

Context Sensitive Regional Transportation Corridor Design Guidelines

Prepared for The Region of Waterloo



Digital Document Navigation

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Glossary

Terms	Definitions
Access Control	Determines the number and spacing of access points to roads, such as intersections, driveways and curb cuts, that are appropriate for a specific road type.
Active transportation	Cycling and walking
Boulevard Elements	The elements of the road, i.e. street furniture, landscaping, decorative lighting, sidewalks, etc., between the property line and the curb of the road.
Buffer Zone	The area between the curb of the road and the adjacent site furnishing zone. This area provides clearance between roadway and boulevard elements.
Carriage Way	The area of the road between the curbs.
Clear Zone	The required set back area from the road to ensure safety in the case of errant vehicles.
Design Speed	A speed that is selected to inform the appropriate geometric design elements of the roadway. The Design Speed does not always match the posted speed.
Encroachments	When an object penetrates the boundary of the adjacent space, such as an awning that protrudes from the front of a building into the road area.
Gateways	Features that are designed and located to announce a special place or area.
Land Use	The official designation of the lands (property) as identified in the Official Plan. Typical land uses could include mixed-use, residential, industrial, agricultural, etc.
Landscape Buffer Zone	A zone that provides a buffer between the outside of the sidewalk and the adjacent properties and building, can also provide a critical zone for accommodating changes in grade.
Landscaping and Site Furnishing Zone	A zone which provide a buffer between the pedestrians and the road. Typically the zone provides opportunities for planted and hardscaped areas with street furniture.
Land-Use Transition Zone	An area that can be either public or private property and provides a setback from the road right of way to the face of the building. The area allows for spill out spaces for patios and/or retail overflow such as flower stands or board signage.
MOE Standards	Ministry of the Environment Standards.
Multi-Use Trail	A combined trail for cyclists, pedestrians, in-line skaters, and personal mobility devices.
Noise Attenuation	The control or reduction of noise.
Pedestrian Clearway	The designated area for walking the street.

<i>Terms</i>	<i>Definitions</i>
People Moving Capacity	The ability for a road to move pedestrians in a comfortable and inviting manner.
Regional Transportation Corridor	Corridors or roads that are identified in the Regional Official Plan as primary routes for moving goods and people.
ROW (Right of Way)	The width of a road from property line to property line.
Special Character Streets	Streets with unique built or natural heritage, scenic views and vistas or other unique identifiers.
Street Design Guidelines	Provide an overall and coordinated vision for the character and design of new street construction and renovation.
Street Elements	The elements of the road between the curbs, i.e. the on-street parking lanes, travel lanes, bicycle lanes, etc., making up the asphalt portion of the road.
TAC Design Guidelines	The guidelines prepared by the Transportation Association of Canada to inform the design and construction of roads.
Transit Facilities	The support elements for a transit system such as shelters, signage and stations.
Transit Priority Lanes	Where a portion of the road is dedicated or prioritized for transit vehicles.
Transportation Corridor Classification	A hierarchy of road/street types that allow for the implementation of context sensitive guidelines that respond to the adjacent land uses, streetscape requirements and engineering constraints.
Utilities	Above ground or below ground infrastructure that supply water, hydro, cable, phone, fiber optics and also deal with sanitation and storm water.

Executive Summary

Study Context

The Region of Waterloo has identified a need to develop design standards to respond to the variety of urban form and modes of transportation that can exist throughout the length of a Regional Transportation Corridor. Through background research and consultation with Regional Staff and Stakeholders, it was determined that the design process for Regional Transportation Corridors needs to be context sensitive to reflect the variety of road types and conditions found in the Region. The recommendations in this document provide direction on how to design and plan Regional Transportation Corridors in a manner that is site specific, while also considering the transportation needs of the Region holistically. This document is intended to become the implementation guidelines for the Regional Official Plan. The principle goals of the Regional Transportation Corridor Guidelines are to:

- Establish a well-defined and descriptive hierarchy for the Regional Transportation Corridors that acknowledges the variation and uniqueness of Waterloo Region and responds to the diversity of adjacent land uses;
- Establish guidelines for the safe, convenient and comfortable movement of goods and people including access management;
- Provide an integrated framework for operational (road) and urban design (boulevard) components that can adapt to a variety of conditions;
- Enhance, develop, promote and integrate sustainable and active forms of transportation (public transit, cycling and walking) by the provision of a comfortable built environment; and
- Become a reference for the Region and Area Municipalities in the preparation of corridor studies, land use plans, road improvement projects, Class EA's and development proposals.

This document focuses on the role of Regional Transportation Corridors and how they can best serve the transportation needs of the community for the movement of goods and people, including trucks, cars, transit, bikes and pedestrians. Embedded in the prescribed design process is a focus on creating vibrant urban streets and scenic rural roads that reflect the character of the adjacent communities. Given the diversity of existing conditions, the guidelines and street design criteria were also developed with a focus on flexibility to ensure that the project designer and design team can respond to the unique character of each roadway.

Regional Heritage

The lands now known as the Region of Waterloo were settled in the early 1800's. The Township of Waterloo was created in 1804; the Township of Woolwich in 1807, the Township of North Dumfries in 1817, the Township of Wilmot in 1828 and Wellesley in 1843 and in 1854 were assembled into the County of Waterloo. In 1973 the Region of Waterloo replaced the County system. The Region now includes four Townships and three Cities. North Dumfries, Wilmot and Wellesley Townships were subdivided by conventional lot and concession patterns. The urban fabric, which gradually developed over centuries along these road networks, is now one of the single most significant heritage elements evident within the Region.

Process

In developing these guidelines, the consultant team worked closely with the Steering Committee and stakeholders in developing consensus for the design and construction of Regional Transportation Corridors. That process also included two consultation meetings with area municipal representatives and a series of public information sessions. Through the process, great achievements were made and a cohesive methodology was established.

Recommended Classifications

Given the diversity of Regional Transportation Corridors, it was decided to implement a classification system that is descriptive in nature and to create combined road and boulevard design guidelines. Based on the research completed to date, it is recommended that a descriptive classification system be utilized. The preferred range of widths identified in this section for roadway and boulevard elements is intended to be flexible to changing conditions and priorities. One such exception would be the designation of a Rapid Transit corridor. The proposed descriptive classifications are as specified below.

Rural Connector

Rural Connectors are comprised of “country roads” located along historical concession right-of-ways in the Region’s rural areas or country side. They are generally continuous across the Region and are flanked by farms and other rural land uses including rural residences on severed lots.

Rural Village - Main Street

Rural Village - Main Streets are short segments of roadway that are generally contained within a village or hamlet, characterized by buildings that address the street. Buildings, lot sizes and right-of-way widths are typically smaller than those found on the outskirts of villages and hamlets in rural areas.

Community Connector

Community Connectors connect to 400 series highways, Conestoga Parkway (expressway), other Community Connectors, Neighbourhood Connectors, and Rural Connectors. They connect communities within the Region and incorporate a high degree of access control. Community Connectors focus on moving vehicles and can be considered for higher order transit corridors.

Neighbourhood Connector

Neighbourhood Connectors are typically continuous across several communities/neighbourhoods within the Region. Neighbourhood Connectors balance active transportation (bicycles and pedestrians), transit and vehicle movement, providing a higher level of priority (design and comfort) for pedestrians, cyclists and transit users.

Avenue

Avenues are located in existing built up areas with adjacent development facing the street but set back to incorporate large front yards and front yard parking, typical of medium to large format commercial, shopping malls, community facilities and low rise neighbourhoods. Avenues have larger right-of-way’s than main streets and include many opportunities for re-urbanization.

Main Street

Main streets are located in existing built up areas characterized by buildings that address the street with small or no setbacks. Buildings, lot sizes and right-of-way widths are typically smaller than those found within Avenues.

Residential Connector

Residential Connectors are short segments of roadway typically located in built up residential areas linking Neighbourhood Connectors and Rural Connectors. They are flanked primarily with residential uses of varying sizes and densities together with supporting neighbourhood uses such as schools, parks, and places of worship. The Residential Connector is a somewhat uniquely Region of Waterloo road type, which typically has a strong presence of single family residential directly facing the street.

Section 1: Introduction



1.1 Study Overview

A series of small settlements emerged in this region following initial settlement in the early 1800's and today, have grown to form 4 townships and 3 cities, all with well established road patterns.

The current urban fabric has largely been influenced by this uniquely historical settlement and road pattern. The network includes Regional, City, Township and Provincial Roadways. Regional Transportation Corridors generally connect the Region's internal circulation network. Provincial roads connect the Region with surrounding communities, and City and Township roads organize the internal transportation network within individual cities and townships. The Regional Transportation Corridor network has been designed to carry high volumes of traffic (including trucks) and connect communities; major commercial, industrial and institutional areas with the Provincial highway system and other major corridors. They also serve the individual needs of the cities, townships and towns that they pass through. More recently, the importance of facilitating and encouraging all modes of transportation including transit, pedestrians and cyclists, on the Regional Transportation Corridor allowance has been recognized.

Due to the extreme variations of urban form and mode of transportation that can exist throughout the length of a corridor, a context sensitive design methodology is needed. The recommendations of this document provide direction on how to design and plan Regional Transportation Corridors in a manner that is site specific, while also considering the transportation needs of the Region in a holistic manner.

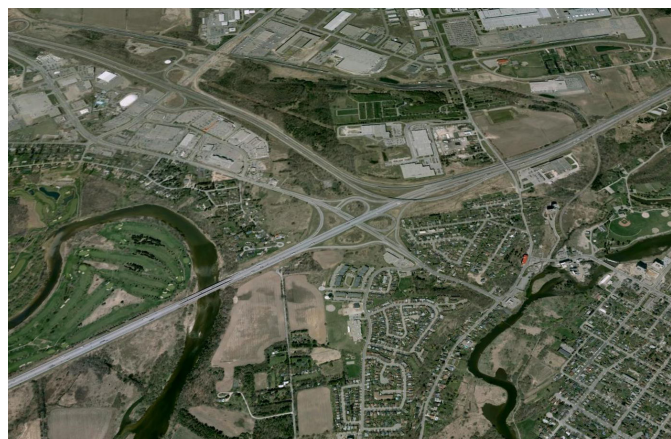
This document focuses on the role of Regional Transportation Corridors and how they can best serve the transportation needs of the community for the movement of goods and people, including trucks, cars, transit, bikes and pedestrians. The study also was structured to help streamline the decision making process for the design and construction of the Corridors. A central focus of this document is the facilitation of walking and cycling throughout the region. The resulting recommendations and decision making framework aims to:

- Respond to the **variety of Regional Transportation Corridors** including the rural areas, hamlets, villages, urban boundaries, city suburbs and urban centres and to the mix of land uses that surround them;
- Create a **flexible framework**, which provides consistency in decision making, that builds on the Region's forward thinking approach to designing roads not only for vehicles, but also for transit, cyclists, and pedestrians and to support the vibrant businesses and communities found throughout the Region. The framework also needs to be adaptable to fit within the existing planning context including: two-tier government system, the Regional Official Plan Policy, the Regional Growth Management Strategy, Area Municipalities, urban design, transit, and traffic planning; and
- Create an **urban design and functional design** process for the design of new roads and the reconstruction of existing roads in the Region. Accommodate a **mix of users**, including horses and buggies, and will follow universal design standards.

1.2 Guiding Principles

This study aims to address several fundamentals relative to Regional Roads. It includes developing a Classification System, preparing Functional Urban Design Guidelines and recommending a decision making framework that will assist Regional Staff and stakeholders, design and plan Regional Roads. The following provides a summary of the key principles that were developed to guide this study. The Regional Transportation Corridor Design Guidelines shall:

- 1** *Establish a well-defined and descriptive hierarchy for the Regional Transportation Corridors that acknowledges the variation and uniqueness of Waterloo Region and responds to the diversity of adjacent land uses;*



- 2** *Establish guidelines for the safe, convenient and comfortable movement of goods and people including access management;*



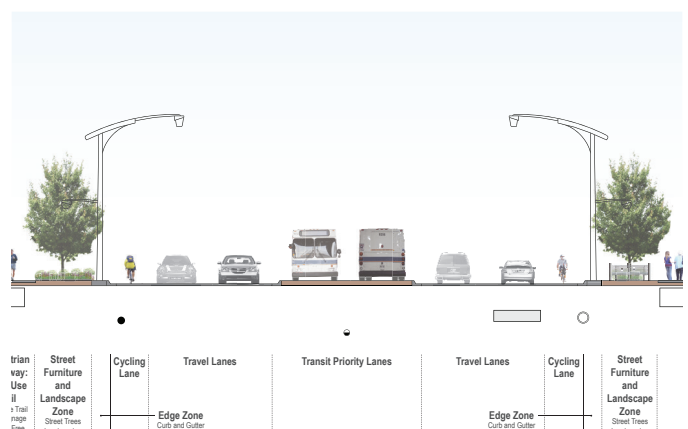
- 3** *Provide an integrated framework for operational (road) and urban design (boulevard) components that can adapt to a variety of conditions;*



- 4** *Enhance, develop, promote and integrate sustainable and active forms of transportation (public transit, cycling and walking) by the provision of a comfortable built environment; and*



- 5** *Become a reference for the Region and Area Municipalities in the preparation of corridor studies, land use plans, road improvement projects, Class EA's and development proposals.*



1.3 Best Practices Summary

(Also refer to Appendix A for Background Documents)

The research component of this study included a comprehensive review of the various road classification systems which have been adopted by municipalities and larger governing bodies throughout Ontario and internationally. In Ontario, reviews were conducted for the Cities of Ottawa, Toronto, and Hamilton as well as the Regions of York, Peel, Durham and Halton. Each municipality presents a different approach in determining their road classification systems. However, each has designated a set number of classifications to create a hierarchy of roads, which are determined by a set of design criteria, generally including right-of-way widths and the intended purposes of the road. Some municipalities, including the City of Ottawa, utilize a highly complex and context-sensitive set of design criteria for their road hierarchies. Such criteria may include: priority levels for winter maintenance, traffic volumes, speed limits, the presence of traffic signals versus stop signs and their desired frequency, and the presence and preferred placement of surface transit, sidewalks, bicycle lanes and multi-use trails, medians, tree plantings, and boulevards.

Terminology varies between municipalities, but ultimately, each classification system consists of a series of arterial, collector, and local roads. The Regions of Peel and Halton, and the Cities of Hamilton and Toronto choose only to develop specific criteria for arterial and major collector roads, while others address the full range of classifications. York Region and the City of Ottawa add an additional degree of complexity by expanding this list to include other road systems, such as municipal freeways or rural roads. Some go a step further by breaking down general road classifications into specific sub-categories. The City of Ottawa, for

example, provides specific design criteria for a variety of arterial and collector road classifications. These include: Urban Residential Collector, Village Residential Collector, Urban Community Collector, Urban Employment Area Collector, Rural Collector, and Rural Arterial Roads.

In the United States, the focus of research was on state-wide road classification systems, including those for North Carolina, New Jersey, Pennsylvania, and California. These states have all developed functional classification systems, consistent with the policies outlined in the American Association of State Highway and Transportation Officials (AASHTO) Green Book. This policy document guides the geometric design of highways and streets in the United States. These classification systems are similar to those designated by Ontario Municipalities. They include: Principal Arterial, Minor Arterial, Collector (subdivided into major and minor collector within rural areas), and Local Roads. A set of criteria are used in determining road classifications. These include: roadway type (including local, neighbourhood, community, and regional), desired operating speeds, average trip lengths, traffic volumes, and intersection spacing.

Internationally, the focus of research was on the standards adopted by Western Australia and the City of Stirling. Throughout Western Australia, and within Stirling, several functional road classifications are used, which are similar to those which have been adopted throughout Ontario and the United States. This hierarchy includes: Primary Distributors, which service regional and inter-regional traffic; District Distributor A Roads, which carry traffic between industrial, commercial and residential areas and generally connect to Primary Distributors; District Distributor B, which performs a similar function to type A district distributors but with reduced capacity; Local Distributors, which carry traffic

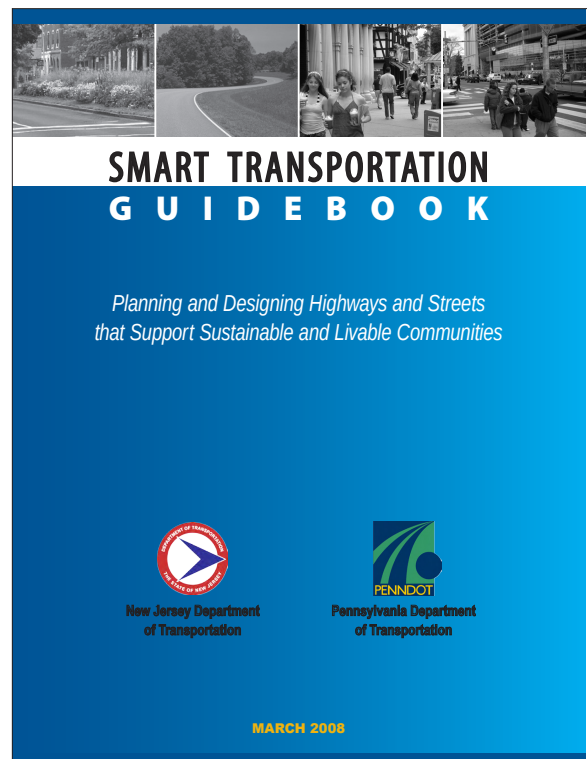
within a cell and link District Distributors at the boundary to access roads; and Access Roads, which provide access to abutting properties. Primary Distributors are managed by upper-level governments, while all other functional classifications are managed by local municipalities.

Two of the leaders in defining industry standards for road classification systems are the Institute of Transportation Engineers (ITE) and the Transportation Association of Canada (TAC). ITE is an international educational and scientific association, and one of the largest and fastest-growing multi-modal professional transportation organizations in the world. TAC is a national association and forum for gathering and exchanging ideas, information and knowledge on technical guidelines and best practices. Both organizations have a mission to promote the provision of safe, efficient, effective and environmentally and financially sustainable transportation services in support of social and economic goals.

In conclusion, it was found that a road hierarchy or classification system was the best manner of addressing a variety of road types and diversity of context. Typically, these road classification systems only addressed the functional aspects of the roads. However, in some cases, for example, the City of Ottawa, where a context sensitive design approach was required, functional road guidelines are combined with urban design guidelines. The method of viewing Arterial Roads within wider city corridors and categorizations, as done by the City of Ottawa, has been carried forward in this study and has been used as a model for the development of context sensitive Transportation Corridor Design Guidelines for the Region of Waterloo. This has been accomplished through an analysis of planned function, including adjacent land use context and public space objectives, and not solely by traffic carrying capacity or travel speed. This has resulted in the creation of six Arterial Road types.



Regional Road Corridor Design Guidelines for the Region of Ottawa-Carleton



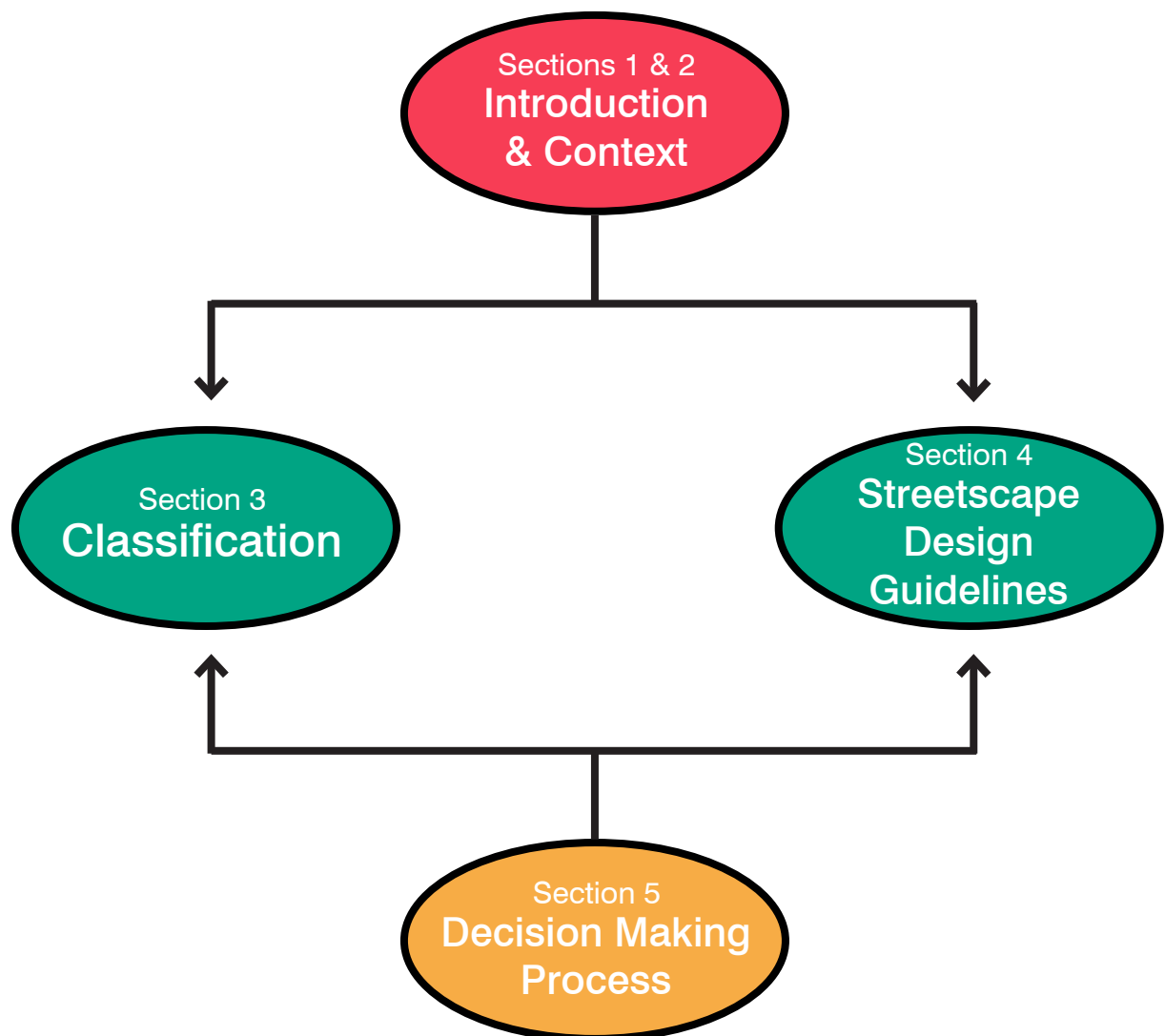
Smart Transportation Guidebook

1.4 Using the Document

This document is divided into 5 sections, Introduction, Context, Classification, Guidelines and Decision Making Framework. Section 1, Introduction, provides an introduction to the study and the key principles. Section 2, Context, describes the context that was considered in the development of this report and the process that was undertaken as a part of the study. Section 3, Classification outlines the study recommendations and describes the classification system. Section 4, Guidelines, provides urban design (boulevard) and functional (roadway) design guidelines related to the design and construction of Regional Transportation Corridors. Lastly Section 5, Decision Making Framework presents the decision making process that was developed throughout the study. The chapter takes a designer through the process, demonstrating how site specific design can be implemented within a hierarchy of Regional Transportation Corridors and a diversity of contexts.

This document is intended to guide project design teams with completing an integrated design process that enables the design team to identify both the existing and planned transportation and infrastructure needs of the public road allowance and identify, evaluate and select the preferred cross-section for the public road allowance that best addresses the collective transportation / infrastructure needs. This integrated design process is an

iterative process in which the needs of the various modes of transportation (pedestrians, cyclists, automobiles, trucks, transit and emergency services) and infrastructure systems (water, wastewater, stormwater, energy and communication) are considered and evaluated for the purpose of reaching consensus amongst the project design team for the selection of the preferred roadway cross-section for the project. The guidelines and dimensions provided in this guide have been developed through consultation with the Region of Waterloo staff and represent a starting point from which project design teams can commence the iterative design process with the knowledge that a process exists in which the needs of the multiple users of the roadway can be considered and evaluated. It is expected that the guidelines and dimensions presented herein may be revised and updated periodically as projects are implemented and monitoring enables the Region to compare observed operating conditions with planned operating conditions such that the need for improvements and updates to the guidelines can be regularly assessed. Implicit in the implementation of these guidelines is the need for the project design team to complete detailed analysis of alternatives, decision making and documentation of both the analysis and decision making. Also implicit in the implementation of this guide is the need for the design team to properly and fully inform those responsible for policies which affect all aspects of a cost effective road design and the potential consequences of their decisions. Once this has been accomplished by the design team, the lead designer / engineer is responsible for giving final approval over any future revisions.



Section 2: Context



2.1 Context

The Region of Waterloo is located in Southwestern Ontario, along Highway 401 approximately one hour west of Toronto. It consists of the cities of Kitchener, Cambridge, and Waterloo, as well as the townships of Wellesley, Woolwich, Wilmot, and North Dumfries. The region spans approximately 1,390 square kilometres, with a census population of 507,096 (2011) and an estimated regional population of 553,000 (2011), including students and other temporary residents. In recent years, Waterloo has become one of the fastest growing regions in Southwestern Ontario, and is experiencing rapid expansion. This expansion is placing increased stress on existing transportation infrastructure and creating new demand for transportation and mass transit services.

Public transportation is provided by Grand River Transit, which was created out of the amalgamation of the former Cambridge Transit and Kitchener Transit Systems. The Region also owns and operates the Region of Waterloo International Airport, the 18th busiest airport in Canada, located near Breslau. The Region is also in the process of planning a rapid transit link system between the Cities of Waterloo, Kitchener, and Cambridge. Regional Council has approved the initiative.

2.2 Process

This project, initiated by the Region of Waterloo, has evolved through 18 months of discussion, evaluation and recommendation process. Working with the Steering Committee, Regional Staff, City Staff and Community Stakeholders, the design team has developed a series of urban design, and roadway elements and guidelines that should be considered within the roadway design process. The team also developed a decision making framework that sets priorities, determines site specific considerations and evaluates the overall role of the roadway in the larger context of the Region.

To ensure ongoing communications with Regional Staff an internal discussion forum (Wiki) was set up. This forum allowed for the ongoing testing and evaluation of ideas throughout the study process.

2.3 Relevant Planning Framework

The following is a summary of current Planning Policy regarding new development abutting / near Regional Transportation Corridors.

2.3.1 Regional Growth Management Strategy (RGMS)

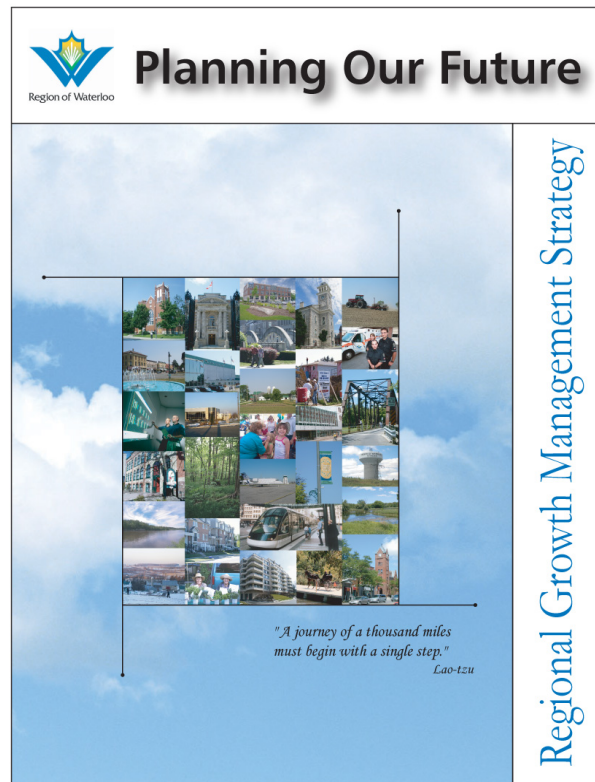
The Regional Growth Management Strategy is a long-term strategic framework which identifies where, when, and how future residential and employment growth will be accommodated. To effectively and efficiently accommodate this growth, the Region relied on a phased implementation approach, as well as a set of six Goals, Ongoing Initiatives and Immediate Actions.

A number of the actions required to satisfy these six broad goals are directly related to transportation corridors in the Region of Waterloo. These goals are summarized below:

- | | |
|----------------|---|
| Goal 1: | Enhance the Natural Environment |
| Goal 2: | Building Vibrant Urban Places |
| Goal 3: | Providing Greater Transportation Choice |
| Goal 4: | Protecting Our Countryside |
| Goal 5: | Fostering a Strong Economy |
| Goal 6: | Ensuring Overall Coordination and Communication |

To provide greater transportation choice, the Regional Growth Management Strategy recommended that:

- Project planning and business plan development provides for the implementation of a higher-order transit system along the Central Transit Corridor (CTC). A multi-stage financial plan is required to ensure feasibility of this initiative;



Regional Growth Management Strategy for the Region of Waterloo

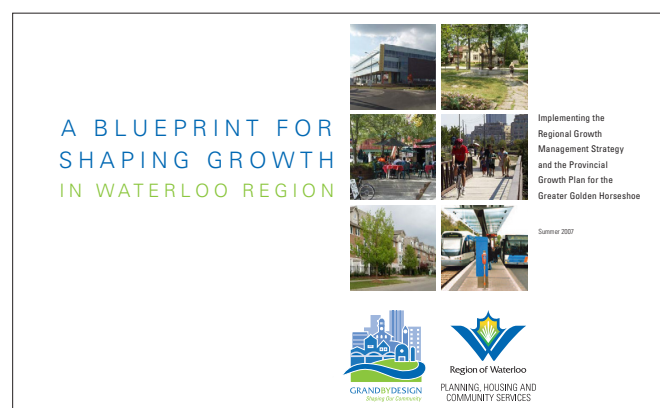
- The Regional Official Plan be amended to build on the directions of the RGMS, the Transportation Master Plan, and the Cycling Master Plan to establish policies which facilitate the increased use of transit and cycling facilities, and pedestrian movement through the development approval process; and
- Alternative forms of financing and various partnership arrangements with senior levels of government, area municipalities, private agencies, and corporations be investigated to fund major transportation infrastructure projects, including reurbanization within the CTC.

2.3.2 A Blueprint for Shaping Growth

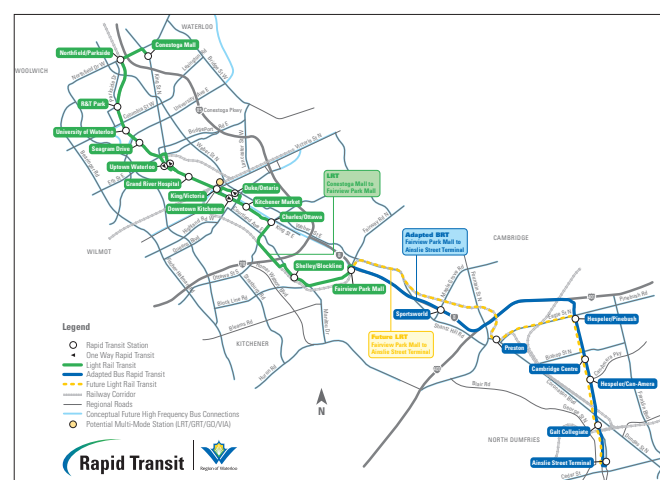
A Blueprint for Shaping Growth combines the priority directions of the RGMS and the Places to Grow, Growth Plan for the Greater Golden Horseshoe, to describe where and how the Region will reurbanize over the next 25 years to ensure a compact, vibrant, transit-supportive community. This document focuses on the relationship between land-use and transportation. The following summarizes the key findings as they relate to regional corridors in the Region of Waterloo.

2.3.2.1 Rapid Transit

In section 1, the Rapid Transit Initiative – a rapid transit system is proposed that connects Kitchener, Waterloo and Cambridge along the CTC - is outlined as a key element of the RGMS, RTMP and the Places to Grow Growth Plan for the Greater Golden Horseshoe. Operating on its own passageway and connecting with (improved) existing bus services, this initiative should ensure enhanced mobility and provide sustainable transportation options for the growing community.



A Blueprint for Shaping Growth in Waterloo Region



Rapid Transit Plan for the Region of Waterloo

2.3.2.2 Reurbanization

The document recognizes, and focuses on, four main areas for reurbanization in the built-up area, including:

- Urban Growth Centres ;
- Major Transit Station Areas (Rapid Transit Stations, Major Transit Stops);
- Reurbanization Corridors (Major Roads/Arterials, Cross Corridors, Rapid Transit Corridor); and
- Other Reurbanization Opportunities.

As part of this vision, and the goals for reurbanization, the existing transit system will be updated to increase accessibility to daily activities. This update envisions a rapid transit system along the CTC complemented by conventional bus service. Of the four development areas, reurbanization along Reurbanization Corridors and at Major Transit Station Areas is most likely to have a direct impact on regional corridors across the Region of Waterloo.

Reurbanization Corridors are areas where people live, work and play in mixed-use high density developments along major roads, arterials or rapid transit corridors that are serviced by high frequency transit systems. Combined with the rapid transit system envisioned for Kitchener, Waterloo and Cambridge, and improvements to the traditional transit service, there will be a variety of travel options available for residents.

2.3.3 Regional Transportation Master Plan (RTMP)

The Regional Transportation Master Plan (RTMP) is expected to be complete in early 2010. The RTMP is a regional policy document that complements and builds upon the Regional Growth Management Strategy (RGMS) and the Official Plan, and represents a “road map” for the regional transportation system to the year 2031.

The RTMP update focuses on transportation and planning strategies that will lead to a more sustainable transportation network for the Region. This, combined with supporting policies, will provide greater mobility choice, and facilitate a reduction in single occupant auto use and an increase in transit use, walking and cycling.

A new RTMP for the Region of Waterloo will promote sustainable practices, including integrated land use and transportation and planning, and cross modal planning. The plan will also consider the requirements of both the rural and urban areas within the Region. There is a recognized need for a new plan to assist the Region, and its constituent municipalities, in moving forward with its major transit initiatives, including the integration of higher order transit in the CTC.

Given a broader community focus on the desire for travel modes that are convenient and competitive with the automobile, including walking, cycling, and transit, the RTMP will identify future system options that reflect a network that is oriented to support greater levels of transit service and usage. It is intended that the new RTMP will recommend a transit-oriented network to complement the existing roadway infrastructure. This will result in a need to assess how existing and future transportation facilities

are planned, constructed, operated and maintained. The Region of Waterloo Transportation Corridor Design Guidelines must build on the regional transportation priorities articulated in the RTMP and the RGMS. In this regard, design guidelines and policies must reflect a desire to accommodate all modes of transportation within each individual corridor and focus on facilitating more competitive movement of people by transit, walking and cycling. In addition, future maintenance and operational practices (snow clearing, street sweeping, etc.) must also reflect a desire to have pedestrian, cycling and transit facilities that can be accessed on a year round basis, where appropriate and warranted by demand.

In concert with the Regional Official Plan, the RGMS and the work being undertaken as part of the RTMP, the Transportation Corridor Design Guidelines provides guidance for the development of major transportation corridors in the Region of Waterloo. Communities that are responsive to the needs of all users from both a design and operational perspective, in the long run, are better able to attract jobs and investment. The guidelines in this document identify and protect Regional interests while promoting sound infrastructure planning, environmental sustainability, economic development and safe corridors and communities.

It is intended that the Transportation Corridor Design Guidelines assist in facilitating the achievement of compact, attractive, transit-oriented and pedestrian friendly communities as envisioned in the RTMP work published to date and other regional policy documents. These guidelines will act as a vehicle for coordinating decision-making on land-use planning, urban development, and system operating strategies, including maintenance practices, transportation planning and economic development.

2.3.4 TAC Geometric Design Guide for Canadian Roads

The Transportation Association of Canada is a national association with a mission to promote the provision of safe, secure, efficient, effective and environmentally and financially sustainable transportation services in support of Canada's social and economic goals.

In Canada as a whole, TAC has a primary focus on roadways and their strategic linkages and inter-relationships with other components of the transportation system. In urban areas, TAC's primary focus is on the movement of people, goods and services and its relationship with land use patterns.

The TAC Geometric Design Guide for Canadian Roads provide information to assist designers with the decision making process for selecting the appropriate combination of features, dimensions and materials for a given design. The guidelines in this document gave consideration to the TAC Geometric Design Guide for Canadian Roads in the development of a range in dimensions for both the boulevard elements and street elements for the alternative arterial roadway classifications.



2.3.5 Accessibility for Ontarians with Disabilities Act (2005)

The purpose of the Accessibility for Ontarians with Disabilities Act is to improve opportunities for persons with disabilities and to provide for their involvement in the identification, removal and prevention of barriers to their full participation in the life of the Province of Ontario. The Act replaced the Ontarians with Disabilities Act, in 2005.

2.3.6 Region of Waterloo: Regional Official Plan

On June 16, 2009, Regional Council adopted the new Regional Official Plan (Regional Official Plan), which established the planning policy framework that the Area Municipalities are to conform with. The new Regional Official Plan is the Region's guiding document for directing growth and change up to the year 2029. The Regional Official Plan represents a fundamental shift in shaping the Region of Waterloo towards a more balanced community structure, building from a strong, long standing tradition of innovative planning and growth management. Furthermore, the Regional Official Plan specifically identifies the transit network; existing, planned and proposed roads and corridors; and Regional Cycling Routes. The document contains policies for an integrated, accessible and safe multi-modal transportation system.

The guidelines contained within this document are designed expressly to build upon the policies and priorities set out in the Regional Official Plan. This includes 5.A.2, which requires the Region, in collaboration with Area Municipalities and community stakeholders, to prepare and regularly update the Regional Transportation Corridor Design Implementation Guidelines. In order to ensure



Regional Official Plan for the Region of Waterloo

full conformity with these priorities, the Regional Official Plan should always be referred to at the beginning of and throughout the transportation corridor design process. Area Municipalities are in the process of updating their Official Plans to conform with Regional Policy. The following sections summarize the existing policy framework in the Area Official Plans.

2.3.7 Municipal Documents

During the first phase of any road design project, the municipal plans and design guidelines are an important tool in informing the character of the road and the adjacent land uses. This section overviews the existing municipal plans.

2.3.7.1 City of Cambridge: Official Plan (July 1999)

The Plan contains policies which require background / supporting studies to be submitted with development applications that may impact Regional Transportation Corridors. Specifically, development proposals should satisfy the Region of Waterloo “that the capacity of the roads and intersections required (will) accommodate the vehicular traffic likely to be generated.” (Paragraph 13.3.1.7.2 (c) (iii))

Where a new direct access or a new road entrance onto a corridor is proposed, the development proposal should comply with the Regional Transportation Corridor Access By-law and related policies or the Proponent should ensure that the appropriate authority has issued the required road entrance permit.

CITY OF CAMBRIDGE OFFICIAL PLAN



January 2004 Consolidation

Official Plan for the City of Cambridge

2.3.7.2 City of Kitchener: Official Plan (October 2008 Consolidation)

The Plan contains extensive policies and guidance regarding Transportation issues, including a commitment to working with the Region of Waterloo to realize development opportunities in close proximity to Regional Transportation Corridors.

General guidance regarding all new development adjacent to these roads is set out in Policy 8.3.4, which states that the City, in co-operation with the Region of Waterloo, will adopt standards which may include: maximum setbacks; 250m intersection spacing to encourage transit use and walking; and regulation of the number of new access points onto Regional Transportation Corridors to preserve their traffic-carrying capacity. Finally, efforts will be made to discourage the location of elementary schools adjacent to these roads.

2.3.7.3 City of Waterloo: Official Plan (April 2004)

The Official Plan outlines the range of complementary uses that may be used to serve a wider community than just a typical residential community adjacent to Regional Transportation Corridors. The objective of such policies is to encourage mixed-use areas with good transportation access. These uses include secondary schools, convenience commercial, institutional uses such as nursing homes, day care centres and spiritual uses, professional offices, medical clinics, automobile service stations, public libraries and community centres. (Paragraph 3.1.2.6)

Regarding the residential component of such areas, paragraph 3.1.2.7 sets out four criteria to be satisfied in development proposals for multiple unit residential dwellings adjacent to Regional Roads:

- Traffic to be directed to Regional Roads to minimize movement into lower areas;

- Close proximity to a concentration of existing/planned commercial/institutional uses or major employment centres;
- Proximity/access to existing/planned public transport routes; and
- Proximity/access to existing/planned parks, open spaces or recreation facilities.

Paragraph 3.1.2.8 deals with the issue of building height and confirms that the “maximum height of any building shall not exceed 12 storeys.” However, in designated areas of High Density Residential uses, which should have direct access to Regional or City Arterial or Collector Roads (Paragraph 3.1.5.1), the maximum height of any building shall be 25 storeys. In such cases the maximum net density should not exceed 250 units per hectare and the minimum net density shall be 100 units per hectare. Finally, in conformity with the Regional requirement for full background / supporting studies, the Plan states that Transportation Facilities Impact Studies must be completed by the proponent and approved by the Region of Waterloo. OPA Sections 54 and 72 should be specifically reviewed relative to the design of new and existing transportation corridors.



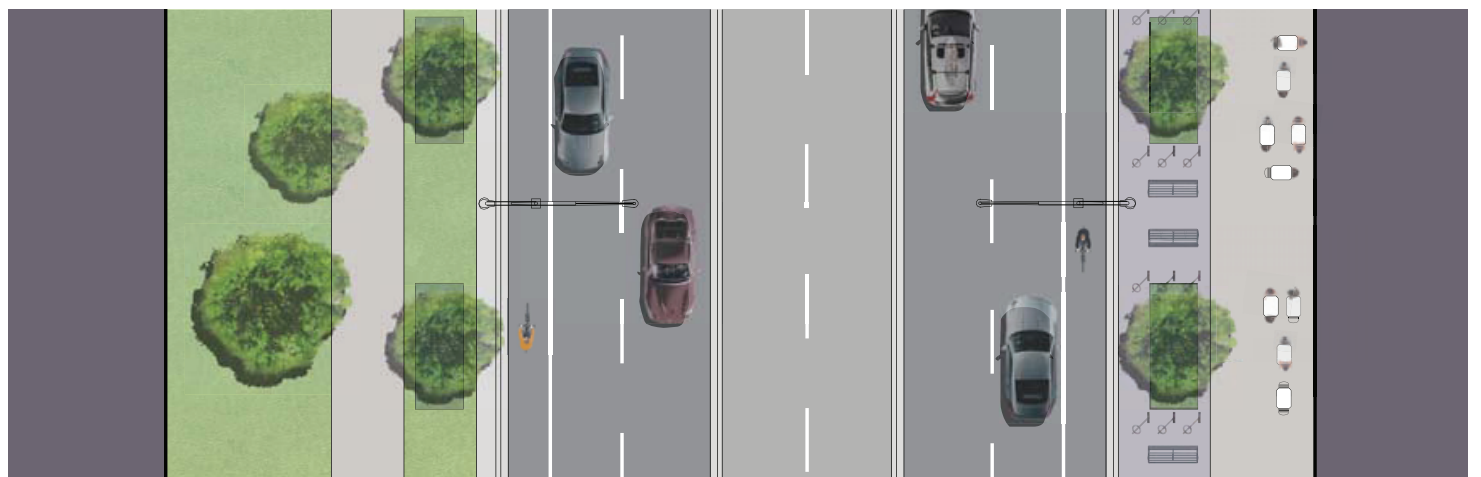
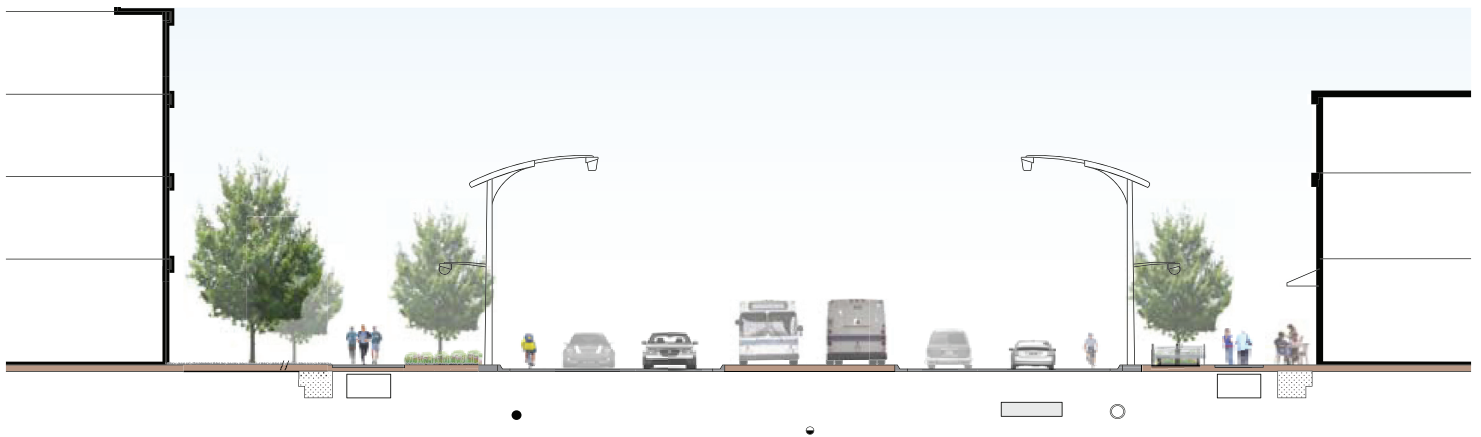
**OFFICIAL PLAN
OF THE
CITY OF WATERLOO**

OFFICE CONSOLIDATION
(Updated as of April 30, 2004)

As approved June 28, 1990, and subsequently amended.

Official Plan for the City of Waterloo

Section 3: Classification



- Legend**
- Storm Sewer
 - Water Main
 - Sanitary Sewer
 - Gas Main
 - District Energy Distribution
 - Duct Banks
 - Common Utility Trench
 - Gas
 - Telecommunication
 - Street Lighting
 - Secondary Hydro
 - Primary Hydro

Boulevard Elements	Street Elements	Boulevard Elements
Landscape Buffer Area Landscaping Drainage Screening Buffering Connections to Multi-Use Trail and Sidewalks	Pedestrian Clearway: Multi-Use Trail Multi-use Trail Trail Signage Barrier Free	Street Furniture and Landscape Zone Street Trees Landscaping Site Furnishings Drainage Lighting Bus Shelters
	Cycling Lane Buffer Zone Curb and Gutter Splash Strip Paved Shoulder Gravel Shoulder Utilities Cycling Signage Street Signage	
	Travel Lanes Buffer Zone Curb and Gutter Splash Strip Paved Shoulder Gravel Shoulder Utilities Cycling Signage Street Signage	
	Transit Priority Lanes Buffer Zone Curb and Gutter Splash Strip Paved Shoulder Gravel Shoulder Utilities Cycling Signage Street Signage	
	Travel Lanes Buffer Zone Curb and Gutter Splash Strip Paved Shoulder Gravel Shoulder Utilities Cycling Signage Street Signage	
	Cycling Lane Buffer Zone Curb and Gutter Splash Strip Paved Shoulder Gravel Shoulder Utilities Cycling Signage Street Signage	
	Street Furniture and Landscape Zone Street Trees Landscaping Site Furnishings Drainage Public Art Bus Shelters	
	Landscape Transition Zone Patios Signage Landscaping Barrier Free Public Art Bus Shelters	
	Pedestrian Clearway: Sidewalk Barrier Free	

The section above illustrates the corridor elements that make up a Regional Transportation Corridor. In the individual roadway classification, each of these elements are considered in a context that is specific to the type of Regional Transportation Corridor being described.

3.1 Rationale

A functional road classification system establishes a “hierarchy” of roads that provides for a gradation in service from access to movement. In a functional system, each type of road serves a distinct stage of the trip making process, as shown in Figure 1 on the following page. The concept is premised on the principle that roads do not operate independently, but are part of an interconnected system, with each type of road performing a particular function in moving people throughout the network and in providing access to adjacent lands. The road system operates most efficiently and safely when each type of facility is designed and managed to serve a particular trip stage consistent with its position in the hierarchy. When a roadway attempts to prioritize both movement and access, neither function is well served.

A defined road hierarchy is essential in meeting the mobility needs of communities, but just as importantly, it can help protect against the adverse impacts of conflicting transportation roles. While some roads should carry higher volumes of traffic at higher speeds, others need to be designed to accommodate lower volumes at lower speeds. An effective road hierarchy will assist in having efficient routes for traffic can have associated decreases in the time and cost of transporting people and goods. An effective road hierarchy can also positively affect quality of life, as it can support and encourage development in locations where it is appropriate and beneficial to the surrounding community.

The key objective of the Region’s new road classification system is to ensure the orderly grouping of roadways in a framework around which the Region and its stakeholders can plan and implement transportation projects, and effectively and safely manage their road systems. An effective classification system allows for good urban design, the co-ordination of land use and transportation,

and helps in establishing appropriate right-of-way widths, roadway and boulevard design standards, traffic operations guidelines, and maintenance operations practices. It can also influence:

- The character of a community;
- Auto-dependency or the use of non-car modes such as walking, cycling and public transit;
- Access to facilities;
- Opportunities for locally-based business and employment; and
- The potential for social interaction and community formation.

