Pedestrian and Bicycle Facility Design Guidance

Prepared by:
URBAN systems

Region of Peel
Working for you

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MESSAGE FROM DIRECTORS

Active transportation, such as walking and cycling, offers multiple benefits including decreased congestion and commute times as well as positive impacts on the public's health and the environment. Given that this is an evolving area of work, it has been important for us to look to jurisdictions that have successfully developed cycling networks to assist us as we implement our planning and transportation plans in Peel. Having safe and well-designed bike lanes and paths will encourage more people to use their bikes for transportation and leisure.

This document is intended to provide planners and engineers who design bicycle and pedestrian facilities with practical design advice and examples of current treatments for use when planning pedestrian and cycling networks. It contains a review of guidelines from North America, selected European countries, and Australia as well as a comprehensive list of resources that can be used throughout the design process.

This document is an example of our commitment to integrated planning at the Region of Peel. We look forward to developing a community that supports active transportation for all citizens.

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In addition, we recognize the hard work of many partners and community organizations across Peel region whose commitment to implement guidelines such as these ones in future development will ultimately create an active and healthy community for the residents of Peel.

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CHAPTER 1

Introduction

Region of Peel's Active Transportation Plan

The Region of Peel is the second largest municipality in Ontario. It provides services to 1.4 million Peel residents and approximately 106,000 businesses in the City of Mississauga, the City of Brampton and the Town of Caledon.

The Region of Peel has various programs and strategies in place to encourage and support active transportation. The Region's Walk and Roll Peel Program, for example, promotes bicycle and pedestrian initiatives and infrastructure as well as the benefits of active transportation.

In 2012, the Peel Regional Council approved the Region of Peel's first Active Transportation Plan. The Plan was completed in collaboration with area municipal staff and with input from internal and external stakeholders, including the general public. The Plan provides a framework for how the Region of Peel will increase the modal share of trips made by walking and cycling, linking with transit, and creating a pedestrian and cycling-friendly environment through:

- seting out policies that direct the practices of the Region to support more walking and cycling;
- recommending active transportation improvements to the existing cycling and pedestrian networks; and
- recommending strategies and programs to shift travel behaviours.

Opportunities to improve walking and cycling environments in Peel

Promoting walking and cycling as attractive and convenient transportation choices can help:
- reduce automobile dependence
- increase physical activity levels
- improve public health
- reduce infrastructure demands, and
- create more livable and vibrant communities.

Communities throughout the world have recognized that the increased use of walking and cycling will also result in a more balanced transportation system that is healthier, more livable, cost-effective and more efficient in terms of the community's infrastructure investments. These communities have also recognized the significant quality-of-life benefits that are associated with walking and cycling as well as the positive economic development benefits that can be enjoyed in the environment that supports walking and cycling.

The Region of Peel already has an extensive network of multi-use trails that provide opportunities for residents and visitors to walk and bicycle for recreational purposes. In addition, the Region has an established network of sidewalks in urban areas, hiking trails, bicycle lanes, and signed bike routes. Looking forward, the intent is to support and encourage people of all ages and abilities to walk and cycle and ensure that the walking and cycling are safe, convenient and competitive travel options. Travel-to-work data provided through the 2011 National Household survey indicates that two per cent of Peel residents walk to work and less than one per cent bicycle to work.

There are a number of challenges that can make choosing active transportation modes over the motor vehicle less attractive within Peel region. For example:

- much of the land use within the region is categorized as low-density
- important destinations are often far away
- there are a number of high-volume arterial roads that carry a high proportion of large trucks, and
- many of the local streets are curvilinear which can make accessing destinations directly difficult.

Despite these challenges, the Region of Peel is looking for opportunities to improve physical activity and promote active forms of transportation and is looking for guidance on planning and designing bicycle and pedestrian facilities for people of all ages and abilities.

The purpose of this document

Transportation engineers are increasingly being called upon to balance the needs of pedestrians, cyclists, and motorists as communities seek strategies to reduce traffic congestion, increase the compactness of urban plans, achieve greater environmental sustainability, and promote the public's health by supporting greater active transportation. The Transportation Association of Canada (TAC) provides guidance for the design of pedestrian and bicylce facilities. However, pedestrian and bicycle facility design is a rapidly-evolving field. As a result, the use of TAC documents is being supplemented by a number of domestic and international guides as well as city-specific urban-street design guides.

The purpose of this document is to provide a targeted comparison of the technical design guidance for pedestrians and bikeways documented in existing TAC publications, leading domestic and international guides, and selected city-specific guides. While pedestrian and bikeway designs overlap with that of complete streets, the specific focus of this report is on pedestrian and bikeway designs.

CHAPTER 2

Bikeway Facility Design

2.1 Bikeway Network Planning

This section provides guidance regarding the planning of bicycle networks to ensure there is appropriate coverage that complements the road network, a variety of bikeway facility types that appeal to a wide range of users, and equitable and convenient access to the bicycle network for all residents, commuters and visitors.

2.1.1 Bicycle Planning Framework

The degree to which a community is cycling-friendly is a function of the policies, programs, and facilities in place. Bicycle facility planners typically consider five elements (referred to as the "5E's" of cycling) as part of a comprehensive bicycle plan:

- **Engineering** addresses the design, implementation, and maintenance of bikeway facilities and how bikeway facilities fit into the broader transportation system.
- **Education** includes teaching or training programs for cyclists and motorists, such as cycling skills courses or bicycle maintenance courses, which are often targeted to key populations such as children or new commuters.
- **Encouragement** is the promotion of cycling through participatory events, such as Bike to Work Week, Bike Month, community bike rides, commuter incentive programs, or Safe Routes to School programs.

- **Enforcement** refers to laws in regards to bicycle use and ensuring that bicyclists and motorists know the rules of the road and share the road safely.
- **Evaluation** is used to confirm that policies, programs and facilities are meeting their intended outcomes.

Globally, experience indicates that a focus on all five of these "E"'s is crucial to achieve major increases in the number of people using bicycles for transportation. However, surveys on bicycle use have consistently shown that safety is the most commonly expressed concern of cyclists. Given this, design professionals need to give careful consideration to properly engineering and designing bicycle facilities to create a safe and comfortable cycling environment. Engineering interventions may present challenges in terms of cost and available road space, but a network of safe, attractive, and connected facilities for cycling is a crucial first step to creating a bicycle friendly city.

2.1.2 Types of Cyclists

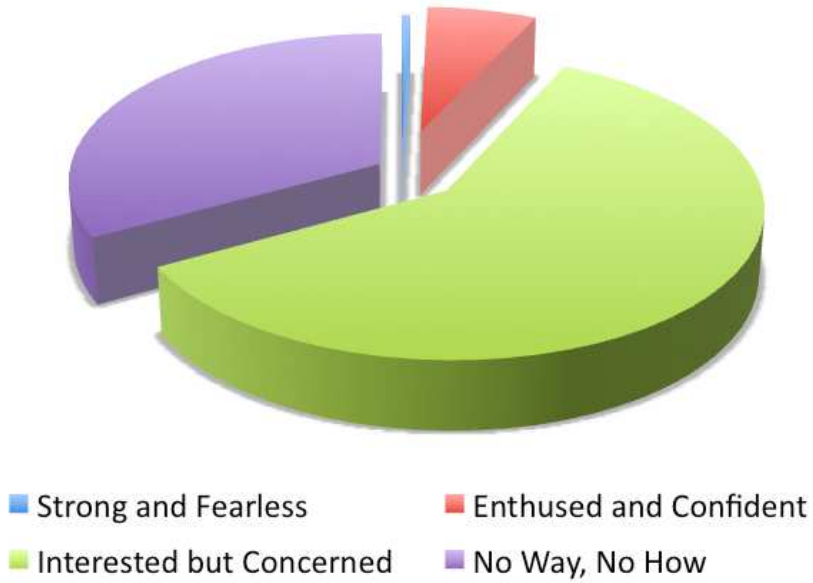
In many communities across North America, only a very small proportion of the population uses bicycles as their main form of transportation. However, in most North American cities cyclists are often seen as a small, fringe group. Yet this is not the case everywhere. In the great cycling cities in Europe – such as Copenhagen, Amsterdam, and Paris – cycling is the travel mode of choice for men and women of all ages, from young to old. People cycle to work and school, for social reasons or for exercise.

In these cities, as much as 40% of all trips are made by bicycle. These numbers and demographics clearly indicate that North America has an untapped market for cycling. The question facing bicycle professionals in North America is how to successfully tap into this market and see a significant increase in bicycle use.

One way to investigate the untapped market for cycling is to look at different types of cyclists, as well as those who currently do not cycle. These groups are likely to have diverse travel behaviours, motivations, and desires. There are a wide range of different types of people who cycle, ranging from those who currently cycle regularly for commuting purposes, to others who may not be comfortable cycling on bicycle routes on busier roadways. Several North American communities have categorized the cycling market based on research that was conducted initially by the City of Portland, Oregon, to characterize cyclists and potential cyclists, and the typical distribution of these cyclist types in a community as follows:

- **Strong and Fearless.** Those that are highly committed to cycling, are already cycling regularly, and will likely cycle regardless of available infrastructure. (Typically less than 1% of residents).
- **Enthused and Confident.** Those that have a high interest in cycling, are confident in their cycling abilities, and will make efforts to cycle as long as reasonable facilities are provided (Approximately 7%).
- **No way, No how.** A wide cross-section of individuals who are unlikely to cycle and are not interested in cycling for a variety of reasons including age, health, disability, or other circumstances (approximately 33%).
- **Interested but Concerned.** A wide cross-section of individuals who have an interest in cycling as part of their regular travel needs, but have significant concerns (typically related to safety or convenience) that limits their desire and commitment to cycling (up to 60%).

Figure 1: Types of Cyclists (Portland, OR)



It is also important to focus on vulnerable user groups such as children, youth, and seniors. These vulnerable groups have unique travel needs, as seniors require safe, accessible and well-connected active transportation infrastructure to move freely around their community without a vehicle.

Youth typically do not often have access to automobiles and are reliant on walking, cycling, or carpooling or transit to get to their destination. Factors such as high traffic speeds, traffic volumes, and inadequate infrastructure can easily deter more vulnerable groups from cycling to their destination. If the design of bicycle network is considered with these groups in mind, then it is likely that a safe, comfortable, and accessible network will result that will attract not only the vulnerable groups, but many other individuals in the interested but concerned group. With this in mind, targeting the interested but concerned group will help to promote cycling for all ages and abilities.

Many cities have focused their planning efforts on providing facilities for cyclists of all **ages and abilities**. **All Ages** is often defined by many agencies and organizations worldwide as persons ranging from children to the elderly, with a common age range often cited as from 8 to 80 years old. It is recommended that the term **All Abilities** be viewed as those people in a healthy physical condition relative to their age, but not including, for example, the visibly impaired or people with physical impairments that limit their ability to cycle.

2.1.3 Network Planning Principles

This section provides guidance regarding the planning of an overall bicycle network to ensure there is appropriate network coverage that complements the road network, a variety of facility options that appeal to different users, and equitable and convenient access to the bicycle network for all residents, commuters and visitors. Bikeway network planning principles include:

- **Comfortable** – To develop comfortable bicycle facilities across a wide range of conditions that are found within cities and communities, a variety of design tools can be utilized. The different types of bicycle facilities and the level of comfort they are associated with will be discussed in greater detail below. However, it is important to note that different bicycle facilities have varying levels of appeal for different users.

  Developing a network that feels comfortable for people of all ages and abilities will require providing those facilities that have the highest benefits for cycling safety and are the most successful at attracting more ridership.

- **Connected** – Research conducted by the Cycling in Cities Program at the University of British Columbia found that while comfortable cycling facilities are important, cyclists need to be able to access these routes quickly and easily. The study found that cyclists are unlikely to detour more than approximately 400 metres to find a route with a bicycle facility. As a result, the study concluded that a bicycle route network with designated facilities spaced a minimum of every 500 metres apart should be the goal for urban areas where there is a desire to increase the modal share of cycling. It has also been recommended that a dense bicycle network should be located where the bicycle network density is highest in urban centres and areas of high cycling potential.

  In addition, providing direct routes that connect to key destinations will ensure that bicycle travel times are competitive with automobiles. Cities and communities are encouraged to develop a network comprised of primary routes, supplemented with sub routes providing connections between bicycle routes.

- **Complete** – It is important that when planning for bicycle facilties, gaps in the network are identified and prioritized. Gaps and incomplete cycling networks have similar impacts on cyclists as road closures have on motorists travelling along the road network.

A traveller encountering an unexpected gap in the network is forced to either detour to a safer route which often requires local knowledge, or to continue through substandard or potentially hazardous conditions. To the extent that traffic hazards are a major deterrent for potential cyclists, examining gaps in the bikeway network is a logical first step in developing a plan for future bicycle upgrades.

2.2 Bikeway Facility Types

There is a range of different types of bicycle facilities that can be applied in various contexts. Six types of on-street and off-street bicycle facilities can be considered throughout a city or region, as summarized below and described in further detail in the following sections.

Figure 2: Bicycle Facilities by Level of Comfort

- **Off-Street Pathways** are physically separated from motor vehicles and provide sufficient width and supporting facilities to be used by cyclists, pedestrians, and other non-motorized users. Off-street pathways can have paved (i.e. asphalt) or unpaved surfaces. Pathway surfacing plays a large role in accessibility, and paved/firm surfaces (i.e. asphalt, stone dust, fine limestone, or gravel screenings) are necessary for accessible pathways.

