HOW WE GO

Niagara Region Transportation Master Plan

Niagara Region Complete Streets Design Guidelines

June 2017

IBI Group in association with
Parsons and Brook McIlroy

NIAGARA 2041 Fostering an environment for Economic Prosperity

Niagara Region

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1.0 Complete Street Typologies

1.1 The Complete Corridor Concept

Complete corridors support smart growth while serving both a placemaking and transportation function.

The integration of land use planning, transportation planning and urban design is critical for developing “Complete Corridors” that support Smart Growth. Niagara Region’s Transportation Master Plan lays the foundation for the Region to develop Complete Corridors.

Complete Corridors are roads and adjacent lands planned with the future context in mind. The public right-of-way and adjacent lands are designed to equitably and efficiently support all mobility modes , based on context, and to assist people of all ages and abilities in travelling throughout the Region. These corridors serve both a placemaking and transportation function and form the spine of healthy communities.

Complete Streets design guidelines for Niagara are organized with this concept in mind. They focus on the boulevard and roadway but also provide guidance for directing growth on lands adjacent to the public right-of-way.

1.2 A New Approach to Regional Roads

The development of six Regional Road Typologies provides a Complete Streets characterization system for roads in the Region with context sensitive planning and design direction.

Regional roads in Niagara exist within a range of urban, transitioning and rural contexts.

The Regional Official Plan (ROP) defines all Regional Roads as Arterials, to assist in addressing the Region's various mobility needs, land use contexts, and natural heritage and built form conditions, six new Complete Street Typologies have been developed. These typologies form the basis of a new "family" of Complete Streets.

The typologies have been created in response to:

- Existing policies and technical best practices;
- Site visits;
- Development of corridor analysis sheets; and
- The grouping of regional roads based on existing and Official Plan planned rights-of-way, operational characteristics, land use, built form and urban design attributes.

The six typologies are:

1. Main Street;
2. Urban General (Narrow);
3. Urban General (Wide);
4. Transitioning;
5. Hamlet; and
6. Rural.

The typologies are based on aspirational visions for Regional Roads in Niagara, forming a coordinated family of Complete Streets. For each typology, a brief description, key design elements and operational attributes and demonstration plans and sections are provided.

The demonstration plans and sections are examples of which elements can be accommodated within the typical planned right-of-way for each typology. They are presented in a manner that recognizes the need for flexibility in their implementation. It is recognized, and expected, that there will be variations on these basic types, which are established as a starting point for detailed design on a corridor by corridor basis.

The six Complete Street Typologies and their descriptions are found on the following pages.

Main Street

Traditional pedestrian oriented shopping streets with mixed-uses and smaller scale buildings found throughout the region.

Main Streets are typically fronted by heritage buildings and have a heritage character. Development is street-oriented and they are often surrounded by stable residential neighbourhoods. Pedestrians should be prioritized with narrow streets, slower traffic, on-street parking, wide sidewalks and enhanced pedestrian amenities. Cycling facilities should also be included.

These roads have historically narrow right-of-way widths (20m – 26m) and are found in urban areas and hamlets, often with a mix of at-grade retail and residential uses. While there is a high potential for movement of people by all modes, pedestrian movement is predominant. The boulevard area forms an important part of the public realm and will have an urban cross-section with an emphasis on streetscaping. Street amenities include wide sidewalks, pedestrian oriented lighting, street trees, transit amenities and opportunities for public art. Needs for on-street parking are often high. The street is to be active transportation and transit supportive with transit oriented land use.

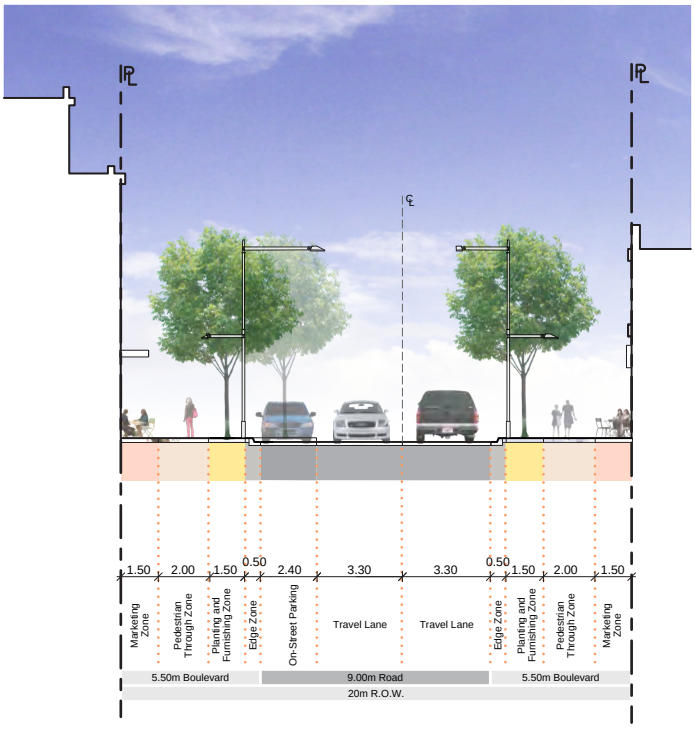
Elements:

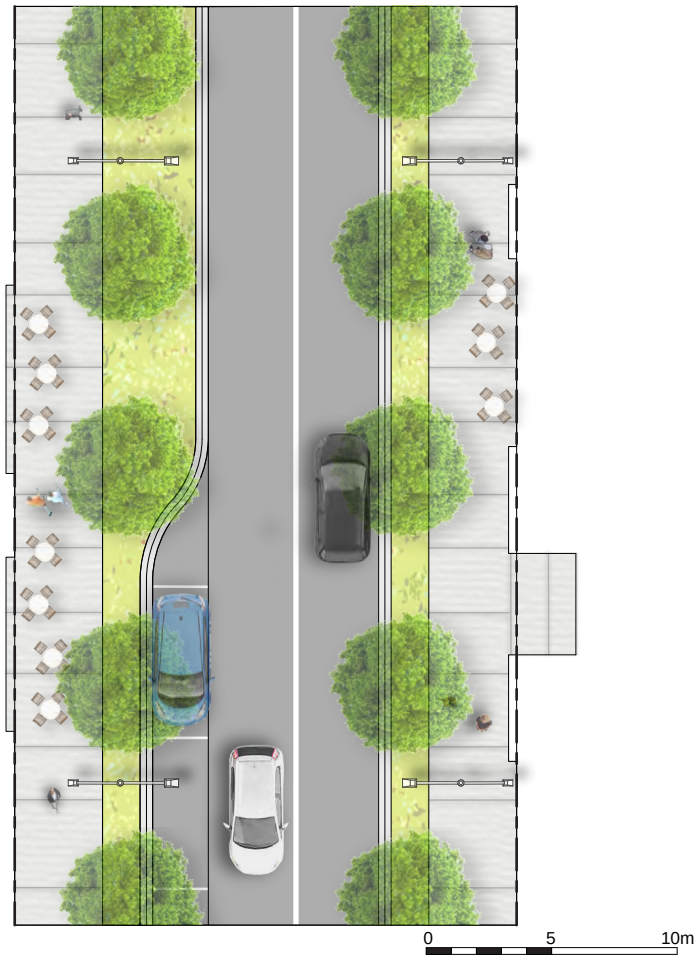
- Wide sidewalks and high quality pedestrian amenities, including pedestrian-scale lighting, benches, etc.;
- Passive traffic calming including narrow vehicle travel lanes, on-street parking, mid-block crossings, bump-outs and signals;
- Transit priority lanes or transit in mixed-traffic;
- Pedestrian crossings at signalized intersections or unsignalized mid-block crossings;
- Dedicated cycling facility (bike lane);
- Dedicated on-street parking; and
- Landscaping includes street trees, shrub/perennial beds, decorative planters.

East Main Street, Welland, ON

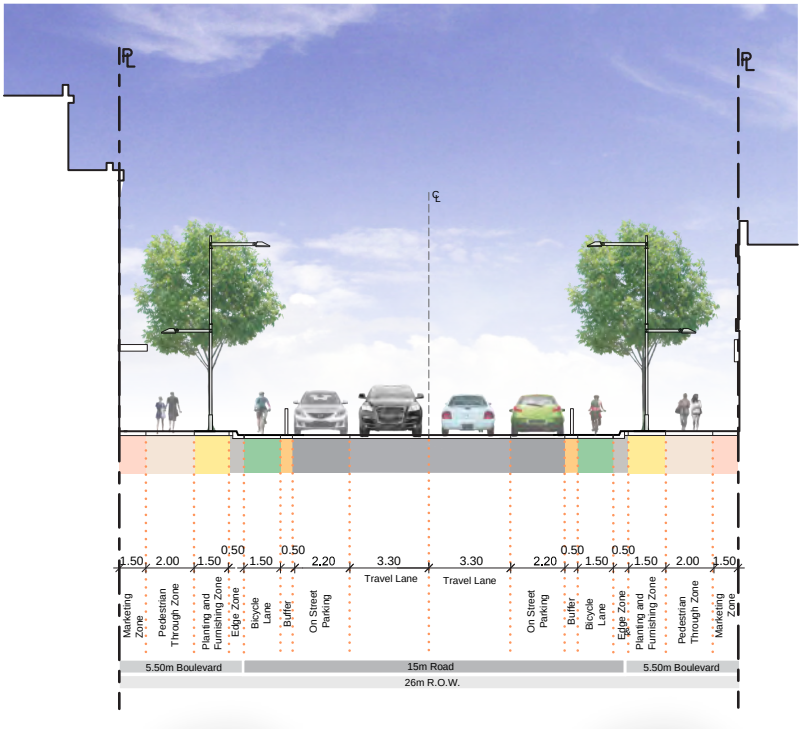
Demonstration Plans

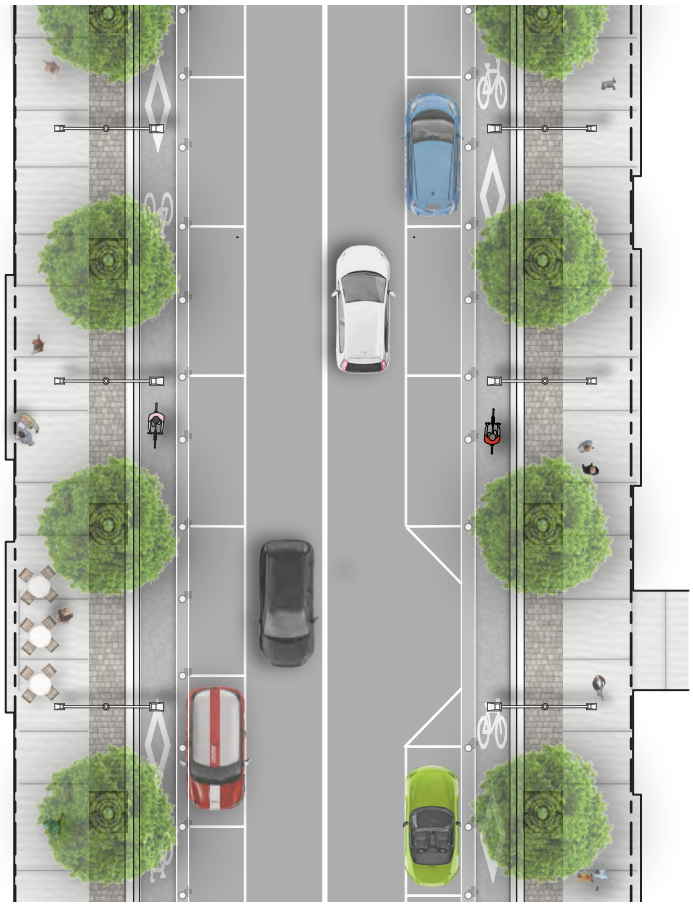
MAIN STREET (20m R.O.W.)





MAIN STREET (26m R.O.W.)
Option 1





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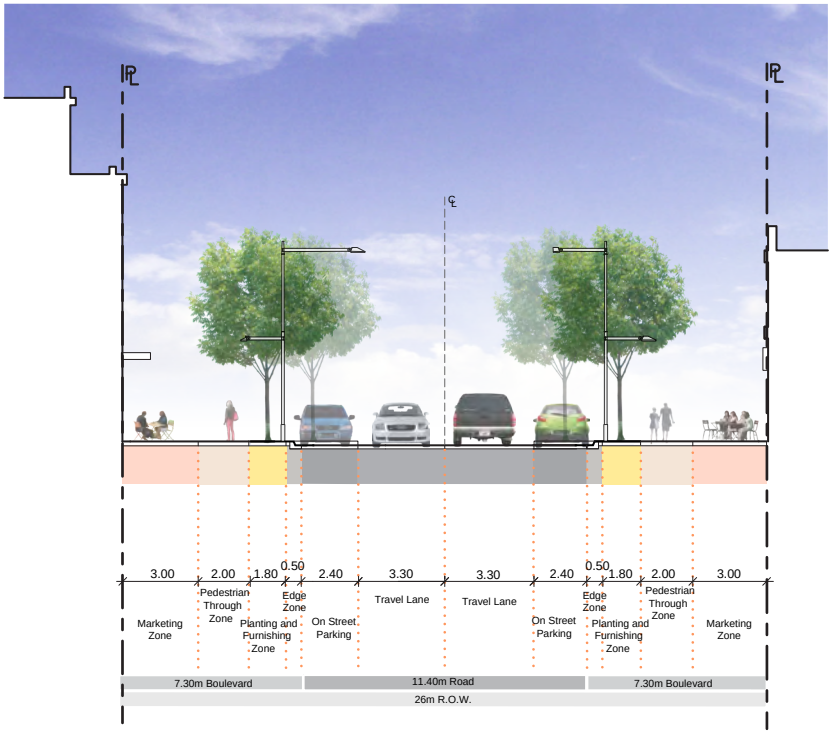
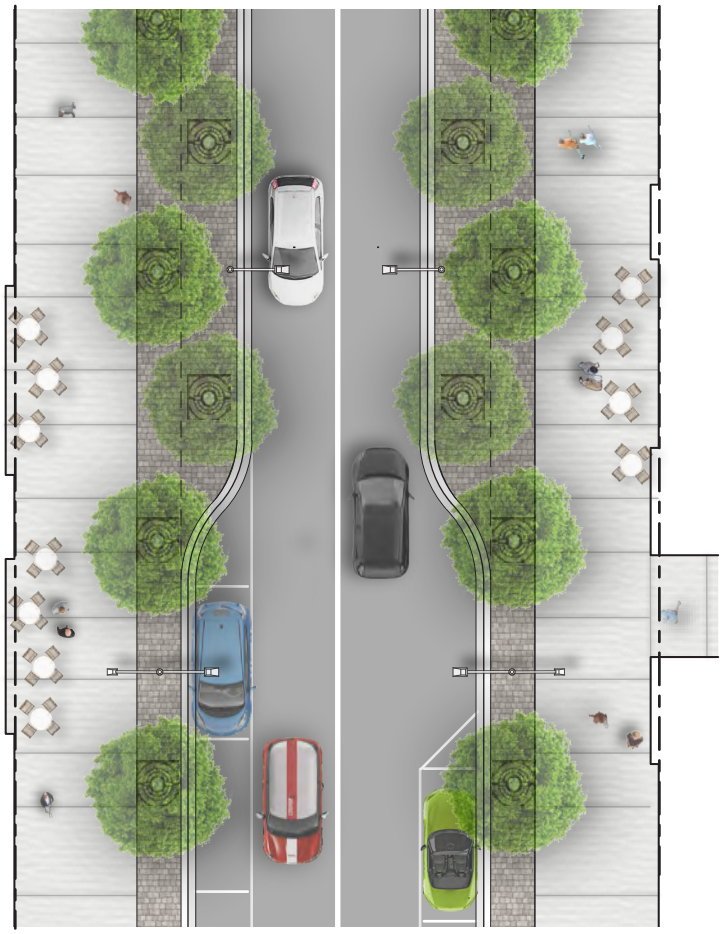
MAIN STREET (26m R.O.W.)
Option 2





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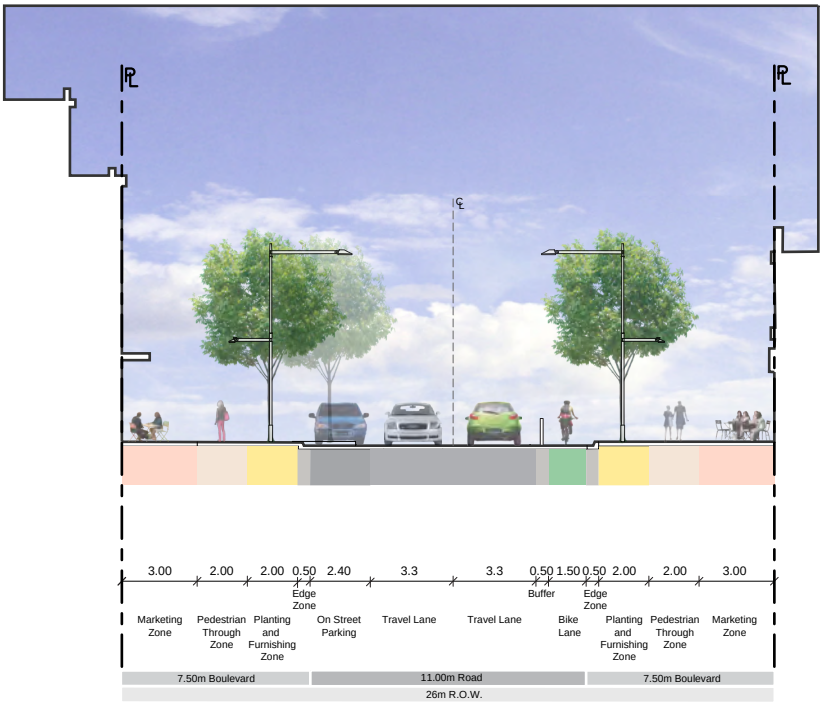
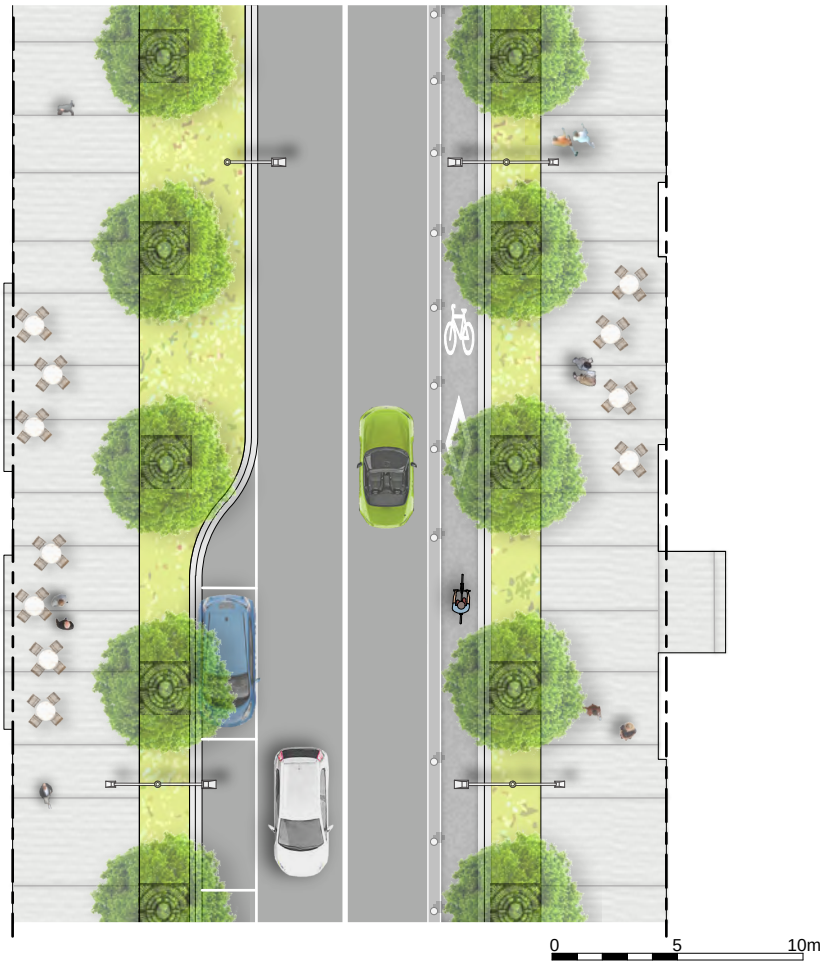
MAIN STREET (26m R.O.W.)
Option 3





Urban General (Narrow)

Narrow urban streets located in the most urbanized, dense and mixed-use urban centres.

Urban General (Narrow) and Urban General (Wide) Streets can be found within the region's most dense, mixed-use urban centres, such as St. Catharines and Niagara Falls. Development is street-oriented and streets are very busy. These streets carry high volumes of all modes of movement, including transit, cyclists, pedestrians, private vehicles and goods movement vehicles.

These roads have historically narrow right-of-way widths (20m – 26m) and are found in urban areas often serving commercial retail and service businesses and/or residential uses. Compared to Main Streets there is less emphasis on streetscaping, however opportunities for sustainable planting and street greening can be sought. Active transportation is important as these streets often connect neighbourhoods within communities, and can form part of the Regional cycling network.