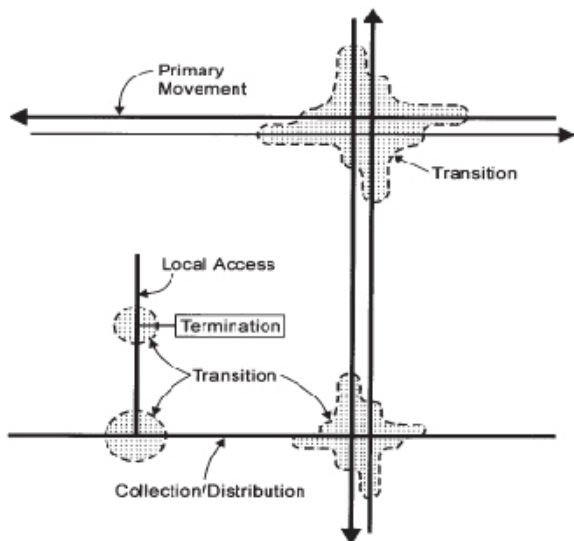
The outcome of a properly classified road system is a network that safely and efficiently moves people and goods, and preserves the communities that exist between primary traffic corridors. A well-defined hierarchy of road types also assists in:

- Planning for the provision of a variety of modes and functions within road corridors;
- Identifying the effects of development in and on surrounding areas and roadways within the hierarchy, prior to making decisions;
- Designing roadways that have regard for accessibility continuity, connectivity, efficiency, amenity and safety;
- Simplifying traffic control measures;
- Targeting roadway design to a specific range of traffic types and volumes, eliminating the need to “over-design” lower class roads, as major traffic accommodated on higher order facilities;
- Providing road users and abutting communities a clearer understanding of the intended function and characteristics of particular roads; and
- Reducing overall network costs.

3.2 Recommendations

The research phase of the study determined that most road authorities generally limited the classification of their arterial roadways to two categories, one being “rural” and the second being “urban” followed by sub-categories comprised of “minor” and “major”. The means of determining where a specific road would fall within the categories of rural / urban and sub-categories of minor / major is generally achieved by comparing the existing / planned operating conditions of the Regional Transportation Corridor with design criteria such as traffic service objective, land use vision / access, travel speed, goods movement, connectivity, transit, cycling and pedestrian provisions, right-of-way width, traffic volume, flow characteristics, parking, minimum intersection spacing, etc.

During the background research phase of the project, the team investigated whether road authorities integrated their roadway classification criteria with their urban design guidelines. Based on the sampling of road authorities it appears that this methodology is just beginning to be adopted. Generally, the urban design guidelines of a road authority focused on improvements to specific locations within an urban area in lieu of providing design guidelines for the various roadway classifications within the jurisdiction of the road authority. The one road authority from our sampling that did integrate their Urban Design Guidelines with their arterial road classifications was the City of Ottawa. This integrated system seems to better facilitate potential conflicts between the urban design and functional elements of the roadway. A summary of the background research on the integration of Roadway Classification Systems and urban design guidelines are briefly summarised in Appendix A.



Hierarchy of Movement in a Functional Circulation System. (Source – Transportation and Land Development, Institute of Transportation Engineers, 2002, p. 4-2)

Given the diversity of Regional Transportation Corridors, it was decided to implement a classification system that is descriptive in nature and to create combined road and boulevard design guidelines. Based on the research completed to date it is recommended that a descriptive classification system similar to that applied by the Region of York and the City of Ottawa be implemented. The preferred range of widths identified in this section for roadway and boulevard elements is intended to be flexible to changing conditions and priorities. The proposed descriptive classifications are as specified in the facing page:

Recommended Roadway Classification System

Rural Arterial Roadways

Rural Connector

Rural Village - Main Street

Neighbourhood Connector - Main Street

Urban Arterial Roadways

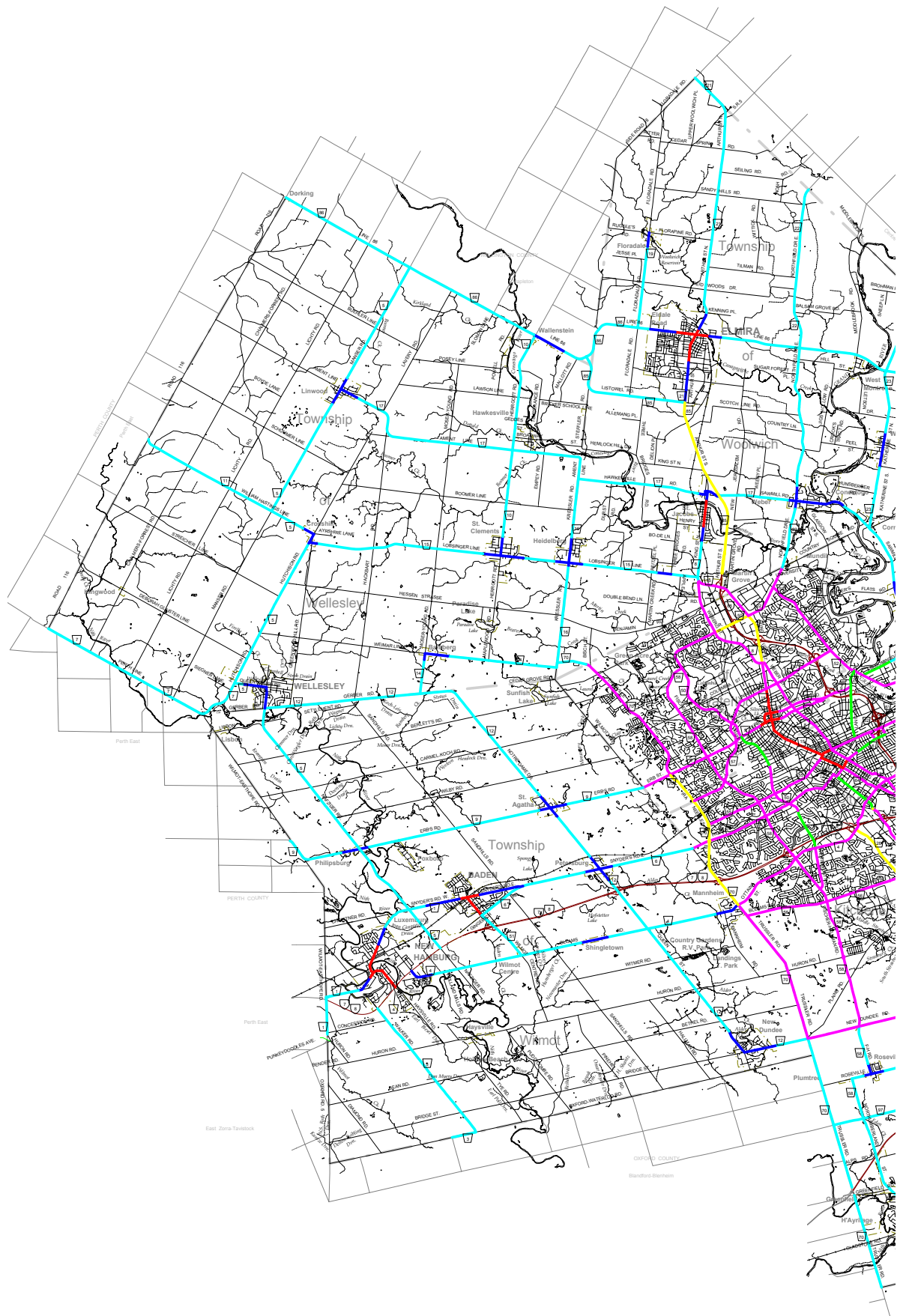
Expressway

Community Connector

Neighbourhood Connector - Avenue

Neighbourhood Connector - Main Street

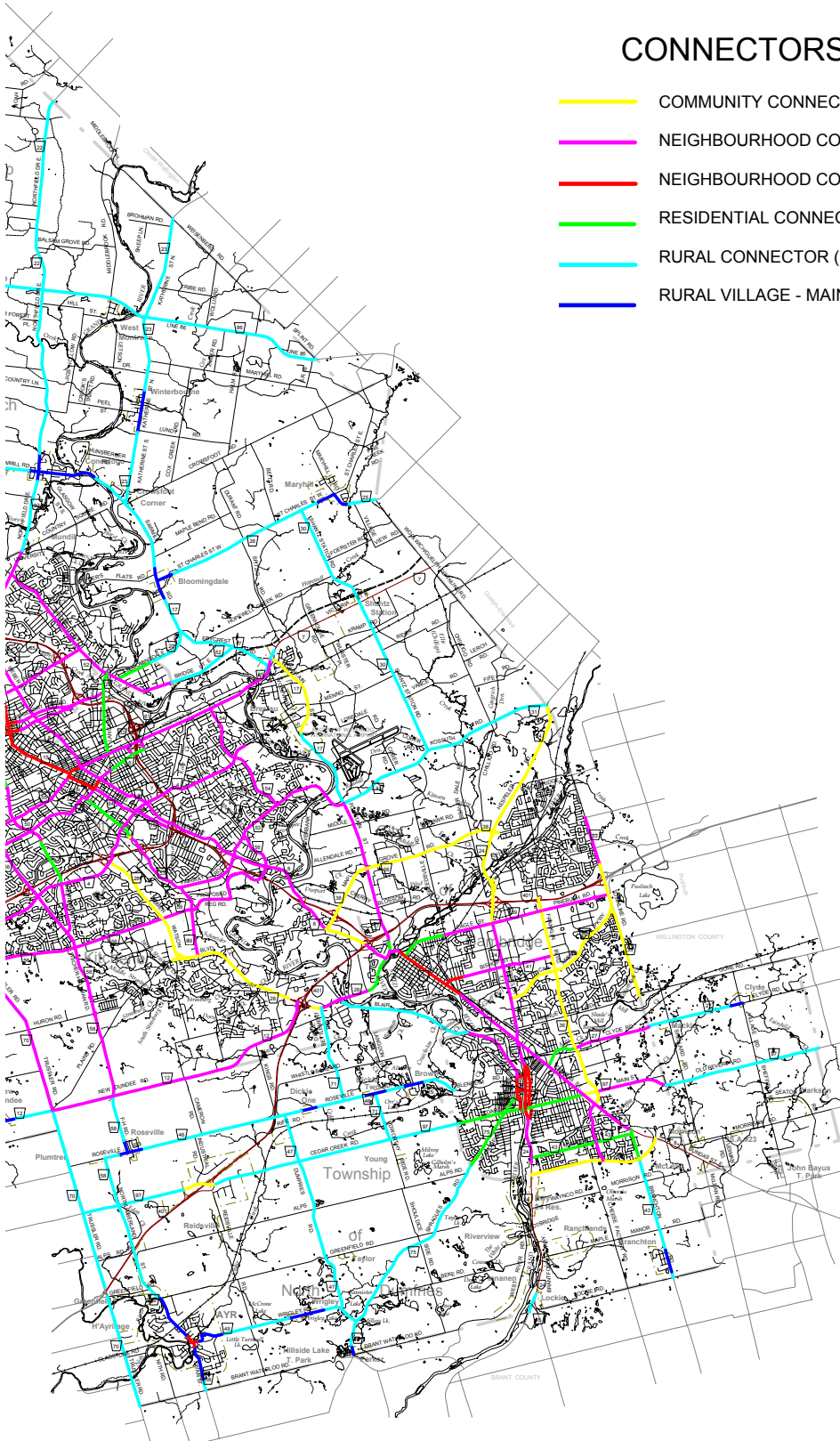
Residential Connector



Draft Connector Classification Map for the Region of Waterloo

CONNECTORS

- COMMUNITY CONNECTOR (COM)
- NEIGHBOURHOOD CONNECTOR - AVENUE (NAV)
- NEIGHBOURHOOD CONNECTOR - MAIN ST (NMS)
- RESIDENTIAL CONNECTOR (RES)
- RURAL CONNECTOR (RR)
- RURAL VILLAGE - MAIN ST (RRMS)



3.3 Community Connector

3.3.1 Introduction

Community Connectors connect to 400 series highways, Conestoga Parkway (expressway), other Community Connectors, Neighbourhood Connectors, and Rural Connectors. They connect communities within the Region and incorporate a high degree of access control. Community Connectors focus on moving vehicles and can be considered for higher order transit corridors.

Examples include Homer Watson Road (from Ottawa Street South to Highway 401), Northfield Drive West (from Weber Street to King Street), and Franklin Boulevard (from Dundas Street to Pinebush Road).

3.3.2 Defining Characteristics

Community Connectors connect to 400 series highways, Conestoga Parkway (expressway), other Community Connectors, Neighbourhood Connectors, and Rural Connectors. They cross several communities within

the Region and incorporate a high degree of access control. Community Connectors focus on moving vehicles and can be considered for higher order transit corridors. Facilities for active transportation (bicycles and pedestrians) are accommodated within the corridor however; consideration should be given to separating the facilities from the roadway. Community Connectors typically incorporate wide, landscaped centre medians.

3.3.3 Key Design Opportunities & Challenges

Typically the adjacent land uses for Community Connectors are low density and are not street related. This poses significant challenges in creating pedestrian and cyclist friendly streets. Tree planting, pedestrian clearways, multi-use trails, crosswalks and the treatment of transit stops become critical in supporting alternate modes including transit.



Examples of a Community Connector include portions of Homer Watson Boulevard, Northfield Drive West, and Franklin Boulevard

3.3.4 Streetscape Design and Operational Criteria

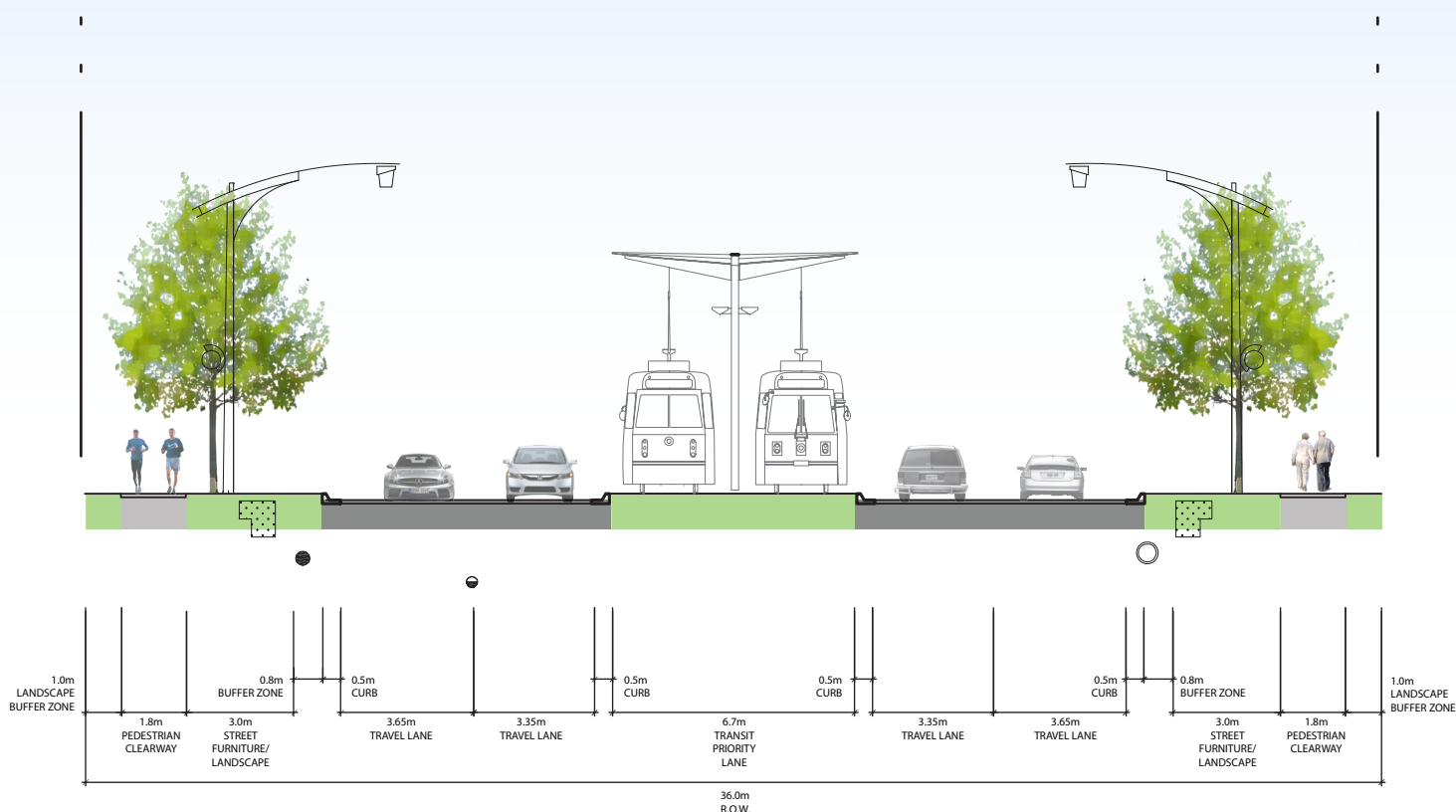
People Moving Capacity	High people moving capacity (autos and commercial vehicles, transit vehicles in mixed traffic or dedicated ROW).
Active Transportation	Active transportation activity accommodated (utilitarian).
Pedestrian Provisions	Pedestrian infrastructure to occur on both sides of the street. Design of features to provide access to transit stops, and ensure linkages to surrounding communities.
Cycling Provisions	Cycling facilities to be provided in keeping with Active Transportation Master Plan.
Transit	Accommodate high order transit services and high occupancy vehicle lanes.
Land Use	Open Space, Institutional, Industrial, Low Rise Residential, Mixed Use, Primary Node.
Existing Adjacent Land Use Context	Adjacent land uses incorporate large setbacks. Development oriented towards internal roadway system and typically does not face or address the street.
Planned Adjacent Land Uses & Access	Accommodate appropriate land uses with a goal to minimize private access or combined access via municipal roads for vehicles. Access for cyclists and pedestrians to provide linkages to transit (maximum walking distance 400m), surrounding communities and key destinations.
Adjacent (existing and proposed) Building Scale & Orientation	Mixture of street-oriented built form of varied size. Increase of density and height adjacent to transit nodes and hubs.
Views	Landscaped median, buildings set back on spacious landscaped lots.
Boulevard Treatment	Boulevard treatment should reflect the street's primary function of moving vehicles. Streetscape / landscaping to provide buffer for pedestrians, cyclists and adjacent land uses and provide visual interest for passing motorists. The boulevard should have an urban cross section including sidewalks separated from roadway pavement, landscape buffers, street trees and appropriate pedestrian and transit amenities.

ROW Width	To be determined by context sensitive design process an ideal right of way width for a Community Connectors would be 36 metres
Auto Travel Speeds	60 to 70 km/h (Posted Speed)
Access	High degree of private access control for vehicles and cyclists. Pedestrian access is not controlled by a fence or other means except where safety is an issue.
Median	Access Control, Turn Lane Protection, Pedestrian Refuge
Connectivity/Continuity	Generally continuous across several communities located both within and outside the Region and connecting to Municipal arterial and collector type roadways as well as provincial series highways with a high degree of access control. Private access is located a minimum of 215m apart.
Crosswalks	Pedestrian crossings formalized only as controlled crosswalks.
Parking	Prohibited
Minimum Intersection Spacing (m)	Signalized intersection spacing to reflect transportation priority of the street by ensuring optimal traffic flows. Preferable spacing is 400m and minimum spacing is 215m, however, spacing should be confirmed by local study. Spacing of unsignalized intersections to be determined through analysis of local operating conditions.
Utilities	Utilities are as shown in the Recommended Section and Plan

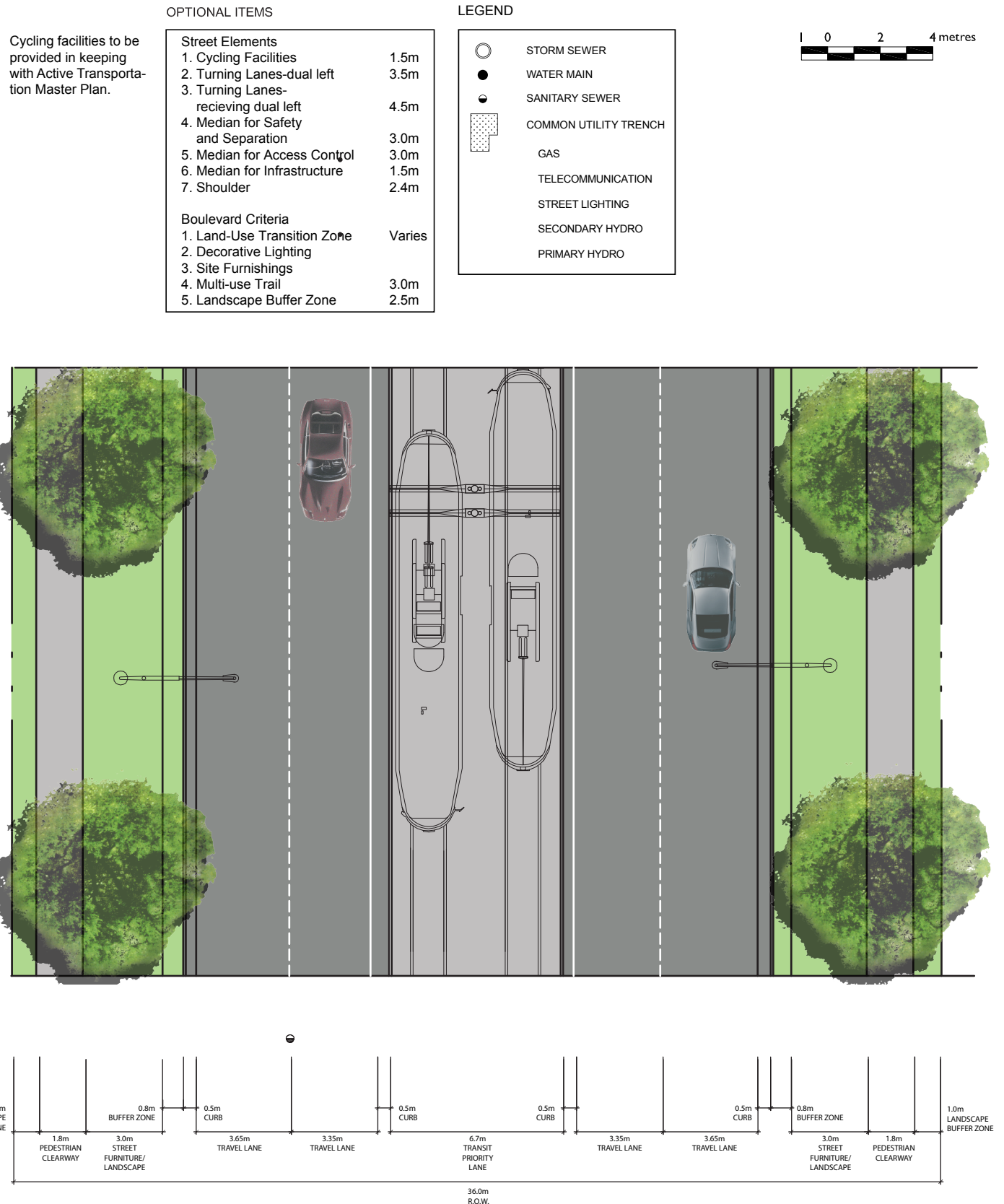
3.3.5 Recommended Section (Community Connector - Dedicated Transit Lanes)

The ideal section and plan were developed by incorporating all of the streetscape and boulevard elements that were determined to be important or necessary. The optional items are identified on the facing page. A preferred right of way width is identified but if space allows the appropriate optional items should be considered.

For additional information on the boulevard, roadway and general characteristics of Transportation Corridors, please refer to Section 4.0 Design Guidelines.



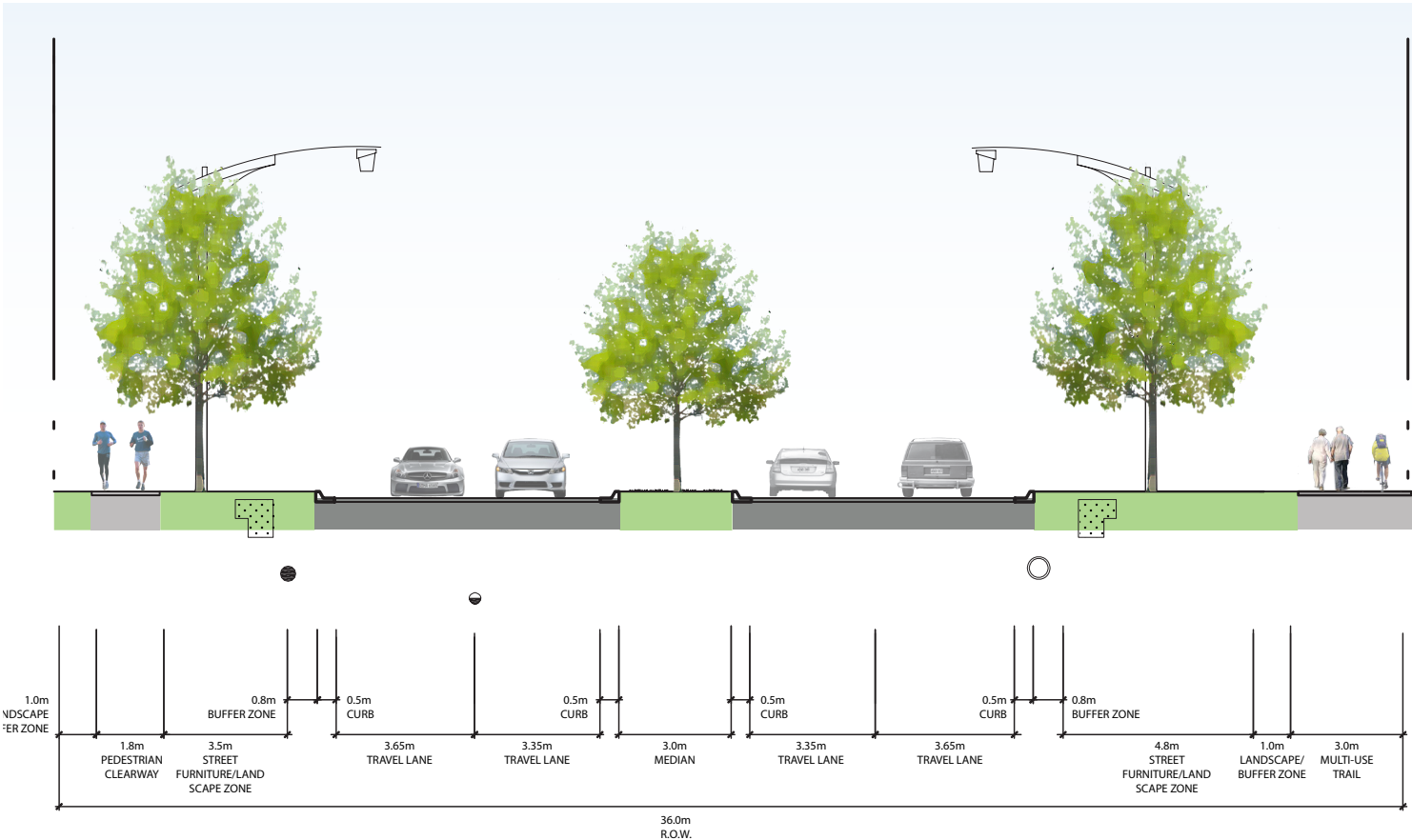
3.3.6 Recommended Plan (Community Connector - Dedicated Transit Lanes)



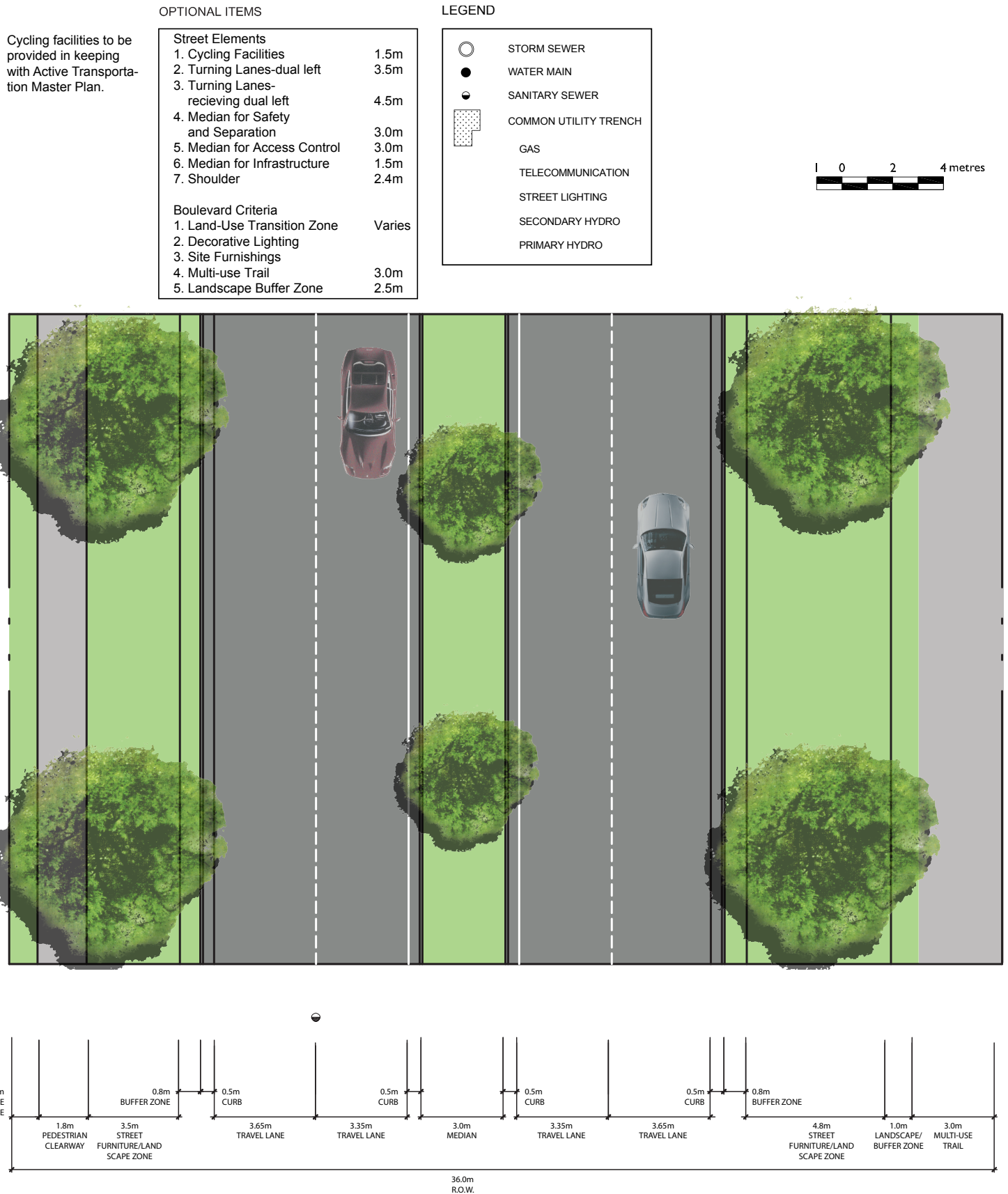
3.3.7 Recommended Section (Community Connector - Landscaped Boulevard)

The ideal section and plan were developed by incorporating all of the streetscape and boulevard elements that were determined to be important or necessary. The optional items are identified on the facing page. A preferred right of way width is identified but if space allows the appropriate optional items should be considered.

For additional information on the boulevard, roadway and general characteristics of Transportation Corridors, please refer to Section 4.0 Design Guidelines.



3.3.8 Recommended Plan (Community Connector - Landscaped Boulevard)



3.4 Neighbourhood Connector

Neighbourhood Connectors are typically continuous across several communities/neighbourhoods within the Region. Neighbourhood Connectors balance active transportation (bicycles and pedestrians), transit and vehicle movement, providing a higher level of priority (design and comfort) for pedestrians, cyclists and transit users. Neighbourhood Connectors can be broken down into two sub categories - Avenues and Main Streets. The descriptions, which follow, will address each in detail.

3.4.1 Avenue

3.4.1.1 Introduction

Neighbourhood Connector: Avenues are roads designed to support active transportation (including walking and cycling) and transit. These roads are good candidates for transit priority lanes. They can prioritize vehicular traffic, but need to support a mix of adjacent land uses that typically require individual access to and from the road.

Examples of a Neighbourhood Connector: Avenue include Hespeler Road (Pinebush Road to Dundas Street), Weber Street (from Fairway Road to Ottawa Street N), and Victoria Street (Fountain Street to Weber Street).

3.4.1.2 Defining Characteristics

Avenues are located in existing built up areas with adjacent development facing the street but set back to incorporate large front yards and front yard parking, typical of medium to large format commercial, shopping malls, community facilities and low rise neighbourhoods. Avenues also include road ways with back-lotted residential. Avenues have larger right-of-way's than main streets and include many opportunities for re-urbanization. The designs for Community Connectors typically incorporate wide, landscaped centre medians.

3.4.1.3 Key Design Opportunities & Challenges

Avenues will serve an important future role in the Region. They represent roadways that can and should transition to transit supportive and pedestrian friendly streets. The adjacent lands often have the potential to evolve over the coming years. How these areas evolve will depend greatly on the design and character of the street to which they are adjacent. If the street prioritizes transit and active modes of transportation, it is likely that future development will support the priority of the street. If the evolution of the street fails to guide development then existing building typologies will remain.



Examples of a Neighbourhood Connector: Avenue include portions of Hespeler Road, Fischer-Hallman Road, Weber Street (shown above), and Victoria Street.

3.4.1.4 Streetscape Design and Operational Criteria

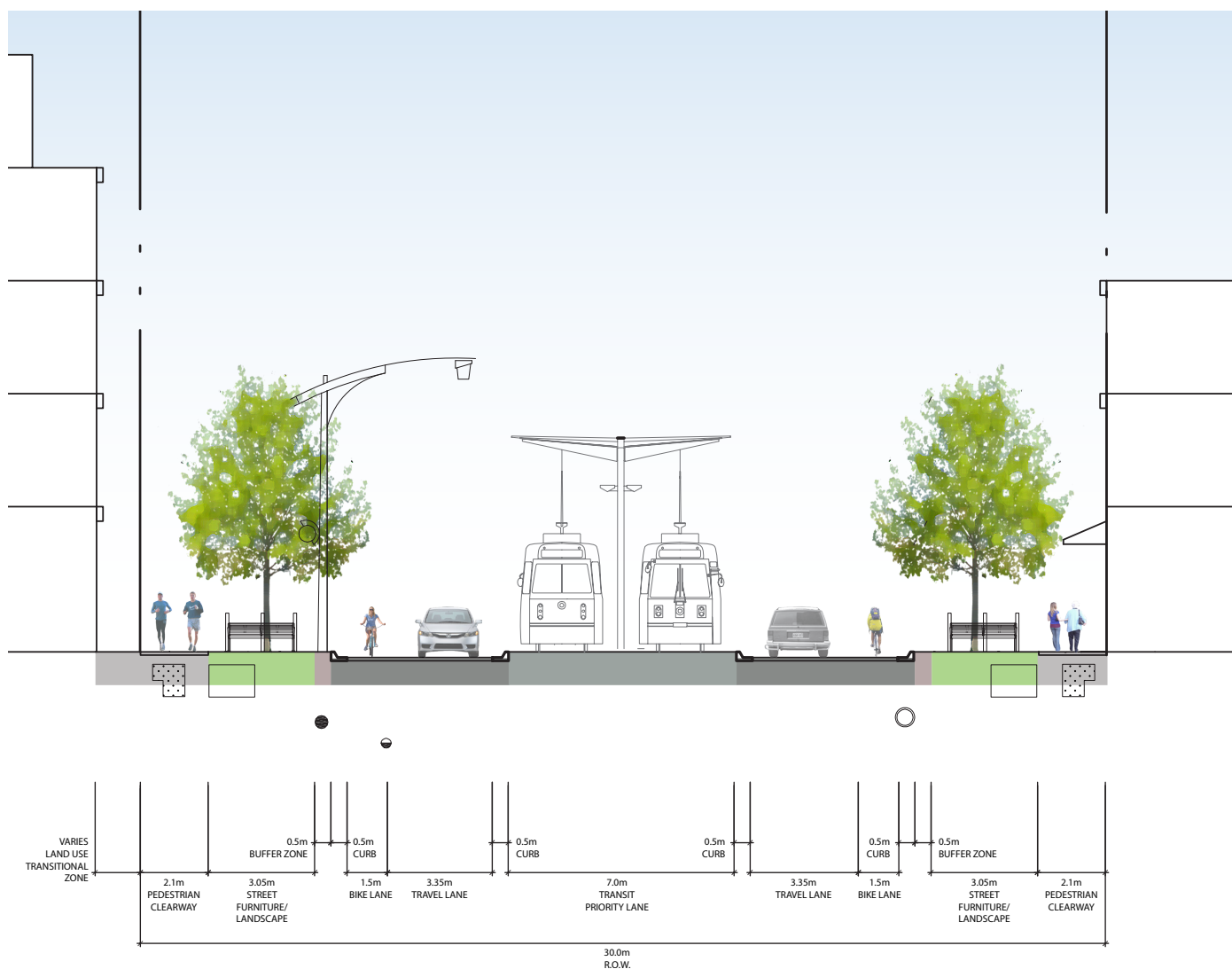
People Moving Capacity	Medium to high people moving capacity (autos and commercial vehicles, transit vehicles in mixed traffic or dedicated ROW). High people moving capacity where HOT or RT provided.
Active Transportation	Significant active transportation activity accommodated (utilitarian and local).
Pedestrian Provisions	Pedestrian infrastructure to occur on both sides of the street. Design of features to provide access to transit stops and adjacent street related development.
Cycling Provisions	Cycling facilities to be provided in keeping with Active Transportation Master Plan.
Transit	Transit supportive and transit priority with connection to higher order service. Transit priority where BRT or LRT provided.
Land Use	Mixed Use, Planned Commercial Campus, Commercial, Low Density Residential, High Density Residential.
Existing Adjacent Land Use Context	Adjacent land uses face the street but are set back to incorporate large front yards and front yard parking. Prevalent land uses include medium and large format commercial, shopping malls, community facilities and low rise neighbourhoods with back-lotted residential.
Planned Adjacent Land Uses & Access	Accommodate existing land uses with shared or combined private access and incremental / progressive access control for vehicles. Access for cyclists and pedestrians to provide linkages to transit (maximum walking distance 400m), surrounding communities and key destinations.
Adjacent (existing and proposed) Building Scale & Orientation	Mixture of street-oriented built form of varied size. Increase of density and height adjacent to transit nodes and HUBs.
Views	Dense “urban” main street fabric with buildings close to the street, transit facilities, street trees landscaping and pedestrian oriented.

Boulevard Treatment	Boulevard treatment should reflect the street's active transportation priority. Streetscaping / landscaping should provide features appropriate for pedestrian and cycling environments adjacent to street related development. The boulevard should have an urban cross section including wide sidewalks, street trees, landscaping, pedestrian, transit amenities and public art.
ROW Width	To be determined by context sensitive design process an ideal right of way width for a Neighbourhood Connector: avenue would be 30 metres
Auto Travel Speeds	50-60 km/h (Posted Speed)
Access	Access control measures are directly related to street movement priority e.g. where vehicular movement is a priority then access is minimized or prohibited. Pedestrian access is not controlled by a fence or other means except where safety is an issue.
Median	Access Control, Turn Lane Protection, Pedestrian Refuge, Traffic Calming, Special Character.
Connectivity/Continuity	Could be continuous across several communities and connecting to Municipal arterial and collector roadways with access control that is directly related to street movement priorities. Permit private access generally located 80m apart with signalized intersections located a minimum of 215m apart.
Crosswalks	Pedestrian crossings formalized only as controlled crosswalks.
Parking	Parking may be permitted except where people movement is impacted or safety is an issue.
Minimum Intersection Spacing (m)	Signalized intersection spacing should ensure appropriate access to adjacent land uses and reinforce a walkable environment. Preferable spacing is 400m and minimum spacing is 215m for storage length and tapering, however, spacing should be confirmed by local study. Spacing of unsignalized intersections to be determined through analysis of local operating conditions.
Utilities	Utilities are as shown in the Recommended Section and Plan

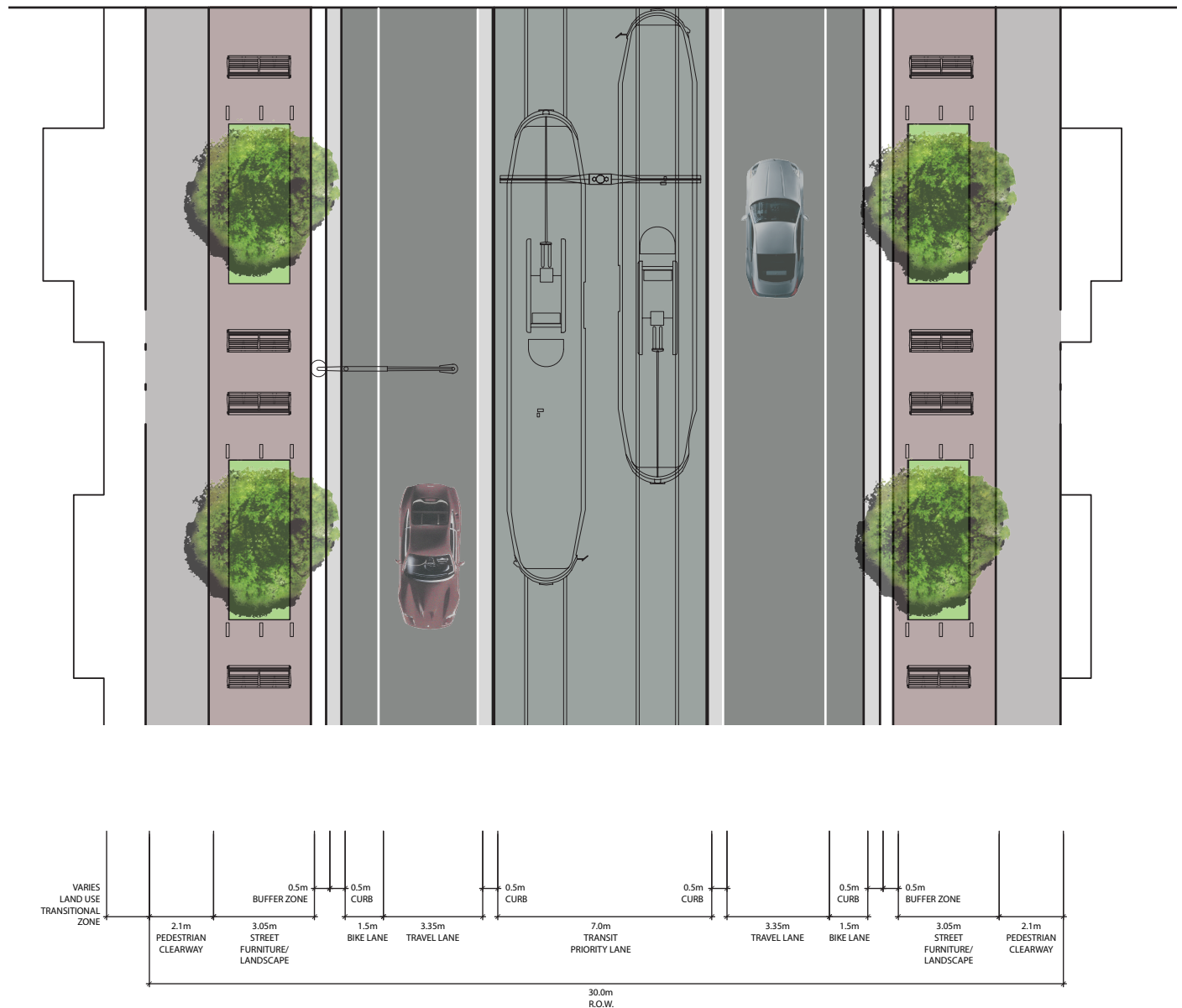
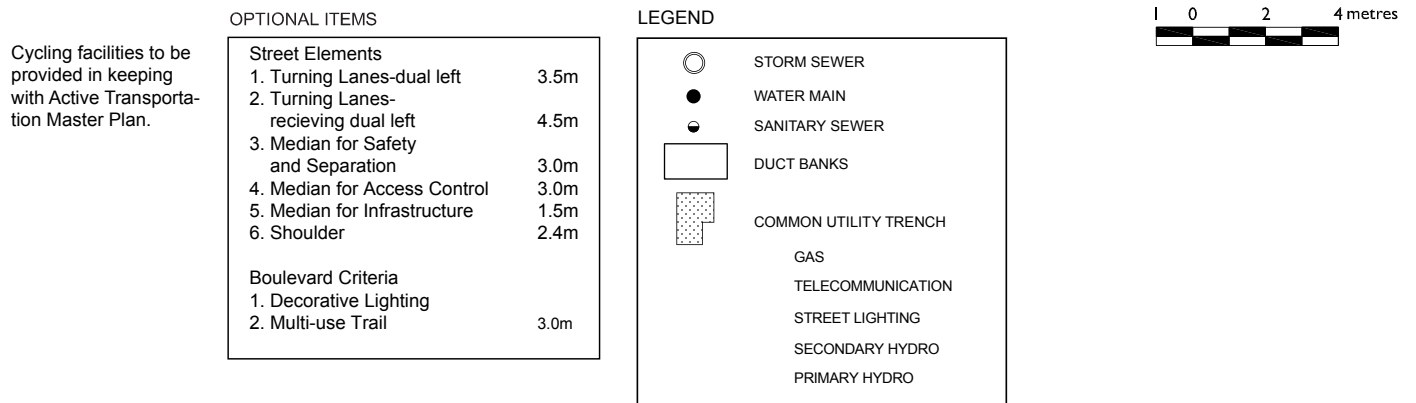
3.4.1.5 Recommended Section (Neighbourhood Connector - Future Avenue Condition)

The ideal section and plan were developed by incorporating all of the streetscape and boulevard elements that were determined to be important or necessary. The optional items are identified on the facing page. A preferred right of way width is identified but if space allows the appropriate optional items should be considered. Optional items can also be included if it is determined that a necessary or important item is not required, e.g. the Transit Priority Lane.

For additional information on the boulevard, roadway and general characteristics of Transportation Corridors, please refer to Section 4.0 Design Guidelines.



