project provides lessons for future challenges. A thorough and inclusive process is important as outlined in the Traffic Calming Policy. For instance, the 17 speed humps split between McEwen Drive and

Lakeview Avenue in the Castell Park/Henderson neighbourhood and their conflict with transit stand as a hard lesson learned of the need for inter-departmental review of calming projects. The traffic calming measures in the Alwington/Sunnyside neighbourhood (between Queen's main and west campuses) provide a snapshot of the potential for retrofit neighbourhood traffic calming in an urban context (Figure 4-7 Willingdon Traffic Circle). In the suburban context, the project on Kingsdale Avenue near Meadowbrook Park and the future impact of the roundabout at Future Crescent and Centennial Drive provide opportunities to examine the potential for both retrofit solutions on existing suburban streets and built-in measures in new developments.



**Figure 4-6 (left): Princess/Bath/Concession Roundabout, c. 1965**

Source: Schliesmann (2009)  
Full circle: Student calls for return of legendary intersection. Kingston Whig-Standard: Kingston, ON.



**Figure 4-7 (Right): Traffic circle on Willingdon Avenue**

Source: Authors.

### 4.5.3 Traffic Calming Best Practices for ‘Great Streets’

As previously mentioned, Canadian practitioners generally rely on the ITE/TAC publication on traffic calming, whereas their U.S. counterparts use the *U.S. Traffic Calming Manual* by the American Planning Association and the aforementioned 1999 manual by the ITE. As a result, traffic calming strategies across municipalities in North America tend to be somewhat homogeneous. Kingston’s existing policy on traffic calming is therefore fairly reflective of ‘best practice’. Nevertheless, Kingston could learn from other cities’ policies and design approaches when it comes to incorporating traffic calming elements that fit ‘Great Streets’ objectives beyond mitigating aggressive driving and speeding.

#### 4.5.3.1 Case Studies – Examples of Traffic Calming from Other Municipalities

*Windsor*<sup>104</sup>: While many cities use a warrant scoring system to rank and prioritize projects, the City of Windsor approaches scoring in a different way. For local streets, tiered solutions are recommended based on a street’s score. Lower score streets employ new signage, and turning restrictions and one-ways are used. Medium score streets require chicanes, narrowing, curb radius reductions and other horizontal measures. Vertical measures are only used for local streets with a high score. For collectors, only horizontal measures are recommended given their impact on transit and emergency vehicles that use collectors. Although every street presents a unique set of challenges and opportunities, this tiered solution approach could be

useful for organizing projects according to funding requirements.

*Brampton*<sup>105</sup>: The City of Brampton’s Neighbourhood Traffic Management Guide employs a different categorization of traffic calming measures. Level I traffic calming measures are minor changes to the road used for modest reductions in speed and creating separation between motorized vehicles and non-motorized users. Level I measures include pavement markings, textured pavements and lane narrowing. Level II measures, such as speed humps, traffic circles, and chicanes, are used when greater speed reductions are warranted and to mitigate short-cutting. Brampton’s policy also provides a thorough reference table of potential traffic control measures and their impacts on operations, safety and the environment of streets.

*Waterloo*<sup>106</sup>: An important insight in the context of Great Streets from the City of Waterloo’s traffic calming policy is the notion that narrowing lanes is a key tool given its relative low cost and effectiveness. Narrowing motorized vehicular lanes also provides much needed and scarce right of way real estate to non-motorized users.

*St. John’s*<sup>107</sup> and *Calgary*<sup>108</sup>: The City of St. John’s and the City of Calgary traffic calming policies both include a toolbox of calming measures that suggests which methods are suitable for different types of streets (e.g. local and collector). The toolbox method is useful for analyzing and visualizing the different kinds of measures and their application to different kinds of streets. This method was used to sort recommended measures according to the Kingston street typology introduced earlier in this report.

#### 4.5.4 Traffic Calming ‘Great Streets’ Recommendations for Kingston

A review of best practices indicates traffic calming is not a one-size-fits-all strategy and no one measure or combination of measures will always be successful. Through an efficient, inclusive and thorough process, traffic calming can be effective in encouraging non-motorized modes by reducing motorized vehicular speeds and volumes without hindering transit, freight and emergency services. The following toolbox overlays the traffic calming best practices on the Kingston street typology:

**Table 4-12: Best Practices toolkit for implementing traffic calming measures** . ✓✓ = This feature is suitable for this road type;  
✓ = This feature could be incorporated, under certain circumstances; x = This feature is not recommended for this road type.

	Urban			Suburban			
	Local	Collector	Arterial	Local	Collector	Residential Arterial	Commercial Arterial
Curb extension	✓✓	✓	x	✓✓	✓	x	✓
Traffic Circle	✓✓	x	x	✓✓	x	x	x
Roundabout	✓✓	✓	x	✓✓	✓	x	x
Raised Median Island	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Chicane	✓✓	x	x	✓✓	x	x	x
On-Street Parking	✓✓	✓✓	x	✓✓	✓✓	x	✓
Speed Hump/Cushion	✓✓	✓	x	✓✓	✓	x	x
Raised Crosswalk	✓✓	✓✓	x	✓✓	✓✓	x	x
Raised Intersection	✓✓	✓	x	✓✓	✓	x	x
Directional Closure	✓✓	✓	x	✓✓	✓	x	x
Right-in, Right-out Island	✓✓	✓	x	✓✓	✓	x	x
Narrowing/Gateway	✓✓	✓✓	✓	✓✓	✓✓	✓	✓
Full Closure	✓✓	x	x	✓✓	x	x	x

## 4.6 Cycling

### 4.6.1 Fundamentals of Cycling

Ideally, all streets in a city should safely and comfortably accommodate cyclists. The availability of interconnected, safe biking routes would focus the public's attention on this active transportation alternative and encourage its use.<sup>109</sup> An increase in levels of bicycle use in Canadian cities would generate a number of benefits including environmental benefits (through reduced emissions of toxic or greenhouse gases), health benefits (related both to the environmental effect and to increased physical activity), and economic benefits (involving reduced congestion and transportation expenses and reduced healthcare costs).<sup>110</sup>

These considerations, as well as the imperative of a democratic share of the road between alternative modes of transportation, demonstrate the importance of promoting the cycling component as an important part of Great Streets. Cycling is an active mode of travel, with utilitarian and recreational categories, which may vary considerably. For the purpose of this project, aspects of utilitarian cycling are taken into consideration.

Cyclists are vulnerable travellers as they are mixed in with motorized traffic, and require particular attention. A recent study examining the association between cyclists' injuries and the cycling environment in Toronto and Vancouver found that route infrastructure does affect the risk of cycling injuries.<sup>111</sup> Arterial and collector streets with parked cars and no bike infrastructure had the highest risk. In comparison,

less risk-prone arrangements (from most to least risk) were major streets with bike lanes, residential street bike routes, and cycle tracks along major streets. A number of principles based on these realities should inform any initiative aiming to integrate bikeways in the existing transportation network<sup>112</sup>:

- Cyclists should have safe, convenient, and comfortable access to all destinations.
- Every street is a bicycle street, regardless of bikeway designation.
- Street design should accommodate all types, levels, and ages of cyclists.
- Cyclists should be separated from pedestrians.
- Bikeway facilities should take into account vehicle speeds and volumes, with shared use on low volume, low-speed roads and separation on higher volume, higher-speed roads.
- Bikeway treatments should provide clear guidance to enhance safety for all users.
- Since most bicycle trips are short, a complete network of designated bikeways has a grid of roughly ½ mile separation between routes



### 4.6.2 Existing Cycling Policy and Conditions in Kingston

According to a 2008 travel survey administered by the City of Kingston, only 2% of work daily trips and 1% of non-work daily trips were relying on the bicycle as a mode of transportation.<sup>113</sup> An earlier study, in 2002, estimated that the average all-day trip length within the City was reported as 6.23km, a distance that could be traveled by most people by bicycle,<sup>114</sup> considering that the local topography is relatively flat.

Based on this knowledge, the City has attempted to increase cycling travel by formally emphasizing cycling as a preferred mode of travel in its 2004 *Transportation Master Plan*. The plan follows closely the recommendations of a *Cycling and Pathways Study* performed in 2003, which assessed the existing infrastructure, proposed appropriate upgrades and extensions, reviewed and developed design standards and provided an implementation strategy for short- and long-term improvements.

According to the Cycling and Pathways Study, the design standards for on-road cycling facilities need to be consistent with the Ontario Ministry of Transportation *Bikeways Planning and Design Guidelines* (1996) and the Transportation Association of Canada *Bikeway Traffic Control Guidelines for Canada* (1998), as well as the Canadian Institute of Planners *Community Cycling Manual* (1990).

The following are some of the relevant design guidelines drawn from this policy framework:

- The surface of the roadway, the gutter area and utility covers have to be sound and bicycle-compatible.
- Cyclists should be ‘filtered’ through traffic diverters and speed humps.
- Where adequate space is available and on-street parking is present, consideration should be made for cyclists to avoid doors’ swing space.
- Designated cycling lanes should have a minimum width of 1.5m, though 1.2m is permitted when necessary.
- When and where possible, cycling facilities should be cleared of snow and ice in the winter months to encourage year-round use.

The City is currently working on the On-Road Bikeway Implementation Plan (March 2009) to build the proposed network identified in the Cycling and Pathways Study of 2003. The implementation plan focused on a “green route”, approximately 10km in length, to provide a convenient route from the west end of the City to the downtown area, with a north-south connection along Centennial Drive. Other routes were included in the scope of work as well, as roads were scheduled for repairs and improvements. Consequently, a number of roads now include designated cycling lanes<sup>115</sup> and sharrows.<sup>116</sup> Cycling lanes are provided on segments of Johnson Street, Queen Mary Road, Portsmouth Avenue,

Front Road, Centennial Drive and Cataraqui Woods Drive. Sharrows were added to Johnson Street and Brock Street due to limited right of way space.

The City has also set in place by-laws for regulating on-street parking on roads with designated cycling lanes and directed staff to develop protocols for signage and maintenance of dedicated marked cycling lanes. An educational and communications program was initiated, as well, to raise local awareness for motorists and cyclists of the rules for roadway sharing, to encourage safe cycling, to make the City's plans visible to the media, and to involve participation of City staff.<sup>117</sup>

### 4.6.3 Cycling Best Practices for 'Great Streets'

The width of the street and the speed and volume of adjacent traffic are the most critical factors to consider in providing , safe bicycle lanes.<sup>118</sup> Another external concern is that of parking, which generally occurs on the right side of the street where cycling is usually accommodated. If parking cannot be removed from the right curb, best practices in street design advise for conversion from angled to parallel parking to provide visibility and width to bikeways or its relocation to the left side of the street on one-way streets.

The main types of cycling infrastructure include bicycle lanes, intersection bikeway elements and signals. The following examples are drawn from a variety of resources and design guidelines handbooks focused on optimal cycling infrastructure design.

#### 4.6.3.1 Bike Lanes

Bike lanes designate an exclusive space for cyclists along streets through the use of pavement markings and signage. They are usually located adjacent to motor vehicle lanes and flow in the same direction as traffic, on the right side of the curb. This type of facility enables cyclists to ride at their preferred speed without interference from motorized traffic.

**Conventional Bike Lanes-** It is desirable to provide bike lanes on major thoroughfares with speed limits of 50 km/h or more, and on streets with high volumes and speeds of less than 50 km/h.<sup>119</sup> The minimum width necessary for bike lanes is 1.2 m, with an ideal width of 1.5 m.<sup>120</sup> Some resources suggest more generous widths of 1.5-1.8 m when the lane is next to on-street parking or roadways, or the street's speed limit is over 50 km/h.<sup>121</sup> A solid white line, along with symbol markings, is often used to separate the lane and a dashed white line is used where vehicles are allowed to merge into the bike lane (such as for right turns or at bus stops).



Source: NACTO



Source: [www.fortworthology.com](http://www.fortworthology.com)

**Coloured Bike Lanes-** Colour is applied to bike lanes in some cases to clearly distinguish the bike lane or to alert roadway users at high conflict areas. It is commonly used at intersections or driveway areas, or where parking/stopping in the bike lane may be an issue.<sup>122</sup>



Source: NACTO

**Buffered Bike Lanes-** Buffered bike lanes are conventional bike lanes with a designated buffer space providing additional physical separation from adjacent motor vehicle traffic. They are recommended on streets with travel speeds above 55 km/h, with high travel volumes, and/or high volumes of truck traffic.<sup>123</sup> Buffers may vary between 0.5m to 1m in width, represented by a double white line or white chevron marks between white lines. The markings should transition to conventional dashed lines at intersection approaches where vehicles have to cross the buffer.



Left-side bike Lanes, Portland, OR.  
Source: [www.pedbikeimages.org](http://www.pedbikeimages.org)

**Left-Side Bike Lanes-** Left-side bike lanes are conventional bike lanes placed on the left side of one-way streets or two-way median divided streets. They are used along streets with heavy delivery or transit use, or frequent parking turnover on the right to avoid potential conflicts associated with right-side bicycle lanes.<sup>124</sup>

**Cycle Tracks-** A cycle track is an exclusive bikeway combining the safety of a separated path with the on-street infrastructure of a conventional bike lane. Cycle tracks are recommended for streets with high vehicular traffic and posted speed above 55km/h. They have different forms but share common elements as they provide exclusive use for bicycles while being separated from motor vehicle travel lanes, parking lanes, and sidewalks.<sup>125</sup>

One-way cycle tracks should be 1.5m to 2m wide when non-elevated. When elevated, 1.75m cycle tracks allow for side-by-side riding or passing. A minimum of 1.5m should be provided at intersections. When configured next to a parking lane, a 1m buffer is desirable to allow for passenger loading and to prevent door collisions. Protection from the adjacent motor vehicle lanes can include a raised or mountable curb, street furnishings, low vegetation or parking. Usually, if no parking is buffering the cycle track from vehicular traffic, a mountable curb is recommended to allow for safe entry and exit to the roadway.<sup>126</sup>



Raised cycle track in Vancouver, BC.  
Source: NACTO

**Marked Shared Lanes (Sharrows)-** Marked shared lanes are used to designate a cycling facility on a street without sufficient width to accommodate bike lanes. Sharrows indicate the appropriate location for cyclists to ride within the lane and remind drivers to look out for cyclists merging into traffic. Nevertheless, sharrows and similar markings do not provide a clear spatial designation and conflicts in the sharing of space may arise. Visibility is also a problem, especially on right turns and merges.<sup>127</sup>

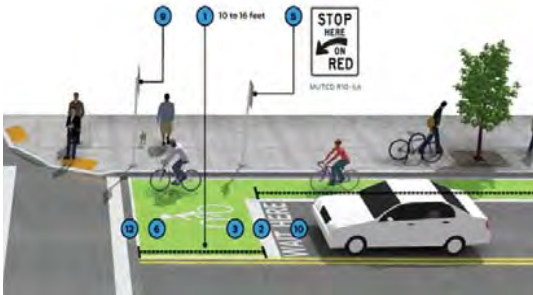


Source: [www.saskatoon.ca](http://www.saskatoon.ca)



### 4.6.3.2 Intersection Facilities

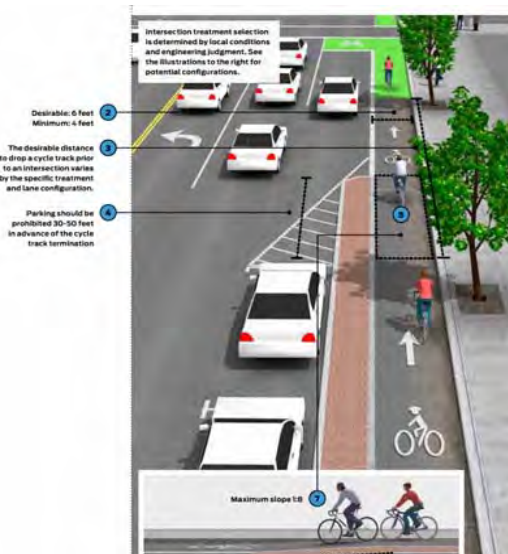
Designs for intersections with bicycle facilities are intended to reduce conflict between cyclists and vehicles by heightening the level of visibility, denoting a clear right of way, and facilitating eye contact between drivers and riders. They are often coordinated with timed or specialized signals.