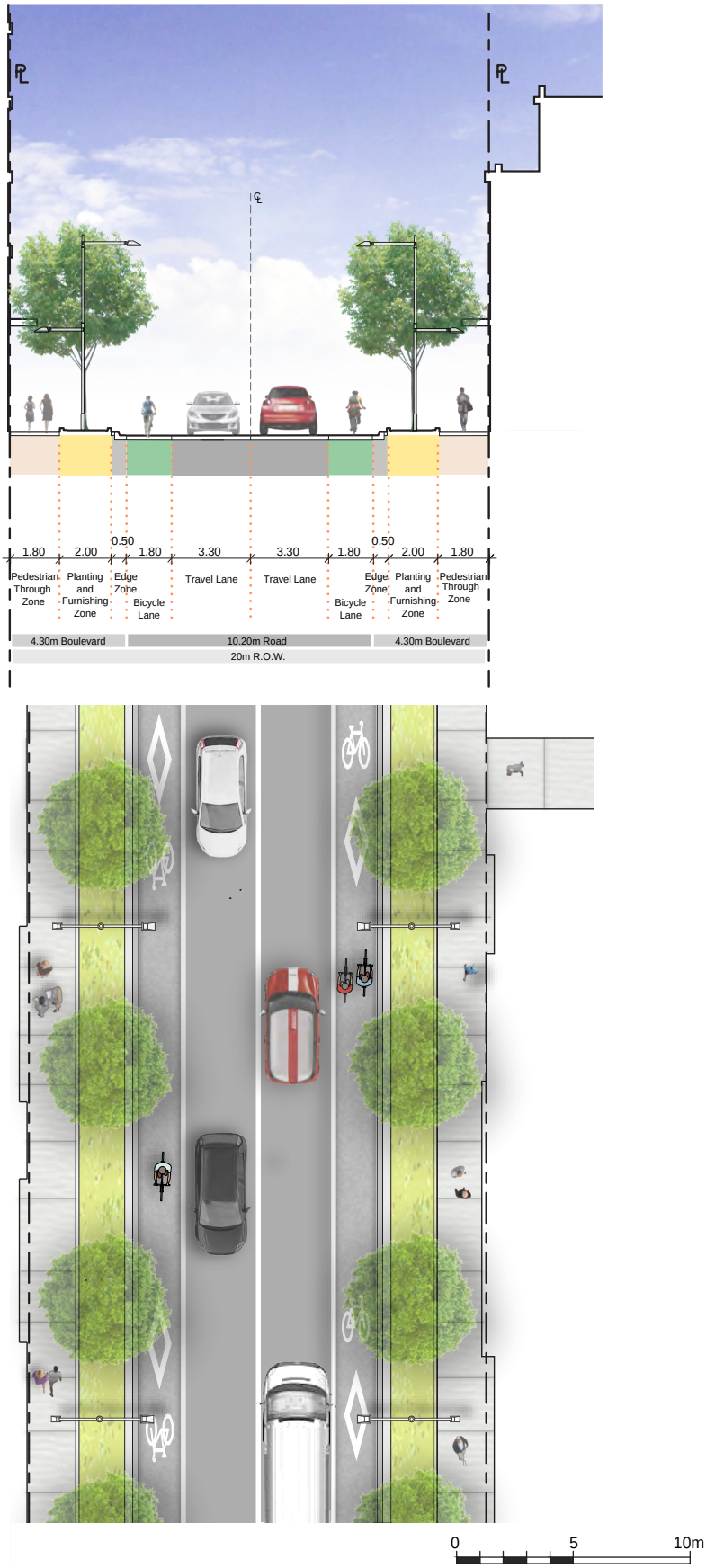
Street design generally accommodates transit and provides safe and dedicated facilities for pedestrians and cyclists. In order to promote safety on such busy streets, the design of these streets should narrow lane widths, or reduce the number of lanes, to devote more space to on-street parking, tree growth, transit and active transportation (e.g. dedicated transit lanes, more comfortable transit stops and wider sidewalks).

Elements:

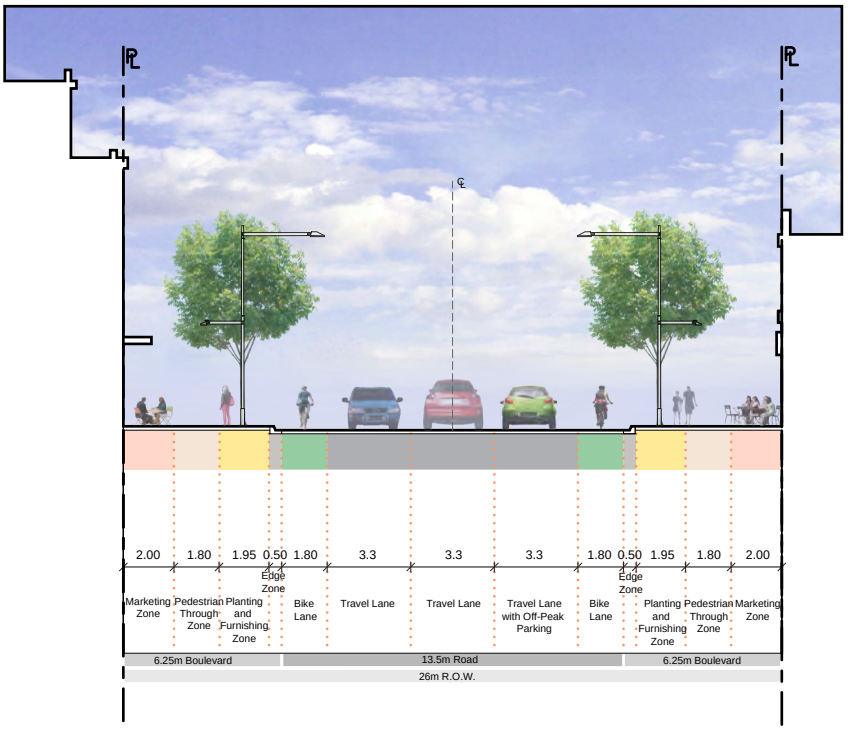
- Wide sidewalks and high quality pedestrian amenities;
- Pedestrian crossings only at signalized intersections;
- Transit amenities with transit in mixed traffic, dedicated transit lane or transit priority lanes;
- Dedicated cycling facility (bike lane or cycle track);
- Dedicated on-street parking;
- May accommodate goods movement but may be limited to certain times of day or locations; and
- Landscaping includes street trees, shrub/perennial beds, decorative planters.

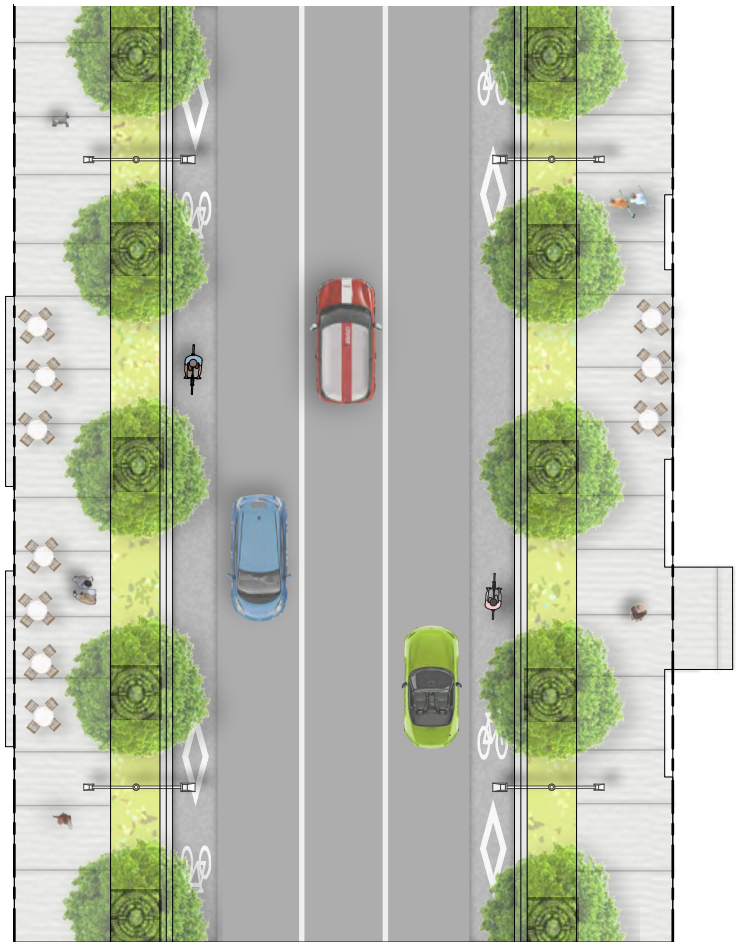
Demonstration Plans

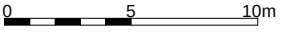
URBAN GENERAL - NARROW (20m R.O.W.)



URBAN GENERAL NARROW (26m R.O.W.)







Urban General (Wide)

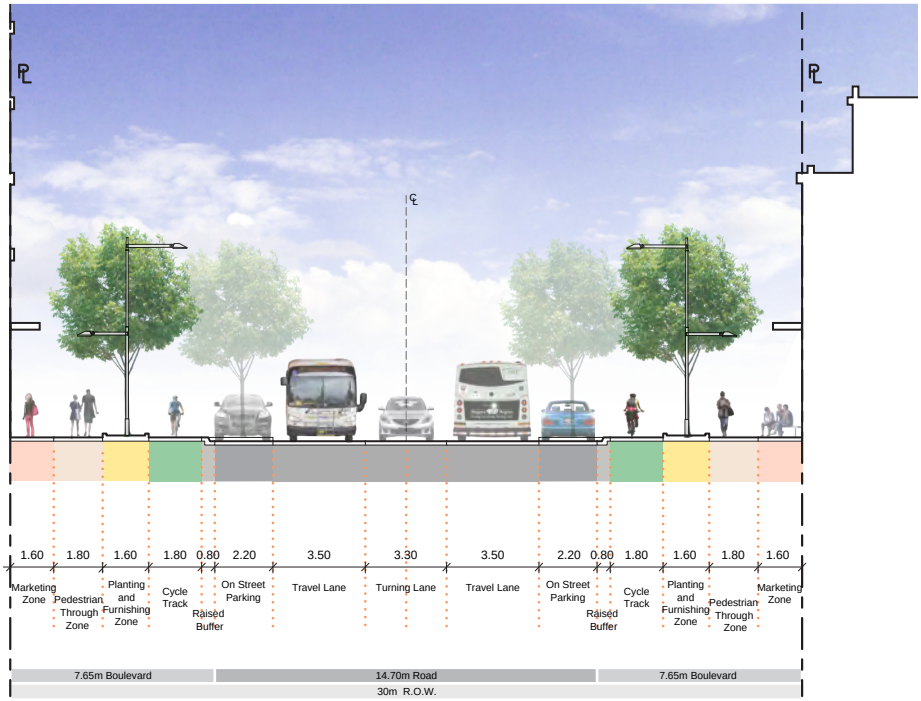
Major urban arterials that support high density development, commercial and retail uses and accommodate all transportation modes.

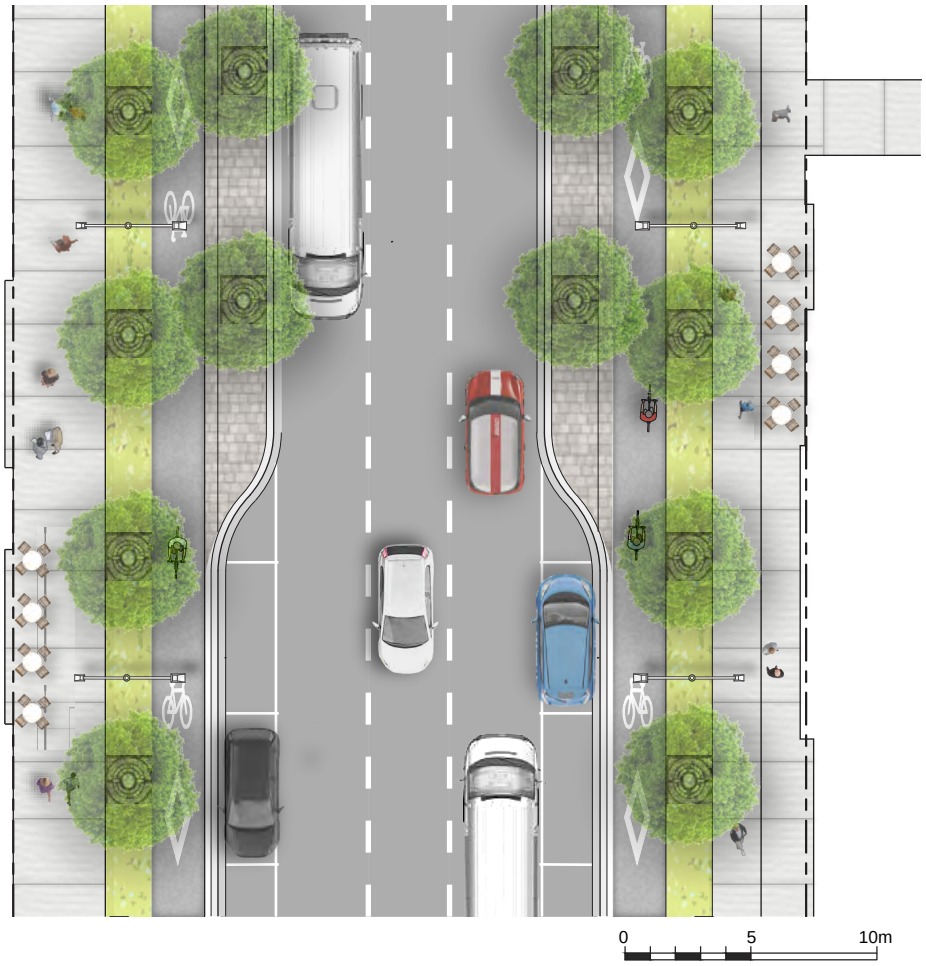
Urban General (Wide) roads generally have wide right-of-way widths (26m – 36m) often with four or more vehicle lanes and physically separated cycling facilities. The corridors may incorporate medians and left-turn lanes at intersections. These corridors often serve commercial retail and service businesses, and connect residential neighbourhoods within communities. Parking is typically provided on-street or within adjacent lands, outside of the right-of-way. Opportunities for street greening are available within the boulevard and can be embellished by landscaping on adjacent lands.

The list or recommended elements for Urban General (Wide) are generally consistent with those of Urban General (Narrow).

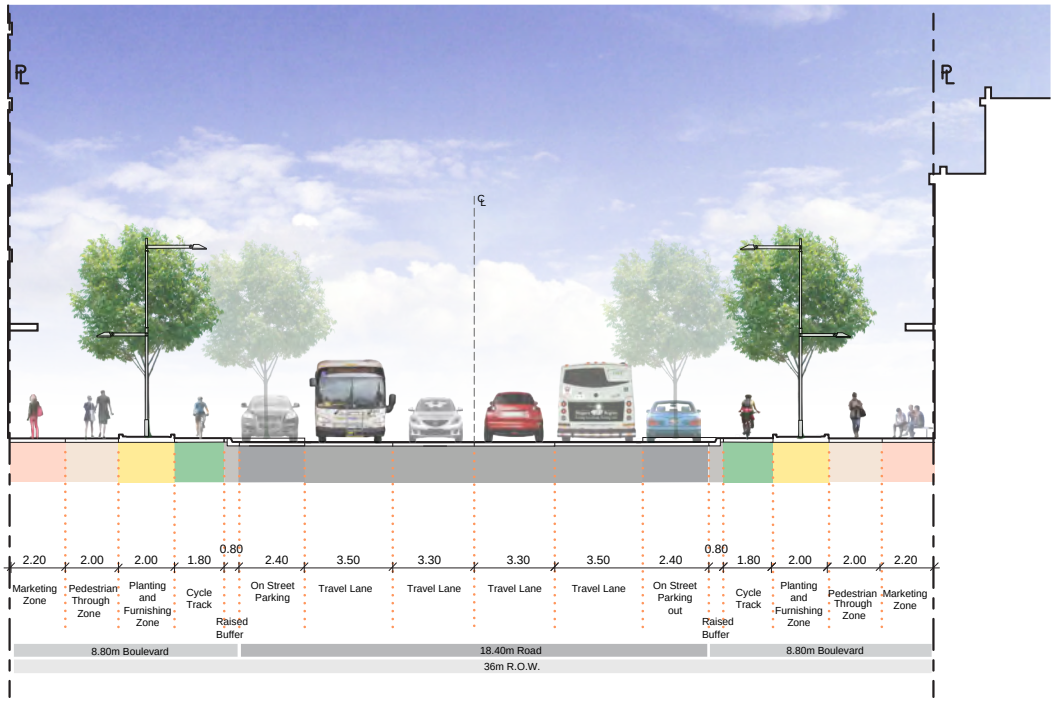
Demonstration Plans

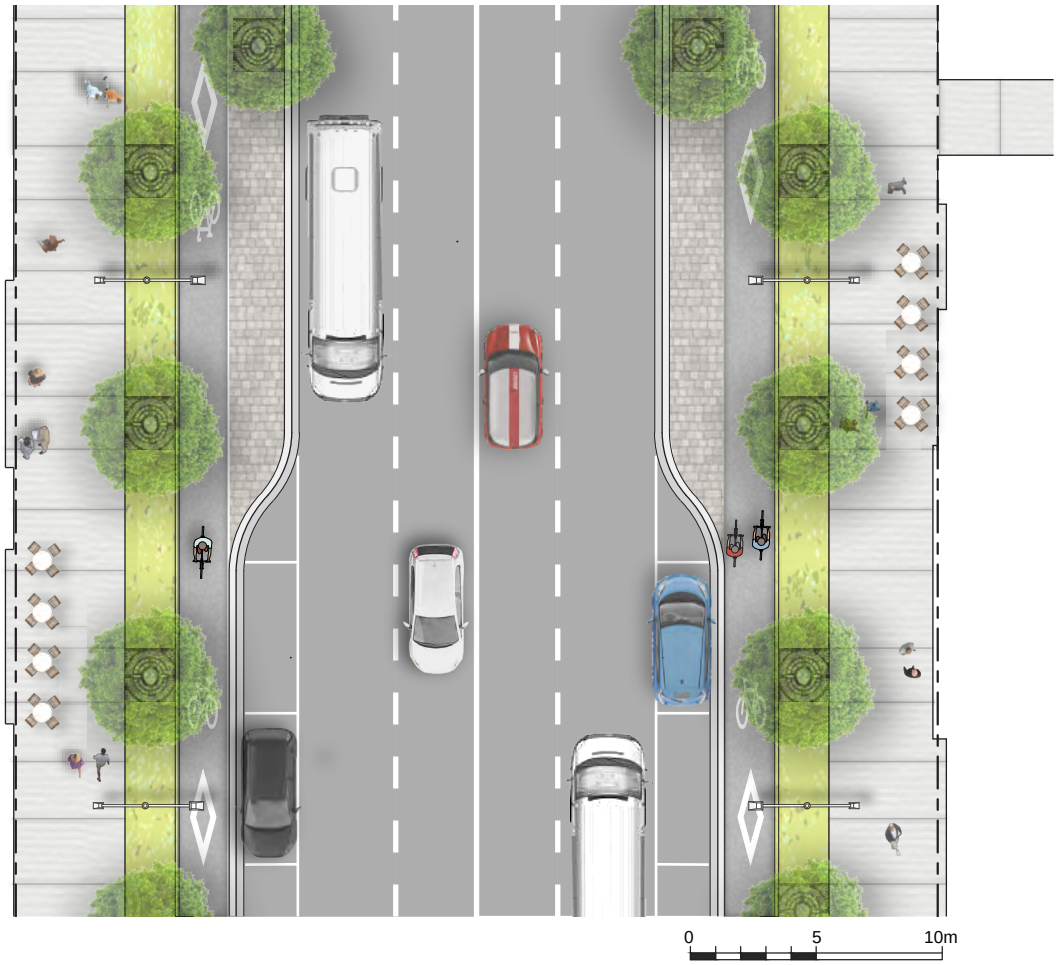
URBAN GENERAL - WIDE (30m R.O.W.)





URBAN GENERAL - WIDE (36m R.O.W.)





Transitioning

Roads located in areas that are transitioning to a more urbanized and mixed-use context.

Transitioning Roads are generally located in commercial or residential areas that are transitioning to a more urbanized and mixed-use context. Generally, they are transitioning from large format retail to medium or high density residential. New development is street-oriented.

These roads generally have wide right-of-way widths (26m – 36m+) with 4 or more vehicle lanes, serving semi-urban and rural areas. The corridors play important roles in connecting communities, cross-region travel and goods movement. They support regional cycling through a range of in-corridor cycling facilities, which are ideally separated. Pedestrians are accommodated on sidewalks or multi-use pathways, depending on the context.

Responding to projected intensification, transitioning roads are expected to accommodate higher vehicle capacity, as well as transit and active transportation. Transit vehicles, cyclists and pedestrians should have dedicated space. These are also major goods movement corridors and may include a centre median and dedicated turning lanes.