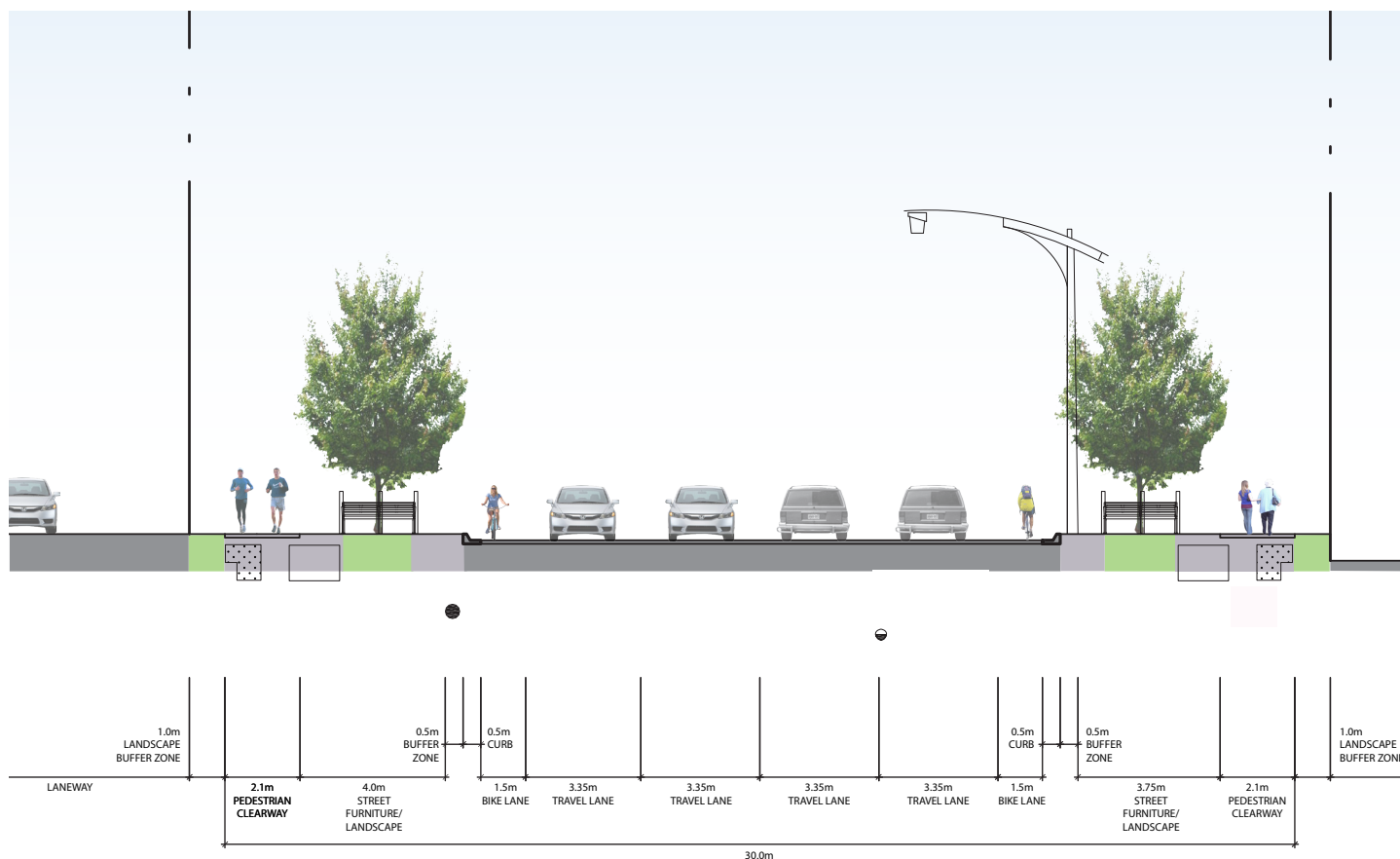
3.4.1.6 Recommended Plan (Neighbourhood Connector - Future Avenue Condition)



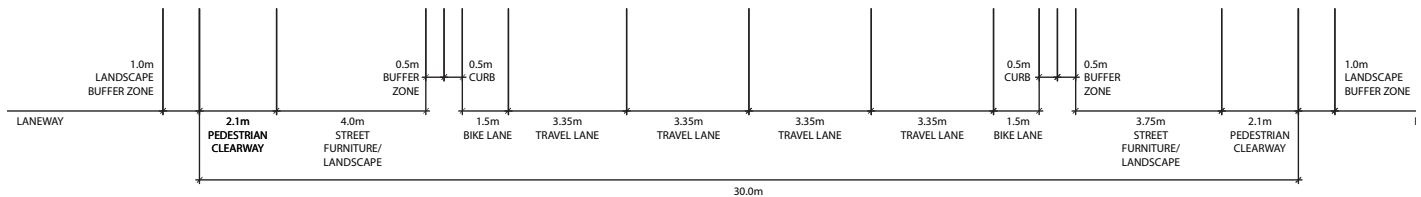
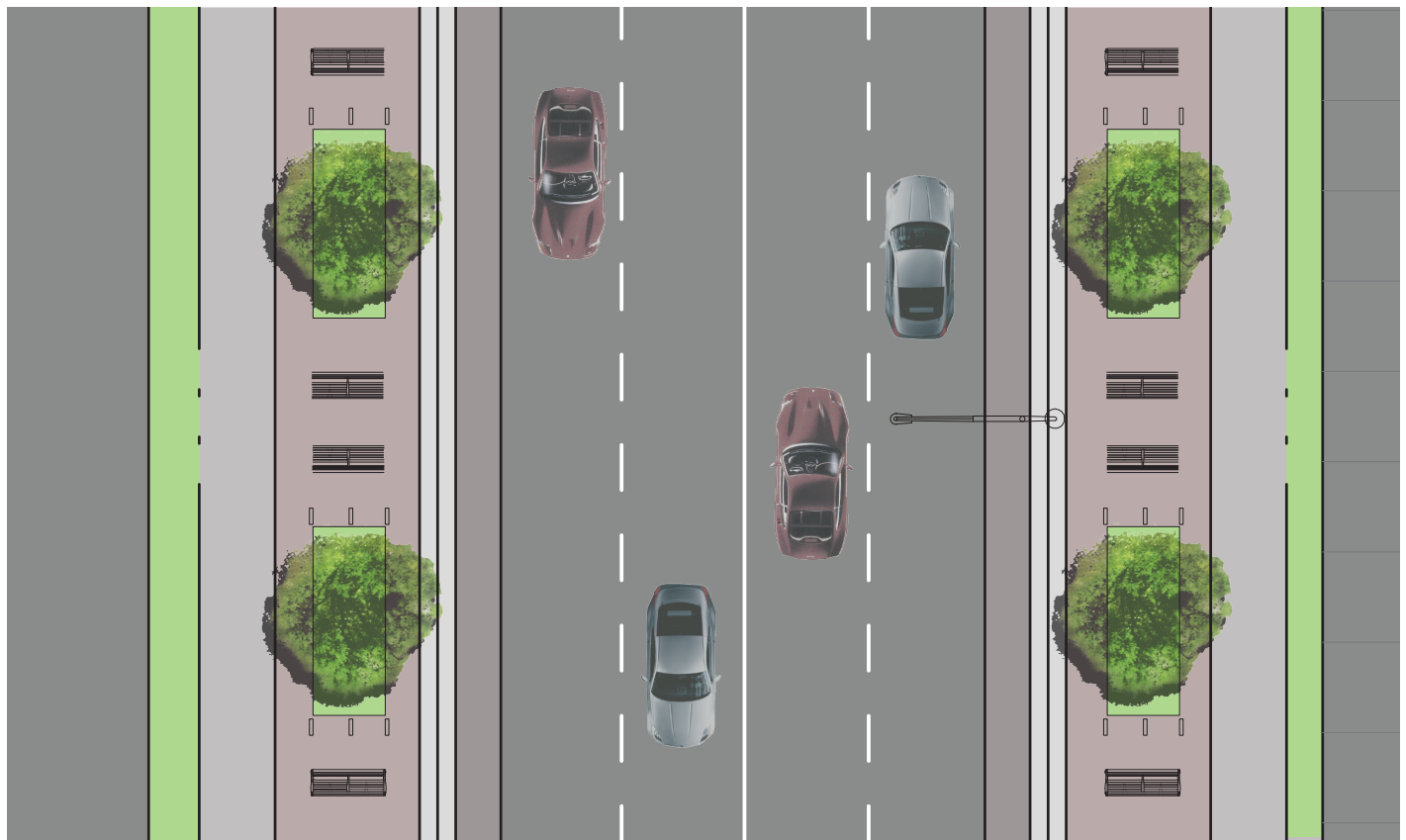
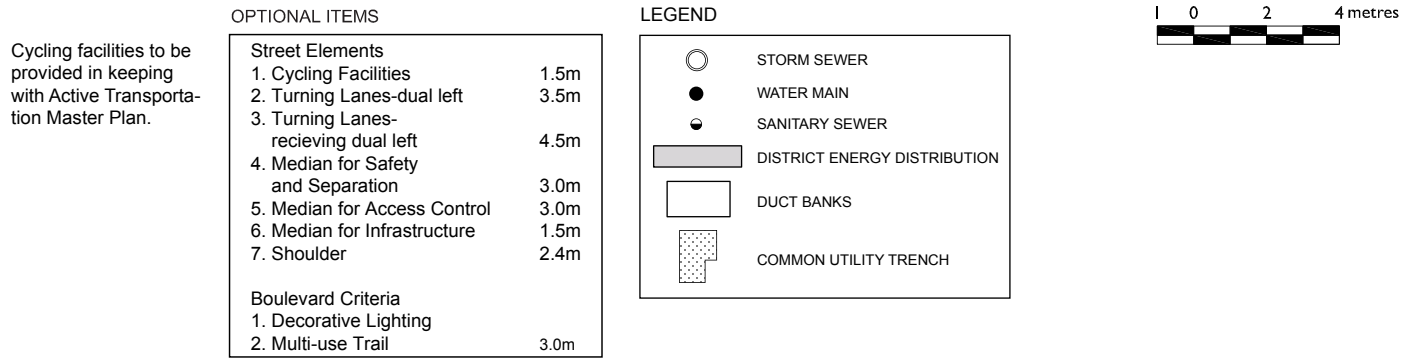
3.4.1.7 Recommended Section (Neighbourhood Connector - Existing Condition)

Currently, Neighbourhood Connectors: Avenues are typically found within low rise retail areas with front yard parking and building setback from the street. This section shows how the recommended right of way design would fit within those existing conditions.

For additional information on the boulevard, roadway and general characteristics of Transportation Corridors, please refer to Section 4.0 Design Guidelines.



3.4.1.8 Recommended Plan (Neighbourhood Connector - Existing Condition)



3.4.2 Main Street

3.4.2.1 Introduction

Neighbourhood Connector: Main Streets are supportive of and prioritize active transportation and transit. They are typically located within the established urban areas and often can be consider special character streets.

Examples of a Neighbourhood Connector: Main Street include King Street North (from University Avenue to William Street), Water Street (from Park Hill Road to Ainslie Street), King Street in St. Jacobs and Snyder's Road East in Baden.

3.4.2.2 Defining Characteristics

Main streets are located in existing built up areas characterized by buildings that address the street with small or no setbacks. Buildings, lot sizes and right-of-way widths are typically smaller than those found within Avenues. Although intensification is encouraged on main streets, re-development should be required to respond to the scale and character of the area.

3.4.2.3 Key Design Opportunities & Challenges

The opportunities associated with Main Street will be an ability to preserve and enhance the existing character of the streets and to positively connect alternate transportation modes through the downtown areas. Challenges will include balancing the road and boulevard requirements within what will most often be a narrow right of way condition, as well as identifying and preserving key characteristics of special character streets, including natural and built heritage features.



Examples of a Neighbourhood Connector: Main Street include portions of King Street North and Snyder's Road East in Baden

3.4.2.4 Streetscape Design and Operational Criteria

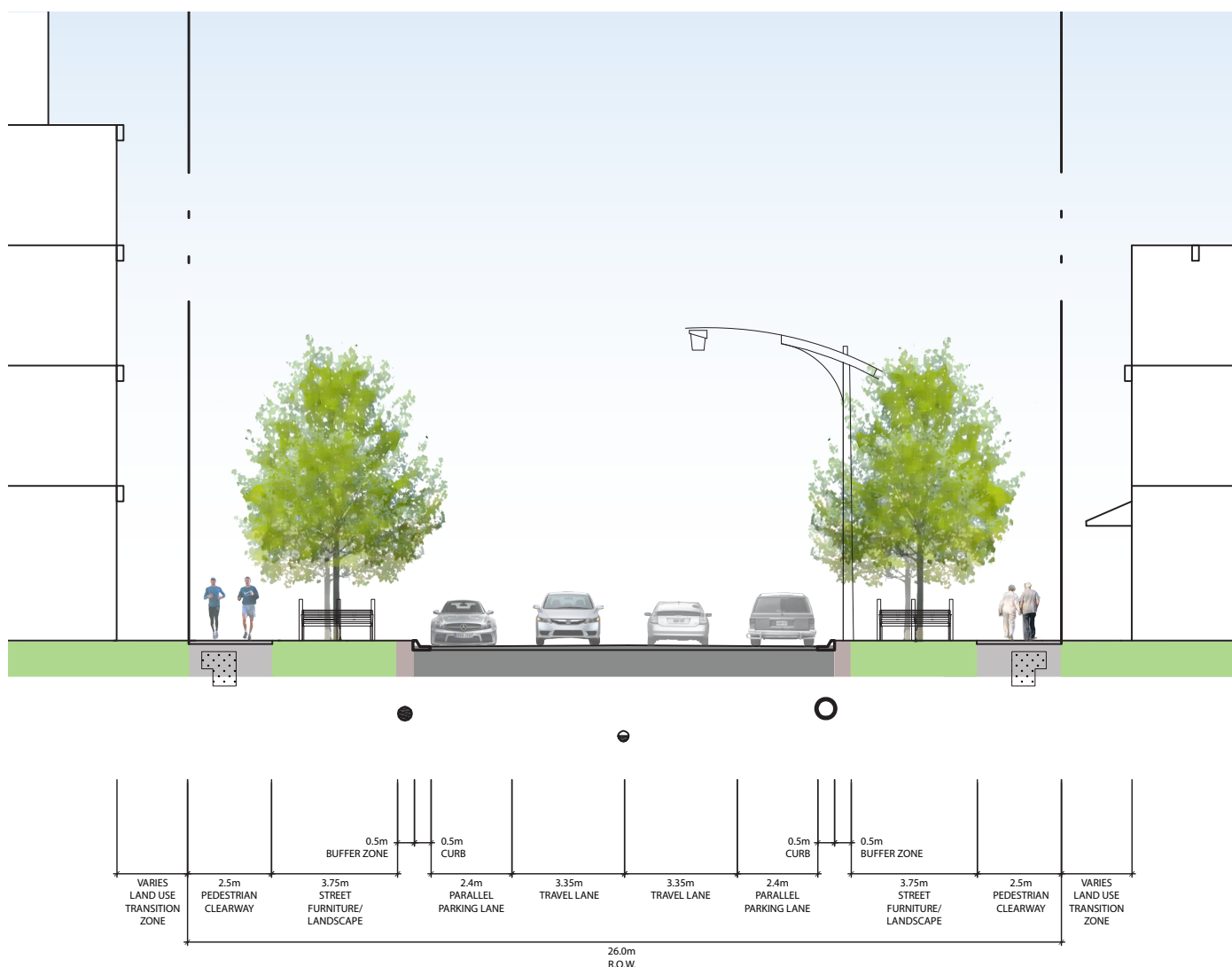
People Moving Capacity	Low to high people moving capacity (autos and commercial vehicles, transit vehicles in mixed traffic or dedicated ROW). High people moving capacity where HOT or RT provided.
Active Transportation	Significant active transportation activity accommodated (utilitarian and local).
Pedestrian Provisions	Pedestrian infrastructure to occur on both sides of the street. Design of features to provide access to transit stops and adjacent street related development.
Cycling Provisions	Cycling facilities to be provided in keeping with Active Transportation Master Plan.
Transit	Transit supportive and transit priority with connections to higher order service. Transit priority where Bus Rapid Transit or Light Rapid Transit provided.
Land Use	Commercial, Mixed Use, High Density Residential, Medium Density Residential, Open Space, Special Districts (Downtown Kitchener)
Existing Adjacent Land Use Context	Adjacent land uses typically address the street with small or no setbacks. Access typical from side streets. Prevalent land uses include commercial and mixed use area, community uses and residential.
Planned Adjacent Land Uses & Access	Accommodate existing land uses with shared or combined private access and incremental / progressive access control for vehicles. Access for cyclists and pedestrians to provide linkages to transit (maximum walking distance 400m), surrounding communities and key destinations.
Adjacent (existing and proposed) Building Scale & Orientation	Mixture of street-oriented built form of varied size. Increase of density and height adjacent to transit nodes and hubs.
Views	Dense “heritage” main street fabric with buildings close to the street, street parking, street trees and is pedestrian oriented.

Boulevard Treatment	Boulevard treatment should reflect the street's active transportation priority. Streetscaping / landscaping should provide features appropriate for pedestrian and cycling environments adjacent to street related development. The boulevard should have an urban cross section including wide sidewalks, street trees, landscaping, pedestrian, transit amenities and public art.
ROW Width	To be determined by context sensitive design process an ideal right of way width for a Neighbourhood Connector: main street would be 26 metres. There are some constrained corridors where 20 metres road allowances need to be accommodated due to the existing built form.
Auto Travel Speeds	50 km/h (Posted Speed)
Access	Access control measures are directly related to street movement priority e.g. where vehicular movement is a priority then access is minimized or prohibited. Pedestrian access is not controlled by a fence or other means except where safety is an issue.
Median	Pedestrian Refuge, Traffic Calming, Special Character
Connectivity/Continuity	Connects to Municipal arterial and collector roadways with access control measures that directly relate to street movement priorities, e.g. where vehicular movement is a priority then access is minimized or prohibited. Permit private access generally located 80m apart with signalized intersections located a minimum of 215m apart.
Crosswalks	Pedestrian crossings formalized only as controlled crosswalks.
Parking	Parking may be permitted except where people movement is impacted or safety is an issue.
Minimum Intersection Spacing (m)	Signalized intersection spacing should ensure appropriate access to adjacent land uses and reinforce a walkable environment. Preferable spacing is 400m and minimum spacing is 215m, however, spacing should be confirmed by local study. Spacing of unsignalized intersections to be determined through analysis of local operating conditions.
Utilities	Utilities are as shown in the Recommended Section and Plan

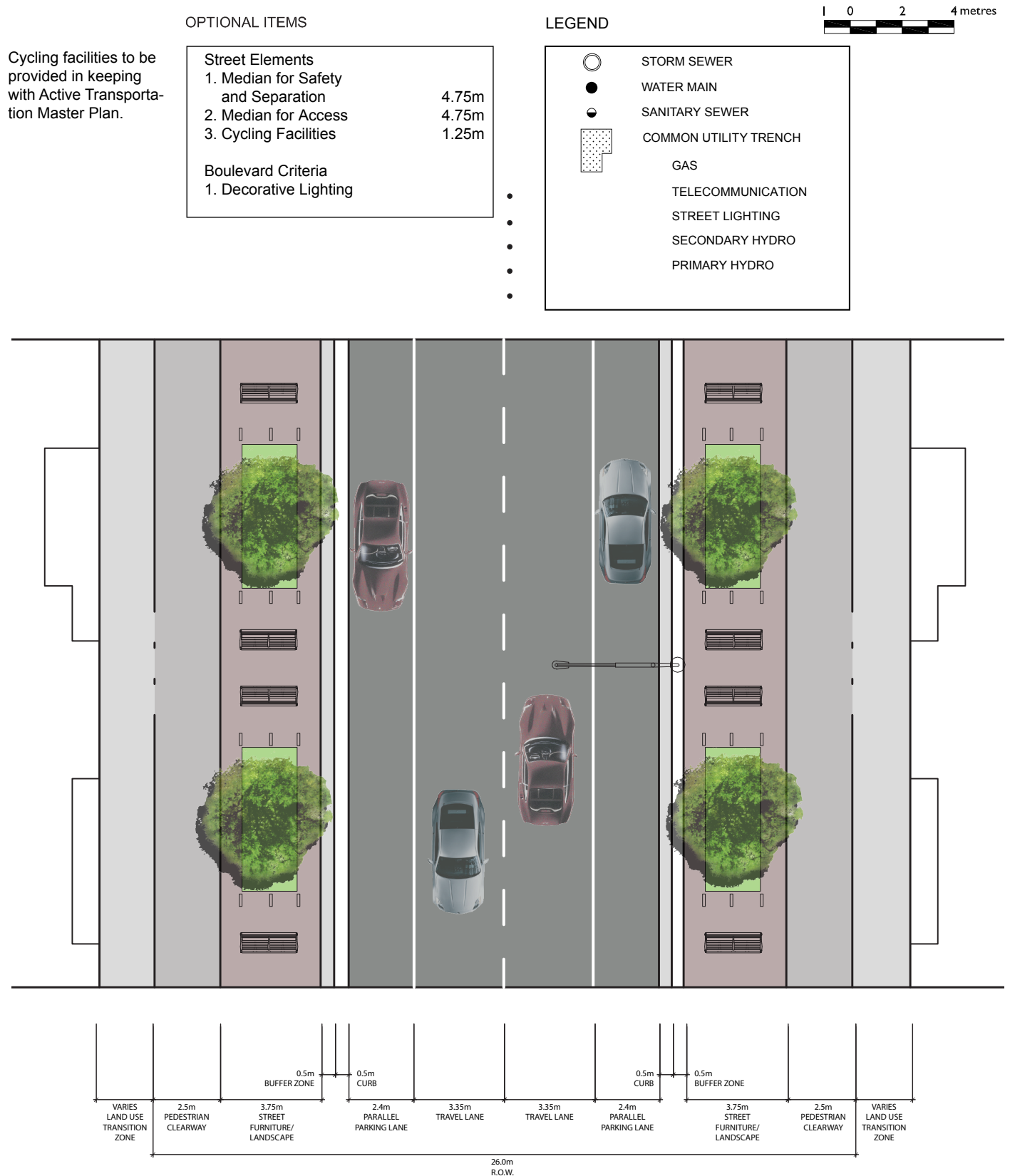
3.4.2.5 Recommended Section (Neighbourhood Connector - Future Main Street Condition)

Neighbourhood Connectors: Main Street have the potential to intensify in the future given the existing building configurations and land uses. This section shows how the recommended right of way design would fit within those future conditions.

For additional information on the boulevard, roadway and general characteristics of Transportation Corridors, please refer to Section 4.0 Design Guidelines.

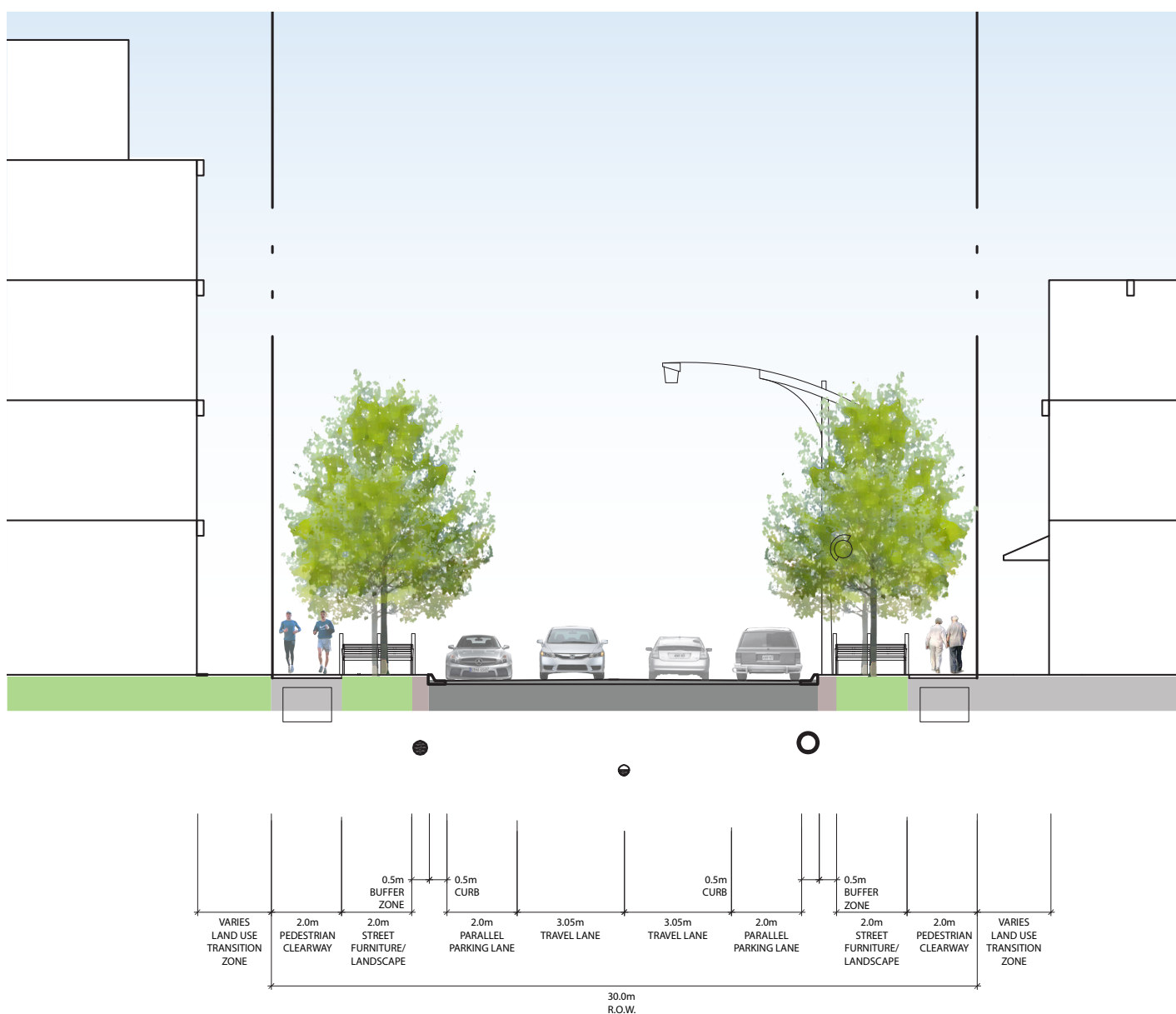


3.4.2.6 Recommended Plan (Neighbourhood Connector - Future Main Street Condition)

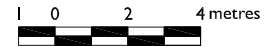


3.4.2.7 Recommended Section (Neighbourhood Connector - Constrained Main Street Condition)

The Region of Waterloo contains many Regional Transportation Corridors, whose right-of-ways are constrained by existing development. This section and plan shows how those streetscape elements, which are recommended in this plan, could be organized to fit within constrained right-of-ways.



3.4.2.8 Recommended Plan (Neighbourhood Connector - Future Constrained Main Street Condition)



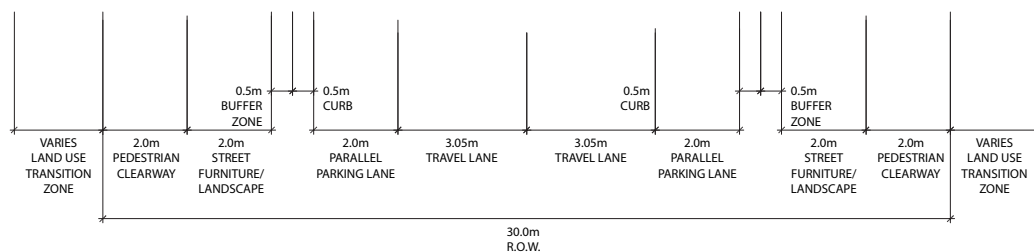
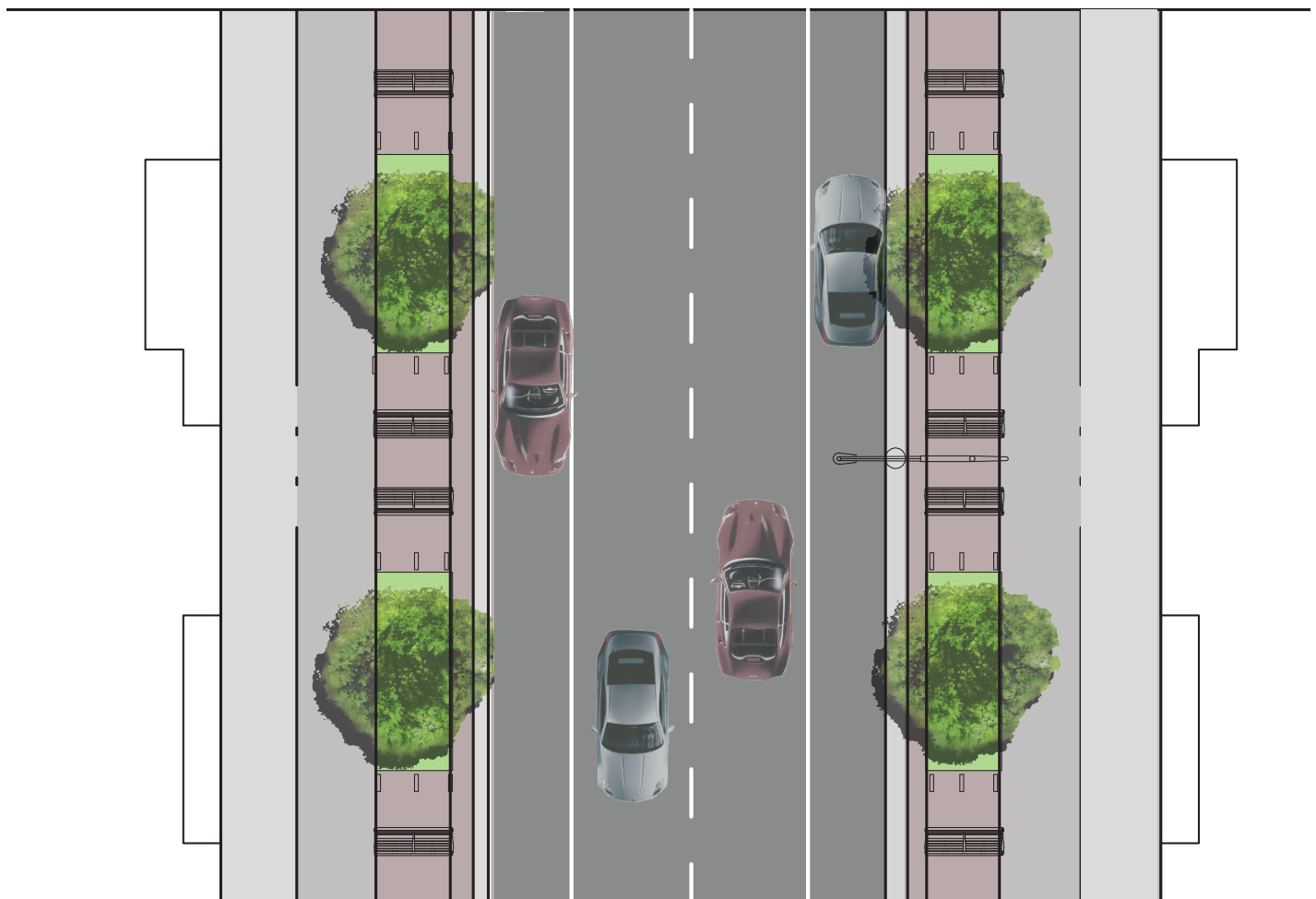
OPTIONAL ITEMS

Cycling facilities to be provided in keeping with Active Transportation Master Plan.

Street Elements	
1. Median for Safety and Separation	4.75m
2. Median for Access	4.75m
3. Cycling Facilities	1.25m
Boulevard Criteria	
1. Decorative Lighting	

LEGEND

	STORM SEWER
	WATER MAIN
	SANITARY SEWER
	DUCT BANKS



3.5 Residential Connector

3.5.1 Introduction

Residential Connectors have a strong focus on active transportation and are transit supportive. Residential Connectors are streets for people and cyclists, and should find a balance with the vehicular needs of the community.

Examples of a Residential Connector include Frederick Street (from Lancaster Street to Bruce Street), Westmount Road (from Queen Street to Ottawa Street), Cedar Street (from Dundas Street to Grand Ridge Drive) and Bridge Street.

3.5.2 Defining Characteristics

Residential Connectors are short segments of roadway typically located in built up residential areas linking Neighbourhood Connectors and Rural Connectors. They are flanked primarily with residential uses of varying sizes and densities together with supporting neighbourhood uses such as schools, parks, and places of worship. Buildings are typically located close to and oriented towards the street with numerous driveways. Residential Connectors are supportive of active transportation (bicycles and pedestrians) and provide facilities (design and comfort) for pedestrians, cyclists and transit users.

3.5.3 Key Design Opportunities & Challenges

The Residential Connector is a somewhat uniquely Region of Waterloo road type, which typically has a strong presence of single family residential directly facing the street. Given the access requirements for those homes, it can be difficult for vehicles to navigate the many driveways, intersections and adjacent land-uses. The designs of these roads need to respect the surrounding context with a design scale in keeping with the surroundings, which includes a high quality public boulevard that supports a variety of active transportation modes and has fully integrated transit stops.



Examples of a Residential Connector include portions of Frederick Street, Westmount Road, Cedar Street and Bridge Street.

3.5.4 Streetscape and Operational Criteria

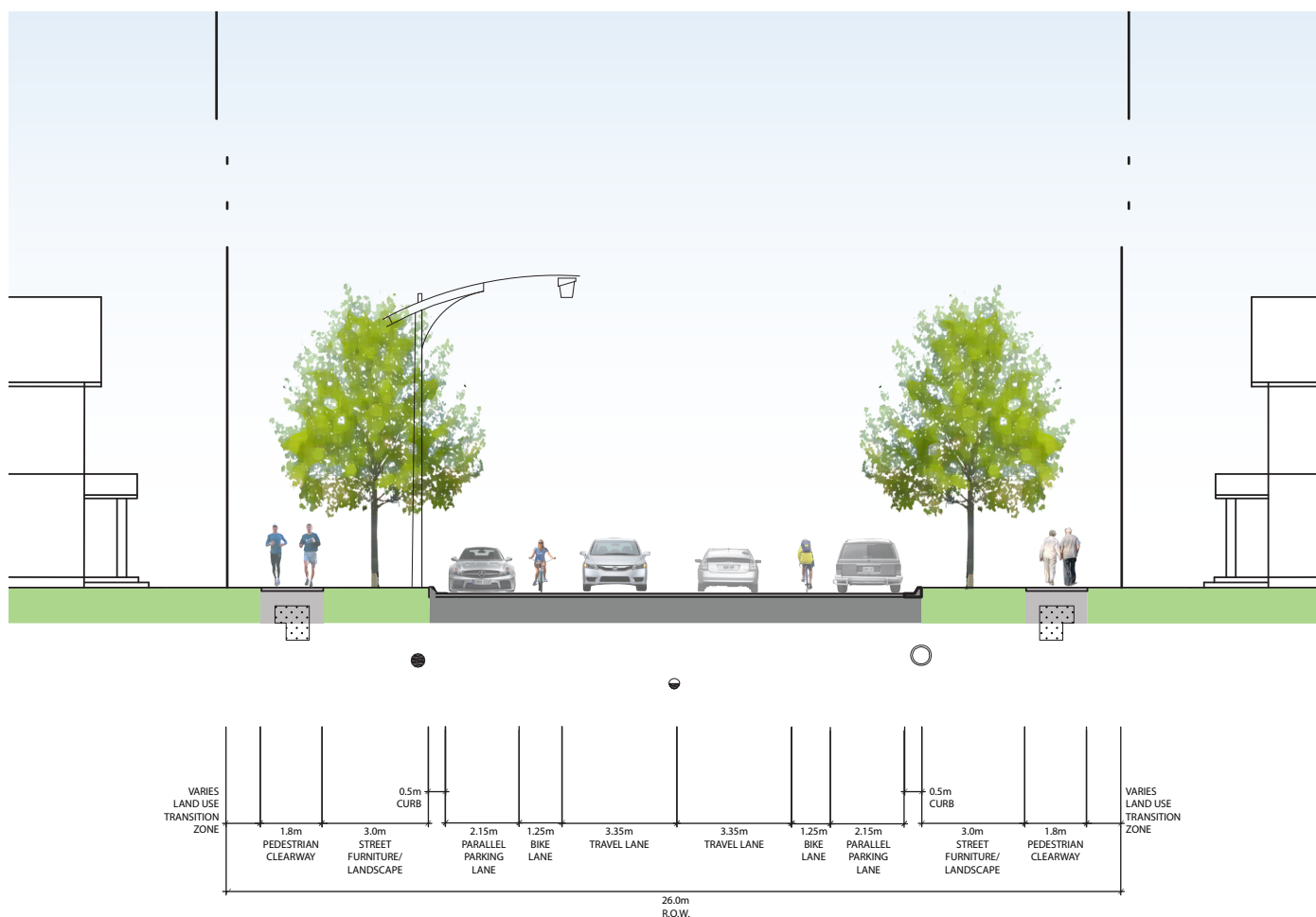
People Moving Capacity	Low people moving capacity (autos and commercial vehicles, transit vehicles in mixed traffic).
Active Transportation	Significant active transportation activity accommodated (utilitarian and local).
Pedestrian Provisions	Pedestrian infrastructure to occur on both sides of the street. Design of features to provide access to transit stops and adjacent neighbourhoods.
Cycling Provisions	Cycling facilities to be provided in keeping with Active Transportation Master Plan.
Transit	Transit supportive connects to higher order service
Land Use	Low Density Residential, Medium Density Residential, Mixed Use
Existing Adjacent Land Use Context	Predominantly low rise neighbourhoods with front yards and individual access.
Planned Adjacent Land Uses & Access	Accommodate existing land uses with individual or shared / combined private access for vehicles. Access for cyclists and pedestrians to provide linkages to transit (maximum walking distance 400m), surrounding communities and key destinations.
Adjacent (existing and proposed) Building Scale & Orientation	Mixture of small scale street-oriented built form.
Views	Dense urban fabric along mature, tree-lined streets.
Boulevard Treatment	Boulevard treatment should reflect the street's active transportation priority. Streetscaping / landscaping should provide features appropriate for pedestrian and cycling environments adjacent to residential areas. The boulevard should have an urban cross section including sidewalks, street trees, landscaping, pedestrian and transit amenities.

ROW Width	To be determined by context sensitive design process an ideal right of way width for a Residential Connector would be 26 metres
Auto Travel Speeds	50 km/h (Posted Speed)
Access	Access control measures are directly related to street movement priority e.g. where vehicular movement is a priority then access is minimized or prohibited. Pedestrian access is not controlled by fence or other means except where safety is an issue.
Median	Pedestrian Refuge, Traffic Calming, Special Character
Connectivity/Continuity	Not typically continuous across communities but are continuous across neighbourhoods. Permits private access with residential driveways, facilitates transit access into adjacent subdivisions
Crosswalks	Pedestrian crossings formalized only as controlled crosswalks.
Parking	Parking may be permitted except where people movement is impacted or safety is an issue.
Minimum Intersection Spacing (m)	Signalized intersection spacing should ensure appropriate access to adjacent land uses and reinforce a walkable environment. Preferable spacing to be determined by local study. Spacing of unsignalized intersections to be determined through analysis of local operating conditions.
Utilities	Utilities are as shown in the Recommended Section and Plan

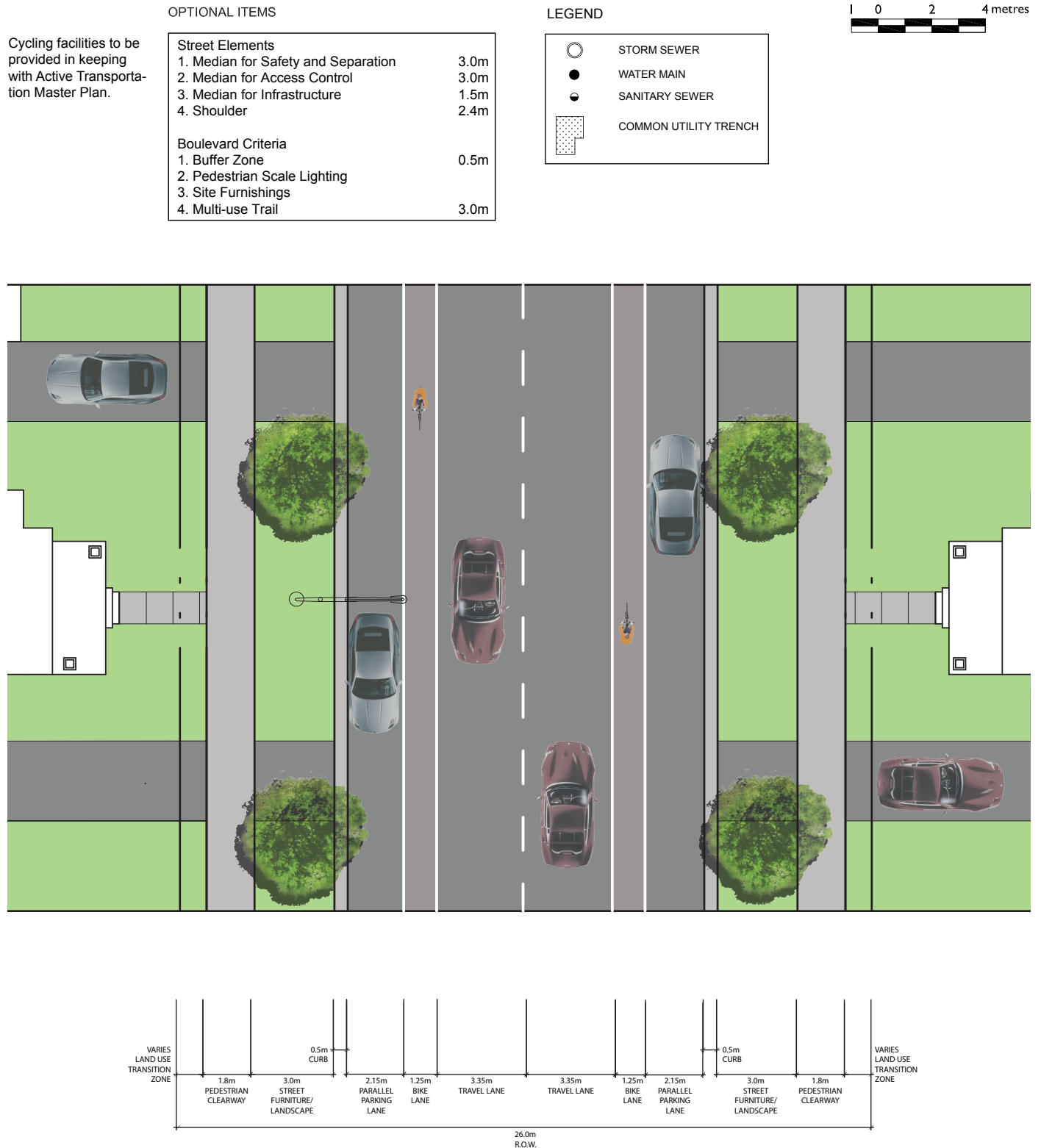
3.5.5 Recommended Section (Residential Connector)

The ideal section and plan were developed by incorporating all of the streetscape and boulevard elements that were determined to be important or necessary. The optional items are identified on the facing page. A preferred right of way width is identified but if space allows the appropriate optional items should be considered.

For additional information on the boulevard, roadway and general characteristics of Transportation Corridors, please refer to Section 4.0 Design Guidelines.



3.5.6 Recommended Plan (Residential Connector)



3.6 Rural Connector

3.6.1 Introduction

Rural Connectors focus on both vehicular movement and active transportation. Many of the Region's Rural Connectors "Country Roads" have scenic qualities and provide important transportation connections to the townships and surrounding communities. With the Mennonite population there is also a need to accommodate buggies on the Rural Connectors.

Examples of a Rural Connector include Dickie Settlement Road (between Roseville Road and Fountain Street South), Trussler Road (between Cedar Creek Road and New Dundee Road), and Erb's Road (between The Wilmot Line and Straus Court - approaching St. Agatha).

3.6.2 Defining Characteristics

Rural Connectors are comprised of "country roads" located along historical concession right-of-ways in the Region's rural areas or country side. They are generally continuous across the Region and are flanked by farms and other rural land uses including rural residences on severed lots. The roads often afford long views of the expansive countryside including agricultural buildings, woodlots, natural features, and farmland. Rural Connectors focus on moving vehicles, however; facilities for bicycles and pedestrians are accommodated to complete connections to specific areas and routes and may occur on or off-road.

3.6.3 Key Design Opportunities & Challenges

Driving on the Region's rural roads can be very scenic and provide a view into the rural life of the Region. The design of these roads can be challenging as the scale of the roadway should fit the surroundings. Rural Connectors are typically travelled at higher speeds, warranting safety features such as cycling facilities, multi-use trails, widened lanes, etc. which can increase the overall scale of the roadway. The identification and preservation of key characteristics of special character streets is important, including natural and built heritage features.

Many Rural Connectors are identified as scenic landscapes or "Scenic Roads" within the Regional Official Plan. The term "Scenic Roads" refers to those Regional Transportation Corridors which are characterized by natural, cultural heritage and recreational features that contribute to their scenic value. These features, to name a few, may include: large trees, heritage buildings, rural character, views to natural beauty, and/or interesting highway geometry. These elements should be protected or preserved in the design and construction of the Region's Rural Connectors.



Examples of Rural Connectors include portions of Trussler Road, and Erb's Road.

3.6.4 Streetscape Design and Operational Criteria

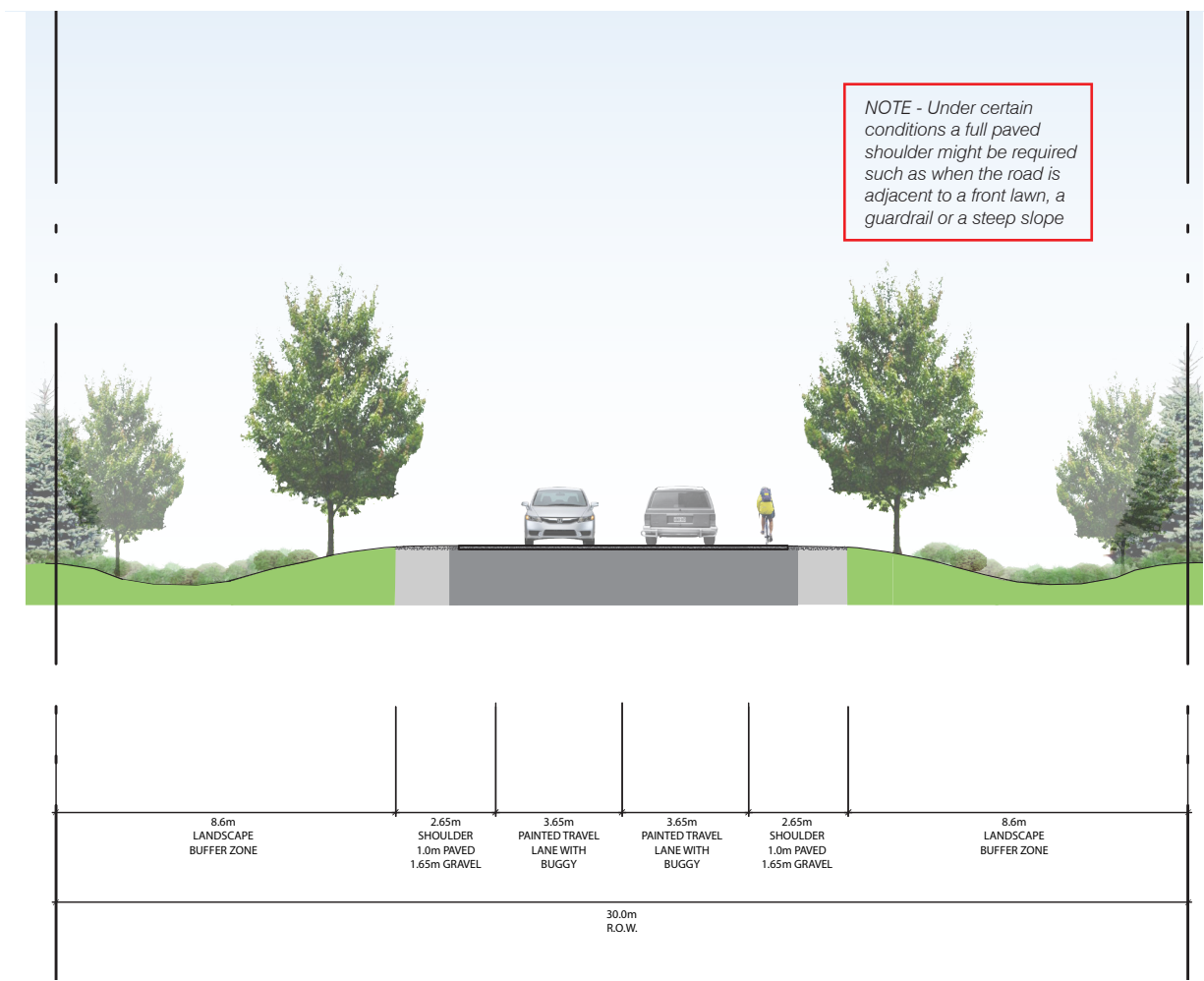
People Moving Capacity	High people moving capacity (autos and commercial vehicles, transit vehicles in mixed traffic, large farm vehicles, horse and buggy).
Active Transportation	Active transportation activity accommodated (with basic provisions for active transportation to meet required demand).
Pedestrian Provisions	Given the anticipated low volumes of pedestrians on Rural Connectors, pedestrian infrastructure is recommended to occur where it is determined to be appropriate. Pedestrian infrastructure should connect pedestrian destinations and provides access to transit stops and ensure linkages to surrounding communities.
Cycling Provisions	Cycling facilities to be provided in keeping with Active Transportation Master Plan.
Transit	Supports transit service where transit routes are designated (existing or planned)
Land Use	Agriculture, Business Park, Institutional, Industrial, Open Space, Commercial, Low Density Residential
Existing Adjacent Land Use Context	Predominantly agriculture with clusters of low density residential, institutional and commercial uses.
Planned Adjacent Land Uses & Access	Accommodate existing land uses with individual or shared private access for vehicles. Access for cyclists and pedestrians to provide linkages to surrounding communities and key destinations where the volume of cyclists and pedestrians warrant the required infrastructure.
Adjacent (existing and proposed) Building Scale & Orientation	Typical agricultural rural fabric. Variety of built form sizes, oriented to but set back from the street.
Views	Rural setting with views of farmland, buildings and natural heritage features

Boulevard Treatment	Boulevard treatment should reflect the street's primary function of moving vehicles. Streetscape / landscaping can where appropriate provide a buffer for pedestrians, cyclists and adjacent land uses and provide visual interest for passing motorists. The boulevard should have a rural cross section including trees and a widened shoulder only where needed should a sidewalk or multi use trail be accommodated.
ROW Width	To be determined by context sensitive design process an ideal right of way width for a Rural connector would be 30 metres
Auto Travel Speeds	60 to 80 km/h (Posted Speed)
Access	Access control measures are directly related to street movement priority e.g. where vehicular movement is a priority then access is minimized or prohibited. Pedestrian access is not controlled by a fence or other means except where safety is an issue.
Median	Turn Lane Protection, Pedestrian Refuge, Special Character
Connectivity/Continuity	Generally continuous across the Region and connecting to Municipal arterial and collector roadways with limited access control.
Crosswalks	Pedestrian crossings formalized only as controlled crosswalks.
Parking	Parking may be permitted except where people movement is impacted or safety is an issue.
Minimum Intersection Spacing (m)	Signalized intersection spacing to reflect transportation priority of the street by ensuring optimal traffic flows. Preferable spacing to be determined by local study. Spacing of unsignalized intersections to be determined through analysis of local operating conditions.
Utilities	Utilities are as shown in the Recommended Section and Plan

3.6.5 Recommended Section (Rural Connector)

The ideal section and plan were developed by incorporating all of the streetscape and boulevard elements that were determined to be important or necessary. The optional items are identified on the facing page. A preferred right of way width is identified but if space allows the appropriate optional items should be considered.

For additional information on the boulevard, roadway and general characteristics of Transportation Corridors, please refer to Section 4.0 Design Guidelines.