Source: NACTO

**Bike Boxes-** A marked bike box gives cyclists a dedicated space to wait in front of cars at a red light. Right-turning drivers are obliged to check if the bike box and bike lane are clear before turning right. Cyclists move through the intersection first when the light turns green and proceed into the bike lane.<sup>128</sup>

The box used to hold queuing cyclists should typically be 3-4.8 m deep, situated between the crosswalk and the expected stop line for vehicles, with a recommended marked ingress lane of 7.5 – 15 m. Marked lines and wording should indicate the stop point for vehicles before the box, as well as the designation of the space as a bike box. Signage and coloured pavement should provide visibility, which encourages compliance by motorists. An egress painted lane is recommended in the intersection to outline potential areas of conflict between cyclists and motorists.<sup>129</sup>



Cycle track approach to an intersection  
Source: NACTO

**Cycle Tracks at Intersections-** A more careful approach to an intersection from a cycle track is typically achieved by removing the protected cycle track barrier or lowering a raised cycle track to street level and shifting the bicycle lane closer to the motor vehicle lane. At these intersections, the experience is similar to that of a conventional bike lane and would involve treatments such as bike boxes and bike signals. Depending on the intersection, the cycle track may transition to a conventional bike lane or a combined bike/turn lane.<sup>130</sup>

**Through Bike Lanes & Combined Bike/Turn Lanes-** Through bike lanes or combined bike/turn lanes provide an opportunity for cyclists travelling on a bike lane or cycle track to correctly position themselves in an intersection with vehicular right turns. A through bike lane is marked with a dotted line, outlining the cyclists' expected path and the potential area of interference with vehicular traffic. However, the marking does not provide clear guidance for cyclists turning right or left. Observations in the media remark that this design is not entirely safe: vehicles may not pay attention when turning right and crossing the bike lane and some may veer right before the dotted line starts.<sup>131</sup>

#### 4.6.3.3 Signals

Bicycle signals as well as signal detection systems facilitate cyclists' crossing of the roadway. Bicycle signals are traditional three lens signals with green-yellow-red lenses that can be provided at standard signalized intersections.<sup>132</sup>

Bicycle detection is used in combination with bicycle signals to alert the signal controller of a waiting or approaching cyclist. Detection occurs either through the use of push-buttons or by automated means such as in-pavement sensor loops, or video systems.<sup>133</sup>

#### 4.6.3.4 Stormwater Grates

As most cyclist facilities are positioned on the right side of the street near the curb, it is important that the paved surface in this zone is clear and smooth. Infrastructure elements like drain inlets and utility covers that extend into this area should be flush with the ground and oriented in such manner to prevent conflicts with bicycle tires (i.e., slots must be perpendicular to direction of travel or stormwater intake should be integrated into the curb).<sup>134</sup>



Through bike lane in Portland, OR  
Source: NACTO



Bicycle detection markings in Portland, OR  
Source: NACTO



Bike friendly storm water drainage cover  
in Toronto, ON (Source:  
[www.donwater.blogspot.ca](http://www.donwater.blogspot.ca))

### 4.6.3.5 Case Studies – Cycling Examples from Other Municipalities

#### *Guelph, ON – Bicycle-Friendly Initiative*

Travel behaviour surveys in the City of Guelph (pop.115,000) suggested that most internal trips within Guelph were less than 4km, which is well within comfortable cycling range. Based on these surveys, the City started the Bicycle-Friendly Guelph Initiative in 2009, aiming to provide a safe, attractive, and practical environment and to increase the citywide average daily bicycle trips from 0.9% to 3% in 10 years.<sup>135</sup>

The key steps of the project included a *Bicycle Amenities Inventory*, a self-evident *Community Awareness* program, the initiation of a *Guelph Cycling Advisory Committee* and the *Development of City-Wide Bicycle Transportation Plan*. Funded through the Federal and Provincial Stimulus Program (under which the three levels of government equally share the costs), the project has currently integrated segregated bike lanes/cycling tracks, sharrows, and bike boxes along the right of way on a number of its busy arterial roads<sup>136</sup> (Figure 4-8).

**Figure 4-8: Bike box in Guelph, ON**  
Source:  
[www.guelphmercury.com](http://www.guelphmercury.com)



#### *Seville, Spain – A Sharp Turnaround*

Seville, Spain, is a notable example of a successful cycling infrastructure development initiative. While examples from Holland and Denmark abound in the literature focused on urban cycling, Seville is notable for its remarkable, relatively short transformation.<sup>137</sup> As recently as 2004, the city had no bike infrastructure, and cycling was seen as an isolated activity (0.2% of all trips in 2000), reserved for elite athletes or low-income people unable to purchase a car. The city used the Netherlands as their inspiration in shaping a new bikeway system (Figure 4-9). It initiated its installation in 2007 and by 2009 it had created a complete network, totalling 87 miles. The network included green bikeways continuing through intersections and roundabouts, facilitating navigation (Figure 4-10). The consequent changes in transportation behaviour were significant: cycling trips represent now 7% of all trips.



**Figure 4-9 (left): Cycle track in Haarlem, the Netherlands.**

Source:  
[www.urbancommuter.wordpress.com](http://www.urbancommuter.wordpress.com)

**Figure 4-10 (right): Segregated signaled bike lanes, in Seville, Spain**  
Source:  
[www.peopleforbikes.org](http://www.peopleforbikes.org)





#### 4.6.4 Cycling 'Great Streets' Recommendations for Kingston

**Table 4-13: Best Practices toolkit for implementing cycling infrastructure.** ✓✓✓ = This feature is ideal for this road type; ✓✓ = This feature is good for this road type; ✓ = This feature could be incorporated, under certain circumstances; x = This feature is not recommended or not needed for this road type.

Roadway Features	Urban			Suburban			
	Local	Collector	Arterial	Local	Collector	Residential Arterial	Commercial Arterial
<b>A. Bicycle Lanes</b>							
A1. Conventional Bicycle Lane	x	✓✓	✓✓	x	✓✓	✓✓	✓✓
A2. Coloured Bicycle Lane	x	✓	✓	x	✓	✓	✓
A3. Buffered Bicycle Lane	x	✓✓✓	✓✓	x	✓✓✓	✓✓	✓✓
A4 Left-Side Bicycle Lane	✓	✓	x	✓	✓	x	x
A5. Cycle Track	x	✓✓	✓✓✓	x	✓✓	✓✓✓	✓✓✓
A6. Sharrow	✓✓	x	x	✓✓	x	x	x
<b>B. Intersection Elements</b>							
B1. Bicycle Box	✓	✓✓✓	✓✓✓	✓	✓✓✓	✓✓✓	✓✓✓
B2. Median Refuge Island	✓	✓✓	✓	✓	✓✓	✓	✓
B3. Dutch Intersection Design	x	✓	✓✓	x	✓	✓✓	✓✓
B4. Through Bicycle Lane	x	✓✓	✓✓	x	✓✓	✓✓	✓✓
B5. Cycle Track Approach to Intersection	x	✓	✓	x	✓	✓	✓
<b>C. Signals</b>							
C1. Bicycle Detection Marking	x	x	✓✓✓	x	x	✓✓✓	✓✓✓
C2. Bicycle Signal	x	x	✓✓✓	x	x	✓✓✓	✓✓✓
<b>D. Other Elements</b>							
Bicycle Friendly Street Infrastructure (drain inlets, utility covers)	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓



### 4.7 Transit

#### 4.7.1 Fundamentals of Transit

An integral component of the vision for making Kingston ‘Canada’s Most Sustainable City’ is the City’s public transportation, provided and managed by Kingston Transit. Past practices of land use design have divided cities into homogeneous, single-use areas of relatively low density, resulting in increased auto-dependency and larger travel distances. For a majority of urban residents, the private automobile has become a utilitarian necessity rather than a luxury. The provision of high quality transit services can increase its attractiveness as a viable alternative to the private automobile. Furthermore, public transit provides mobility, environmental, health, and economic benefits for the entire community.

Fundamentally, an ideal public transit service should feature<sup>138</sup>:

- A hierarchy of transit services tailored to context-specific needs.
- A ridership experience that promotes safety and security, convenience and reliability, comfort, and accessibility for all users, including persons with disabilities or special needs.
- The encouragement of having the transit network integrated with pedestrian pathways and cycling networks, and vice versa.

#### 4.7.2 Existing Transit Policy and Conditions in Kingston

##### 4.7.2.1 Kingston Official Plan<sup>139</sup>

The Kingston Official Plan (OP) details several policies directly related to public transit within Section 4- *Infrastructure and Transportation*. Notable policies include:

**Policy 4.6.1-** The Council-endorsed Strategic Direction “A New Direction” in the Kingston Transportation Master Plan (2004), as described in Section 2.5.10 of this Plan, is intended to foster sustainability within the City and to reduce reliance on the automobile by satisfying travel demand through the efficient use of the existing infrastructure, and by providing the facilities and services to **encourage walking, cycling and transit as priority modes**, before expanding the City’s road infrastructure.

**Policy 4.6.10-** Improving connections between the active modes of walking, cycling and transit will be required through such means as improved pedestrian amenities, connected on and off street cycling routes, bicycle storage, improved transit routing and amenities, and such site plan control matters as locating building entrances near sidewalks and transit stops, and providing weather protection for pedestrians and transit users.

**Policy 4.6.38-** Specific means of encouraging transit use include, but are not limited to:

- The appropriate design of roads and intersections to accommodate transit vehicles;
- Adequate and appropriate bus stops, which may include shelters, benches, and terminal transfer points; and,
- Planning for transit stops within 300 metres of major activity centres, and 95 per cent of urban residences.

#### 4.7.2.2 Kingston Transportation Master Plan<sup>140</sup>

The Kingston Transportation Master Plan (KTMP) guides public transit in Kingston. The KTMP outlines Kingston's strategic direction for the development of its transportation networks, programs and priorities. In terms of transportation mode share, the KTMP has adopted a strategy that aims to increase transit use during the peak commuting times from 3% (as of 2004) to over 11% over the course of the next 20-25 years. Furthermore, the KTMP's transit strategy aims to:

- Proactively increase existing transit use by providing full-service, accessible transit, comprising high-frequency peak period service and extended off-peak service.
- Tailor service levels and route structures to reflect the different needs of urban and rural communities within the City by providing a mix of flexible and fixed routes, community bus routes, commuter and tourist shuttles, and local charters.

- Fully coordinate services with inter-city bus, train, ferry and airport passenger services.
- Provide fully accessible service to the inter-city bus terminal, rail station, ferry docks and airport.
- Provide a mix of fully accessible, attractive modern vehicles to meet market demands.

The KTMP also recommends transit innovations including enhanced fixed routes and higher levels of service in major travel corridors:

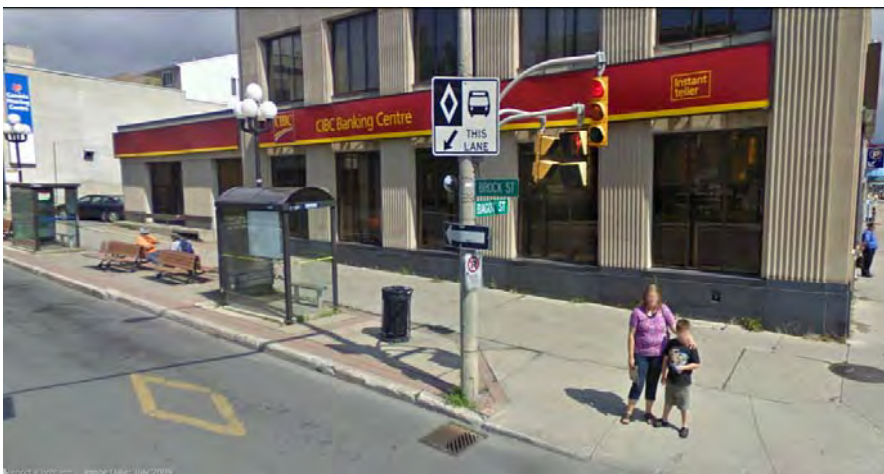
**Corridor Transit Service-** Major transit corridors that have been identified include Princess Street, Bath Road, Division Street, Highway 2 (LaSalle Causeway), Gardiners Road, King/Union Street and John Counter Boulevard. Service on three major transit corridors, Princess Street, Bath Road (east of Gardiners Road) and Division Street, would operate at 10-minute frequencies, based on projected transit trips and the defined minimum service level to achieve the goals of the plan.

**Fixed Route Service-** These routes offer service operating at approximately 15-minute frequencies, servicing existing and emerging communities in Kingston, and are meant to feed into the Corridor Transit Service at major transfer points. The maximum walking distance to these transit stops should be 400 metres.

**Flexible Route Service-** Alternatively, this type of service would have fixed stops along routes with small deviations, when required. This could be appropriate in areas where it is not cost-effective to operate a unique Fixed Route Service, areas with low development density or lower traffic volumes, or areas with passengers unable to get to a bus stop (e.g. persons with disabilities, or seniors).

**An Enhanced Kingston Downtown Transit Terminal-** Kingston Transit's Downtown Transfer Point at the intersection of Bagot and Brock Streets is a stop for thirteen routes (Figure 4-11). To account for projections of greater travel demands, this transit terminal must assume a more significant role, which could be aided with improved waiting area facilities.

**Figure 4-11: The Kingston Downtown Transit Terminal at the intersection of Bagot and Brock Streets, Source: Google Streetview.**

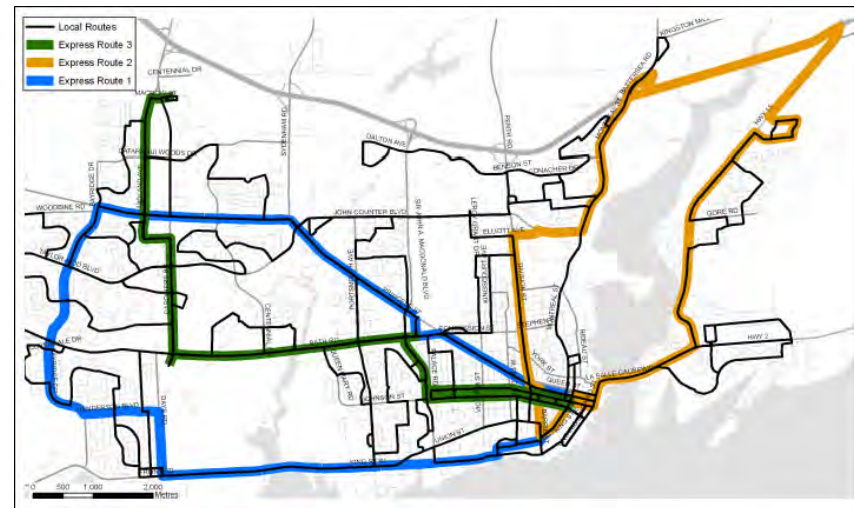


### 4.7.2.3 Kingston Transit Redevelopment Plan 2011-2015<sup>141</sup>

The Kingston Transit Redevelopment Plan 2011-2015 (KTRP) details how the Kingston Transit system can meet current and future travel demands. This includes two initial phases in 2013 and 2015 and an outline for future phases of implementation post-2015. Overall, the improvements for 2015 will include:

- Three express bus routes that link the City's urban areas with fast, reliable, service that operates on a 15-minute frequency during the weekday peak periods and at a 30-minute frequency at other times (Figure 4-12).