- **Cycle Tracks** are physically separated from motor vehicle travel lanes but are located within the road right-of-way. Cycle tracks are a hybrid type bicycle facility combining the experience of an off-street path with the on-street infrastructure of a conventional bicycle lane. In many cases cycle tracks are separated by landscaping or curbs from the sidewalk, facilitating separation between cyclists and pedestrians as well.

- **Local Street Bikeways** are routes on streets with low vehicle speeds and volumes, which include a range of treatments ranging from relatively basic facilities consisting of signage and pavement markings to bikeways with varying degrees of traffic calming implemented to improve safety for cyclists and other road users.

- **Bicycle Lanes** are separate lanes that are designated exclusively for bicycle travel and also include pavement markings.

- **Shared Use Lanes** provide direct routes for experienced cyclists along the outer lane of a roadway.

- **Shoulder Bikeways** are typically found on streets without curb and gutter with shoulders wide enough for bicycle travel. Shoulder bikeways often, but not always, include signage alerting motorists to expect bicycle travel along the roadway.

Most cities and regions focus on providing a bicycle network that is comfortable and attractive for the 'interested but concerned' segment of the population.

2.3 Bikeway Facility Selection Guidelines

As described in the previous section, there is a range of different types of bicycle facilities that can be applied in various contexts, including off-street pathways, cycle tracks, bicycle lanes, local street bikeways, shared use lanes, and shoulder bikeways. However, before any specific type of bicycle facilities can be designed and implemented, it is important to assess which type of facility is most desirable.

There are a range of documents that can be used to help inform bikeway facility selection. Some international examples include the Cycling Embassy of Denmark's Collection of Cycle Concepts 2012, which is a document aimed at transportation planners, intended to provide guidance for generating more and safer bicycle activity. With cycling being a long-established form of transportation in many Danish cities, the Cycling Embassy provides comprehensive guidance on bicycle planning and infrastructure design, aimed often at a large cross section of the population. In the Netherlands, the CROW Design Manual for Bicycle Traffic also informs the facility selection guidelines presented in this chapter. The CROW Manual is a document that provides guidance on the key ingredients to incorporate bicycles safely into the traffic and transportation system.

Within Canada and within North America, the National Association of City Transportation Officials' (NACTO) Urban Bikeway Design Guide, Transportation Association of Canada's (TAC) Geometric Design Guide for Canadian Roads, and Ontario Traffic Counil (OTC) Ontario Traffic Manual (OTM) Book 18: Cycling Facilities were also part of determining the facility selection guidelines. The American Association of Transportation Highway Officials (AASHTO) Guide for the Development of Bicycle Facilities was also reviewed, although there was less focus within this manual on facilities that are optimal for attracting people of all ages and abilities. There are a number of things to take into consideration when choosing facility type and one of the most common questions is when and what conditions are apporiate for each type of facility.

The most important consideration for bikeway facility selection is motor vehicle volumes and speeds. The figures below depict facility selection guidelines from Denmark (Collection of Cycling Concepts) and the Netherlands (CROW Manual) based on motor vehicle volumes and speeds. In Denmark, separation to a bicycle lane is suggested at greater than 4,000 vehicles per day and posted speeds of more than 35 km/hr. Cycle tracks are suggested at speeds greater than 40 km/hr and high vehicle volumes, and on lower-volume routes with speeds greater than 55 km/hr. In the Netherlands, separation is recommended via bicycle lanes beyond volumes of 5,000, where speeds are greater than 40km/hr. Bicycle lanes are also recommended on low-volume cycling routes with speeds less than 50 km/hr. For speeds greater than 50 km/hr, separation using cycle tracks is recommended in CROW. Bicycle facility selection should always be based on a combination of general guidelines and a corridor review that takes local context into account.

Road category	Max. speed of motorised traffic (km/h)		Motorised traffic intensity (pcu/day)	Cycle network category: basic network ($I_{bicycle}$ > work 750/day)	cycle route ($I_{bicycle}$ 500-2500/day)	main cycle route ($I_{bicycle}$ > 2000/day)
	n/a		0	solitary track		
Estate acces roead	walking pace or 30 km/h		1 - 2.500	combined traffic		cycle street or cycle lane (with right of way)
			2.000 - 5.000			
			> 4.000	cycle lane or cycle track		
District acces road	50 km/h	2x1 lanes	irrelevant	cycle track or parallel road		
		2x2 lanes				
	70 km/h			cycle track,moped/cycle track or parallel road		

Research from the City of Portland, Oregon, supports the notion that once motor vehicle speeds on major roads exceed 30-40 km/h, then a cycle track or another bicycle facility with physical separation is needed to achieve a quality that supports cycling for all ages and abilities. For example, the City of Portland surveyed those in the 'interested but concerned' category with the following question:

Imagine a major urban or suburban street with four lanes, on-street parking, traffic speeds of 30-35 miles *(i.e. 50-55 km/hr)* per hour and no bike lane. What if:

Option 1: A painted bicycle lane was added?

Option 2: A wide bicycle lane, separated from traffic by a raised curb or parked cars was added?

Two per cent of the 'interested but concerned' participants said they would feel very comfortable if a painted bicycle lane was added (Option 1). In contrast, 43% of the 'interested but concerned' participants stated they would feel very comfortable if a separated bicycle lane was added (Option 2). This indicates the ability of bicycle lanes as compared to cycle tracks to attract the 'interested but concerned' demographic.

Other factors that should be taken into consideration when considering facility selection in addition to traffic volumes and speeds include:

- What is the cost of the project and how can costs be minimized? Consider the financial costs of the bicycle project, and how the project affects other transportation modes and the surrounding urban environment.
- In general, traffic calming, even enhanced traffic calming, involves fewer costs than building a bicycle facility. In terms of traffic diversion, costs depend on the corridor as it may have broader impacts on other streets.
- When comparing bicycle projects, the chance of an instant success or an easy win should be given priority especially when bicycle projects are seen as potentially controversial.
- It is important to limit adverse impacts on other modes as much as possible. Sometime the impacts of creating bicycle facilities that are good for all ages and abilities will significantly affect other modes.
- The costs and benefits of the project are also closely linked to the communication around the project and the story. If it is possible, engage with ambassadors for the project, as this can prove to be a very useful communication avenue (i.e., big workplaces, private business, schools etc.)
- It is important to consider the impact of a bicycle facility on parking availability, particular in loading and drop-off areas that support local businesses.

2.4 Bikeway Facility Design Guidelines

2.4.1 Relevant Documents

Once the preferred type of bicycle facility has been selected, the next step is to focus on the proper design and implementation of the facility. This section outlines some of the resources that can be used to design different types of bicycle facilities. While most of these guidelines focus on on-street bicycle facilities and considerations at intersections and conflict zones, many also address other factors that influence cyclist comfort and safety. Some of these factors include interactions with pedestrians and other modes, land use, and urban design. While intended to provide overall guidance on a range of facilities, many of the existing guidelines allow for the project team to exercise flexibility, creativity, and professional judgment in the design and implementation of different bicycle facilities.

This section provides a list of resources that were reviewed to produce a table that identifies which manuals contain specific information about different design characteristics. This table is intended to act as a resource to quickly identify the best sources of information for designing different components of the bicycle network.

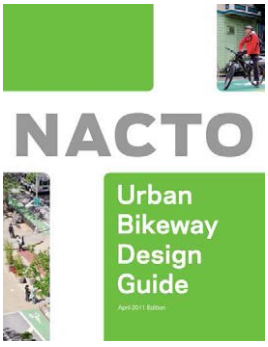
For the purpose of this report, the following is a list of bicycle facility design guidelines and manuals that can be used to provide guidance for designing a complete cycling network. While this is not necessarily the complete list of available resources, they are the most common and well used. Relevant bikeway design guidelines that can be considered by practitioners desiging bicycle facilities include:

Transportation Association of Canada (TAC) Documents

- **Traffic Signal Guidelines for Bicycles (2014)** – Developed in 2014, this document outlines best practices in traffic signals for bicycles. The document includes examples and recommendations for installing traffic signals that accommodate cyclists at intersections.
- **Bikeway Traffic Control Guidelines for Canada (2012)** – TAC updated its 1998 Bikeway Traffic Control Guidelines for Canada in 2012. The updated guidelines incorporate changes to recommended practices made in other recently completed TAC documents, such as studies regarding the use of coloured bicycle lanes, bicycle signage, and bicycle pavement markings in conflict zones. This document provides guidance regarding the use of signage and pavement markings for bicycle facilities, and should be used in conjunction with other relevant documents described below. The document also includes examples through figures and descriptions of a variety of typical applications of bicycle facilities.
- **Geometric Design Guide for Canadian Roads (1997)** – Chapter 3.4 of the Geometric Design Guide for Canadian Roads provides guidelines for bicycle facilities. The purpose of this guide is to provide designers with a set of guidelines and examples of common practice for the geometric design of bicycle facilities that will be useful in producing sound designs that are sensitive to the needs of both cyclists and other users.

North America (National, Provincial and State Organizations)

- **NACTO - Urban Bikeway Design Guide (2011)** – The National Association of City Transportation Officials (NACTO) was formed in the mid 1990's to improve communication between American cities regarding urban transportation issues. Cities for Cycling is an on-going NACTO project to catalogue, promote and implement the world's best bicycle transportation practices in American municipalities. NACTO's Cities for Cycling project was developed out of the need for improved information sharing concerning the design of bicycle facilities in the United States. Many cities currently experiment with innovative bicycle infrastructure designs from Europe, as well as pioneer some of their own; however, no comprehensive design guidelines exist on these more recent innovations.



The NACTO Cities for Cycling Project has developed a comprehensive, Urban Bikeway Design Guide, which seeks to fill this gap by informing and promoting bicycle facility best practices in the United States and demonstrating how to develop world-class cycling facilities. The guide includes both a print version and a dynamic, regularly-updated web-based version that includes a platform for discussion and information exchange, and a printed summary that will be updated regularly. The guide serves cities that are interested in improving the safety, convenience, and comfort of their cycling network. The guide covers a range of bikeway treatments, including bicycle lanes, cycle tracks, intersection treatments, signals, and signs and markings. More information on NACTO's Cities for Cycling project can be found at http://nacto.org/cities-for-cycling/design-guide/

- **NACTO – Urban Street Design Guide (2013)** – Also created by the National Assoication of Transportation Officials (NACTO), the Urban Street Design Guide focuses on the design of city streets and public spaces. The Urban Street Design Guide is unlike other national manuals because it emphasizes city street design as a unique practice with its own set of design goals, parameters, and tools. More information about the Urban Street Design Guide can be found at http://nacto.org/usdg/
- **AASHTO Guide for the Development of Bicycle Facilities (2012)** – The American Association of State Highway and Transportation Officials (AASHTO) has prepared a comprehensive and widely-used guide to provide information on the development of facilities to enhance and encourage safe bicycle travel. The guide provides information to help accommodate bicycle traffic in most riding environments, including planning considerations, design and construction guidelines, and operation and maintenance recommendations. Instead of providing strict standards, the document provides sound guidelines that will be valuable in attaining good design sensitive to the needs of both bicyclists and other road users. The guide includes an overview of bicycle planning, guidelines for shared roadways, signed shared roadways, bicycle lanes, shared use paths, and other design considerations, such as railroad crossings, bicycles on freeways, bicycle facilities through interchange areas and roundabouts, and support facilities. The Guide for the Development of Bicycle Facilities is available for purchase at https://bookstore.transportation.org/item_details.aspx?ID=1943
- **Ontario Traffic Manual Book 18: Cycling Facilities (2014)** – The purpose of the Ontario Traffic Manual (OTM) is to provide information and guidance for transportation practitioners and to promote uniformity of treatment in the design, application and operation of traffic control devices and systems across Ontario. Book 18 incorporates current best practices in Ontario, Canada, and internationally. The guidelines cover a broad range of traffic situations, and they are based on many factors which determine the specific design and operational effectiveness of bicycle facilities. This document can be downloaded from http://www.cwats.ca/en/about-CWATS/resources/Book_18_-_Bicycle_Facilities.pdf
- **VeloQuebec - Planning and Design for Pedestrians and Cyclists (2010)** – VéloQuébec is a Quebec-based non-profit corporation that works to promote cycling for transportation, leisure and tourism purposes. The organization has developed this comprehensive technical handbook which provides essential information to successfully plan and create effective and efficient bicycle facilities. The handbook is intended primarily for engineers, planners and others and has been used extensively by municipalities throughout Canada to provide guidance for the design of bicycle infrastructure. The Technical Handbook of Bikeway Design is available for purchase at http://www.velo.qc.ca/english/index.php?page=publications.