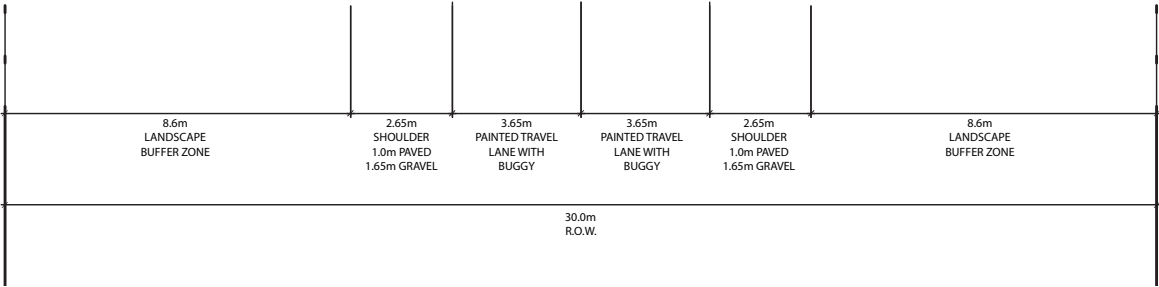
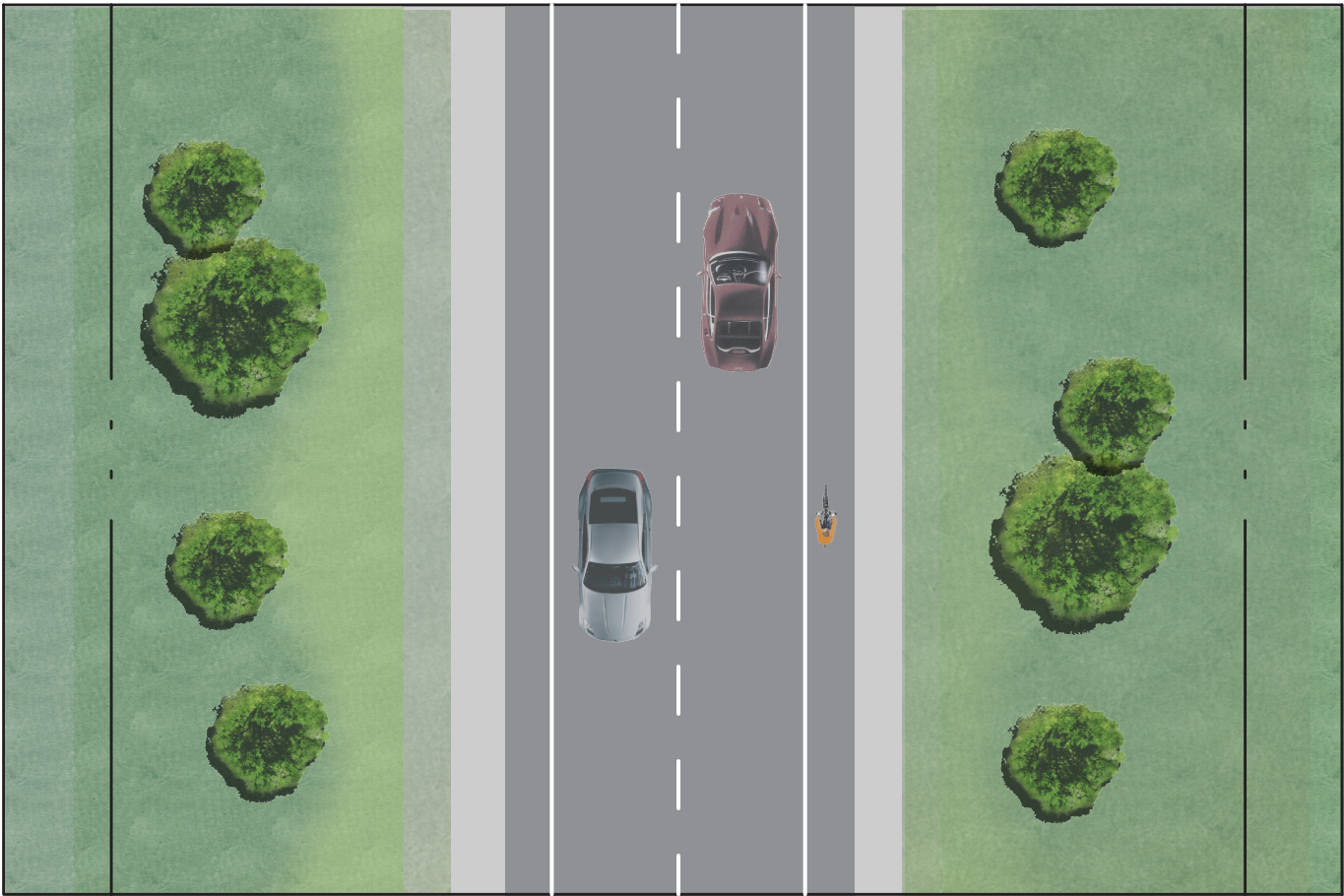


3.6.6 Recommended Plan (Rural Connector)

Cycling facilities to be provided in keeping with Active Transportation Master Plan.

OPTIONAL ITEMS

Boulevard Criteria	
1. Pedestrian Clearway	2.1m
2. Landscape and Site Furnishing Zone w/ Trees	2.0m
3. Transit Facilities	
4. Multi-Use Trail	3.0m
5. Cycling Facilites	1.8m



3.7 Rural Village - Main Street

3.7.1 Introduction

Rural Village - Main Streets are prioritized for vehicular movement and active transportation. The Rural Village - Main Street will typically be connected to Rural Connectors at either end. The role of the Main Street is to support the urban life of the village and to move traffic efficiently through town at an appropriate speed.

Examples of a Rural Village - Main Streets include Hutchinson Road (from William Hastings Line to Lobsinger Line), Nafziger Road (from Queens Bush Road to Gerber Road), and Fischer Hallman Road (from Paul Avenue to Roseville Road).

3.7.2 Defining Characteristics

Rural Village - Main Streets are short segments of roadway that are generally contained within a village or hamlet, characterized by buildings that address the street. Buildings, lot sizes and right-of-way widths are typically smaller than those found on the outskirts of villages and hamlets in rural areas. Rural Village - Main Streets focus on moving vehicles, however; facilities for bicycles and pedestrians are accommodated to complete connections to specific areas and routes and may occur if space allows. Pedestrian and cyclist movement within villages and hamlets will receive a high level of priority (design and comfort) appropriate for the setting.

3.7.3 Key Design Opportunities & Challenges

The key design challenge with the Rural Village - Main Street will be balancing vehicular and truck traffic while identifying and preserving the character and heritage of the village or hamlet. Although the road design should appropriately accommodate traffic, designing the street to be consistent with the local character should be a priority.



Examples of a Rural Village - Main Streets include Hutchinson Road (from William Hastings Line to Lobsinger Line), Nafziger Road (from Queens Bush Road to Gerber Road), and Fischer Hallman Road (from Paul Avenue to Roseville Road).

3.7.4 Streetscape Design and Operational Criteria

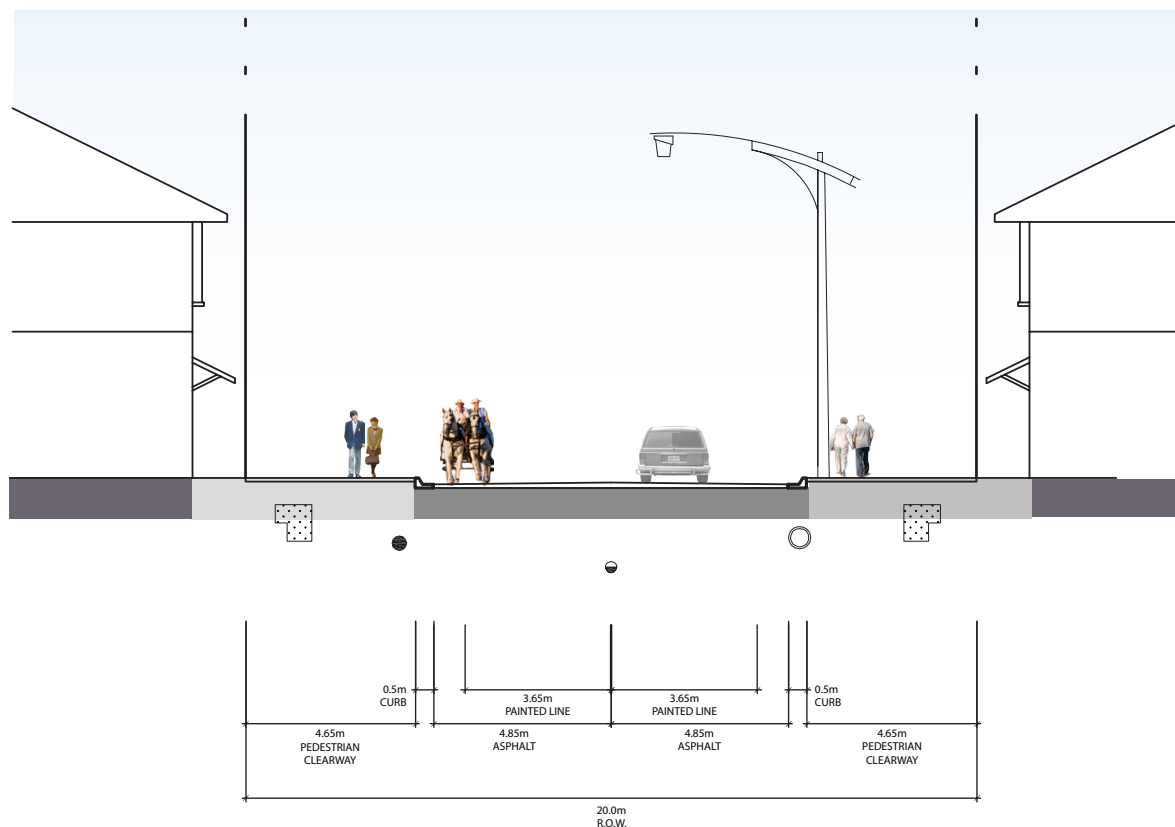
People Moving Capacity	High people moving capacity (autos and commercial vehicles, transit vehicles in mixed traffic, large farm vehicles, horse and buggy).
Active Transportation	Active transportation activity accommodated (utilitarian and local).
Pedestrian Provisions	Pedestrian infrastructure to occur on both sides of the street. Design of features to provide access to transit stops (where provided), ensure linkages to surrounding communities and street related development..
Cycling Provisions	Cycling facilities to be provided in keeping with Active Transportation Master Plan.
Transit	Supports transit service where transit routes are designated (existing or planned)
Land Use	Agricultural, Low Density Residential, Commercial, Industrial Retail, Mixed-Use, Open Space
Existing Adjacent Land Use Context	Predominantly agricultural lands with clusters of low density residential, villages, hamlets, parks, trails and natural areas.
Planned Adjacent Land Uses & Access	Accommodate existing land uses with individual or shared private access for vehicles. Access for cyclists and pedestrians to provide linkages to key destinations.
Adjacent (existing and proposed) Building Scale & Orientation	Mixture of small scale street-oriented built form in villages and hamlets.
Views	Rural setting with views of farmland, buildings, natural heritage features, villages and hamlets.

Boulevard Treatment	Boulevard treatment should reflect the street's active transportation priority. Streetscape / landscaping to provide buffer for pedestrians, cyclists and adjacent land uses and provide visual interest for passing motorists. In villages and hamlets, an urban cross section may apply including sidewalks, street trees, landscaping, pedestrian, transit amenities and public art.
ROW Width	To be determined by context sensitive design process an ideal right of way width for a rural connector would be 20 metres.
Auto Travel Speeds	50 to 60 km/h (Posted Speed)
Access	Access control measures are directly related to street movement priority e.g. where vehicular movement is a priority then access is minimized or prohibited. Pedestrian access is not controlled by a fence or other means except where safety is an issue.
Median	Turn Lane Protection, Pedestrian Refuge, Special Character
Connectivity/Continuity	Not typically continuous across communities and are generally contained within a village or hamlet.
Crosswalks	Pedestrian crossings formalized only as controlled crosswalks.
Parking	Parking may be permitted except where people movement is impacted or safety is an issue.
Minimum Intersection Spacing (m)	Signalized intersection spacing should ensure appropriate access to adjacent land uses and reinforce a walkable environment. Preferable spacing to be determined by local study. Spacing of unsignalized intersections to be determined through analysis of local operating conditions.
Utilities	Utilities are as shown in the Recommended Section and Plan

3.7.5 Recommended Section (Rural Village - Main Street)

The ideal section and plan were developed by incorporating all of the streetscape and boulevard elements that were determined to be important or necessary. The optional items are identified on the facing page. A preferred right of way width is identified but if space allows the appropriate optional items should be considered.

For additional information on the boulevard, roadway and general characteristics of Transportation Corridors, please refer to Section 4.0 Design Guidelines.



3.7.6 Recommended Plan (Rural Village - Main Street)

Cycling facilities to be provided in keeping with Active Transportation Master Plan.

OPTIONAL ITEMS

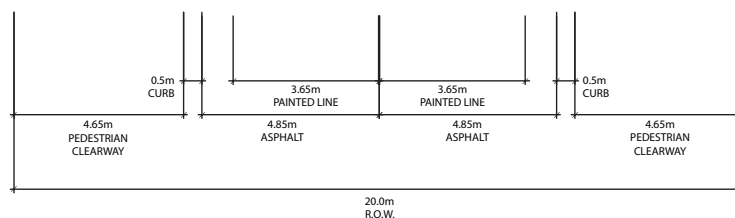
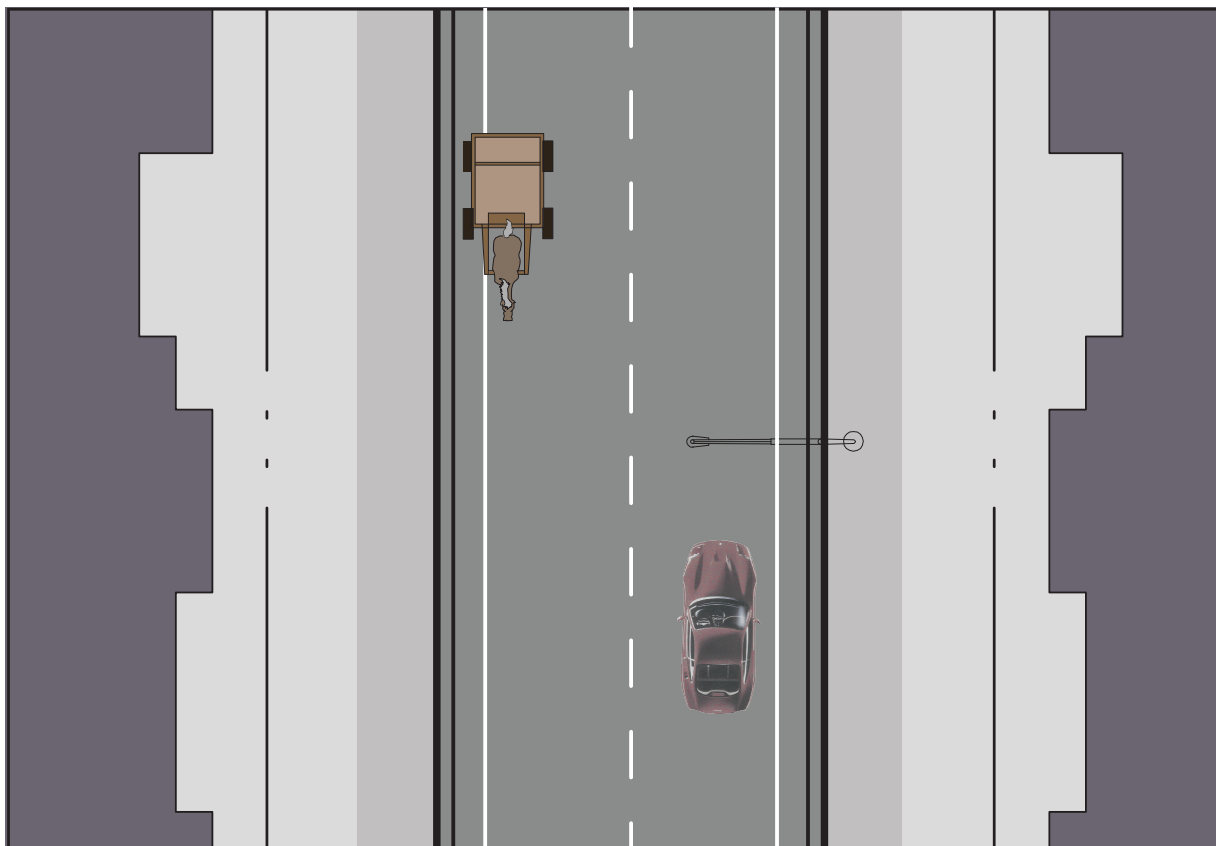
Street Elements	
1. Median for Safety and Separation	3.0m
2. Median for Access Control	3.0m
3. Median for Refuge	3.0m
4. Parallel Parking Lane	2.4m
5. Cycling Facilities	1.2m

Boulevard Criteria

1. Landscape Zone and Site Furnishing Zone w/ Trees	3.0m
2. Landscape Zone and Site Furnishing Zone w/o Trees	2.0m
3. Buffer Zone	0.5m
4. Land-Use Transition Zone	1.0m
5. Decorative Lighting	
6. Site Furnishings	

LEGEND

	STORM SEWER
	WATER MAIN
	SANITARY SEWER
	COMMON UTILITY TRENCH
	GAS
	TELECOMMUNICATION
	STREET LIGHTING
	SECONDARY HYDRO
	PRIMARY HYDRO



Section 4: Streetscape Design Guidelines



4.1 Street Design Guidelines

This section provides guidelines for the functional and urban design of both the boulevard and roadway streetscape elements. The guidelines are divided into three sections. The boulevard encompasses all of the street design elements that are located on either side of the roadway surface. The roadway constitutes all of the functional travel and parking elements that are located within the curbs and asphalt area. General guidelines apply to the linear length of the road or are pertinent to both the road and boulevard.

Boulevard Guidelines include:

- Pedestrian Clearway
- Buffer Zone
- Land-Use Transition Zone
- Transit Facilities
- Multi-use Trails
- Decorative Lighting
- Landscaping and Site Furnishing Zone
- Site Furnishings

Roadway Guidelines include:

- Transit Priority Lanes
- Cycling Facilities
- Travel Lanes
- Turning Lanes
- Passing Lanes
- Medians
- Parallel Parking

General Guidelines include:

- Transit Corridors
- Utilities
- Maintenance
- Noise Attenuation
- Special Character Streets / Scenic Roads
- Transition Areas / Gateways
- Intersection Design
- Minimum Carriage Way
- Encroachments
- Public Art
- Clear Zone
- Design Speed
- Fencing
- Interchange Design

4.2 Boulevard Guidelines

4.2.1 Pedestrian Clearway

Definition and Goal

The pedestrian clearway is the portion of the sidewalk or multi-use trail dedicated expressly to walking. The defined area must remain clear, both horizontally and vertically, for the movement of pedestrians. The pedestrian clearway is located directly adjacent to buildings, transition zones or landscape buffers, depending on the street classification.

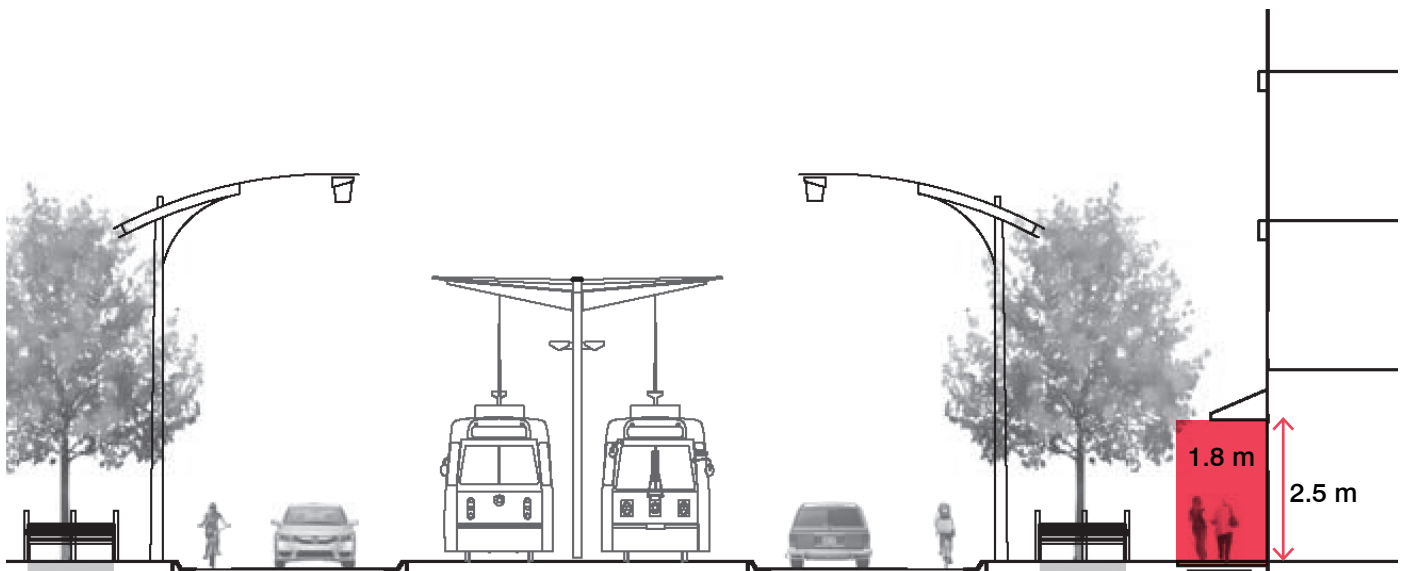
Priorities

As outlined in the Regional Official Plan, achieving a liveable Region is a priority in both the urban and rural areas. A key component of liveability is ensuring that communities are interconnected not just with roads

but with a structure for cyclists and pedestrians. To achieve goal 3.2 of the Regional Official Plan “Increase transportation opportunities for pedestrians, cyclists and transit users”, it is recommended that every future and existing Regional Transportation Corridor have a dedicated pedestrian clearway. For rural road ways or roads that include a multi-use trails the exclusion of a pedestrian clearway can be considered. The following section provides the design and functional guidelines for establishing a pedestrian clearway.

Guidelines

To create a walkable street, pedestrians need to be given a clearly demarcated, continuous zone that is protected from vehicular traffic, referred to in this document as a pedestrian clearway. The use of strategically placed



Pedestrian Clearways are recommended to be a minimum of 1.8 metres in width, with a minimum of 2.5 metres of vertical clearance.

elements (e.g. planters, trees, landscaping, street furniture, etc.) between pedestrians and vehicles gives pedestrians an added sense of security, thus encouraging the use of the pedestrian clearway area.

- The preferred material for sidewalks is poured in place concrete with a broom finish for traction, although other materials can be considered as required;
- When pedestrian travel is considered a priority, a continuous public sidewalk should be provided on both sides of Regional Transportation Corridors unless an alternate pedestrian route such as a multi-use trail is provided;
- Pedestrian clearways are recommended to be a minimum of 1.8 metres in width with wider sidewalks adjacent to shops, institutions and public areas;
- Sidewalks within the clearway should be continuous

across driveways.

- Where crossings over driveways and intersections occur, sidewalks should be marked through other materials from the roadbed to provide visual contrast;
- Sidewalk edges and curbs should be graded and scored at intersections to provide barrier-free access for people physically and visually impaired;
- Signage boards within the pedestrian clearway should not be permitted when a Land-Use Transition Zone or a landscaping and site furnishing zone is provided;
- Overhead signage and canopies should not be located any lower than 2.5 metres; and
- Seating and retail spill-out spaces should not be permitted within the pedestrian clearway.



The preferred material for sidewalks is poured in place concrete with a broom finish for traction, although other materials can be considered as required.



The pedestrian clearway provides a continuous zone that is protected from vehicular traffic.

4.2.2 Buffer Zone

Definition and Goal

The buffer zone is the area immediately back of the curb, providing clearance between the roadway and boulevard elements. The buffer zone provides a safety buffer against car doors, mirrors etc., and to accommodate road signage, utility posts and snow storage.

Priorities

The buffer zone is important in the safety and maintenance of a roadway. Where the roadway is constrained and a continuous landscaping and site furnishing zone has been provided, some overlap between the two can be considered to minimize the overall right-of-way width. The buffer zone is most important for Community Connectors as it provides an important zone to store snow in the winter.

Guidelines

- The buffer zone should be constructed of a material that is appropriate for snow storage;
- The buffer zone can be considered to have overlap with the site furnishing zone if deemed appropriate and the right-of-way is constrained;
- The buffer zone should not overlap with cycling facilities;
- If an buffer zone is included in the roadway, designers can potentially reduce the overall width of the shoulder but the combined dimension of the shoulder and buffer zone should not be less then the recommended dimension of the shoulder; and
- Road signs, lighting, utility poles and appropriate below ground utilities can be located within the buffer zone.



A buffer zone is a street feature, which is used to minimize street clutter and assist with snow storage.

4.2.3 Land-Use Transition Zone

Definition and Goal

The area between the pedestrian clearway and the building front or private property line is called the Land-Use Transition Zone. The area provides a dedicated location for window shopping, retail overflow, small patios, and doorways/building entrances. This area may also contain private street furniture, private signage merchandise displays, etc.

Priorities

The need for a transition zone varies depending on the existing and long term vision for an area. In predominately urban retail areas within the cities or villages, this zone is optional but recommended as it can add to the viability of the retail areas by providing generous areas for outdoor patios and retail street sales. This zone is also recommended in residential areas as it can assist in transitioning from the public to the private realm.

Guidelines

- In retail areas the Land-Use Transition Zone may contain above ground utilities, private seating areas, planters, signage, and temporary retail displays;
- Elements from this zone can not impede the pedestrian clearway in any manner;
- The Land-Use Transition Zone can be located within the public right-of-way or on the adjacent private property;
- If located in the public right-of-way, no permanent elements may be installed without regional approval;
- Overhanging signage can be installed if it does not interfere with pedestrian travel and meets the signage

regulations for the area, including the Region's Sign By-law; and

- Way-finding signage can be included as per the Region's Tourism and Essential Services Signage Policy.



The land-use transition zone provided a dedicated location for window shopping, retail overflow, small patios, and doorways / entrances.

4.2.4 Transit Facilities

Definition and Goal

The need for accessible and central transit facilities is a focus of the Regional Official Plan. How transit services interrelate with the road and boulevard impacts the safety and visual quality of the street design. Key interaction points occur at road transition areas, transit stops and at intersections. An appropriately designed interaction can minimize traffic conflicts and encourage pedestrian connections to transit services. The street design should seamlessly transition passengers from transit to alternate modes of transportation e.g. walking, cycling and/or driving.

Priorities

Well designed and safe transit stops and stations are an important consideration in the design of the boulevard. These areas should take priority over other elements such as the Parallel Parking Lanes and the Land-Use Transition Zone.

Guidelines

- Transit shelters/stops should have barrier-free access from the sidewalk and be located in a way that does not interfere with the pedestrian clearway;
- Transit stops should be located near building entrances and given priority over parallel parking lanes;
- Where possible, and unless there is a very wide boulevard, shelters should be placed behind sidewalks as this improves safety and visibility.
- Where this is not possible, transit stops / shelters may be located within the Landscape and Site Furnishing Zone. In these instances, transit stops / shelters should be placed at an adequate distance from the curb (typically 1 metre minimum);
- Position transit shelters at least 1 m away from curbs and sidewalks to prevent accidental damage from snow maintenance equipment;
- Provide concrete pads in the waiting and loading areas of transit stops. The pads should be flush with the sidewalk to provide accessibility to passengers using wheelchairs, and textured to provide tactile directional cues for visually impaired riders;
- Limit the use of bus bays to roads with speed limits of 80 km/h or greater, or where a site-specific safety hazard or need has been identified;
- Transit stops/stations should include a shelter for weather protection;
- Ensure that the concrete loading pad is long enough to serve passengers exiting from all doors of transit vehicles, and at least 1.8 to 2 m wide, to accommodate wheelchairs;
- In cases where shelters cannot be accommodated behind sidewalks, stand-alone shelters should be located on the inner boulevard, adjacent the curb, to improve visual connections between the shelter

and the approaching transit vehicle. This location will also promote a more compact roadway corridor and minimize conflicts with land uses, such as residential development. Only place stand-alone shelters in the outer boulevard (towards the property line) where roadway travel speeds are high and roadway corridor widths are generous. The integration of transit shelters with other uses or development may also warrant the creation of waiting areas in other locations. Regardless of the shelter location, visual connection to approaching vehicles and direct pedestrian access to the vehicles must be provided;

- Use transit shelters that have transparent walls providing visual connection between waiting transit users and approaching transit vehicles. Transparent shelters will also provide visual surveillance of transit shelter areas, improving pedestrian safety. Transit shelters should be located outside of the intersection sight visibility triangle;
- Two openings in the shelter, when feasible, should be used to reduce entrapment areas.
- Openings preferably should face the sidewalk, especially if the shelter is between the road and the sidewalk. This reduces the road splash and snow clearing problems.
- Consider providing an open, roofed shelter if budget or site-specific characteristics prohibit the construction of an enclosed shelter; and
- Choose transit shelter designs that reflect the identity and character of the local area.



Transit facilities should be designed to minimize traffic conflicts and encourage pedestrian connections to transit services.

4.2.5 Multi-Use Trails

Definition and Goal

A multi-use trail is a type of sidewalk with an asphalt or gravel surface for the use of both pedestrian and non-motorized vehicles. Multi-use trails are sometimes located adjacent to streets with large landscape buffers and can be used by both pedestrian and cyclists.

Priorities

In cases where the road speed is not conducive towards having a sidewalk and/or cycling facilities directly adjacent to the street, a multi-use trail can encourage alternate modes at a convenient yet safe distance from vehicular travel. Typically, if a pedestrian clearway is provided, then cycling facilities should be included within the roadway. If a pedestrian clearway is not necessarily required and there is a landscape buffer, a multi-use trail should be considered. Where appropriate, a multi-use trail should be added to existing Regional Transportation Corridors to support an interconnected pedestrian and cycling network.

Guidelines

- Multi-use trails should be constructed with a durable surface;
- Multi-use trails should be connected to the existing pedestrian and cyclist networks;
- Multi-use trails can be used as mid-block connections to adjacent development when appropriate;
- Multi-use trails should be fully accessible;
- The seasonal nature of the trail should be considered in its design, e.g. the trail surface should be durable enough to withstand snow clearing if the trail is to be cleared in the winter;
- Trails that link to the larger cycling transportation network should be maintained year round;
- Trails should be located adjacent to the landscape buffer zone; and
- Trails should range from 3-4 metres depending on the anticipated use.



Multi-use trails are sometimes located adjacent to streets with large landscape buffers and can be used by both pedestrians and cyclists.

4.2.6 Decorative Lighting

Definition and Goal

Decorative lighting is designed to be attractive, producing a special streetscape character and to enhance the pedestrian environment and improve the perception of pedestrian safety.

Priorities

Decorative lighting is an optional design element for Regional Transportation Corridors, but it is essential in encouraging pedestrian traffic in many streetscape conditions. In urban areas, decorative lighting not only lights the pedestrian clearway zone, but provides an appropriate scale that is comfortable for pedestrians. In more remote locations, where pedestrian clearways or multi-use trails are not adjacent to buildings, decorative lighting mark pathways and encourage their use.

Guidelines

- The design process for Regional Transportation Corridors should consider the potential and future locations of pedestrian lighting and should coordinate with the Cities or business associations in order to determine if lighting is required;
- The Region can provide a suitable location for decorative lighting in the right of way, when requested by Area Municipalities. Coordination should occur between the Region and municipalities so that partnerships can occur to implement Decorative Lighting.
- Appropriate locations for continuous decorative lighting should be identified by the municipality along pedestrian routes, and should be based on crime prevention through environmental design standards.
- Decorative lighting may be designed as a freestanding fixture or be building mounted to reduce clutter in the boulevard;
- Decorative Lighting can be located within the Landscape and Site Furnishing Zone or within the Land-Use Transition Zone if they are affixed directly to buildings;
- Additional decorative lighting should be considered in existing areas where there is a high volume of pedestrian activity, including key intersections, transit stops, multi-use trail crossings, etc.
- The design and placement of decorative lighting should conform with the Region's illumination policy.



Decorative lighting enhances the pedestrian environment and improves the perception of pedestrian safety.

4.2.7 Landscaping and Site Furnishing Zone

Definition and Goal

The landscaping and site furnishing zone is the area of the boulevard that provides a buffer between the pedestrian clearway and traffic. The zone contains planted and hardscaped areas with a potential for site furnishing such as benches, bicycle locks and transit shelters. Establishing a hierarchy for the site furnishing zone is important to create vibrant streets where vehicular and pedestrian travel can coexist.

Priorities

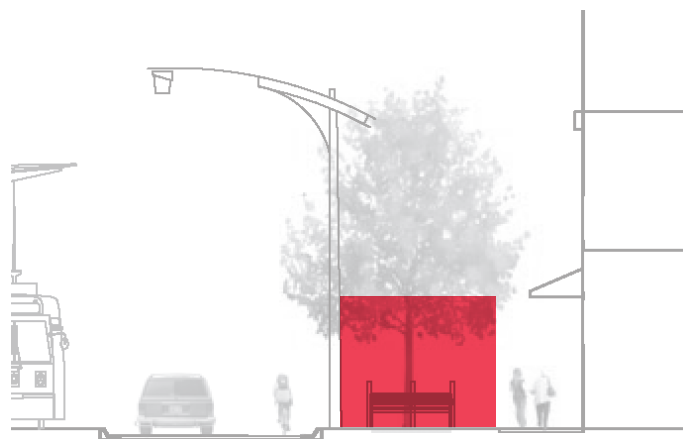
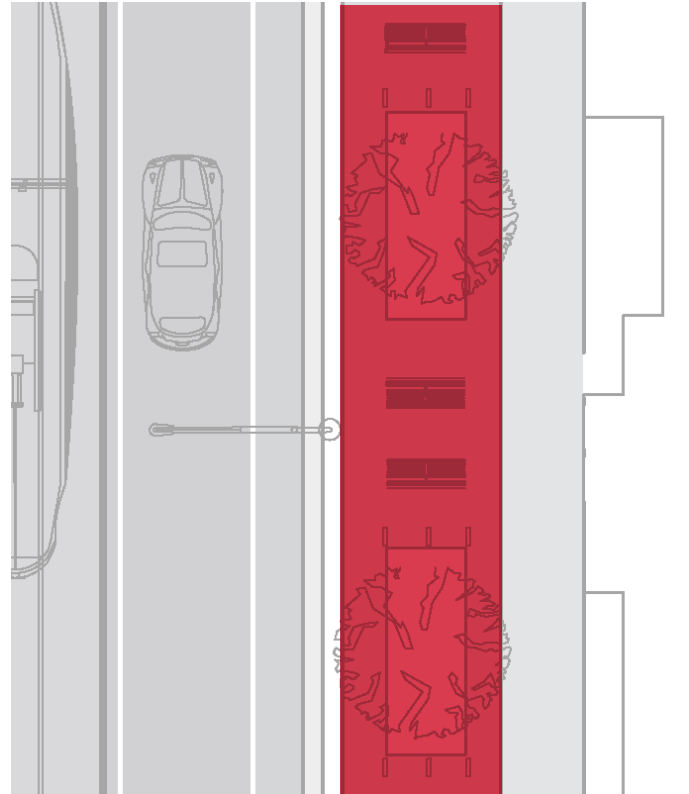
The landscaping and site furnishing zone should be incorporated/planned for all Regional Transportation Corridors that have or anticipate pedestrian clearways directly adjacent to the street. The more traffic the more necessary the landscaping and site furnishing zone becomes as a buffer for pedestrians from the travel lanes. In more urban areas where right-of-way widths are constrained, the landscaping and site furnishing zone can be intermittent, sharing the same sectional location as the parallel parking lanes or transit facilities.



The landscaping and site furnishing zone provides a buffer between the pedestrian clearway and traffic.

Guidelines

- The planting and furnishing zone can be hardscaped or landscaped, landscaped is anticipated for less urban areas and a mix of hardscaped and landscaped for more urban areas;
- Hardscaping and landscaping should be designed to be low maintenance and durable.
- Low maintenance planters and planting areas should be used at the street edge to soften hard surfaces and buffer the pedestrian clearway from the road;
- Hardscaping can have a material difference from the pedestrian clearway to visually differentiate it from pedestrian travel areas;
- Wherever possible, this zone should contain a linear planting of trees;
- In urban areas, trees should be planted in continuous tree trenches to encourage longevity and viability;
- Wherever possible, plantings should be used to announce entrances, accent open space areas and define the pedestrian clearway;
- All street furniture and signage should be located within this zone; and
- No part of the furniture or signage elements should impede travel within the adjacent pedestrian clearway.
- Consideration should be given to maintaining appropriate sight distances at major access points. This can be accomplished by avoiding the use of large trees and vegetation that may reduce visibility, and by providing low lying vegetation as an alternative.
- Street tree locations should be coordinated with utilities to minimize root pruning during utility maintenance and to ensure planter size for optimum tree growth.



The Landscaping and Site Furnishing Zone contains planted and hardscaped areas with a potential for site furnishing such as benches, bicycle racks and transit shelters.

4.2.7.1 Bioswales

Definition and Goal

A bioswale functions as a stormwater filter by capturing, temporarily storing, and treating stormwater runoff by passing it through engineered filter media. Given the need to protect the groundwater supply in the Region of Waterloo, a bioswale shall include an underdrain which conveys the filtered stormwater to a storm drain system or other suitable surface outlet. Further, the bioswale should include an impermeable liner if the facility is located in an area with permeable native soils. The primary component of a bioretention practice is the filter bed with a mixture of sand, soil, and organic material as filtering medium. Pre-treatment, such as a settling forebay or grass filter strip, precedes the filter bed to remove particles that could otherwise clog the filter bed.

Priorities

Bioswales should be located within the Landscaping and site furnishing zone. Their inclusion in the design of Regional Transportation Corridors should be addressed on a project by project basis. A bioswale provides an opportunity to educate the public on the need to manage the quality of runoff from the public road and how stormwater quality control measures can be implemented both effectively and aesthetically.

Guidelines

- Drainage swales should be planted with salt tolerant, indigenous shrubs and grasses to filter stormwater.
- Bioswales are stormwater management measures that provide quality control benefits by means of filtration. The addition of an underdrain and potentially impermeable liner (HDPE liner) where native soils are permeable, enables bioswales to function without harm to Regional groundwater resource, for example; Evergreen Brick Works in Toronto.
- Vegetated surface drainage swales should be used, where possible, to minimize the drainage loads and provide water quality measures at source.
- Drainage swales in urban areas should be built with an overflow drain that links to the stormwater management infrastructure.
- Where back-up infrastructure does not exist (e.g. rural roads), bioswales should be adequately designed and sized to treat stormwater flows and include the provision of an underdrain that outlets to a surface drain.
- Infiltration of stormwater runoff from roadway surfaces is not an acceptable approach to managing runoff from Regional Transportation Corridor allowances.
- Bioswales are appropriate on Avenues and Main Streets and may occur in areas in front of public buildings as an interpretive education tool, or in a special character area.



Bioswales capture, temporarily store, and treat stormwater runoff.

4.2.8 Site Furnishings

Definition and Goal

Site furnishings are streetscape elements that contribute to the safety, comfort and utility of public space. Site furnishings include seating, parking metres, bicycle racks, newspaper boxes, waste receptacles, transit shelters, planter boxes and mail boxes.

Priorities

Site furnishings are always an important element of a boulevard's design, but their inclusion provides important amenities that support pedestrian and transit use. Although they are not mandated, areas for their future inclusion should be provided within the Landscape and Site Furnishing Zone. Site Furnishings help create a transit supportive environment with seating and other amenities at transit stops.

Guidelines

- Street furnishings should be placed in a coordinated manner that does not obstruct the pedestrian clearway or vehicular circulation to driveways, parking, loading and/or service areas;
- Site furnishings should be designed to allow pedestrians to feel safe and want to linger in the space;
- Preference should be given to furniture made of durable, renewable, locally produced materials;
- Only publicly (regional or city) owned and maintained furniture can be located within the regional right-of-way; and
- Within a boulevard's design, locations for street furniture should be predetermined with a priority on areas directly adjacent to transit stations / stops.



Site furnishing elements contribute to the safety, comfort and utility of public space.

4.3 Roadway Guidelines

4.3.1 Transit Priority Lanes

Definition and Goal

Transit priority lanes are travel lanes dedicated to transit vehicles, such as light rail or bus rapid transit. Transit priority lanes enable public transit to be a more attractive and viable option for commuters. The goal of transit priority lanes is to minimize delay to transit vehicles along congested roadways and through intersections thereby providing a faster commute time for transit passengers.

Priorities

Transit priority lanes should be considered on routes that have high existing / planned transit usage.

Guidelines

- Where dedicated transit lanes are provided in the same direction of travel as the adjacent through lanes, the width of the transit lane should be the same as the adjacent through lane or 0.2m less, but not less than 3.35m.
- Where a contraflow lane is provided the width should be 4.0m where the design speed is greater than 60 km/h and 3.7 m to 4.0 m where the design speed is equal to or less than 60 km/h.
- Transit stop locations and transit-oriented development should be focused at the intersections with cross-streets.



Transit priority lanes enable public transit to be a more attractive and viable option for commuters.



Transit priority lanes minimize delays to transit vehicles along congested roadways and through intersections.

- 4.0m would be required for high occupancy vehicle lanes to accommodate cyclists, taxis, buses, and emergency vehicles.
- Where bus bays are provided, the minimum width of the bus bay should be 3.0m.
- Coordinate bus movements with traffic flow to avoid conflicts.
- Give transit vehicles equal or greater priority at intersections.
- In urban neighbourhoods and residential connectors, provide bus stops at intersections, letting passengers disembark adjacent to the corner where crosswalk lines and signal heads are located.
- Pedestrian access along transit priority corridors:
 - Ensure that the maximum walking distance to a conventional transit stop does not exceed 450m for at least 95% of all the residences, and 600 to 800m for major transit stations.
 - Ensure that the maximum distance between pedestrian access points to a Regional Transportation Corridor are generally no more than 250 m.
 - Position transit stops as close as possible to intersections and crosswalks.
 - Provide permeable street patterns allowing pedestrians to access public transit.



Transit priority lanes provide a faster commute time for transit passengers.

4.3.2 Cycling Facilities

Definition and Goal

Cycling facilities include bike lanes, paved shoulders, shared bicycle/parking lanes, wide curb lanes, multi-use off-road trails and shared bicycle/other vehicle lanes. A cycling route may include any of these types of cycling facilities.

Priorities

The Cycling Master Plan / Active Transportation Master Plan is the guiding document in determining the need and location for cycling facilities. Cycling facilities on all road classifications, with the exception of the Community Connector roadway, is considered important in providing the Region with an efficient multi-modal transportation network. The Community Connector roadway is a higher speed high volume road and the mixing of on road cycling / vehicular traffic should only be considered after other options, such as off-road facilities or alternate parallel cycling routes are considered.

Guidelines

- Section 3.3 of the Cycling Master Plan provides an overview of the typical cycling facility types and design guidelines for the Regional network. Section 3.3 of the Cycling Master Plan is not meant to be inclusive. As safety and design guidelines from government agencies evolve, so too will the guidelines applied by the Region of Waterloo, rather it is to provide an overview of typical facility types and design guidelines. The “Ontario Bikeways Planning and Design Guidelines” published by the Ministry of Transportation (MTO) and



Cycling facilities are an important component of the Region's multi-modal transportation network.

the “Bikeway Traffic Control Guidelines for Canada” by Transportation Association of Canada (TAC) should be referred to for additional detail regarding design treatments. To ensure consistency throughout the system, any deviations from the guidelines described in this text shall be subject to review and approval by Transportation, with the advice of Transportation Planning and the RCAC.

- The width of the cycling lane should be considered in conjunction with the width of the adjacent travel land and if there is no gutter present, a wider bike lane should be considered.
- Please refer to Appendix B Section 1.5 for additional guidelines for cycling facilities.

4.3.3 Travel Lanes

4.3.3.1 Curb Design

Definition and Goal

Curbs are raised or vertical elements located adjacent to a travelled lane, parking lane or shoulder. The purpose of which is to provide drainage control, right-of-way reduction with the elimination of open ditch drainage systems, guidance and access control.

Priorities

Curbs are generally a necessary design element in urban environments and where right-of-way width is limited. When curbs are used as a means to work within a reduced right-of-way then a storm drainage system is required to ensure adequate level of service is provided for the management of runoff from the roadway.



Curbs provide drainage control, right-of-way reduction, guidance, and access control.

4.3.3.2 Shoulder Design

Definition and Goal

Shoulders are a critical element of rural cross-section roadways. The shoulder provides a recovery area for errant vehicles, a refuge for stopped or disabled vehicles, an area out of the travel lanes for use by emergency and maintenance vehicles and lateral support for the roadway structure.

Priorities

Shoulders are normally provided on rural road cross-sections and are desirable on high speed arterial roadways with design speeds greater than 80 km/h.

Guidelines

- It is important to make a clear distinction between travel lanes and shoulders so as to not encourage the use of the shoulder as a travel lane. Alternate means of achieving this include:
 - The use of pavement of contrasting colour and/or texture;
 - The use of pavement edge striping. This approach is effective where the shoulder is partially paved with the same material as the through travel lane.
 - Pavement markings should be striped at 3.35 metres. An additional 0.3m should be considered if at least 12% of roadway traffic consists of trucks and heavies combined.
 - The use of shoulders with a steeper cross-slope than the adjacent travel lane.



Shoulders provide a recovery area for errant vehicles, a refuge for stopping or disabled vehicles, and an area for emergency vehicles.

4.3.3.3 Curb / Shoulder Lanes

Definition and Goal

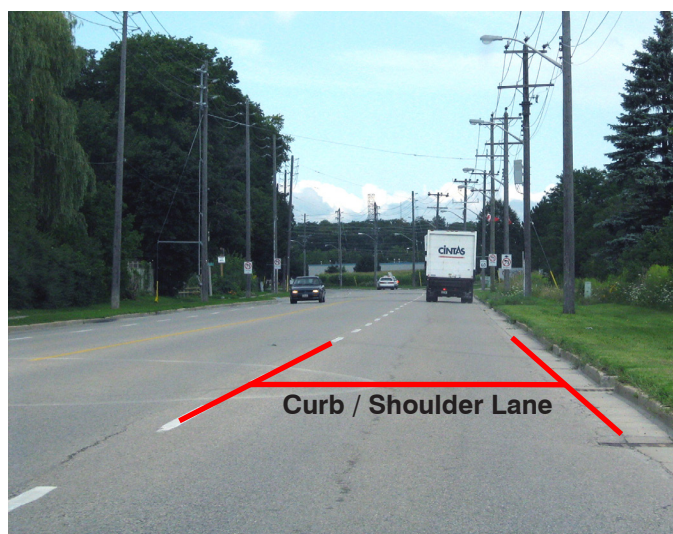
A curb / shoulder travel lane provides for the movement of vehicles travelling from one destination to another, not including shoulders and auxiliary lanes. The specified lane widths accommodate the vehicular traffic on the roadway. The goal of the roadway designer is to select a travel lane width that best serves all users of the road allowance.

Priorities

Pedestrian priority streets will generally have smaller travel lane widths as means to encourage vehicular traffic to slow down to facilitate the safer interaction of the vehicles / cyclists / pedestrians.

Guidelines

- Keep the number and width of travel lanes as few and narrow as possible, while considering safety and capacity requirements, to reduce the amount of surface, to reduce the width of crosswalks, and to dedicate as much of the road allowance as possible for the boulevard elements.
- Design traffic lane widths based on the road design speed, traffic volume, number and type of trucks and buses and the available road allowance.
- Roadways with curb (no gutter) sections generally selected where right-of-way or physical constraints exist, When selecting a curb (no gutter) section consideration should be given to specifying curb face inlet catchbasins as such drainage facilities enable cyclists to maintain a consistent line of travel.
- Curb / Shoulder lanes should generally be between 3.35 and 3.65 metres along Community Connectors, Neighbourhood Connector - Avenues, Residential



Curb / Shoulder lanes provide for the movement of vehicles travelling from one destination to another, not including shoulders and auxiliary lanes.



Connectors, and Rural Connectors where space is not required for buggies, with the preferred lane width being 3.65 metres.

- Curb / Shoulder lanes should generally be between 3.05 and 3.65 metres along Neighbourhood Connector - Main Streets and Rural Village - Main Streets where space is not required for buggies, with the preferred lane width being 3.65 metres.
- A reduced curb lane width should be considered if there is an adjacent cycling lane or parallel parking lane.
- The width of the cycling lane should be considered in conjunction with the width of the adjacent lane.

4.3.3.4 Curb Lanes with Buggy Traffic

Definition and Goal

For Regional Transportation Corridors that have been identified as buggy routes, consideration shall be given to the operation of buggies and interaction with other modes of transportation in the Transportation Engineering decisions.

Priorities

On Regional Transportation Corridors where buggy travel exists, the design and construction of the road must account for the required safety and design standards.

Guidelines

- Curb side travel lanes with buggy traffic should be 4.85m in width and striped to provide a vehicular travel lane width of 3.35m on the Rural Connectors and Rural Village - Main Street classifications.
- Please refer to Appendix B for additional detailed guidelines



Curb / shoulder travel lanes can be widened to facilitate the safe interaction of vehicles, cyclists, and buggies.

4.3.4 Turning Lanes

4.3.4.1 Right / Left Turning Lanes

Definition and Goal

Right / left turn lanes are auxiliary lanes, the purposes of which are to provide additional capacity at intersections and improve the level of service of the roadway.

Priorities

The provision of right / left turn lanes is an important element in all road classifications and required to develop an efficient transportation network.

Guidelines

- For two-lane Regional Transportation Corridors with a rural cross-section at controlled intersections, pave the gravel shoulders at the corners of the intersection to avoid maintenance problems and provide more paved surface for drivers passing left-turning vehicles on the through road.
- Dual right-turn lanes are not recommended unless required for signalized capacity.
- Please refer to Appendix B for detailed guidelines on left turning lanes.