**Figure 4-124: The proposed Express Route #1, #2, #3, expected to be completed by 2015, Source: Kingston Transit Redevelopment Plan.**



- Redesigning existing routes to take advantage of the express route backbone, increasing reliability and reducing travel times.

- Bus stops serving the express routes will be upgraded with accessible concrete pads, shelters and benches.
- Technology will be introduced to provide real-time bus arrival information for riders and traffic signal priority along major corridors.

The KTRP notes that the current transit system experiences high variability in the characteristics of bus stop infrastructure and accessibility. Of the over 800 bus stops (as of August 2011), there are 134 shelters and 97 seating benches. The bus stop environments range from “curb-side, accessible stops with shelters and lighting” to “roadside stops located on gravel shoulders or grass boulevards”. KTRP aims to uphold a set of uniform bus stop design guidelines, and to eventually update all local and collector street bus stops. The KTRP’s design guidelines include:

- A larger 9m pad length to allow riders to step onto a hard surface from both the front and rear doors.
- A waiting pad width of at least 1.5m and up to 3m along the curb-side to provide sufficient space for queuing riders and manoeuvring of mobility devices.
- Protected space for future shelter or bench installation.
- Requirements for linkage to existing pathways or sidewalks.
- Provision for future accessibility requirements such as tactile strips and signage.

As noted by the KTMP and KTRP, the greatest challenge to an efficient public transit system in Kingston is the degree to which investment has already been made into car-supportive transportation policies and infrastructure. The Highway Traffic Act, for example, refers to a very limited scope of street types (i.e. local, collector, arterial) and prescribes for very limited roadway rights afforded for pedestrians, cyclists, and transit users. The lack of respect for these modes stems from this limited road typology (as outlined in the Kingston Official Plan), which causes sweeping generalizations of guidelines that do not accurately describe the functions of all Kingston roadways as intended. Under the current conditions, the efficiency of the Kingston Transit service suffers from the over-extension of services. Moving forward, emphasis must be placed on fostering more balance between road user groups, ensuring that road users have a comfortable, safe, and attractive choice of modes.

#### 4.7.3 Transit Best Practices for Great Streets

Resources such as the Ontario Ministry of Transportation *Transit Design Guidelines*,<sup>142</sup> *A Review of International Best Practice in Accessible Public Transportation for Persons with Disabilities*<sup>143</sup> from the United Nations Development Programme, as well as the Orange County Transportation Authority *Bus Stop Safety and Design Guidelines*<sup>144</sup> and B.C. Transit *Infrastructure Design Guidelines*<sup>145</sup> are a distillation of transit-friendly land use planning, urban design and operational practices, drawing from experiences primarily in Ontario. Planning for Great Streets involves designing arterials and collector streets in a manner that enhances public transit efficiency and ease of use, while balancing the needs of pedestrians, cyclists, and other motorized vehicles.





Source: City of Chennai, India

### 4.7.3.1 Bus Bays

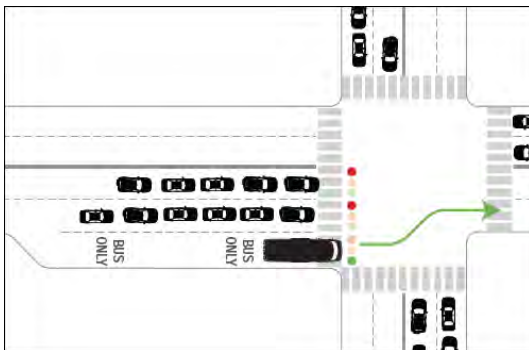
Bus bays (or bus turnouts), are special zones on the side or shoulder of a main roadway that act as bus stops; however, bus bays can interfere with a continuous bike lane, require street widening, and buses may experience difficulty exiting a bus turnout to merge with traffic. They are appropriate in major trip-generating areas where there may be considerable passenger load times, and/or on the far-side of an intersection to avoid conflicts with right-turning vehicles.<sup>146</sup>



Source: [www.livestreets.ru](http://www.livestreets.ru)

### 4.7.3.2 Bus Bulbs

The implementation of bus bulbs has been suggested as an effective way of providing more pedestrian space while simultaneously slowing the flow of traffic. Bus bulbs extend the sidewalk to the edge of a traffic lane so that the bus can be more easily aligned with the curb without large steering movements, and the bus can remain on the main roadway. In addition, the extension of the sidewalk creates a more defined space for street parking.<sup>147</sup>



Source: Ontario Ministry of Transportation - Transit Design Guidelines

### 4.7.3.3 Queue Jump Lanes

Bus bays can be complemented by a queue jump lane, an additional roadway lane restricted to public transit vehicles. The queue jump lane is accompanied with a priority transit signal that gives a traffic notification for transit vehicles to get a head start over other vehicles in traffic. This signal allows the transit vehicle to merge into regular travel lanes immediately beyond the traffic signal. This reduces congestion and delays caused by the signal and improves the operational efficiency of the transit system by assigning it priority over single-occupant automobiles.<sup>148</sup>

### 4.7.3.4 Transit Stops

Transit service stops should be designed so that the waiting area is separated from traffic and from splashing during rain or snow. There should be adequate clear space with minimal clutter to enter, wait, and board without obstructing passersby. Personal security is enhanced through good lighting (e.g. self-contained, solar-powered lights; or close proximity to streetlights or businesses), and open-concept design with low fencing and vegetation. Accessible walkways should exist between the immediate bus stop zone and surrounding footpaths. Shelter and seating should be provided, especially in an area prone to extreme weather. Amenities such as waste receptacles and bicycle racks should be provided, as should Way-finding in the form of clear displays with information on bus routes serviced by the stop; this may include providing information in a tactile form for the visually impaired such as raised letters, numbers, and symbols (but not necessarily Braille). Furthermore, concrete bus pads should be utilized that match the height of the bus' step (for easy wheelchair access, Figures 4-13 and 4-14).<sup>149</sup>

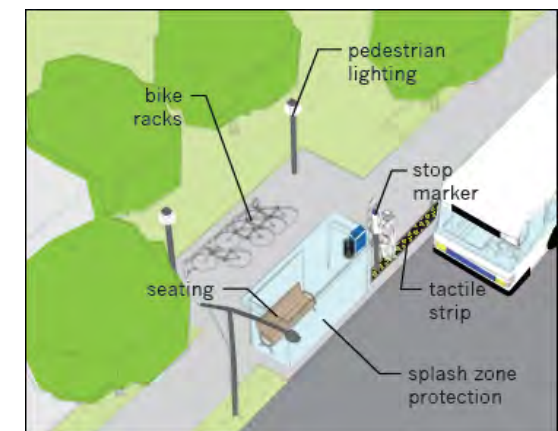


**Conceptual renderings of two potential transit stop configurations (above and below),** Source: Ontario Ministry of Transportation - Transit Design Guidelines.

**Figure 4-13(right): A Brampton bus shelter serving multiple service routes, a possible template for Kingston's Transfer Points.** Source: Ontario Ministry of Transportation - Transit Design Guidelines



**Figure 4-14 (left): A York Region transit stop for its Bus Rapid Transit (BRT) express-style service routes could serve as a template for the KTRP's future Express Route bus stops,** Source: Ontario Ministry of Transportation - Transit Design Guidelines



### 4.7.3.5 High-Occupancy Vehicle (HOV) Lanes



A municipal HOV lane along Dufferin Street in Toronto, Ontario. Note the types of vehicles allowed and times of enforcement. Source: York Region Transportation Services Committee

HOV lanes are restricted traffic lanes that help move more people through congested areas using fewer vehicles. These lanes are reserved for the exclusive use of vehicles with multiple occupants – usually at least 2 including the driver and a passenger –including carpools and buses. Emergency vehicles (e.g. police, fire, ambulance) are exempt from the restrictions.

Within a municipality's roadway, HOV lanes are intended to serve high-frequency local public transit buses and taxis in the curbside (rightmost) lanes. Unlike highway HOV lane restrictions which are enforced by Ontario Provincial Police (OPP) officers, enforcing municipal HOV lanes can be challenging because drivers need to make right turns at regular intervals. As there are currently few examples of successful implementation of municipal HOV lanes in cities comparable to Kingston,<sup>150</sup> the applicability/feasibility of this type of traffic measure in a Kingston context to help manage traffic congestion necessitates further research. Fundamentally, municipal HOV lanes<sup>151</sup> function most effectively if:

- The public receives sufficient information, education, and marketing about the benefits to this transportation alternative to the single-occupant private automobile.
- There is clear signage to indicate where HOV lanes begin and end, which vehicles are allowed in the lane(s), and during which times the lane restrictions apply (e.g. use of a diamond symbol, with a bus diagram, during peak commuting hours).
- Lane restrictions are enforced.

#### 4.7.4 Transit 'Great Streets' Recommendations for Kingston

**Table 4-14: Best Practices toolkit for implementing transit infrastructure.** ✓✓ = This feature should be incorporated into this road type;  
✓ = This feature could be incorporated, under certain circumstances; x = This feature is not recommended for this road type.

Roadway Features	Urban			Suburban			
	Local	Collector	Arterial	Local	Collector	Residential Arterial	Commercial Arterial
Municipal HOV Lanes	x	x	✓✓	x	x	✓✓	✓✓
Contraflow HOV Bus Lanes	x	x	✓	x	x	✓	✓
Queue Jump Lanes	x	x	✓	x	x	✓	✓
Priority Transit Signals	x	x	✓	x	x	✓	✓
Bus Transponders	x	x	✓✓	x	x	✓✓	✓✓
Bus Bulbs	✓	✓	✓	✓	✓	✓	✓
Bus Turnouts	x	✓	x	x	✓	✓	✓
<b>Bus Stop Features</b>							
Bus Stop Shelter	x	✓✓	✓✓	x	✓✓	✓✓	✓✓
Seating and Waiting Area	✓	✓✓	✓✓	✓	✓✓	✓✓	✓✓
Lighting (self-contained or from streetlights)	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Clear Signage and Wayfinding	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Real-Time Schedule	x	✓	✓	x	✓	✓	✓
Bicycle Parking Storage	x	✓✓	✓✓	x	x	x	✓✓
Garbage and Recycling Receptacles	x	✓✓	✓✓	x	✓✓	✓✓	✓✓
Concrete Bus Pad	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Downtown Kingston Terminal Enhancement	x	x	✓✓	x	x	x	x



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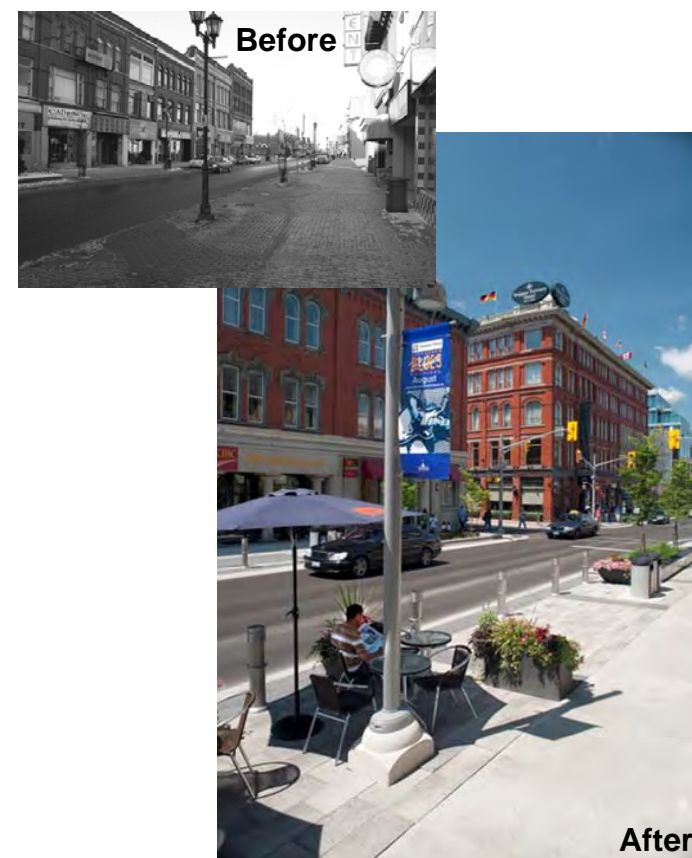


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## 5.1 'Great Streets' in Canada

### 5.1.1 King Street West, Kitchener, ON

The redesign of King Street includes lower curbs, wider sidewalks to improve accessibility, 120 new street trees, bike racks to encourage cycling, environmentally friendly planter beds that collect and filter stormwater, new and improved transit shelters, Improved street lighting and seating, custom bollards that delineate on-street parking spaces and can also be used to facilitate street closures for cultural and social events. King Street has also been designated as a 'Green Street' by Tree Canada for its contribution to creating an environmentally sustainable street design.



Source: <http://www.completestreetsforcanada.ca/examples/king-street-kitchener>

### 5.1.2 York Boulevard, Hamilton, ON

The City of Hamilton reconstructed York Boulevard as part of the redesign of Hamilton's Farmers market. The new street includes bike lanes, buffered boulevards, combinations of street and pedestrian lighting and street furnishings such as bike racks and benches.





### 5.1.3 James Street, Hamilton ON

The City of Hamilton recently adopted a 'Pedestrian Mobility Master Plan' that calls for more 'Complete Streets'. James Street achieves this with traffic calming measures such as bulb-outs and on-street parking, pavement changes, and wide sidewalks with street furnishings. Street vegetation is also incorporated.



### 5.1.4 Local Residential Street, Calgary AB

Part of Calgary's Complete Streets Plan, this example provides a good example of a residential Great Street. The highly vegetated street incorporates vegetated bulb-outs with on-street parking. The street also includes sidewalks on both sides of the street.



### 5.1.5 Collector Street, Calgary, AB

This street is a prime example of a complete street with effective use of medians and pedestrian crossings. The vegetated medians promote green infrastructure and offer safe crossings for pedestrians. The street also includes bike lanes and bulb-outs with on-street parking.



### 5.1.6 St George Street, Toronto ON

A prime example of a Great Street, St. George Street in Toronto provides pedestrians wide sidewalks, a vegetated boulevard buffering the roadway from pedestrians, bike lanes and traffic calming measures including on-street parking and speed humps.



Source: <http://www.completestreetsforcanada.ca/examples/st-george-street-toronto>





### 5.2 'Great Streets' in North America



#### 5.2.1 Rozzelles Ferry Road, Charlotte, NC

The streetscape was enhanced by the addition of clearly marked pedestrian crosswalks and a corresponding refuge median, street trees and planting strips. The new bike lanes also facilitate cycling on this road, which was previously unsuitable for cyclists.

Source: National Complete Streets Coalition,



#### 5.2.2 Selwyn Avenue, Charlotte, NC

On Selwyn Avenue, both the curb extension and the roundabout narrow the roadway, forcing motorists to slow down as they drive through this residential neighborhood.

Source: National Complete Streets Coalition,



#### 5.2.3 Suburban Residential, Charlotte, NC

Example of a Great Street in Charlotte that makes use of several bulb-outs, with on-street parking, and creates opportunities for green infrastructure.

Source: National Complete Streets Coalition,

### 5.2.4 Main Street, Hamburg, NY

Hamburg's main street has wide sidewalks, curb extensions, and well-marked crosswalks which help pedestrians cross safely to the various businesses along the street. On-street parking gives those traveling by car easy access. Coloured pavement helps visually narrow the travel lanes, keeping speeds at an appropriate level.