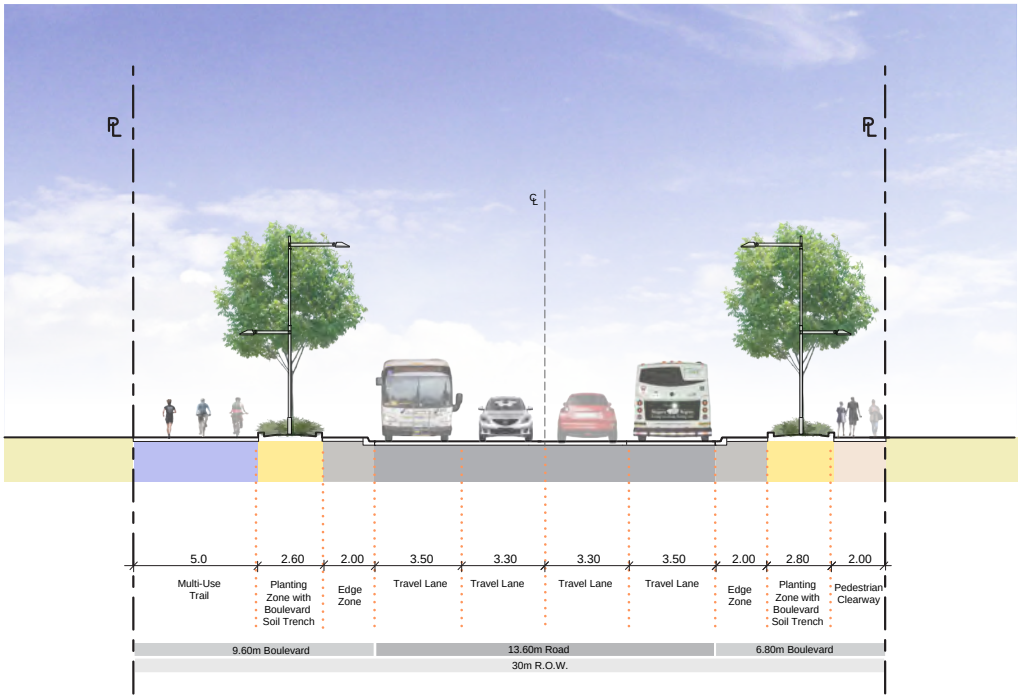
Elements:

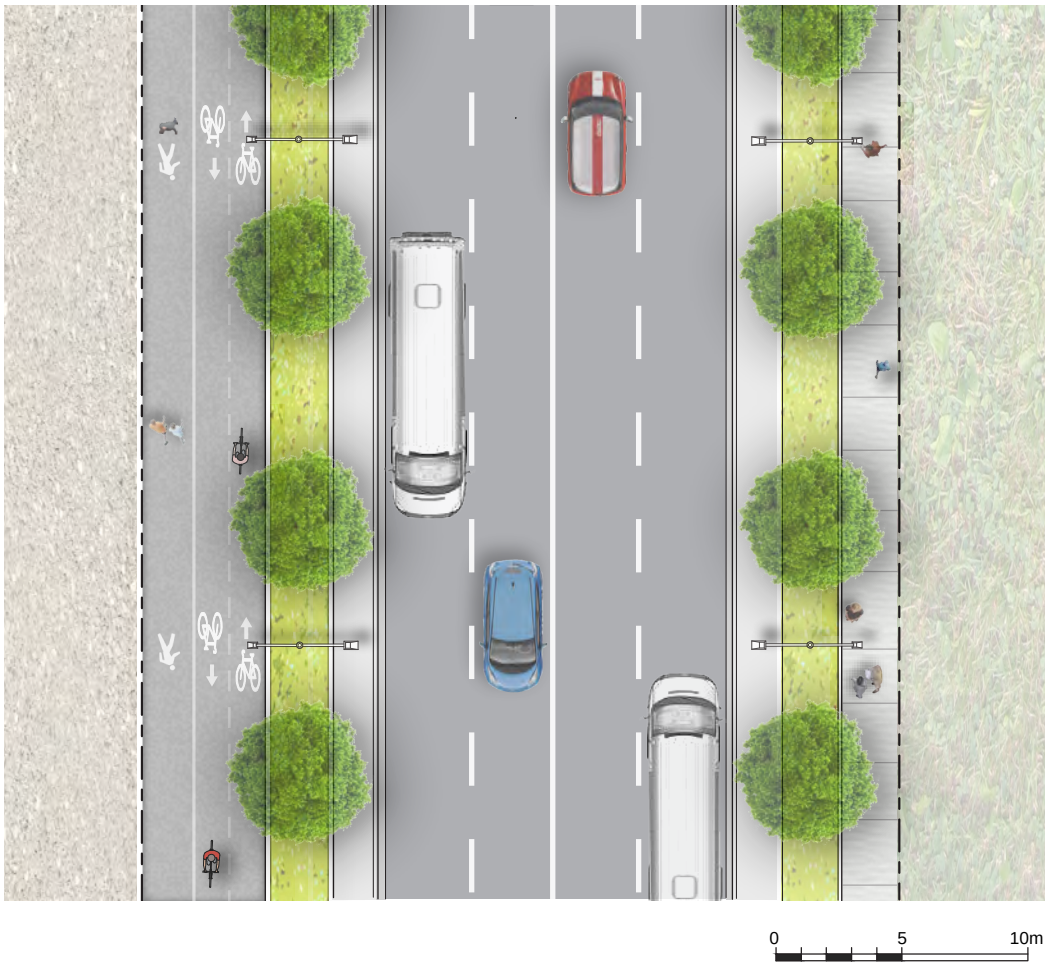
- Wide sidewalks and high quality pedestrian amenities;
- Pedestrian crossings only at signalized intersections;
- Transit amenities with transit in mixed traffic, dedicated transit lane or transit priority lanes;
- Dedicated cycling facility (cycle track or multi-use path);
- Permit off-peak parking;
- Street supports goods movement; and
- Landscaping can include street trees, shrub/perennial beds, raised planters, buffer planting.

Regional Road 50 in Welland, ON is an example of a transitioning road early in its development.

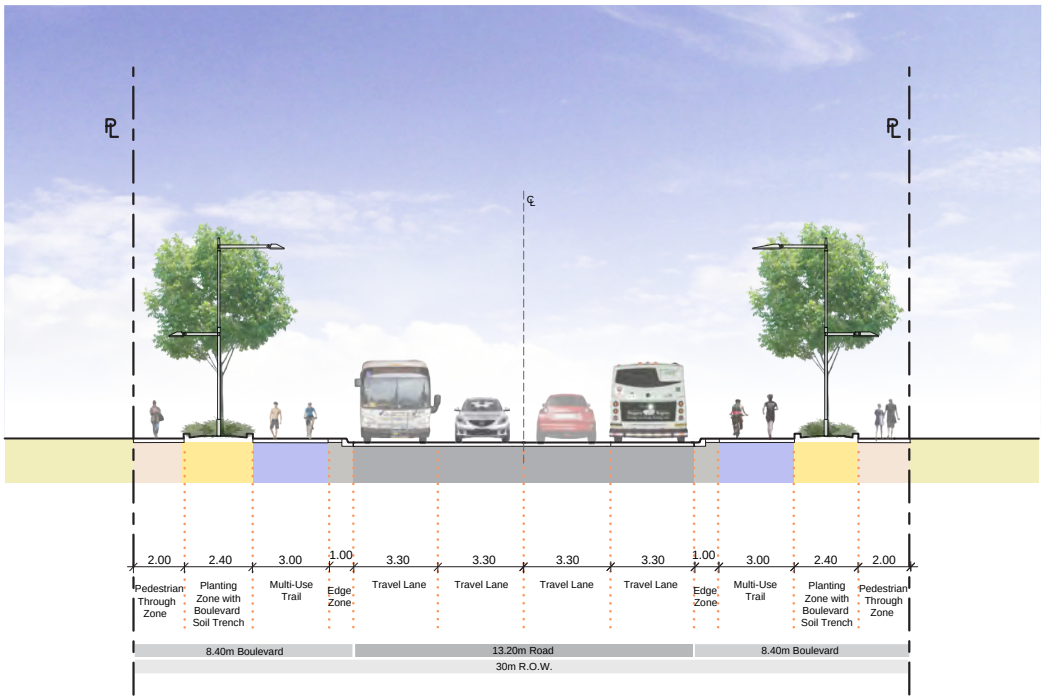
Demonstration Plans

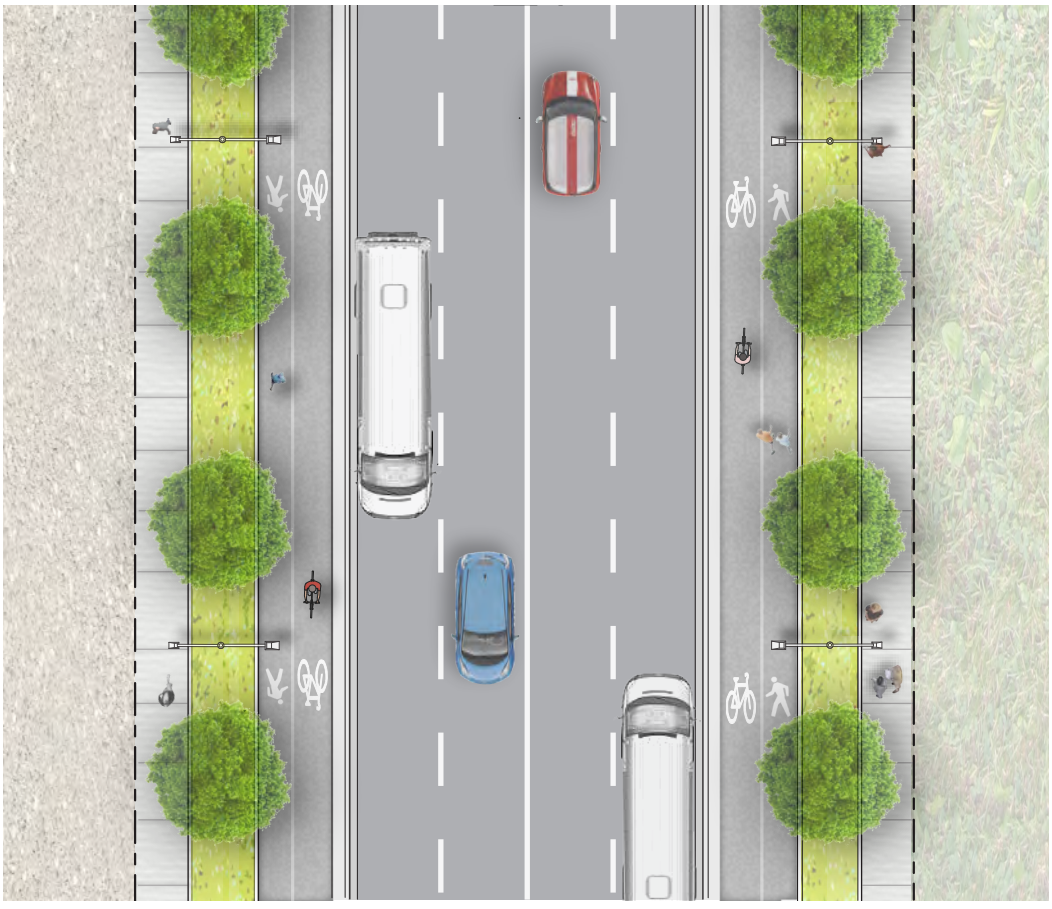
TRANSITIONING (30m R.O.W.)





TRANSITIONING (30m R.O.W.)





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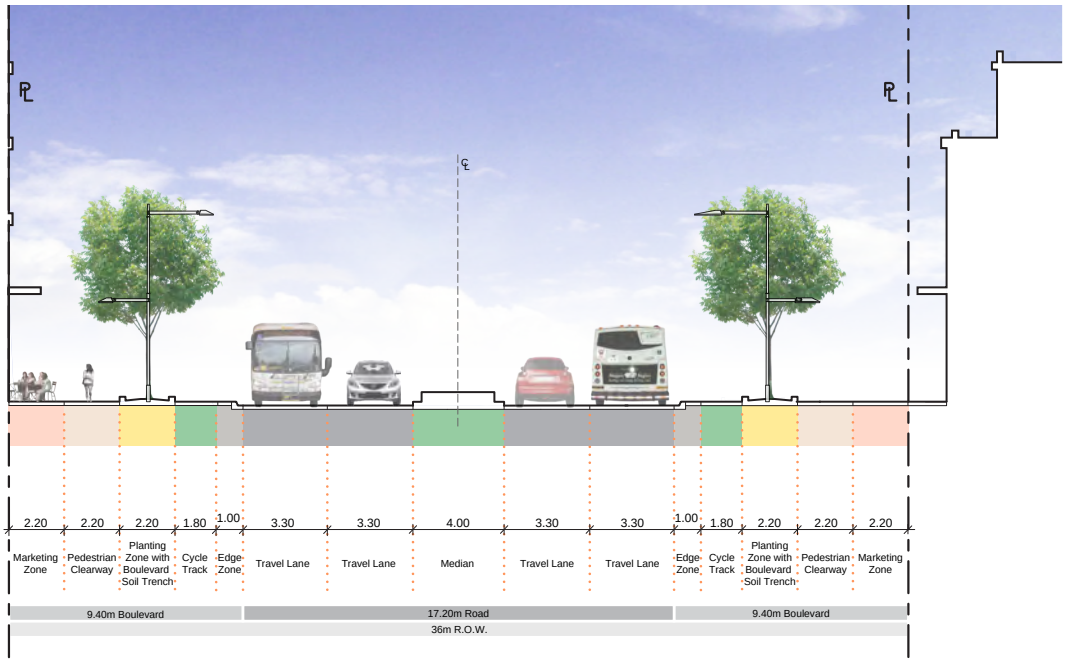
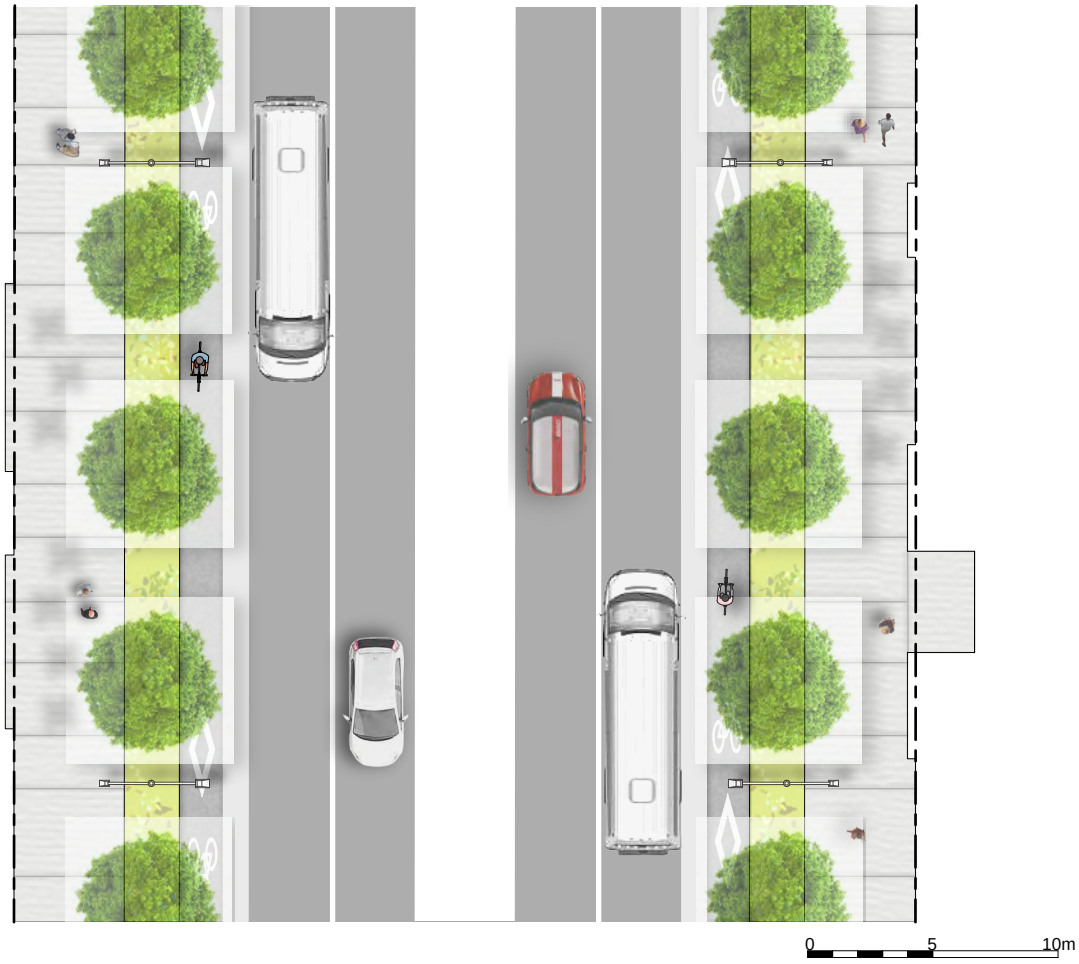
TRANSITIONING (36m R.O.W.)





Hamlet

Small rural communities with street oriented retail

Hamlets are small communities found throughout rural areas of the Region. They are portions of streets that pass through villages serving local residents as well as through-traffic. Hamlets are often centered around an intersection or a section of highway, and may include residential frontages or a small number of commercial or other uses that serve the community.

These roads have historically narrow right-of-way widths (20m – 26m), although some examples of Hamlets with larger rights-of-way exist, and are found in hamlets serving commercial retail, service businesses and/or residential uses. These corridors form the “heart” of Hamlets, where opportunities for streetscaping can be pursued. The street is to be active transportation supportive.

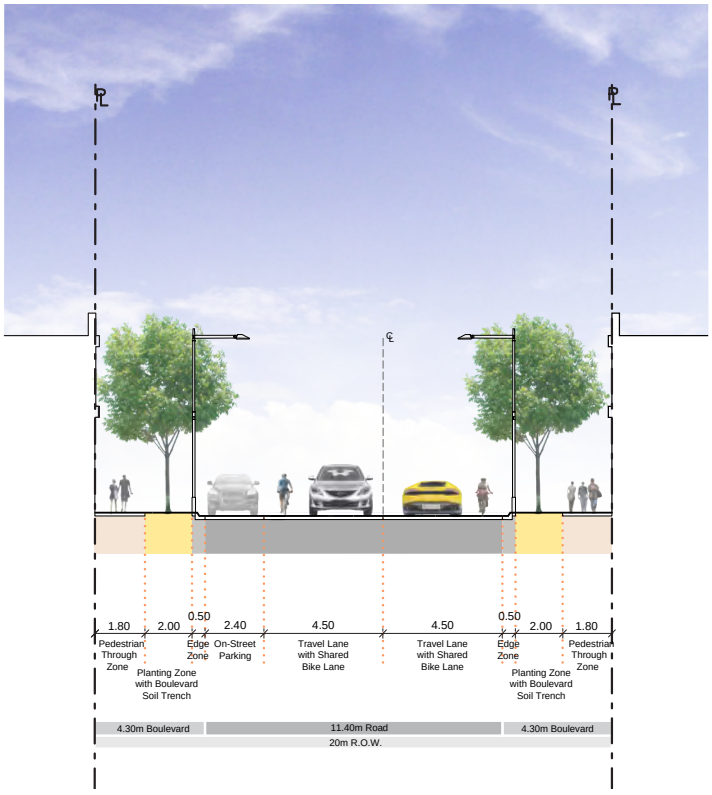
In contrast with Rural Roads, Hamlets should slow traffic through smaller settlements. These roads will be designed to support the local community and calm traffic as they transition into a village setting. As they are associated with clusters of low density residential or commercial development, boulevards should include sidewalks, street trees, on-street parking, cycling facilities and other amenities to support local residential and retail activity.

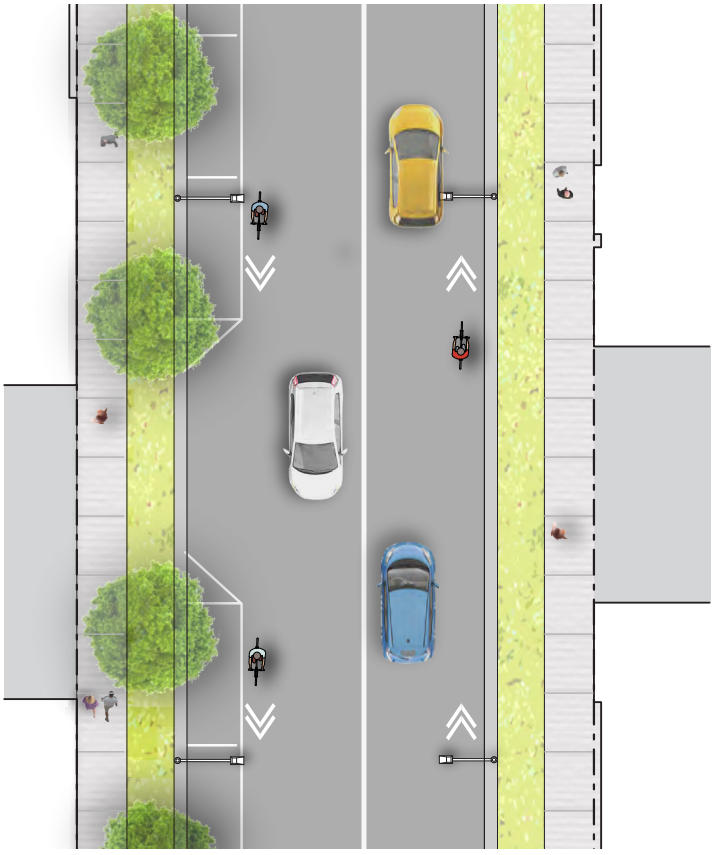
Elements:

- Sidewalks and pedestrian amenities, including pedestrian-scale lighting, benches, etc.;
- May include dedicated on-street parking;
- Limited goods movement;
- Pedestrian crossings at signalized intersections; and
- Landscaping includes street trees, shrub/perennial beds.