North American City Specific Manuals

- **Portland State University - Fundamentals of Bicycle Boulevard Planning & Design (2010)** – This guidebook can be downloaded at http://www.pdx.edu/ibpi/sites/www.pdx.edu.ibpi/files/BicycleBoulevardGuidebook%28optimized%29.pdf
- **NCHRP Report 766 - Recommended Bicycle Lane Widths for Various Roadway Characteristics (2014)** – This report can be downloaded at http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_766.pdf
- **City of Edmonton - Complete Street Guidelines (2013)** – This report can be downloaded at: http://www.edmonton.ca/city_government/city_vision_and_strategic_plan/complete-streets.aspx

- **City of Calgary - Complete Streets Guide (2014)** – This report can be downloaded at http://www.calgary.ca/Transportation/TP/Pages/Planning/Calgary-Transportation-Plan/Complete-Streets.aspx

European Resources

- **Cycling Embassy of Denmark - Collection of Cycle Concepts 2012 (2012)** – This document is intended to provide examples of bicycle facilities that are currently in use in Denmark. The purpose of the document is to provide inspiration and motivation for creating more and safer bicycle traffic in Denmark as well as the rest of the world.This document can be downloaded at http://www.cycling-embassy.dk/wp-content/uploads/2013/12/Collection-of-Cycle-Concepts-2012.pdf
- **Netherlands CROW Design Manual for Bicycle Traffic (2007)** – This manual from the Netherlands focuses on providing facilties that provide cyclists with bicycle friendly infrastructure based on examples from the Netherlands. The CROW manual can be purchased at http://www.crow.nl/publicaties/design-manual-for-bicycle-traffic

Australian Resources

- **VicRoads Supplement to the Austroads Guide to Road Design (2010)** – Part 6A provides specific guidance regarding the design of pedestrian and cyclist paths. The document is available for download at https://www.vicroads.vic.gov.au/business-and-industry/technical-documents/vicroads-supplement-to-the-austroads-guide-to-road-design
- **NSW Bicycle Guidelines (2003)** – The document is available for download at http://www.jcu.edu.au/soc/bug/resources/Cycling%20specific%20resources/NSW%20Bicycle%20Guidelines%20ON-LINE%20v1-2.pdf

2.4.2 Summary of Applicable Bikeway Design Guidelines

Each manual was reviewed to identify the guidance it provides for designing a variety of characteristics that are often incorporated into a cycling network. The design characteristics that were included in the review are summarized below:

- **Bicycle facilities**
  - **Off-street pathways**
    - Multi-use pathways
    - Separated pedestrian and bicycle facilities
  - **Cycle tracks**
    - One-way cycle tracks
    - Two-way cycle tracks
    - Curb/median protected cycle tracks
    - Elevated cycle tracks
    - Parking protected cycle tracks
    - Bollard protected cycle tracks
  - **Bicycle lanes**
    - Painted bicycle lanes
      - No on-street parking
      - On-street parking

        - Buffered bicycle lanes
        - Shoulder bikeways
        - Contraflow bicycle lanes
    - **Shared Use Facilities**
        - Local street bikeways
        - Shared use lanes
- **Intersection and Crossing Treatments**
    - **Intersection Approaches**
        - Mixing zones
        - Turning zones
- **At intersections**
    - Advance stop lines
    - Bike boxes
    - Two-stage left turn boxes
    - Median refuges
    - Traffic circles
    - Roadabouts
    - Protected intersections
    - Intersection crossing markings
    - Coloured pavement markings
- **Signals**
    - Bicycle activated signals
    - Signal Timing
        - Leading bicycle intervals
        - Separate signal phase
    - Bicycle specific signal heads
    - Intersection restrictions
- **Transit integration**
- **Other**
    - Retrofitting streets for bicycle lanes
    - Signage
    - Pavement markings
    - Maintenance
    - Wayfinding

A glossary of a number of these terms and facilities, including pictures and examples, can be found in **Appendix A**. In addition, there are a number of videos available on-line that help to provide visual examples of some of the treatments and designs that are discussed in this report.

- **Roundabouts:** https://www.youtube.com/watch?v=q664_GjTyoE
- **Protected Intersections:** https://www.youtube.com/watch?v=igQf1l49ado

Each of the manuals identified above was reviewed to determine the type and level of guidance they provide for the list of design characteristics identified above. As seen in the summary table below, colour codes were assigned to allow for the quick identification of the level of information provided by each manual for each topic. **Green** indicates that the manual provides design guidance, including measurements, visual examples, and/or information about how the treatment can be designed.

Yellow identifies that the guide or manual identifies this type of facility or treatment and discusses it in general terms but does not provide any specific guidance. Finally, **red** indicates that this design feature was not mentioned in the document.

The visual summary presented in **Table 1** provides the user with a quick reference of which manuals provide guidance for which treatments. For example, it is easy to identify that if an individual requires guidance on designing a cycle track they should look at manuals such as the NACTO's Urban Bikeway Design Guide, OTM's Book 18: Cycling Facilities, and VeloQuebec's Planning and Design for Pedestrians and Cyclists. A more detailed summary of the results from the review of guidelines for each specific design characteristic is found in **Appendix C.** This detailed table identifies the guidance that each document provides, a summary of the most common recommendations, and any additional relevant information. They are broken down by the different categorizes outlined in **Table 1**. A summary of key observations and general guidance based on this review of guidelines is provided following **Table 1.**

Table 1: Summary of Cycling Guidelines and Manuals

Off-Street Pathways

The reviewed TAC manuals provide general guidelines for **multi-use pathways** and **separated pedestrian and bicycle facilities**. Other manuals that provide specific guidance for off-street pathways recommend a typical pathway width of 3 m for **multi-use pathways** and note that when designing for **separated pedestrian and bicycle facilities,** the bicycle facility should be a minimum of 1.5 m wide, according to VeloQuebec, VicRoads, and NSW.

Cycle Tracks

As noted above, the existing TAC manuals provide little to no guidance for designing cycle tracks. There are, however, other North American and international examples that provide specific design recommendations. The manuals that provide detailed guidance for cycle tracks include: NACTO's Urban Bikeway design Guide; OTM Book 18: Cycling Facilities; VeloQuebec's Planning and Design for Pedestrians and Cyclists; City of Edmonton's Complete Streets Guidelines; the Cycling Embassy of Denmark's Collection of Cycle Concepts; Netherland's CROW Design Manual for Bicycle Traffic; and the NSW Bicycle Guidelines.

- **One-way Cycle Tracks**: Seven of the reviewed manuals provide recommended widths for one-way cycle tracks, five of which identify 1.5 metres as a minimum width. The two manuals reviewed from Europe identify minimum widths that are wider than 1.5 m.
- **Two-way Cycle Tracks**: Four manuals advise a minimum lane width of 3 m for a two-way cycle track.
- **Curb/Median Protected Cycle Tracks:** Most manuals do not include guidance on curb/median protected cycle tracks with the exception of NACTO's Urban Bikeway Design Guide, OTM's Book 18, Netherlands CROW Design Manual, and NSW Bicycle Guidelines.
- **Elevated Cycle Tracks:** Five manuals specifically discuss elevated cycle tracks, providing some information about width, height, and the type of curb that should be installed.
- **Parking Protected Cycle Tracks:** NACTO and two other guidelines have specific lane width buffers ranging from between 0.5 – 1 m.
- **Bollard Protected Cycle Tracks:** Details on Bollard Protected Cycle Tracks are only examined in OTM's Book 18, with the TAC and other manuals providing general discussions.

Bicycle Lanes and Other On-Street Facilities

A greater number of manuals provide guidance for bicycle lanes. For standard bicycle lanes, design recommendations are found in TAC's Bikeway Traffic Control Guidelines, NACTO's Urban Bikeway Design Guide, AASHTO's Bike Guide, OTM's Book 18, VeloQuebec's manual, the NCHRP Report 766, both the City of Edmonton's and City of Calgary's Complete Streets Guide, the Cycling Embassy of Denmark's Collection of Cycle Concepts, Netherland's CROW Design Manual for Bicycle Traffic, and the NSW Bicycle Guidelines.

- **Painted Bicycle lanes (no parking):** Most of the manuals recommend a typical width of 1.5 m on painted bicycle lanes with no on-street parking.
- **Painted Bicycle Lanes (with parking):** Most manual recommend a lane width of 1.5 m but also recommend a buffer when the bicycle lane is located adjacent to on-street parking.

- **Buffered Bicycle Lanes:** Most manuals have information on buffered bicycle lane design with the exception of TAC, the Fundamentals of Bicycle Boulevard Planning & Design, the VicRoads manual, and NSW Bicycle Guidelines. As noted above, buffered bicycle lanes are most often associated with bicycle lanes located on streets with on-street parking. The buffer width recommendations range from between 0.5 – 1 m.
- **Shoulder Bikeways:** Paved shoulders are discussed in TAC's Geometric Design Guide for Canadian Roads and four other manuals, recommending a standard 1.2 – 1.5 m width.
- **Contraflow Bicycle Lanes:** Contraflow bicycle lanes are mentioned in a number of guidelines which provide guidance about the width of the lanes and the placement of sharrows.
- **Local Street Bikeways:** Guidelines for local street bikeways are provided in the manuals from NACTO, AASHTO, OTM, VeloQuebec, and the City of Edmonton.

Shared Use Facilities

- **Shared Use Lanes:** TAC and most of the reviewed guidelines provide recommendations on shared use lanes including the placement of sharrow stencils based on lane width and the presence of parked vehicles.
- **Shoulder Bikeways:** Paved shoulders are discussed in TAC's Geometric Design Guide for Canadian Roads and four other manuals, recommending a standard 1.2 – 1.5 m width.

Intersection Approaches

Intersection approaches refer to the space where cyclists and motor vehicles interact prior to entering the intersection. As collisions at intersections are the most common and often the most severe, recommendations and guidance for designing safe and comfortable facilities for all road users is important.

- **Mixing Zones:** Specific guidance and recommendations for designing bicycle facilities where cyclists and right turning vehicles share the space is provided in seven of 16 (including TAC) of the manuals reviewed. This includes guidance on recommended pavement markings, positioning, and types of intersections where these treatments are the most suitable.
- **Turning Zone:** TAC provides general design guidance for turning zones (including visual examples), where right turning vehicles cross over a through bicycle lane to enter the right turn lane. Examples of these types of treatments can be found in nine of the 16 manuals.

At Intersections

Several bicycle treatments found at intersections create turning movements and places for cyclists to safely wait to cross the intersection. They are listed below:

- **Advance Stop Lines:** Advance stop line design is discussed in TAC's Traffic Signal Guidelines for Bicycles, as well as four other documents. Based on the review of these manuals, four state that the vehicle stop line should be setback 2 m from the bicycle stop line.
- **Bike Boxes:** There are eight manuals that provide guidance for designing bike boxes, the majority recommend a depth of approximately 4 m. This includes TAC's Bikeway Traffic Control Guidelines for Canada.

- **Two-Stage Left Turn Boxes:** Most manuals do not have guidance on two-stage left turn boxes, with the exception of NACTO's Urban Bikeway Design Guide, OTM Book 18, and Netherlands CROW Design Manual.
- **Median Refuges:** Many of the manuals reviewed offer guidance or mention median refuge designs with the exception of the reviewed TAC manuals, NCHRP, and VicRoads.
- **Roundabouts:** Details on roundabouts are briefly addressed in the TAC manuals; however, manuals like AASHTO and VeloQuebec provide more details and design guidance.
- **Traffic Circles:** There was limited guidance provided specific to traffic circles in most of the manuals reviewed with the exception of VeloQuebec, the Fundamentals of Bicycle Boulevard Planning & Design and the NSW Bicycle Guidelines.
- **Protected Intersections:** Only Ontario OTM Book gives description and design suggestions on protected intersections.
- **Intersection Crossing Markings,** which includes recommendations for pavement markings that continue through the intersection to provide guidance for cyclists of where they should position themselves in the intersection. The most detailed guidance is provided in NACTO Urban Bikeway Design Guide, OTM Book 18, VeloQuebec, manuals from Europe and Australia.
- **Coloured Pavement Markings:** Recommendations and examples of coloured pavement markings are presented in most documents with the exception of TAC's, NCHRP, City of Edmonton Street Guideline, and City of Calgary's Streets Guide.

Signals

Intersection signals, including bicycle activated signals, leading bicycle intervals, and separate signal phases can help to improve cyclists' and all road users' comfort and safety. The TAC Traffic Signal Guidelines for Bicycles, NACTO's Urban Bikeway Design Guide, and the City of Edmonton and the City of Calgary's Complete Street Guidelines provide the most detailed recommendations on traffic signals specific to bicycle users.

- **Bicycle Activated Signal:** Guidelines for this feature are discussed in six manuals. The manuals mainly discuss how the technology works, when using it is appropriate, and where it should be positioned.
- **Leading Bicycle Intervals:** TAC, NACTO, the City of Calgary, and the City of Edmonton provide an understanding of how bicycle leading intervals function and how they can be incorporated into existing intersections to enhance cyclists' comfort and safety.
- **Separate Signal Phase:** Most information on separate signal phase is found in TAC, NACTO's Urban Bikeway Design Guide, the Cycling Embassy of Denmark's manual, and Netherland CROW Design Manual.
- **Bicycle Specific Signal heads:** TAC suggests bicycle specific signal head should be installed within 30 m of the cyclist stop bar, in addition three other manuals provide some guidance on bicycle specific signal heads.
- **Intersection Restrictions:** Intersection restrictions are briefly discussed in the TAC manuals; however, the guidance for these types of restrictions is very context specific and, therefore, detailed guidance is not provided.

Transit Integration

TAC has no input on transit integration; however, there are several other manuals where a general description and design recommendations are provided.

Other

- **Retrofitting Streets for Bicycle Lanes:** Retrofitting tips are mentioned in a couple of the manuals; however, TAC's manuals are not included in this list.
- **Signage:** Signage specifications are discussed throughout TAC's manuals, particularly the Bikeway Traffic Control Guidelines for Canada, and most of the reviewed documents.
- **Pavement Markings:** Information on pavement markings is found in most manuals.
- **Maintenance:** Suggestions on maintenance are not found in the TAC's manuals; however, there are other manuals that provide details throughout on maintenance of specific facility types and information about why maintenance is important throughout the year.
- **Wayfinding:** TAC only offers brief examples on wayfinding, but additional recommendations are included in manuals by NACTO, AASHTO, and others.