### 5.2.5 Local Residential, Portland, OR

Suburban local residential streets should have traffic calming measures. This example of a chicane can be used for traffic calming and stormwater management. This highly vegetated street promotes the 'Green' aspect of Great Streets.



### 5.2.6 Collector Street, Portland, OR

This Great Street in Portland includes roadways with on-street parking and accessibility amenities such as crosswalks and cycle paths. Moreover, the street incorporates bulb-outs with vegetated swales.





### 5.2.7 Residential Collector, Philadelphia PA

This street provides an example of the use of a pedestrian walkways and cycle track. Pedestrians are separated from the roadway and offered pedestrian-scaled lighting. Street trees and benches offers amenities for pedestrians. In addition, the roadway includes on street parking which acts as a traffic calming measure.



### 5.2.8 Boulder, CO

Great Streets are built with all users in mind. This example uses a multi-purpose pathway for pedestrians and cyclists. Moreover, vegetation offers opportunities for green infrastructure.



### 5.2.9 N 130th, Seattle WA

Completed as part of the 'Complete Streets Project' in Seattle, this reconstructed road includes buffered bicycle lanes and bulb-outs with pedestrian crossings. In this example, the pedestrian crossing coupled with a median helps to protect pedestrians throughout the entire crossing. Moreover, the street incorporates chicanes and on-street parking as street calming measures.



### 5.2.10 La Jolla Boulevard, San Diego CA

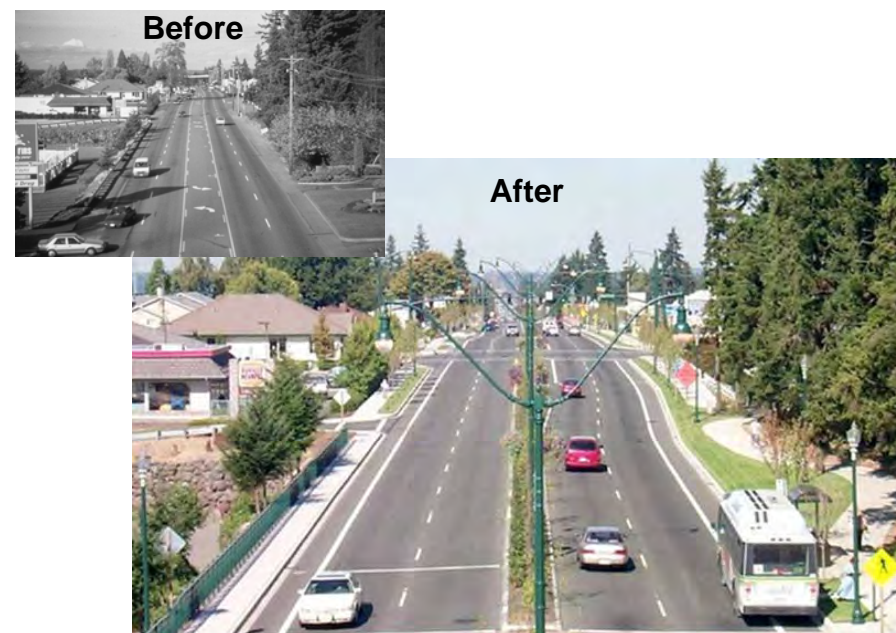
These before and after photos show La Jolla boulevard completely re-done. This street makes use of a roundabout as a significant traffic calming measure. With the use of this roundabout, the street incorporates vegetated medians, vegetated boulevards, sidewalks with bulb-outs and on-street parking. Moreover, the well-marked pedestrian crossings at the roundabouts make for safe crossings for pedestrians.



### 5.2.11 Bridgeport Way, WA

Bridgeport way was completely redone to include a center median with street trees and lights, sidewalks, bikes lanes, bus shelter, planting strips with trees, coloured pedestrian crossing and curb ramps

Source: National Complete Streets Coalition







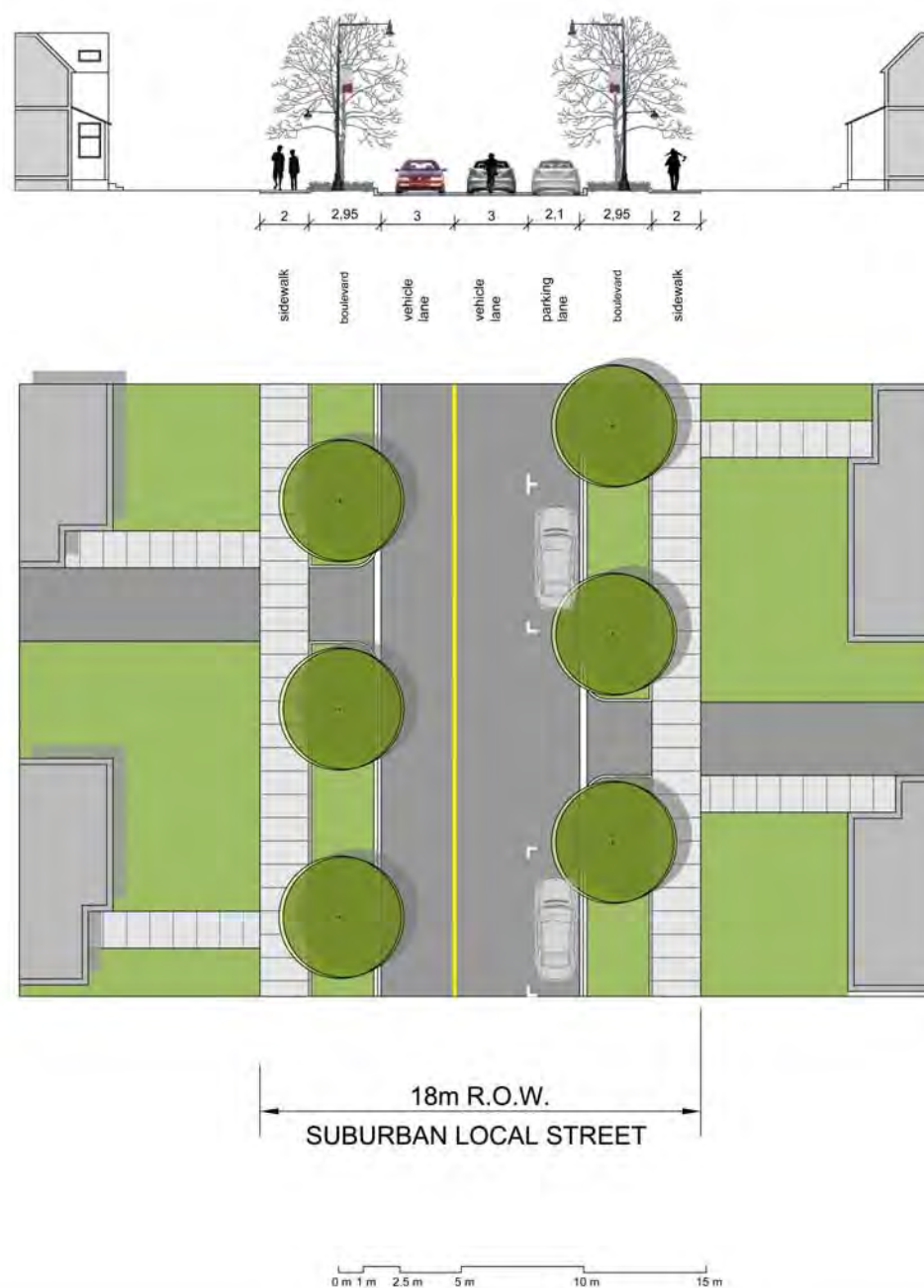
## 6.0 'Great Street' Design Guidelines

### 6.1 Introduction

This chapter represents the application of the best practices toolkits developed in Chapter 4 for each of the seven elements of Great Streets to the Kingston contextualized street typology presented in Chapter 2. By applying the best practices to actual Kingston streets, the chapter offers a vision for what Great Streets in Kingston could look like in the future. Each of the seven street typologies is presented in turn and is accompanied with three components. The first component is the guidelines for the street typology (e.g. Suburban Collect Street Guidelines), which comprise the combination of each element's recommendation toolkit into a new toolkit (guidelines) and offer technique recommendations specific to the street typology in question. The second component is the design aspect of the guidelines. The designs are presented as both cross-sections and plan-views. The third and final component is the artistic renderings of a 'before' and 'after' scenario for each Kingston street example that fits within the presented typology. Together, these sections offer a near-complete guide to Great Streets in Kingston.

## 6.2 Suburban Local Street Guidelines (18 & 20 m ROW)

<b>Elements</b>	<b>Widths (m)</b>	<b>Notes</b>
<b>Travel lanes</b>	<b>3</b>	<ul style="list-style-type: none"> <li>Provides safe travelling distances for emergency vehicles while providing traffic calming on local streets.</li> </ul>
<b>Parking lanes</b>	<b>2.1</b>	<ul style="list-style-type: none"> <li>On one side only.</li> <li>Narrower parking lanes for longer stays.</li> </ul>
<b>Boulevard</b>	<b>2.65</b> (18 m ROW)  <b>3.65</b> (20 m ROW)	<ul style="list-style-type: none"> <li>Placed on either side of the street between sidewalk and parked cars to offer space for street amenities such as trees and lighting for pedestrians, cyclists, and automobiles.</li> <li>Use good quality soil of organic content to ensure longevity of street trees, understory plants, and vegetated swales.</li> </ul>
<b>Sidewalks</b>	<b>2</b>	<ul style="list-style-type: none"> <li>Sidewalks on both sides of the street to promote walking.</li> </ul>
<b>Cycling</b>	<b>-</b>	<ul style="list-style-type: none"> <li>Cyclists should move in the travel lanes with motor vehicles due to low traffic volumes.</li> <li>Sharrows may be appropriate where roads are narrower or where higher traffic volumes exist.</li> </ul>
<b>Traffic Calming at intersections</b>		<ul style="list-style-type: none"> <li>Particularly important where pedestrian crossings and traffic volumes are high (e.g. schools).</li> <li>Provides space for stormwater planters, trees and other bioretention features.</li> <li>Traffic Calming Measures:               <ul style="list-style-type: none"> <li>⇒ Bulb-outs (curb extensions)</li> <li>⇒ Roundabout</li> <li>⇒ Traffic Circle</li> <li>⇒ Median island</li> <li>⇒ Chicane</li> <li>⇒ Raised intersection or crosswalk</li> </ul> </li> </ul>
<b>Street Lighting</b>		<ul style="list-style-type: none"> <li>Pedestrian-scaled lighting for automobiles and pedestrians.</li> <li>Can be combined with roadway lighting.</li> </ul>







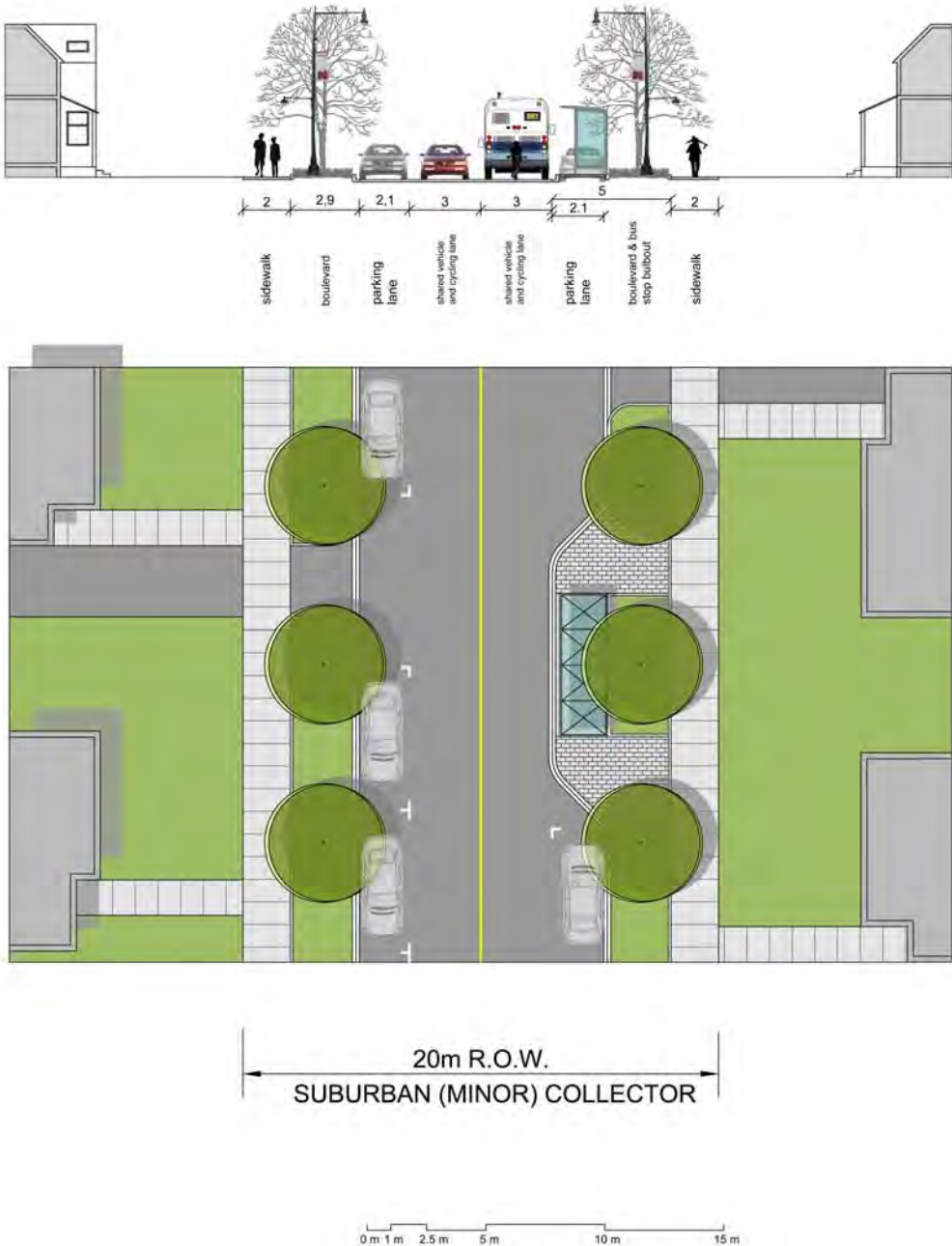
**Lotus Avenue  
Before**



**Lotus Avenue  
After**

## 6.3 Suburban (Minor) Collector Street Guidelines (20 m ROW)

<b>Elements</b>	<b>Widths (m)</b>	<b>Notes</b>
<b>Travel lanes</b>	<b>3</b>	Provides safe travelling distances for emergency vehicles while providing traffic calming on collector streets.
<b>Parking lanes</b>	<b>2.1 each</b>	<ul style="list-style-type: none"> <li>On both sides of the street.</li> <li>Narrower parking lanes for longer stays.</li> <li>Parking lanes interspersed with bulb-outs (in areas with reduced on-street parking requirements).</li> </ul>
<b>Boulevard</b>	<b>2.6</b>	<ul style="list-style-type: none"> <li>Placed on either side of the street between sidewalk and parked cars to offer space for street amenities such as trees, benches and lighting for pedestrians, cyclists, and automobiles.</li> <li>Street trees and vegetated swales with understory plants using high organic content soil fill to ensure growth and longevity.</li> </ul>
<b>Sidewalks</b>	<b>2</b>	<ul style="list-style-type: none"> <li>Sidewalks on both sides of the street to promote walking.</li> </ul>
<b>Cycling</b>	<b>-</b>	<ul style="list-style-type: none"> <li>Cyclists should move in the travel lanes with motor vehicles due to low traffic volumes.</li> <li>Sharrows may be appropriate where roads are narrower or where higher traffic volumes exist.</li> </ul>
<b>Transit-oriented street furniture</b>		<ul style="list-style-type: none"> <li>Attractive bus stops, including sheltered seating areas, waste receptacles, bike racks, user-friendly maps and schedules.</li> </ul>
<b>Bulb-outs (curb extensions)</b>		<ul style="list-style-type: none"> <li>Allows transit to stay in the travel lane while calming traffic and providing for efficient bus service.</li> <li>Provides space for stormwater planters, other bioretention features and transit-oriented street furniture.</li> <li>Interspersed within parking lanes.</li> </ul>
<b>Traffic Calming at intersections</b>		<ul style="list-style-type: none"> <li>Particularly important where pedestrian crossings and traffic volumes are high (e.g. schools).</li> <li>Provides space for stormwater planters, trees and other bioretention features.</li> <li>Traffic Calming Measures: <ul style="list-style-type: none"> <li>⇒ Bulb-outs (curb extensions)</li> <li>⇒ Roundabout</li> <li>⇒ Median island</li> <li>⇒ Raised intersection or crosswalk</li> </ul> </li> </ul>
<b>Street Lighting</b>		Pedestrian-scaled lighting for automobiles and pedestrians. Can be combined with roadway lighting.