Demonstration Plans

HAMLET (20m R.O.W.)





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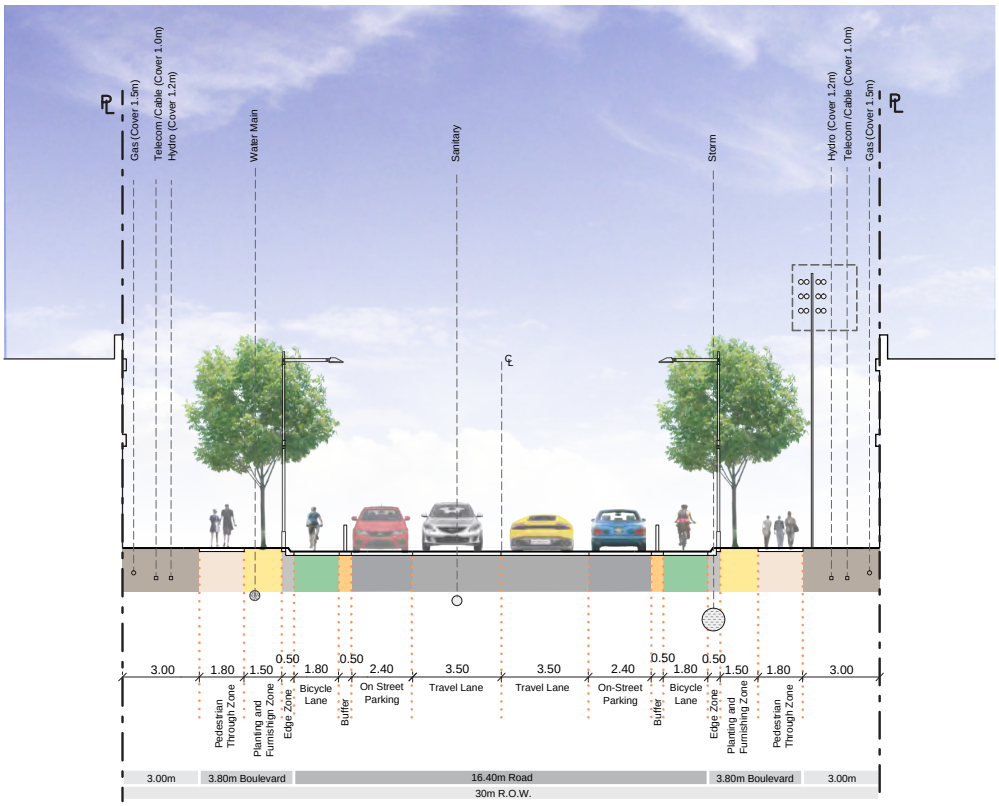
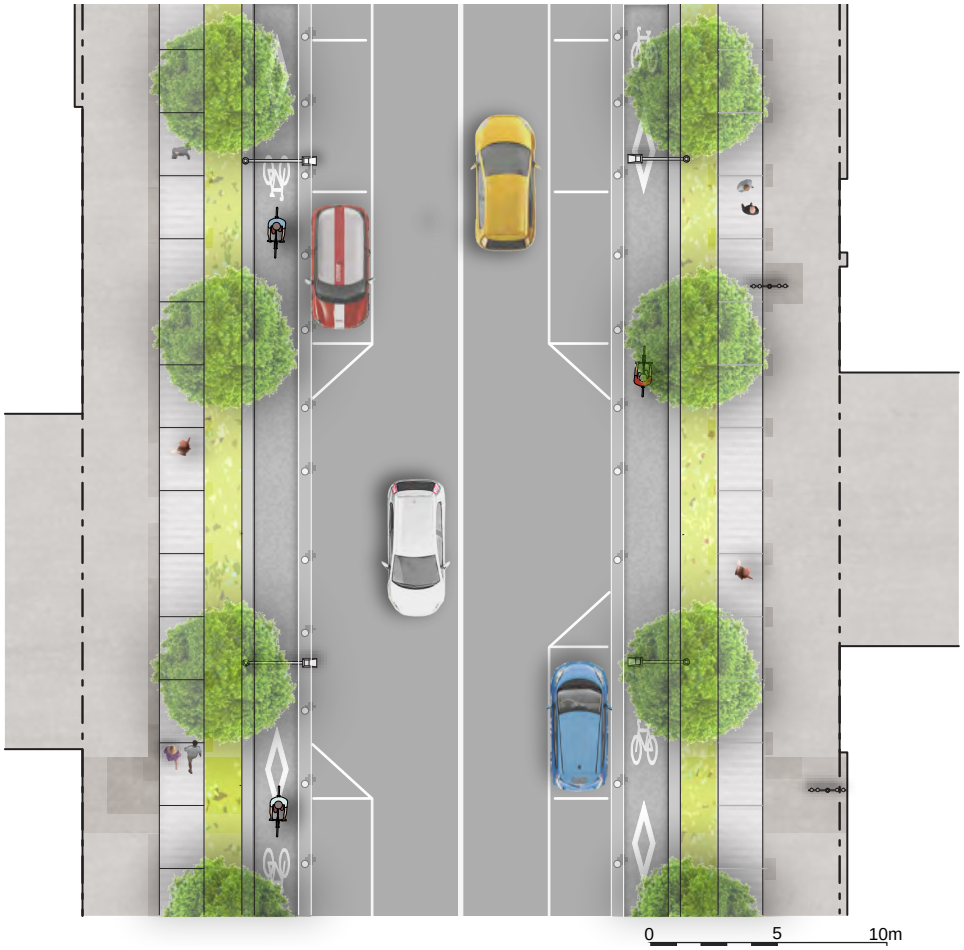
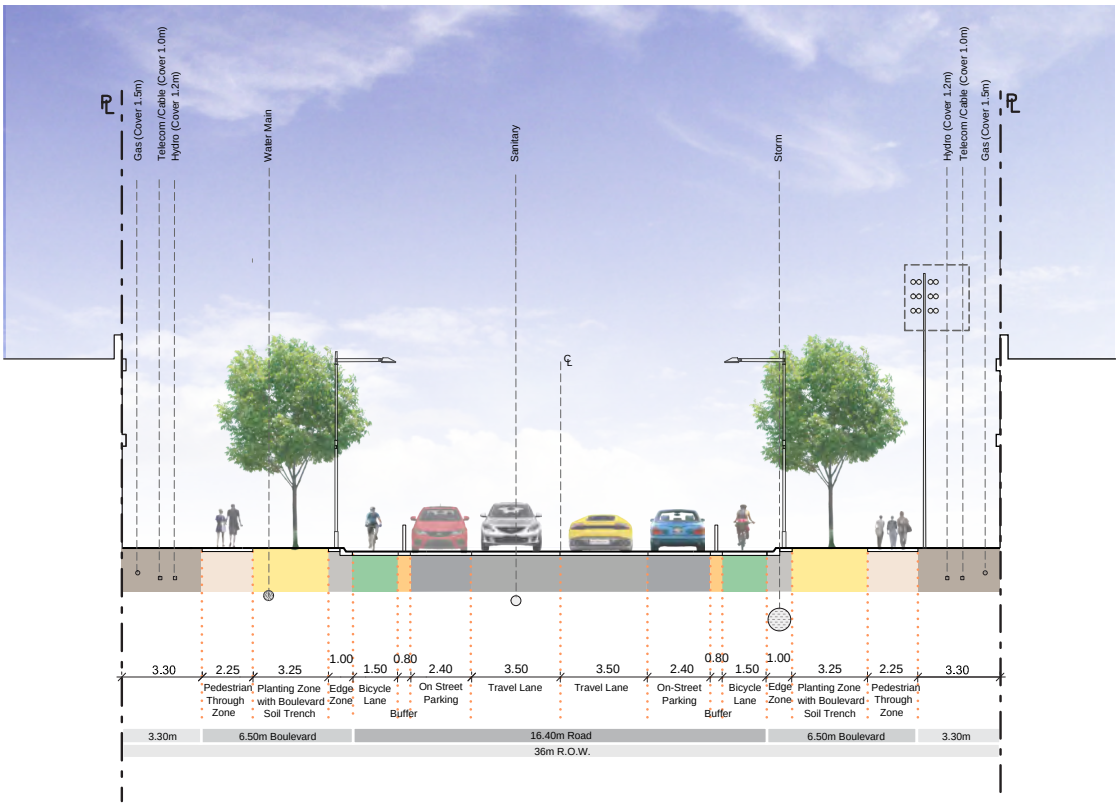
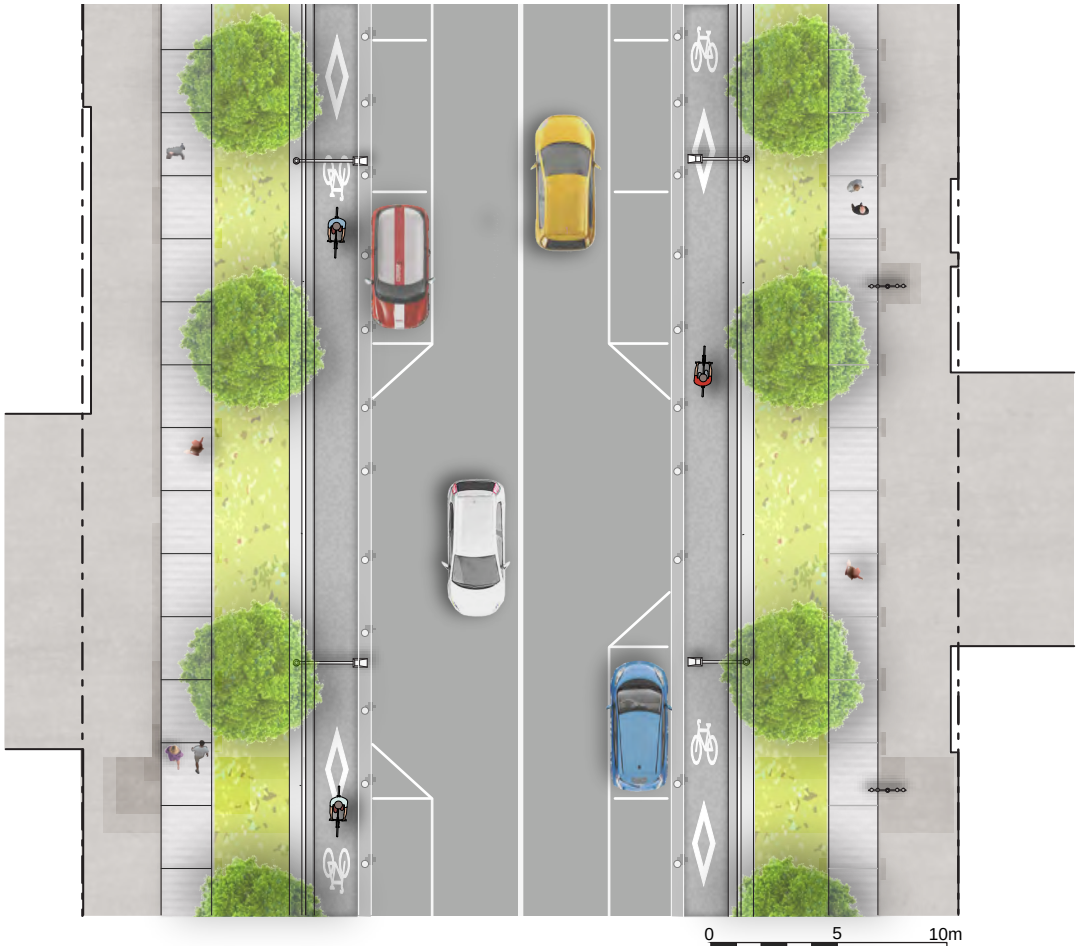
HAMLET (30m R.O.W.)





HAMLET (36m R.O.W.)





Rural

Efficient movement, primarily for private and goods movement vehicles, along with recreational cycling facilities.

Rural roads are located primarily within the Region's agricultural and natural areas, such as along the escarpment. Their primary function is to move private and goods movement vehicles. However, they should also include recreational cycling facilities (for example, a paved shoulder or multi-use path) and may also accommodate transit. The edges of rural roads should include drainage swales.

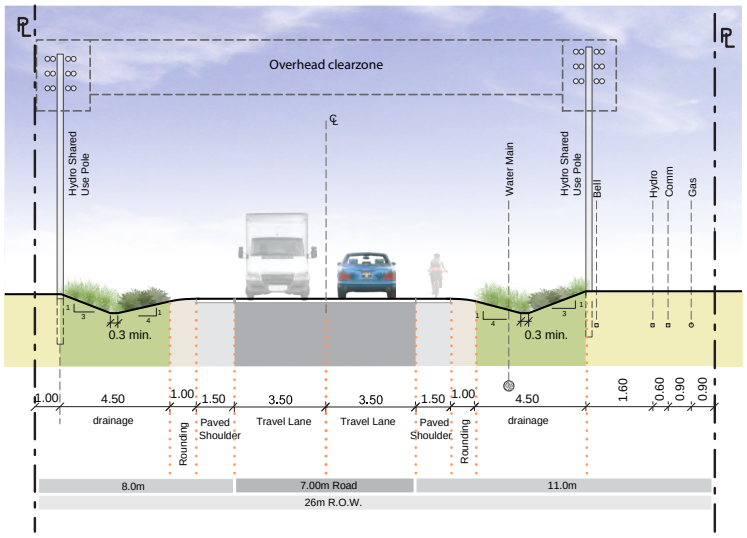
These roads have varying right-of-way widths (20m to 36m+) depending on the number of travel lanes. They serve rural areas and connect communities across the Region. The focus is vehicular movement and goods movement as well as supporting rural cycling through wide, paved shoulders. Opportunities to accommodate both pedestrians and cyclists on multi-use pathways or trails along the corridor edge can be pursued where part of the regional cycling and pedestrian network.

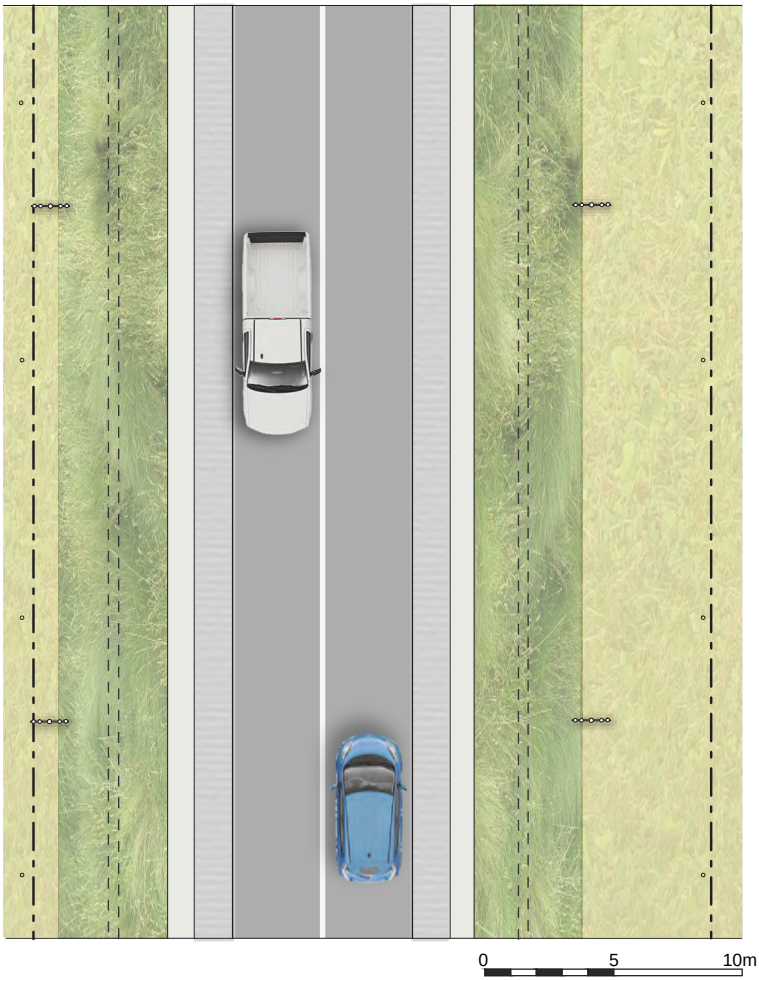
Elements:

- Rural cross-section;
- Paved shoulder for cycling;
- Sidewalks where it passes through a Hamlet or Village;
- Street trees only in Hamlet or Village;
- Wide lane widths;
- Access control not necessary;
- Pedestrian crossing at signalized intersections;
- No on-street parking except in Hamlet or Village;
- Transit in mixed-traffic;
- Primary goods movement corridor; and
- Landscaping includes buffer planting, naturalized drainage swales, street planting.

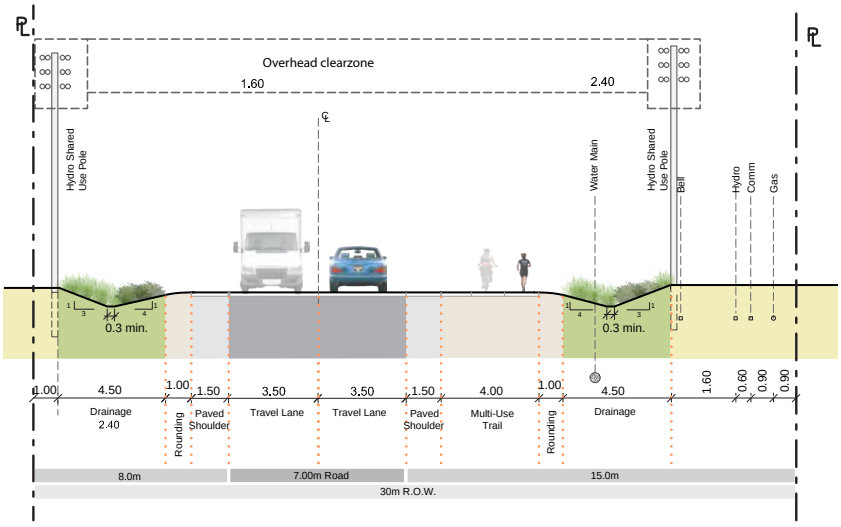
Demonstration Plans

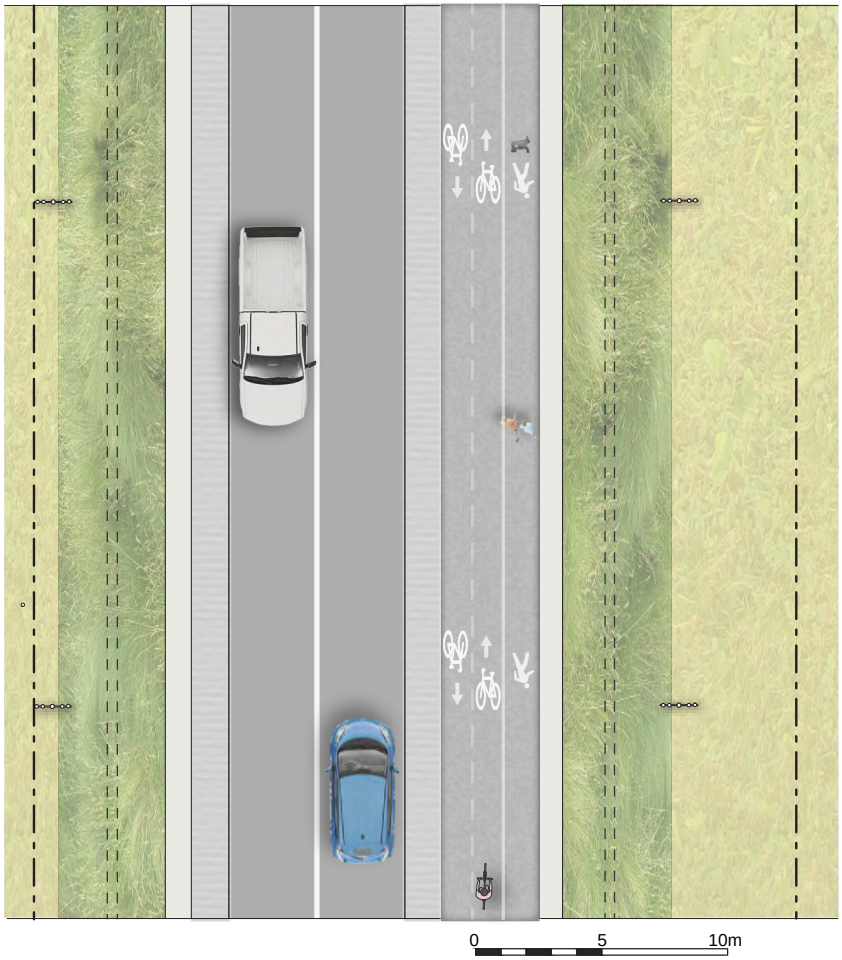
RURAL (26m R.O.W.)