More detailed tables were created which reference the page numbers of manuals and summarize the specific recommendations they make. These detailed tables can be found in **Appendix C.** Based on the findings of this review, it is clear that the features included in manuals can differ significantly, as can the recommendations themselves. The most comprehensive manuals for designing bicycle facilities are:

- NACTO's Urban Bikeway Design Guide;
- VeloQuebec's Planning and Design for Pedestrians and Cyclists;
- OTM Book 18: Cycling Facilities; and
- The manuals from Denmark and the Netherlands.

CHAPTER 3

Pedestrian Facility Design

There are a number of benefits associated with walking and promoting a walkable community that is safe, comfortable, and well connected for all residents and visitors. These include significant quality of life and positive economic development benefits. A brief example of each is provided below:

- **Economic Benefits** are seen as a result of supportive pedestrian design as they can help to encourage residents to take short trips to local businesses by walking, instead of driving farther away in adjacent community. A pedestrian-friendly community can also attract more visitors to the city who will in turn be patrons of the city's services and amenities.
- **Livable Community.** A pedestrian-friendly community can encourage a more livable and enjoyable place to be, with a stronger sense of place and freedom of mobility. Communities that support walking can contribute to safer streets and improved social interactions.
- **Health Benefits.** Walking is also associated with promoting healthier communities by supporting and improving mental and physical health. The World Health Organization has identified physical inactivity as one of the main leading risk factors for global mortality and as an underlying factor for many chronic diseases. Walking and cycling increase physical activity levels, which can reduce the risk of heart disease, diabetes, cancer as well as mental illness.
- **Environmental Benefits.** Walking has many environmental benefits as it can reduce vehicle trips, congestion, air pollution, and can help to reduce greenhouse gas emissions.

3.1 Pedestrian Network Planning

There are a number of factors that influence an individual's decision to walk. The list of variables associated with pedestrian-friendly design is extensive, and it is plausible that some or all of these factors could have an influence on an individual's decision to walk. This section provides a brief review of some of the design characteristics that are believed to have an impact of walkability. While not all of these factors are identified in the guidelines discussed later on in this chapter, it is still important to consider these factors when designing and encouraging pedestrian activity.

3.1.1 Land Use Mix and Distance to Destinations

The importance of land use, including distance to destinations as an influence on active transportation, has been recognized as a major factor in a number of studies. Land use is often defined as the distance, environmental quality, and convenience to access destinations. Some of these destinations include different types of residential establishments, office services, and retail uses. Research has found that walking frequency is positively associated with both commercial and residential density as well as distance to schools and recreation sites. An important component of measuring land use mix is that a variety of land uses should be well integrated and mixed within the community rather than separated from one another. Having a mix provides residents with access to all of their daily needs within walking distance as opposed to having to drive throughout the city to access all of their needs. It is believed that the shorter the distance to the destination, the more likely individuals are to walk to it.

3.1.2 Street, Sidewalk and Trail Connectivity

Block length, the number of intersections, access to trails, and the presence of well-maintained high quality sidewalks are often the measurements of street and sidewalk connectivity and can impact how often an individual walks.

Small blocks and a complete sidewalk network, that is accessible, smooth, and made of high quality materials are all factors that help to create a positive walking environment. Intersections are an important measurement for walkability because greater numbers of intersections often means that there are more direct travel routes. Research has shown that individuals are less likely to walk for transportation when they have longer travel distances and non-direct routes.

3.1.3 Other Characteristics

There are several other factors besides land use, distance to destinations, and street connectivity that can influence rates of walking. These factors include access and proximity to schools, parks, the presence of sidewalks and trails, the type of topography, as well as access and integration with transit. Some of these variables are outlined below:

- **Schools** – Schools are destinations that can promote active transportation as part of a daily routine. Whether this is walking to travel to school or to use the playground and field facilities for exercise, the presence and proximity of schools in a neighbourhood can have an impact on the pedestrian experience.
- **Location and Access to Parks** – Parks are considered ideal places for people to gather. They are believed to be desirable destinations, they add character and appeal to neighbourhoods, and they promote active transportation. They can create areas for people to meet and socialize, and they are considered imperative in their role in creating a vibrant city. In a related topic, street trees and access to green spaces are believed by some to help promote walking.
- **The Presence of Sidewalks and Walking Paths** – Sidewalks and access to high quality walking paths are seen to be critical features of the built environment when looking at factors that influence walking. They provide a safe place for pedestrians to walk, separated from motorized traffic. Ideally, both sides of the street should have sidewalks in order to have a high level of pedestrian continuity. Sidewalks and walking paths are important in promoting physical activity by providing an easy and well-planned route that is safe and accessible. Sidewalks should also be in good condition, well-kept, even, clear, and safe for walking.
- **Topography** – The slope of a street can have a dramatic effect on the visual appearance of the street and the neighbourhood as a whole. Most people consider streets with small or no hills to be easier to walk along than streets with steeper hills. Gentle hills and slight changes in topography can create pleasant views and a visually appealing streetscape. However, a steep hill that makes walking difficult or uncomfortable for major population groups would be considered too steep and creates a difficult walking environment. Each individual experiences the effect of hills differently and, as a result, the impact of hills is often based on perception. This makes fully understanding the degree of influence of topography on walking unclear.
- **Access to Transit** – A higher concentration of jobs and residents makes transit more viable. Because most individuals who use transit are pedestrians for part of their trip, understanding neighbourhood convenience in terms of access to transit could provide some insight into transportation mode share and how the location of bicycle facilities impacts this. Access to transit can also make important community destinations more accessible and provide better access, although the relationship between walking and cycling and public transit are not always clear.
- **Accessibility** – It is important that the walking network is accessible and usable by a large cross section of people, including people with disabilities, seniors, and parents with children. It is important that the design of the walking environment includes accessibility features to accommodate the unique needs of these groups and to provide better pedestrian circulation for everyone.

3.2 Pedestrian Facility Types

There is a range of different types of pedestrian facilities that can be applied in various situations and offer a range of comfort levels. **Figure 1** below identifies seven different types of pedestrian facilities; however, this list is not inclusive and there are a number of other options available. These seven facility types are described briefly below.

Figure 1: Pedestrian Facilities by Level of Comfort

- **Off-Street Pedestrian Only Pathways** are physically seperated from motor vehicles and cyclists. They can be paved (i.e., asphalt) or unpaved and should be accessible via curb ramps. They should be designed to be wide enough to allow for at least two pedestrians to pass each other.
- **Multi-Use Pathways** are physically separated from motor vehicles and provide sufficient width and supporting facilities to be used by cyclists, pedestrians, and other non-motorized users. Off-street pathways can have paved (i.e., asphalt) or unpaved surfaces. Pathway surfacing plays a large role in accessibility, and paved/firm surfaces (i.e., asphalt, stone dust, fine limestone, or gravel screenings) are necessary for accessible pathways.
- **Wider Sidewalks** are often found in areas with high pedestrian volumes, such as commercial centres, around transit facilities, within a city's downtown core. They often have a furnishing and frontage zone, but should have a wider clear zone for pedestrian movement than standard sidewalks discussed below.
- **Buffered Sidewalks** are sidewalks that provide some form of buffer between pedestrians and the street. Buffers can include trees, furniture, and landscaped boulevards. Buffers often range in width based on where they are located and take into consideration vehicle volumes, vehicle speeds, and surrounding land uses.

- **Sidewalks** are paved pathways that are located on the side of the road. They are designated spaces for pedestrians and can range in width depending on the land use and road classification. Sidewalks should be accessible, with curb ramps, free of obstructions, smooth, and well maintained.
- **Unpaved Sidewalks** are pathways that are located on the side of the road. They are often informal pedestrian pathways, located in the absence of a paved sidewalk. They are often not easily accessible.
- **Paved Shoulders** are typically found on streets without curb and gutter with shoulders wide enough for pedestrian travel. Shoulder sidewalks often, but not always, include signage alerting motorists to expect pedestrians travel along the roadway.

3.3 Pedestrian Design Guidelines

3.3.1 Relevant Documents

Once the pedestrian facilities and design features have been selected, the next step is to focus on the proper design and implementation of the facility. This section outlines some of the resources that can be used to design different types of pedestrian facilities including sidewalks, pathways, intersection treatments, and streetscape features, to name a few. Many of these manuals focus on designing for pedestrians, and ensuring they have a safe, comfortable, and vibrant environment to walk weather it is walking for transportation or recreation purposes. A number of these manuals address both designs for pedestrians and cyclists and have already been mentioned in the previous chapter. It is also important to note that there are fewer guidelines available that are specific to pedestrian design; however, many of them do provide detailed and specific guidance. While this is not necessarily the complete list of available resources, they are the most common and well-used. Relevant pedestrian related resouces include:

Transportation Association of Canada Document

- **Geometric Design Guide for Canadian Roads (1997)** – Sections 2.2 and 2.3 of the Geometric Design Guide for Canadian Roads provide guidelines for pedestrian facilities. The purpose of this guide is to provide designers with a set of guidelines and examples of common practice for the geometric design of pedestrian facilities that will be useful in producing sound designs that are sensitive to the needs of both pedestrians and other users.
- **Pedestrian Crossing Control Guide (2012)** – This document provides guidelines on the use of devices for pedestrian crossing control relating to new installations or where existing installations need to be retrofitted. The Guide is primarily intended to augment the information about pedestrian crossing control devices and their applications contained in the *Manual of Uniform Traffic Control Devices for Canada (MUTCDC)*. The main objective of this Guide is to promote uniformity across Canada with respect to the approach used in the provision of pedestrian crossing control, while improving road safety for these users.

North America (National, Provincial and State Organizations)

- **NACTO – Urban Street Design Guide (2013)** – Already mentioned in the cycling chapter, the Urban Street Design Guide focuses on the design of city streets and public spaces.

This document provides more guidance for designing pedestrian facilities than bicycle facilities. More information about the Urban Street Design Guide can be found at: http://nacto.org/usdg/

- **VeloQuebec - Planning and Design for Pedestrians and Cyclists (2010)** – Also already mentioned in the cycling chapter, this handbook is intended primarily for engineers, planners and others and has been used extensively by municipalities throughout Canada to provide guidance for the design of pedestrian infrastructure. The technical handbook is available for purchase at: http://www.velo.qc.ca/english/index.php?page=publications.
- **Ontario OTM Book 15: Pedestrian Crossing Facilities (2010)** – The purpose of the Ontario Traffic Manual (OTM) is to provide information and guidance for transportation practitioners and to promote uniformity of treatment in the design, application and operation of traffic control devices and systems across Ontario. The OTM Book 15: Pedestrian Crossing Facilities includes consolidated references to relevant material that is provided in other OTM Books as applicable to pedestrian treatments. This document can be downloaded from http://www.directtraffic.ca/wp-content/uploads/2014/02/Book-151.pdf

- **AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities (2004) –** The purpose of this guide is to provide guidance on the planning, design, and operation of pedestrian facilities along streets and highways. This guide is intended for planners, roadway designers, and transportation engineers. Specifically, the guide focuses on identifying effective measures for accommodating pedestrians on public rights-of-way. Appropriate methods for accommodating pedestrians, which vary among roadway and facility types, are described in this guide. This guide is available for purchase at https://bookstore.transportation.org/item_details.aspx?id=119

North American City Specific Manuals

- **City of Edmonton - Complete Street Guidelines (2013)** – This report can be downloaded at http://www.edmonton.ca/city_government/city_vision_and_strategic_plan/complete-streets.aspx
- **City of Calgary - Complete Streets Guide (2014)** – This report can be downloaded at http://www.calgary.ca/Transportation/TP/Pages/Planning/Calgary-Transportation-Plan/Complete-Streets.aspx
- **Pedestrian and Transit Oriented Design (2013**) – This book can be purchased through Amazon.

3.3.2 Summary of Applicable Pedestrian Design Guidelines

Each manual was reviewed to identify the guidance provided for designing a variety of characteristics that are often incorporated into a pedestrian network. The design characteristics that were included are listed below:

- **Pedestrian Facilities**
  - **Sidewalks**
    - Width
    - Surface material
    - Cross slope
  - **Buffered sidewalks**
  - **Furnishing zone**

    - **Frontage Zone**
    - **Pathways**
        - Multi-Use
        - Pedestrian only
        - Stairways
    - **Shared Spaces ex. Woonerfs**
- **Intersection and Crossing Treatments**
    - Midblock crossings
    - Crossing channelized turn lanes
    - Intersection crosswalks
    - Crossing distance
    - Raised crosswalks
    - Curb extensions
    - Raised intersections
    - Median refuges
    - Coner radius
- **Signals**
    - Pedestrian activated signals
    - Pedestrian countdown timers
    - Leading pedestrian intervals
    - Audible pedestrian signal
    - Pedestrian scrambles
- **Accessibility**
    - Curb ramps
    - Wheelchair users
- **Transit Integration**
- **Conflict Zones and Mixing Zones**
    - Driveways and alleyways
    - Shared use area (elephants feet)
- **Streetscape Guidelines**
    - Lighting
    - Crime Prevention Through Environmental Design (CPTED)
    - Street furniture
    - Street trees and landscaping
    - Aesthetic and architectural features
- **Other**
    - Maintenance
    - Wayfinding
    - Chicanes
    - Pedestrian speed

A glossary of a number of these terms and facilities, including pictures and examples, can be found in **Appendix B**. As was done for bicycle facilities, the manuals identified above were reviewed to identify the type of guidance they provide for the list of design characteristics identified above. The visual summary presented in **Table 2** provides the user with a quick reference of which manuals provide guidance for which treatments.