## 6.4 Suburban (Major) Collector Street Guidelines (26 m ROW)

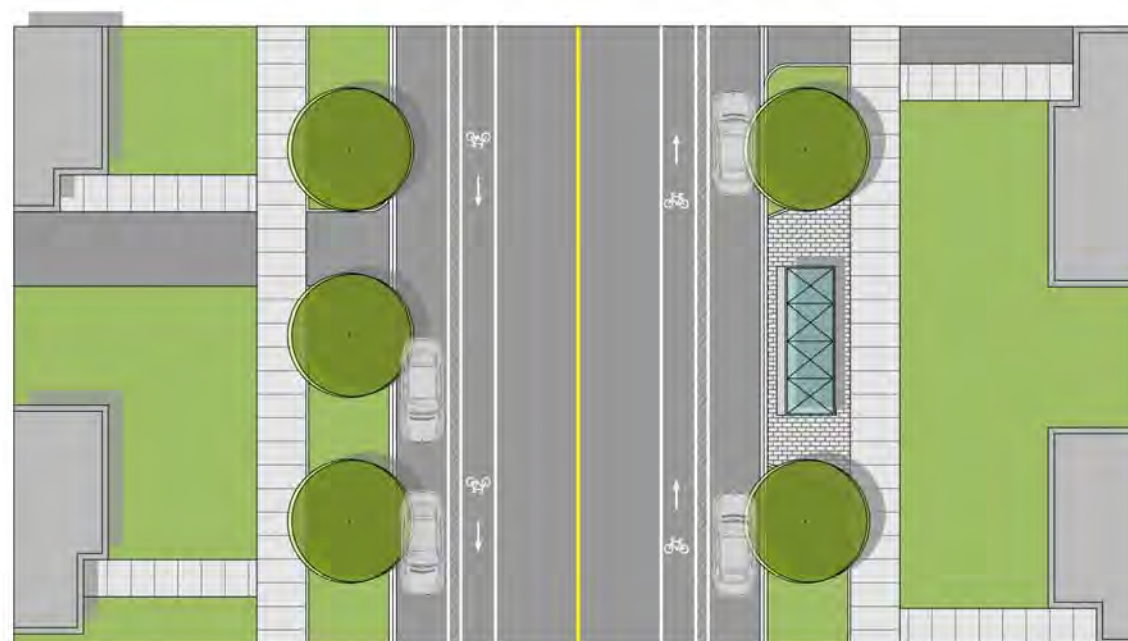
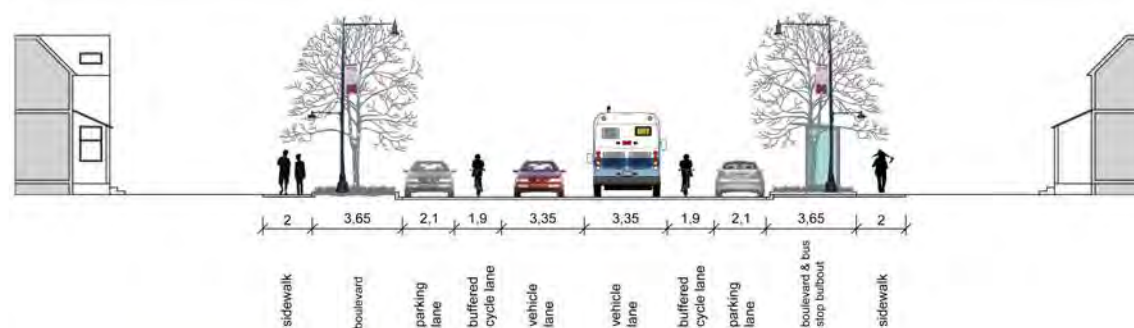
Many existing Suburban Collector streets feature Reversed Frontage Lots. These are not recommended for new developments as the backyard fences along the sidewalk contribute to a poor walking environment. To mitigate the effect of existing reversed frontage lots, access to properties can be provided from rear lane ways, along with the following recommendations below. This will help provide connections for pedestrians and enhance the pedestrian realm.

<b>Elements</b>	<b>Widths (m)</b>	<b>Notes</b>
<b><i>Raised Median for streets with reversed fronting lots</i></b>	<b>4.6</b>	<ul style="list-style-type: none"> <li>Placed with turning lane at intersections.</li> <li>Trees &amp; vegetated swales (depressed) with curb cuts to feed street runoff into vegetated median.</li> </ul>
<b><i>Travel lanes</i></b>	<b>3.35</b>	<ul style="list-style-type: none"> <li>Provides safe travelling distances for emergency vehicles while providing traffic calming on collector streets.</li> </ul>
<b><i>Parking lanes (only for non-reversed frontage streets)</i></b>	<b>2.1</b>	<ul style="list-style-type: none"> <li>On both sides of the streets.</li> <li>Narrower parking lanes for longer stays.</li> </ul>
<b><i>Boulevard</i></b>	<b>3.85 (reversed frontage)</b> <b>3.65 (no reversed frontage)</b>	<ul style="list-style-type: none"> <li>Placed on either side of the street between sidewalk and parked cars to offer space for street amenities such as trees, benches and lighting for pedestrians, cyclists, and automobiles.</li> <li>Street trees and vegetated swales with understory plants using high organic content soil fill to ensure growth and longevity.</li> </ul>
<b><i>Sidewalks</i></b>	<b>2</b>	<ul style="list-style-type: none"> <li>Sidewalks on both sides of the street to promote walking.</li> </ul>



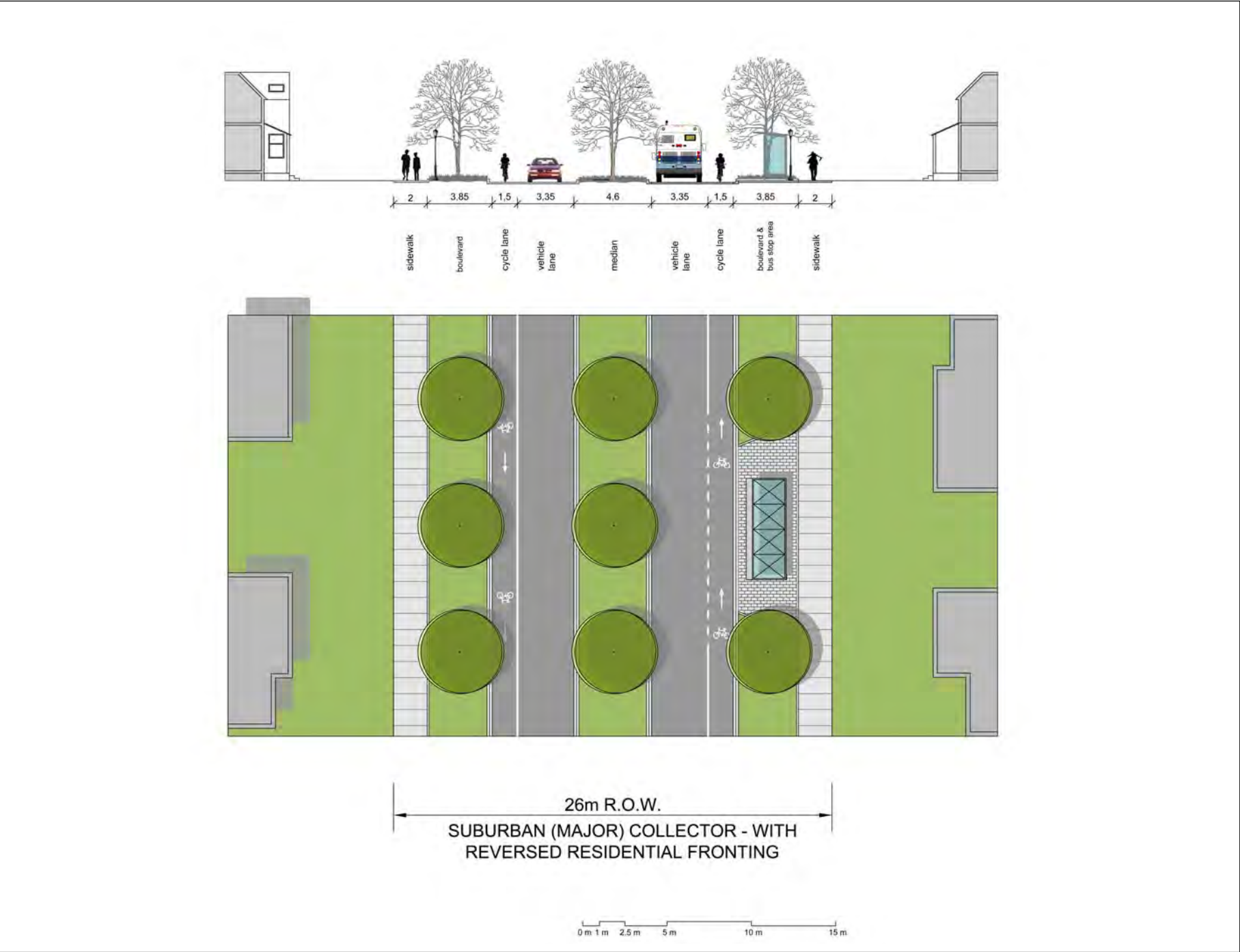
## Suburban (Major) Collector Street Guidelines (26 m ROW) Cont...

<b>Elements</b>	<b>Widths (m)</b>	<b>Notes</b>
<b>Cycle Lanes</b>	1.9 each (non-reversed frontage) 1.5 each (reversed frontage)	<ul style="list-style-type: none"> <li>• Wider cycle lanes are provided where there is on-street parking to protect cyclists from swinging doors.</li> <li>• Clearly marked, designated bicycle lanes to provide safe travel for cyclists.</li> </ul>
<b>Transit-oriented street furniture</b>		<ul style="list-style-type: none"> <li>• Attractive bus stops, including sheltered seating areas, waste receptacles, bike racks, user-friendly maps and schedules.</li> </ul>
<b>Bulb-outs (curb extensions) where there is no reverse frontage</b>		<ul style="list-style-type: none"> <li>• Allows transit to stay in the travel lane while calming traffic and providing for efficient bus service.</li> <li>• Provides space for stormwater planters, other bioretention features and transit-oriented street furniture.</li> <li>• Interspersed within parking lanes.</li> </ul>
<b>Traffic Calming at intersections</b>		<ul style="list-style-type: none"> <li>• Particularly important where pedestrian crossings and traffic volumes are high (e.g. schools).</li> <li>• Provides space for stormwater planters, trees and other bioretention features.</li> <li>• Traffic Calming Measures: <ul style="list-style-type: none"> <li>⇒ Bulb-outs (curb extensions)</li> <li>⇒ Roundabout</li> <li>⇒ Median island</li> <li>⇒ Raised intersection or crosswalk</li> </ul> </li> </ul>
<b>Street Lighting</b>		<ul style="list-style-type: none"> <li>• Pedestrian-scaled lighting for automobiles and pedestrians.</li> <li>• Can be combined with roadway lighting.</li> </ul>