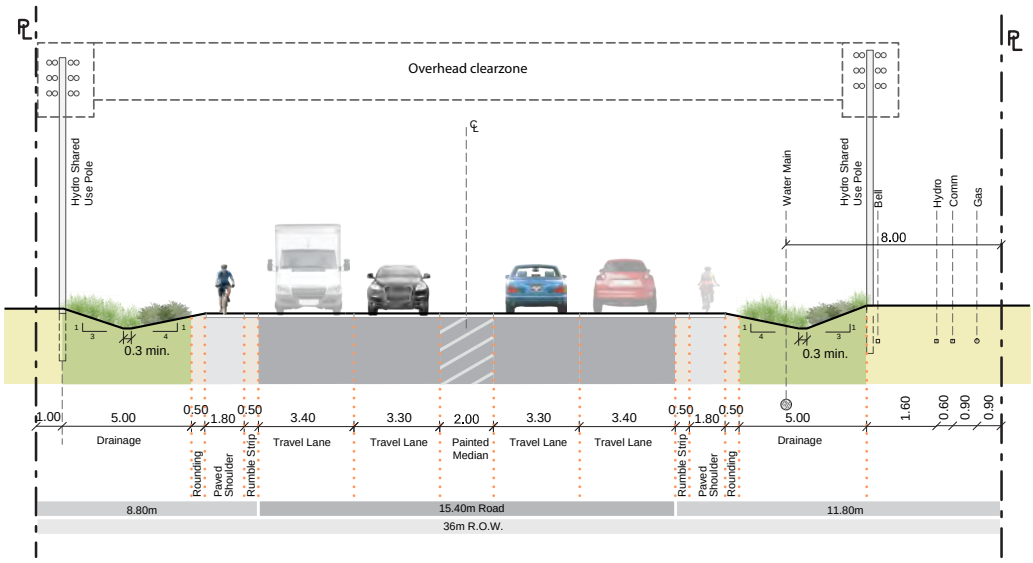


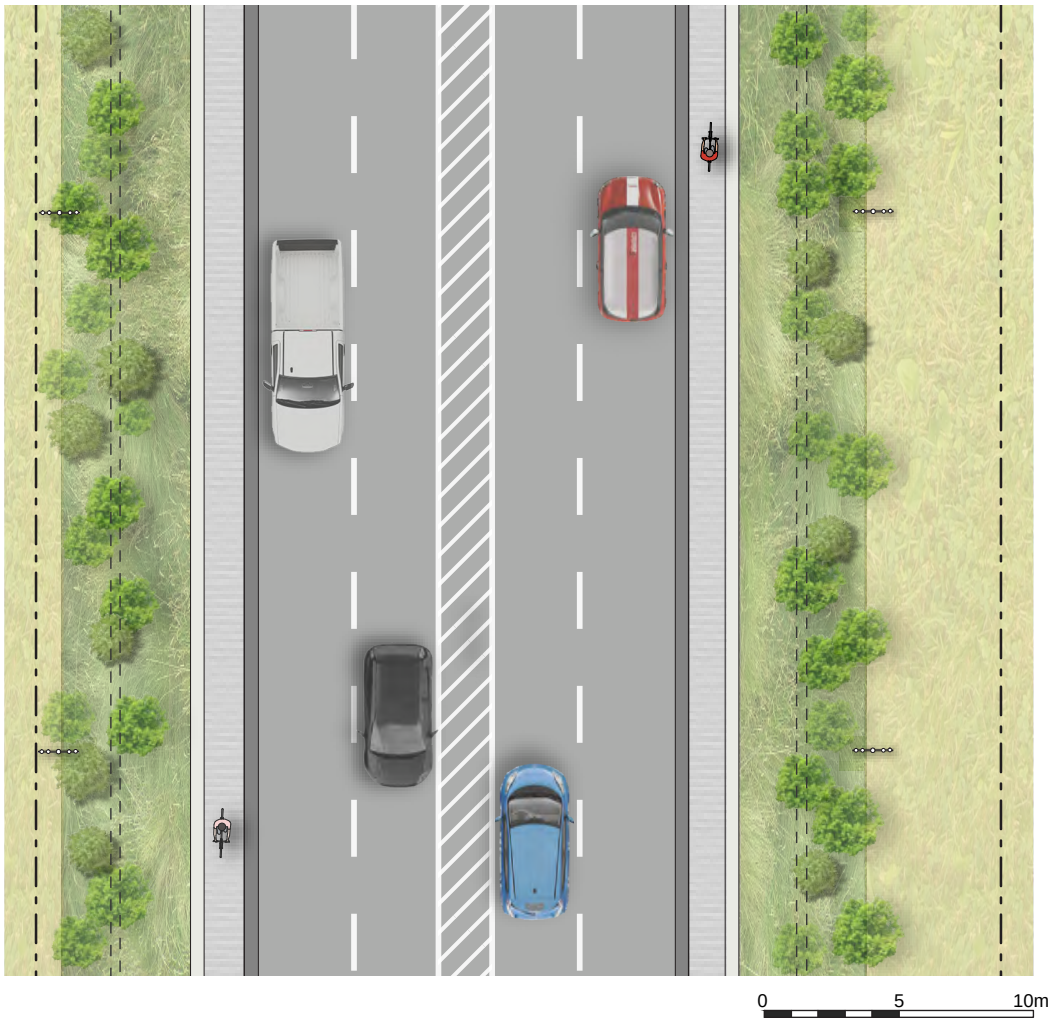
RURAL (30m R.O.W.)





RURAL (36m R.O.W.)





2.0 Design Guidelines

2.1 Complete Street Design Guidelines

The following guidelines outline best practices for the design of boulevard and roadway elements.

The design guidelines in this section outline best practices for the elements that comprise the boulevard and roadway of Regional Roads in Niagara. Both are critical to creating a cohesive design that functions effectively within its context. Boulevard elements are the items of the public realm located between the building frontage and the curb of the road. Roadway elements are those items that make up the street from curb to curb.

This section also outlines guidelines for intersections for the four urban typologies (Main Street, Urban General (Narrow), Urban General (Wide) and Transitioning), as well as transitions and general street elements.

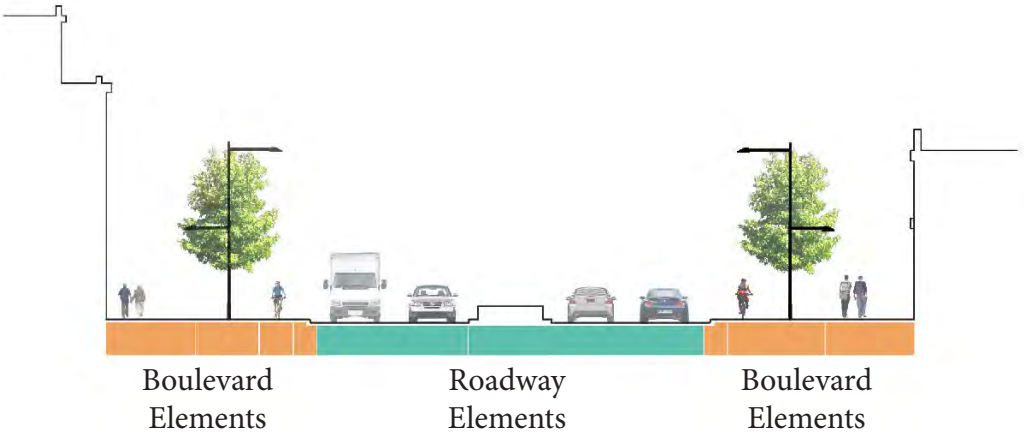
Using This Section:

The location of each element within the cross-section and the typologies to which it can apply are identified through shading and colours in the Typology and Cross-Section Keys. The Typology Key and Cross Section Key are described below.

Typology Key: Element applies to bolded typologies and does not apply to light grey typologies

Main Street	**Transitioning**
Urban General (Narrow)	Hamlet
Urban General (Wide)	Rural

Cross Section Key: Boulevard elements are identified with orange and roadway elements are identified with green.



2.2 Boulevard

Patio and Marketing Zone

The patio and marketing zone is located between the pedestrian clearway and the building frontage. It provides a dedicated area for spill-out retail, patios, awnings, window displays and building entrances. It also may contain street furniture and signage.

Main Street	Transitioning
Urban General (Narrow)	Hamlet
Urban General (Wide)	Rural

Objectives:

The patio and marketing zone defines the transition from the public to the private realm and is particularly important in urban areas. Within urban areas a key focus of the patio and marketing zone is to add to the character of the street where street related retail, patios and pedestrian activity is common and encouraged.

Guidelines:

- The patio and marketing zone may be within the public right-of-way or on adjacent private property. If it is located within the public right-of-way, no permanent elements may be installed without Regional or Municipal approval;
- Elements that may be located within this zone include private seating areas, planters, signage, and temporary retail displays. In areas with retail at grade, this zone should be wider to accommodate active at-grade uses;
- Elements within the patio and marketing zone should not impede the pedestrian clearway in any manner; and
- Overhanging signage and awnings can be installed if they do not impede pedestrian travel in any manner and meet local signage regulations.

The Patio and Marketing Zone supports active at-grade uses

Pedestrian Through Zone

The pedestrian through zone, often referred to as the sidewalk, is the portion of the boulevard dedicated to the movement of pedestrians. As conduits for pedestrian movement they enhance connectivity and walkability. They should be located directly adjacent to the building frontage, property line or patio and marketing zone, depending on the road typology and context within the Region.

Main Street	**Transitioning**
Urban General (Narrow)	**Hamlet**
Urban General (Wide)	Rural

Objectives:

Pedestrian through zones are critical for promoting active transportation and healthy communities. They should be fully accessible and free of obstructions. All Regional roads, aside from Rural Arterials, should include the pedestrian through zone to promote complete communities and active transportation. In active urban areas, the pedestrian through zone should be as wide as possible while still recognizing the role of the other boulevard elements in developing a public realm that provides places for people to sit, talk, eat, drink and play.

Guidelines:

- Pedestrian through zones shall have a minimum unobstructed width of 1.8m and be wider in areas of higher density and with high pedestrian activity, particularly when adjacent to street front retail and public areas;
- Pedestrian through zone width dimensions should be consistent block-to-block;
- Pedestrian through zones should have a vertical clear space for overheard signage and canopies of at least 2.5m;
- Within urban areas a continuous public pedestrian through zone should be provided on both sides of the road, unless an alternate pedestrian route such as a multi-use trail is provided;

A wide unobstructed pedestrian through zone enhances connectivity and promotes walkability

- Pedestrian through zones should be designed to meet all AODA standards and be unobstructed both horizontally and vertically;
- For pedestrian through zones on busy streets, textured edges and sound assisted crosswalks should be used to assist the visually impaired;
- Pedestrian through zones should be constructed of a solid, stable and textured material, such as concrete or interlocking brick or paving. The pavement base should be significant to minimize heaving and damage by tree roots;
- Generally, the pedestrian through zone should be constructed of poured concrete. Higher quality treatments, such as granite edges, should be considered in key areas along Main Streets or in special areas such as downtowns or historic districts;
- Pedestrian through zones should be coordinated with the design of feature paving across boulevards, intersections, crosswalks and driveways to ensure visibility and accessibility of the pedestrian network;
- Where crossings over driveways and intersections occur, clearways should be continuous and marked with materials that provide visual contrast from the roadway pavement;
- Where pedestrian activity is concentrated such as at schools and retail shops, the pedestrian through zones should be expanded or augmented with decorative paving to create a larger surface area;
- Pedestrian through zones should connect with adjoining recreational trail networks wherever possible;
- Signage is not permitted within the pedestrian through zone when a planting and furnishing zone or patio and marketing zone is provided; and
- The pedestrian through zone should be free of obstructions such as seating, retail spill-out spaces, etc.

Planting and Furnishing Zone

The planting and furnishing zone is located between the pedestrian through zone and the edge zone and provides an additional buffer between the roadway and pedestrians. The planting and furnishing zone is vital for developing a comfortable and inviting street environment and should be included on all Niagara Region streets that have a pedestrian through zone. In addition to functioning as a safety buffer it provides space for trees, raised planters, street furniture; and infrastructure such as bicycle parking, transit shelters and utilities.

Main Street	**Transitioning**
Urban General (Narrow)	**Hamlet**
Urban General (Wide)	Rural

Objectives:

The planting and furnishing zone provides space for amenities such as street furniture and landscaping. The zone is important for creating aesthetically attractive streetscapes that respond to the unique characteristics of an area and activate the street. Planting and furnishing zones should create optimal growing conditions for street trees to ensure a long life and a healthy and robust tree canopy.

Guidelines:

- The width of the planting and furnishing zone may vary between 1.0 to 3.0 metres depending on available space, with not less than 1.0 metre recommended;
- No elements located within the planting and furnishing zone should impede travel within the adjacent pedestrian through zone;
- Appropriate sight distances should be maintained at major access points;
- Street furniture, street trees and public way finding signage should be located within the planting and furnishing zone;
- The planting and furnishing zone can be hardscaped or softscaped or include a mix of both types of landscaping;
- The design of hardscaped and softscaped surfaces should be designed to promote low maintenance and durable materials;
- Hardscaping materials in the planting and furnishing zone should be different than those materials used for the pedestrian through zone to provide a visual differentiation for the space to be used for pedestrian travel;
- Permeable paving shall be provided above soil cells to improve water and oxygen retention to tree roots;
- In hardscaped areas, trees should be planted in continuous tree trenches utilizing soil cells to encourage longevity and viability. Soil cells can be extended under on street parking, multi-use paths and bike facilities where soil volume is critical;
- Trees planted in urban areas should be provided with a minimum of 16m^3 of quality soil with direct access to an additional 14m^3 through shared root space. Trees should have enough soil volume to reach a minimum of 40cm diameter at 40 years of age;
- In softscaped areas, trees should be planted

in a continuous boulevard soil trench with access to additional soil volume within and outside the right-of-way. Break-out-zones should be provided under sidewalks and multi-use paths to allow tree roots to access adjacent soils without damaging infrastructure;
- Coordination with utility providers is important to minimize root and crown pruning during utility maintenance and to maximize tree pit and canopy size for healthy tree growth;
- Where possible, Low Impact Development (LID) principles should be applied in this zone to control stormwater on-site and minimize discharge to the local stormwater system (refer to the LID section for more information);
- The proportions of installed street furniture should respond to the width of the planting and furnishing zone. For example, on a narrow boulevard where the planting and furnishing zone is 1.0 metres wide, furniture should be narrow enough to comfortably fit within this space. Where conditions permit this can also be achieved through orientation and organization of street furniture; and
- Although the planting and furnishing zone is the preferred zone for the placement of street furniture, in specific situations, furniture placement is acceptable in the patio and marketing zone.

See section 2.6 Street Furniture under General Guidelines for further direction on the items located within the Planting and Furnishing Zone.

Plantings and street furniture contribute towards a strong public realm as is evident in this photo of Niagara on the Lake

Edge Zone

The edge zone is located between the roadway and the planting and furnishing zone. It provides a buffer between the roadway and boulevard.

Main Street	Transitioning
Urban General (Narrow)	Hamlet
Urban General (Wide)	Rural

Objectives:

The primary purpose of the edge zone is to provide a safety buffer for pedestrians from vehicular traffic including private automobiles and to a lesser extent bicycles. The edge zone can also accommodate road signage and utility posts, helping to unclutter the planting and furnishing zone. It also plays an important role in road maintenance, especially in terms of accommodating snow storage.

Guidelines:

- The edge zone should not overlap with cycling facilities;
- The edge zone should be constructed of a durable material appropriate for snow storage and street cleaning; and
- Road signs, utility poles, lighting and appropriate below ground utilities can all be accommodated within the edge zone.

The edge zone demarcates the boulevard from the roadway

Cycle Track

Cycle tracks are physically protected, off street bicycle lanes that are located within the boulevard and utilized where the highest degree of cycling segregation is desired across Niagara. They are for the exclusive use of cyclists and provide additional safety and comfort over on-street bicycle lanes or mixed travel lanes. Curbs, bollards or planters can be used to separate the cycle track from the roadway.

Main Street	**Transitioning**
Urban General(Narrow)	Hamlet
Urban General (Wide)	Rural

Objectives:

The primary objective of the cycle track is to increase cycling across Niagara by accommodating a wider range of cycling ability and experience. Cycle tracks reduce collisions between automobiles and bicycles. They are intended to provide additional safety and comfort over on-street bicycle lanes and encourage cycling for those not comfortable riding in mixed traffic.

Guidelines:

- Cycle tracks should be demarcated from vehicle lanes via the use of planters, a curb, bollards, street parking, a gutter or another physical barrier;
- Where cycle tracks are located adjacent to a sidewalk there should be a clear delineation between elements;
- Sufficient sightlines need to be provided at intersections to reduce the probability of collisions between automobiles and bicycles;
- Ensure appropriate design treatments for pedestrian crossings and transit facilities where they intersect with cycle tracks;
- Limit and consolidate access points (or driveways) along a road with a cycle track to avoid conflict and/or include appropriate treatments for areas where cycle tracks and driveways interact;
- Cycle tracks can be uni-directional (one way) or bi-directional (two way). Careful consideration should be taken when designing a bi-directional cycle track as it will have a significant impact on intersection design; and
- Refer to OTM Book 18 –bike facilities for detailed design guidance.

Cycle tracks provide additional safety and comfort for cyclists

Multi-Use Paths

Multi-use paths are located within the boulevard and are large paths designed to accommodate multiple modes of active transportation including pedestrians, cyclists and other non-motorized modes of movement. They are particularly recommended on Niagara's Regional Roads in suburban, rural or industrial areas with large ROWs and with high permitted vehicle speeds and heavy traffic.

Main Street	**Transitioning**
Urban General (Narrow)	Hamlet
Urban General (Wide)	**Rural**

Objectives:

The objective of a multi-use path is to provide a safe, dedicated, well protected space to encourage alternative modes of travel. They can also provide important connections to larger cycling and trail networks across Niagara.

Guidelines:

- There are two types of treatments for multi-use paths: (1) pathways to be shared by both pedestrians and cyclists; and (2) pathways designed to distinguish between walking and cycling/rollerblading areas to minimize conflicts between the different modes of

Multi-use paths provide a safe, dedicated, well protected space to encourage alternative modes of travel

travel;
- For type 1 (combined), the pathways should ideally measure 3.0m with a painted centerline;
- For type 2 (separated), the pathways should ideally measure 4.5m total, with 1.5m dedicated for pedestrians and 3.0m for cyclists and rollerbladers;
- An additional 1.5m buffer is to be cleared on either side of the paved multi-use path surface;
- Durable surfaces, such as asphalt or concrete, should be used in the design of most multi-use paths within the Region. The designer should consider the seasonal nature of the path in choice of materials;
- Gravel should only be used on multi-use paths in rural or sensitive natural areas;
- Multi-use paths located within sensitive natural environments, such as the Niagara Escarpment, should be constructed of low impact materials;
- Multi-use paths should be designed with grades less than 10% where possible;
- Trails with steep grades should be widened to provide extra space for cyclists;
- Multi-use paths should be fully accessible;
- Where appropriate, paths should include adequate amenities, such as seating, waste receptacles, lighting and signage. Amenities should be designed according to site-specific conditions and their location should ensure that there are no obstructions to the free movement of active transportation;
- Multi-use paths should connect to existing pedestrian and cyclist networks and provide access to natural heritage features; and
- Consideration should be given to shared use policy for multi-use paths (i.e., pedestrians, cyclists, rollarbladers, ATVs, and snowmobiles).

Low-Impact Development

LID is an approach to managing stormwater run-off at the source by replicating natural watershed functions. It uses simple, cost-effective methods to capture, detain and treat stormwater.

Main Street	**Transitioning Avenue**
Urban General (Narrow)	**Hamlet Arterial**
Urban General (Wide)	**Rural Arterial**

Objectives:

LID involves the management of stormwater runoff by treating it at the source using landscape features to replicate natural watershed functions. It is not appropriate in all cases, but should be considered on a project by project basis.

The goal of LID is to mimic a site's predevelopment hydrology by using design techniques that infiltrate, filter, store and detain runoff at or near its source. Techniques are based on the premise that stormwater management is not the same as stormwater disposal. Instead of conveying and managing / treating stormwater through large costly end of pipe infrastructure, LID addresses stormwater through small, cost-effective landscape features located at the source.

Guidelines:

- Incorporate LID practices where possible and as appropriate to the road typology. LID options can include:
    - Bio-swales or drainage swales;
    - Bioretention planters, units or curb extensions;
    - Perforated pipe systems;
    - Permeable paving;
    - Pre-cast tree planters or soil cells.
- Where possible, replace unnecessarily paved areas with permeable materials (medians, dedicated parking lanes/ lay-bys, traffic islands). However, do not use permeable materials within the pedestrian clearway;
- Ensure appropriate monitoring and maintenance plans are established and communicated to maintenance personnel;
- Landscaping should not encroach on sight triangles;
- Selection of materials should be based on

Bioswales capture, treat, and discharge stormwater, restricting the flow of pollutants into the water supply
(Credit: Civil and Structural Engineer: http://cenews.com/article/9993/bold-redevelopment)

engineering constraints and the surrounding street context;
- Where possible, water should pass through engineered filter media and include an underdrain which conveys the filtered stormwater to a stormwater drain system or other suitable surface outlet;
- Use salt tolerant, indigenous shrubs and grasses as these will prove resilient in the winter and require less maintenance; and
- In rural areas, convert degraded culverts and ditches to grass swales.