The colour coding is the same as described for bicycle facilities above. **Green** indicates that the manual provides specific design guidance, including measurements, visual examples, and information about how the treatment can be designed. **Yellow** identifies that the guide or manual does identify this treatment and discusses it in general terms but does not provide any specific design guidance. Finally, **red** indicates that this design feature was not mentioned in the document.

Overall, NACTO's Urban Street Design Guide, VeloQuebec's Planning and Design for Pedestrian and Cycling, AASHTO's Guide for the Planning, Design and Operation of Pedestrian Facilities, and TAC's Geometric Design Guide for Canadian Roads provide the most detailed guidance for designing facilities for pedestrians. OTM's Book 15 provides the most detailed guidance specific to pedestrian crossing facilities and signals at both midblock and intersection crossings.

Table 1: Summary of Pedestrian Guidelines and Manuals

Pedestrian Summary

Sidewalks

Most of the manuals reviewed provide recommendations specific to sidewalks, including minimum width, cross slope, and buffers. TAC's Geometric Design Guide for Canadian Roads as well as manuals from NACTO (Urban Street Design Guide), VeloQuebec, AASHTO, and the Complete Street Guidelines from the Cities of Calgary and Edmonton provide good guidance; however, the recommended widths vary.

- **Width**: TAC's Geometric Design Guide for Canadian Roads and five other manuals provide similar specifications for the width of typical pedestrian sidewalks (minimum 1.5 m); however, guidance and widths for commercial areas vary.
- **Surface Material:** Most manuals do not include guidance on surface material with the exception of VeloQuebec and AASHTO which identify concrete as the preferred material.
- **Cross Slope:** The normal cross slope of 0.02 m/m (2%) should not be exceeded according to TAC, VeloQuebec, and AASHTO. The other manuals did not provide guidance for cross slope.
- **Buffered Sidewalks:** Design details on buffered sidewalks can be found in the TAC's Geometric Design Guide for Canadian Roads and four other manuals. All manuals that provide guidance identify different preferred widths for different land uses, with wider buffers recommended for streets with higher vehicle volumes and speeds.
- **Furnishing Zone:** Information on furnishing zones is included in most manuals, including the TAC's Geometric Design Guide for Canadian Roads; however, only the City of Edmonton's Complete Street Guideline provides number values.
- **Frontage Zone:** Frontage zones are mentioned in TAC and other guidelines, but only AASHTO and the City of Edmonton's Complete Street Guideline specified a typical width of 0.5 – 0.8 m.

Pathways

Most manuals with the exception of VeloQuebec's do not provide a lot of guidance for designing pathways.

- **Multi-Use:** Most manuals do not include guidance on multi-use pathways with the exception of VeloQuebec, City of Edmonton, and the City of Calgary. However, other bicycle specific manuals identify 3 m as the minimum width for multi-use pathways.
- **Pedestrian Only:** Details on pedestrian only pathways are only provided in VeloQuebec which suggests a minimum width of 1.2 m.
- **Stairways**: Only two of the manuals provide a detailed discussion on stairway design, one of which is TAC. TAC recommends a minimum width of 1.1 m and a maximum vertical rise of 3.7 m.
- **Woonerf/Shared Space:** Descriptions specific to shared space design can be found in the manuals from NACTO, VeloQuebec, AASHTO, and the Urban Land Institute's Pedestrian and Transit Oriented Design.

Intersections and Crossing Treatment

The list of intersection and crossing treatments below can be implemented to help improve pedestrian safety when crossing the street. Overwhelmingly, NACTO, VeloQuebec, AASHTO, OTM's Book 15, and the City of Calgary's Complete Streets Guide provide the most guidance for designing these treatments. Both of TAC's manuals also provide some recommendations.

- **Midblock Crossings:** Eight of the nine manuals have at least a general discussion specific to midblock crossings. This includes location suggestions and other design criteria. NACTO and OTM provides the most detailed recommendations including stop line set back distance. TAC's Pedestrian Crossing Control Guide identifies different crossing controls for midblock crossings.
- **Crossing Channelized Turn Lanes:** There are detailed discussions about pedestrian crossings at channelized turn lanes in five of the manuals. Many of the recommendations provided are specific to improving safety for pedestrians. TAC provides specific examples of pedestrian facilities at channelized turn lanes as does OTM's Book 15.
- **Intersection Crosswalks:** Some discussion of intersection crosswalks can be found in all of the manuals reviewed. Accessibility, crosswalk width, and pavement markings are some of the key recommendations made in the documents including the two TAC manuals, the most detailed recommendations can be found in OTM's Book 15.
- **Crossing Distance:** Most manuals, including those from TAC addressed the importance of providing pedestrians with reduced crossing distances through different design treatments.
- **Raised Crosswalks:** Raised crosswalks are not discussed in either TAC manual but they are found in other manuals including NACTO, OTM's Book 15, VeloQuebec, and AASHTO.
- **Curb Extensions:** Design recommendations for curb extensions are provided in TAC`s Geometric Design Guide for Canadian Roads and six other manuals; however, there is little agreement between the manuals on recommended dimensions.
- **Median Refuges:** Manuals from TAC and five other manuals provide some design guidance for median refuges, particularly in terms of appropriate width and accessibility.
- **Corner Radius:** Corner radius designs are covered in a number of the listed documents; however, they are not addressed in the TAC manuals. Based on the review, a radius of 3 m is generally used.

Signals

Intersection signals, including pedestrian activated signals, countdown timers, audible signals, and pedestrian scrambles, can be incorporated into an intersection to help improve pedestrian comfort and safety. TAC's Pedestrian Crossing Control Guide as well as the NACTO, VeloQuebec, OTM's, and AASHTO manuals provide the most guidance for pedestrian considerations at signalized intersections.

- **Pedestrian Activated Signals:** Pedestrian activated signals are addressed in some way in most of the manuals reviewed. The manuals mainly provide guidance about where signals should be located, signal timing considerations, and the placement of push buttons.
- **Pedestrian Countdown Timers:** Most manuals do not include guidance on pedestrian countdown timers, with the exception of TAC's Pedestrian Crossing Control Guide and AASHTO's pedestrian manual.
- **Audible Pedestrian Signal:** Only AASHTO and OTM's Book 15 have a general discussion on audible pedestrian signals.

- **Leading Pedestrian Intervals:** Information on leading pedestrian intervals can be found in NACTO's Urban Street Design Guide as well as OTM's Book 15. They are also discussed more generally in the manuals from VeloQuebec, AASHTO, and the City of Edmonton.
- **Pedestrian Scrambles**: Pedestrian scrambles are briefly mentioned in OTM's Book 15, VeloQuebec's manual, and Pedestrian and Transit Oriented Design.

Accessibility

All of the manuals review address accessibility in some way, though it is important to note that many reference additional documents that provide more specific detail.

- **Curb Ramps:** All manuals include some guidance on curb ramp design and, as mentioned, many of the manuals refer to other documents that would provide specific details for design considerations, including preferred slope and location of curb ramps in relation to crosswalks.
- **Wheelchair Users:** Details on providing facilities that accommodate wheelchair users are covered in most of the manuals reviewed, or other manuals are referenced.

Transit Integration

The TAC's manuals have limited input on transit integration; however, there are several other manuals where a general description and design recommendations are provided.

Conflict Zones and Mixing Zones

There is limited information in the manuals reviewed specific to design recommendations for conflict and mixing zones.

- **Driveways and Alleyways:** Pedestrian considerations at driveways and alleyways are only discussed generally in TAC's Geometric Design Guide for Canadian Roads and more specifically in AASHTO's manual in reference to the cross slope considerations at access points.
- **Shared Use Areas (Elephants Feet):** No information on Shared Use Areas is found in any manuals.

Streetscape Guidelines

All of the manuals reviewed provide some guidance regarding streetscaping; however, most provide only general recommendations about how these features can best be incorporated into the pedestrian environment.

- **Lighting:** General lighting guidance can be found in TAC's manuals and seven other manuals.
- **Street Furniture:** Most manuals include descriptions on street furniture with the exception of TAC's Pedestrian Crossing Control Guide.
- **Street Trees and Landscaping:** Some discussion and guidance is provided regarding street trees and landscaping in the majority of manuals reviewed.
- **Aesthetic and Architectural Features:** Recommendations and interim design strategies for architectural features are discussed throughout most of the documents.

Other

- **Maintenance:** Considerations for maintenance are included in most manuals, and most of the discussions are quite general and focus on understanding the importance of maintaining facilities throughout the year.
- **Wayfinding**: Wayfinding and signage discussions are only mentioned generally in TAC's manuals, VeloQuebec, and AASHTO manuals.
- **Chicanes**: Chicanes are not discussed in the TAC's manuals, but some descriptions are found in the NACTO, VeloQuebec, and AASHTO manuals.
- **Pedestrian Speed:** Based on the reivew of manuals, typical pedestrian speed of 1.2 m/s is generally used in calculations according to TAC, VeloQuebec, and AASHTO.

A more detailed table that references page numbers of manuals where guidance and specific design recommendations including widths, where applicable, are provided can be found in **Appendix D**. Based on the findings of this review, and as was identified in the cycling chapter, it is clear that the characteristics discussed in each manual can differ, as do the recommendations. The most comprehensive manuals for designing pedestrian facilities are:

- NACTO's Urban Street Guide;
- VeloQuebec's Planning and Design for Pedestrians and Cyclists;
- AASHTO's Guide for the Planning, Design and Operation of Pedestrian Facilities; and
- TAC's Geometric Design Guide for Canadian Roads (to a lesser extent).

OTM's Book 15 provides detailed guidance on pedestrian considerations at crossing locations.

APPENDICES

APPENDIX A

Glossary of Terms - Bikeways

CYCLE FACILITIES

Off-Street Pathways

Multi-Use Pathways are off-street pathways where pedestrians, cyclists and other users share the same travel space.

Separated Bicycle and Pedestrian Pathways are off-street pathways that provide separation between pedestrians and cyclists.

Cycle Tracks (Protected Bicycle Lanes)

Curb/Median Protected Cycle Tracks are on-street facilities physically separated from motor vehicles and from pedestrians on the sidewalk by a curb or median. They can be either **one-way** or **two-way**.

Elevated Cycle Tracks are elevated the entire length of the cycle track, with the exception of major crossings. This includes separate drainage on the cycle track. Elevated cycle tracks can be either **one-way** or **two-way**.

Parking Protected Cycle Tracks are located between the on-street parking and the curb. The parked vehicles act as a buffer for the cyclists from moving traffic. Parking protected cycle tracks can be either **one-way** or **two-way**.

Bollard Protected Cycle Tracks can be cheap, simple, and quick solutions to create a barrier that makes cyclists feel adequately separated from vehicles. Typically, bollards can be used for pilot projects. Bollard protected cycle tracks can be either **one-way** or **two-way**.

Bicycle Lanes

Painted Bicycle Lanes are on-street travel lanes designated for bicycles. They are identified with a white line and a bicycle symbol.

Buffered Bicycle Lanes are conventional painted bicycle lanes with a painted buffer between cyclists and moving vehicles or parked vehicles or both.

Shoulder Bikeways are typically found on streets without curb and gutter with shoulders wide enough for bicycle travel. Shoulder bikeways often, but not always, include signage alerting motorists to expect bicycle travel along the roadway.

Contra Flow Bicycle Lanes allow cyclists to travel both directions along a one-way street. Often denoted by a bicycle lane (for cyclists travelling in the opposite direction) and a shared use lane for cyclists travelling the same direction as vehicles.

Shared Use Facilities

Local Street Bikeways are located on local streets with lower traffic volumes and are designated routes for cyclists. They often have some form of traffic calming.

Shared Use Lanes are often denoted by the use of a “sharrow” pavement marking to indicate that this is a shared space. Bicycles and motorists have to share the lane.

INTERSECTION AND CROSSING TREATMENTS

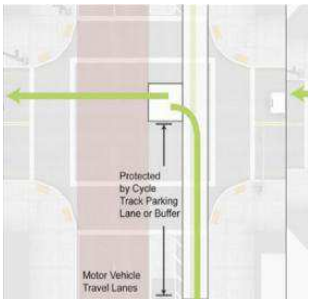
Intersection Approaches

Mixing Zones are when vehicle right-turn lanes and through bicycle lanes are combined and shared by both road users.

Turning Zones are identified as locations where motor vehicles have to cross over a through travelling bicycle lane to make a right hand turn.

At Intersections

Bike Box and Advance Stop Lines provide space for cyclists to wait to cross the intersection. They are often located in advance of the automobile stop line and provide the cyclists with a "head start".



Launch Pad/Two-Stage Left Turn enable cyclists to make a left turn by continuing through an intersection to a location that sets them up to safely wait to cross the intersection and complete the turning movement.

Median Refuges provide a space in the middle of the road for cyclists to cross one direction of traffic and wait until there is a clearing to cross the other half of the intersection.

Traffic Circles are raised islands located in the centre of an intersection. Vehicles travel around the circle to complete turning movements. **Roundabouts** are similar but are often larger than traffic circles.

Protected Intersections incorporate a combination of treatments, including bicycle signal phases, specific design elements, and space allocation that protect cyclists when travelling through intersections.