26m R.O.W.  
 SUBURBAN (MAJOR) COLLECTOR - NO  
 REVERSED RESIDENTIAL FRONTING







**Portsmouth Avenue  
Before**

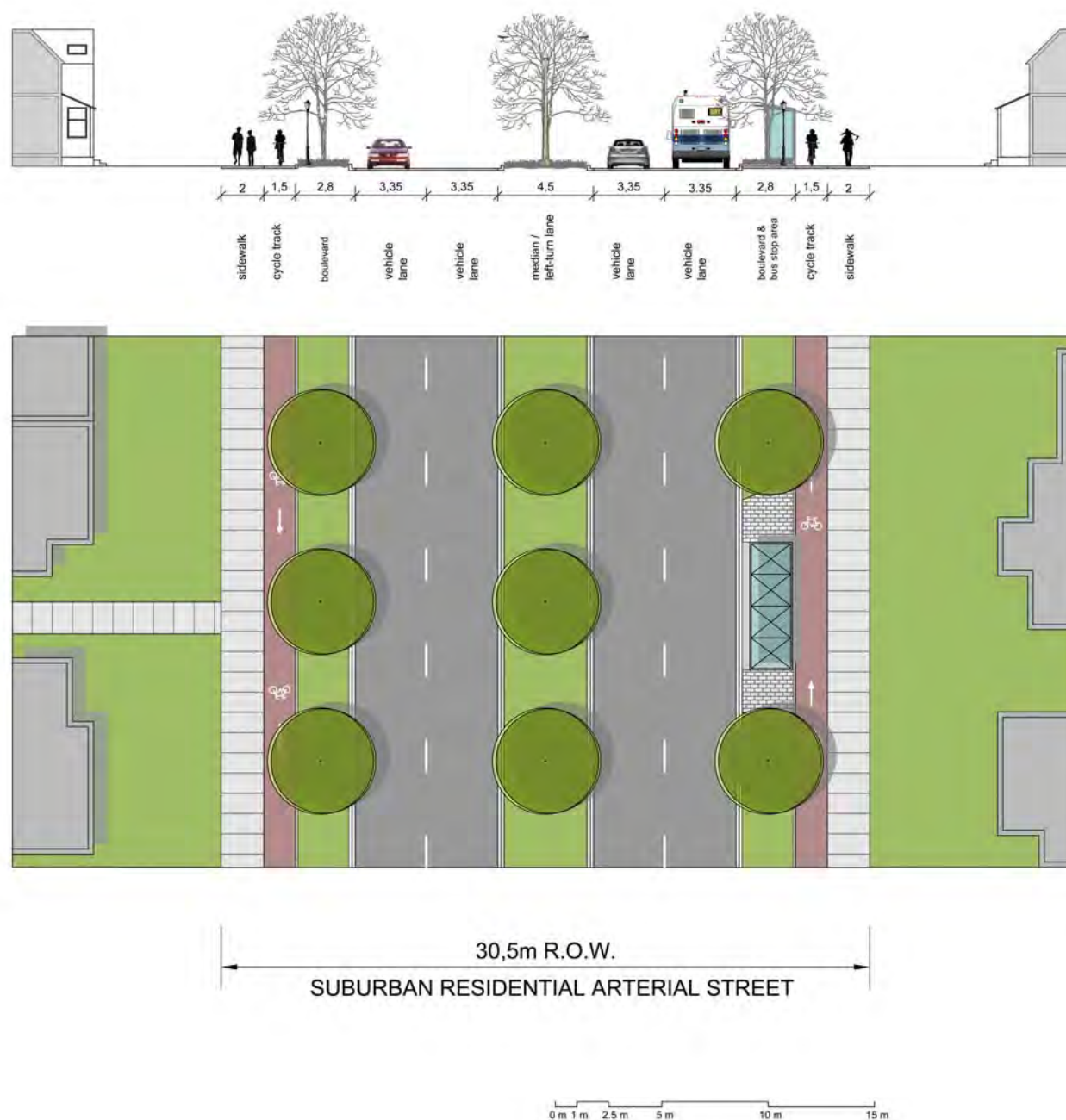


**Portsmouth Avenue  
After**



### 6.5 Suburban Residential Arterial Street Guidelines (30.5 m ROW)

<b>Elements</b>	<b>Widths (m)</b>	<b>Notes</b>
<b><i>Raised Median</i></b>	<b>4.5</b>	<ul style="list-style-type: none"> <li>Placed with turning lane at intersections.</li> <li>Trees &amp; vegetated swales (depressed) with curb cuts to feed street runoff into vegetated median.</li> </ul>
<b><i>Travel lanes</i></b>	<b>3.35</b>	<ul style="list-style-type: none"> <li>Provides safe travelling distances for emergency vehicles, transit, and transport trucks.</li> </ul>
<b><i>Boulevard</i></b>	<b>2.8</b>	<ul style="list-style-type: none"> <li>Placed on either side of the street between cycle tracks and travel lanes as vegetated areas for stormwater management, aesthetic benefits, and traffic calming.</li> <li>Consist of street trees and vegetated swales with curb cuts to convey runoff.</li> <li>Bus pads provided along boulevards to allow express transit to stay in the travel lane.</li> </ul>
<b><i>Sidewalks</i></b>	<b>2 m</b>	<ul style="list-style-type: none"> <li>Wider sidewalks on both sides of the street to promote walking.</li> <li>Pedestrian signals at intersections.</li> <li>Street benches and waste receptacles along sidewalks.</li> </ul>
<b><i>Cycling</i></b>	<b>1.5</b>	<ul style="list-style-type: none"> <li>Cycle tracks on both sides of the street to provide safety from high volumes of traffic.</li> <li>Bike boxes at intersections to facilitate safe turns.</li> </ul>
<b><i>Transit-oriented street furniture</i></b>		<ul style="list-style-type: none"> <li>Attractive bus stop with enhanced amenities for express service routes, including sheltered seating areas, waste receptacles, bike racks, user-friendly maps and schedules.</li> </ul>
<b><i>Street Lighting</i></b>		<ul style="list-style-type: none"> <li>Pedestrian-scaled lighting separate from roadway lighting.</li> </ul>
<b><i>Vegetated strip</i></b>	<b>2.75</b>	<ul style="list-style-type: none"> <li>Understory cover between fences and sidewalk.</li> <li>Drought-resistant species with good quality, high organic content soil.</li> </ul>
<b><i>Street frontage residential use</i></b>		<ul style="list-style-type: none"> <li>Conversion of reverse frontage housing complexes encouraged; access to the 'back' of the buildings provided through existing parking areas.</li> <li>Medium- and high-density (mid-rise) residential development encouraged for new residential arterial streets, utilizing internal parking on adjacent streets or laneway access.</li> <li>Entrances face the main street. For corner lot buildings, main entrance located on the corner facing the major intersection to promote walking and cycling.</li> </ul>





**Taylor-Kidd Boulevard  
Before**

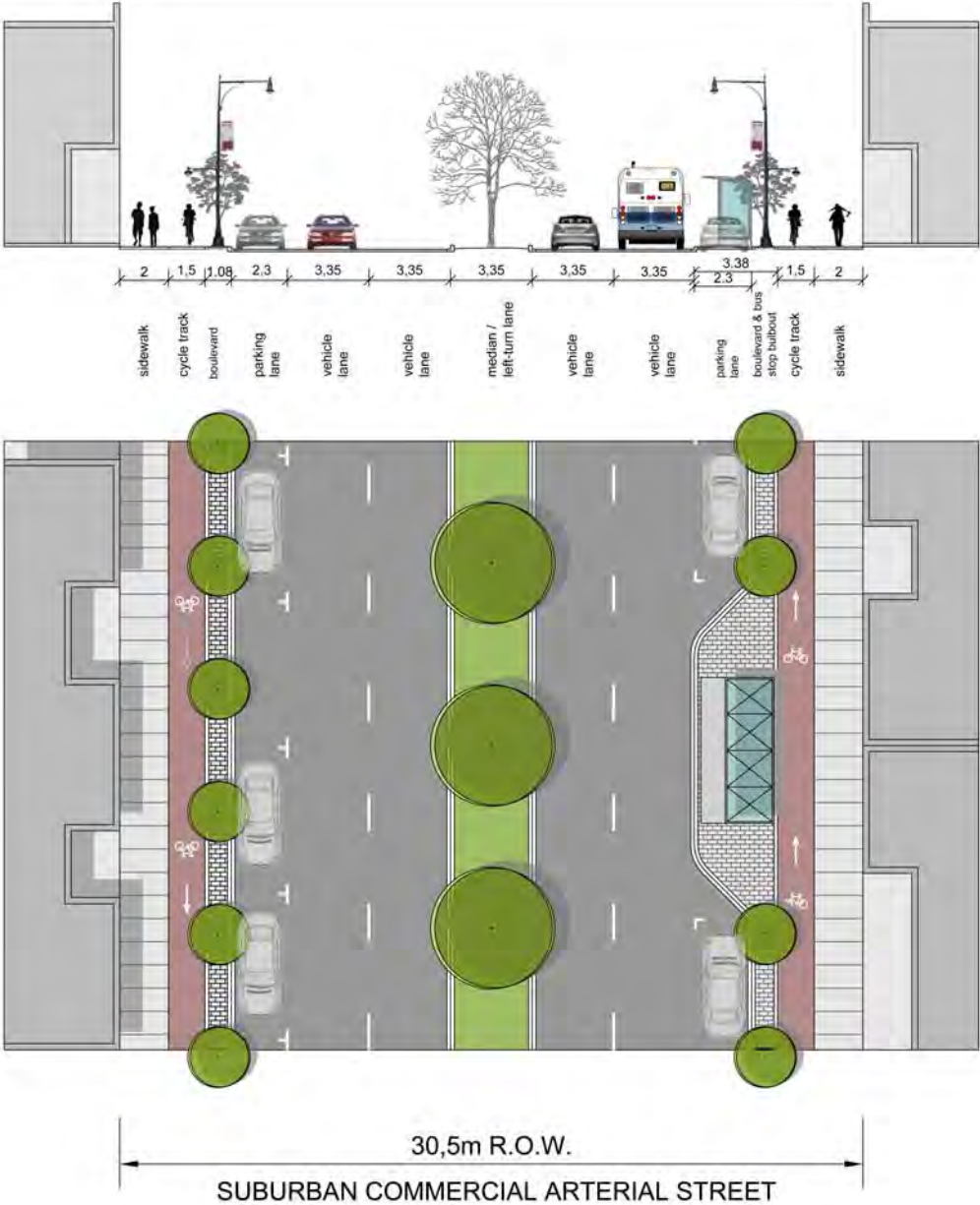


**Taylor-Kidd Boulevard  
After**

## 6.6 Suburban Commercial Arterial Street Guidelines (30.5 m ROW)

<b>Elements</b>	<b>Widths (m)</b>	<b>Notes</b>
<b><i>Raised Median</i></b>	<b>3.35</b> (Unless required for emergency vehicles)	<ul style="list-style-type: none"> <li>Placed with turning lane at intersections.</li> <li>Trees &amp; vegetated swales (depressed) with curb cuts to feed street runoff into vegetated median.</li> </ul>
<b><i>Travel lanes</i></b>	<b>3.35</b>	<ul style="list-style-type: none"> <li>Provides safe travelling distances for emergency vehicles, transit, and transport trucks.</li> </ul>
<b><i>Parking lanes</i></b>	<b>2.3</b>	<ul style="list-style-type: none"> <li>On both sides of the street.</li> <li>Wider parking lanes for in and out traffic.</li> <li>Parking lanes interspersed with bulb-outs (in areas with reduced on-street parking requirements).</li> </ul>
<b><i>Boulevard</i></b>	<b>1.075</b>	<ul style="list-style-type: none"> <li>Placed on either side of the street between sidewalk and parked cars to offer space for street amenities such as trees, benches and lighting for pedestrians, cyclists, and automobiles.</li> <li>Permeable pavement for stormwater infiltration and to distinguish boulevard from the pedestrian realm.</li> <li>Covered channels to direct runoff.</li> </ul>
<b><i>Sidewalks</i></b>	<b>2</b>	<ul style="list-style-type: none"> <li>Wider sidewalks on both sides of the street to provide for high volumes of pedestrian traffic.</li> <li>Pedestrian signals at intersections.</li> <li>Street benches along sidewalks.</li> </ul>
<b><i>Cycling</i></b>	<b>1.5</b>	<ul style="list-style-type: none"> <li>Cycle tracks on both sides of the street to provide safety from high volumes of traffic.</li> <li>Bike boxes at major intersections to facilitate safe turns.</li> <li>At minor intersections, cyclists dismount and cross the street along with pedestrian traffic.</li> </ul>
<b><i>Bulb-outs (curb extensions)</i></b>		<ul style="list-style-type: none"> <li>Allows transit to stay in the travel lane while calming traffic and providing for efficient bus service.</li> <li>Provides space for stormwater planters, other bioretention features, and transit-oriented street furniture.</li> <li>Interspersed within parking lanes.</li> </ul>
<b><i>Transit-oriented street furniture</i></b>		<ul style="list-style-type: none"> <li>Attractive bus stop with enhanced amenities for express service routes, including sheltered seating areas, waste receptacles, bike racks, user-friendly maps and schedules.</li> </ul>
<b><i>Street Lighting</i></b>		<ul style="list-style-type: none"> <li>Pedestrian-scaled lighting separate from roadway lighting.</li> </ul>





**Gardiners Road  
Before**



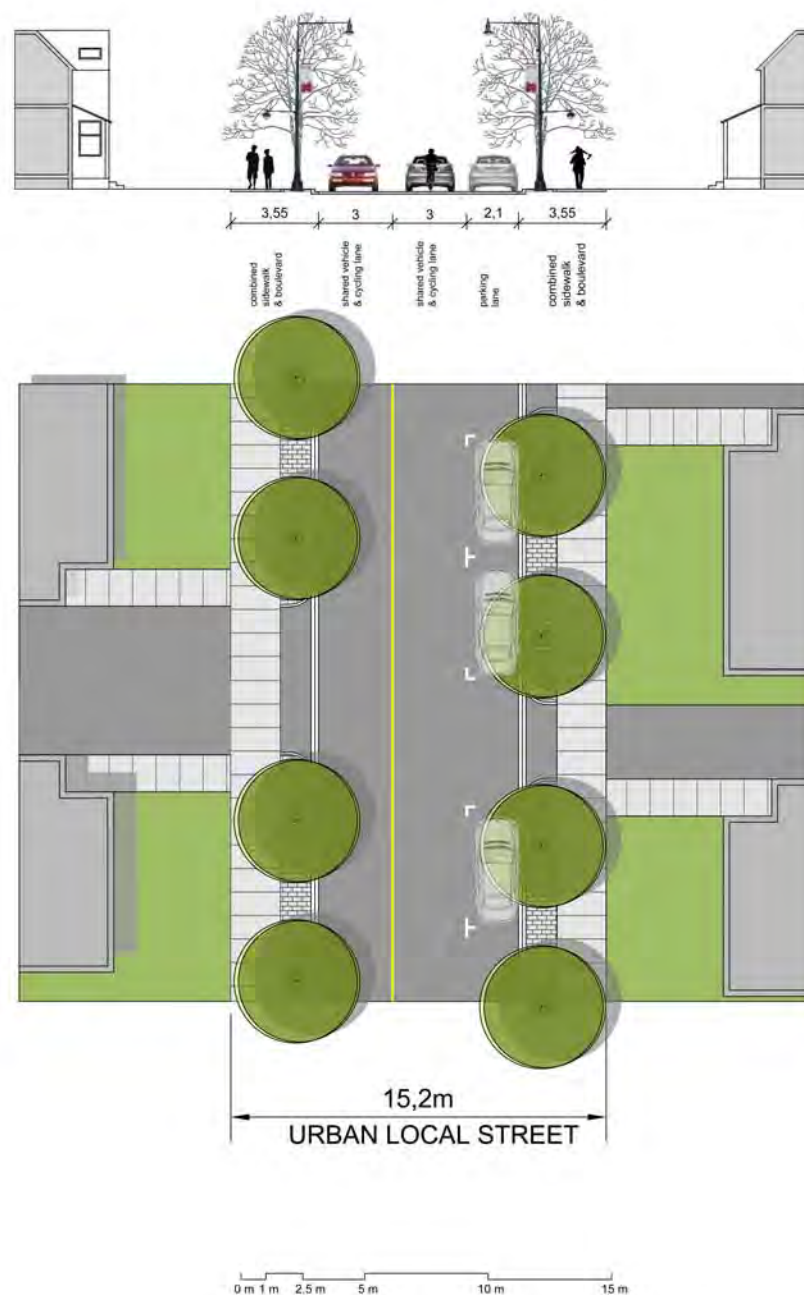
**Gardiners Road  
Intermediate**



**Gardiners Road  
After**

### 6.7 Urban Local Street Guidelines (12.2, 15.2 & 20.1 m ROW)

<b>Elements</b>	<b>Widths (m)</b>	<b>Notes</b>
<b>Travel lanes</b>	3	<ul style="list-style-type: none"> <li>Provides safe travelling distances for emergency vehicles while providing traffic calming on local streets</li> </ul>
<b>Parking lanes</b>	2.1	<ul style="list-style-type: none"> <li>Narrower parking lanes for longer stays .</li> <li>On both sides of the street for 20 m ROW.</li> <li>On one side only for 15 m ROW.</li> <li>No street parking for 12 m ROW.</li> </ul>
<b>Combined Boulevard &amp; Sidewalk</b>	2.8 (12m ROW) 3.25 (15m ROW) 4.65 (20m ROW)	<ul style="list-style-type: none"> <li>Placed on either side of the street between sidewalk and parked cars to offer space for street amenities as well as for snow storage</li> <li>Silvacells (underground).</li> <li>Planters: trees, shrubs, flowers, etc.</li> <li>Sidewalks on both sides of the street to promote walking.</li> <li>Permeable pavement to distinguish boulevard from the pedestrian realm.</li> <li>Channels to divert stormwater to surface planters.</li> </ul>
<b>Cycling</b>	-	<ul style="list-style-type: none"> <li>Cyclists should move in the travel lanes with motor vehicles due to low traffic volumes.</li> <li>Sharrows may be appropriate where roads are narrower or where higher levels of traffic exist.</li> </ul>
<b>Traffic Calming at intersections</b>		<ul style="list-style-type: none"> <li>Particularly important where pedestrian crossings and traffic volumes are high (e.g. schools).</li> <li>Provides space for stormwater planters, trees and other bioretention features.</li> <li>Traffic Calming Measures: <ul style="list-style-type: none"> <li>⇒ Bulb-outs (curb extensions)</li> <li>⇒ Roundabout</li> <li>⇒ Traffic Circle</li> <li>⇒ Median Island</li> <li>⇒ Chicane</li> <li>⇒ Raised intersection or crosswalk</li> </ul> </li> </ul>
<b>Street Lighting</b>		<ul style="list-style-type: none"> <li>Pedestrian-scaled lighting for automobiles and pedestrians.</li> <li>Can be combined with roadway lighting.</li> </ul>