Building a bioswale adjacent to the edge zone
(Credit: Cornell University: http://blogs.cornell.edu/hort/2014/09/13/urban-eden-students-plant-tower-road-bioswale/)

Transit Facilities

Transit facilities should be located within the planting and furnishing zone. They include the amenities associated with the provision of transit; including seating, shelters, waste receptacles, signage, lighting and route information.

Main Street	**Transitioning**
Urban General (Narrow)	**Hamlet**
Urban General Wide)	**Rural**

Objectives:

The primary objective of transit facilities is to encourage transit use. This can be done through providing transit facilities that are safe, convenient, comfortable, clear and accessible.

Guidelines:

- Particularly within urban areas, transit facilities should include accessible shelters that provide weather protection, seating, waste receptacles, lighting and route information;
- Transit shelters should include access to real-time information that identifies arrival times for incoming transit vehicles;
- Transit stops, including access to vehicles, should provide barrier free access for transit users;
- Sidewalks should connect directly to transit shelters to provide direct access for transit users and to promote safety and convenience;
- Transit facilities should be located such that they ensure protected sight lines;
- Transit stops should be located near building entrances where possible and given priority over on-street parking;
- Provide concrete pads in the waiting and loading areas of transit stops. In order to improve accessibility, concrete pads should be flush with sidewalks and textured to provide directional cues;
- Shelter openings should preferably face the sidewalk. This will provide better accessibility and reduce issues associated with road splash and snow clearing;
- Where raised cycle tracks are constructed between the roadway and the sidewalk, consideration should be given to surface treatments and signage to help differentiate space for cycling and space for waiting/ accessing transit. A number of tools are available to mitigate the potential for conflict between the various modes. For example, a pavement marking with a zig-zig pattern communicate to cyclists where they are to

Existing Niagara Falls Transit Shelter

yield to transit users crossing the cycle track from the transit shelter to access a bus;
- Tree planting should be provided adjacent to transit shelters to provide shade, a windbreak and an attractive environment;
- Run-off from transit shelter roofs should be directed to adjacent tree pits or other soft landscaping; and
- Far-side stops are encouraged to enhance efficiency and safety by reducing delays required before proceeding through an intersection.

Existing York Region Transit Shelter, at McCowan Road. (Credit: http://www.mto.gov.on.ca/english/transit/supportive-guideline/enhancing-access-transit.shtml

Lighting

Site lighting focuses on illuminating the environment to anticipate and respond to the needs of users. Lighting may be needed to serve a number of functions including safety and security, wayfinding, highlighting social spaces and interacting with the natural and built environments. The overall design of lighting should enable all of these functions to coexist and enhance the user experience.

Main Street	**Transitioning**
Urban General (Narrow)	**Hamlet**
Urban General (Wide)	**Rural**

Objectives:

Site lighting can add colour and vibrancy to an area at night as well as providing safety and security after dark. The same consideration that is provided for the pedestrian through zone should be applied to bike lanes. It is essential that all people feel safe and that the lighting chosen illuminates the entire walkway.

Lighting is especially important at building entrances, intersections, stairs, sudden changes in grade, dead ends and remote walkways.

Guidelines:

- Light poles should be coordinated with other streetscape elements and utility equipment, both above and below ground;
- Fixtures should not be placed near tree foliage that may block their light. The anticipated height and diameter of the tree canopy should be considered in relation to the height and spacing of lighting fixtures, the need for a certain level of light, and the desire for uniformity;
- Lighting of outdoor spaces should be designed carefully, taking into account placement, intensity, timing, duration, and colour;
- Relate lighting levels to the functions of a particular space in the evening or at night;
- Lighting can be provided by street lights, bollards, faced lights, shop windows and other elements of the cityscape;
- Steps or stairway lighting should provide sufficient light for people to see the stairs and differentiate between risers and treads: their visibility depends on the materials used for the steps, as well as the physical form of the stairs;
- Appropriate light sources should be chosen, and fixtures should be designed to direct light precisely, with shielding used to prevent light trespass and glare;
- High-pressure sodium lighting, typically used in city street-light fixtures, should be avoided. It casts a yellowish-orange glow that distorts colours, diminishes visual clarity and undermines the quality of the night-time urban environment;
- The illumination standard set for pedestrian walkways by the Canadian Standards Association is 0.4 footcandles, at which level a person's face can be identified from a distance of 12-15 m;
- Street and road lights are usually installed on 9-15 m high poles, spaced 45-75 m apart;

- The lighting of hardscape elements from a distance can negatively affect night-time vision and should be avoided; and
- Up-lighting should only be used where it will not interfere with the pedestrian's vision.

Decorative Lighting

Decorative lighting can enhance pedestrian experience and safety and provide points of visual interest. Lighting features may be located within the planting and furnishing zone or installed directly on buildings.

Main Street	Transitioning
Urban General (Narrow)	**Hamlet**
Urban General (Wide)	Rural

Objectives:

The purpose of decorative lighting is to animate streets and sidewalks, enhance safety and emphasize streetscape character. Decorative lighting can be used to reflect the local context of the neighbourhood and surrounding cultural environment. Decorative lighting can also be used to highlight special features such as heritage buildings, character areas or landscaping and art features.

Guidelines:

- Decorative lighting should be located within the planting and furnishing zone or land use transition zone if affixed directly to buildings;
- When making decisions about the appropriateness of decorative lighting the designer should consider location, impacts of light pollution and sustainability (energy efficiency, directional lighting that reduces wasted energy, LED lighting, solar power, street reflectors and sensors);
- Within urban areas decorative lighting should be designed to be pedestrian scale in urban areas while the primary objective within rural areas and/or along multi-use paths is to enhance safety and visibility;
- Consideration should be given to providing additional or feature pedestrian-scale lighting in areas with high volumes of pedestrian activity;
- Wherever appropriate consolidate road and pedestrian lighting onto one pole, to minimize visual clutter. Similarly, attach a light arm/luminaire to hydro poles where appropriate;
- Where appropriate, consolidate signage, wayfinding and public art within the decorative lighting pole;
- The location of pedestrian lighting must adhere to utility standards; and
- The design process for Regional roads should consider the potential and future locations of pedestrian lighting and should coordinate with local municipalities or business associations in order to determine if lighting is required.

Decorative lighting can enhance pedestrian experience and safety

Bump-Outs

Bump-outs, also called curb extensions, are a widening of the boulevard and narrowing of the roadway in a strategic location. Bump-outs visually and physically narrow the roadway, creating safer and shorter crossings for pedestrians and are only used in conjunction with on-street parking. They can be used to accommodate transit facilities, site furnishings, signage and landscaping.

Main Street	Transitioning
Urban General (Narrow)	Hamlet
Urban General (Wide)	Rural

Objectives:

The primary objective of a bump out is to calm vehicular traffic, increase visibility of pedestrians and provide shorter crossing distances. Bump-outs provide additional space to pedestrians, particularly beneficial in areas with high volumes of pedestrians. They provide space for street furniture, landscaping, signage and transit facilities and can support placemaking objectives.

Guidelines:

- The width of a bump-out should be slightly less than the width of the parking lane (typically 2.0m for a 2.4m parking lane);
- Bump-outs should only be built on streets with on-street parking;
- Bump-outs shorten the crossing distance for pedestrians. They should be located to maximize pedestrian space and aligned to minimize crossing distances;
- In addition to intersections, bump-outs may be located at existing / planned mid-block pedestrian crossings;
- Bump-outs may include transit stops, seating, trees, raised planters, bike parking, public art, wayfinding and signage, etc.;
- Bump-outs should be located and designed not to impede a driver's view of pedestrians;
- Bump-outs should not encroach on cyclists space where applicable;
- Bump-outs can be implemented using low-cost, interim materials. In such cases, bump-outs should be demarcated from the existing road bed using temporary curbs, bollards, planters, or striping;
- When designing bump-outs, consider road maintenance such as street sweeping and snow removal;
- Give consideration to the conveyance of gutter drainage and major storm overland flow when detailing the design of the bump-out; and
- Bump-outs should be located at the downstream side of a catch basin to ensure that the impacts of stormwater flow are minimized at areas of high pedestrian crossing.

Bump-outs provide additional space for pedestrian amenities and transit facilities

2.3 Roadway

Conventional Bike Lanes

Bike lanes provide a designated area of the roadway for cyclists and improve awareness and safety between motorized vehicles and cyclists. On-road cycling facilities include conventional bike lanes, buffered bike lanes and paved shoulders. They can be implemented across Niagara on all road typologies depending on local conditions.

The type of on-road cycling facility that is appropriate depends on context, traffic volume and road typology. Although cycling is permitted on all Regional Roads, the purpose of cycling facilities is to formalize space on the street for bicycles and to provide a safer, more efficient environment for cyclists.

The first type of on-road cycling facility addressed in this report is conventional bike lanes.

Main Street	Transitioning
Urban General (Narrow)	Hamlet
Urban General (Wide)	Rural

Objectives:

The purpose of conventional bike lanes is to create separation between cyclists and automobiles by designating space on the road for cyclists through the use of pavement markings and signage. Bike lanes are typically located to the right side of the street, between the adjacent travel lane and curb, road edge or parking lane. They facilitate predictable behaviour and movements between bicyclists and motorists.

Guidelines:

- Conventional Bike Lanes are reserved exclusively for cyclists on the street using the diamond symbol;
- Vehicle parking or stopping is not permitted within cycling facilities;
- The desirable conventional bike lane width is 1.8 m. If bicycle traffic is heavy (more than 1500 bicycles per day), a width of 2.0 m allows riders to overtake one another without encroaching on the adjacent vehicle travel lane. A lane wider than 2.0 m is not advisable because motorists may mistake it for an extra vehicle travel lane and use it to pass on the right;
- When designing cycling facilities designers should use signs and symbol markings for cycling facilities as per the Transportation Association of Canada (TAC) Bikeway Traffic Control Guidelines for Canada and OTM Book 5, 11 and 18;
- A through bike lane shall not be positioned to the right of a right turn only lane unless split phase signal timing is used;
- If sufficient space exists, separation should be provided between bike lane striping and parking boundary markings to reduce door zone conflicts;
- Lane lines and stencil markings should be maintained to clear and legible standards;
- Bike lanes should be maintained to be free of potholes and debris,
- Utility cuts should be back-filled to the

same degree of smoothness as the original surface; and

- Additional guidance on the design of cycling facilities can be found in:
    - Ontario Bikeways Planning and Design Guidelines (Ministry of Transportation);
    - Bikeways Traffic Control Guidelines for Canada (Transportation Association of Canada).

Refer to the Bikeway Master Plan for additional information.

Bike lanes provide designated space for cyclists facilitating predictable behaviour between cyclists and motorists and promoting safety.

Buffered bike lanes are conventional bicycle lanes paired with a designated buffer space separating the bicycle lane from the adjacent vehicle travel lane and/or parking lane.

Buffered Bike Lanes

Buffered bike lanes are conventional bicycle lanes paired with a designated buffer space separating the bike lane from the adjacent vehicle travel lane.

Main Street	**Transitioning**
Urban General (Narrow)	Hamlet
Urban General (Wide)	Rural

Objectives:

The purpose of a buffered bike lane is to provide additional safety for cyclists over and above conventional bike lanes.

Buffered bike lanes provide greater space for cyclists than conventional bike lanes without making the bike lane appear so wide that it could be mistaken for a vehicle travel lane. Buffered bike lanes provide a physical buffer between the vehicle travel lane and bike lane and provide space for cyclists to pass slower moving bicycles without having to encroach into the vehicle travel lane. This encourages cycling by both improving safety and contributing to the perception of safety.

Guidelines:

- Buffered Bike Lanes are reserved exclusively for cyclists on the street using the diamond symbol;
- Vehicle parking or stopping is not permitted within cycling facilities;
- The desirable buffered bike lane width is 2.3 m (1.8 m bike lane plus 0.5 m buffer);
- When designing cycling facilities designers should use signs and symbol markings for cycling facilities as per the Transportation Association of Canada (TAC) Bikeway Traffic Control Guidelines for Canada and OTM Book 5, 11 and 18;
- On intersection approaches with right turn only lanes, bike lanes should be transitioned to a through bike lane to the left of the right turn only lane, or a combined bike lane/turn lane should be used if available road space does not permit a dedicated bike lane;
- On intersection approaches with no dedicated right turn only lane the buffer markings should transition to a conventional dashed line. Consider the use of bike boxes at these locations;
- If sufficient space exists, separation should be provided between bike lane striping and parking boundary markings to reduce door zone conflicts;
- Lane lines and stencil markings should be maintained to clear and legible standards;
- Bike lanes should be maintained to be free of potholes and debris,
- Utility cuts should be back-filled to the same degree of smoothness as the original surface; and
- Additional guidance on the design of cycling facilities can be found in:
    - Ontario Bikeways Planning and Design Guidelines (Ministry of Transportation);
    - Bikeways Traffic Control Guidelines for Canada (Transportation Association of Canada).

Refer to the Bikeway Master Plan for additional information related to bike lanes.

Paved Shoulders

Paved shoulders are a viable cycling facility type along rural roads to connect urban areas and hamlets and destinations/attractions along the regional cycling network.

Niagara Region's present practice in rural areas is to provide standard 3.5 m vehicle travel lanes, edge lines and 0.5 m paved shoulders. Encouraging safe cycling along proposed bikeway routes will require a widening of the shoulder.

Main Street	Transitioning
Urban General (Narrow)	Hamlet
Urban General (Wide)	**Rural**

Objectives:

The purpose of a paved shoulder is to provide refuge for a disabled vehicle and can create a viable cycling facility type in the Rural Arterial context.

Other benefits of paved shoulders include reducing maintenance costs associated with grading of gravel shoulders, serving as a refuge for disabled vehicles, accommodating emergency vehicles, extending the life of vehicle travel lanes through improving the lateral support for the roadway structure and reducing run-off-the-road collisions.

Guidelines:

- Paved shoulder facilities should always be separated from the motor vehicle travel portion of the road by an edge line (pavement marking), and should be clearly identified through bicycle route signing. Edge lines should only be used on rural roads where there are no curbs, and should be a single line placed on the right side of the travel lane closest to the paved shoulder;
- The preferred design width for a paved shoulder bikeway facility is 1.5 m;
- Regional Roads that are designated as both a Commercial Vehicle Truck route and Bikeway Facility should have standard paved shoulders of 1.5 m plus a minimum 0.5 m granular shoulder;
- The decision on whether to sign a paved shoulder that is less than 1.5 m as a bikeway should depend on the AADT volume and percentage of commercial vehicle traffic the road experiences;
- The maximum paved shoulder width should be 2.5 m to avoid confusing the shoulder for a vehicle travel lane;
- Where the grade of the road approaches or exceeds 8 percent, and conditions permit, an additional 0.5 m should be included where possible in the width of the paved shoulder;
- On roads where sight lines are an issue due to the vertical or horizontal curvature of the road, cautionary signs may be warranted to restrict passing maneuvers;
- Paved shoulders on rural roads should not be denoted as reserved bicycle lanes since they should still be used as a refuge for disabled vehicles;
- Rumble strips are not recommended on shoulders with a width less than 1.6 m;
- Where rumble strips are used there must be

a 3 m break in the strips every 10 m to 20 m, to facilitate cyclists ability to move into the vehicle travel lane when necessary;
- Paved shoulders designated as part of the bikeway network should be cleared of road debris and snow to accommodate cyclists; and
- In the spring, summer and fall months a program or litter, debris and leaf removal should be considered.

Paved shoulders on rural roads improve safety and comfort for cyclists over shared vehicle travel lanes.

Vehicle Travel Lanes

Vehicle travel lanes provide for the safe and efficient movement of vehicles. The recommended width and number of vehicle travel lanes depends on the width of the right-of-way, desired level of service and road typology.

Main Street	Transitioning
Urban General (Narrow)	Hamlet
Urban General (Wide)	Rural

Objectives:

The number and width of travel lanes should be reduced as much as possible to minimize the amount of road surface and crossing distances, while increasing the width of the boulevard.

Guidelines:

- Refer to the demonstration cross-sections and typology matrix for guidance on the number and width of travel lanes;
- Vehicle Travel Lanes should have an inside/passing lane of either 3.3m (Main Street, Urban Arterial, Transitioning Avenues and Hamlet Arterial) or 3.5m (Rural Arterial) and an outside travel lane/shoulder lane of 3.5m (all typologies) in width. The outside travel lanes for Urban Arterials and Transitioning Avenues can be 3.3m if the right-of-way includes a bike lane with painted buffer;
- Travel lanes should not exceed 3.5 m except in the case of shared travel lanes, which has a target width of 4.3 m;
- Consider decreasing the width of the travel lane to a minimum of 3.0 m where there is little truck and bus traffic;
- Turning lanes will have a width of 3.25 m;
- Curb lanes for the Main Street, Urban General and Hamlet typologies may include on-street parking ;
- On Rural Roads, clearly distinguish between travel lanes and shoulders to discourage the use of the shoulder as a travel lane. This can include:
  - Pavement of contrasting colour and/or texture;
  - Pavement edge striping – effective where the shoulder is partially paved with the same material as the through travel lane.
- Curbs should be mountable and continuous across private entrances when pedestrian and cycling modes of travel exist on the boulevard.

Reduce the Number and Width of Vehicle Travel Lanes (Niagara On The Lake) (Credit: Suitcase and Heels: http://www.suitcaseandheels.com/niagara-on-the-lake-in-photos/).

Shared Travel Lanes

Shared travel lanes are vehicle travel lanes shared between motorized vehicles and bicycles used in situation where roadway geometry and/or operations do not readily lend themselves to bike lane implementation. These lanes include the shared-use pavement marking symbol, or "sharrow", to alert motor vehicles to the presence of cyclists and to alert road uses of the lateral position cylists are expected to occupy.

There are two main applications of shared travel lanes. These include:

1. Side-by-Side; and
2. Single file lanes.

The shared travel lanes side-by side application is intended for use on lanes that are wide enough for side by side cyclist/driver operation, but not wide enough to accommodate a bike lane. The single file application is intended for use on lanes that are too narrow for cyclists and drivers to operate in a side-by-side manner.

Shared lane markings should not be considered a substitute for bicycle lanes, cycle tracks, or other separation treatments where space permits for these types of facilities.

Main Street	Transitioning
Urban General (Narrow)	**Hamlet**
Urban General (Wide)	Rural

Objectives:

Shared travel lanes are primarily used when there is not enough space within the ROW to accommodate both a bicycle lane and a travel lane for motorized vehicles. Markings on a shared travel lane increase awareness of other users and provide a certain level of protection for cyclists. The general purpose is to indicate to cyclists the correct positioning on the roadway, and to indicate to drivers the position where cyclists may be expected.

Guidelines:

- The optimal width for a shared travel lane is 4.3 m and shall not be less than 4.0 . At vehicle travel lane widths less than 4.0 m, drivers cannot safely pass a cyclist without encroaching into the adjacent travel lane;
- The TAC-recommended shared lane marking design consists of two white chevron markings with a strike width of 100 mm spaced at 100 mm and located above the bicycle symbol stencil;
- In addition to the side-by-side and single file options below, shared lane markings may be used to:
    - Fill gaps in an otherwise continuous multiuse path or bicycle lane;
    - Transition cyclists across traffic lanes or from conventional bike lanes or cycle tracks to a shared lane environment;
    - Direct cyclists along circuitous routes; and
    - Designate movement and positioning of bicycles through intersections.

Side-by-Side

- If a road carries transit vehicles of trucks a vehicle travel lane width of 4.3 m is desired for side-by-side operation in accordance with TAC guidelines. A travel lane width of 4.0 to 4.2 m is permissible if no transit vehicles or trucks are present in the shared lane (as per the TAC Geometric Design Guide for Canadian Roads);
- Markings on side-by-side shared use lanes should be used on roadways with posted vehicle speeds of 60 km/hr or less;
- On roadways without on-street parking, markings should be placed so that the centre of the marking is 1.0 m (minimum 0.75 m) from the edge zone or curb;
- On roadways with on-street parking, markings should be a minimum of 3.4 m from the edge zone or curb so that the cyclist position is outside of the door zone (considered to extend 2.9 m from the edge zone or curb);
- Markings should be spaced immediately after an intersection and 10 m before the end of a block. Within urban areas, markings should be spaced longitudinally at intervals of approximately 75 m; and
- The recommended signage to accompany sharrow markings in side-by-side application is the Share the Road Sign (WC-47) and mandatory supplementary tab (WC-47S). The sign warns drivers that there is adequate driving space for cyclists on the road and advises extra caution to both drivers and cyclists for the upcoming section of the road.

Single File

- For single file applications, the marking is placed in the centre of the lane if the lane is less than 4.0 m wide;
- Posted vehicle speed limits should be 50 km/hr or less;
- Markings should be spaced immediately after an intersection and 10 m before the end of a block. Within urban areas, markings should be spaced longitudinally at intervals of 75 m; and
- The shared use single file sign is used to warn motorists and cyclists that cyclists are allowed full use of the lane ahead and to warn motorists that the lane is too narrow for side-by-side operation. Shared use lane markings should be used to mark the location where cyclists should position themselves within the lane.