Intersection Crossing Markings are used to indicate the path for cyclists through the intersection. They provide guidance for both cyclists and motor vehicle drivers.

Coloured Conflict Zone Markings have been used to designate conflict zones and areas where cyclists are travelling. They provide visual reminder of the presence of cyclists.

SIGNALS

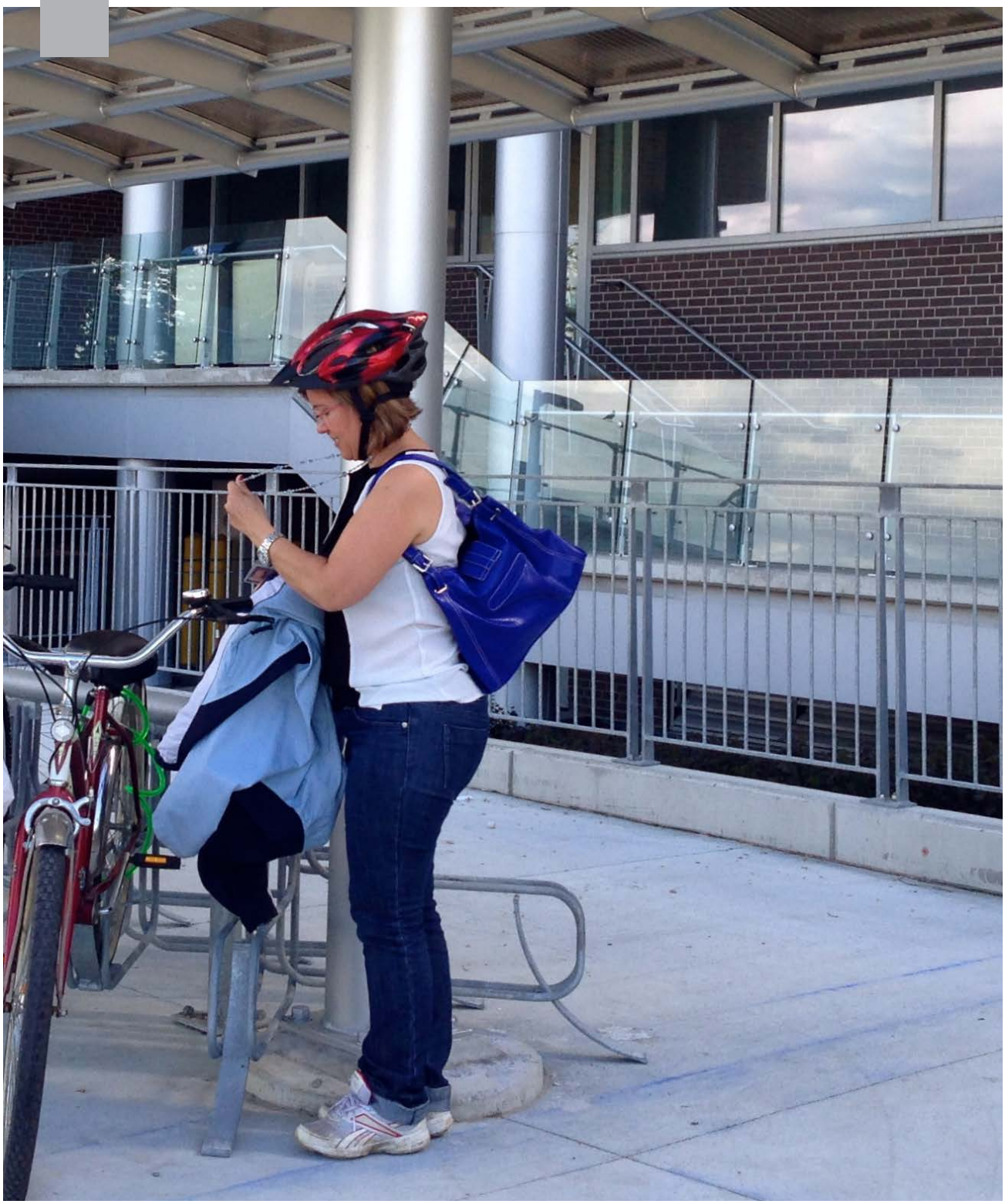
Bicycle Activated Signals, also referred to as half-signals, are used to assist cyclists in crossing major streets in areas where there is high cyclist demand, but where a full traffic signal is not warranted.

Signal Timing can be adjusted to reduce wait times for cyclists at intersections. Other options include providing leading bicycle intervals and separate bicycle signal phases.

Bicycle Specific Signals provide cyclists with their own signal to indicate when it is safe to enter an intersection without conflict from other vehicles attempting to make movements in the intersection.

APPENDIX B

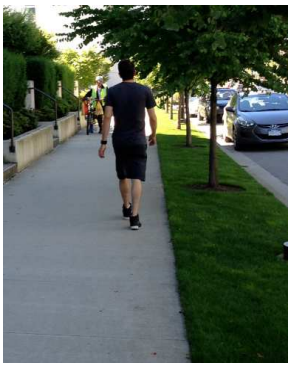
Glossary of Terms - Pedestrian Facilites



PEDESTRIAN FACILITIES

Sidewalks

Sidewalks are paved pathways that are located on the side of the road. They are designated space for pedestrians. The **width**, **surface material**, and **cross slope** are also important factors that need to be addressed during the design phase.



Buffered Sidewalks are sidewalks that provide some form of buffer between pedestrians and the street. Buffers can include trees, furniture, landscaped boulevards, etc.

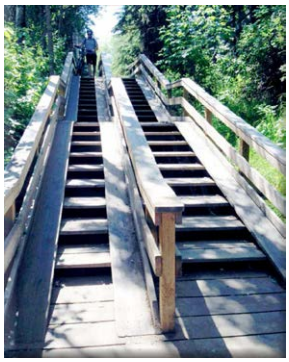
Furnishing Zones are not included in the minimum width of the sidewalk. They include a segment of the sidewalk usually adjacent to the street that is the location of any benches, trash bins, bicycle parking, etc.

Frontage Zones are not included in the minimum width of the sidewalk. They include a segment of the sidewalk adjacent to store fronts. They are often covered by awnings, are the location of sandwich boards, restaurant patios, etc.

Off-Street Pathways

Separated Bicycle and Pedestrian Pathways are off-street pathways that provide separation between pedestrians and cyclists.

Multi-Use Pathways are off-street pathways where pedestrians, cyclists and other users share the same travel space.



Stairways are a set of steps or stairs and their surrounding walls or structures. They are often used in areas with steep topography.

Shared Spaces are roads where motor vehicles, pedestrians, and bicyclists travel without lane assignment. Generally, there are no sidewalks or other features to separate modes.

INTERSECTION AND CROSSING TREATMENTS

Midblock Crossings are pedestrian crossing facilities implemented to accommodate pedestrian crossing demand between intersections and away from signalized intersections.

Crossing Channelized Turn Lanes often increase intersection efficiency for vehicles. However, crossing them can be challenging for pedestrians in certain situations. Pedestrian considerations should be made when designing these features.

Crosswalks are the simplest crossing treatment, which involves pavement markings indicating the crosswalk and accompanying signs.

Crossing Distance can be shortened by the use of curb extensions. **Curb extensions** are an extension of the curb into the parking lane at intersections to reduce speeds and increase the visibility of road users.

Raised Crosswalks are elevated pedestrian crossings that extend the sidewalk across the street through the creation of a flat topped speed hump.

Raised Intersections are flat elevated areas that span an entire intersection.

Median Refuges provide a space in the middle of the road (median) for cyclists to cross one direction of traffic and wait until there is a clearing to cross the other half of the intersection.

Corner Radii can help to lower design speeds and shorten crossing distances. A shorter curve radius and a narrower lane width can result in slower vehicle speeds.

SIGNALS

Pedestrian Activated Signals, often referred to as a half-signal, are used to assist pedestrians in crossing major streets in areas where there is high pedestrian demand, but where a full traffic signal is not warranted.

Pedestrian Countdown Timers are used to provide information to pedestrians about how much time is left to cross the street at a signalized intersection.

Leading Pedestrian Intervals give pedestrians the "Walk" symbol several seconds before motor vehicles traveling in the parallel direction are given a green light. This allows pedestrians to get a head start on crossing before vehicles begin turning, making them more visible to motorists.

Audible Pedestrian Signals emit a verbal message, an audible tone, or a vibration to indicate to visually impaired pedestrians when they have the right-of-way to cross the street.

Pedestrian Scrambles are an exclusive pedestrian phase at a signalized intersection where vehicular movements are prohibited at all approaches while pedestrians are permitted to cross diagonally and longitudinally.

ACCESSIBILITY

Curb Ramps help provide access for people on wheelchairs, with mobility aid and strollers to the sidewalk when there is a change in elevation.

Wheelchair users – all pedestrian facilities should be accessible for pedestrian users. This requires considerations for curb ramps, reasonable cross slopes, pathways free of obstructions, etc.

APPENDIX C

Detailed Design Guidelines - Bikeways

Cycling Guidelines - TAC

		Manuals and Guidelines			
Design Characteristics		**TAC - Traffic Signal Guidelines for Bicycles**	**TAC - Bikeway Traffic Control Guidelines for Canada**	**TAC - Geometric Design Guide for Canadian Roads**	
Bicycle Facilities					
Off Street Pathways					
Multi-Use		See Section 4.1 Bicycle Trail Crossing at an intersection (Figure 4.1)	See Section 3.7.10 and 3.7.11 for signage See Section 8.7 - Typical Multi-Use Trail Crossing intersection treatments	See Section 3.4.6 pg. 3.4.6.1 - Bicycle lane two-way shared with pedestrians 2.5m -3.5m. one-way shared with pedestrian 2.0m-3.0m (however this may be more like elevated cycle tracks)	
Separated Pedestrian and Bicycle Facilities		See Section 4.3 Bicycle Crossings at Intersection Pedestrian Signals	See Section 3.7.11 for signage	Bike Paths are physically separated from the roadway in a bicycle exclusive lane touched on in section 3.4.3.4	
Cycle Tracks					
One -way Cycle Tracks					
Two- way Cycle Tracks					
Curb/Median Protected Cycle Tracks					
Elevated Cycle Tracks					
Parking Protected Cycle Tracks					
Bollard Protected Cycle Tracks				Some discussion on bicycle lane delineators Section 3.4.8.2 pg. 3.4.8.1 - 3.4.8.3	
Bicycle Lanes					
Painted bicycle lanes (no on-street parking)			Bicycle Lane Typical applications See 8.1.1 - Reserved Bicycle lane Signage 3.7.9 - Bicycle lane pavement markings see Section 7.2.1 - Bicycle lane symbols and word placement markings see section 7.41, 7.42, 7.43	Some general discussion of bicycle lanes in Section 3.4.3.2 pg. 3.4.3.1 and 3.4.3.2 and section 3.4.5 - Notes that desirable bike widths for design are 1.2m to 1.6m for one-way and 2.2 m to 2.6 m for two -way (does not specify if there is parking or no parking) However in section 3.4.6 lane widths are identified as - Two way bicycle lane 2.5m-3.5m, One way bicycle lane 1.5m-2.0m	
Painted bicycle lanes (on-street parking)			Bicycle Lane Typical applications See 8.1.1 - Bicycle lanes adjacent to full time on-street parking, parking width should be 2.5m and bicycle lane should be 1.5m - 2.0m. Reserved Bicycle lane Signage 3.7.9 - Bicycle lane pavement markings see Section 7.2.1 - Bicycle lane symbols and word placement markings see section 7.41, 7.42, 7.43	See above	
Buffered bicycle lanes					
Shoulder Bikeways				Some general discussion of shoulder bikeways in Section 3.4.3.2 pg. 3.4.3.1 and 3.4.3.2 - widths provided on pg.3.4.6.2 widths for paved shoulders vary from a min of 1.5 m to 3.0 m	
Contraflow bicycle lanes		See Section 4.4 and Figure 4.6 - Contraflow bicycle signal heads should be mounted on the same pole as the pedestrian signals, and the same height as the pedestrian signal head. Bicycle stop bar should be placed on the near side of the intersection approx. 1.0 m from the ped crosswalk, with supplemental signage	See Typical Application 8.4 - Contraflow bicycle lane should be 1.5m-2.0m in width. When placed between parked cars and the curb the lane should be 2.0 m wide. See Section 4.6.6 for Contraflow Bicycle Lane Crossing Signage - Bicycle lane pavement markings see Section 7.2.2		