4.3.4.2 Dual Left Turning Lanes

Definition and Goal

Dual left turn lanes can be used at intersections that have high left turning movements. The goal of the dual left turning lanes is to provide additional capacity at the intersection, improve the level of service of the roadway and optimize the operation of the transportation network.

Priorities

Dual left turn lanes are generally implemented on higher volume roadways and roadways with a high percentage of left turning bus / truck traffic.

Guidelines

- The width of the approach lane should be 3.5m.
- The width of the receiving or departure lane is a function of the turning characteristics of the design vehicle and is generally 4.5m.
- Review alternative routes to avoid use of dual left turns.
- Please refer to Appendix B for detailed guidelines on left turning lanes.



Right / left turn lanes are auxiliary lanes, which provide additional capacity at intersections and improve the level of roadway service.

4.3.5 Passing Lanes

Definition and Goal

The passing lane, also known as the median lane, is a through travel lane the need for which is a function of required capacity and the desired level of service for the operation of the roadway. The primary function of the passing lane is the same as the curb / shoulder lane.

Priorities

Passing lanes are considered necessary in all roadway classifications and the need is a function of the traffic demands and the desired level of service during periods of peak demand.

Guidelines

- Generally the passing lane width will be the same or less than the specified width of the curb / shoulder lane.
- The preferred width of the passing lane is 3.35m for the UCC, UNC-Avenue, URC and RC classifications.
- The preferred width of the passing lane is 3.25m for the UNC-Main Street and RMS classifications.

4.3.6 Medians

Where wider right-of-ways are present on Regional Transportation Corridors, potential may exist for the provision of a median, which can be placed between opposing traffic lanes. Medians can also be used to define a special urban district, especially in high density residential conditions. The following section provides an overview of the different types of medians and how they can be used.

4.3.6.1 Medians for Safety and Traffic Flow Separation

Definition and Goal

A median for safety and separation functions as a safety barrier the goal of which is to reduce the risk of high speed head on collisions.

Priorities

Medians for safety and separation are considered important for the road classifications with the higher operating speeds.



Passing lanes provide for the movement of vehicles travelling from one destination to another.

Guidelines

- Medians on a divided urban street provide multiple opportunities related to safety, traffic operations, access control and aesthetics in addition to safety. These opportunities include:
 - Improved safety by means of physical separation of opposing traffic flows;
 - Storage area for left turning vehicles out of the path of the through traffic stream;
 - Provision of pedestrian refuge space;
 - Control of access by restricting left turns and u-turns to specific median openings;
 - Provision of physical space for the effective placement of traffic control devices and bridge piers; and
 - Provision of space for landscaping and streetscaping treatments to enhance aesthetics and promote traffic calming.
- Consider medians on roads with higher posted speeds to divide opposing traffic lanes and reduce the risk of high speed collisions.
- The preferred width of these median types is 3000mm as it enables the provision of left turn lanes at intersections and sufficient width remains to install poles / electrical handholes for the traffic control purposes. Medians will require evaluation to ensure sufficient width is available at intersections to construct the left turn lane, the specified curb type, the traffic signal pole and the electrical / communication handholes for the traffic signals.
- Also consider limiting the use of medians to reduce the road corridor width. Use medians as a traffic control measure after other measures are considered.
- Consider landscaped medians for special districts or important roads. Medians can: accommodate road light poles or spatially define wide road corridors.
- Select landscape materials for medians according to the guidelines for Streetscape Furnishing Zone, and have particular regard for survivability, salt tolerance, and the need for consistency with landscaping on the road edge and on adjacent lands.
- Consider planting trees in the medians along roadways with design speeds of 70 km/h and less.
- Refer to the “In-Service Evaluation of Major Urban Arterials with Landscaped Medians – Phase II “ WSDOT Research Report dated July 2009 for guidance in evaluating the risks of planting trees in medians on roadway medians with design speeds greater than 60 km/h.



Medians can function as a safety barrier in order to reduce the risk of high speed head on collisions. They may also include vegetation.

4.3.6.2 Medians for Access Control

Definition and Goal

A median for access controls turning traffic on roads with many driveway entrances and heavy traffic. The goal of this median is to reduce the risk of collision by controlling the location of the turning movements along the roadway.

Priorities

The priority and need is a function of the volume of traffic and the number driveway entrances along the length of the roadway.

Guidelines

- Construct medians along roads with numerous driveways to control traffic turning movements at specific locations, to provide pedestrian refuge at wide crossings, and to provide space for traffic signals and utility poles.
- This traffic control condition is required where higher traffic volumes and speeds are to be accommodated and where turning movements need to be restricted.

4.3.6.3 Mid-Block Medians for Refuge

Definition and Goal

A median for refuge is an area within the travelled portion of the roadway where pedestrians have the ability to protect themselves from the hazard of completing a full crossing of the travel lanes on the multi-lane roadway. The goal of the median for refuge is to provide a more pedestrian friendly road allowance and reduce the risk of pedestrian / vehicular collisions.



Medians can be used to control the location of vehicle turning movements along major roadways.

Priorities

Consideration should be given to providing a pedestrian refuge island for a Regional Transportation Corridor, particularly where the distance to the nearest controlled crossing is in the range of 500m or greater, and where there are seniors or school children from junior kindergarten to grade 8 crossing the road.

Guidelines

- On multi-lane roadways medians can provide an opportunity for pedestrians to seek refuge while crossing the roadway.
- At signalized intersections in which the pedestrian crossing phase is at the lower end of the desirable crossing times and pedestrians are unable to complete the crossing of the entire intersection, a median will permit them to safely wait until the next crossing phase.
- The preferred width for the Community Connector and the Neighbourhood Connectors is 3000mm. The minimum desired width is 1750mm.
- The preferred width for the Residential Connector and the Rural Village - Main Street is 2400mm. The minimum desired width is 1750mm. Where possible, wider median refuge can be provided.
- See Appendix B for additional guidelines pertaining to pedestrian refuge islands.



Medians can provide opportunities to add character to a streetscape, in addition to controlling traffic movement.

4.3.6.4 Medians for Infrastructure

Definition and Goal

A median for infrastructure provides an area within the travelled portion of the roadway to locate signal poles, streetlight pole and signage poles.

Priorities

The provision of a median for infrastructure is considered important for all road classifications where intersections have traffic control signals.

Guidelines

- The width of a median for infrastructure is a function of the curb type and the size of the above ground infrastructure to be located in the median.
- The designer needs to consider the size of the infrastructure to be located in the median when selecting a median width. The preferred median width of 1600mm provides for a 500mm curb & gutter and a 600mm wide platform. This platform width provides for the installation of the 600mm wide infrastructure component (streetlight pole, traffic signal pole, electrical / communication handhole, etc.)
- If the electrical / communication handhole needs require a handhole larger than that provided by OPSD-2112.01 then a median width larger than 1600mm needs to be designed.
- If constrained, a 1.0 m width can be used with a barrier curb instead of a curb and gutter design.



Medians can provide space for roadway infrastructure, including poles for traffic signals, lights, and signage.

4.3.6.5 Medians with Landscaping

Definition and Goal

Landscaped medians provide opportunities to add character to a streetscape, in addition to controlling traffic movement. Although landscaped medians can be found on a variety of roads, they are most important on wide rights-of-ways, where they provide spatial definition and a comfortable sense of enclosure that encourages drivers to slow down and pedestrians to feel comfortable in the space. Through landscaping, the median can contribute to the sense of place of a street or district.

Priorities

Provide within roadways with a high number of travel lanes or where control of vehicle turning movements is important.

Guidelines

- Do not use on narrow rights-of-way or on main streets where spatial and visual connection between opposite sides of the street is important.
- Attempt to provide continuity and avoid piecemeal arrangements to achieve full impact of median.
- Consider a landscaped medians on streets where a unique character or identity is desired.
- Landscaped medians should only be considered if there is generous space for sidewalks and other elements within the roadway edge.
- Generally design the median width to be 5-6 m at intersections, so that a 3.25 m vehicle left turn lane can be taken from the median while retaining a sufficient median width for pedestrian refuge, traffic signal infrastructure and signs. At other locations, a 3-4 m median width is sufficient for tree health and growth.
- For medians without a hard surface and where posted travel speeds exceed 60 km/h, construct a 500mm wide salt strip around the perimeter of the island to eliminate winter kill due to salt exposure. This salt strip should be constructed of the same material as other hard surface island treatments, with a 2% minimum cross fall (e.g., interlocking brick, asphalt, or textured concrete).
- Apply the same guidelines for landscaping for medians as for road edge landscaping, ensuring consistency with landscaping on the road edge and adjacent lands. Where a median does not have a hard surface, consideration should be given to planting grasses, shrubs and perennials. Where trees are desired in landscaped medians, the use of continuous or individual planter boxes should be encouraged to protect trees from salt spray.

4.3.7 Parallel Parking

Definition and Goal

Parallel parking is an optional design element that if implemented properly can facilitate the creation of a vital and active street.

Priorities

It should be considered where a main street retail environment is desired in certain regional centres and corridors, as it will promote walking and slow traffic, thereby improving the visibility of shops. It can also be used as short-term loading space for small commercial uses on retail streets and reduce development costs for small businesses by permitting parking to be provided on street.

Guidelines

- On-street parking is also a useful addition to residential streets and can serve as visitor parking
- Promote on-street parking on streets with land uses that are directly accessible from the corridor to promote retail and business uses and shield pedestrians from traffic.
- Avoid diagonal parking.
- Ensure pedestrians at crosswalks are easily seen by motorists. This can be accomplished by not permitting parking adjacent to the crosswalk, or by extending the sidewalk out towards the travel lane for the creation of a “bump-out” at crosswalks. This strategy can also be applied at transit stops.
- Do not consider on-street parking on streets with an operating speed of over 60 km/h.
- Consider metering on-street parking to promote short-term parking.



Parallel parking can be used to facilitate the creation of a vital and active street.

4.4 General Guidelines

4.4.1 Transit Corridors

Definition and Goal

Transit corridors are Regional or Area Municipal Roads on a dedicated passageway outside of mixed traffic that accommodate existing or planned high frequency transit service.

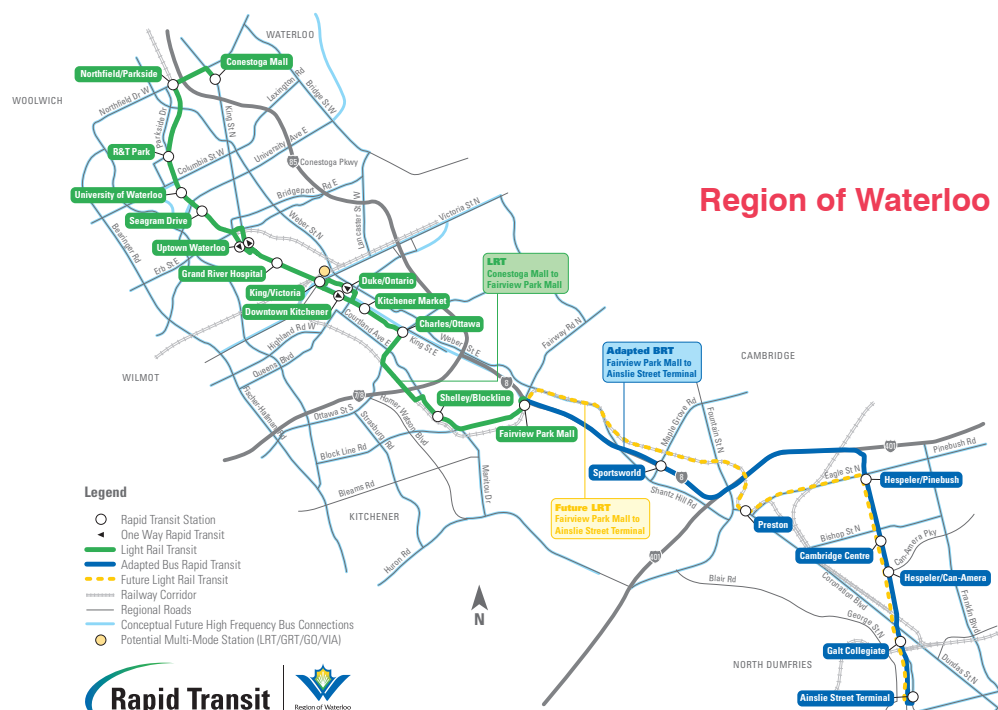
Priorities

Priority is placed on moving relatively higher numbers of transit users a significant distance with the focus placed on the design of the areas, or nodes, surrounding stations. A significant amount of the proposed LRT corridor is on existing roads with narrow road allowances. The functional design completed for the LRT has managed to reasonably accommodate boulevard and street elements without significantly impacting adjacent properties.

However, there are several constrained segments of the LRT route that can not accommodate certain elements or the minimum widths identified in these guidelines. In these instances, the priority is placed on the provision of appropriate transit infrastructure.

Guidelines

- Stations along these corridors should be closely integrated with at-grade uses, such as retail;
- Densities at station nodes should be relatively high to provide a large number of transit users within walking distance; and
- Pedestrian and cycling connections to station areas should be direct and convenient.
- Redevelopment or intensification areas should be anticipated and designed for transit corridors.



Proposed Rapid Transit routes from the "Connecting to the Future Plan for Light Rail Transit".

4.4.2 Utilities

Definition and Goal

Coordinating utilities and boulevard elements is essential to ensure that adequate access is provided for repairs and services and to minimize disruptions to the pedestrian clearway and traffic, and to ensure the safety of maintenance personnel. Underground and above ground utilities can have major impacts on the design and function of a roadway. It is a goal to maximize the service life of all infrastructure in the right-of-way and minimize lifecycle costs by means of coordination and the completion of an integrated planning and design process with the Right-of-Way stakeholders. The design and placement of all utilities must conform to the standards set out by the Ministry of Environment.

Priorities

Standards for the placement and location of utilities need to be observed in the design of all Regional Transportation Corridors. Safety standards and concerns related to their placement must be observed, but the design of these spaces should pro-actively consider the placement of utilities.

Guidelines

The provision of utilities is one of the primary roles of a public road allowance. The above and below grade utilities need to be located in a manner that is safe and efficient. The separation of utilities is required to ensure adequate clearances for proper maintenance of utility lines and to reduce the risk of interference between different types of service. However, where the creation of relatively compact edge of road condition is desired, there may need to be the adoption of joint utility trenches and other strategies to achieve narrower overall edge of road dimensions.

The following pipework and utility design guidelines identify preferred locations. It is acknowledged that most Regional Capital Works projects have constraints that generally require the designer to develop consensus amongst the owners / operators of the pipework and utilities under the guidance of the Region of Waterloo as the right-of-way manager.

General:

- Coordinate the scheduling of Regional / public / private utilities capital works programs.
- Implement damage prevention programs.
- Document and retain as-built records of all constructed infrastructure.
- Bury services and utilities, where practical, to minimize their visual impact.
- There must be a minimum 3 m separation between power lines and any physical development. For urban roadways with a barrier curb and a design speed of 60 km/h or less, the minimum setback between the back of curb and the edge of pole is 0.25m.
- Locate utility poles 3 to 4 m from the property line on rural roads, and in accordance with existing guidelines for minimum sightline and sight triangle distances.
- 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.

Potable Water Supply Pipework:

- Under normal conditions, a minimum horizontal separation distance of 2.5 metres, from outside of pipe to outside of pipe, shall be provided between potable water supply pipework and any storm / sanitary sewer, storm / sanitary sewer maintenance hole, non-potable water supply pipe and district energy distribution system pipework.
- Hydrant placement shall conform to the standards set out in the Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services.
- Potable water supply pipework should be located a minimum of 0.5 m from a storm catchbasin. The distance shall be measured from the nearest edge of the structure to the outside wall of the pipework.

Non-Potable Water Supply Pipework:

The Region has raw water transmission pipework located throughout the Region for the purpose of conveying groundwater from well water sources to treatment plant facilities. Such pipework shall be separated from potable water supply pipework in accordance with 1st bullet of the “potable water supply pipework” guidelines.

Under normal conditions, a minimum horizontal separation distance of 2.5 metres, from outside of pipe to outside of pipe, shall be provided between the raw water transmission supply pipework and any storm / sanitary sewer, storm / sanitary sewer maintenance hole and district energy distribution system pipework.

Raw water transmission line pipework should be located a minimum of 0.5 m from a storm catchbasin. The distance shall be measured from the nearest edge of the structure to the outside wall of the pipework.

Sanitary Sewers:

- Sanitary sewers shall generally be located at the centreline of the roadway and a minimum of 3.0 m from the storm sewer.

Storm Sewers:

- Storm sewers shall generally be located inside of the curb line.

Watermain, Sanitary and Storm Sewer Crossings:

- Under normal conditions, watermain shall cross above sewers with sufficient vertical separation (0.15m) to allow proper bedding and structural support of the watermain and sewer main. For more information, please refer to the MOE standards for watermain, sanitary and storm water crossings.
- When it is not possible for the watermain to cross above the sewer, the watermain passing under the sewer shall be protected by providing:
 - A vertical separation of at least 0.5m between the invert of the sewer and the crown of the watermain;
 - Adequate structural support for the sewer to prevent excessive deflection of joints;
 - The length of the watermain pipe shall be centred at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

Utility Crossings:

- Where watermain cross over or under utilities other than sewers, the clearance and type of crossing provided shall conform to the requirements of the particular utility involved and provide bedding and structural support of the watermain and utility.

Designing for Conditions Other than Normal:

For all other conditions refer to the MOE “Procedures to Govern the Separation of Sewers and Watermains” and the MOE “Sewer and Watermain Installation: Separation Distance Requirements”.

Cable Utilities:

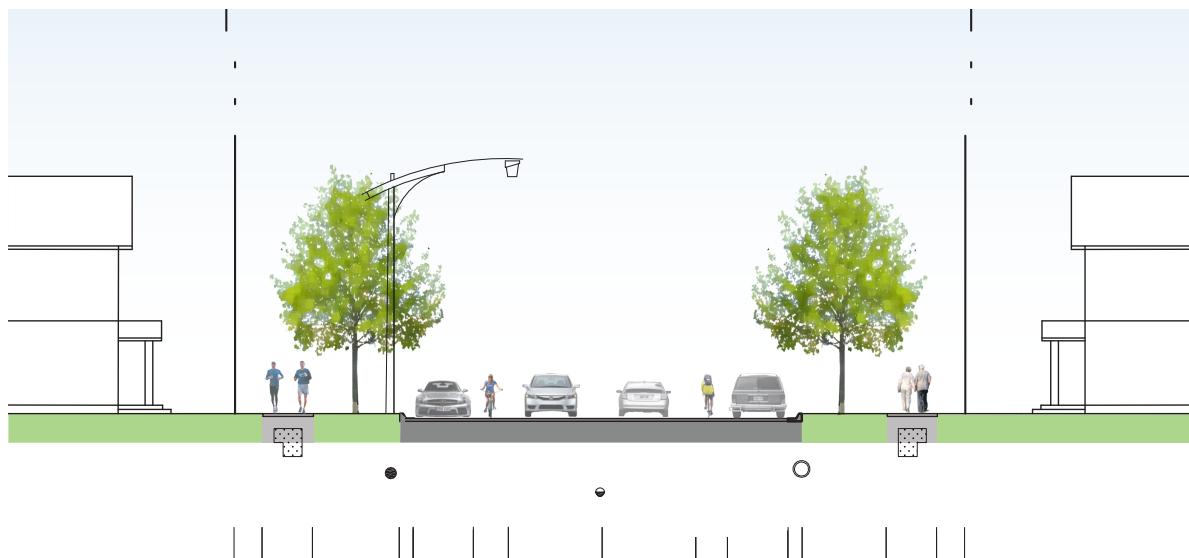
- Use joint utility trenches where possible. They should be used for hydro, fiber optic, telephone, cable TV and other emerging technologies. They can be from 0.6 metres to more than 1 metre deep, 2 m from sanitary sewer, storm water and water mains and 1 m from gas mains. Joint utility trenches may include gas lines in the future. Care should be given to ensure there is no interference with tree roots. Trenches can be located under boulevards or sidewalks.

Utility Pedestals:

- Coordinate the location of utility pedestals with street design and landscaping. The most common approach

to this situation is to align pedestals with street light poles or hydrants. The typical placement is 1 pedestal for every 8 residences within a subdivision.

- Hydro transformers take up more space than other pedestals and are typically situated beyond the street right-of-way in easements but sometimes are within the corridor. Consult with utilities prior to the installation of any screening device. Appropriately screen transformers in such a manner to allow easy access by the hydro utility.
- Large above ground telecommunications infrastructure, such as Walk-in-Cabinets (WICS) and Outside Plant Interface Cabinets (OPI), shall be located and designed to be compatible with its environment and shall be permitted to be located within the public right-of-way or on private property through easements. Locations for these sites shall be determined early on in the planning process.



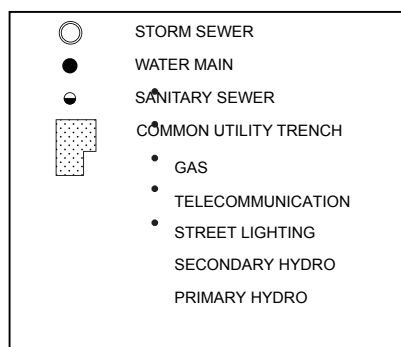
Gas Mains:

- Gas mains are typically located close to the property line. Locate gas mains 1 m from other underground services and at a depth of 1 m.
- In urban areas, place new gas mains on both sides of the arterial road, where possible, to minimize the number of gas mains running across it. This reduces future costs for gas services for new development and road reconstruction.

Conflicts:

- Coordinate landscape plans with service/utility plans to minimize long-term conflicts with tree roots and branches.
- Consider placing utility infrastructure at appropriate locations underground or away from tree drip lines, considering the reach of the tree's roots at maturity to avoid damage from tree roots.
- Consider subsurface or trenchless technology installation rather than tree removal to address conflicts with underground utilities if existing trees are larger than 150 mm caliper.
- Replace trees that are removed as a result of utility works, with trees of the same or greater caliper where practical.

LEGEND

**4.4.3 Maintenance****Definition and Goal**

The life cycle and maintenance of a road are key concerns, affecting long-term cost, environmental sustainability and the perceived quality of the place and experience. It is important not to compromise the long-term longevity and quality of materials, planting and furnishings to save on short-term costs.

Priorities

Maintenance requirements should be considered when deciding the placement and design of landscaping, medians, curbs and sidewalks, to avoid accidental damages. In the Region of Waterloo's climate, snow clearing is particularly important to ensure safe access for users of the road and sidewalks.

Guidelines

- Design bullnoses of medians to be contoured, to reduce the risk of maintenance vehicles damaging the curb;
- Consider the spatial needs of snow maintenance activities when planting shrubs and building planter boxes, designing lane widths, etc., if space is limited on the inner boulevard;
- Align light poles, utility poles and street furniture to leave space for snow storage;
- Consider planting coniferous trees or high shrubs outside the right-of-way in open, windswept areas to reduce snow drifting. Planting is preferable to snow fencing as screens in rural areas;
- Develop appropriate policies and management practices to address conflicts between on-street parking and snow clearing and street cleaning; and
- Where posted speeds are 60 km/h or greater, provide a 0.5 m maintenance strip around the perimeter of grass medians to eliminate winter kill due to salt exposure.
- Consider the maintenance of utilities and maintaining traffic flow when designing roadway widths, etc.

4.4.4 Noise Attenuation

Definition and Goal

Traffic on arterial roads adjacent to residential areas can cause noise that is disruptive to residents. This is especially true on high-speed, high-volume arterials next to subdivisions. Noise levels must conform to provincial and municipal guidelines as well as the Region's Noise Policy. The traditional solution has been to build noise attenuation fences or walls. These fences or walls isolate the arterial road from the adjacent neighbourhoods, presenting a continuous barrier to pedestrian traffic. In order to ensure the provision of pedestrian friendly streets wherever possible, noise attenuation fences or walls should only be used where absolutely necessary.

Priorities

Noise attenuation strategies should begin with the design of the road itself. This can be accomplished through the provision of visual cues to reduce vehicle noise, such as narrowed traffic lanes, paving material changes, on-street parking, vegetation, bump-outs near intersections, etc. Remaining noise should be blocked without the use of fences or walls, if possible. If as a last resort noise fences or walls are required, every effort should be made to reduce their visual impact and avoid blocking pedestrian and bike access.

Guidelines

- Eliminate rattling maintenance hole covers as a source of noise by positioning them where vehicles will be less likely to run over them (i.e., at the centre of traffic lane);
 - If a barrier is warranted, consideration should be given to using berms and landscaped buffers, which should be incorporated into other open and recreational spaces;
 - Necessary land requirements should be determined in the development application process prior to draft approval (e.g. plans of subdivision), including keeping sight lines and sight triangles clear;
 - Avoid using noise attenuation fences or walls if possible. They should only be used as a last resort and should integrate pedestrian connections to the adjacent communities and should be constructed to ESA standards; and
 - Integrate the design of attenuation fences and walls with their surroundings using a variety of designs, colours and textures, vines and other plantings. If required, attenuation fences or walls should be visually appealing. Select materials based upon life span and future maintenance.
- Promote development oriented to the street. Buildings should buffer sensitive noise receptors as opposed to other noise attenuation measures such as walls, fences and berms;
 - Reduce noise at the source by reducing the speed of vehicles through design and transportation design consistent with the roadside environment;

4.4.5 Special Character Streets / Scenic Roads

Definition and Goal

Historic downtowns, heritage buildings, and natural spaces are some of the most valued assets of any community. They provide an important quality of place and identity for the municipalities in which they are situated. They are both a link to the past and are often an anchor for future economic growth. The design of arterial roads through such areas is usually very unique, reflecting the specific history and/or visual or natural character of each place. The balance between land use, built form and the transportation characteristics of the road corridor also tend to be very specific and unique.

The term “Scenic Roads” refers to those Regional Transportation Corridors which are characterized by natural, cultural heritage and recreational features that contribute to their scenic value. These features, to name a few, may include: large trees, heritage buildings, rural character, views to natural beauty, and/or interesting highway geometry.

Priorities

As outlined in Section 3.G.28 of the Regional Official Plan, the defining features of a Scenic Road should be identified during the beginning stages of the Decision Making Process, and where feasible, the scenic value of such features should be protected and/or enhanced along Regional Transportation Corridors. Area Municipalities should be encouraged to establish policies in their official plans to protect the scenic value of Regional Transportation Corridors under their jurisdiction wherever possible.

Guidelines

- Priority should be given to maintaining those features which are special or scenic and preserve the character of the street. This includes, built form, heritage planting, scenic road configurations such as bends or valleys, and open space connectivity.
- Priority should be given to maintaining scenic or special features on all Regional Transportation Corridors, or Regional Transportation Corridor segments.
- Conserve the historic urban fabric along the road corridor to maintain diversity and enrich the experience of corridor users. This will often require specific and idiosyncratic design approaches to building setbacks and the width of the road corridor;
- Avoid narrowing sidewalks and removing on-street parking and/or landscaping. The presence of slow moving through-traffic, on-street parking and a quality public realm are all required to preserve and enhance existing retail uses;
- Only consider a by-pass of a hamlet or village after market feasibility study, which can be included within

the Environmental Assessment process, having regard for the provisions of the Regional Official Plan. The creation of by-pass roads around settlements can deaden the retail environment along historic main streets by removing much of the through traffic;

- Examine unique design initiatives, such as higher order landscaping and streetscaping, for places of historic, cultural, or natural importance, in consultation with the public; and
- Integrate the design of the road edge with that of the adjacent open spaces, where arterial roads cross or are adjacent to significant natural areas and open spaces. The design of the road edge should be consistent aesthetically and uphold the same environmental standards.



Historic downtowns, heritage buildings, and natural spaces provide an important quality of place and identity for their respective municipalities.

4.4.6 Transition Areas / Gateways

Definition and Goal

Transition areas are located where one road classification designation changes into another or where a road classification transitions from an urban to a rural context. A transition area can be a temporary condition to facilitate the phasing of the construction of the capital works road improvement project.

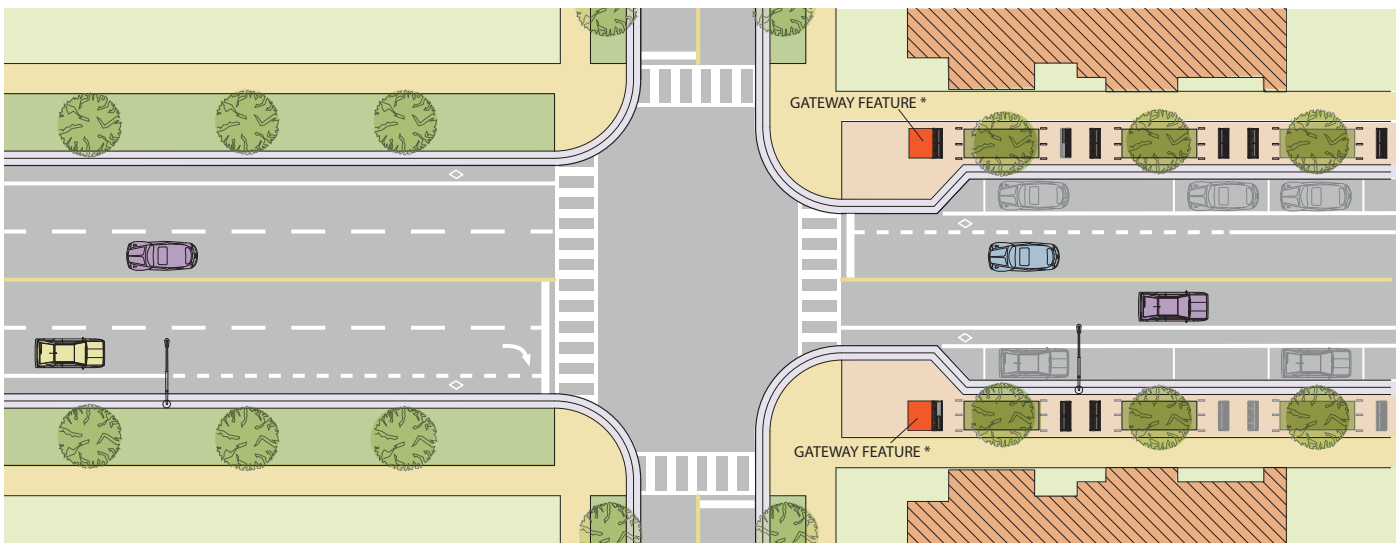
Gateways are features that are designed and located to announce a special place or area.

Priorities

Transitions areas should be designed such that motorists have sufficient time to prepare for and react to changes in the design of the roadway elements.

Guidelines

- Introduce transition measures that will safely lower the speed of vehicles entering the project area by sending a clear message to the driver that there is a change in context. Changes in building height and setback, the width and number of travel lanes and the shoulder treatment are all means of providing visual clues.
- When introducing a curb at the transition between a rural and urban road cross-section the curb on the urban section is normally flared out to match the edge of the shoulder on the rural section. Flare rates of 24:1 for a design speed of 80 km/h and 15:1 for 50 km/h are considered appropriate. The end of the curb is normally tapered down to be flush with the shoulder surface to prevent blunt impacts between the curb and vehicle tires or snow clearing equipment.
- Transition areas should be located such that decision site distance in accordance with Table 1.2.5.6 of the TAC Geometric Design Guidelines for Canadian Roads is achieved.
- Gateways should be combined with transition areas.



Transition areas can facilitate the phasing of the construction of the capital works road improvement project.

4.4.7 Intersection Design

Definition and Goal

The design of intersections need to respond to the travel demands of the roadway, the pedestrian requirements of the surrounding area and the anticipated cycling traffic. As these elements are sometimes conflicting, it is important to prioritize the need of each intersection and respond to each with a site specific design.

Priorities

It is essential that all intersections should be designed to accommodate pedestrian, cyclists and motorists. The treatment of intersections at Regional Transportation Corridors should be consistent wherever possible to eliminate uncertainty for its users. The following sections provide guidelines on the elements of an intersection.

4.4.7.1 Curb Return Radius

Definition and Goal

In general, the tighter the curb return, the better for pedestrians in terms of the length of time it takes for a pedestrian to cross the travelled roadway. Larger curb return radii require pedestrians to walk further and allow for vehicles to move more quickly around corners. Larger curb return radii are generally considered in areas with higher right turn truck movements to mitigate conflict between pedestrians and the rear wheels of the trucks. The goal is to ensure the right radius that balances road and boulevard users.

Priorities

The curb return radius should reflect the design and function of the roadway. The combination of slowing traffic and reducing the time pedestrians spend in the street improves the safety and comfort of an intersection but may increase travel times for motorists. The design of intersections will need to prioritize these two opposing functions.

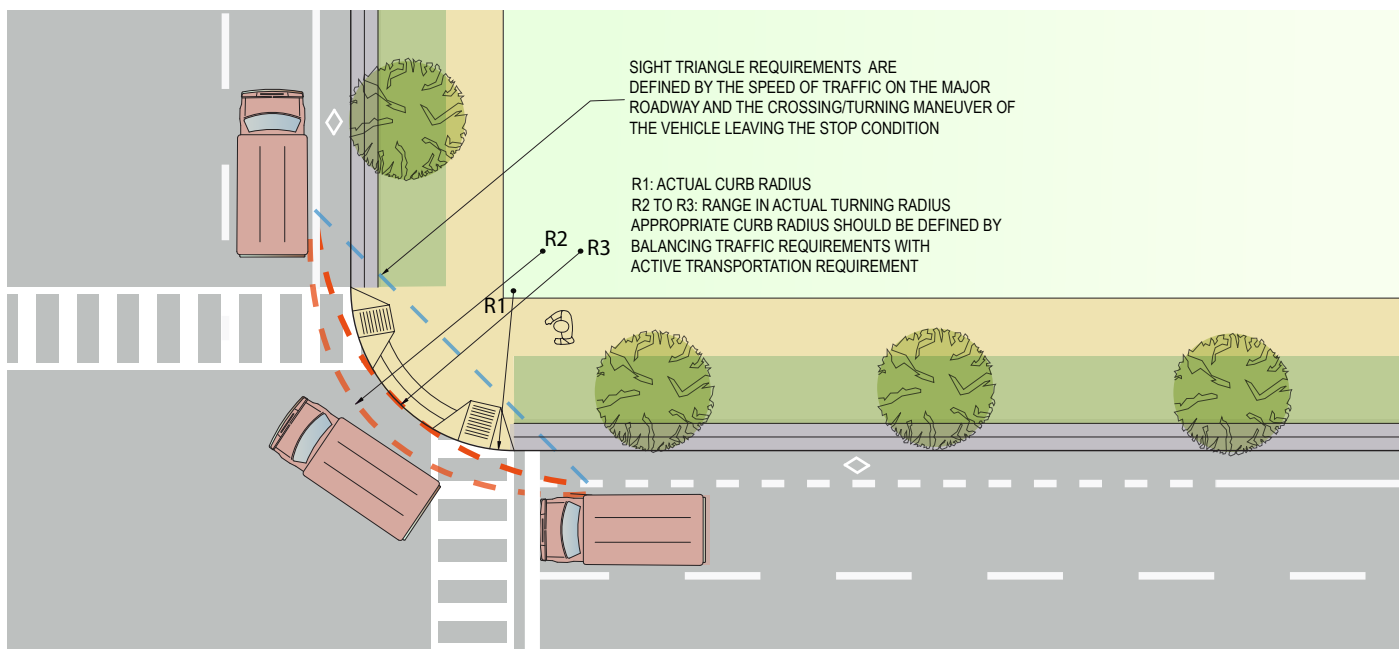


requirements, and anticipated cycling traffic.

The design of intersections should respond to travel demands, pedestrian

Guidelines

- To avoid oversized curb radii, determining the appropriate design vehicle is important. The curb radii should be designed to accommodate 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.
- Designers should avoid specifying a small curb radii if large vehicles are regularly completing turning movements. Such conditions result in an encroachment onto the pedestrian realm and compromises safety and degrade the curbing.
- The designer should keep in mind that the effective turning radius may be larger than the specified curb radii when considering the effect of parking and cycling lanes in the roadway cross-section.
- The curb radius on Neighbourhood Connector: Main Streets and the Rural Village - Main Streets intersecting with other roadway classifications where there is significant pedestrian activity and where moderate traffic volumes with a large percentage of passenger vehicles, a curb radii of 6.0m can be considered. A curb radius of 4.5m to 9.0m can be considered for locations where appropriate. In some locations, based on geometrics and volume of trucks turning, a larger radius may be required.
- Generally a curb radius of 7.5m to 9.0m will accommodate most turns on the Regional Transportation Corridors, particularly with roads



The curb return radius should reflect the design and function of the roadway.

with less than 5% trucks. A curb radius of 7.5m and a parking lane should permit a single unit truck to turn without encroachment. In some locations, based on geometrics and volume of trucks turning, a larger radius may be required.

- For an intersection of a Regional Transportation Corridor with a local municipal street with an urban cross-section, generally use a 9m radius for the curb where:
 - There is a significant volume (more than 35 AADT) of heavy trucks using the side-street. A regular garbage truck route does not constitute a significant volume of heavy trucks;
 - There is a bus route on the side-street;
- The intersection is signalized; or
- The posted speed on the Regional Transportation Corridor is 70 km/h or greater.
- For intersections where the percentage of larger vehicles are significant the designer should consider the following:
 - Identify the design turning vehicle for the intersection;
 - Selecting curb radii to suit the turning needs of the design turning vehicle;
 - Evaluate the benefit of tapered or compound circular radii; and
 - Evaluate the benefit for channelized right turns with a pedestrian refuge island.



The curb return radius should generally range from 7.5 m to 9.0 m

4.4.7.2 Crosswalk Treatment

Definition and Goal

Crosswalks assist pedestrians in safely crossing vehicular roads. The design of a crosswalk can greatly influence the effectiveness of how they are used.

Priorities

It is essential that all intersections should be designed to accommodate pedestrian, cyclists and motorists. The treatment of crosswalks at Regional Transportation Corridors should be consistent wherever possible to eliminate uncertainty for its users.

Guidelines

- Crosswalks must be easily understood, clearly visible, and incorporate realistic crossing opportunities for pedestrians;
- Crosswalks should be oriented at 90 degrees to the curb for shortest crossing distance;
- Signed and/or painted crosswalks should be signalized to ensure pedestrian safety;
- The delineation of pedestrian crossings is recommended to give a visual cue of the crossing. This can be achieved by incorporating painting treatments or using other material treatments where appropriate;
- Locate catchbasins (CB's) immediately upstream of crosswalks to assist pedestrians with safe movement across the street;
- Do not locate CB's in crosswalk / do not locate crosswalks on CB's; and
- School route crossing will be considered on a case by case basis.



Crosswalks assist pedestrians in safely crossing vehicular roads.

4.4.7.3 Sight Triangles

Definition and Goal

Sight triangles ensure sufficient sight distance is provided for the driver of the vehicle approaching an intersection to perceive potential conflicts and carry out the necessary action to avoid a conflict and negotiate the intersection safely. Sight triangles can also be used to accommodate traffic signal control and other utility equipment.

Priorities

Sight triangles are an important component of all intersection designs. The implementation of a properly designed sight triangle will mitigate the risk of potential traffic conflicts and improve public safety.

Guidelines

- The design of a sight triangle is a function of road width of major street, design speed of the major street, the minor street design vehicle length and stop block set-back distance on minor street.
- Refer to Section 2.3.3.2, Sight Triangles, of the TAC Geometric Design Manual for guidance on the sizing of sight triangles.
- Sight triangles provide building setbacks at intersections and provide guidance on location / removal of parking, signs, trees, hedges and utility appurtenances.
- Landscape materials located within the sight triangle shall be designed and maintained as follows:
 - Tree canopy within the sight triangle should have vertical clearance of 2.4 metres.
 - Shrubberies and street furniture within the sight triangle should be no taller than 0.45 metres.
- The dedication of daylight triangles may be required during the development process. These daylight triangles provide land for sight distance, possible right turn channelization and location for traffic control devices.
- In built-up areas, specifically Urban Growth Areas, consideration to reducing the sight triangle may be given if there is no demonstrated collision history and the land is not required for utility / traffic signal equipment.
- Section 2.3.3.2, Sight Triangles, of the TAC Geometric Design Manual will be referenced to ensure appropriate visibility during the development approval process and applicants may be required to ensure that there are no sight obstructions higher than 0.45 metres within the calculated sight triangle.

4.4.7.4 Channelized Right Turns

Definition and Goal

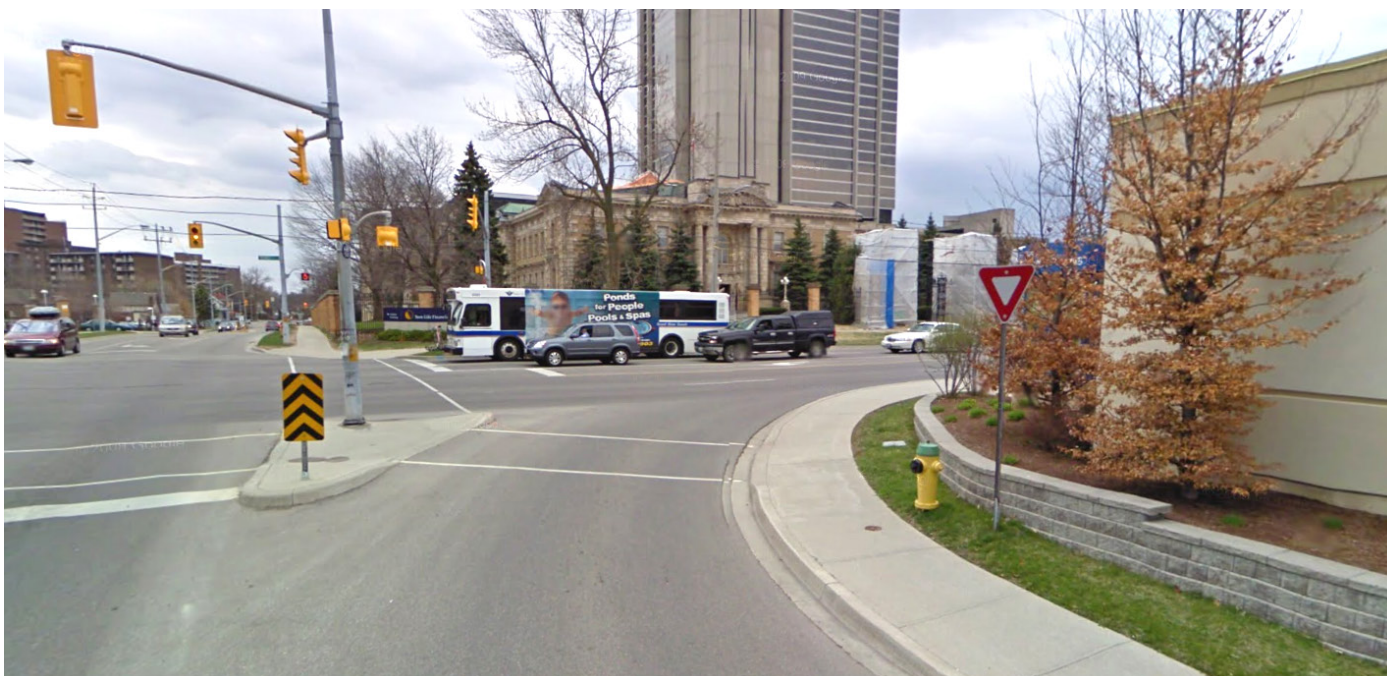
Channelized right turn lanes provide a pedestrian crossing solution to the design of intersections with high right turn movements.

Priorities

When a right turn lane is required, channelized right turns can be used to minimize the width of pedestrian crossings.

Guidelines

- Based on the ITE - Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities, 2006, designers should give consideration to:
- Providing accessible islands, raised, and big enough for pedestrians to wait at least 1.2m from the face of curb in all directions, and accommodate accessible features, such as curb ramps. A painted island is not satisfactory for pedestrians; and
- Provide signing, if warranted, to remind drivers of their legal obligation to yield to pedestrians.
- Designers should be judicious in the use of channelized right turn lanes.
- The design of channelized right turn lanes should conform to the Region of Waterloo Standard Design for Channelized Right Turn Lanes.
- Please refer to Appendix B for detailed guidelines on the design of Channelized Right Turns.



Channelized right turn lanes provide accessible refuge islands for pedestrians on streets with high right turn movements.

4.4.7.5 Curb Extensions

Definition and Goal

Curb Extensions or Bumpouts extend the line of the curb into the travelled way, reducing the width of the street and typically occur at intersections. Curb extensions can be effective in reducing the time pedestrians spend in the street and promotes comfort and safety for pedestrians.

Priorities

Typically the extension occupies the same sectional location as a parallel parking lane and can at time include tree plantings and landscaping. Curb extensions can be used at mid-block locations if appropriate (e.g. for transit stops). Curb extensions should used to the benefit of the public realm and to assist with transition in road types.

Guidelines

- Consider where active transportation is a priority as it provides an opportunity to create friction for the

motorist and to implement both formal / informal mid-block pedestrian / cycling crossings.

- Consider widening the north / east side of street to give pedestrian the benefit of the sun.
- The width should be less than the width of the parking lane. A typical width is 1.8 m.
- Should only be implemented on streets with on-street parking.
- Locate at existing / planned mid-block pedestrian crossings.
- Locate in front of fire hydrants to facilitate improved access to hydrant by emergency services.
- Locate at downstream side of catchbasin to improve local drainage conditions if function includes mid-block crossing.
- Provides opportunities for landscaping and information display.
- Consider need to warn vehicles of bump out condition.
- Consider maintenance requirements when designing (i.e. Street sweeping and snow removal).



Curb extensions and bumpouts typically occupy the same sectional location as a parallel parking lane.

4.4.7.6 Modern Roundabouts

Definition and Goal

A modern roundabout is a circular-shaped intersection in which all traffic flows through the intersection in a counter clockwise direction. Although a modern roundabout is similar to neighbourhood traffic circles and old-style rotary intersections, a modern roundabout has specific geometric features that allow it to provide superior traffic-carrying capacity and exhibit better safety performance than these other types of circular intersections. The main benefits of roundabouts are:

- Roundabouts generally provide a greater level of safety than other types of intersections for motorists, pedestrians and cyclists and have been proven to dramatically reduce injury collision rates (70 to 90%) at intersections converted from traffic signals;
- Roundabouts can accommodate the volumes of traffic typically experienced on our Regional Transportation Corridors and typically will outperform, in terms of delays and queues, a similar sized All-Way Stop Control or a signalized intersection;
- Roundabouts have lower negative environmental impacts because the lower delays associated with them result in lower fuel consumption and lower vehicle emissions; and
- Roundabouts provide more opportunities to improve aesthetics than other types of intersections.



A modern roundabout allows traffic to flow through the intersection in a counter-clockwise direction.

Priorities

A roundabout must be considered for a new intersection or whenever any improvements are being considered at an existing intersection to address capacity or collision issues. Such improvements could include the installation of traffic signals or a four-way stop, road widening to provide through or turning lanes or vertical or horizontal alignment changes.

Guidelines

- The assessment of feasibility of a roundabout in comparison to other forms of traffic control should conform to the Region of Waterloo Transportation Impact Study Guidelines.
- The design of roundabouts should conform to the general design principles of good composition and speed control through adequate deflection for entering traffic. General guidance in this regard can be obtained from the US Federal Highway Administration (FHWA) guide entitled “An Informational Guide to Roundabouts”. More specific design guidance should be obtained from the State of Wisconsin Department of Transportation Facilities Development Manual Chapter 11 Section 26: Roundabouts. Refer to the Region of Waterloo Standard Drawings for design details.
- The design of roundabouts should conform to the Region of Waterloo Standard Roundabout Details.



Roundabouts provide opportunities to improve aesthetics through landscaping.

4.4.8 Minimum Carriage Way

Definition and Goal

The minimum width of a one lane – one way travel lane required to allow an emergency vehicle to pass a stopped vehicle in the travel lane.

Priorities

Applicable to one-way one lane travel lanes with continuous medians.

Guidelines

- Provide a minimum lane width of 4.5m (from edge of pavement to edge of pavement)
- Consider use of mountable curb & gutter sections as a means to improve the ability of a motorist to move clear of an approaching emergency vehicle.



A minimum carriage way width of 4.5m should be provided in all cases.

4.4.9 Encroachments

Definition and Goal

Encroachments are elements that extend into the adjacent streetscape area, such as hanging signage that protrudes into the pedestrian clearway or street lighting located in the landscape and street furniture zone that protrudes into to the roadway.

Priorities

Encroachments create a layering of streetscape element that, if considered carefully, can help to frame the street and pedestrian realm. If adjacent private building elements encroach into the public boulevard (e.g. awnings or signage) they are not permitted to impede the pedestrian clearway in any manner.

Guidelines

- Most likely encroachments include awnings, at-grade signs, overhead signs, planting, public art, and buildings;
- Buildings should not encroach into the Right-of-Way; and
- Other features, such as awnings, lighting and plantings are acceptable depending on the circumstances.
- Encroachments should not conflict with utilities. Encroachment agreements will be required.

4.4.10 Public Art

Definition and Goal

Public art is a work of art that is temporary or permanent and is located in an outdoor or indoor setting. Public art is accessible to the public and enhances the public realm by educating or bringing awareness to a special aspect of the area or the community. Public art can be landscape/architectural designs, streetscape elements, site specific sculptures, and/or community improvement projects such as murals, inlaid sidewalk designs, sewer covers, planting, etc.