Sharrows are reflective signs in the centre of shared travel lanes to signify areas where bicycles and cars should take care and share the road (Credit: Ride the City: http://www.cityofcapegirardeau.org/Spotlight.aspx?PageID=577).

Medians

Medians are reserved areas that separate opposing lanes of traffic and can either be painted or physically separated from traffic. Medians serve a wide variety of functions but are generally used on wider roads with higher speeds of vehicle traffic where access control is desired.

Medians have historically defined the character of many wonderful grand boulevard streets. However, when not properly treated medians can contribute to making streets appear wider and and when not physically separated with curbed median spaces, these roads can contribute to speeding. Medians can also make roads wider and introduce crossing challenges for pedestrians and cyclists or when designed properly offer respite.

Main Street	**Transitioning**
Urban General (Narrow)	Hamlet
Urban General (Wide)	**Rural**

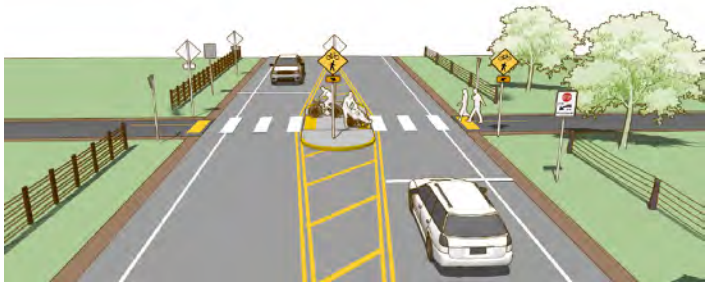
Objectives:

Medians may be used to serve a safety and separation function by acting as a barrier between opposing lanes of traffic. On wide avenues they can provide refuge for pedestrians crossing multi-lane roads. They also serve an access control function reducing the risk of collisions due to turning traffic.

From an aesthetic point of view medians can provide spatial definition and a comfortable sense of enclosure that encourage drivers to slow down and enhance comfort. Medians provide space to locate infrastructure such as traffic signals, lighting and signage as well as wayfinding, street furniture, public art etc., which can contribute towards a sense of place and character.

Guidelines:

- The optimum median width is 4.0m. Widths should enable the provision of left turn lanes at intersections and be of sufficient width to accommodate trees and infrastructure;
- Medians should not be located on streets with narrow rights-of-way where spatial and visual connections between opposite sides of the street are important; and
- Medians designed for pedestrian refuge should be fully accessible and include street furniture (see OTM Book 6).



A median safety island should allow path users to cross one lane of traffic at a time. (Credit: Small Town and Rural Design Guide: http://ruraldesignguide.com/physically-separated/shared-use-path)

On-Street Parking

On street parking provides space for automobiles to park and is located adjacent to the outside, or curb lane. On-street parking can be dedicated for all hours or only on off-peak hours. Typically Main Streets and Hamlets will provide all hours dedicated on-street parking while Urban General and Transitioning Roads will provide on-street parking only during off-peak hours. It is noted that the existing Road Design Guidelines for Niagara indicate that on-street parking is typically not permitted on Regional Roads.

Main Street	**Transitioning**
Urban General (Narrow)	**Hamlet**
Urban General (Wide)	Rural

Objectives:

The purpose of on-street parking is primarily to provide access to commercial and employment opportunities. On-street parking can encourage healthy main street retail environments; improve safety and visibility of shops and slow vehicular traffic thus improving pedestrian safety.

Guidelines:

- On-street parking should be located parallel to the sidewalk;
- The ideal width for on-street parking is 2.2m to 2.4m, although a width of 2.0m is permissible in constrained areas;
- Promote metering for on-street parking to encourage short-term parking, which is more supportive of healthy retail environments;
- On-street parking should not be considered on streets with an operating speed of over 60km/hr;
- On-street parking should be restricted adjacent to crosswalks. Bump-outs are encouraged at these locations;
- Ensure appropriate buffering and safety for cyclists in cycling facilities;
- Dedicated on-street parking can be paved with material that differentiates it from vehicle travel lanes; and
- The creation of flex-parking bays have a positive impact on the visual nature of the public realm and create opportunities to utilize the space differently during festivals or other high pedestrian volume events.

On-street parking can encourage healthy main street retail environments; improve safety and visibility of shops and slow vehicular traffic thus improving pedestrian safety.

Parklets

Parklets are temporary or permanent public spaces located in place of one or more on-street parking stalls. Parklets should have a distinctive design that incorporates seating, greenery, and/or bike racks and accommodate unmet demand for public space on thriving neighbourhood retail streets or commercial areas.

Parklets are often applied where narrow or congested sidewalks prevent the installation of traditional sidewalk cafés or where local property owners or residents see a need to expand the seating capacity and public space on a given street.

Main Street	Transitioning
Urban General (Narrow)	Hamlet
Urban General (Wide)	Rural

Objectives:

The primary purpose of on-street parking is to provide public space in constrained areas and to extend the pedestrian accessible public realm into the roadway. In addition to providing park space for people to congregate, socialize and relax, parklets have been shown to increase revenue for adjacent businesses.

Guidelines:

- Parklets generally entail the conversion of one or more parallel parking spaces or three to four angled parking spaces, but may vary according to context and desired character;
- The desired minimum width for a parklet is the width of the parking lane;
- Parklets should be located at least one parking space away from intersections. Where installation of a parklet is under consideration near an intersection, volumes of turning traffic, sightlines, visibility and daylighting should be taken into account;
- Parklets should have no interference with utility access, fire hydrants, accessible parking, public transit, or curbside drainage;
- The design of any individual parklet may vary. Designs may include seating, greenery, bicycle racks, or other features, but should always strive to become a focal point for the community and a welcoming public gathering place;
- Parklet design should incorporate high-quality durable materials;
- Parklets should include vertical elements such as planters or bollards to improve visibility to traffic;
- To ensure visibility to moving traffic and parking cars, parklets must be buffered by a wheel stop at a desired distance of 1.2 m from the parklet.
- Where a parklet stretches the length of an entire curb, barrier free design must be taken into account. Parklets should have a flush transition at the pedestrian clearway and edge zone to permit easy access and avoid tripping hazards;
- Parklets should use a slip-resistant surface to minimize hazards and accessible to wheelchair users;
- Design of parklets should not inhibit drainage of stormwater runoff. Design should

include small channels between the platform and base to facilitate drainage; and
- Consider the removal of parklets during the winter to prevent conflicts with plows and street cleaning vehicles.

Victoria, BC's first parklet (Credit: http://www.cityspaces.ca/parklet/).

Bridges

Bridges provide key linkages within the transportation network. Historically bridge design has often not properly accounted for adequate walking and cycling infrastructure. Bridges have long lifecycles and as such it is important to ensure that as part of a complete streets network their design consider bicycle and pedestrian travel. As well, bridges can function as gateway features providing important aesthetic and placemaking opportunities.

Main Street	**Transitioning**
Urban General (Narrow)	**Hamlet**
Urban General (Wide)	**Rural**

Objectives:

Bridge projects are expensive, time-intensive projects that can last for generations, as such, it's important that they be designed thoughtfully to maximize benefit.

Anticipating the needs of all users, including active transportation requirements, and balancing these needs during design and construction is important for developing a true regional complete streets network. Bridges have a large impact on the landscape. As such, design excellence should be sought to showcase strong design and maximize placemaking opportunities.

Guidelines:

- Bridges along wine routes shall accommodate walking and cycling;
- Wherever possible, bridges and overpasses should be designed to accommodate all users, for example by providing a pedestrian clearway on either side of the structure. Appropriate widths and other features should be determined in consultation with relevant geometric standards and guidelines;
- Design bridges to enable pedestrians to see from one end to the other for safety. Integrate ramps into the structure and provide direct connections to adjacent pedestrian clearways;
- On busy overpasses, the provision of planted or structural buffers between the pedestrian clearway and vehicle travel lanes can help to enhance the sense of safety for pedestrians;
- On all bridge decks, care should be taken to ensure that smooth bicycle safe expansion joints are used. In cases where expansion joints are uneven, covers should be considered. For lift span bridges (or other bridge types) with grate type decking, accommodations for providing smooth surfaces for cyclists and pedestrians should be considered, particularly when the connection has been identified as significant; and
- The primary purpose for lighting installed on bridges is to provide adequate lighting for vehicles and pedestrians. However, in cases where the bridge plays a significant gateway and/or placemaking function decorative post-top lighting or pedestrian lighting can be installed for either aesthetic purposes or to provide additional functionality.

2.4 Intersection Design for Urban Typologies

The overarching principle for intersection design in urban areas is to keep them as compact as possible to encourage safety for pedestrians, cyclists and motorists. Intersections are shared spaces, and should be designed to ensure that users are aware of one another and move predictably in order to promote mobility and safety goals. Successful intersection design prioritizes safety and access for all users, as appropriate to the street typology, and enhances the public realm.

The intersection design guidelines within this report support the following hierarchy of modes:

1. Pedestrians;
2. Cyclists and other active transportation users;
3. Public Transit;
4. High Occupancy Vehicles; and
5. Single Occupancy Vehicles.

Reduced Curb Return

Curb returns guide vehicles in turning corners and separates vehicular traffic from pedestrian areas at intersections. In practice tighter curb returns are better for pedestrians, as they minimize crossing distances, and longer curb returns are better for large trucks and buses as they provide a larger turning radius.

Objectives:

The objective for reduced curb return is to reduce the radii to the greatest extent possible on urban road typologies to increase walkability and pedestrian safety. Larger curb return radii may only be considered on roads that provide important goods movement routes.

Guidelines:

- The designer should determine the appropriate design vehicle early in the process to identify the largest vehicle type that will frequently turn the corner. This approach assumes that the occasional large vehicle can encroach into the opposing travel lane;
- The designer should keep in mind that the effective turning radius will be larger than the actual curb radius. This is particularly important when considering the effect of parking and cycling lanes in the roadway cross-section; and
- Changes to curb radii should have a neutral impact on the operation of cycling facilities.

Sight Triangles

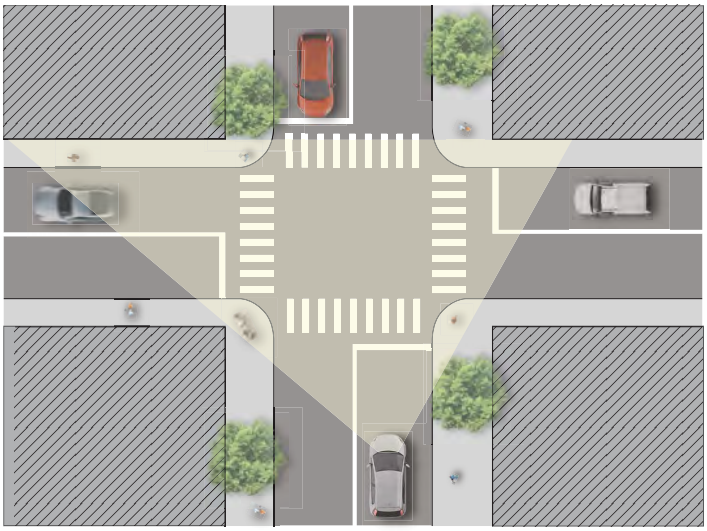
Sight triangles are intended to provide increased visibility at intersections for the safety of pedestrians, cyclists and motorists at corner lots.

Objectives:

The goal of a sight triangle is to provide clear visibility between all modes of transportation to mitigate the risks of potential conflict.

Guidelines:

- Traffic signals and signage must be unobstructed and free of tree cover and visual clutter;
- In urban areas where buildings are located at the property line, the sight triangle is best implemented by means of four way stop conditions or “no right turn on red”;
- In urban areas, corners frequently act as a gathering place for pedestrians and business as well as people gathering boulevard elements. Design should facilitate eye contact between these users, rather than focus on the creation of clear sightlines for moving traffic only;
- To improve visibility parking should not be located within 10m of the intersection;
- Vegetation should be set back from the crosswalk to ensure sufficient space for sight-lines and snow storage during the winter months;
- Intersections should be well lit to improve visibility between pedestrians, cyclists and motorists;
- To improve sight lines properly trim vegetation, move stop lines back from the cross walks, restrict parking near intersections and use curb extensions;
- Street trees should be sited a minimum of 1.5m from the curb face;
- Any landscaping within the sight triangle shall maintain a tree canopy with a vertical clearance of 2.4m;
- Plant material (shrubs, perennials, grasses, etc.) and street furniture within the sight triangle should be no taller than 0.9m; and
- Fixed objects, such as trees, buildings, signs and street furniture deemed to decrease visibility and safety should not be removed without first considering alternative safety mitigation measures such as a reduction in traffic speeds, increase in visibility through curb extensions or geometric design, or the addition of supplementary warning signs.



Sight triangles ensure sufficient sight distance at intersections for the safety of pedestrians, cyclists and motorists.

Roundabouts

A roundabout is a type of circular intersection with no traffic signals or stops in which drivers yield at entry to traffic in the roundabout, then enter the intersection, move in one direction around a central circular island, then exit at their desired street.

Objectives:

Roundabouts typically outperform, in terms of delays and queues, similar sized all-way stop control or signalized intersections. Roundabouts can provide a greater level of safety for motorists but not pedestrians; minimize environmental impacts, decrease idling and offer opportunities for improved aesthetics.

Roundabout can provide visual interest by incorporating plantings, including trees, and placemaking elements, including gateways.

Guidelines:

- Roundabouts should be carefully designed to accommodate pedestrians and cyclists at crossings, but in general terms should only be used in locations with lower volumes of pedestrians and cyclists;
- Designers should undertake site-specific analyses to assess feasibility prior to implementing a modern roundabout;
- Roundabouts on Regional Roads shall be designed to accommodate buses and large trucks, including fire trucks, using aprons of sufficient width to accommodate the vehicle movements;
- Shrubs or trees within the roundabout can beautify the street and promote traffic calming but need to be properly maintained so they do not hinder visibility;
- Include marked crosswalks around the perimeter of the roundabout for pedestrians and discourage pedestrian crossing to the central island;
- Crosswalks at roundabouts should generally be zebra markings (2.5 metres x 0.45 metres), unless there are very low pedestrian volumes (i.e. less than 20 pedestrians in 8 hours). Where there are very low pedestrian volumes at the roundabout, then parallel striped crosswalks are acceptable. The curb cut should be 2.5 metres wide;
- Signage should be provided before the entrance to the roundabout indicating that automobiles must yield to cyclists when cycling facilities are not provided.
- Refer to additional design guidance for best practices for the integration of multi-use paths, sidewalks and/or cycle tracks with roundabouts.

Roundabouts, such as this example at East Main Street in Welland, may reduce traffic delays and queues (Credit: Welland Tribune: http://www.wellandtribune.ca/2014/09/05/at-least-five-crashes-since-roundabout-opened).

Curb Extensions at Intersections

Curb extensions, or bump outs (refer to Section 4.2), visually and physically narrow the roadway, creating safer and shorter crossings for pedestrians, while increasing the available space for street furniture, benches, plantings and street trees.

Objectives:

Curb extensions increase the overall visibility of pedestrians to motorists and cyclists. They tighten intersection curb radii and encourage slower turning speeds. Curb extensions may also have a passive effect on traffic calming, provide space for on-street parking and allow for buses to provide curbside pickup.

Guidelines:

- The width of the curb extension should be slightly less than a parking lane. A typical width is 2.0m for a 2.4m wide parking lane;
- Curb extensions should only be implemented on streets with on-street parking;
- The designer shall consider maintenance requirements such as snow removal and street cleaning;
- Curb extensions may use special paving or an edging treatment to distinguish the space as a plaza separate from the through travel area;
- Curb extensions provide opportunities for landscaping and information display and should include tree plantings and street furniture to create an improved boulevard;
- The designer should consider planting street trees on the curb extensions to provide a vertical element to warn vehicles of their approach;
- Give consideration to the conveyance of gutter drainage and major storm overland flow when detailing the design of the curb extension; and
- Curb extensions can be implemented using low cost, interim materials. In such cases, curb extensions should be demarcated from the existing road bed using temporary curbs, bollards, planters or striping.

Curb extensions at intersections minimize the crossing distance for pedestrians while increasing the available space for vegetation and street furniture.

Crosswalk Treatment

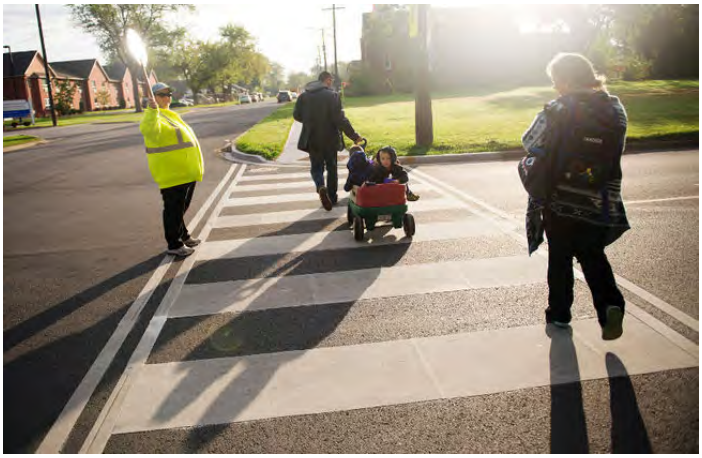
Crosswalk treatments assist pedestrians in safely crossing streets by signifying the crossing point for vehicles approaching an intersection.

Objectives:

The purpose of crosswalk treatments is to improve pedestrian safety by minimizing the distance travelled by pedestrians and clearly identifying spaces that provide pedestrian priority treatment. On wider intersections a refuge area or median should be provided.

Guidelines:

- Pedestrian crossings should be at grade, except in instances where they are crossing limited access highways;
- All signalized intersections must have marked crosswalks unless pedestrians are prohibited from the roadway, or if there is physically no pedestrian access on either corner and no likelihood that access can be provided;
- Crosswalks should be oriented 90 degrees to the curb to minimize pedestrian crossing distance;
- In urban areas, all new crosswalk signals should include pedestrian countdowns to create a more predictable crossing environment;
- High-visibility ladder, zebra and continental crosswalk markings are preferable to standard parallel or dashed pavement markings;
- Designers may incorporate unique pavement treatments or markings to identify pedestrian priority areas and alert motorists to their approach;
- Street lighting should be provided at all crosswalks;
- In cases where bicycles frequently queue in the crosswalk or may benefit from an advanced queue, a bike box should be utilized;
- In areas of unique interest, the designer should consider unique crosswalk treatments to reflect the character of the neighbourhood:
- Crosswalks should be designed to be fully accessible. At areas with high pedestrian volumes, the crossing should be raised almost to sidewalk level to eliminate ramps for pedestrians, increase the visibility of the crossing and to slow motorists to the desired speed; and
- Locate catchbasins immediately upstream of crosswalks to assist pedestrians with safe movements across the street.



Zebra markings such as these shown at the intersection of Plymouth Road and First Street in Welland improve crosswalk visibility and pedestrian safety

Cycling Facilities at Intersections

Cycling facilities at intersections can include lane delineations, turning facilities, signage, signalization and pavement markings.

Objectives:

Intersections are one of the most common areas of conflict between cyclists and other modes of movement. The purpose of cycling facilities at intersections isto ensure that the interaction of motorists, cyclists and pedestrians is consistent, predictable and safe.

Guidelines:

- Bicycle lane delineations, turning paths, pavement symbols, signage and road surface should always be clearly visible to both cyclists and motorists. Visibility is especially important at intersections where various modes of transportation interact and cyclists are most likely to get into collisions;
- Conflicts between motorists and cyclists should be minimized by separating uses, having cyclists travel in the same direction as automobile traffic and provide appropriate bicycle lane widths with sufficient space for encounters, passing and evasive maneuvers;
- At uncontrolled intersections bicycle lane stripes should not be extended through a pedestrian crosswalk or any street intersection (with the exception of dashed lines which is optional through some intersections);
- Chevrons may be used for increased visibility within conflict areas or across entire intersections;
- Bike lane at intersection with right turn lane: Bicyclists going straight ahead shall be to the left of right turning traffic;
- Cycle Track Considerations: Cycle tracks should be designed to reduce conflicts for cyclists, and provide connections to and from the track. At intersections, they should be shifted closer to the travel lane and barriers and grade separation should be removed. The design through the intersection is similar to a conventional bike lane, and a bicycle signal may be used;
- The implementation of “Protected Intersections” or dutch junctions should also be considered by the Region as a tool to create cycling facilities at intersections for all ages and all abilities; and
- Refer to OTM Book 18 for detailed guidance on cycle track facility design at intersections.

Intersection Crossing Markings - Chicago, IL (Credit: NACTO: http://nacto.org/publication/urban-bikeway-design-guide/intersection-treatments/intersection-crossing-markings/).

Bike Boxes

Bike boxes are designated areas for bicycles at signalized intersections that provide cyclists with a safe and visible way to get ahead of queuing traffic during the red signal phase. Cyclists stop in front of motorists and can proceed through the intersection first when the light turns green.