Cycling Guidelines - TAC

		Manuals and Guidelines			
Design Characteristics		**TAC - Traffic Signal Guidelines for Bicycles**	**TAC - Bikeway Traffic Control Guidelines for Canada**	**TAC - Geometric Design Guide for Canadian Roads**	
Shared Use Facilities					
Local Street Bikeways					
Shared Use Lanes			See Typical Application 8.1.2, 8.1.3 and 8.2 for transitions from shared use to bicycle lane. Seeds shoulder be 60 km/h or less. On roadways without on street parking, place marking so the centre is 1.0m but a min of 0.75m from the edge of pavement or edge of curb. On roads with full time parking, place marking so that the centre of the marking is a desired min of 3.4 m from the curb. For single file operation pace the marking in the centre of the lane if the lane is less than 4.0 m wide, posted speed should be 50 km/h or less. See Section 4.6.7 Shared the Road Signage - See Section 7.4.3 for Shared Use Lane Symbols	See Section 3.4.6 pg. 3.4.6.2 bicycle routes and shared roadway right lane on an arterial street - AADT 0-1000 standard roadway lane 4.0m, AADT 1000-3000 standard roadway lane 4.3m - AADT 3000-6000 4.0m - 4.5m and AADT >6000 4.3m -4.8m. Where bicycles and parked cars share a lane the min width is 4.0 m, assuming a 2.4 m parking bay. A lane of 3.0m wide allows bicycle commuters to pass without crossing into the next lane.	
Intersection and Crossing Treatments					
Intersection Approaches					
Mixing zones			See Typical Application 8.3 Figure #19 & 20 See Section 3.2.3, 3.2.4, 3.2.6	See Section 3.4.7.4 and particularly figure 3.4.7.3	
Turning zones			See Typical Application 8.3 Figure #12 & 13 See Section 3.2.3, 3.2.4, 3.2.6	See Section 3.4.7.4 and particularly figure 3.4.7.3	
At Intersections					
Advance stop lines		See Section 4.5 - Bicycle signals may be used in conjunction with advance stop bars for bicycles, which allow cyclists to position themselves ahead of motor vehicles during a red signal			
Bike boxes			Bicycle Box re: Stop Lines 7.3.2 - Typical application 8.3.1 Recommended depth is 4.0m or a minimum depth of 2.75m. Right turn on red movements should be prohibited for vehicles turning right through the bicycle box.		
Two-stage left turn boxes					
Median refuges			Signage for obstruction Section 4.0		
Roundabouts			See Typical Roundabout Application 8.6 Roundabout Directional Signage 5.3.1.3		
Traffic circles			Only what is noted above		
Protected intersections		See Section 4.1/Figure 4.2 - References OTM Book 18			
Intersection crossing markings			See examples from Section 8.0 for typical applications (8.3.2) - Provides signage and pavement marking recommendations See Section 8.3.2 See 7.3 for Transverse Pavement Markings (includes Elephants feet)		
Coloured pavement markings					
Signals					
Bicycle activated signals		See Section 3.4	Cyclist push button signage Section 4.6.9 (pg. 41) - See Section 7.4.6 Bicycle Detection Marking Symbol		
Leading bicycle intervals		See Section 4.5 An advanced bicycle phase can help cyclists start moving through the intersection before motorists, signal should be placed adjacent to the bicycle lane on the far side of the intersection. See also Section 3.3 and 3.4 - Report on formulae for calculating the signal timing found in Appendix A			

Cycling Guidelines - TAC

		Manuals and Guidelines			
Design Characteristics		**TAC - Traffic Signal Guidelines for Bicycles**	**TAC - Bikeway Traffic Control Guidelines for Canada**	**TAC - Geometric Design Guide for Canadian Roads**	
Separate signal phase		See Section 3.3 and 3.4 - Report on formulae for calculating the signal timing found in Appendix A			
Bicycle specific signal heads		See section 3.2.2, 3.3 and 3.4 - Should be installed on the far side of intersections and within 30m of the cyclist stop bar, if further than 30m use 300mm bicycle signal lenses or install signal at the near side of the intersection. Must not act as a physical impediment			
Intersection restrictions		Touched on briefly specific to each treatment	Provides general signage options See section 3.0		
Transit integration					
Other					
Retrofitting streets for bicycle lanes					
Signage		Throughout document for specific examples	Throughout document	Brief discussion in section 3.4.8.3 pg. 3.4.8.3	
Pavement markings		Throughout document for specific examples	Throughout document		
Maintenance					
Wayfinding		Throughout document for specific examples	Provides recommendations on the distance and the location of different types of decision and directions signs (wayfinding)	Brief discussion in section 3.4.8.3 pg. 3.4.8.3 - 3.4.8.4	

Cycling Guidelines - Other North American Organizations

		Manuals and Guidelines					
Design Characteristics		**NACTO - Urban Bikeway Design Guide**	**NACTO - Urban Street Design Guide**	**AASHTO Bike Guide**	**Ontario OTM Book 18 Bicycle Facilities**	**VeloQuebec - Planning and Design for Pedestrians and Cyclists**	
Bicycle Facilities							
Off Street Pathways							
Multi-Use				See Chapter 5 - Section 5.2.1 - The appropriate paved width for a shared use path is dependent on the context, volume, and mix of users. The minimum paved width for a two-directional shared use path is 3.0m. Typically widths range from 3.0m to 4.3m with the wider values applicable to areas with high use **(3.0-4.3m typical)**	In boulevard Facilities See Section 4.4.1 pg. 104-106 - Two Way In-Boulevard Shared Facility Desired width 4.0m suggested min 3.0m	See Chapter 4 - Minimum recommended width is 3.0 m - design speed 30 km/h. Minimum walking width is 1.8 m - Also has a section specific to pathways at intersections pg. 42 (min 3.0m)	
Separated Pedestrian and Bicycle Facilities						See Chapter 4 - 3.0m bicycle path allows for cyclists to overtake each other or travel two ways, there is a minimum width of 2.5m between two obstacles, widths under 2.0m are to be avoided all together. One way bicycle paths required width is 1.5m with an extra 1.0m clearance on each side - Also has a section specific to pathways at intersections pg. 42 (min 1.5m one-way, min 2.5m two-ways)	
Cycle Tracks		One way protected / Raised / Two Way Cycle Tracks					
One -way Cycle Tracks		See One-way Cycle Tracks - The minimum desired width for a cycle track should be 5 feet. In areas with high bicyclist volumes or uphill sections, the minimum desired width should be 7 feet **(min 1.5m typical, min 1.7m high volume)**	Some mention of one way cycle tracks on pg. 9 re downtown 1-way street		See Section 4.3 pg. 97-98 - One-way cycle track desired width 2.0m (suggested min 1.5m) **(min 1.5m) -** width of separation varies	See Chapter 5 pg. 80 - At least 1.5m wide and a 0.5m buffer (min 1.5m)	
Two- way Cycle Tracks		See Two Way Cycle Tracks - The desired two-way cycle track width is 12 feet. Minimum width in constrained locations is 8 feet (Recommended). A dashed yellow centreline should be used to separate two-way bicycle traffic and to help distinguish the cycle track from any adjacent pedestrian areas (Recommended) **(min 3.7 typical, min 2.4 constrained)**			See Section 4.3 pg. 97-98 - Two way cycle track desired width 4.0m (suggested min 3.0 m) **(min 3.0m) -** width of separation varies	See Chapter 5 pg. 80-81 - see one way cycle tracks - bi-direction is not recommended due to increased potential for conflicts	
Curb/Median Protected Cycle Tracks		See One Way Protected Cycle Tracks - A raised median, bus bulb or curb extension may be configured in the cycle track buffer area to accommodate transit stops. Bicyclists should yield to pedestrians crossing the roadway at these points to reach the transit stop			See Section 4.2.2 pg. 81-83 - Concrete curb/Median/Planters - Desired width 2.0m lane + 1.0 buffer (suggested min 1.5m lane + 0.5m buffer) **(min 1.5m, min 0.5m buffer)**	Some design examples found in images See Chapter 5 pg. 80-81	
Elevated Cycle Tracks		See Raised Cycle Tracks - Cycle track should be vertically separated from the street at an intermediate or sidewalk level (Required). Raised cycle track shall be protected from the adjacent motor vehicle travel lane (Required). Mountable curb should have 4:1 slope edge (Required) **(4:1 slope edge)**			In boulevard Facilities See Section 4.4.1 pg. 104-106 One-Way In-Boulevard Bicycle Facility Desired 2.0m width suggested min 1.8m	See Chapter 5 pg. 81 (Sidewalk level bicycle path) 1.0 m - 1.5 m in width - pedestrian section should be 1.8 m or wider, curb should be 15cm high. Where parking is prohibited a 7.5cm mountable curb would allow cyclists to pass and use the street, a second curb should separate the path from the sidewalk **(1.0-1.5m typical, 15cm high curbs)**	
Parking Protected Cycle Tracks		See One Way Protected Cycle Tracks - Desired parking lane and buffer combined width is 11 feet (Recommended) - One way Cycle Track lane width desired minimum 5 to 7 feet (Recommended) - Parking buffer desired width is 3 feet (Recommended) - Parking should be prohibited near the intersection to improve visibility/ The desirable no-parking area is 30 feet from each side of the crossing **(min 1.5-2.1m one-way, 0.9m buffer)**			See Section 4.2.2 pg. 81-83 - Marked Buffer / On Street Parking Desired width 1.5m lane + 1.0 buffer (suggested min 1.5m lane + 0.5m buffer) - Two-Way In-Boulevard Bicycle Facility desired width 3.5m suggested min 3.0m **(min 1.5m one-way, min 3.0m two-way, 0.5m buffer)**	See Chapter 5 pg. 80 - At least 1.5 m wide, with at least 0.5 m buffer to allow vehicle doors to open if applicable. A minimum parking setback of 6.0m from the intersection is required (min 1.5m, 0.5m buffer)	

Cycling Guidelines - Other North American Organizations

	Manuals and Guidelines				
Design Characteristics	**NACTO - Urban Bikeway Design Guide**	**NACTO - Urban Street Design Guide**	**AASHTO Bike Guide**	**Ontario OTM Book 18 Bicycle Facilities**	**VeloQuebec - Planning and Design for Pedestrians and Cyclists**
Bollard Protected Cycle Tracks	See One Way Protected Cycle Tracks - re: Tubular Markers - Minimum desired width of the painted buffer is 3ft, buffer space should be used to locate bollards. (Recommended). Tubular markers may be used to protect the cycle track from the adjacent travel lane. The colour of marker shall be the same colour as the pavement marking they supplement (Optional) **(min 0.9m buffer)**			See Section 4.2.2 pg. 81-83 - Flexible Bollards Desired width 2.0m lane + 0.5 buffer (suggested min 1.5m lane + 0.5m buffer) **(min 1.5m lane, 0.5m buffer)**	Some design examples found in images. See Chapter 5 pg. 80-81
Bicycle Lanes					
Painted bicycle lanes (no on-street parking)	See Conventional Bike Lanes - The desirable bike lane width - 6 feet. The desirable ridable surface adjacent to a street edge is 4 feet, with a minimum width of 3 feet. (Required) **(min 0.9m-1.2m)**	Does not offer specific guidelines but identifies bicycle lanes in a number of examples of street concepts	See Section 4.6 - Provides examples of bicycle lanes on two-way and one-way streets. Under most circumtances the recommended width for bicycle lanes is 1.5m. Wider facilities are recommended on routes with high bicycle use and without on-street parking, recommended width is 1.8-2.4m (1.5m typical, 1.8-2.4m high volume)	See Section 4.2.1 pg. 53 - Curbside bicycle lanes should be 1.8 m wide, may provide 2.0m facilities where bicycle volumes are higher (min 1.5m), when bicycle lane is splitting two travel lanes desired width is 2.0m (min 1.8m) (min 1.5m one-way, min 1.8m two way)	See Chapter 5 pg.78 - Preferably on streets where the speed limit is 50km/h or less and never be bi-directional, lane width is usually 1.5m, can be increased to 1.8m on streets with higher vehicle volumes, if bicycle volumes are more than 1500 cyclists per day 2.0m width is recommended (min 1.5m typical, min 1.8-2.0m high volume)
Painted bicycle lanes (on-street parking)	See Conventional Bike Lanes - The desirable width is 14.5 feet from the curb face to the edge of the bicycle lane; the minimum reach is 12 feet. A bike lane next to a parking lane shall be at least 5 feet wide, unless there is a marked buffer between them. (Required) **(min 1.5m)**	Bicycle lane recommended at 6 feet (1.8 m) with a 3 foot (0.9 m) buffer (min 1.8 m)	See Section 4.6.4 - Bicycle lanes located adjacent to a narrow parking (2.1m) with high turnover bicycle lanes should be 1.8m-2.1m - minimum width of 1.5 m - section also provides recommendations for parallel and diagonal parking **(min 1.5m)**	See Section 4.2.1 pg. 53-54 Conventional Bicycle Lane adjacent to on-street parking - desired width 1.5m lane + 1.0 m buffer (suggested min 1.5 m lane + 0.5m buffer). It is recognized that the parking lane width may vary between 2.0 and 2.5 m. (min 1.5m lane, min 0.5m buffer)	See Chapter 5 pg. 79 - Bicycle lane between 1.5m and 1.8m wide, automobile lane between 3.0m and 3.5 m wide, parking lane between 2.1m and 2.5m wide (1.5m-1.8m)
Buffered bicycle lanes	See Buffered Bike Lanes - The buffer shall be marked with 2 solid white lines and shall have an interior diagonal cross hatching or chevron markings if 3 feet in width or wider. (Required) The combined width of the buffer(s) and bike lane should be considered "bike lane width" - Where buffers are used, bike lanes can be narrower because the shy distance function is assumed by the buffer. - Buffers should be at least 18 inches wide **(min 0.9m lane, min 0.5m buffer)**	Bicycle lane recommended at 6 feet (1.8 m) with a 3 foot 0.9 m buffer (min 1.8 m)		See Painted bicycle lanes with on street parking	See Chapter 5 pg. 80 - At least 1.5 m wide and a 0.5 m buffer if beside parked cars (min 1.5m lane, min 0.5m buffer)
Shoulder Bikeway			See Section 4.5 pg. 4-7 - Shoulder width should be based on the context of the roadway, On uncurbed cross sections with no vertical obstructions, adjacent to the roadway paved shoulder should be at least 1.2m wide. Shoulder width of at least 1.5m is recommended from the face of the guardrail, curb or other roadside barrier to provide additional operating width. Additional shoulder width is desirable if vehicle speeds exceed 50mph, or if used by heavy trucks **(min 1.2-1.5m)**	See Section 4.1.2 - Signed bicycle routes with paved shoulders should typically have shoulders between 1.5 and 2.0 m (min 1.2 m) of pavement width depending on the volume, speed and mix of vehicular traffic may also include a buffer zone between 0.5 and 1.0 m wide to provide greater separation between motorists and cyclists - (min 1.2m, 0.5-1.0m buffer)	See Chapter 5 page 76 - 50km/h or less ASDT <2000 or >2000 = 1.0 m - 50km/h to 70km/h ASDT<2000=1.0 m ASDT>2,000=1.5 m - >70km/h ASDT 1.5m ASDT>2000=1.75 (min 1.0-1.75m)
Contraflow bicycle lanes	See Contraflow Bicycle Lanes - Signage and signals are very important - A solid double yellow line markings should be used to demarcate the lane from opposing traffic - Add buffer to bicycle lane if space exists		See Section 4.6.3 pg. 4-12 - The bicycle lane should be placed on the correct side of the roadway, if there is insufficient room then a shared lane marking should be used. Appropriate separation should be placed between the two directions of traffic to designate travel lanes in both directions, pavement markings are the simplest form of separation, medians or traffic separators provide more separation between motorists and bicycles travelling in opposing directions. If medians or traffic separators are used the contra-flow bicycle land width should be at least 2.1 m. (min 2.1m)	See Section 4.2.3 pg. 91 - Contraflow Bicycle Lane Desired width 2.0m (Suggested min 1.8m) Contraflow Bicycle Lane adjacent to on-street parking 2.0 m lane + 1.0 m buffer to parking (suggested min 1.8 m lane + 0.5 m buffer to parking) **(min 1.8m lane, 0.5m buffer)**	See Chapter 5 pg. 83 - 1.5m to 1.8m bicycle lane, 3.3m - 4.5m shared use lane with pavement markings **(1.5-1.8m)**
Share Use Facilities					
Local Street Bikeways	See Bicycle Boulevards - Route planning, signs and pavement markings, speed management, volume management, minor street crossings, major street crossings, offset crossings, green infrastructure	See pg. 26 for Residential Shared Street	See Section 4.10 pg. 4-33 - Section discusses and identifies several design elements that are commonly included in local street bikeways	See Section 5.1 pg. 118 - Bicycle Priority Streets includes guidance for design characteristics including traffic reduction, intersection treatments, priority and traffic calming	See Chapter 5 pg. 84 - 91 - Provides recommendations for designing bicycle boulevards including the importance of traffic calming and the recommended cross sections based on vehicle volumes and land use type