There are many different types of public art, in advance of public art commission or competition the appropriate type should be determined. Some art pieces are simply an extension of a planned public works project such as sidewalk pressed patterns or inlaid poetry. Other pieces are stand alone and represent an element of the site such as heritage, sustainability, etc. Public art can be used to bring awareness to Regional context e.g. water shed and sustainability, heritage, transportation, community, and to highlight landmarks, views and vistas, etc.

Priorities

Public art should be used where possible to improve the public realm and to educate or inform the community. Public art pieces should be located in areas that do not interfere with the pedestrian clearway or vehicular traffic.

Guidelines

- The use of public art should be limited near forms of traffic control (e.g. stop signs) in order to minimize driver distractions.
 - Public art should be designed specifically for its location and add to the identity and profile of the community;
 - Public art pieces should be durable and easily maintained; and
 - Public art should be both physically and visually accessible and barrier free. The incorporation of universal design principles is encouraged. For example, public art is encouraged to incorporate Braille on interpretive materials and include touchable maquettes whenever possible.
- Recommended public art locations include sites of cultural significance or high-use areas such as public parks, plazas, street intersections, walkways, trails, courtyards, gardens and institutional or public building sites;



Public art can be provided in a variety of forms including sculptures, murals, inlaid sidewalk designs, sewer covers, planting, etc.

4.4.11 Design Speed

Definition and Goal

Design speed is a speed selected as a basis to establish appropriate geometric design elements for the roadway cross-section. The following cross-sectional design elements in these guidelines need to give consideration to the design speed. The design speed selection is up to the Project Designer and not the Design Team as the designer will take professional responsibility for the safety aspect of the design.

- Transit priority lane width
- Travel lane width
- Cycling lane width
- Curb radii
- Shoulder width
- Clear zone
- Site triangles
- Sight distance

Urban Connector Guidelines

- The desired operating speed is the speed of traffic that in the expert judgement of the project designer best reflects the function of the roadway and the surrounding context. Identifying the desired operating speed allows the designer to select the design speed and the appropriate roadway cross-sectional elements.
- Differences in design speed at transitions should not be more than 20 km/h. Drivers should be warned well in advance of the transition.
- It is desirable to have a stronger relationship between the posted speed limit, design speed and the operating speed so as to provide the opportunity to implement these guidelines. Therefore for the roadways with a desired operating speed of less than 70 km/h the desired operating speed should equal the design speed.



The design speed of a road can influence the visual character.

and the posted speed. For roadways with a desired operating speed of 70 km/h and greater, the design speed should be 10 km/h over the desired operating speed and the posted speed should be equal to the desired operating speed.

Rural Connector Guidelines

- Where the 85th percentile operating speed is known, generally use this as the design speed. This is the preferred measure for design speed unless the number is very high or low.
- In designing a new road or where the operating speed is unknown, the design speed may be estimated based on the expected average operating speed and posted speed as follows:

Expected Average Operating Speed (km/h)	Posted Speed (km/h)	Design Speed (km/h)
40	40	40-50
50	50	50-60
60	60	70-80
70	70	80-90
80	80	90-100
90	90	100 -110
100	100	110-120

4.4.12 Clear Zone

Definition and Goal

The Clear Zone is the total roadside border area, starting at the edge of the travelled lane, available for safe use by errant vehicles. This may consist of auxiliary lanes, curbs, shoulders, recoverable slopes, non-recoverable slopes, and/or a clear run-out area. The desired width is dependent upon traffic volumes and speed, and on the roadside geometry.

Table 4.4.12a
Clear Zone Widths - Tangent Road Sections

Design Speed (km/h)	Clear Zone Width (m)		
	AADT $\geq$ 6000	AADT $\geq$ 1500 and $<$ 6000	AADT $<$ 1500
100	7	6	5
90	6	5	4
80	5	4	4
70	4	3	3
60 or less	3	3	3
60 or less with barrier curb	0.5	0.5	0.5

Guidelines

- On any project where the offsets in Table 4.4.12.a cannot be cost effectively accommodated and protection is not provided, a statement in the design criteria will indicate this fact. Approval of the design criteria by the project designer will be required and justification of reduced offsets will be retained in the project file. Justification of reduced offsets may be completed by means of an evaluation of alternative clear zone design approaches.
- Please refer to Appendix B for detailed guidelines regarding the Clear Zone.
- In urban areas where the operating speed is 60 kph or less, a barrier curb may be used to shield hazards, provided the clear zone offsets cannot be met and removal or relocation is not practical. The offsets shown in Table 4.4.12a may not always be practical in urban areas. In these areas, utility poles, fire hydrants, etc. may be located immediately adjacent to the roadway. Removal or relocation may not be possible and shielding with guide rails may not be practical due to the number of entrances and crossings.

4.4.13 Fencing

Definition and Goal

Fencing is a physical and sometimes visual barrier that prevents access to properties adjacent to a Regional Road. Regional staff requires that fences be installed for back and side-lotted residential properties. Although preventing access to a Regional Road is one element of this policy, it is also important to restrict encroachments such as sheds, plantings, etc. on the Regional right-of-way. Generally, the entire right-of-way is required for Regional purposes such as sidewalks and utilities which can be obstructed with these kinds of encroachments. Often times a property owner may erect a private fence inside a chain-link fence required as part of the development agreement. This can result in an area that cannot be maintained well and garbage collects or grass cannot be cut.

Priorities

Fencing should be located 0.15m in from the property line adjacent to the Land-use Transition Zone or the Landscape Buffer.

Guidelines

- If an individual property owner does not wish for a fence to be installed they could apply to the Region to have this condition waived with agreement that the Region would have the right to remove any encroachments immediately upon being discovered on the Regional right-of-way.
- Fencing should only be necessary when it is a requirement for safety and security and to prevent encroachments on the road right-of-way.
- Fencing design and installation is to meet ESA Standards.
- If a building is oriented towards a Regional Transportation Corridor, fencing should not be a requirement of site plan approval.
- When mid-block connections can be established, the removal or retrofit of existing fencing should be considered.
- In new developments, mid-block connections should be facilitated.
- If required, the height of all fences should be no more than 1.4 metres to allow for a visual connection to the adjacent land uses.
- Fencing can be detrimental to all levels of active transportation and should be carefully considered on a site by site basis.
- Fencing is not required in conditions where window streets are used to avoid back-lotting, where buildings front onto the Regional Transportation Corridor, and where landscaped stormwater management ponds are used as buffers between private properties and the roadway.
- Regional Staff should ask for the installation of fences for back and side-lotted residential properties adjacent to Regional Roads.
- If a developer proposes installing their own fence on private property and the appropriate security is provided to the Region, to ensure the fence is installed, the Region would consider deleting this condition.

4.4.14 Interchange Design

Definition and Goal

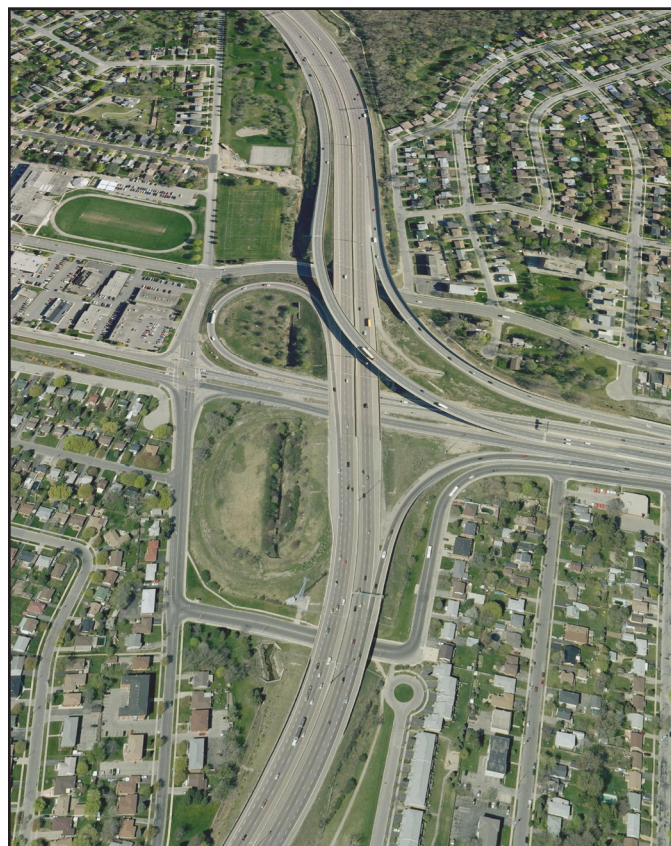
Interchanges can be physical, psychological and visual barriers that sometimes prevent pedestrian and cyclist comfort. One of the goals of the Regional Transportation Master Plan is to limit the number of man-made barriers to the seamless flow of pedestrians and cyclists.

Priorities

The Region will continue to work with the Ministry of Transportation in finding solutions and methods of implementing crossings for pedestrians and cyclists at interchanges. This includes cost sharing initiatives.

Guidelines

- The Cycling Master Plan sets out a requirement to maintain a continuous network for pedestrians and cyclists within existing and future interchanges.
- Disrupting the movement of pedestrians and cyclists on either side of interchanges is not permitted, as it is not in keeping with the Region's intent for the character of its Regional Transportation Corridors.



Interchanges should be design in a manner which is conducive to pedestrian and bicycle travel.

Section 5: Decision Making Process



5.1 Implementation

The implementation of this document is executed through the use of the decision making framework outlined in Section 5.2. When starting the design process for a new road or road reconstruction, the design team and project designer will use the templates to gather background information, inform the decision making process, track decisions as they are made, and design the ultimate road section and streets. It is the intention of this document that it be used as a reference text to inform the process and to direct discussions. This document and its guidelines are intended as implementation tools for the Regional Official Plan.

5.1.1 Updates

Flexibility to respond to site specific conditions is built into the guidelines and recommendations of this document. This flexibility allows the design team / project designer to accommodate a variety of streetscape and boulevard conditions for each classification type. If additional flexibility is required or if additional guidelines are to be added, a formal review and approval of those amendments would be required.

5.1.2 Right of Way Width Determination

No additional right of way widths are required as a result of this process. Optimal right of way widths have been recommended for each classification type, but designers have the ability to adjust road elements to fit site specific conditions. As such, it is not the intention of this document to recommend that additional width be secured where narrower right of ways exist, but that the elements of the roadway be considered independently with a specific roadway in mind. It is also the intention of this document to provide guidance through the design process of roads and to potentially help establish minimum road right of ways for future Regional Transportation Corridors.

5.1.3 Construction Costs and Cost Sharing

This document has an overall recommendation to reduce the asphalt width of roadways. This reduction in asphalt width provides the region with a cost savings in road construction. The cost saving could be applied to the boulevard improvements. For new roadway elements such as public art, improved planting, street furniture, accent paving, etc. cost sharing and other funding measures should be investigated. Where possible, funding partners, sponsors and/or development funding measures should be employed. In addition, opportunities should be explored to allow for private streetscaping sponsorship.

5.1.4 Next Steps

As the decision making framework is used to direct the design process for new and reconstructed roadways, its application will be tested and the tracking of decision making will be made. This framework is intended to streamline the design process and identify potential issues early on.

At regular intervals, the framework should be reviewed and new opportunities to streamline the process should be identified. The decision making framework is intended to be an evolving process that responds to the needs of the user (project designer and design team). If amendments to the framework are required, recommendations should be provided to the relevant department directors and the project managers for discussion and approval. If amendments to the decision making framework are made, an information package of the revisions should be provided to all users to ensure that the new process is then used for all road design projects.

5.2 Process Overview

Step 1 Context

Determine both the planning / policy context and the physical context for your street. It is important to note that both the planning / policy and physical context may vary over the length of the street.

Step 2 Confirm Classification

Confirm the Regional Classification for your street. Refer to the Street Classification Matrix and Regional Transportation Corridor Classification Mapping to confirm.

Step 3 Produce Objectives

Considering information collected through Steps 1 and 2, determine high level objectives for the street that include recognition of potential opportunities and constraints with respect to both planning and physical context. These objectives should serve as a 'check and balance' for each decision that is made throughout the process. Objectives may vary over the length of the street in response to context. It is possible that the objectives created in this section may need to be re-visited as the process unfolds.

Step 4 Street Priorities

Consider both the Boulevard Elements and the Street Elements that are required to support the priority movement on your street. This step is an iterative process designed to establish the priority of different elements within the right-of-way where there is competition for the physical space available.

Step 5 Build Your Section

Step 1

Context

Determine the context for your street considering the following:

Part A Planning Framework & Policy Context

Regional Official Plan

- What are the key aspects that influence the future role and design of the street? For example:
- What is the planned Right of Way width?
- What is the current and planned adjacent land use? Where applicable, refer to Municipal Official Plans.
- What sensitive areas are in proximity? Eg. natural habitat network, provincially significant wetlands, water resources protection areas, well sensitive areas etc.
- What is the current and planned transit service?

Municipal Policies, Plans and Design Guidelines

- What municipal or township documents apply? E.g. Municipal plans, urban design guidelines and policy documents
- What are the key aspects of each plan that influence the future role and design of the street? For example:
- What is the current and planned adjacent land uses?
- What other policy and guideline documents influence the future of the street? Eg. Strategic Downtown/Uptown Plans, Community Improvement Areas, Urban Design Guidelines etc.

Other

Transportation Master Plan

- What are the key aspects that influence the future role and design of the street?
- How does the improvement support the goals, principles and objectives in the Regional Transportation Master Plan?
- How does the project improve transit service?

Other Regional Policy Documents

- How does the project address objectives in other Regional Policy Documents such as:
- Cycling Master Plan
- Pedestrian Charter

Other Transportation Environmental Assessments

Grand River Conservation Authority

- What are the drainage goals and objectives for the watershed?

Utility Companies

- What are the requirements for the roadway?
- What are the separation distances?

Part B Physical Context

Existing Regional Transportation Corridor

- What is the existing Right of Way width?
- What are the current issues?
- What opportunities exist to complete the project as an integrated design with municipal services and utilities?

Open Space and Natural Features

- What and where are natural heritage resources and sensitive areas? (Refer to Part 1, Regional Official Plan)
- What are unique or special physical features? Eg. watercourses, distinct topography, views, mature trees and landscaping etc.
- Are there parks and open spaces (eg. cemeteries, golf courses, community centres, parks)? What uses are accommodated?

Built Form

- What is the character of existing built form?
- Are there cultural heritage resources and listed properties and structures?
- What is the character and vision for planned built form? (eg. scale, density, architectural character)

Move to
Step 2

Step 2 Confirm Classification

Determine the Regional Classification for your street. Refer to the Street Classification Matrix and Regional Transportation Corridor Classification Mapping to confirm.

Part A Street Classification



Urban

☐

Community Connector

☐

Neighbourhood Connector: Avenue

☐

Neighbourhood Connector: Main Street

☐

Residential Connector

Rural

☐

Rural Connector

☐

Village Main Street

☐

Neighbourhood Connector: Main Street

Part B Street Classification

Confirm Priority Mode

Identify the priority mode of movement for the street considering the street classification and the goals , principles, and objectives in the Regional Transportation Master Planning:

-

Pedestrians (Active Transportation Priority)
-

Cyclists (Active Transportation Priority)
-

Transit (Active Transportation Priority)
-

Commercial and Private Vehicles (Vehicle Priority)



Move to
Step 3

Step 3 Produce Objectives

Considering information collected through Steps 1 and 2, determine high level objectives for the street that include recognition of potential opportunities and constraints with respect to both planning and physical context. These objectives should serve as a 'check and balance' for each decision that is made throughout the process. Objectives created in this section may need to be revisited as the process unfolds.

Part A Consider the Following to Produce Your Objectives



Do your objectives answer the following questions?

- What mode of movement is the priority?
- How are other modes integrated?
- What is the functional role from a transportation perspective?
- What is or should be the character and aesthetics of the street?
- What are the site specific conditions and how should they be addressed?
- What are the opportunities?
- What are the challenges?
- What are your operational vs. qualitative objectives?
- Consider that the objectives may vary over the length of the street.

Part B Produce Your Objectives



Specific Street Objectives

- What mode of movement is the priority?

Move to

4A

Community Connector

4B

Neighbourhood Connector: Avenue

4C

Neighbourhood Connector: Main Street

4D

Residential Connector

4E

Rural Connector

4F

Village Connector

Step 4A Community Connector

Consider both the Boulevard Elements and the Street Elements that are required to support the priority movement on your street. The following pages provide work sheets to assist in establishing the priority and width of different elements within the right-of-way where there is competition for the available physical space available. Once the work sheets are completed fill in the blanks below.

Start with all of the Elements and Preferred Criteria. Make adjustments by deleting Elements and/or using minimum Criteria.

'Necessary' elements should be considered a given within the street right-of-way. They are the elements that **MUST** be included.

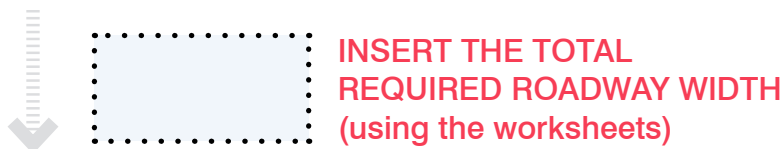
'Important' elements should be considered next to 'Necessary' elements and are elements that **SHOULD** be included.

'Optional' elements are features that **WOULD BE GOOD** to include should space be available.

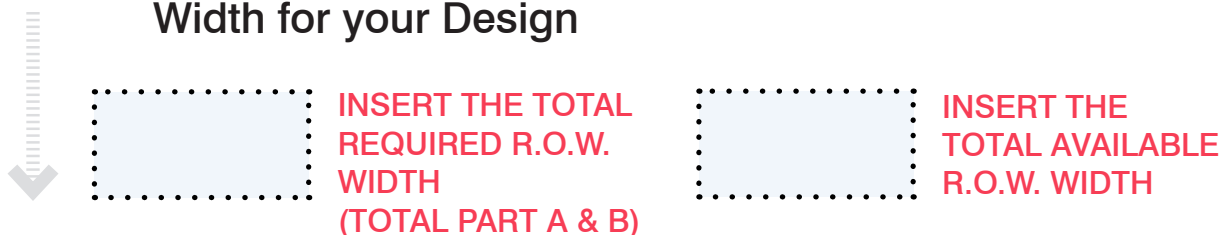
Part A - Determine the Boulevard Elements and Width



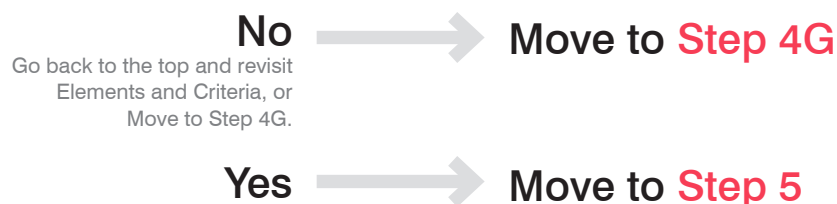
Part B - Determine the Roadway Elements and Width



Part C - Determine the required Right of Way Width for your Design



Can the required and desired elements fit within the existing or future right of way?



Part A - Determine the Boulevard Elements

#	ELEMENT	PREFERRED	RANGE	WIDTH	COMMENTS
1	Pedestrian Clearway (Necessary)	1.80 m	1.5 - 2.1 m		
2a	Landscaping and Site Furnishing Zone (with trees) (Necessary)	3.0 m	2.0 - 3.0 m		
2b	Landscaping and Site Furnishing Zone (without trees) (Necessary)	2.0 m	1.0 - 2.0 m		
3	Buffer zone (Necessary)	0.80 m	0.5 - 0.8 m		
4	Land-Use Transition Zone (Optional)	1.0 m	varies		Range varies by land-use type.
5	Transit Facilities (Necessary)	To be placed within Landscape and Site Furnishing Zone			
6	Decorative Lighting (Optional)	To be free standing			
7	Site Furnishings (Optional)	To be placed within Landscape and Site Furnishing Zone			
8	Utilities (Necessary)	Coordination will be required between the various authorities			
9	Multi-Use Trail (Optional)	3.0 m	3.0 - 4.0 m		
10	Landscape Buffer Zone (Optional)	2.5 m	1.0 - 2.5 m		

Part B - Determine the Roadway Elements

#	ELEMENT	PREFERRED	RANGE	WIDTH	COMMENTS
1	Transit Priority Lanes (Important)	4.0 m	3.65 - 4.0 m		
2	Cycling Facilities (Consistent with Active Transportation Master Plan)	1.5 m	1.25 - 1.5 m		
3	Travel Lanes - Curb / Shoulder (Necessary)	3.65 m	3.35 - 3.65 m		
3a	Additional width for Travel Lanes - curb shoulder w/o cycling lanes only (Optional)	n/a	n/a		
4	Travel Lanes - Curb Lane with Buggy Traffic (n/a)	n/a	n/a		
5	Travel Lanes - Passing (Important)	3.35 m	3.25 - 3.5 m		
6	Turning Lanes - Right (Important)	3.25 m	n/a		
7	Turning Lanes - Left (Important)	3.25 m	3.0 - 3.35 m		
8	Turning Lanes - Dual Left (Important)	3.50 m	n/a		Avoid use where possible.
9	Turning Lanes - Receiving Dual Left (Important)	4.50 m	n/a		

Part B - Determine the Roadway Elements

#	ELEMENT	RECOM	RANGE	WIDTH	COMMENTS
10	Median for Safety and Separation (Optional)	3.0 m	1.75 - 5.0 m		
11	Median for Access Control (Optional)	3.0 m	3.0 - 5.0 m		
12	Mid-Block Median for Refuge (Important)	3.0 m	1.75 - 3.0 m		
13	Median for Infrastructure (Optional)	1.60 m	1.0 - 1.75 m		
14	Parallel Parking (n/a)	n/a	n/a		
15	Curb (Important)	0.50 m	0.21 - 0.5 m		Coordination required between various authorities.
16	Shoulder (Optional)	2.4 m	1.8 - 2.4 m		

Part C - RETURN TO PAGE ONE OF THE Community Connector WORKBOOK



Compile Recommendations 4A - Page 1

Step 4B Neighbourhood Connector: Avenue

Consider both the Boulevard Elements and the Street Elements that are required to support the priority movement on your street. The following pages provide work sheets to assist in establishing the priority and width of different elements within the right-of-way where there is competition for the available physical space available. Once the work sheets are completed fill in the blanks below.

Start with all of the Elements and Preferred Criteria. Make adjustments by deleting Elements and/or using minimum Criteria.

'Necessary' elements should be considered a given within the street right-of-way. They are the elements that **MUST** be included.

'Important' elements should be considered next to 'Necessary' elements and are elements that **SHOULD** be included.

'Optional' elements are features that **WOULD BE GOOD** to include should space be available.

Part A - Determine the Boulevard Elements and Width



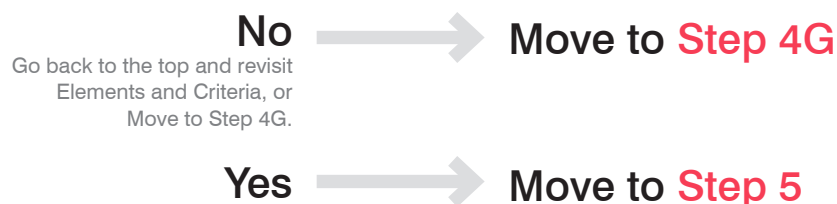
Part B - Determine the Roadway Elements and Width



Part C - Determine the required Right of Way Width for your design



Can the required and desired elements fit within the existing or future right of way?



Part A - Determine the Boulevard Elements

#	ELEMENT	PREFERRED	RANGE	WIDTH	COMMENTS
1	Pedestrian Clearway (Necessary)	2.10 m	1.5 - 2.1 m		
2a	Landscaping and Site Furnishing Zone (with trees) (Necessary)	4.0 m	2.0 - 4.0 m		
2b	Landscaping and Site Furnishing Zone (without trees) (Necessary)	2.0 m	1.0 - 2.0 m		
3	Buffer zone (Important)	0.50 m	n/a		
4	Land-Use Transition Zone (Optional)	1.0 m	varies		Range varies by land-use type.
5	Transit Facilities (Necessary)	To be placed within Landscape and Site Furnishing Zone			
6	Decorative Lighting (Optional)	To be building mounted or free standing			
7	Site Furnishings (Optional)	To be placed within Landscape and Site Furnishing Zone			
8	Utilities (Necessary)	Coordination will be required between the various authorities			
9	Multi-Use Trail (Optional)	3.0 m	3.0 - 4.0 m		
10	Landscape Buffer Zone (n/a)	n/a	n/a		

Part B - Determine the Roadway Elements

#	ELEMENT	PREFERRED	RANGE	WIDTH	COMMENTS
1	Transit Priority Lanes (Important)	4.0 m	3.65 - 4.0 m		
2	Cycling Facilities (Consistent with Active Transportation Master Plan)	1.5 m	1.25 - 1.5 m		
3	Travel Lanes - Curb / Shoulder (Necessary)	3.65 m	3.35 - 3.65 m		
3a	Additional width for Travel Lanes - curb shoulder w/o cycling lanes only (Optional)	n/a	n/a		
4	Travel Lanes - Curb Lane with Buggy Traffic (n/a)	n/a	n/a		
5	Travel Lanes - Passing (Important)	3.35 m	3.25-3.35 m		
6	Turning Lanes - Right (Important)	3.25 m	n/a		
7	Turning Lanes - Left (Important)	3.25 m	3.0 - 3.35 m		
8	Turning Lanes - Dual Left (Optional)	3.50 m	n/a		Avoid use where possible.
9	Turning Lanes - Receiving Dual Left (Optional)	4.50 m	n/a		

Part B - Determine the Roadway Elements

#	ELEMENT	RECOM	RANGE	WIDTH	COMMENTS
10	Median for Safety and Separation (Optional)	3.0 m	1.75 - 5.0 m		
11	Median for Access Control (Optional)	3.0 m	3.0 - 5.0 m		
12	Mid-Block Median for Refuge (Important)	3.0 m	1.75 - 5.0 m		
13	Median for Infrastructure (Optional)	1.60 m	1.0 - 1.75 m		
14	Parallel Parking (Optional)	2.4 m	2.0 - 2.4 m		
15	Curb (Important)	0.50 m	0.21 - 0.5 m		Coordination required between various authorities.
16	Shoulder (Optional)	2.4 m	1.8 - 2.4 m		

Part C - RETURN TO PAGE ONE OF THE URBAN NEIGHBOURHOOD: AVENUE CONNECTOR WORKBOOK



➤ Compile Recommendations 4B - Page 1

Step 4C Neighbourhood Connector: Main Street

Consider both the Boulevard Elements and the Street Elements that are required to support the priority movement on your street. The following pages provide work sheets to assist in establishing the priority and width of different elements within the right-of-way where there is competition for the available physical space available. Once the work sheets are completed fill in the blanks below.

Start with all of the Elements and Preferred Criteria. Make adjustments by deleting Elements and/or using minimum Criteria.

'**Necessary**' elements should be considered a given within the street right-of-way. They are the elements that **MUST** be included.

'**Important**' elements should be considered next to 'Necessary' elements and are elements that **SHOULD** be included.

'**Optional**' elements are features that **WOULD BE GOOD** to include should space be available.

Part A - Determine the Boulevard Elements and Width



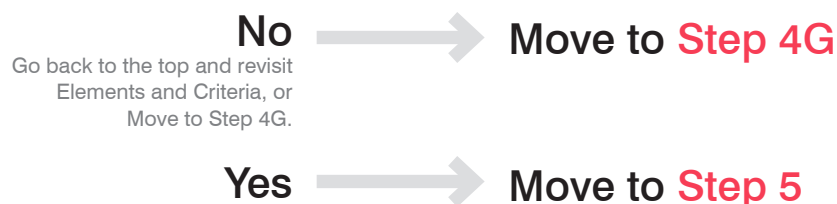
Part B - Determine the Roadway Elements and Width



Part C - Determine the require Right of Way Width for your Design



Can the required and desired elements fit within the existing or future right of way?



Part A - Determine the Boulevard Elements

#	ELEMENT	PREFERRED	RANGE	WIDTH	COMMENTS
1	Pedestrian Clearway (Necessary)	2.5 m	1.5 - 2.5 m		
2a	Landscaping and Site Furnishing Zone (with trees) (Important)	3.0 m	2.0 - 3.0 m		
2b	Landscaping and Site Furnishing Zone (without trees) (Important)	2.0 m	1.0 - 2.0 m		
3	Buffer zone (Important)	0.50 m	n/a		
4	Land-Use Transition Zone (Important)	1.0 m	varies		Range varies by land-use type.
5	Transit Facilities (Necessary)	To be placed within Landscape and Site Furnishing Zone			
6	Decorative Lighting (Optional)	To be building mounted or free standing			
7	Site Furnishings (Important)	To be placed within Landscape and Site Furnishing Zone			
8	Utilities (Necessary)	Coordination will be required between the various authorities			
9	Multi-Use Trail (n/a)	n/a	n/a		
10	Landscape Buffer Zone (n/a)	n/a	n/a		

Part B - Determine the Roadway Elements

#	ELEMENT	PREFERRED	RANGE	WIDTH	COMMENTS
1	Transit Priority Lanes (Important)	4.0 m	3.65 - 4.0 m		
2	Cycling Facilities (Consistent with Active Transportation Master Plan)	1.25 m	1.25 - 1.5 m		
3	Travel Lanes - Curb / Shoulder (Necessary)	3.65 m	3.05 - 3.65 m		
3a	Additional width for Travel Lanes - curb shoulder w/o cycling lanes only (Optional)	n/a	n/a		
4	Travel Lanes - Curb Lane with Buggy Traffic (n/a)	n/a	n/a		
5	Travel Lanes - Passing (Important)	3.25 m	3.25-3.35 m		
6	Turning Lanes - Right (Important)	3.25 m	n/a		
7	Turning Lanes - Left (Important)	3.25 m	3.0 - 3.35 m		
8	Turning Lanes - Dual Left (n/a)	n/a	n/a		Avoid use where possible.
9	Turning Lanes - Receiving Dual Left (n/a)	n/a	n/a		

Part B - Determine the Roadway Elements

#	ELEMENT	RECOM	RANGE	WIDTH	COMMENTS
10	Median for Safety and Separation (n/a)	n/a	n/a		
11	Median for Access Control (n/a)	n/a	n/a		
12	Mid-Block Median for Refuge (n/a)	n/a	n/a		
13	Median for Infrastructure (n/a)	n/a	n/a		
14	Parallel Parking (Optional)	2.4 m	2.0 - 2.4 m		
15	Curb (Necessary)	0.50 m	0.21 - 0.5 m		Coordination required between various authorities.
16	Shoulder (n/a)	n/a	n/a		

Part C - RETURN TO PAGE ONE OF THE URBAN NEIGHBOURHOOD: MAIN STREET CONNECTOR WORKBOOK



Compile Recommendations 4C - Page 1

Step 4D Residential Connector

Consider both the Boulevard Elements and the Street Elements that are required to support the priority movement on your street. The following pages provide work sheets to assist in establishing the priority and width of different elements within the right-of-way where there is competition for the available physical space available. Once the work sheets are completed fill in the blanks below.

Start with all of the Elements and Preferred Criteria. Make adjustments by deleting Elements and/or using minimum Criteria.

'**Necessary**' elements should be considered a given within the street right-of-way. They are the elements that **MUST** be included.

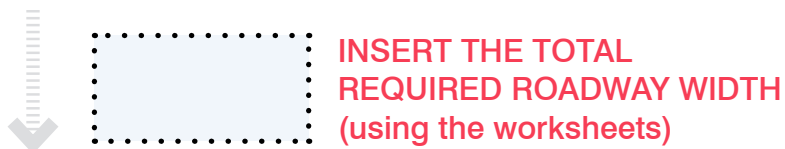
'**Important**' elements should be considered next to 'Necessary' elements and are elements that **SHOULD** be included.

'**Optional**' elements are features that **WOULD BE GOOD** to include should space be available.

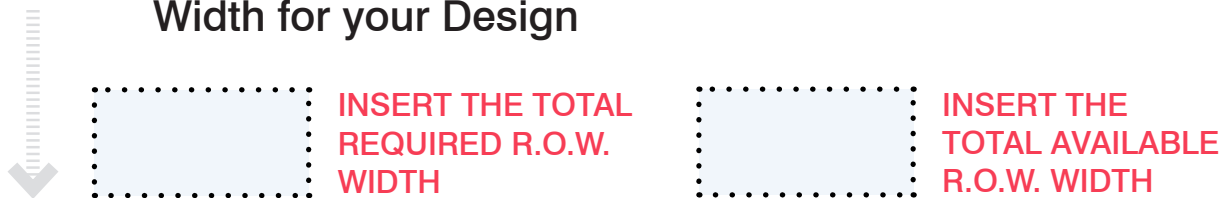
Part A - Determine the Boulevard Elements and Width



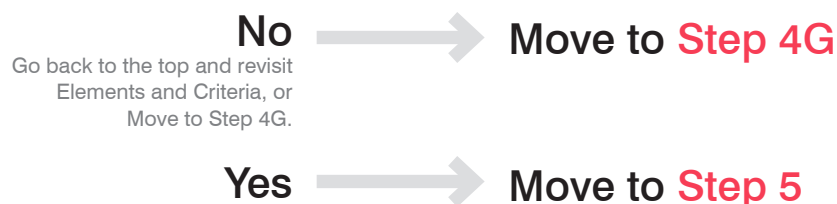
Part B - Determine the Roadway Elements and Width



Part C - Determine the required Right of Way Width for your Design



Can the required and desired elements fit within the existing or future right of way?



Part A - Determine the Boulevard Elements

#	ELEMENT	PREFERRED	RANGE	WIDTH	COMMENTS
1	Pedestrian Clearway (Necessary)	1.8 m	1.5 - 2.1 m		
2a	Landscaping and Site Furnishing Zone (with trees) (Important)	3.0 m	2.0 - 3.0 m		
2b	Landscaping and Site Furnishing Zone (without trees) (Important)	2.0 m	1.0 - 2.0 m		
3	Buffer zone (Optional)	0.50 m	n/a		
4	Land-Use Transition Zone (Necessary)	1.0 m	varies		Range varies by land-use type.
5	Transit Facilities (Necessary)	To be placed within Landscape and Site Furnishing Zone			
6	Decorative Lighting (Optional)	To be building mounted or free standing			
7	Site Furnishings (Optional)	To be placed within Landscape and Site Furnishing Zone			
8	Utilities (Necessary)	Coordination will be required between the various authorities			
9	Multi-Use Trail (Optional)	3.0 m	3.0 - 4.0 m		
10	Landscape Buffer Zone (n/a)	n/a	n/a		

Part B - Determine the Roadway Elements

#	ELEMENT	PREFERRED	RANGE	WIDTH	COMMENTS
1	Transit Priority Lanes (Important)	4.0 m	3.65 - 4.0 m		
2	Cycling Facilities (Consistent with Active Transportation Master Plan)	1.25 m	1.25 - 1.5 m		
3	Travel Lanes - Curb / Shoulder (Necessary)	3.65 m	3.35 - 3.65 m		
3a	Additional width for Travel Lanes - curb shoulder w/o cycling lanes only (Optional)	n/a	n/a		
4	Travel Lanes - Curb Lane with Buggy Traffic (n/a)	n/a	n/a		
5	Travel Lanes - Passing (Important)	3.35 m	3.25-3.35 m		
6	Turning Lanes - Right (Important)	3.25 m	n/a		
7	Turning Lanes - Left (Important)	3.25 m	3.0 - 3.35 m		
8	Turning Lanes - Dual Left (n/a)	n/a	n/a		Avoid use where possible.
9	Turning Lanes - Receiving Dual Left (n/a)	n/a	n/a		

Part B - Determine the Roadway Elements

#	ELEMENT	RECOM	RANGE	WIDTH	COMMENTS
10	Median for Safety and Separation (Optional)	3.0 m	1.75 - 5.0 m		
11	Median for Access Control (Optional)	3.0 m	3.0 - 4.75 m		
12	Mid-Block Median for Refuge (Important)	3 m	1.75 - 5.0 m		
13	Median for Infrastructure (Optional)	1.60 m	1.0 - 1.75 m		
14	Parallel Parking (Optional)	2.4 m	2.0 - 2.4 m		
15	Curb (Important)	0.50 m	0.21 - 0.5 m		Coordination required between various authorities.
16	Shoulder (Optional)	2.4 m	1.8 - 2.4 m		

Part C - RETURN TO PAGE ONE OF THE RURAL CONNECTOR WORKBOOK



➤ Compile Recommendations 4D - Page 1

Step 4E Rural Connector

Consider both the Boulevard Elements and the Street Elements that are required to support the priority movement on your street. The following pages provide work sheets to assist in establishing the priority and width of different elements within the right-of-way where there is competition for the available physical space available. Once the work sheets are completed fill in the blanks below.

Start with all of the Elements and Preferred Criteria. Make adjustments by deleting Elements and/or using minimum Criteria.

'Necessary' elements should be considered a given within the street right-of-way. They are the elements that **MUST** be included.

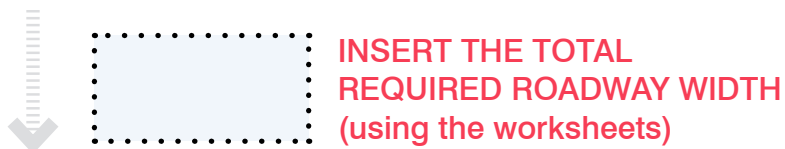
'Important' elements should be considered next to 'Necessary' elements and are elements that **SHOULD** be included.

'Optional' elements are features that **WOULD BE GOOD** to include should space be available.

Part A - Determine the Boulevard Elements and Width



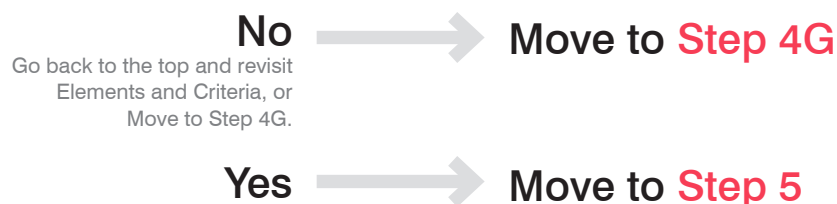
Part B - Determine the Roadway Elements and Width



Part C - Determine the required Right of Way Width for your Design



Can the required and desired elements fit within the existing or future right of way?



Part A - Determine the Boulevard Elements

#	ELEMENT	PREFERRED	RANGE	WIDTH	COMMENTS
1	Pedestrian Clearway (Optional)	2.1 m	1.5 - 2.1 m		
2a	Landscaping and Site Furnishing Zone (with trees) (Important)	3.0 m	2.0 - 3.0 m		
2b	Landscaping and Site Furnishing Zone (without trees) (Optional)	2.0 m	1.0 - 2.0 m		
3	Buffer zone (n/a)	n/a	n/a		
4	Land-Use Transition Zone (n/a)	n/a	n/a		Range varies by land-use type.
5	Transit Facilities (Optional)	To be placed within Landscape and Site Furnishing Zone			
6	Decorative Lighting (Optional)	To be free standing			
7	Site Furnishings (n/a)	n/a			
8	Utilities (Necessary)	Coordination will be required between the various authorities			
9	Multi-Use Trail (Optional)	3.0 m	3.0 - 4.0 m		
10	Landscape Buffer Zone (Optional)	2.5 m	1.0 - 2.5 m		

Part B - Determine the Roadway Elements

#	ELEMENT	PREFERRED	RANGE	WIDTH	COMMENTS
1	Transit Priority Lanes (Optional)	4.0 m	3.65 - 4.0 m		
2	Cycling Facilities (Consistent with Active Transportation Master Plan)	1.5 m	1.25 - 1.5 m		
3	Travel Lanes - Curb / Shoulder (Necessary)	3.65 m	3.35 - 3.65 m		
3a	Additional width for Travel Lanes - curb shoulder w/o cycling lanes only (Optional)	1.0 m	n/a		
4	Travel Lanes - Curb Lane with Buggy Traffic (Important)	4.85 m	4.0 - 4.65 m		
5	Travel Lanes - Passing (Important)	3.35 m	3.25-3.35 m		
6	Turning Lanes - Right (Important)	3.25 m	n/a		
7	Turning Lanes - Left (Important)	3.25 m	3.0 - 3.35 m		
8	Turning Lanes - Dual Left (n/a)	n/a	n/a		Avoid use where possible.
9	Turning Lanes - Receiving Dual Left (n/a)	n/a	n/a		

Part B - Determine the Roadway Elements

#	ELEMENT	RECOM	RANGE	WIDTH	COMMENTS
10	Median for Safety and Separation (Optional)	3.0 m	1.75 - 5.0 m		
11	Median for Access Control (Optional)	3.0 m	3.0 - 4.75 m		
12	Mid-Block Median for Refuge (n/a)	n/a	n/a		
13	Median for Infrastructure (Optional)	1.60 m	1.0 - 1.75 m		
14	Parallel Parking (n/a)	n/a	n/a		
15	Curb (n/a)	n/a	n/a		
16	Shoulder (Necessary)	2.4 m	1.8 - 2.4 m		

Coordination required between various authorities.

Part C - RETURN TO PAGE ONE OF THE Rural Village - Main Street CONNECTOR WORKBOOK



Compile Recommendations 4E - Page 1

Step 4F Rural Village - Main Street Connector

Consider both the Boulevard Elements and the Street Elements that are required to support the priority movement on your street. The following pages provide work sheets to assist in establishing the priority and width of different elements within the right-of-way where there is competition for the available physical space available. Once the work sheets are completed fill in the blanks below.

Start with all of the Elements and Preferred Criteria. Make adjustments by deleting Elements and/or using minimum Criteria.

'Necessary' elements should be considered a given within the street right-of-way. They are the elements that **MUST** be included.

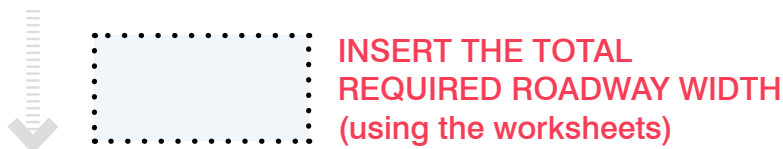
'Important' elements should be considered next to 'Necessary' elements and are elements that **SHOULD** be included.

'Optional' elements are features that **WOULD BE GOOD** to include should space be available.

Part A - Determine the Boulevard Elements and Width



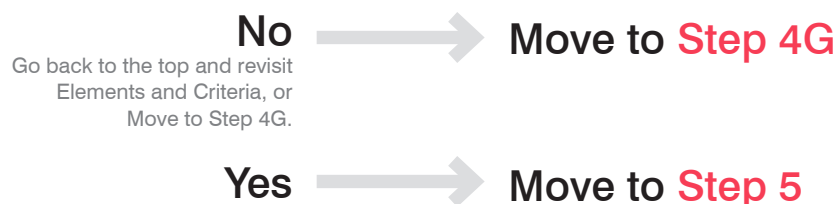
Part B - Determine the Roadway Elements and Width



Part C - Determine the required Right of Way Width for your Design



Can the required and desired elements fit within the existing or future right of way?



Part A - Determine the Boulevard Elements

#	ELEMENT	PREFERRED	RANGE	WIDTH	COMMENTS
1	Pedestrian Clearway (Necessary)	2.1 m	1.5 - 2.1 m		
2a	Landscaping and Site Furnishing Zone (with trees) (Optional)	3.0 m	2.0 - 3.0 m		
2b	Landscaping and Site Furnishing Zone (without trees) (Optional)	2.0 m	1.0 - 2.0 m		
3	Buffer zone (Optional)	0.5 m	n/a		
4	Land-Use Transition Zone (Optional)	1.0 m	varies		Range varies by land-use type.
5	Transit Facilities (Necessary where required)	To be placed within Landscape and Site Furnishing Zone			
6	Decorative Lighting (Optional)	To be building mounted or free standing			
7	Site Furnishings (Optional)	To be placed within Landscape and Site Furnishing Zone			
8	Utilities (Necessary)	Coordination will be required between the various authorities			
9	Multi-Use Trail (n/a)	n/a	n/a		
10	Landscape Buffer Zone (n/a)	n/a	n/a		

Part B - Determine the Roadway Elements

#	ELEMENT	PREFERRED	RANGE	WIDTH	COMMENTS
1	Transit Priority Lanes (Optional)	4.0 m	3.65 - 4.0 m		
2	Cycling Facilities (Consistent with Active Transportation Master Plan)	1.25 m	1.25 - 1.5 m		
3	Travel Lanes - Curb / Shoulder (Necessary)	3.65 m	3.05 -3.65 m		
3a	Additional width for Travel Lanes - curb shoulder w/o cycling lanes only (Optional)	1.0 m	n/a		
4	Travel Lanes - Curb Lane with Buggy Traffic (Important)	4.85 m	4.0 - 4.85 m		
5	Travel Lanes - Passing (Important)	3.25 m	3.25-3.35 m		
6	Turning Lanes - Right (Important)	3.25 m	n/a		
7	Turning Lanes - Left (Important)	3.25 m	3.0 - 3.35 m		
8	Turning Lanes - Dual Left (n/a)	n/a	n/a		Avoid use where possible.
9	Turning Lanes - Receiving Dual Left (n/a)	n/a	n/a		

Part B - Determine the Roadway Elements

#	ELEMENT	RECOM	RANGE	WIDTH	COMMENTS
10	Median for Safety and Separation (Optional)	3.0 m	1.75 - 5.0 m		
11	Median for Access Control (Optional)	3.0 m	3.0 - 4.75 m		
12	Mid-Block Median for Refuge (Optional)	3.0 m	1.75 - 5.0 m		
13	Median for Infrastructure (n/a)	n/a	n/a		
14	Parallel Parking (Optional)	2.4 m	2.0 - 2.4 m		
15	Curb (Necessary)	0.5 m	0.21 - 0.5 m		Coordination required between various authorities.
16	Shoulder (n/a)	n/a	n/a		

Part C - RETURN TO PAGE ONE OF THE Rural Village - Main Street CONNECTOR WORKBOOK



Compile Recommendations 4C - Page 1

Step 4G Options

In some cases, using only Necessary Elements and minimum Preferred Criteria may not fit within the street right-of-way. In these cases, other options could be explored to achieve the space required. Other Options include the following:

Land Acquisition

- Land acquisition could be explored to achieve the additional space required to meet the objectives of your street.

Re-visit the Classification

- It could be possible that the classification of the street, or portion of the street, may need to be revised.

Development Setbacks

- Where redevelopment is anticipated, a building setback could be applied to achieve the additional space required to meet the objectives of your street.
- The property included in the setback would remain in private ownership but would be used for public access.
- This requirement is not typically within the Region's jurisdiction. Recommendations for setbacks would be coordinated with the municipalities and townships.

Other

Step 5 Build Your Section

Appendix A: Background Documents

Region of Waterloo

Transportation Corridor Design Guidelines

Draft “ Best Practices for Urban Design Guidelines and Functional Road Standards ”

Prepared by:

AECOM

Date: May 2010

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1. Introduction

The purpose of this report is to present a summary of the background and research completed to date on the practices of local, regional and international road authorities as they relate to the descriptive classification of their roadway networks and identify draft best practices for urban design guidelines and functional road standards for the regions arterial road network. Although the focus of the research is primarily related to arterial type roadways, we have in some instances included classification information for other lower and higher order roadways.

The Region of Waterloo draft Transportation Engineering Practice document (ref: blue book 2008 07 25) was reviewed for the purpose of understanding the Regions Transportation strategy and the initiatives and actions being considered for implementation of the strategy. The Region of Waterloo strategic transportation goals and key strategic-related actions are summarized as follows:

Region of Waterloo Strategic Focus 2007-2010 (May 26, 2008)

As set out in the Region's Corporate Strategic Plan, the Transportation Engineering initiatives should address the Region's objectives to:

- Improve air quality in Waterloo Region.
- Enhance, develop, promote and integrate sustainable and active forms of transportation (public transit, cycling and walking).
- Optimize the use of existing infrastructure.

Transportation Division Key Strategic-Related Actions (May 26, 2008)

Focus Area 1: Environmental Sustainability: Protect and Enhance the Environment

- Consider tree planting program and enhancement to current plantings
- Continue to implement roundabouts in our construction designs
- Continue to promote and implement salt management plans

Focus Area 2: Growth Management

- Develop a long-term funding strategy for sidewalks, cycling and walking facilities.
- Develop design guidelines for Regional roads
- Transit priorities

Focus Area 5: Infrastructure:

- Ensure asset management programs are in place for all Regional infrastructure.
- Continue to review and optimize the Region's traffic control systems.
- Continue to review and implement a long-term funding strategy for road repair and reconstruction.
- Continue to update master plans for all key infrastructure areas (transportation, airport, etc)
- Continue to implement the capital projects required to meet the needs of growth.
- Improve coordination of master planning within TES and PHCS

The Region's arterial road network should be developed as an integrated, safe and efficient transportation system facilitating the movement of people and goods within the Region, and between the Region and other areas. The road network is a key element of this system, accommodating vehicular travel between points of trip origin and destination, providing direct access to abutting property and providing rights-of-way for the development of active transportation systems (public transit, cycling and walking).

A road network generally consists of a hierarchy of roads that provides for a gradation in function from access to movement. For example, the primary function of a freeway is movement, whereas at the other extreme it is the primary function of a local road to provide access. The network operates most efficiently if each class of road in the hierarchy is designed to serve its intended function and purpose (e.g. goods movement). Most roads are designed to serve multiple functions and purposes. However, mixing incompatible functions and purposes can impact mobility and livability within a community. For this reason, roads are classified and designed based on their function and purpose, so that suitable design and operating criteria can be established to minimize, if not alleviate, conflicts between competing objectives.