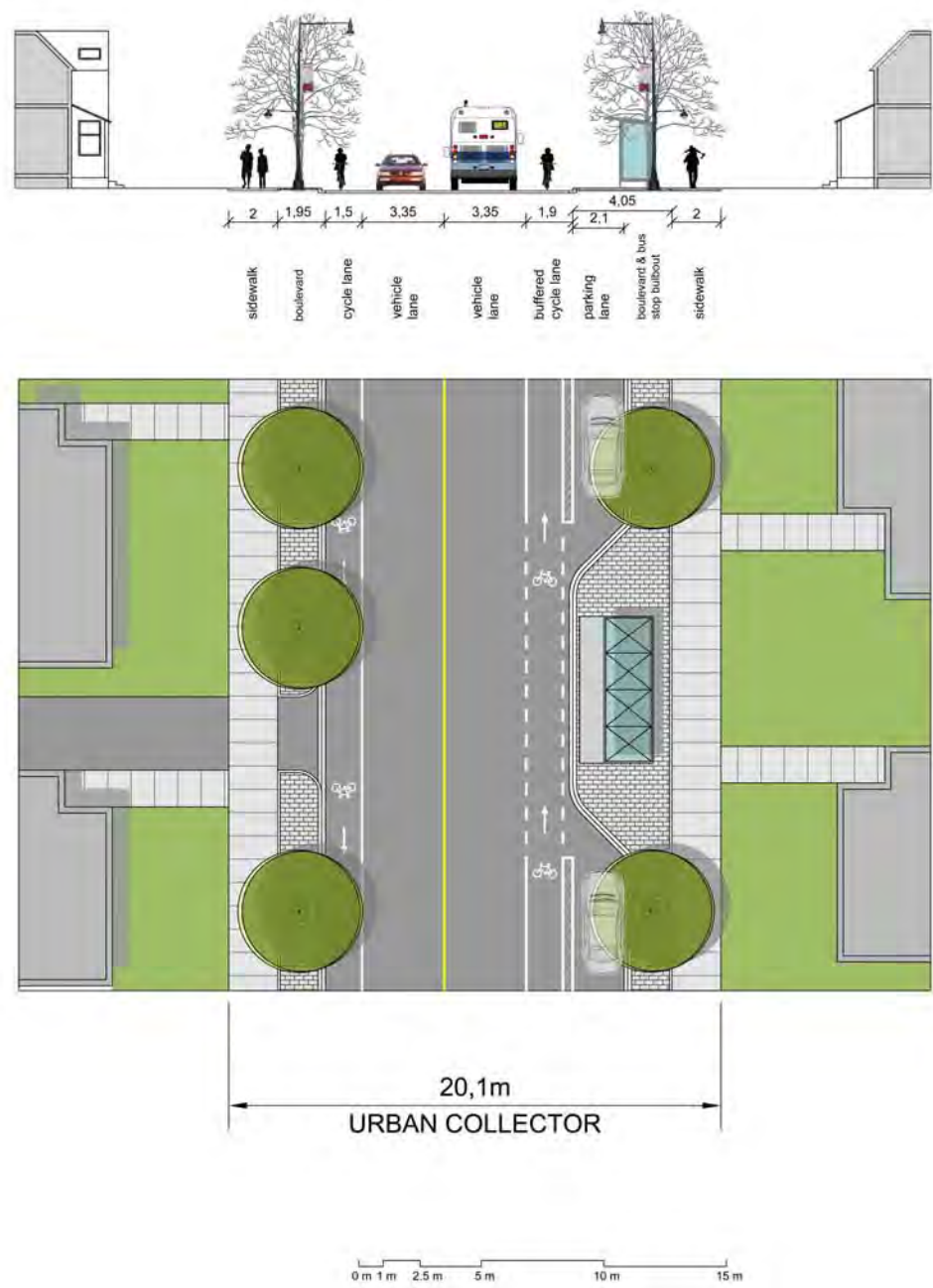
**Albert Street  
Before**



**Albert Street  
After**

## 6.8 Urban Collector Street Guidelines (20.1 m ROW)

<b>Elements</b>	<b>Widths (m)</b>	<b>Notes</b>
<b>Travel lanes</b>	<b>3.35</b>	<ul style="list-style-type: none"> <li>Provides safe travelling distances for emergency vehicles while providing traffic calming on collector streets.</li> </ul>
<b>Parking lanes</b>	<b>2.1</b>	<ul style="list-style-type: none"> <li>On one side only.</li> <li>Narrower parking lanes for longer stays.</li> </ul>
<b>Combined Sidewalks and Boulevard</b>	<b>3.95 (where street parking) 6.05 (where no street parking)</b>	<ul style="list-style-type: none"> <li>Placed on either side of the street between sidewalk and parked cars to offer space for street amenities as well as for snow storage.</li> <li>Silvacells (underground).</li> <li>Planters: trees, shrubs, flowers, etc.</li> <li>Sidewalks on both sides of the street to promote walking.</li> <li>Permeable pavement to distinguish boulevard from the pedestrian realm.</li> <li>Channels to divert stormwater to surface planters.</li> </ul>
<b>Cycling</b>	<b>1.9 (where street parking) 1.5 (where no street parking)</b>	<ul style="list-style-type: none"> <li>Wider cycle lanes are provided where there is on-street parking to protect cyclists from swinging doors.</li> <li>Clearly marked, designated bicycle lanes to provide safe travel for cyclists.</li> </ul>
<b>Bulb-outs (curb extensions)</b>		<ul style="list-style-type: none"> <li>Allows transit to stay in the travel lane while calming traffic and providing for efficient bus service.</li> <li>Provide space for stormwater planters, other bioretention features and transit-oriented street furniture.</li> <li>Interspersed within parking lane.</li> </ul>
<b>Traffic Calming at intersections</b>		<ul style="list-style-type: none"> <li>Particularly important where pedestrian crossings and traffic volumes are high (e.g. schools).</li> <li>Provide space for stormwater planters, trees and other bioretention features.</li> <li>Traffic Calming Measures: <ul style="list-style-type: none"> <li>⇒ Bulb-outs (curb extensions)</li> <li>⇒ Roundabout</li> <li>⇒ Median island</li> <li>⇒ Raised intersection or crosswalk</li> </ul> </li> </ul>
<b>Street Lighting</b>		<ul style="list-style-type: none"> <li>Pedestrian-scaled lighting for automobiles and pedestrians.</li> <li>Can be combined with roadway lighting.</li> </ul>





**Union Street  
Before**

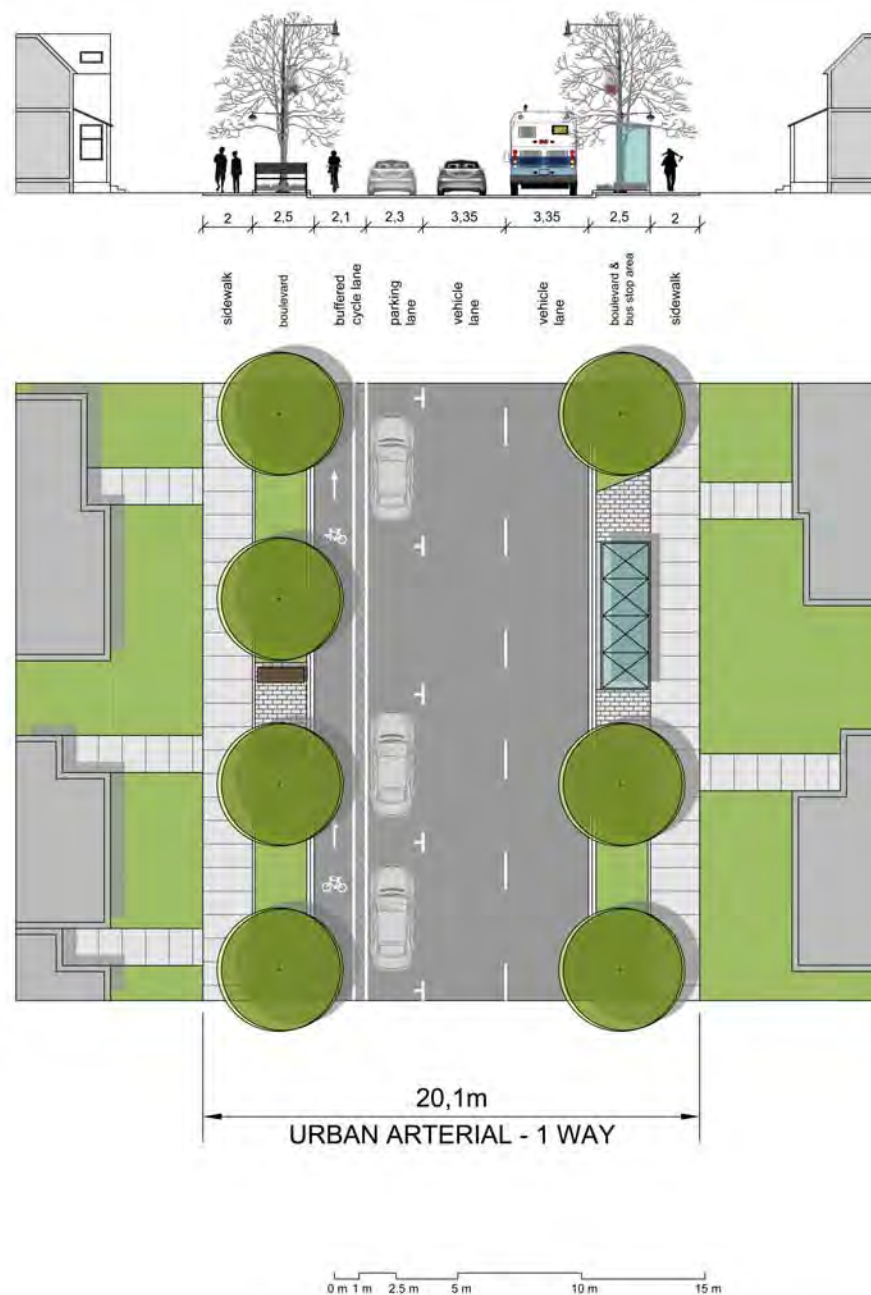


**Union Street  
After**



### 6.9 Urban Arterial (one way) Street Guidelines (20.1 m ROW)

<b>Elements</b>	<b>Widths (m)</b>	<b>Notes</b>
<b>Travel lanes</b>	<b>3.35</b>	<ul style="list-style-type: none"> <li>Provides safe travelling distances for emergency vehicles, transit, and transport trucks.</li> </ul>
<b>Parking lanes</b>	<b>2.3</b>	<ul style="list-style-type: none"> <li>On one side only.</li> <li>Wider parking lanes for in and out traffic.</li> </ul>
<b>Boulevard</b>	<b>2.2</b>	<ul style="list-style-type: none"> <li>Placed on either side of the street between sidewalk and travel lanes to offer safety for pedestrians, space for street amenities as well as for snow storage.</li> <li>Bioretention features such as silvacells (underground), planters using good quality (high organic matter) soil, permeable pavement to define boulevard from the pedestrian realm, and channels to divert stormwater to surface planters.</li> </ul>
<b>Sidewalk</b>	<b>2</b>	<ul style="list-style-type: none"> <li>On both sides of the street to promote walking.</li> <li>Street furniture including enhanced bus shelters, bike racks, waste receptacles, and benches.</li> </ul>
<b>Cycling</b>	<b>2.1</b>	<ul style="list-style-type: none"> <li>Clearly marked, buffered cycle lanes are placed between parked cars and boulevard to offer extra protection from swinging doors and moving traffic to provide safe travel for cyclists.</li> <li>Bike boxes placed at intersections.</li> </ul>
<b>Traffic Calming at intersections</b>		<ul style="list-style-type: none"> <li>At intersections where pedestrian crossings and traffic are high (e.g. schools).</li> <li>Bulb-outs and/or raised intersection or crosswalk.</li> </ul>
<b>Transit-oriented street furniture</b>		<ul style="list-style-type: none"> <li>Attractive bus stop with enhanced amenities for express service routes, including sheltered seating areas, waste receptacles, bike racks, user-friendly maps and schedules.</li> </ul>
<b>Street Lighting</b>		<ul style="list-style-type: none"> <li>Pedestrian-scaled lighting for automobiles and pedestrians.</li> <li>Can be combined with roadway lighting.</li> </ul>





**Johnson Street  
Before**

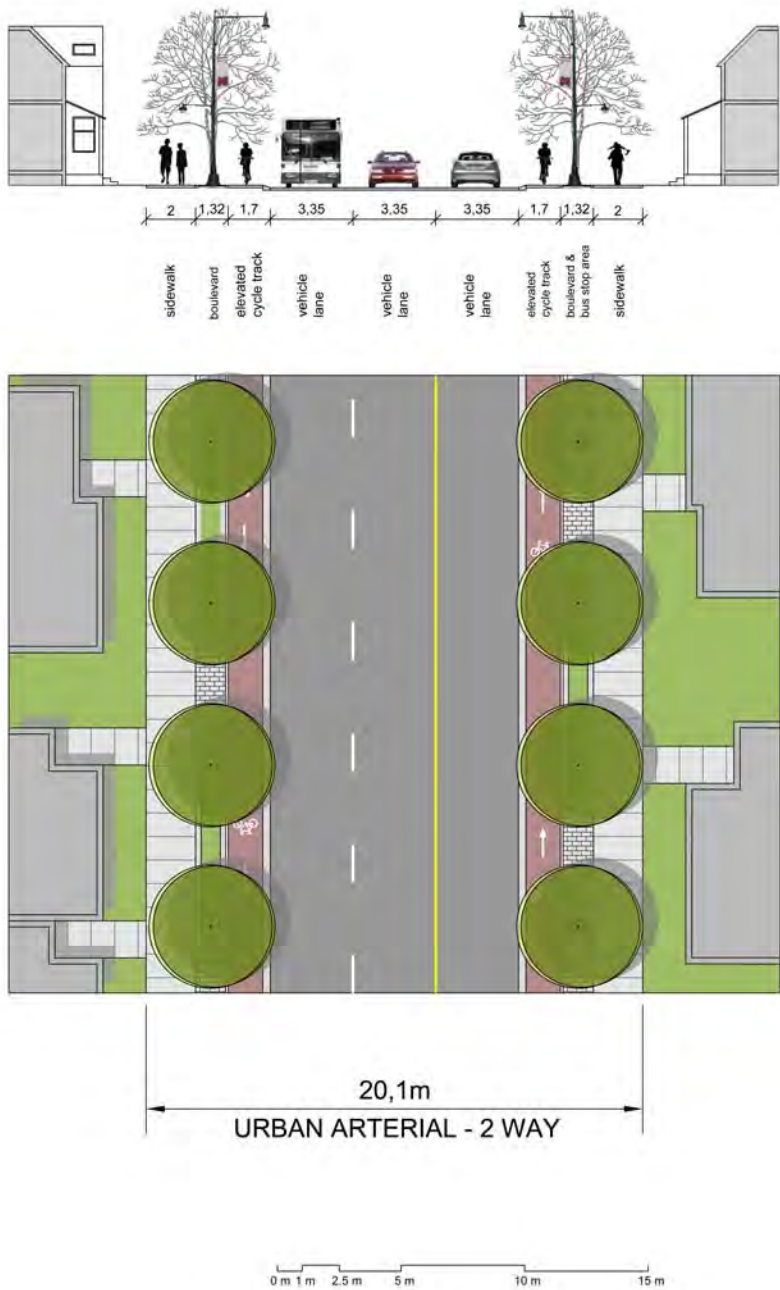


**Johnson Street  
After**

## 6.10 Urban Arterial (two way) Street Guidelines (20.1 m ROW)

<b>Elements</b>	<b>Widths (m)</b>	<b>Notes</b>
<b>Travel lanes</b>	<b>3.35</b>	<ul style="list-style-type: none"> <li>Provides safe travelling distances for emergency vehicles, transit, and transport trucks.</li> </ul>
<b>Parking lanes</b>	<b>-</b>	<ul style="list-style-type: none"> <li>No on-street parking, in order to create space for pedestrian and cycling amenities.</li> </ul>
<b>Combined Sidewalk and Boulevard</b>	<b>3.32</b>	<ul style="list-style-type: none"> <li>Combined sidewalk and boulevard on both sides of the street to promote safe walking environment as well as space for street amenities and snow storage.</li> <li>Bioretention features such as silvacells (underground), planters using good quality (high organic matter) soil, permeable pavement to define boulevard from the pedestrian realm, and channels to divert stormwater to surface planters.</li> <li>Street furniture including enhanced bus shelters, bike racks, waste receptacles, and benches.</li> </ul>
<b>Cycling</b>	<b>1.7</b>	<ul style="list-style-type: none"> <li>Elevated cycle tracks placed between travel lane and boulevard to offer extra protection from moving traffic.</li> </ul>
<b>Traffic Calming at intersections</b>		<ul style="list-style-type: none"> <li>At intersections where pedestrian crossings and traffic are high (e.g. schools).</li> <li>Bulb-outs and/or raised intersection or crosswalk.</li> </ul>
<b>Transit-oriented street furniture</b>		<ul style="list-style-type: none"> <li>Attractive bus stop with enhanced amenities for express service routes, including sheltered seating areas, waste receptacles, bike racks, user-friendly maps and schedules.</li> </ul>
<b>Street Lighting</b>		<ul style="list-style-type: none"> <li>Pedestrian-scaled lighting for automobiles and pedestrians.</li> <li>Can be combined with roadway lighting.</li> </ul>





## 7.0 Recommendations and Conclusion

This chapter will provide policy recommendations inspired by the research conducted on best practices for seven elements of ‘Great Streets’. These recommendations are presented under major themes, categorized under transportation, the pedestrian realm, and the natural environment. This chapter will also identify recommended areas of future research to explore the feasibility of additional aspects of ‘Great Streets’.