Objectives:

Bike boxes increase visibility, reduce signal delay for cyclists, improve motorist behavior and safety and reduce the risk of "right hook" collisions.

Guidelines:

- Bike boxes should be implemented on roads with designated cycling facilities and significant volumes of cyclists;
- Bike boxes should be designated as typically green painted area containing a white bicycle symbol with a section of green bicycle lane preceding the box;
- Right turns on red lights are generally not permitted; and
- Implementation should include a public education program to educate residents and visitors on the proper use of bike boxes at intersections.

Bike Box - Portland, OR (Credit: NACTO: http://nacto.org/publication/urban-bikeway-design-guide/intersection-treatments/bike-boxes/)

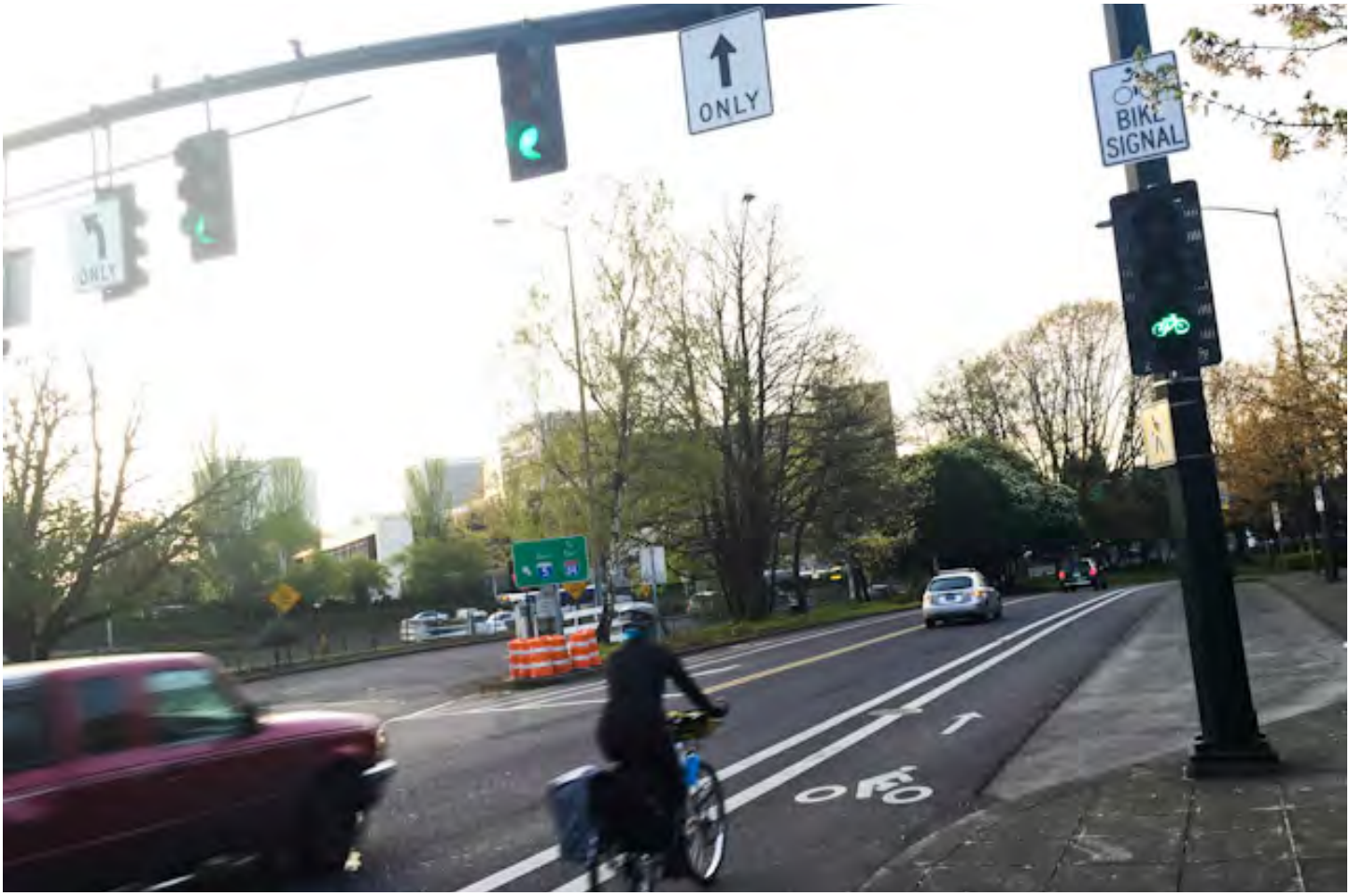
Signals

Traffic and bicycle signals indicate crossing priorities at intersections. They can be used at mid-block pedestrian and cycling crossings in high-traffic areas.

While physical enhancements to an intersection may designate space for cyclists, pedestrians and public transit, traffic and bicycle signals improve efficiency and reduce delay, compliance, safety and convenience, and influence mode choice.

Objectives:

The primary objectives of a Complete Streets approach to traffic and bicycle signals is to prioritize walking, cycling and transit use at intersections to enhance safety, mode choice and the development of more complete communities.



Bicycle Signal in Portland, OR provides green light for cyclists (Credit: BikePortland.Org: http://bikeportland.org/2015/04/13/new-bike-signal-north-moda-center-adds-greentime-southbound-biking-139306).

Guidelines:

Traffic Signals

- To promote a more permeable network short cycle lengths of 60-90 seconds are ideal for urban areas;
- Designers should consider the length of crossings for all users and abilities when using shorter cycle lengths. This is particularly important in areas with large elderly populations and within the 1.6 km school walking radius as defined by the Niagara Student Transportation Services; and
- Where it is difficult for elderly pedestrians and children to cross in a single signal cycle, efforts should be made to shorten the crossing distance via road diets, curb extensions and other measures.

Bicycle Signals

- Bicycle signals should be implemented under the following conditions:
    - At intersections with high numbers of vehicle and automobile collisions.
    - At complex intersections that may otherwise be difficult for cyclists to navigate.
    - At intersections near schools.
    - Where a bike path or multi-use path crosses a street and the needed bicycle clearance time differs substantially from the needed pedestrian clearance time.
    - At intersections with contra-flow bicycle movements that otherwise would have no signal indication.
- Bicycle signals shall be placed in a location clearly visible to oncoming cyclists;
- If the bicycle signal is used to separate through bicycle movements from right turning vehicles then right turns on red shall be prohibited when the bicycle signal is active;
- Passive actuation of bicycle signals is preferred to the use of push buttons. If push buttons are used, they should be mounted such that bicyclists do not have to dismount to actuate the signal

2.5 Transitions

General

Transitions occur when:

1. One road typology changes into another; or
2. The desired operating speed changes along a roadway.

Transitions can be permanent or temporary and must be considered on all road typologies. For example, a temporary transition would manage the phasing or staging of construction projects.

Objectives:

The objective is to manage transitions to give clear visual cues to vehicle operators that change is occurring and to ensure that they can respond accordingly.

Transitions can serve as visual cues of changes in:

- Functional emphasis from an automobile-oriented road to a pedestrian-oriented road;
- Change in road typology or speed;
- Width of road, either a narrowing/widening of lanes or decrease/increase in number of lanes; and
- Land use changes, such as a transition between a commercial and residential district.

Cross-sectional changes, such as the overall curb to curb width of the street as appropriate for the context and street type, need to be managed in the transition area.

Transitions from one speed zone to another should be introduced in a manner that gives motorists adequate time to prepare for, and react to, changes in roadway design. Designers need to introduce transition design changes that will safely lower the speed of motorists who are changing from one context to another by sending a clear message to the driver that a change is approaching.

Guidelines:

Transition areas need to be designed to accommodate changes in speed, context, cross-section, and road typology, such as a change from a Transitioning to a Rural typology.

Transition guidelines apply to the corridors roadway, boulevard and built form.

Roadway Measures

- Transition areas should be located such that decision site distance is in accordance with Table 1.2.5.6 of the TAC Geometric Design Guidelines for Canadian Roads is achieved;
- Where the difference in the desired speeds between the two contexts is great, a transition speed zone is required to avoid large reductions in the speed limit by providing two or more speed limit reductions;
- Differences in design speeds at transitions should not be more than 20km/hr. Drivers should be warned well in advance of the transition;
- Changes in speed zones can utilize other traffic control devices such as warning signs and beacons, or can utilize appropriate traffic calming measures such as changes in the cross-section;
- Where the transition zone is particularly short, periodic measures such as speed platforms or rumble strips (in rural areas only) may be considered;
- Changes in the width and number of travel lanes and the shoulder treatment can also serve to calm traffic;
- The shortest transition can be achieved at an intersection by the use of a roundabout; The desired speed and contexts can be different on the various roads connecting to the roundabout; and
- The design of transition areas can include the changing of a shoulder on a rural cross-section to a parking lane and/or bike lane on the urban cross-section.

Boulevard and Built Form Measures

- Traffic calming measures can include element changes (e.g. street trees, lower street lights, curbs, textured paving, on-street parking) and periodic entrance features and coordinated street furniture;
- Land use and building style can provide visual cues to transition, particularly street defining designs in commercial and retail areas such as buildings addressing the right-of-way, awnings, and glazing;
- Changes in building height and setback are also measures to calm traffic. Introducing taller buildings closer to the street helps to inform drivers of the change from a rural or suburban context to an urban context; and
- Entrance features or gateways can contribute to traffic calming in transition areas. Such treatments can include landscape features, planting beds, signage, way-finding, entrance architectural features, building features, art and hardscape features such as medians, curb extensions and decorative pavements.

Transitioning Regional Road on Birchmount Road at Highway 7, Markham (Credit: www.googlemaps.com).

2.6 General Guidelines

Public Art

Public art is art in any media that is accessible to all and has been planned and executed with the intention of being staged within the public domain.

Public art complements and enhances the environment and brings public spaces to life. It can be permanent or temporary and serves an important placemaking role. Public art can draw attention to local, regional, global or universal themes and can be used to highlight landmarks, attractions, views and vistas as well as reflect the spirit of a place, unique history or aspirations. Art installations can be stand alone or integrated into buildings, street furniture and other infrastructure.

Objectives

Public art should be used, where possible, to improve the public realm; adding visual interest and providing sensations for passersby that can range from thought provoking to calming.

Rag Tree Installation at the Grimsby Public Art Gallery, Sept 2012

Guidelines:

- Recommended public art locations include high use areas such as public parks, plazas, curb extensions, multi-use paths, et;
- The use of public art should be limited near forms of traffic control (i.e. stops signs) to minimize driver distractions and view obstructions;
- Public art should not interfere with the pedestrian through zone or vehicular traffic and may not be appropriate for high-traffic walking areas unless it functions as street furniture;
- Public art should be designed specifically for its location and to add to the identity and profile of the community;
- The aim in the design and planning phases should include integrating, where possible, public art with other elements of the streetscape such as light poles, benches, trash receptacles and utility boxes;
- Public art installations should be durable and easily maintained; and
- Public art should be physically and visually accessible, barrier-free and incorporate universal design principles. For example, public art is encouraged to incorporate Braille on interpretive materials.

Examples of public art integrated into street furniture.

Street Furniture

Street furniture in the public realm consists of the benches and seats, waste receptacles, fountains, shelters, weather protection, etc that provide the settings for resting, sitting and eating and social encounters with others. Such settings may be of great importance to the elderly, those with limited mobility, and adults who have small children. In addition to their functional aspect, items of urban furniture such as benches and tables in parks and squares can also be socially significant, as they give sites a comforting and appealing presence and draw people together.

Main Street	**Transitioning**
Urban General (Narrow)	**Hamlet**
Urban General (Wide)	Rural

Objectives:

The primary purpose of street furniture is to provide the amenities that offer pedestrians shelter and protection as well as places to sit, socialize, relax and reflect.

Street furniture serves both a functional and placemaking function. Street furniture, when context sensitive and properly integrated in the design of a public space, creates an identity and develops a sense of place around it.

Guidelines:

- Street furniture that has been planned and coordinated as part of a broader design concept are more successful than those where they have been selected piecemeal without taking account of architectural character, weather conditions or user's needs;
- The locations of the furnishings should be based on their function and should be coherent with the patterns and designs of the hard surfaces at the site;
- Street furniture should not be located within the pedestrian through zone;
- Street furniture should not give the appearance of being cluttered, so that, for example, signs should be attached to a single post or column when possible;
- Group amenities such as seating areas should be set up where they will be used, such as at pedestrian junctions and near transit stops;
- Street furniture should be designed with the aim of being accessible for all including the disabled and elderly, and also to enable triangulation, i.e. linked together to stimulate social encounters;
- Furnishings must be constructed of safe materials and designed to prevent injury, without sharp edges or exposed fasteners;
- The type of furniture and its arrangement should take into account visibility and sightlines, lighting and accessibility issues;
- Furniture selection and design should take into account weather effects such as sunlight, expansion and contraction, wind stress, moisture, frost, ice and salt spray; and
- Street furniture should contrast signficantly in colour with the background where they are located, and have a luminance contrast

of at least 30 percent to increase visibility to pedestrians. This can be supplemented by coloured borders in the pavement, which marks the edges of the street furniture to guide pedestrians around it.

Seating

- The best locations for benches are places where there is heavy pedestrian use such as retail shopping corridors, transit stops, plazas, spaces outside cultural institutions, etc;
- In high activity areas there should be access to seating every 60m (or every 50m if there is intense activity);
- There should also be rest facilities at regular intervals of 100-200m with the needs of the disabled and elderly kept in mind;
- Benches should be set up near other amenities such as bus shelters, kiosks, news stands, waste receptacles, etc., and arranged where there is protection from the wind and to allow a choice of sitting in the sun or shade; and
- Benches set at right angles to each other create situations conducive to socialization.

Waste Receptacles

- The most common error in placing waste receptacles is putting them wherever there is an empty space, instead of in places where people will use them;
- Waste receptacles should be highly visible and accessible to minimize littering;
- Waste receptacles should be located where they are most likely to be used, in crowded areas like busy intersections, close to crosswalks, beside take-out food shops or vendors, at bus stops, in plazas and near other items of street furniture; and
- Receptacles should be situated far enough away from seating areas to minimize the unpleasant effects of trash odors and insects on users and their fronts should be set back at least 30 cm from walkways.

Waste receptacle located adjacent to seating.

Utilities

Provision of utilities by means of designating utility corridors is one of the primary roles of the public road allowance and underground and above ground utilities can have major impacts on the design and function of a roadway.

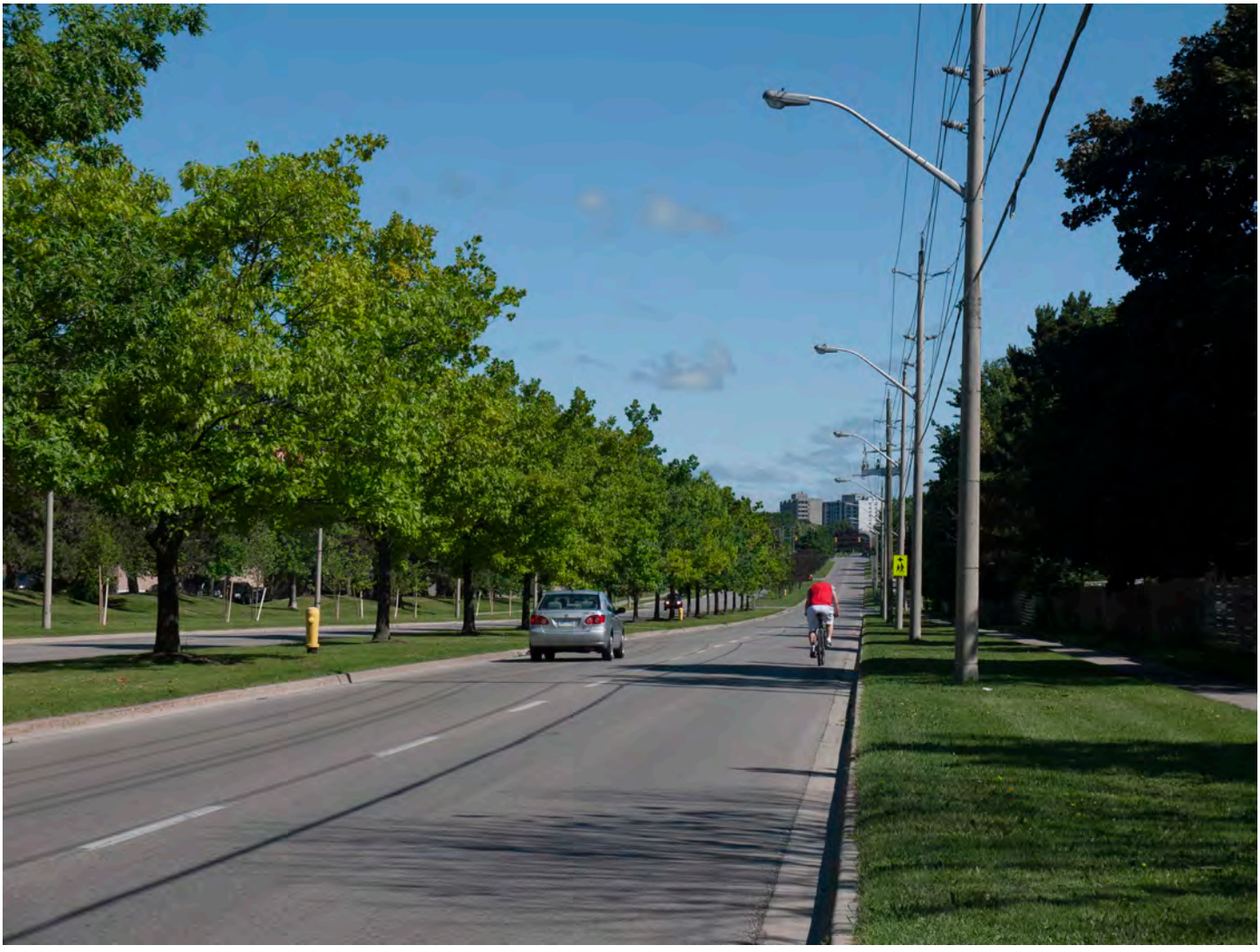
Objectives

The design and siting of utilities have a number of different objectives, key to these objectives are to locate them in a manner that is safe, efficient and unobtrusive. Strategies should be adopted to create a compact edge of road condition and coordinating utilities and boulevard elements is essential to ensure that adequate access is provided for repairs and services, to minimize disruptions to the pedestrian clearway and traffic, and to ensure the safety of maintenance personnel.

Guidelines:

- Coordinate the scheduling of Regional, public, and/or private utilities capital works programs;
- Standards for the placement and location of utilities must be observed, but the design of these spaces should proactively consider coordination, impact on the public realm and long-term service life;
- Consider joint utility trenches and other strategies to achieve narrower overall edge of road dimensions;
- Consideration should be given to maximizing the service life of all infrastructure in the right-of-way, as well as minimizing life cycle costs by means of coordination and the completion of an integrated planning and design process with the right-of-way stakeholders;
- Document and retain as-built records of all constructed infrastructure;
- Bury hydro facilities, services and utilities where practical, in order to minimize their visual impact;
- There must be a minimum 3m separation between power lines and any physical development. For urban roadways with a barrier curb and a design speed of 60km/hr or less, the minimum setback between the back of curbs and the edge of poles is 0.25m;
- Locate utility poles 3 to 4m from the property line on rural roads, and in accordance with existing guidelines for minimum sightline and sight triangle distances;
- Overhead clearance requirements are a function of site condition and may vary along an alignment. Ensure that the overhead clearance zone is in accordance with CSA Standard C22.3 No.1-06 Overhead Systems;
- Minimize the visibility of utility accessories, such as utility boxes. This can be achieved by placing accessories in inconspicuous places, and/or by screening them with plantings. Ensure such screening does not interfere with access to the accessories. Utility providers should also be encouraged to consider innovative methods of containing utilities and determining locations for large utility equipment and utility cluster sites;
- Coordinate landscape plans with service/utility plans to minimize long-term conflicts with tree roots and branches;
- Maintain a 1m clearance between watermains and tree roots; and
- Consider subsurface or trenchless

technology installation rather than tree removal to address conflicts with underground utilities.



Hydro lines and trees are offset to allow trees to grow to maturity.

3.0 Associated Standards and Guidelines

This section acknowledges the existence and role of various other design standards and guidelines including:

- Model Urban Design Guidelines, Niagara Region (2005);
- Canadian Guide for Greener Roads, Transportation Association of Canada (January 2015);
- Bikeway Traffic Control Guidelines for Canada, Transportation Association of Canada (February 2012);
- Traffic Signal Guidelines for Bicycles, Transportation Association of Canada (April 2014); and
- Ontario Traffic Manual, Book 18, Cycling Facilities (December 2013).

Other resources include:

- NACTO Urban Street Design Guide, National Association of City Transportation Officials (2013);
- NACTO Urban Bikeway Design Guide, National Association of City Transportation Officials (2014)
- Essentials of Bike Parking, Association of Pedestrian and Bicycle Professionals (2015);
- Planning and Design for Pedestrians and Cyclists: A Technical Guide, Velo Quebec (2010); and
- Guide for the Development of Bicycle Facilities, American Association of State Highway and Transportation Officials (2012).


Niagara Region