This report will also serve as the basis for the development of detailed **Transportation Corridor Guidelines** for the Region of Waterloo. It is intended that the Region and area municipalities use the Guidelines as a reference in the preparation of corridor studies, land use plans, road improvement projects and Class Environmental Assessment studies, and in the review of development applications. The Guidelines recommend best practices and provide a matrix of road design strategies that are adaptable over time in both the urban and rural contexts.

It is expected that the application of the Transportation Corridor Guidelines will result in arterial roads that:

- Accommodate a wide range of transportation options;
- Support and are compatible with abutting land uses; and
- Create an inter- and intra-regional network that serves the diverse economic, social and environmental need of the Region

Preparation of this report relied largely upon literature from the Institute of Transportation Engineers (ITE) and the Transportation Association of Canada (TAC), supplemented with a research of current practices in other GTA municipalities as well as international road authorities.

2. Need for a Functional Road Classification System

A well defined road hierarchy is essential in meeting the mobility needs of communities, but just as importantly, it can help protect against the adverse impacts of motorized traffic in local neighborhoods'. While some roads should carry higher volumes of traffic at higher speeds, others need to be designed to accommodate lower volumes at lower speeds. This satisfies the commuting needs of the public while ensuring that neighborhoods' thrive between main traffic corridors. The absence of a hierarchy of roads would result in less efficient routes for traffic with associated increases in the time and cost of transporting people and goods. The quality of life would also decline, as motorized traffic would increasingly infiltrate neighborhoods' to avoid mounting congestion.

A functional road classification system establishes a “hierarchy” of roads that provides for a gradation in service from access to movement. In a functional system, each type of road serves a distinct stage of the trip making process, as shown in Figure 1. The concept is premised on the principle that roads do not operate independently, but are part of an interconnected system, with each type of road performing a particular function in moving traffic throughout the network and in providing access to abutting lands. The road system operates most efficiently and safely when each type of facility is designed and managed to serve a particular trip stage consistent with its position in the hierarchy. When a roadway attempts to prioritize both movement and access, neither function is well served. This compression of functions typically results in high collision rates, traffic congestion and excessive vehicle emissions and fuel consumption.

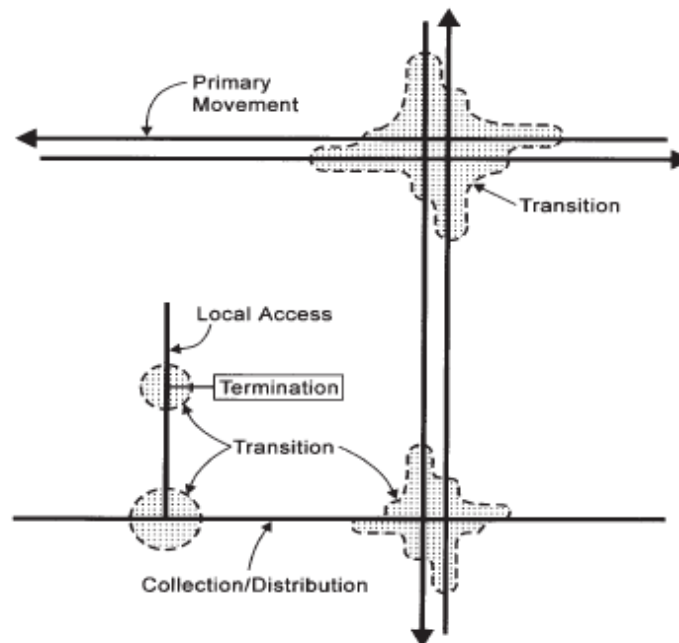


Figure 1- Hierarchy of Movement in a Functional Circulation System

(Source – Transportation and Land Development, Institute of Transportation Engineers, 2002, p. 4-2)

The key objective of a functional road classification system is to ensure the orderly grouping of roadways in a framework around which authorities can plan and implement transportation projects, and effectively and safely manage their road systems. An effective classification system allows for the co-ordination of land use and Durham Region transportation, and helps in establishing appropriate right-of-way widths, roadway and boulevard design standards, traffic operations guidelines, and maintenance operations practices. It can also influence:

- The character of a community;
- Auto-dependency or the use of non-car modes such as walking, cycling and public transit;
- Access to facilities
- Opportunities for locally-based business and employment; and
- The potential for social interaction and community formation.

The outcome of a properly classified road system is a network that safely and efficiently moves people and goods, and preserves the communities that exist between primary traffic corridors. A well-defined hierarchy of road types also assists in:

- Planning for the provision of a variety of modes and functions within road corridors
- Identifying the effects of development in and on surrounding areas and roadways within the hierarchy, prior to making decisions;
- Designing roadways that have regard for accessibility, continuity, connectivity, efficiency, amenity and safety;
- Simplifying traffic control measures
- Targeting roadway design to a specific range of traffic types and volumes, eliminating the need to “over-design” lower class roads, as major traffic accommodated on higher order facilities;
- Providing road users and abutting communities a clearer understanding of the intended function and characteristics of particular roads; and
- Reducing overall network costs.

Two of the leaders in defining industry standards for road classification systems are the Institute of Transportation Engineers (ITE) and the Transportation Association of Canada (TAC). ITE is an international educational and scientific association, and one of the largest and fastest-growing multimodal professional transportation organizations in the world. TAC is a national association and forum for gathering and exchanging ideas, information and knowledge on technical guidelines and best practices. Both organizations have a mission to promote the provision of safe, efficient, effective and environmentally and financially sustainable transportation services in support of social and economic goals.

3. Preliminary Recommendations

The research phase of the study determined that most road authorities generally limited the classification of their arterial roadways to two categories, one being “rural” and the second being “urban” followed by sub-categories comprised of “minor” and “major”. The means of determining where a specific road would fall within the categories of rural / urban and sub-categories of minor / major there is generally achieved by comparing the existing / planned operating conditions of the Regional roadway with design criteria such as traffic service objective, land service / access, travel speed, goods movement, connectivity, transit, cycling and pedestrian provisions, right-of-way width, traffic volume, flow characteristics, parking, minimum intersection spacing, etc..

We also investigated during our background research phase of this project whether road authorities integrated their roadway classification criteria with their urban design guidelines. Based on our sampling of road authorities it appears that this is not a common practice. Generally the urban design guidelines of a road authority focused on improvements to specific locations within an urban area in lieu of providing design guidelines for the various roadway classifications within the jurisdiction of the road authority. The one road authority from our sampling that did integrate their Urban Design Guidelines with their arterial road classifications was the City of Ottawa. The results of our background research on the integration of Roadway Classification Systems and Urban Design Guidelines for our sampling of road authorities and agencies are briefly summarised in Section 7 of this report.

The Region of Waterloo has expressed a desire to implement a classification system that is descriptive in nature. Based on the research completed to date we recommend that consideration be given to the implementation of a descriptive classification system similar to that applied by the Region of York and the City of Ottawa. We recommend that the following classifications be considered as a starting point for discussion with the Region of Waterloo staff and that refinements to both the descriptive classifications and their evaluating criteria be determined as part of the next steps of this study. The descriptive classifications are as specified in the following table:

Table 1 - Preliminary Recommended Arterial Roadways Classification System	
Rural Arterial Roadways	Urban Arterial Roadways
Rural Connector	
Village Connector	
	Expressway
	Urban Community Connector
	Urban Neighbourhood Connector - Avenue
	Urban Neighbourhood Connector – Main Street
	Urban Residential Connector

The operational criteria and urban design criteria for each of the above roadway classifications have been prepared and submitted to the Region of Waterloo for review on December 23, 2008 in the form of a “Draft Classification System Matrix”. Initial feedback was received from Graham Vincent on December 30, 2008 and the project team is in the process of reviewing the feedback and updating the Draft Classification Matrix for re-submission to the Region of Waterloo.

4. Roadway Classification Research Summary

A summary of the roadway classification systems used by the road authorities research during this phase of the study are presented in **Table 2**. A number of these systems are discussed in more details in the sections that follow the table.

Table 2 - Roadway Classification Overview

Authority	Roadway Classes
Transportation Association of Canada (TAC)	• Freeways • Arterials • Collectors • Locals
Institute of Transportation Engineers (ITE)	• Arterials - Freeways - Principal Arterials - Major Arterials - Minor Arterials • Collectors - Major - Minor • Locals - "Loop" - Cul-de-sac
City of Ottawa	• City Freeway • Arterial Road • Major Collector and Collector Road (Sub-classifications: Urban, Village, Rural) • Local Roads
Region of Durham	• Type A Arterial – Predominantly serves inter-regional and inter-municipal trips • Type B Arterial – Predominantly serves inter- and intra-municipal trips • Type C Arterials – Predominantly serves intra-municipal trips
City of Toronto	• Major Arterial Roads – Traffic movement is primary; >20,000 vehicles per day • Minor Arterial Roads – Traffic movement is primary; 8,000 to 20,000 per day • Collector Road – Access to property and traffic movement; 2,500 to 8,000 vehicles per day.
Region of York	• Class VI Expressway • Class V Commuter • Class IV Commercial/Commuter • Class III Main Street • Class II Rural – Multilane • Class I Rural – 2 Lane
Region of Peel	• Provincial Highway • Arterial • Major Collector • Minor Collector • Local

Table 2 (Continued) - Roadway Classification Overview	
Authority	Roadway Classes
Regional Municipality of Halton	- Provincial Highways and Freeways – connect urban areas or nodes in different regions. - Major Arterials – connect urban areas or nodes in different municipalities. - Multi-Purpose Arterials – serve a combination of the fractions. - Minor Arterials – distribute traffic to and from Major or Multi-Purpose Arterials
City of Hamilton	Rural - Arterial - Collector - Local Urban - Arterial - Major - Minor - Collector - Residential - Industrial / Commercial - Local - Residential - Industrial / Commercial
USA states: North Carolina, New Jersey Pennsylvania, California	Functional classification consistent with the AASHTO Green Book - Arterial - Collector - Local Sub-classifications <u>Rural</u> - Arterial - Principal (e.g. Interstate) - Minor - Collector - Major - Minor - Local <u>Urban</u> - Arterial - Principal (e.g. Interstate, Freeways, Expressways) - Minor - Collector - Local

5. Transportation Association of Canada (TAC)

Refer: *Geometric Design Guide for Canadian Roads*, Transportation Association of Canada, 1999

The TAC divides roads into the following functional classes:

- Freeways
- Arterials
- Collectors
- Locals

Design requirements are specified separately for urban and rural roads.

The geometric design guide for arterial roads, for example is shown in the **Table 3** below.

Table 1 – TAC Geometric Design Guide for Canadian Arterial Roads		
Criteria	Arterial Classes	
	Major	Minor
Traffic Service Objective	Traffic Movement Primary Consideration	Traffic Movement Major Consideration
Land Service/ Access	Rigid access control	Some access control
Travel Speed	Design Speed of 60-100kph (urban) and 80-130 kph (rural) Average Speed of 50-90 kph (urban) and 60-100 kph (rural)	Design Speeds of 50-70kph (urban) Average Speed 40-60 kph (urban)
Goods Movement	Accommodate all vehicle types, up to 20% trucks	Accommodate all types of trucks
Connectivity	Desirable connections – Collectors, Arterials, Expressways and Freeways	
Transit	Express and local bus routes	
Cycling and Pedestrian Provisions	Cycling – Lane widening or separate facilities desirable Pedestrians – Sidewalks may be provided, separate facilities desirable	
Right-of-way Width	20*-45**m	
Traffic Volume	10,000-30,000 vehicles per day	5,000-20,000 vehicles per day (urban)
Flow Characteristics	Uninterrupted flow except at signals and crosswalks	
Parking	Prohibited or Peak Hour Restrictions	Peak Hour Restrictions
Minimum Intersection Spacing	400 m	200 m

Notes: * 20 m right of way is acceptable for retrofit conditions

** Wider rights of way may be required to accommodate other facilities such as utilities, noise attenuation installation, bikeways and landscaping. For new roads, the immediate provision of wider rights of way may be considered to accommodate such facilities.

6. Institute of Transportation Engineers (ITE)

Refer: *Transportation and Land Development, Institute of Transportation Engineers, 2002*

The ITE classifies roads into two broad classes:

Higher order roads where traffic movement is the primary purpose and access is stringently managed. These routes are intended to carry through traffic and serve longer distance trips between centres; and

Lower order roads where land access is the primary purpose and traffic movement is impeded by the frequency of accesses. These routes are intended to carry locally orientated traffic between higher order roads and their origin or destination.

Within these two broad groups, roads are further classified to reflect variations in terms of how land use is served.

Road systems are divided into three functional classes:

1. Arterials
2. Collectors
3. Locals

Arterials, Collectors and Locals are sub-divided as tabulated below.

Table 2 – ITE Road Classification System			
Order	Function	Basic Functional Classes	Functional Types
Higher order roads	Movement Priority	Arterial	Freeways Principle Arterials Major Arterials Minor Arterials
		Collector	Major Collector Minor Collector
		Local	"Loop" Cul-de-sac
Lower order roads	Access priority		

7. Roadway Classification System Information from Local and External Road Authorities

7.1 City of Ottawa Information

Refer: *City of Ottawa Website*

The description that follows of the various classifications of roads is not meant to be interpreted as an absolute standard or limit, which if varied, would automatically necessitate an amendment to this Plan. Rather, these characteristics are intended to act as benchmarks against which variations in any given situation can be assessed in light of the relevant goals and objectives of this Plan. Policy 31 of Section 2.3.1 of this Plan states under what circumstances an amendment is required for changes – additions or deletions – of certain identified road classes on Schedules E to H. The following highlights the classification system used in this Plan for existing and future City roadways:

City Freeway

City freeway describes a limited access highway with high-speed traffic that serves the need for intra-city travel similar to the provincial limited access highways. Highway 174 between Highway 417 (Queensway) and Trim Road in Orléans is the only city freeway.

Arterial Roads

The arterial roads are the major roads of the City that carry large volumes of traffic over the longest distances. The majority of these roadways were formerly identified as regional roads. To best provide access to arterials, block lengths and intersections should be spaced and designed to accommodate all transportation modes; vehicular access to adjacent properties should be controlled to minimize turning movements and to reduce conflicts between travel modes; and arterials road corridors should provide a high degree of connectivity between land uses and places along and across the route. For certain roads such as the Airport Parkway, the City may apply different standards to development with regard to access and setbacks. It is recognised that the arterial road system links to provincial and inter-provincial roads, which are all an integral part of the overall network.

Arterial roads function as major public corridors in the urban communities and villages they traverse. They not only accommodate car and truck traffic, but also serve pedestrians, cyclists and public transit buses. The roadway and its boulevard are therefore designed to meet the needs of these users through the provision, where appropriate, of such features as sidewalks, cycling lanes, and bus stops and shelters. In parts of the urban area and villages additional roadside features include: street furniture, pedestrian-scale lighting, and trees and other landscaping. This greenery provides visual appeal, summer shade and a defining sense of the linear nature of these travel corridors. The planning of land uses and the local road network on lands adjacent to arterial roads may occur in a manner that can reduce the need for noise attenuation barriers or fencing along extensive lengths of roadway. [Amendment 15, September 8, 2004]

Major Collector and Collector Roads

The collector roads connect communities and distribute traffic between the arterial system and the local road system. These roads tend to be shorter and carry lower volumes of traffic than do the arterials. Direct access to collector roads from adjacent properties will be permitted where such access will not introduce traffic safety or capacity concerns. The design and construction of collector roads will accommodate the safe and efficient operation of transit services. In general, a major collector is a roadway that acts as a connection between an arterial road and collector roads.

Collector roads are the principal streets in urban and village neighbourhoods and are used by local residents, delivery and commercial vehicles, transit and school buses, cyclists, and pedestrians. The reduced speed and

volumes of traffic on collector roads, compared with arterial roads, make collectors more accommodating for cyclists and pedestrians. Tree plantings, bus stops, community mailboxes and other streetscape features create roadways that are integrated with their neighbourhood. [Amendment 15, September 8, 2004]

Local Roads

Local roads are found within communities and distribute traffic from arterial and collector streets to individual properties, typically over short distances. Local roads, to varying degrees, also serve a collector road function by distributing traffic between collector streets and other local streets. Pedestrians and cyclists are major users of local roads, starting or finishing their journeys along these roads. [Amendment 15, September 8, 2004]

One of the hallmarks of the Regional Road Corridor Design Guidelines is the way in which the City's designated Arterial Roads are viewed as streets within wider city corridors and categorized following an analysis of planned function including adjacent land use context and public space objectives and not solely by traffic carrying capacity or travel speed. This resulted in six (6) Arterial Road types, including Urban Core, Urban Residential, Urban (and Village) Main Street, Suburban Commercial, Suburban Residential, and Suburban Business / Institutional. [*City of Ottawa Collector & Rural Road Corridor DESIGN GUIDELINES*]. The needs and designs of each Road type are then reflected in Road cross-sections and corresponding Right-of-Way widths. A similar analysis of the context and planned function for the Major Collector Roads (Urban Area), Collector Roads (Urban Area and Rural Area), and Arterial Roads (Rural Area) was completed. This led to the identification of the following six (6) main Road types for these guidelines:

1. Urban Residential Collector

These roads are the most "minor" of the City's collector road network. They are typically located in the General Urban area and are flanked primarily with residential uses of varying sizes and densities together with supporting neighbourhood uses such as schools, parks, and places of worship. They are often shorter segments that connect these uses to other Collector Roads and Arterial Roads. Buildings are located close to and oriented towards the street with numerous driveways. The street is enclosed with a canopy of trees and flanked by greenery. They are two lane roads with an urban cross-section and on-street parking. Utilities are buried in newer parts of the City, with some overhead lines remaining in older sections.

2. Village Residential Collector

These roads are located in the Villages and serve adjacent village residences on larger lots and occasionally parks and schools. They are shorter segments that connect these uses to other Collector Roads and Arterial Roads. Buildings are set back from the street with larger front lawns, sometimes in a forest setting. They are two lane roads with a rural (shoulder and ditch) cross-section. Utilities are buried in newly constructed streets.

3. Urban Community Collector

These relatively long road segments are often designated as Major Collectors. They are typically located in the General Urban Area and Mixed Use Centres. They are flanked by a very wide range of uses and densities, and building sizes. In more-urban areas, these roads often have a "main street" function, with multi-storey mixed use buildings set close to the street. In more "suburban" areas, these roads are lined with larger community components such as schools, major parks, and civic buildings as well as higher density residential uses. In both cases, the number and spacing of driveways is limited in response to the higher volumes of traffic that may use the corridors. They are typically two lane roads with an urban

cross-section and lined with trees. They often provide on-street parking, although some have been constructed in the past with four traffic lanes without on-street parking. Utilities are buried in newer parts of the City, with some overhead lines remaining in older sections

4. Urban Employment Area Collector

These relatively short road segments are located in the City's business parks and industrial areas, typically on lands designated Employment Area and Enterprise Area. They are flanked by typically large office and industrial buildings on spacious lots with surface parking areas and relatively widely-spaced individual driveways. Landscaping along the street is often provided on private land in a campus setting. These streets are most often two-lanes, only occasionally providing for on-street parking. The segments connect the employment uses to the adjacent Arterial Road network, and in some cases form part of the City's Urban Truck Route network. Utilities are buried in newer parts of the City, with some overhead lines remaining in older sections.

5. Rural Collector

These designated Collector Roads are comprised of the majority of the "country roads" located along historical concession right-of-ways in the City's Rural Area. They are flanked by farms and other rural land uses including rural residences on severed lots. The roads often afford long views of the expansive countryside including intermittent buildings, woodlots, natural features, and farmland. The roads have two-lanes with shoulders and open ditches. Overhead pole lines are common.

6. Rural Arterial

These designated Arterial Roads comprise the longer and more heavily-traveled roads in the Rural Area. They are a combination of main concession roads as well as some former Provincial Highways now under the City's Jurisdiction.

They are flanked by farms and other rural land uses including rural residences on severed lots as well as some rural businesses. The roads often afford long views of the expansive countryside including intermittent buildings, woodlots, natural features, and farmland. The roads have two-lanes with shoulders and open ditches. Overhead pole lines are common. The comparative characteristics of these six (6) road types are summarized on Table 1 (opposite). Demonstration cross-sections, design emphases, and right-of-way requirements are provided in Appendix A. These demonstration plans will enable a review of current right-of-way width protection requirements set out in the Official Plan. They will also serve as a starting point for engineering designs that adequately provide for below-ground infrastructure.

Table 3 - Ottawa Collector and Arterial Road Typology and Comparative Characteristics

Road Type	Prevalent Land Use Designation	Prevalent Adjacent Land Use Context	Prevalent Adjacent Lot Sizes and Access	Prevalent Adjacent Building Scale & Orientation	Landscape and Visual Environment	Typical Roadside Drainage	Typical Length and Connectivity	Traffic Lanes and Parking	Traffic Volumes and Speed	Typical Roadway Classification
Urban Residential Collector	Urban Area (General Urban Area)	Residential; Institutional, Open Space, Minor Commercial	Smaller lots with individual driveway access	Smaller buildings oriented close to road	Tight-knit urban fabric along well enclosed tree-lined streets	Curb and catchbasin	Shorter segments that connect a neighbourhood to other collectors and arterials	Typically 2 lanes, with On-Street parking	Lower speed and volume	Collector
Village Residential Collector	Village	Residential, Open Space	Smaller lots with individual driveway access	Smaller buildings oriented close to road	Buildings in spacious green setting along tree-lined streets	Shoulders, ditches and swales	Shorter segments that connect a neighbourhood to other collectors and arterials	Typically 2 lanes	Lower speed and volume	Collector
Urban Community Collector	Urban Area (General Urban Area, Mixed Use Centres, Central Area)	Mixed Use, Residential, Institutional, Open Space, Commercial	Range of lot sizes, some limitations and consolidation of lot access	Varying- size buildings oriented close to road	Tight-knit urban fabric along well enclosed, tree-lined streets	Curb and catchbasin	Longer segments that connect a neighbourhood between arterials	Typically 2 lanes with On-Street parking, occasionally 4 lanes	Moderately higher speed and volume	Major Collector
Urban Employment Area Collector	Urban Area (Employment Area, Enterprise Area)	Business Park, Offices, Commercial	Larger lots with individual driveway access	Larger buildings oriented to road but often set back	Variety of buildings on spacious landscaped lots along tree-lined streets	Curb and catchbasin	Shorter segments that connect a business park to arterials	Typically 2 lanes, occasionally 4 lanes	Lower speed and volume	Collector, Major Collector

Table 4 - Ottawa Collector and Arterial Road Typology and Comparative Characteristics (Continued)

Road Type	Prevalent Land Use Designation	Prevalent Adjacent Land Use Context	Prevalent Adjacent Lot Sizes and Access	Prevalent Adjacent Building Scale & Orientation	Landscape and Visual Environment	Typical Roadside Drainage	Typical Length and Connectivity	Traffic Lanes and Parking	Traffic Volumes and Speed	Typical Roadway Classification
Rural Collector	Rural Area	Farmland, Rural Residential, Vacant Rural Lands, Natural Areas	Large rural lots and severed residential lots with driveway access	Small and large buildings set well back from road	Rural, open setting with long views of farmland, scattered buildings and natural features	Shoulders, ditches and swales	Long segments that connect rural lands to other collectors and arterials	Typically 2 lanes	Higher speed, lower volume	Collector
Rural Arterial	Rural Area		Large rural lots and severed residential lots with driveway access	Small and large buildings set well back from road	Rural, open setting with long views of farmland, scattered buildings, and natural features	Shoulders, ditches and swales	Very long segments connecting rural lands between arterials and highways	Typically 2 lanes	Higher speed and volume	Arterial

7.2 Region of Durham Information

Table 5 – Recommended Arterial Road Classification System			
Criteria	Arterial Classes		
	Type A Arterial	Type B Arterial	Type C Arterial
Typical Service Objective	Traffic movement primary consideration. Predominantly serves inter-regional and inter-municipal trips.	Traffic movement major consideration. Predominantly serves inter- and intra-municipal trips.	Traffic movement slightly more important than land access. Predominantly serves intra-municipal trips.
Land Service/Access	Rigid/Progressive access control. Permit private access generally located a minimum of 200 m apart in Urban Areas. Permit large scale commercial and industrial developments, mixed use developments and higher density developments with shared or combined access.	Incremental/Progressive access control. Permit private access generally located a minimum of 80 m apart in Urban Areas. Promote higher densities with shared or combined access.	Limited access control. Promote higher densities with shared or combined access, or limit to single detached dwelling unit frontage.
Typical Daily Traffic Volume	>10,000 AADT	5,000-40,000 AADT	4,000-20,000 AADT
Flow Characteristics	Uninterrupted flow except at traffic control signals	Uninterrupted flow except at traffic control signals	Uninterrupted flow except at traffic control signals and pedestrian crossings
Travel Speed	70 km/h urban, 80km/h rural	60 km/h urban, 80 km/h rural	50-60 km/h
Goods Movement	Generally no restrictions	Generally no restrictions	Generally no restrictions
Connectivity	Connects with freeways and arterials	Connects with freeways, arterials and collectors	Connects with arterials, collectors and limited local road access
Transit	May serve as major and minor transit corridors and as regional transit spines	May serve as major transit corridors and as regional transit spines	May serve as minor transit corridors and as local transit corridors and connectors to regional transit spines
Cycling and Pedestrian Provisions	Cycling provisions to be determined through completion of the Regional Cycling Plan Study. Sidewalk on both sides with separation from traffic lane preferred for pedestrians.	Cycling provisions to be determined through completion of the Regional Cycling Plan Study. Sidewalk on both sides for Pedestrians.	Cycling provisions to be determined through completion of the Regional Cycling Plan Study. Sidewalks on both sides for pedestrians, however, may not be required in industrial areas.
Parking	Prohibited or peak hour restrictions	Prohibited or peak hour restrictions	Not recommended where traffic movement is impacted or it becomes a safety issue

Table 6 (Continued) – Recommended Arterial Road Classification System

Criteria	Arterial Classes		
	Type A Arterial	Type B Arterial	Type C Arterial
Minimum Intersection Spacing	700 m intersection spacing in north-south direction. *300 m/500 m intersection spacing in east-west direction. Signalized intersections where required.	525 m major intersection spacing in north-south direction. *300m/500 m major intersection spacing in east-west direction. Some minor intersections (T-type) mid-block subject to possible future control, if necessary to maintain corridor progression. Signalized intersections where required.	300 m intersection spacing. Some minor intersections with future control provisions, if necessary due to capacity and queuing considerations. Signalized intersections where required but not consecutive.
Right-of-Way Width	36-45 m right-of-way 36 m for ultimate 2- 4 lane cross-section. 40 m for ultimate 4-lane cross-section with channelized right turn lanes at intersections. 45 m for ultimate 6-lane cross-section. Maintain width through corridor for alignment of utilities and boulevard features 4-6 lanes within the Urban Area and 2-4 lanes outside the Urban Area	30-36 m ** & *** right-of-way. 36 m for ultimate 4-lane cross-sections. Existing/Future 4 lanes within the Urban Area and 2-4 lanes within the rural area.	26-30 m ** right-of-way, dependent on transit facilities, on street parking and established development (i.e. downtown). 2-4 lane cross-sections within the Urban Area.
Continuity	Continuous across regional areas or larger municipal areas.	Typically continuous across several municipalities.	Typically continuous within a single municipality with few spanning two or more; may be shorter and discontinuous sections when serving major traffic generators.
Cross-section Features	Enhanced through development of supporting circulation system, roadway widening, raised medians, coordination of traffic signals consolidation of private accesses, reducing and controlling local residential street intersections, adding auxiliary lanes at intersections, channelized non-traversable medians, improved curb radii, and provision of right turn lanes.		
Vehicle Priority	To be considered as part of strategic goods movement network. Consideration may be given for transit priority measures including dedicated transit lanes, queue jump lanes, and priority signals.	To be considered for goods movement. Consideration may be given for transit priority measures including queue jump lanes, and priority signals	Predominantly passenger and service vehicles, low to moderate truck traffic (except in Centres and Employment areas)
Network Spacing	Generally 6.5 km between north/south and east/west arterials.	Generally 1.6 km between north/south arterials and 2.0 km between east/west arterials.	Generally, no less than 0.8 km between north/south and east/west arterials.

Exceptions to Table 6 - Recommended Arterial Road Classification System - Region of Durham :

* In some cases, spacing for east-west arterials can be reduced to 300 m if signals are “coupled” provided adjacent intersections are a minimum of 500 m away.

** Reduced right-of-way widths will only be considered in locations identified as exceptions in the Area Municipal Official Plans in accordance with Regional policy.

*** Wider rights-of-way may be required to accommodate other facilities such as transit, utilities, noise attenuation installation, bikeways and landscaping. For new streets, the immediate provision of wider rights-of-way may be considered to accommodate such facilities. Unless otherwise identified by another appropriate comprehensive planning process or Official Plan, a corridor study or Environmental Assessment shall be undertaken to identify any exceptions to the right of way widths identified in this Table.

7.3 City of Toronto Road Classification Information

The City of Toronto designates a system of Major Streets, and classifies them in eight right-of-way widths, ranging from less than 20 metres to 45 metres or greater. The City has also adopted a new road classification system to consolidate and replace the various road classification systems inherited from its seven former municipalities. This classification system provides a full range of criteria for Major (having stronger access controls and rights-of-way ranging from 20-45 metres) and Minor Arterials (allowing more flexible property access with rights-of-way ranging from 20-30 metres). The criteria includes traffic movement versus property access, typical daily traffic volume (both directions), minimum number of peak period lanes (excluding bicycle lanes), desirable connections, flow characteristics, legal speed limit, accommodation of pedestrians, accommodation of cyclists, surface transit, surface transit daily passengers, heavy truck restrictions, typical spacing between traffic control devices, and typical right-of-way width.

Collector Roads

- Provide access to property and traffic movement;
- 2,500 to 8,000 vehicles per day;
- Less than 1,500 bus (or streetcar) passenger per day;
- Signalized intersections at arterial roads;
- Sidewalks on both sides of the road; and
- Medium priority for winter maintenance

Minor Arterial Roads

- Traffic movement is a primary function;
- 8,000 to 20,000 vehicles per day;
- 1,500 to 5,000 bus passenger per day;
- Speed limits 40 to 60 km/hr;
- No “Stop” signs; main intersections controlled by traffic signals;
- Sidewalks on both sides; may have bicycle lanes; and
- High priority of winter maintenance

Major Arterial Roads

- Traffic movement is a primary function;
- Subject to access controls;
- Greater than 20,000 vehicles per day;
- Greater than 5,000 bus passengers per day;
- Speed limits 50 to 60 km/hr;
- Sidewalks on both sides; may have bicycle lanes; and
- High priority of winter maintenance

•

7.4 The Region of York Regional Road Classification Information

The Regional Municipality of York designates a road network comprised of eight right-of-way widths, ranging from 20-60 metres. The planned basic road widths shown in the York Regional Official Plan indicate the maximum widths that may be necessary to construct the roadway and ancillary utilities. The Region has also prepared a report entitled *Regional Streets: Standards for Rights-of-Way and Boulevards* which matches road rights-of-way to their expected function and use. This document refers to the TAC Geometric Design Guide for Canadian Roads in defining an integrated and enhanced approach to road design. Such approach balances considerations for traffic with those of urban design and liveability.

Reference is also made to an access guideline of the region, entitled as follows

Access Guideline for Regional Roads – Section 5

Transportation and Works Department

Regional Municipality of York

September, 2007

(Obtained from the Internet)

For the purpose of these Guidelines, Regional roads are divided into six classes as follows.

Class	Description
Class I	Rural – 2 Lane
Class II	Rural – Multilane
Class III	Main Street
Class IV	Commercial/Commuter
Class V	Commuter
Class VI	Expressway

The attributes of each road class are summarized in the table below.

Table 7 – Region of York Road Classification

	TYPE I Rural – 2 Lane	TYPE II Rural - Multilane	TYPE III Main Street	TYPE IV Commercial/ Commuter	TYPE V Urban Commuter	TYPE VI Expressway
Master Plan Cross-section	2 Lanes	4 Lanes	2 -5 Lanes	4 – 7 Lanes	4 – 7 Lanes	>=6 Lanes
Appearance			In mature business, residential areas, high driveway density, narrow frontages	Medium driveway density, direct commercial access	Access at signalized intersections, low driveway density	Access only at traffic signals, very low driveway density
Driveway Density	Low	Low	High	Medium	Low	Low
Operating Speed	High	Very High	Low to Medium	Low to Medium	Low	Low
Traffic Pattern				Pronounced AM peaks, similar midday & PM peaks, high weekend peak, truck traffic	Pronounced AM and PM peaks, pronounced tidal flows	
Surrounding Land-Use	Agricultural, open space, industrial, institutional	Agricultural, open space, industrial, institutional	Mainly residential, condominiums OR commercial, office, institutional, industrial and retail	Mainly large commercial, office, institutional, industrial and retail	Mainly residential, institutional, open space	
Design			Sidewalks	HOV lane, median, sidewalks	HOV lane, median, cyclist lane, sidewalks	Median
Pedestrians	Very low	Low	Very High	High	Medium	Low

7.5 The Region of Peel Arterial Roadway Classification Information

The Regional Municipality of Peel designates Major Roads in their Official Plan, and classifies them in nine right of way widths, ranging from 20-50 metres. The Region completed a strategic update of their Official Plan. The Peel Official Plan provides general direction regarding access control, intersection spacing, and the accommodation of cyclists and haul routes. Peel Regional Council has also adopted a “Level of Service Policy” to ensure adequate transportation capacity on Regional roads. This policy outlines thresholds for the ratio of traffic volume to the capacity of the road.

7.6 The Regional Municipality of Halton Arterial Roadway Classification Information

The Regional Municipality of Halton designates a network of Major Arterials and Minor Arterials. Major Arterials provide a high degree of access control, up to 6 lanes, with rights-of-way up to 42 metres. Minor Arterials provide an intermediate degree of access control, up to 6 lanes, with rights-of-way of up to 35 metres. The Region also designates Multi-Purpose Arterials that run through nodes or connect nodes. The Official Plan provides both functional (i.e. level of travel demand, goods movement, transit accommodation) and general design guidelines (i.e. level of access control, right-of-way width, number of travel lanes, requirements for HOV and/or transit priority lanes, adjacent land uses).

According to Internet sources, the arterial roads in Halton Region are divided into categories based on their function:

- **Provincial Highways and Freeways** serve high volume inter-regional travel demands, including truck traffic, high-order transit and HOV lanes. They connect urban areas or nodes in different regions.
- **Major Arterials** serve high volume inter-regional and regional travel demands, including truck traffic, high-order transit and HOV lanes. They connect urban areas or nodes in different municipalities and distribute traffic to and from Provincial Highways and Freeways.
- **Multi-Purpose Arterials** serve a combination of the functions of Major and Minor Arterials while connecting Major Arterials through urban areas or nodes.
- **Minor Arterials** serve moderate to high volume local travel demands, including local truck traffic and local transit. They distribute traffic to and from Major and Multi-Purpose Arterials

Table 8 – Function of Major Transportation Facilities

Facility Type	Function	General Design Criteria
Provincial Freeways	• Serve mainly inter-regional travel demands • Accommodate truck traffic • Accommodate high-order transit services and high-occupancy-vehicle lanes • Carry high volumes of traffic • Connect urban areas or Nodes in different regions	• Full access control • Minimum 4 travel lanes • Noise-sensitive land uses to be discouraged along right-of-way
Provincial Highways	• Serve mainly inter-regional travel demands • Accommodate truck traffic • Accommodate high-order transit services and high occupancy vehicle lanes • Carry high volumes of traffic • Connect urban areas or Nodes in different regions	• High degree of access control • Transit-supportive land uses to be encouraged along right-of-way within urban areas • Right-of-way requirements up to 50m
Major Arterials	• Serve mainly inter-regional and regional travel demands • Accommodate truck traffic • Accommodate high-order transit services and high occupancy vehicle lanes • Connect urban areas or Nodes in different municipalities • Carry high volumes of traffic • Distribute traffic to and from Provincial Freeways and Highways	• High degree of access control • Transit-supportive land uses to be encouraged along right-of-way within urban areas • Right-of-way requirements up to 50m
Multi-Purpose Arterials	• Serve a mix of functions of Major Arterials and Minor Arterials • Typically connects Major Arterials through urban areas or nodes	• Intermediate degree of access control • Transit-supportive land uses to be encouraged along right-of-way • Right-of-way requirements up to 50m
Minor Arterials	• Serve mainly local travel demands • Accommodate local truck traffic • Accommodate local transit services • Connect urban areas or Nodes within the same municipalities • Carry moderate to high volumes of traffic • Distribute traffic to and from Major and Multi-Purpose Arterials	• Intermediate degree of access control • Right-of-way requirement generally up to 35m unless specifically identified in a Local Municipal Official Plan

Facility Type	Function	General Design Criteria
Transitway / Busway Corridor	• Accommodate only transit and emergency vehicles • Accommodate inter-regional, regional and local bus routes • Permit high operating speed of transit vehicles • Connect Nodes	• Exclusive right-of-way for transit vehicles • Transitway / busway preferably located within right -of-way of highway/freeway • Station spacing 1km or further apart except within Nodes • Transit-supportive land uses to be encouraged around stations
Rail Lines	• Serve all types of people and goods movements by rail at the regional or national scale • Accommodate commuter rail movement to major urban centres in the Greater Toronto Area and surrounding region	• Grade separations at intersections with other major transportation facilities • Noise- or vibration-sensitive land uses to be discouraged along right-of-way • Transit-supportive land uses to be encouraged around commuter rail stations

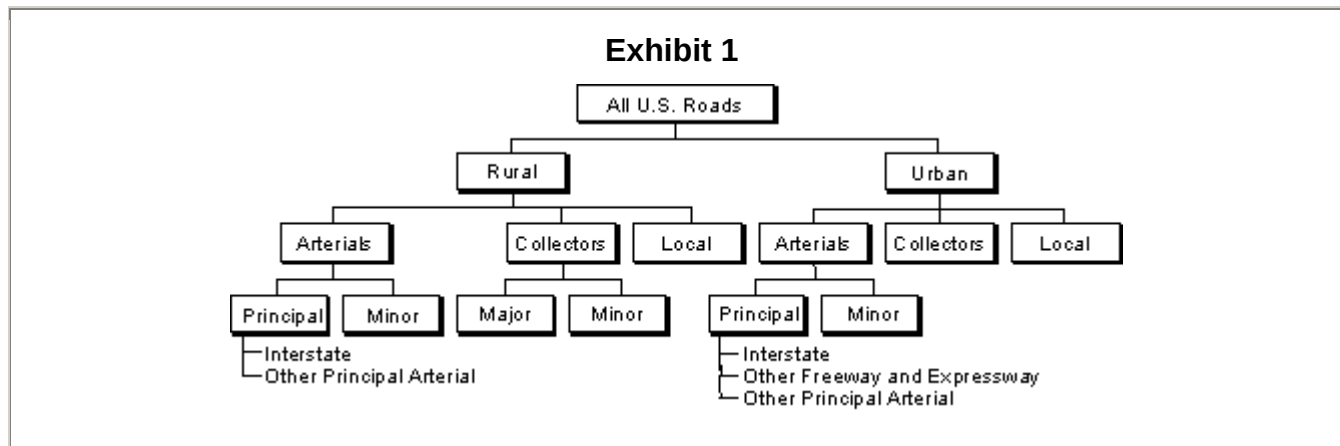
7.7 The City of Hamilton Arterial Classification Information

The City of Hamilton designates arterial roads with rights-of-way ranging from 60 metres, where there is complete control of access to abutting land use, to 26-36 metres, when there is only partial or no control of access to abutting land use. The City defines arterial roads as strategic links in the road network needed to carry out relatively high volumes of long distance traffic within, between or through Area Municipalities, and/ or to provide access past major geographic barriers and to inter-regional highways.

7.8 DOT – State of North Carolina – Functional Classification System

The Highway Functional Classification System distinguishes among public roads by the service they provide. Exhibit 1 describes the hierarchy of the Highway Functional Classification System (HFCS).

Arterials provide the highest level of mobility, at the highest speed, for long, uninterrupted travel. The Interstate Highway System is an arterial network. Arterials generally have higher design standards than other roads, often with multiple lanes and some degree of access control.



The rural arterial network provides interstate and intercounty service so that all developed areas are within a reasonable distance of an arterial highway. This network is broken down into principal and minor routes. The rural principal arterial network is more significant. It serves virtually all urban areas with populations greater than 50,000 people. Additionally, most urban areas larger than 25,000 people are served by rural principal arterial highways. Rural principal arterial highways provide an integrated network without stub connections except where needed because of unusual geographic or traffic conditions (for example, connections to international borders, coastal cities, waterports and airports). The rural principal arterial network is divided into two subsystems, Interstate highways and other principal arterials.

In 1997, the rural principal arterial system accounted for about 3.3 percent of total miles in the United States. This small portion of highways carried 46.8 percent of rural traffic and 18.3 percent of total travel in the United States. The other element of the rural arterial system, minor arterials, represented 3.5 percent of total U.S. miles, carrying 16.5 percent of rural traffic and 6.4 percent of total travel in the United States.

Similarly, in urban areas, the arterial system is divided into principal and minor arterials. The urban principal arterial system is the most important group; it includes Interstate highways, other freeways and expressways, and other principal arterials. The urban principal arterial system serves major metropolitan centers, corridors with the highest traffic volume, and those with the longest trip lengths. It carries most trips entering and leaving urban areas, and it provides continuity for all rural arterials that intercept urban boundaries. In 1997, the urban principal arterial system accounted for 1.9 percent of total miles in the United States. However, this network carried 57.8 percent of urban traffic and 35.5 percent of total travel in the United States.

Urban minor arterial roads provide service for trips of moderate length and at a lower level of mobility. They connect with urban principal arterial roads and rural collector routes. In 1997, the urban minor arterial network represented 2.3 percent of total U.S. mileage. This system carried 19.5 percent of urban traffic and 12.0 percent of total travel in the United States.

Collectors provide a lower degree of mobility than arterials. They are designed for travel at lower speeds and for shorter distances. Collectors are typically two-lane roads that collect and distribute traffic from the arterial system.

The rural collector system is stratified into two subsystems: major and minor collectors. Major collectors provide service to any county seat not on an arterial route. They also serve larger towns not accessed by higher order roads, and important industrial or agricultural centers that generate significant traffic (but are avoided by arterials).

Rural major collectors accounted for 10.9 percent of total U.S. miles in 1997. They carried 20.2 percent of rural traffic and 7.9 percent of total travel in the United States.

Rural minor collectors are spaced at intervals, consistent with population density, to collect traffic from local roads and to insure that all urbanized areas are within a reasonable distance of a collector road. The rural minor collector system accounted for 6.9 percent of total U.S. mileage in 1997. These roads carried 5.3 percent of rural traffic and 2.1 percent of total travel in the United States.

In urban areas, the collector system provides traffic circulation within residential neighbourhoods and commercial and industrial areas. Unlike arterials, collector roads may penetrate residential communities, distributing traffic from the arterials to the ultimate destination for many motorists. Urban collectors also channel traffic from local streets onto the arterial system. In 1997, the urban collector network accounted for 2.2 percent of U.S. road mileage. It carried 8.04 percent of urban traffic and 4.9 percent of total U.S. travel.

Local roads represent the largest element in the American public road network in terms of mileage. For rural and urban areas, all public road mileage below the collector system is considered local. Local roads provide basic access between residential and commercial properties, connecting with higher order highways. In 1997, rural local roads represented 54.1 percent of total U.S. road mileage. Local roads carried only 11.5 percent of rural traffic and 4.5 percent of total travel in the United States. Urban local roads, meanwhile, accounted for 14.9 percent of total U.S. road mileage, 14.3 percent of urban traffic, and 8.7 percent of total U.S. travel.

7.9 Smart Transportation Guidebook – New Jersey DOT & Pennsylvania DOT

A new roadway typology is proposed for the Guidebook in order to design roadways that better reflect their role in the community and the larger transportation network.

Currently, every roadway owned by NJDOT or PennDOT, or by county governments in New Jersey, is assigned a functional classification consistent with the AASHTO Green Book:

- Principal Arterial
- Minor Arterial
- Collector (subdivided into major collector and minor collector within rural areas)
- Local

A problem with the existing functional classification system is that an entire highway is sometimes placed into a certain class based on select characteristics – such as the overall highway length, or traffic volumes – although its level of access and mobility are not consistent with other roadways in that class.

For example, many state highways are classified as principal arterials even if they are far more vital to community access than to regional mobility. This creates a dilemma for highway designers: the application of design standards for that class may encourage higher operating speeds than are appropriate for segments serving community access.

To address this issue, a roadway typology is proposed which better captures the role of the roadway within the community.

It focuses more narrowly on the characteristics of access, mobility and speed. If a segment of an arterial roadway has a relatively low speed, is important to community access, and has a lower average trip length, it should not be designed like a high order arterial. Further, under this approach, roadways are segmented to a greater degree

than traditional functional classification. If one segment of a roadway has low average trip lengths and has consistently lower speeds, its design should be different than another section which carries long trips.

The roadway typology is presented in Table 5.1 and illustrated in Figure 5.1. It should be emphasized that this should be used only as a planning and design “overlay” for individual projects, and does not replace the traditional functional classification system used in both states.

The roadway classes shown in Table 5.1 correspond to the classifications of arterial, collector and local as described in the 2001 AASHTO Green Book. Their design values should likewise correspond to the design guidelines provided in the Green Book.

Different state highways have different community roles, and the Guidebook recommends that this should be reflected in the design. Some state highways, such as NJ Route 1, will be considered as a Regional Arterial because of their importance to regional mobility. On the other hand, Route 27, which is classified as a principal arterial by NJDOT, actually operates more like a community arterial or a community collector. Parallel to Route 1 and the New Jersey Turnpike, this highway has a low average trip length. Maintaining regional mobility becomes a smaller concern on Route 27 and similar state roadways.

Whatever the road classification, traffic mobility and safety are important goals on state highways, and must be considered on all roadway projects. These goals will continue to receive significant attention on roads with acute safety or congestion problems. Mobility and safety goals are balanced with local development goals on projects.

PennDOT owns many roads in Pennsylvania, from arterials down through local roads. NJDOT controls a much smaller share of the road network, and virtually all of its roadways are arterials. Because of the relatively high volumes found on many NJDOT roadways, the maintenance of mobility on regional arterials remains a strong emphasis.

Table 9 – Roadway Categories – New Jersey DOT & Pennsylvania DOT

Roadway Class	Roadway Type	Desired Operating Speed (mph)	Average Trip Length (mi)	Volume	Intersection Spacing (ft)	Comments
Arterial	Regional	30-55	15-35	10,000-40,000	660-1,320	Roadways in this category would be considered “Principle Arterial” in traditional functional classification.
Arterial	Community	25-55	7-25	5,000-25,000	300,1,320	Often classified as “Minor Arterial” in traditional classification but may include road segments classified as “Principal Arterial.”
Collector	Community	25-55	5-10	5,000-15,000	300-660	Often similar in appearance to a community arterial. Typically classified as “Major Collector.”
Collector	Neighbourhood	25-35	<7	<6,000	300-660	Similar in appearance to local roadways. Typically classified as “Minor Collector.”
Local	Local	20-30	<5	<3,000	200-660	

7.10 California Department of Transport (CALTRANS)

As is the case with New Jersey DOT & Pennsylvania DOT, CALTRANS also follows the functional classification that is consistent with the AASHTO Green Book. The functional system is summarised below [RE: http://www.dot.ca.gov/hq/tsip/hseb/func_clas.html]

Functional System	Services Provided
Arterial	Provides the highest level of service at the greatest speed for the longest uninterrupted distance, with some degree of access control
Collector	Provides a less highly developed level of service at a lower speed for shorter distances by collecting traffic from local roads and connecting them with arterials
Local	Consists of all roads not defined as arterials or collectors; primarily provides access to land with little or no through movement

Recently CALTRANS passed legislation in terms of which the design of local streets must incorporate “complete streets principles” The purpose is to make roads and streets safer and more convenient for bikes, pedestrians, people with disabilities and seniors, while helping to reduce greenhouse gas emissions and ease traffic congestion.

7.11 Western Australia

[<http://www.mainroads.wa.gov.au/UnderstandingRoads/FactsFigures/TrafficData/FunctionalRoadHierarchy/Pages/FunctionalRoadHierarchy.aspx>]

Functional Types and Criteria:

Primary Distributors: These provide for major regional and inter-regional traffic movement and carry large volumes of generally fast moving traffic. Some are strategic freight routes and all are National or State roads. They are managed by Main Roads.

District Distributor A: These carry traffic between industrial, commercial and residential areas and generally connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property. They are managed by Local Government.

District Distributor B: Perform a similar function to type A district distributors but with reduced capacity due to flow restrictions from access to and roadside parking alongside adjoining property. These are often older roads with a traffic demand in excess of that originally intended. District Distributor A and B roads run between land-use cells and generally not through them, forming a grid which would ideally space them around 1.5 kilometres apart. They are managed by Local Government.

Local Distributors: Carry traffic within a cell and link District Distributors at the boundary to access roads. The route of the Local Distributor discourages through traffic so that the cell formed by the grid of District Distributors only carries traffic belonging to or serving the area. These roads should accommodate buses but discourage trucks. They are managed by Local government.

Access Roads: Provide access to abutting properties with amenity, safety and aesthetic aspects having priority over the vehicle movement function. These roads are bicycle and pedestrian friendly. They are managed by Local government.