### 7.1 Right of Ways (ROW) and Lane Widths

In many cases, the quoted ROW for any given street may not in fact be representative of what width of ROW is feasibly modifiable. In such cases, moving to a smaller width’s specifications and recommendations is advisable as recommendations are largely dictated by what space is available. For example, if a street’s ROW is closer to 15m in spite of being designated as a 20m ROW, it is recommended that the 15m ROW designs are utilized.

Despite this report’s strong encouragement of walking and cycling as alternative modes, the reality is that travel lanes are still important for transit service, emergency services, and the personal automobile. Nevertheless, the current lane widths in Kingston are often well beyond what is necessary for the safe, convenient and efficient circulation of various motorized road users. This report recommends lane widths of 3m for local streets only due to legislated emergency vehicle requirements. However, it is advised that municipal staff work with emergency response services to **work towards lane widths of 2.75m**. This report recommends **reducing**

**lane widths wherever possible** with two goals in mind. First, reducing lane widths affords more ROW space for other important elements. Second, reducing lane widths acts as a traffic calming measure, thereby further encouraging motorists to share the road and be more mindful of other users travelling along or crossing the ROW.

One final and specific concern in the orientation of ROWs is the current City policy with respect to reverse frontage lots on major collectors. **In the future, reverse frontages on these kinds of streets should not be permitted.** This issue can be solved through the use of laneways. While the building could front on to the major collector, it could be serviced from the rear laneway. This will help mitigate the negative impact reverse frontage lots have on the streetscape and encourage wider use of the pedestrian realm.

### 7.2 Transportation

Our research on best practices for the elements of cycling, transit, and traffic calming has identified techniques and policies whose installation and adoption would contribute greatly towards creating ‘Great Streets’ for Kingston. As a primary goal of this report is to encourage streets that are accessible for all modes, our policy recommendations are grounded in making cycling and public transit safer and more convenient, while reducing the negative effects of motor vehicle use.

A successful cycling culture is founded upon cycling infrastructure that prioritizes the safety of cyclists, while mitigating conflicts with other modes of transportation. A

**cycle network integrated throughout the city** that connects residential neighbourhoods with activity centres would allow for a healthy travel option for Kingston residents. Care must be taken to provide facilities that accommodate all potential cyclists, irrespective of age or abilities. **Segregated facilities** (i.e. those separated from other traffic with some vertical obstacle) **should be implemented where possible** as these are more encouraging to cyclists and provide a greater sense of safety. That being said, all streets should be considered streets for cycling. Like many other aspects of 'Great Streets', education and promoting change in street users' behaviour to be more accommodating of other modes are crucial to creating a cycle-friendly community.

The development of successful public transit infrastructure also requires continued attention. Moving forward, efforts to increase transit ridership could focus on improving ease of use to retain current transit riders and to attract new users through both built form and educational outreach. Utilizing available technology could improve accessibility to transit service. This can be in the form of easy-to-read route maps and real-time schedule updates that offer convenience to transit users, as well as priority transit traffic signals that support the use of public transit. Particularly along less-frequented suburban streets, it is important to **provide safe and convenient bus stop infrastructure and raise the minimum standard for transit user comfort**. Transit is also an essential part of making 'Great Streets' as it can be easily linked with walking and cycling to promote healthier lifestyles among residents. Efforts should be made wherever possible to place stops at comfortable walking distances from common points of origin and destinations as well as provide clearly

visible bike racks (to deter theft). Improving these linkages with other modes is crucial to promoting transit as a versatile service that can efficiently cater to a variety of users.

The aim of traffic calming is to reduce vehicular speed on Kingston streets and is most successful when incorporating the three E's: (i) Engineering of streets, (ii) Education of the community, and (iii) Enforcement of regulations.<sup>1</sup> Engineering streets with traffic calming features that require automobile users to travel slower is only effective when combined with community education regarding the appropriate use and location of these measures, the enforcement of speeding regulations and the lowering of statutory speed limits (especially on local streets). A review of Kingston's Traffic Calming Policy (2007)<sup>2</sup> highlights the importance of a thorough and inclusive process; however this policy might be improved by altering the requirements for the implementation of a traffic calming project. For instance, residents are often not aware or accepting of the benefits of such measures until after they have had time to reflect on its effectiveness. This policy must also balance the needs of the immediate neighbourhood and those of the wider network. Reductions in vehicular speeds should be encouraged across the board without hindering transit, freight and emergency services. This report strongly encourages the City to **explore the appropriateness of traffic calming techniques beyond the standard speed hump**.

It is strongly recommended that the City explore **a street parking strategy** that increases the utility of these spaces, especially on urban streets. The demand for parking in the urban core and near key sites (e.g. KGH, Queen's campus)

can be readily satisfied with street parking as opposed to surface parking lots. Many of the City's urban surface lots are located on valuable development lands and do not reflect a long-term solution. Given parking is often a net loss proposition; the City should more aggressively explore monetizing street parking. For example, purchasable permits for local residents and day permits for other users as well as live-updates of parking availability would go a long way to improving parking management.

### 7.3 The Pedestrian Realm

In addition to pedestrian safety and accessibility, amenities such as pedestrian-scale lighting and street furniture are crucial to providing a safe, convenient, comfortable, accessible and well-used pedestrian realm.

The City of Kingston's Official Plan Section 4.6.6 states that the City supports wide sidewalks with a range of amenities.<sup>3</sup> Minimum combined sidewalk and boulevard width requirements should be increased to 3.7 metres (12 feet) for arterial and collector streets, and to 3 metres (9 feet) for local streets. The City should **develop a sidewalk widening strategy that prioritizes specific areas such as urban areas with high volumes of pedestrian and vehicle traffic, and those with street-level commercial activity.** This strategy should work in conjunction with Public Works' schedules for road or utility repairs to ensure efficiency and cost effectiveness.

To ensure that pedestrians are prioritized as street users with equal, if not greater, rights than the automobile, the City must

continue to lobby for necessary changes to the Highway Traffic Act of Ontario. Specifically, the Act restricts the City of Kingston's Pedestrian Crossing Guidelines so that the City cannot develop municipal bylaws that allow pedestrians the right-of-way at uncontrolled traffic intersections<sup>4</sup>. Unless this provincial policy is amended to allow pedestrians the right-of-way at uncontrolled intersections, it will continue to encourage an automobile-centric culture that diminishes the pedestrian realm and discourages its use. In the meantime, the City should continue to install well-marked and strategically placed Courtesy Crossings on two-lane streets with relatively high pedestrian and traffic volumes and no other traffic controls within 200 metres. In addition, installation of medians and curb extensions can also reduce crossing distances for pedestrians, thereby reducing the risk of collisions.

Accessibility is also a vital component of an inclusive and safe pedestrian realm. The City should install accessible pedestrian signals at all signalized traffic intersections to enable safer crossing. Clearly distinguishable curb ramps or raised crosswalks flush with sidewalk corners should also be provided to allow those with visual or mobility challenges to cross street safely and with ease.

The installation and upkeep of pedestrian-scale lighting and street furniture should be prioritized on streets with high pedestrian volumes, those with street-level commercial activity, and those with pedestrian safety concerns. Combined pedestrian and street lighting can be a cost effective solution, where appropriate. Bicycle racks should be accessible and provided close to trip destinations. To further



improve pedestrian safety, bollards should be installed on streets with high pedestrian volumes where vehicle traffic and pedestrian walkways are not otherwise clearly separated.

### 7.4 The Natural Environment

Green stormwater infrastructure and street trees, when used effectively, can be aesthetically pleasing and functional, by acting as traffic calming features, alleviating pressure on the City's stormwater management infrastructure, improving air quality, reducing the urban heat island effect, and providing a pleasing overall pedestrian environment.

**The City should aim for a minimum of one tree per lot, preferentially selecting native species that thrive in local conditions and offer a sense of place.** The City must also ensure that trees are tailored to suit their location. For example, street trees on arterials and collectors must be larger than those on local streets to be able to withstand higher levels of stress after planting, and larger trees or trees with wider root systems should be placed on streets with wider right of ways. The use of high organic content soil will provide high quality growing conditions for trees while reducing the level of upkeep needed. Although street trees and utilities must be separated as much as possible, columnar or vertically oval-shaped trees can be used in narrow ROWs to minimize interference with utilities. Another way to achieve minimum interference is through the use of root guards in tree pits.

As for green stormwater infrastructure, the most effective and efficient time to incorporate techniques is in the planning

stage for new development and redevelopment. This is a cost-saving measure, as ensuring green infrastructure is considered from the start makes for easier and proper implementation, while also allowing more time for public education, consultation and feedback. For new developments, early design considerations can endeavour to locate utilities in shared subterranean trenches beneath paved surfaces such as sidewalks instead of pervious surfaces such as the roadway boulevard. Policies to prevent degradation and compaction of soil from development are vital in encouraging tree and plant growth into maturity. Efforts to establish good growing conditions by protecting the soil from the start will lead to greater benefits from larger, healthier trees and plants in the public realm. Overall, **new and re-development design considerations should aim to disconnect the impervious surface as much as possible in order to facilitate rainwater infiltration and maintain the natural hydrological cycle in the city.**

### 7.5 Areas of Further Research

This section details topics and techniques that require further research due to their breadth or lack of empirical trials in mid-sized Canadian cities.

**Street Intersections:** Crafting a comprehensive 'Great Streets' policy or street design for intersections has proven difficult due to intersections being an interface zone between many modes of transportation (pedestrians, cyclists, transit, and automobiles). Their design would also be extremely context-sensitive and based on a variety of factors including abutting land uses and traffic volumes. Since the opportunity

for inter-modal conflict is highest at intersections, it is critical to implement street designs that reduce vehicle and bicycle speeds at conflict points to improve safety for all road users. Indeed, an efficient intersection is one with clear signage, markings and signals that effectively communicate the appropriately designated space for each road user. A crucial component for success is changing the perception that the ROW and intersections are there to serve only motorized vehicles. Well-designed intersections can help to instill a sense of mutual respect for each mode's safe journey along the ROW and contribute to the efficient and convenient flow of multi-modal traffic.

**Further Contextualization:** Future research should explore considerations for further contextualizing streets for specialized land uses. For example, policy recommendations and street designs would offer greater specificity for school zones, hospital zones, and other sensitive areas. As has been noted throughout this report, streets are highly context sensitive and although the classifications proposed in this report are a starting point, further contextualization should be considered. For example, the City of Calgary's *Complete Streets Guide* proposes further classifying streets and recommends measures based on the kinds of activities suitable in the street. In this way, residential streets, activity centre streets, commercial streets and industrial streets would be targeted for different improvements, but all under the same vision of 'complete streets'.<sup>5</sup> Many techniques detailed in this report could be uniformly applied, however many require or serve a certain context, which should be top of mind when planning 'Great Streets'.

**Municipal HOV Lanes:** The use of municipal HOV lanes requires more research into best practices for comparable-sized cities. As traffic demands increase in downtown Kingston, HOV lanes become a more viable option as transit service ridership gains favour as an alternative to single-occupancy automobiles. For example, the Express Route #3, proposed for 2015 implementation by the Kingston Transit Redevelopment Plan,<sup>6</sup> is slated to travel along Brock Street and Johnston Street, making it ideal for HOV lanes as these two urban arterial streets act as thoroughfares into and out of downtown Kingston. On a municipality's roadway, the lanes are intended to serve high-frequency transit and taxis in the curbside (rightmost) lanes. Unlike highway HOV lane restrictions, which are enforced by Ontario Provincial Police (OPP) officers, enforcing municipal HOV lanes can be challenging because drivers need to make right turns at regular intervals and would therefore need to enter the HOV lane. Alternatively, contra flow HOV bus lanes, which are typically installed on one-way streets, would allow for the routine changing of lane direction during peak commuting hours to increase the flow of traffic (for example, a lane heading downtown in the AM peak times and away from the downtown in the PM peak times). However, contra flow arrangements require a significant educational shift and can therefore take time to implement.

### 7.6 Conclusion

The best practices examples of street features presented in this report were used to develop a street design toolbox to help City of Kingston planners and decision-makers to prioritize user needs depending on the type of street and its objectives. This toolbox was then used as the basis to present Kingston case studies for each type of street in order to showcase how an integrated policy emphasizing both 'Complete' and 'Green' streets could create 'Great Streets' for Kingston and move the City closer to achieving its social, environmental, and economic goals.

In order to create 'Great Streets', it is essential for decision-makers, planners, engineers and Kingston citizens alike to change their way of thinking about the purpose, structure and function of their streets. This will allow the City move from automobile-centric design and policies towards a more balanced approach to street planning that takes all users and modes into consideration. If used effectively, 'Great Streets' principles can help create the kind of community envisioned in the City of Kingston's Official Plan and other policies – a community with well-connected, safe, accessible, and lively streets that accommodate all users and modes equally, and are supportive of natural processes.

### Notes

1. Minnesota Local Road Research Board. "The Three Es of Traffic Calming." December 2008. <<http://mn-traffic-calming.org/cgi-bin/index.cgi?file=/xml/TheThreeEs.xml;section=resource>>
2. City of Kingston. January 2012. Traffic Calming Policy (2007). <<http://www.cityofkingston.ca/residents/transportation/streets/trafficcalming/index.asp>>
3. City of Kingston. January 2012. "Kingston's Official Plan" <<http://www.cityofkingston.ca/business/development/officialplan/>>
4. City of Kingston Engineering Department (Traffic Division). April 2008. Pedestrian Crossing Guidelines.
5. City of Calgary (2011) 2011 Interim Complete Streets Guide.
6. City of Kingston. August 2011. "Kingston Transit Redevelopment Plan 2011-2015." <[http://www.cityofkingston.ca/pdf/transit/TransitRedevelopmentPlan\\_2011-2015.pdf](http://www.cityofkingston.ca/pdf/transit/TransitRedevelopmentPlan_2011-2015.pdf)>