7.12 City of Stirling (Australia)

[<http://www.stirling.wa.gov.au/home/development/Roads+and+Footpaths/Road+Classification.htm>]

Road Classification

The City is responsible for the care and maintenance of over 1000km of roads within the municipality. The following categories of roads are shown on the City's Functional Road Classification Plan. In Western Australia there are 5 classifications of roads. This is termed a Road Hierarchy and is a graded list of road categories ranked in order of traffic function. It is used when describing roads by function in order to provide a consistent approach to road planning throughout the state. Classification enables identification of the necessary road characteristics and associated traffic movements so that appropriate design standards and adjacent urban development can be chosen. Classifying roads in this way recognises that roads are not all the same. At the lower end of the scale are those roads that are designed to give priority to residential property access, while at the higher end are those roads that carry large volumes of traffic relatively unimpeded over long distances. In 1980 the City of Stirling was one of the first local authorities to adopt a Functional Road Hierarchy. This road hierarchy was developed jointly with the Ministry for Planning and Main Roads Western Australia.

Primary Distributors

Roads forming the major network comprising Freeways and Controlled Access Roads which are solely under the jurisdiction of Main Roads Western Australia. These roads carry over 35000 vehicles per day.

District Distributors

District Distributor roads are separated into two further sub-categories denoted A and B. The District Distributor A class roads carry 15000 to 35000 vehicles per day and form part of the major network for vehicular distribution within the City. District Distributor B roads carry 7000 to 20000 vehicles per day.

Local Distributors

Roads carrying 3000 to 7000 vehicles per day being part of the minor distribution network.

Access Roads

Roads carrying less than 3000 vehicles per day being part of the local road network.

The major benefits of road classification are:

- To provide orderly grouping of streets and roads in a framework that governs the planning and implementation of construction and maintenance projects;
- To provide a sound basis for traffic route management, transport and land use;
- To assist in the adoption of appropriate standards of construction of traffic routes and road traffic management;
- Capacities of designated routes can be reviewed and appropriate action taken to ensure function and operation accord

7.13 Ministry of Transportation Ontario (MTO)

The Ministry of Transportation Ontario (MTO) **Geometric Design Standards for Ontario Highways** document provides guidance regarding classification for road planning and design. **Chapter A – Highway Classification** of the **Geometric Design Standards for Ontario Highways** document further discusses the functional classification process, identifies classification criterion and defines the various classification levels and hierarchy. The MTO document defines the Functional Classification System as the predominant method of classification for highway planning and design. The manual describes the Functional Classification System as follows:

‘Functional classification is the predominate method of grouping highways for transportation planning and design purposes. The Ontario Provincial Highways’ “Future Perspective”, the “Highway Inventory” process and the “System Management Plan” recognize the Functional Classification System as the major divisional unit for highway planning purposes. The objective of functional classification is to group highways, roads and streets into connected systems, having similar functions, purposes and importance in the highway network. Functional classification also differentiates between roads on the basis of land service, traffic service and traffic use.’

8. Integration of Roadway Classification Criteria and Urban Design Guidelines

8.1 Overview

During our background research phase of this project we investigated whether road authorities integrated their roadway classification criteria with their urban design guidelines. Based on our sampling of road authorities it appears that this is not a common practice. Generally the urban design guidelines of a road authority focused on improvements to specific locations within an urban area in lieu of providing design guidelines for the various roadway classifications within the jurisdiction of the road authority. The one road authority from our sampling that did integrate their Urban Design Guidelines with their arterial road classifications was the City of Ottawa. The results of our background research on the integration of Roadway Classification Systems and Urban Design Guidelines for our sampling of road authorities and agencies are briefly summarised in the sections that follow.

8.2 Regional Road Authorities

The Regional road authorities researched herein do not have published Urban Design Guidelines. They would typically have Transportation Master Plans that take account of Roadway Classification Criteria. Specific reference is made to:

- York Region Transportation Master Plan Update: Implementation of Transit Oriented Development. Issue Paper. MMM Group. April 2008.
- The Region of York prepared a report entitled Regional Streets: Standards for Rights-of-Way and Boulevards which matches road rights-of-way to their expected function and use. This document refers to the TAC Geometric Design Guide for Canadian Roads in defining an integrated and enhanced approach to road design. Such approach balances considerations for traffic with those of urban design and livability.

8.3 TAC and ITE

No evidence could be found from Internet web searching and limited telephonic enquiries to the TAC and the ITE that these two organisations currently recommend or promote to their membership that local road authorities integrate road classification criteria with urban design guidelines.

8.4 City of Ottawa

The City of Ottawa completed urban design guidelines for Arterial Mainstreets and Traditional Mainstreets through its “Ottawa by Design” program. References are:

- Urban Design Guidelines for Arterial Mainstreets (City of Ottawa, 2006);
- Urban Design Guidelines for Traditional Mainstreets (City of Ottawa, 2006);

Reference is also made to the Road Corridor Planning & Design Guidelines (2007), which incorporates the road classification system.

8.5 City of Toronto

The City of Toronto has a “City of Toronto Streetscape Manual” (May 1997) that is being referenced in their urban design guidelines. There are several urban design guidelines that are focussed on development types and area. The City also incorporates specific streetscape design criteria into urban design guidelines that are issued for particular areas. One example is the Clairtrell Area Context Plan (2005) that refers to the Sheppard Av. and Bayview Av. streetscape guidelines.

8.6 City of Hamilton

The following is noted:

- The Transportation Master Plan was developed in coordination with an Urban Design Guidelines Study (2003).
- The Site Plan Guideline component of the Urban Design Guidelines speaks to road design issues, although not specifically mentioning a classification system.

8.7 Other

City of Brampton

The Development Design Guidelines of the City Of Brampton contains detailed road cross section information, categorised by road category. The document can be viewed at the Web location: [\[www.city.brampton.on.ca/city_dept/pdd/community-design/guidelines/Part%205C_StreetNetwork.pdf\]](http://www.city.brampton.on.ca/city_dept/pdd/community-design/guidelines/Part%205C_StreetNetwork.pdf)

City of Fairfield (in California, USA)

The Design & Development Guidelines of the City of Fairfield incorporates road classification criteria into the guideline document. The website reference is www.ci.fairfield.ca.us/files/DDG.pdf.

Appendix B:

Technical Documents

Guideline Excerpts

1.1 Roundabouts

1.1.1 Roundabout Warrants

Undertake an Intersection Control Study to compare life-cycle costs of a roundabout versus traffic control signals. As per report E-03-045, undertake an Intersection Control Study when design work is being considered for:

- A new intersection on a Regional Transportation Corridor;
 - An existing intersection where traffic signals are warranted;
 - An existing Regional Transportation Corridor intersection which is programmed for improvements to address an identified safety or capacity problem; and
 - Any other location as determined by Regional staff or Regional Councillors.
- roundabouts generally provide a greater level of safety than other types of intersections for motorists, pedestrians and cyclists and have been proven to dramatically reduce injury collision rates (70 to 90%) at intersections converted from traffic signals;
 - roundabouts can accommodate the volumes of traffic typically experienced on our Regional Transportation Corridors and typically will outperform, in terms of delays and queues, a similar sized All-Way Stop Control or a signalized intersection;
 - roundabouts have lower negative environmental impacts because the lower delays associated with them result in lower fuel consumption and lower vehicle emissions; and
 - roundabouts provide more opportunities to improve aesthetics than other types of intersections.

1.1.2 Common Roundabout Questions

A modern roundabout is a circular-shaped intersection in which all traffic flows through the intersection in a counterclockwise direction. Although a modern roundabout is similar to neighbourhood traffic circles and old-style rotary intersections, a modern roundabout has specific geometric features that allow it to provide superior traffic-carrying capacity and exhibit better safety performance than these other types of circular intersections.

Modern roundabouts are currently in widespread use in the United Kingdom, Australia and many mainland European countries and have been implemented in various locations in the United States. The main benefits of roundabouts are:

Given the considerable benefits of modern roundabouts in certain situations, Regional Council, on April 9, 2003, approved the adoption in principle of modern roundabouts on Regional Transportation Corridors where appropriate design standards can be met.

Why are roundabouts safer than signalized intersections?

Numerous recent safety studies conducted in Europe and in the United States have concluded that there are as much as 80% fewer injury-related collisions (both for motorists and pedestrians) at modern roundabouts than at signalized intersections. In a recent study conducted in the United States which examined 55 signalized intersections that had recently been converted to roundabouts, there was a dramatic reduction (75%) in the number of injury-related collisions after the roundabouts were implemented. Many

of these roundabouts were located in areas of the United States where the local motorists had no familiarity with roundabouts. There are relatively few serious collisions at roundabouts because:

- There are fewer conflict points for vehicles, cyclists and pedestrians;
- Vehicle speeds are low (approximately 40 km/h to 50 km/h);
- There is a lower speed differential between users (cars, bikes and pedestrians);
- The lower speeds and geometry reduce the severity of collisions that do occur; and
- Pedestrian crossing distances are shorter and crossing requires looking in one direction only.

Which is preferred? Traffic Signals or Roundabouts?

Prior to including a modern roundabout as an alternative design concept, Regional staff will undertake an Intersection Control Study to assess the feasibility of implementing a modern roundabout. The Intersection Control Study compares a roundabout to a traffic signal based on how much each design concept costs, how each design concept addresses safety and motorist delay and on how each concept affects the environment. Each alternative design concept is evaluated using the following criteria:

- Safety (Motorists, Pedestrians and Cyclists);
- Traffic Operations;
- Fuel Consumption and Emissions;
- Aesthetics;
- Property Impacts;
- Construction Costs; and
- 20 Year Life-Cycle Cost including Injury Collision Cost.

How do motorists, cyclists and pedestrians use a roundabout?

Motorists approaching the roundabout must yield to all traffic already in the roundabout. Once in the roundabout, motorists have the right-of-way and travel counter-clockwise keeping the central island on their left side. Motorists should not enter the roundabout beside large trucks because these vehicles may require the entire roadway width to circulate.

Cyclists may choose to enter and traverse the roundabout in the same fashion as a motorist. Alternatively, should the cyclist lack the experience to traverse the roundabout like a motorist, at multi-lane roundabouts ramps are available at the entries and exits to allow cyclists to leave the roadway, walk their bikes around the intersection and then re-enter the roadway.

Pedestrians must use the marked crosswalks around the perimeter of the roundabout and should never walk in the circulatory roadway or cross to the central island. Pedestrians must wait for a safe gap in traffic before starting any crossing. Pedestrians need only to cross one direction of traffic at a time and should use the splitter islands as a refuge.

Additional information about how to use a roundabout can be accessed using the Region of Waterloo website at www.region.waterloo.on.ca (just click on the roundabout symbol.)

Are the roundabouts big enough for large trucks?

The roundabouts are designed to accommodate buses and large trucks such as fire department ladder trucks

and tractor trailers; however, large vehicles will use most of the pavement when travelling through the roundabout. Therefore, when a large truck is in the roundabout, there will not be enough room for another vehicle to enter beside it and motorists should never pass another vehicle while in the roundabout. Additional information can be accessed using the Region of Waterloo website at www.region.waterloo.on.ca (just click on the roundabout symbol.)

1.1.3 Roundabout Pavement Markings

Do not paint fish-hook lane designation symbols on approaches to roundabouts.

- Develop all auxiliary lanes on approaches to roundabouts from the right edge of pavement with the exception of exclusive left-turn lanes. This encourages through and left-turning traffic to use the left lane and encourages right-turning traffic to make a lane change on the approach to the roundabout. The resulting traffic operation mitigates exit-type collisions at roundabout exit points.
- Extend the 10cm yellow edge line past the splitter island up to the roundabout yield line. The intent of this is to accentuate the curved alignment thus promoting counter-clockwise travel through the roundabout.
- Extend the 10cm white right edge line around the radius of a roundabout from approaching leg to 1st encountered exit leg.
- Paint yield lines with 45cm 1-1-1 white skip lines.
- Only paint hatching where required to visually increase the diameter of the centre island.
- On approaches to splitter islands, ensure that the centreline is appropriately tapered around the splitter island.
- Crosswalks at roundabouts should generally be ladder striping (2.5m x 0.45m), unless there are very low pedestrian volumes (say 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 also be 2.5 m wide.
- Roundabout markings should be an overlay application of MMA (not inlaid).

1.1.4 Roundabout Signs

Regulatory Signs

- Position Ra-2 yield sign on each approach leading into roundabout 3-5m in advance of the yield line on the right-hand side. If there is more than 1 approaching lane or a cross-section that would accommodate more than 1 lane at a roundabout entrance, then locate Ra-2 yield sign on both the left and right side of the approach. Place the bottom of the yield sign no less than 1.5m above ground to maintain sight distance for drivers.
- Yield surveys at roundabouts (see file T05-01) have determined that:
 - for every 100 vehicles – 1 vehicle will yield to pedestrians waiting to cross if the pedestrian stands and waits at the curb, without stepping into the crosswalk
 - motorists are more likely to yield to more aggressive pedestrians
 - motorists in the curb lane are more likely to yield to pedestrians
- Position Rb-121a One-Way Arrow-board atop one horizontally-positioned oversized Wa-33LR Object

- Marker signs. Position the combination of these signs on the centre island directly facing on-coming traffic to help reinforce counter-clockwise direction of travel through the roundabout.
- Use lane designation signs on approaches that have 2 or more lanes. Position sign assemblies on the right side of the roadway and median island, staggered at a distance of approximately 30m where possible.

Warning Signs

- Use Roundabout Ahead sign on all approaches to roundabout where practical (for example, a closely spaced traffic control signal may prohibit a logical position for this sign). Place in accordance with OTM Book 6. Do not post an advisory speed tab sign to supplement this sign because it can mislead a motorist into thinking that a potential stop is not required.
- Supplement the Roundabout Ahead sign with a 20cm Continuous Advance Warning Beacon only where visibility of roundabout is restricted, where observance to roundabout is found to be substandard or where roundabouts may not be expected by motorists such as remote Regional Transportation Corridors.
- Install Yield Ahead Wb-1A or Wb-101A upstream of a yield sign only when a yield sign is not visible from the location where drivers must first see it, in order to bring their vehicles safely to a controlled condition at the roundabout. Consider these signs if there is evidence that drivers are not noticing or heeding to the yield condition.

Street Name Exit Flag-Type Signs

- Mount these signs on the top left side of splitter islands to help direct motorists to the intended destination.
- Position the face of these signs to directly face the upstream exit flag-type sign, facing traffic coming around the roundabout.

Diagrammatic Roundabout Guide Signing

- Shall be white text on green background.
- Shall not be larger than 6' x 8'
- Use street names only, do not supplement with Regional Transportation Corridor numbers.
- On guide signs, only provide street names for exiting legs.
- Incorporate Upper and Lower case in all text for better legibility.
- Consider Advance Diagrammatic Destination Signs only where:
 - a road is considered a primary route leading to a particular destination.
 - all legs at a roundabout are primary roads leading to independent destinations, otherwise a guide sign will appear to be missing information. (i.e one leg only has a destination)
- Use Diagrammatic Street Name signs at all roundabouts located 100m upstream of the roundabout. Complete detailed review to determine if adequate property exists.
- If a leg of a roundabout is considered residential and carries local traffic, do not provide diagrammatic street name sign on that particular leg.
- Incorporate trailblazer sign(s) into Diagrammatic Guide Sign, however roadway must be a direct

connecting route to a Provincial highway.

- Minimum Letter Height (see OTM Book 1B) based on reading time, perception-reaction time, manoeuvre time, required legibility distance, minimum letter height and symbol legibility where:
 - Reading Time = $\frac{1}{2}$ second per word and 1 second per symbol
 - Perception-Reaction Time = 1 second if manoeuvre required (i.e. stop)
 - Manoeuvre Time = Initial Operating Speed (km/h) / 8.8 {km/(h * sec)}
 - Total Time Required = Reading Time + Perception Reaction Time + Manoeuvre Time
 - Travel Speed = [(Reading Time + Perception Reaction Time)(Initial Speed) + (Manoeuvre Time * Average Speed)] / Total Time Required
 - Required Legibility Distance = Total Time Required * Travel Speed * 0.28
 - Minimum Letter Height = Required Legibility Distance / (Legibility-Distance-to-Letter-Height Ratio)

Note: Average Speed = $0.5 \times (\text{initial speed} + 0)$

Legibility-Distance-to-Letter-Height Ratios

Font Type	Ratio
Series C	4.2
Series D	4.2
Series E(M)	4.8
Clearview	4.8

With the Diagrammatic Street Sign is located 100m prior to roundabout, speed reduction can continue for 100m after the sign is passed. Therefore, the required legibility distance of 215m can be reduced by 100m to 115m.

Minimum Letter Height using Clearview font for this sign = $(215\text{m} - 100\text{m}) / 4.8 = 24 \text{ cm}$

The Advance Destination Sign if required should be located no less than 215m prior to intersection and should use a consistent font size and text:

Note: Minimum Font = 20 cm or 8"

1.1.5 Staff Notification Procedures for New Roundabouts

- Prior to any opening there will be a walk through involving Traffic Engineering and Operations staff. Systems staff should be attend if there are any potential issues with adjacent traffic control signals. At the walk through, discuss any outstanding issues including any signing or pavement marking issues.
- Traffic Engineering staff advises Donna Gill of the date and time the roundabout is to be opened.
- Donna Gill sends out fax/email notification to emergency services, local municipalities, media, etc. (persons notified are the same as for road closures).
- Donna puts copy of notification in appropriate file for historical purposes and updates databases and Traffic & Parking Bylaw.

1.2 Pavement Widths

1.2.1 Recommended Pavement Width Guidelines for Rural Cross-Sections

- Striped at 3.35 metres
- Extra 0.3 metres to be considered if greater than 12% trucks and heavies combined (minimum 400 trucks and heavies AADT).
- For multilane rural roads the desirable pavement width is 3.35 m for the passing lane.
- The remaining gravel shoulder width should be a minimum of 1.8 m (6 feet) wide with a desirable width of 2.4 m (8 feet). If the remaining gravel shoulder width is less than 1.8 m, then consider reducing the bikeway width, increasing the width of the gravel shoulder platform, or paving the entire shoulder. The maximum pavement width for one lane plus shoulder is to be 6.0 metres.
- Each project is to be looked at on an individual basis.
- Use discretion with respect to bike lane widths, based on geometric constraints. Desired practice is to be determined.

1.3 Auxiliary Lanes

Note: In addition to the warrants listed below, auxiliary lanes may be warranted based on collision history.

1.3.1 Right and Left-Turn Lanes

- Left-turn lanes, storage length and taper length for unsignalized intersections: MTO Geometric Design Standards for Ontario Highways, Section E.A.1, Section E.9 and warrant graphs. Minimum 20 to 50 left turns per hour in one or more peak hours, depending on collisions, property requirements, number of lanes, impacts to through capacity, etc. A four-lane road generally has less need for additional lanes than a two-lane road. Design with minimum 15 m storage and 30 m taper; 45 m taper is preferred.
- For a two-lane Regional Transportation Corridor with a rural cross-section at a stop-controlled T-intersection, include a left-turn lane and a shadow lane on the through road to avoid maintenance problems with drivers passing left-turning vehicles on the shoulder. If a left-turn lane is not feasible, consider a slip-around lane.
- For a two-lane Regional Transportation Corridor with a rural cross-section at a stop-controlled 4-leg intersection, pave the gravel shoulders at the corners of the intersection to avoid maintenance problems and provide more paved surface for drivers passing left-turning vehicles on the through road.
- Right-turn lanes for unsignalized intersections: minimum 100 right turns per hour in one or more peak hours. In urban areas, storage length = (right turn volume in peak hour) x 7m/veh / 30 veh in 2 minutes; minimum 30 m storage, minimum 60 m taper. In rural areas, see MTO Geometric Design Standards Table E7-1, minimum 75 m taper, do not

add on storage length to parallel lane for unsignalized rural intersections.

- Right-turn taper: right-turn lane is warranted but there are property constraints; or at rural intersection where traffic is cutting across the shoulder to turn right and operating speed is 60 km/h or less. If the operating speed is greater than 60 km/h, then a parallel lane is required.
- Dual right-turn lanes: NOT recommended unless required for signalized capacity
- Left- or right-turn lanes at signalized intersections:
 - At existing signalized intersections, warrant is based on signalized capacity analysis.
 - For new signal installations on roads with posted speed of 70 km/h or greater, left-turn lanes should be constructed on the main road (the road with the highest volume).
 - For new signal installations on roads with posted speed of 50 or 60 km/h, the need for auxiliary lanes is based signalized capacity analysis.
 - For future signalized intersections, capacity analysis should be undertaken to determine the need for a new right-turn lane if there are more than 100 right turns per hour and the need for a new left-turn lane if there are more than 60 left turns per hour.
 - Minimum 30 m storage.

When an existing curbside through/right lane is converted to a right-turn-only lane, the pavement markings for the right-turn lane should include a solid white line from the stop bar to a distance of approximately 45 m, where the lane marking should change to skip striping. Paint right-turn arrows in the right-turn lane for the required storage length or to match the arrows in a parallel left-turn lane

or for 45 m, whichever is greater. Generally place the first arrow approximately 15 m back from the stop bar and the remaining arrows at a spacing of approximately 30 m. For signalized intersections, the storage length is based on signalized capacity requirements. Consider the installation of overhead lane designation signs.

1.3.2 Slip-Around Lanes

- Slip around or by-pass lanes: MTO Geometric Design Standards for Ontario Highways, Section E.9.1.2; used at a rural T-intersection on a two-lane Regional Transportation Corridor where a left-turn lane is not feasible but the gravel shoulder is being damaged or gravel is being thrown on the road by vehicles slipping by turning vehicles. A proper left-turn lane is preferred over a slip-around lane because a slip-around lane basically creates a deficient left-turn lane.

1.3.3 Two-Way Left-Turn Lanes

- Two-way left-turn lanes (TWLTL): consider when there is a high number of rear-end collisions involving vehicles turning left into private driveways, but only for roads with AADT less than 25,000 vehicles/day and where drivers do not have to cut through a queue of traffic to get in/out of the driveway

It is understood that a left-turn queue at an intersection may spill back into the TWLTL for storage purposes. Installing a raised centre median to limit the left-turn lane storage would compromise the capacity in the through lane, and is not recommended. Drivers wishing to turn left in the opposing direction to the left-turn queue may be advised to drive

the queue and do a U-turn rather than attempting to cut through the queue. Drivers wishing to turn left in the same direction as the queue may be advised to check to their left before pulling into the left-turn lane.

1.3.4 Dual Left-Turn Lanes

Dual left-turn lanes are used at a number of signalized intersections throughout the Region of Waterloo. Dual left-turn lanes in the Region are always operated with a fully-protected left-turn signal phase. Dual left-turn vehicles are not allowed to turn during the permissive period.

Dual left-turn lanes are generally recommended where:

- the left-turn volume exceeds 400 vehicles/hour;
- either the adjacent land use or the roadway configuration (including adjacent intersections) restrict the storage length of a single left-turn lane; or the combinations of intersection turning movements or the roadway configuration restrict the capacity of a single left-turn lane;
- the intersection cannot be brought to a satisfactory level of service with a single left-turn lane and adjustments to signal timing; and
- no reasonable alternative, including a roundabout, is preferable.

Pros and cons of dual left-turn lanes compared to single left-turn lanes are summarized as follows:

- Queue length: Reduces queue length. For example the EB dual left-turn movement for Ottawa Street at Fischer-Hallman Road experiences queues of up to 100 m. If this movement were to operate from

a single left-turn lane the queue would increase to approximately 198 m. This queue length would negatively affect adjacent intersections. (The single lane operation is based on giving Ottawa Street priority over Fischer-Hallman Road.)

- Capacity: Increases left-turn capacity and overall intersection capacity because of efficient signal timing (less time needed for protected left phase). May increase capacity in an adjacent through lane by providing adequate storage for a left-turn queue that would otherwise spill into the adjacent through lane.
- Signal timing: In peak hours, allows shorter cycle length because of the additional left-turn capacity or more allocation of green time to other critical movements. In off-peak hours, may result in a longer cycle length because of the fully-protected left-turn phase requiring a longer minimum cycle length.
- Delay: In peak hours, can reduce the delay for turning vehicles by up to 37% over a single left-turn lane with more green time. Generally reduces delay for other movements because less time is required to accommodate the dual left compared to single left. In off-peak hours, the wait for the fully-protected left-turn phase may increase delay.
- Intersection footprint: Requires shorter storage length for left-turning vehicles. May require less property and have a lower construction cost. Requires wider intersection and wider approach for the entire storage length of the dual left-turn lane. May require wider receiving lanes. May require more property and have a higher construction cost.
- Aggressive driving: In peak hours, may reduce the number of aggressive drivers taking chances and

accepting smaller gaps in opposing traffic to make their turn or continuing to turn left well into the clearance interval (amber and all red). In off-peak hours, the perceived long wait for the fully-protected left-turn phase may result in some drivers turning left on the red indication, rather than waiting for their phase. Opposing drivers may attempt to turn right on red during the fully-protected left-turn phase.

- **Motorist safety:** Reduces conflicts with opposing traffic. The Federal Highway Administration Publication No. FHWA-HRT-04-091 “Signalized Intersections: Information Guide” indicates that while multiple left-turn lanes may increase sideswipe collisions, they have an estimated reduction of 29% in all fatal/injury collisions, 26% in all property damage collisions, 29% in all fatal/injury rear-end collisions, 47% in all fatal/injury left-turn collisions, and 20% in angle fatal/injury collisions. May increase sideswipe collisions, where a left-turning vehicle sideswipes an adjacent left-turning vehicle. Possible mitigation for sideswipe collisions includes durable lane continuity markings.
- **Pedestrians** May improve pedestrian safety because the dual left-turn phase operates in a fully-protected mode. Most pedestrian collisions in the Region of Waterloo occur at signalized intersections while the pedestrian is in the crosswalk with the right-of-way. About half of these pedestrians are struck by a vehicle turning left on green. The fully-protected left-turn phase removes the conflict between pedestrians and the left-turning vehicles. Increases pedestrian crossing distance and time by adding an additional lane. Required pedestrian crossing time may impact signal timing. Pedestrians may not want to wait through the fully-protected left-turn phase for their

pedestrian walk indication. Pedestrians may be restricted to crossing on the far leg of the intersection from the dual left-turn lanes.

- **Lane utilization:** In peak hours, relatively balanced utilization of both left-turn lanes may be expected (53/47 split or closer), based on observed saturation flow rates within the Region. In off-peak hours, turning vehicles may favour one left-turn lane over the other, depending on the most popular downstream movement.
- **Heavy vehicles:** Better accommodates a heavy vehicle turning left because the heavy vehicle can use both left-turn lanes rather than swinging into an adjacent through lane.

1.4 Design of Channelized Right-Turn Lanes

Channelized right-turn lanes are preferred where possible, and in an urban area should be designed with geometrics similar to those at the intersection of University/Westmount. Benefits of properly-designed channelized right-turn lanes include:

- Shorter crossing distance for pedestrians, resulting in shorter exposure distance and shorter signal cycles.
- Less likely for pedestrians to be hit by vehicles turning right on red.
- Less likely for cyclists on the sidewalk to ride out into the crosswalk.
- More right-turn traffic capacity than without channelization, although less capacity than free-flow channelization.
- Fewer rear-end collisions.

Channelized right-turn lanes may be included where there is:

- A need for right-turn capacity.
- An unusual pedestrian or bicyclist collision pattern in the crosswalk.
- A skewed intersection with a long crosswalk.
- A wide intersection with a long crosswalk.
- A desire to make an intersection more pedestrian friendly.

Where required to meet right-turn capacity demand and there are few pedestrians, include deceleration and acceleration lanes to design standards for a free-flow right-turn lane. Note that this will make the channel more like a ramp and less friendly to pedestrians.

1.5 Cycling Facilities

1.5.1 Introduction

As noted in the TAC Guidelines for the Design and Application of Bikeway Pavement Markings, February 2007, the use of bicycle pavement markings may not necessarily increase cyclist safety in a given situation. The use of a marking in an inappropriate location (e.g. due to roadway operation or geometric characteristics) may place the cyclists in vulnerable situations. The indiscriminate use of some types of markings may foster cyclist and/or motorist complacency (e.g. cyclists feel safer than they really are.) Attempting to use bicycle pavement markings to promote cycling in areas where there are very few or no cyclists, the markings may lose their significance. However, the practitioner must also consider the potential latent demand that markings may serve. The potential safety impacts of a marking should therefore be carefully considered before installation. Bicycle pavement markings may not increase safety if they are not properly obeyed by motorists and cyclists.

- Cycling facilities include bike lanes, paved shoulders, shared bicycle/parking lanes, wide curb lanes, multi-use off-road trails and shared bicycle/other vehicle lanes. A cycling route may include any of these types of cycling facilities.
- Note that the Region of Waterloo Transportation Engineering practice is subject to revision. Please check that you are referring to the most current practice. When in doubt, consult with Transportation Engineering staff.
- Charge all bicycle signs and markings to the appropriate capital project account. If the signs and markings are not part of a capital project, charge them to the Cycling Reserve Fund miscellaneous account. Traffic Engineering staff should confirm the

charge with the Region's TDM Planner before issuing a service request for bicycle signs and markings to be charged to the Cycling Reserve Fund.

1.5.2 Standards for Reserved Cycling Facilities

A cycling facility may be non-reserved which allows shared use by cyclists and others, or it may be reserved exclusively for cyclists using the diamond symbol. A diamond bike lane is reserved for the exclusive use of cyclists. A diamond bike lane may be a bike lane or a paved shoulder.

- Cycling facilities that are less than 1.25 m in width will generally not be reserved. The Transportation Division will decide whether a cycling facility will or will not be reserved.
- Amend the Regional Traffic and Parking By-law for each new diamond bike lane that is implemented to reserve the lane and to restrict parking in the lane. If a diamond bike lane is included in Design & Construction plans that have been approved by Regional Council, then a Planning & Works report is not required to implement the diamond bike lane. In this case, send the by-law amendment directly to Regional Council.
- Diamond bike lanes must be marked with diamond symbol pavement markings. Diamond symbols should be 0.5mx2m as per TAC guidelines.
- Place "reserve bike lane" signs, diamond markings and bicycle symbol markings along diamond bike lanes as per OTM Books 5 and 11. For both urban and rural locations, place signs and markings together at a maximum spacing of 300 m as per OTM Book 5 and 15 m downstream from the end of the

curb radius of every major intersection.

- Include "reserved bike lane ends" signs where the diamond bike lane ends and does not continue on any other leg of an intersection, except at a roundabout. Do not paint "ends". At a roundabout, place a "reserved bike lane ends" sign 100 m in advance of where the bike lane ends, whether the bike lane continues beyond the roundabout or not.

Signs and Symbols for Reserved Cycling Facilities

- Use glass beads in the painted symbols to make them retro-reflective. Repaint markings once per year, as early in the spring as possible. Inspect symbols marked in thermo plastic or MMA annually and remark on an as-needed basis.
- Paint symbols along cycling facilities as per stamped pavement marking plan.
 - Where bicycle symbols are needed on shoulders or lanes reserved for buggy and bicycle traffic, paint both bicycle and buggy symbols together.
 - Place bicycle symbols so that they are facing approaching cyclists/drivers.
 - Bicycle symbols should be 1mx2m. Size bicycle symbols to fit in the cycling facility if the facility is less than 1.5 m wide.
- Paint directional arrows as directed by Traffic Engineering staff. This is used where cyclists have been observed riding the wrong way on a cycling facility.
- Paint an "X" on the pavement in the cycling facility before all railway crossings, as per the Transportation Association of Canada (TAC) Bikeway Traffic Control Guidelines for Canada. The painted "X" in the cycling

- facility should be 0.5x2m as per TAC guidelines.
- Paint left-turn arrows in bicycle left-turn lanes, as per TAC guidelines. Size left-turn arrows to fit in the bike lane if the lane is less than 1.5 m wide.
- Add wayfinding tabs below cycling facility signs as directed by Traffic Engineering staff. The tabs are to provide route guidance. Traffic Engineering staff will work with the Region's TDM Planner to develop an appropriate signing plan for route guidance. The signing plan should be in accordance with the Region's Tourism and Essential Services Signing Policy. The tab colours should be white on green. Distances to settlement areas are generally measured to the town hall or, if there is no town hall, to the main intersection of the settlement area.

Pavement Width and Striping for Reserved Cycling Facilities

- Provide pavement width and striping for cycling facilities as per Regional Pavement Width Guidelines for urban and rural cross-sections.
- Provide striping for bike lanes along the route and at approaches to intersections as per TAC guidelines. Note: Paint bicycle through lanes to the left of introduced right-turn lanes, as per TAC guidelines.
- Use "skip" striping for bike lanes where traffic has the option to cross the bike lane. This includes an approach to an intersection where traffic may turn right across the bike lane. For the approach to a stop-controlled intersection, use a 15m 1-1-1 skip line. For the approach to a signalized intersection, use a 30m 1-1-1 skip line.
- If the bike lane striping goes to "skip" and then solid again, paint the symbols again e.g. where crossing

an exit ramp, as per TAC guidelines.

- Design for a minimum 1.5 m width for bicycle left-turn lanes. Design the length of the bicycle left-turn lane to be similar to the storage length excluding the taper of the adjacent vehicular left-turn lane, or to a minimum length of 15 m as per TAC guidelines. Consider a cantilever sign over painted bicycle left-turn lanes.
- Discontinue visual and audible transverse rumble strips at the edge line. Do not place rumble strips in the cycling facility.
- Roadway pavement markers (such as "cat's eyes") are devices mounted on or in the road surface to supplement or replace pavement markings. On roads that are cycling routes, do not place roadway pavement markers other than in the centerline of the road.
- If there must be a choice between a turn lane and a bike lane because of limited pavement width, first try minimum lane widths to fit both in. If it is not possible to fit both in, then consider the following. If the need for the turn lane is based on a protected signal phase, higher-than-expected collisions or excessive delay, then choose the turn lane. Otherwise choose the bike lane. If there is a choice between removing or reducing the width of a left-turn lane or a right-turn lane, generally keep the left-turn lane and reduce or remove the right-turn lane.

1.5.3 Standards for Non-Reserved Cycling Facilities

- Do not paint diamond symbols in non-reserved cycling facilities.
- Avoid placing bicycle route signs along non-reserved cycling routes. All Regional Transportation Corridors

1.6 Road Safety Reviews

are cycling routes.

- In particular, where edge line markings are provided to narrow a wide lane and provide better guidance to motorists but the space between the edge line and the curb is not wide enough for a bike lane (minimum 1.25 m) or parking is allowed, avoid signing the road as a bicycle route. The public does not understand the difference between a non-reserved bike lane and a reserved bike lane, and expects that a cyclist should be able to travel within and that vehicles should be prohibited from parking within what they think is a bike lane.
- Where a cycling route crosses a road midblock, do not paint dots to delineate the cycle crossing.

1.6.1 Introduction

This section provides a checklist of issues that Regional staff and consultants should consider in undertaking safety impact studies and road safety reviews. The checklist does not cover all aspects of a road safety review, and is not a substitute for the observation skills and judgement of the reviewer. The checklist is merely a useful tool.

Information for this section was drawn from the following reports:

- Ontario Traffic Manual Book 1C: Introduction to the Ontario Traffic Manual Appendix C – Positive Guidance Toolkit, July 2001
- Roadside Safety Manual, Ministry of Transportation of Ontario, March 1993.
- An Introduction to Road Safety Science, Human Factors North Inc., June 2001.

1.6.2 Background Data

The reviewer should review the following background data if available before undertaking a site inspection:

- air photo (available from GIS Locator on the Region's website)
- design and/or construction drawings
- turning movement counts and vehicle classifications (may be available from the Region's Transportation Division)
- Traffic and Parking By-law with respect to parking restrictions, posted speed, turning restrictions, etc. (A hardcopy is available for viewing at the Region's Transportation Division)

- average and 85th percentile operating speeds (may be available from the Region's Transportation Division)
- collision analysis; look for characteristics where the actual number of collisions is generally at least 10 more than expected over the past 5 years (collision data is available from the Region's Transportation Division). Collision characteristics may include:
 - impact type
 - severity (fatal, injury, property damage only)
 - environment condition (clear, rain, snow, etc.)
 - light (daylight, dawn, dusk, dark)
 - road surface condition (dry, wet, snow, slush, etc.)
 - apparent driver action (driving properly, following too close, exceeding speed limit, etc.)
 - direction at fault
 - time of day
 - day of week
 - type of vehicles
- general road grades (available from the Region's Transportation Division)
- signal phasings and level of service analysis as per Regional practice
- warrants for signals or all-way stops as per Regional policy and practice
- warrants for auxiliary turning lanes as per Regional practice
- warrants for illumination as per Regional policy and practice
- warrants for sidewalks as per Regional practice
- previous road safety reviews

1.6.3 Site Investigation

The site investigation should include a drive-through and a walk-through of the site, taking photos and making observations regarding motorist, cyclist and pedestrian behaviour. The reviewer should record a description of the site, hazards, driver expectancy violations, and driver task complexity. The reviewer should talk to the Waterloo Regional Police and involve them in the site investigation if necessary. Characteristics of the site include:

- adjacent land uses
- physical characteristics of road
 - horizontal and vertical alignment
 - road surface
 - cross-section
 - number of travel lanes and auxiliary lanes
 - median and traffic island type/width
 - shoulder type/width
 - sidewalks
 - crosswalks
 - bike paths
 - walkways
 - bus stops
 - driveways
 - illumination
 - vertical and lateral clearances at overpasses
- road traffic control devices, and their size and placement, including:
 - signs (e.g. posted speed, truck restrictions, parking restrictions)
 - signals
 - beacons
 - pavement markings

1.7 Pedestrian Refuge

- delineation devices
- railway gates
- rumble strips
- intersection characteristics (auxiliary lanes, tapers, channelization, turn radii)
- traffic operations (delay, congestion, queues)

Possible hazards include:

- fixed object hazards:
 - poles
 - trees
 - fences
 - signs
 - culverts
 - curbs
 - ditches
 - bridge supports
 - bridge piers
 - bridge abutments
 - railings
 - guide rails & end treatments
 - street furniture
 - mail boxes
 - bus shelters
 - rock outcrops
 - water bodies
 - construction zones
 - parked vehicles
 - pedestrian refuge with railings
 - retaining walls
 - buildings

1.7.1 Pedestrian Refuge Island Design

- Do not paint a crosswalk of any type, including dots to delineate an uncontrolled pathway across a Regional road.
- pedestrian refuge: NO new railings on pedestrian refuges, NOT recommended because of the potential collision hazards including spearing of a driver or a pedestrian, a pedestrian walking in front or behind the railing, and the provision of a false sense of security to a pedestrian.
- See Regional Standard Drawing RWSD 217. A typical pedestrian refuge island is in the range of 4 m long. The preferred minimum width of any pedestrian refuge island is 3.0 m as defined in the standard drawing, unless there are severe limitations. Do not go below 1.75 m width. Where there is additional asphalt space, use it for the island, for example at a wide shadow lane.
- Not all median islands are pedestrian refuge islands. Although able-bodied pedestrians may use any median to more easily cross the road, the median may not have curb cuts or be illuminated to the standard of a pedestrian refuge island.
- An appropriately designed pedestrian refuge island means a short section of raised median with proper tapers for approaching traffic (not just suddenly veering them to one side), signing that includes a combination of the Rb-25 (keep right at island) and Wa-33L (tiger tail) at each end of the short section of raised median, and no railings. Approach tapers to be designed as per OTM Book 11.
- To accommodate physically disabled persons and people with visual disabilities, provide a dropped

concrete pathway to permit wheelchair accessibility. Avoid asphalt pathways between two islands because the visually impaired use a change in road surface texture as an indicator that they are on the island.

- The island will feature a diagonal pathway. Visually impaired persons with seeing-eye dogs have expressed concern regarding diagonal pathway, however this design feature is acceptable. Typically seeing-eye dogs are trained to cross roadways at perpendicular angles.
- Paint the vertical face of refuge island curb yellow to improve visual conspicuity for visually impaired persons. [This is subject to finding a suitable, low-maintenance durable paint. If there is no suitable type of paint available, then do not paint it.]
- Install Wait for Gap (Wc-28) signs only when warranted as specified in OTM Book 6 – Warning Signs.
- Install Pedestrian Ahead (Wc-7) signs only when warranted as specified on OTM Book 6 – Warning Signs.
- Illumination to be provided on both sides of the unmarked pedestrian crossing for two-way streets, regardless of the number of lanes. Use 150 Watt HPS luminaires as per the Region's Illumination Policy. Ideally, unless there is already existing illumination, place one luminaire on each side approximately 6 to 8 m offset before the unmarked pedestrian crossing for approaching traffic. If there is already illumination on one side of the road, then add a luminaire on the other side. If there is already illumination on both sides of the road, then the existing illumination will suffice. This will provide for optimal vertical illumination of the pedestrian (it will light up the side of the pedestrian rather than the top of their head). Note that illumination is also provided at the start of any median island, as per the Region's Illumination

Policy. Ensure that no illumination is placed within 6 to 8 m after the crossing to avoid negative contrast of the pedestrian. This may be achieved by adjusting the placement of the island between existing poles.

- The cost of a pedestrian refuge island in an already paved gore area would in the order of \$12,000.

Recommended Preferred & Minimum Criteria for the Street Elements

		Road Classifications																	
	Street Elements (Travelled Portion of R-of-W)	Community Connector			Neighbourhood Connector: Avenue			Neighbourhood Connector: Main Street			Residential Connector			Rural Connector			Rural Village: Main Street		
		Need	Preferred	Range	Need	Preferred	Range	Need	Preferred	Range	Need	Preferred	Range	Need	Preferred	Range	Need	Preferred	Range
			(mm)	(mm)		(mm)	(mm)		(mm)	(mm)		(mm)	(mm)		(mm)	(mm)		(mm)	(mm)
1	Transit Priority Lanes	Important	4000	3650-4000	Important	4000	3650-4000	Important	4000	3650-4000	Important	4000	3650-4000	n/a	4000	3650-4000	Optional	4000	3650-4000
2	Cycling Facilities	(4)	1500	1250-1500	(4)	1500	1250-1500	(4)	1250	1250-1500	(4)	1250	1250-1500	(4)	1500	1250-1500	(4)	1250	1250-1500
3	Travel Lanes - curb / shoulder (11) (6) (1)	Necessary	3650	3350-3650	Necessary	3650	3350-3650	Necessary	3650	3050-3650	Necessary	3650	3350-3650	Necessary	3650	3350-3650	Necessary	3650	3050-3650
3a	Additional width for Travel Lanes - curb shoulder without cycling lanes only	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Optional	1000	n/a	Optional	1000	n/a
4	Travel Lanes - curb lane with Buggy Traffic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Important	4850 ⁽²⁾	4000-4850	Important	4850 ⁽²⁾	4000-4850
5	Travel Lanes - passing (10)	Necessary	3350	3250-3350	Important	3350	3250-3350	Important	3250	3250-3350	Important	3350	3250-3350	Important	3350	3250-3350	Important	3250	3250-3350
6	Turning Lanes - right	Important	3250	n/a	Important	3250	n/a	Important	3250	n/a	Important	3250	n/a	Important	3250	n/a	Important	3250	n/a
7	Turning Lanes - left	Important	3250	3000-3350	Important	3250	3000-3350	Important	3250	3000-3350	Important	3250	3000-3350	Important	3250	3000-3350	Important	3250	3000-3350
8	Turning Lanes - dual left	Optional	3500	n/a	Optional	3500	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
9	Turning Lanes - receiving dual left	Optional	4500	n/a	Optional	4500	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
10	Median for Safety and Separation	Optional	3000	1750-5000	Optional	3000	1750-5000	n/a	n/a	n/a	Optional	3000	1750-5000	n/a	3000	1750-5000	Optional	3000	1750-5000
11	Median for Access Control	Optional	3000	3000-5000	Optional	3000	3000-5000	n/a	n/a	n/a	Optional	3000	3000-4750	n/a	3000	3000-4750	Optional	3000	3000-4750
12	Mid-Block Median for Refuge (7)	Important	3000	1750-3000	Important	3000	1750-5000	n/a	n/a	n/a	Important	3000	1750-5000	n/a	n/a	n/a	Optional	3000	1750-5000
13	Median for Infrastructure (5)(8)	Optional	1600	1000-1750	Optional	1600	1000-1750	n/a	n/a	n/a	Optional	1600	1000-1750	n/a	1600	1000-1750	n/a	n/a	n/a
14	Parallel Parking Lane	n/a	n/a	n/a	Optional	2400	2000-2400	Optional	2400	2000-2400	Optional	2400	2000-2400	n/a	n/a	n/a	Optional	2400	2000-2400
15	Curb	Important	500	210-500	Important	500	210-500	Necessary	500	210-500	Important	500	210-500	n/a	n/a	n/a	Necessary	500	210-500
16	Shoulder (3)	Optional	2400	1800-2400	Optional	2400	1800-2400	n/a	n/a	n/a	Optional	2400	1800-2400	Necessary	2400 ⁽⁹⁾	1800-2400	n/a	n/a	n/a

Notes:

1 The width of the cycling lane should be considered in conjunction with the width of the adjacent lane.

2 The Rural Connector classification could include curbed cross-section and as such curb lane with buggy traffic width has been specified to provide for such condition.

3 From outside of curb lane, not edge of pavement

4 Active Transportation Master Plan should be referenced.

5 Necessary at signalized intersections

6 Use minimum lane width of 4.5m where there is a continuous median and one lane only

7 Designs are location specific and require individual evaluation

8 If median width is 1.0m use barrier curb instead of curb and gutter

9 Rural Roads with buggy traffic to have 1.0m -1.5 m of paved shoulder with the remaining area gravel

10 The need for passing lanes will be determined through the Transportation Master Plan and the Environmental Assessment process.

11 A reduced lane width should be considered if there is an adjacent cyclign lane or parallel parking.

Recommended Preferred & Minimum Criteria for the Boulevard Elements

Region of Waterloo Corridor Design Guidelines

Boulevard Criteria		Community Connector			Neighborhood Connector: Avenue			Neighborhood Connector: Main Street			Residential Connector			Rural Connector			Rural Village: Main Street		
		Need	Preferred	Range	Need	Preferred	Range	Need	Preferred	Range	Need	Preferred	Range	Need	Preferred	Range	Need	Preferred	Range
1	Pedestrian Clearway (1)	Necessary	1.8m	1.5-2.1m	Necessary	2.1m	1.5-2.1m	Necessary	2.5m	1.5-2.5m (3)	Necessary	1.8m	1.5-2.1m	Optional	2.1m	1.5-2.1m	Necessary	2.1m	1.5-2.1m
2a	Landscape Zone and Site Furnishing Zone: With Trees	Necessary	3.0m	2.0-3.0m	Necessary	4.0m	2.0-4.0m	Important	3.0m	2.0-3.0m	Important	3.0m	2.0-3.0m	Important	3.0m	2.0-3.0m	Optional	3.0m	2.0-3.0m
2b	Landscape and Site Furnishing Zone: Without Trees	Necessary	2.0m	1.0-2.0m	Necessary	2.0m	1.0-2.0m	Important	2.0m	1.0-2.0m	Important	2.0m	1.0-2.0m	Optional	2.0m	1.0-2.0m	Optional	2.0m	1.0-2.0m
3	Buffer Zone (2)	Necessary	0.8m	0.5-0.8m	Important	0.5m	0.5m	Important	0.5m	0.5m	Optional	0.5m	0.5m	n/a	n/a	n/a	Optional	0.5m	0.5m
4	Land-Use Transition Zone	Optional	1.0m	Varies	Optional	1.0m	Varies	Important	1.0m	Varies	Necessary	1.0m	Varies	n/a	n/a	n/a	Optional	1.0m	Varies
5	Transit Facilities	Necessary	Placed within Landscape and Site Furnishing Zone		Necessary	Placed within Landscape and Site Furnishing Zone		Necessary	Placed within Landscape and Site Furnishing Zone		Necessary	Placed within Landscape and Site Furnishing Zone		Optional	Placed within Landscape and Site Furnishing Zone		Necessary (where required)	Placed within Landscape and Site Furnishing Zone	
6	Decorative Lighting	Optional	Free-standing		Optional	Building Mounted or Free-Standing		Optional	Building Mounted or Free-Standing		Optional	Free-standing		Optional	Free-standing		Optional	Building Mounted or Free-Standing	
7	Site Furnishings	Optional	Placed within Landscape and Site Furnishing Zone		Optional	Placed within Landscape and Site Furnishing Zone		Important	Placed within Landscape and Site Furnishing Zone		Optional	Placed within Landscape and Site Furnishing Zone		n/a	n/a		Optional	Placed within Landscape and Site Furnishing Zone	
8	Utilities	Necessary	Coordination required between various authorities		Necessary	Coordination required between various authorities		Necessary	Coordination required between various authorities		Necessary	Coordination required between various authorities		Necessary	Coordination required between various authorities		Necessary	Coordination required between various authorities	
9	Multi-Use Trail (2)	Optional	3.0m	3.0-4.0m	Optional	3.0m	3.0-4.0m	n/a	n/a	n/a	Optional	3.0m	3.0-4.0m	Optional	3.0m	3.0-4.0m	n/a	n/a	n/a
10	Landscape Buffer Zone	Optional	2.5m	1.0-2.5m	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Optional	2.5m	1.0-2.5m	n/a	n/a	n/a

Notes:

- 1) Consider 2.1m for Pedestrian Clearway at approach to intersection or other conflict points
- 2) In constrained R.O.W. conditions the buffer zone can be incorporated into the Landscape and Site Furnishing Zone
- 3) In certain situations a wider sidewalk might be warranted and should be reviewed on a case by case basis