Cycling Guidelines - Other North American Organizations

		Manuals and Guidelines					
Design Characteristics		**NACTO - Urban Bikeway Design Guide**	**NACTO - Urban Street Design Guide**	**AASHTO Bike Guide**	**Ontario OTM Book 18 Bicycle Facilities**	**VeloQuebec - Planning and Design for Pedestrians and Cyclists**	
Shared Use Lanes		See Shared Lane Markings - Shared use lane markings should not be used on shoulders - Frequent, visible placement of markings is essential. Shared use lanes markings used to bridge discontinuous bicycle facilities or along busier streets should be placed more frequently (50 to 100 feet) than along low traffic bicycle routes (up to 250 feet or more). Lateral placement is critical to encourage riders to avoid the "door zone" and to encourage safe passing behavior. MUTCD guidance recommends minimum placement when a parking lane is present at 11 feet from the curb face. On streets with posted 25 mph speeds or slower, preferred placement is in the center of the travel lane. On streets with posted 35 mph speeds or faster and motor vehicle volumes higher than 3,000 vpd shared lane markings are not a preferred treatment. If on-street vehicle parking is not present, SLm should be placed far enough from the curb to direct bicyclists away from gutters, seam, and other obstacles. (min 3.4m with parking)	Does not offer specific guidelines but identifies shared use lanes in a number of examples of street concepts	See Section 4.3 pg. 4.2 (shared lanes) - Marked shared lanes Section 4.4 - On streets with on-street parallel parking, markings should be places at least 3.4m from face of the curb - On streets without on-street parallel parking, marking should be placed at least 1.2m from face of curb. - The shared lane man be placed farther into the lane than the min distance where appropriate - should not be used on roadways that have a speed limit above 35mph - also provides example of shared lane pavement marking. **(min 3.4m with parking, min 1.2m without parking)**	See Section 4.1 pg. 38 - Practitioners may choose to add an optional 'sharrow' or 'Shared Use Lane Marking' at regular intervals - Wide Shared Roadway / Signed Bicycle Route desired width 4.5m (min width 4.0 m) Narrow Shared Roadway / Signed Bicycle Route Desired width 4.0m (min width 3.0m) Shared Use Lane signage discussed in section 4.1.1.2 Sharrow pavement markings are discussed in Section 4.1.1.3 including location on streets with and without on street parking - Wide Signed Bicycle Route without Parking sharrow should be placed 1.0 m from the face of the curb - Wide Shared Roadway / Signed Bicycle Route w/ on-street parking the centre of the sharrow should be placed at least 1.3 m from the edge of the curb. If the shared travel lane is less than 4.0 m wide from the edge of the parking lane, the sharrow should be placed in the centre of the travel lane - Narrow Shared Roadway On roadways where the travel lane is too narrow for motorists to safely pass cyclists in a single lane, motorists and cyclists are encouraged to travel in single file and cyclists are encouraged to use the full lane - sharrow should be located in the centre of the lane (min 3.0-4.0m)	(Not specifically Shared Use Lanes but shared Roadways) See Chapter 5 page 73	
Intersection and Crossing Treatments							
Intersection Approaches							
Mixing zones		See Combine Bike Lane / Turn Lane - Some form of bicycle marking shall be used to clarify bicyclist positioning within the combined lane. This can include dotted striping or a shared lane marking. If the lane is continuing into the mixing zone, A dotted 4 inch line and bicycle lane marking should be used to clarify bicyclist positioning within the combined lane **(1.2m)**	Does not offer specific guidelines but identifies shared mixing zones in a number of examples of street concepts	See Section 4.8 pg. 4-22 - Specific to right turns with shared through/right turn lanes. On approaches to intersection that do not have right turn only lanes, bicycle lane lines are either solid or dotted or may be temporarily dropped (see Figure 4-16). If dotted line used, dotted line should begin 15m to 60m prior to the crosswalk, the bicycle lane should resume with a solid line on the far side of the intersection approaches where right turns are permitted. - instead of dotted lines bicycle lanes could be dropped recommendations on when to use treatments is provided	See Pg. 60 - 65 - Provides guidelines from TAC (see TAC Bikeway Traffic Control Guidelines) as well as alternative designs includes signage and pavement marking guidelines.		
Turning zones		See Through Bike Lanes - The desired width of a dotted bike transition lane and through bike lane is 6 feet with a minimum width of 4 feet - The through bike lane shall be placed to the left of the right-turn only lane. Dotted lines signifying the merge area shall begin a minimum of 50 feet before the intersection (MUTCD). Dotted lane line transition areas to through bike lanes shall not be used on streets with double right turn lanes. **(min 1.2m-1.5m)**		See Section 4.8.1 pg. 4-24 - Right Turn Considerations with Right Turn Only Lanes. The through bicycle lane should be a minimum of 1.2m wide, however, 1.5 m is preferable. Motorists are required to yield to bicyclist at the entrance to the right-turn-only lane. **(min 1.2-1.5m)**	See Pg. 65-69 Provides guidelines from TAC (see TAC Bikeway Traffic Control Guidelines) as well as alternative designs includes signage and pavement marking guidelines.	See Chapter 5 pg. .101 - and Figure 5.35 - A bicycle lane to the left of a right-Turing lane makes it easier for cyclists to go straight ahead and gives those waiting for a green light a place to do so without conflicting with right turning vehicles	
At Intersections							
Advance stop lines					See pg. 70 - Design recommends a 2.0m advance stop line for cyclists **(2.0m typical)**	See Chapter 5, pg. 100 recommends a 2.0m advance stop line for cyclists **(2.0m typical)**	
Bike boxes		See Bike Boxes - Box should be 10-16 feet deep. Stop lines and pavement markings indicate where vehicles and cyclists should stop. An ingress lane should be used to define the bicycle space. Coloured pavement markings are recommended. Signage required **(3.0-4.9m depth)**			See pg. 76 - 77 - The depth of the bike box, specifically the distance between the crosswalk and the vehicular stop bar, should be 5.0 m to cater to the volume of cyclists as well as bicycles with trailers. In constrained situations, this may be reduced to a minimum of 4.0 m. Bicycle pavement marking symbols should be applied between the crosswalk and the stop bar for motor vehicles. Coloured pavement may also be considered to enhance the visibility of the bike box. (min 4.0m depth)	See Chapter 5, pg. 100 identifies a minimum bike box depth of 4.0m **(min 4.0m depth)**	

Cycling Guidelines - Other North American Organizations

		Manuals and Guidelines				
Design Characteristics		**NACTO - Urban Bikeway Design Guide**	**NACTO - Urban Street Design Guide**	**AASHTO Bike Guide**	**Ontario OTM Book 18 Bicycle Facilities**	**VeloQuebec - Planning and Design for Pedestrians and Cyclists**
Two-stage left turn boxes		See Two Stage Turn Queue Boxes - require a designated area, with pavement markings and a bicycle stencil. The queue box shall be placed in a protected area.		Nothing on two stage left turn boxes but there is a section on left turn consideration (see Section 4.8.2)	See pg. 78 - This designated space should be marked with a white rectangular or square box using 100 mm wide solid lines surrounding a turn arrow pointing in the direction in which cyclists will leave the intersection, plus a bicycle symbol oriented according to the direction from which they entered. See Also pg. 88 for left turn boxes specific to separated bicycle facilities	Recommends no treatment for left turning cyclists particularly if vehicle volumes are low Chapter 5 pg. 101
Median refuges		See Median Refuge Island - The desirable width of the median refuge is 10 feet or greater, minimum width is 6 feet - When applied on a two-way street, the median refuge shall be placed along the centerline of the roadway between the opposing directions of travel. Pavement markings on the approach of the refuge island shall follow existing guidelines - The approach edge of the raised median shall be outlined in retro reflective white or yellow material. **(min 1.8m-3.0m)**	See Pedestrian Safety Islands - Pedestrian safety islands should be at least 6 feet wide, but have a preferred width of 8–10 feet. Where a 6-foot wide median cannot be attained, a narrower raised median is still preferable to nothing. The minimum protected width is 6 feet, based on the length of a bicycle or a person pushing a stroller. The refuge is ideally 40 feet long. The cut--through or ramp width should equal the width of the crosswalk. **(min 1.8m wide, min 12.2m long)**	See pg. 5-48 - Crossing islands and raised medians (specific to mid-block crossings)	See Section 5.8.1.4 pg.146 - For unsignalized midblock crossings on multi-lane roadways, a protected space in the centre of the road, known as a 'median refuge island', may be provided. This enables cyclists, pedestrians and other trail users to cross traffic approaching from one direction at a time. The median island should be a minimum of 2.0 m wide to accommodate regular bicycles and pedestrians with pushchairs. Where feasible, a width of 3.0 m should be provided to accommodate bicycles with trailers.	See Chapter 5 pg.108 - For description of how islands and refuges can be used for traffic calming and See pg. 99 for description of pedestrian refuges
Roundabouts		See Shared Lane Markings - Use shared lane markings within single or multi-lane roundabouts		See Section 4.12.11 pg. 4-63 - Notes that single lane roundabouts are easier to navigate for cyclists than multi-lane, also has section on designing roundabouts for bicyclists to transverse roundabouts on the sidewalk	See Section 5.3 pg. 125 - Single land and Multi-Lane roundabouts	See Chapter 5 pg. 102 - 104 - Includes large and small roundabouts. Safe solution is to have cyclists follow alongside the pedestrian route
Traffic circles		See Bicycle Boulevards (Minor Street Crossings and Speed Management) - Traffic circles are identified as potential bicycle boulevard intersection treatments however notes, Treatments shall be considered using engineering judgment and shall consider the safety and comfort of bicycle movements along the bicycle boulevard.		Similar to above section, no specific section on traffic circles		See Chapter 5 pg. 102 - 104 includes large and small roundabouts - In small roundabouts cyclists share the single-lane circle with motorists, on approaches the bicycle lane is discontinued prior to the circle, cyclists merge with automobile traffic as the roadway narrows.
Protected intersections					See Section 4.3.14 pg. 102 - 104 for designs and description	
Intersection crossing markings		See Intersection Crossing Markings - Dotted lines shall bind the bicycle crossing space. Striping width shall be a minimum of 6 inches adjacent to motor vehicle travel lanes. Dotted lines should be 2 foot lines with 2 to 6 foot spacing. Crossing lane width should match width and positioning of the leading bike lane. On crossings of two-way paths and cycle tracks, markings should indicate that there is two-way traffic. Elephant's feet markings may be used as an alternative to dotted line extensions **(min 0.15m striping width, 0.6m lines with 0.6m-1.8m spacing)**	Some examples of intersection crossing markings throughout		See pg. 70- 72- Identified treatment options available: no treatment; bicycle stencils or chevrons 1.5m to 10m spacing; sharrows at 1.5 m to 15 m spacing; dashed guidelines (with optional bike stencils or chevrons but not sharrows), green colour treatment; or dashed guidelines (with optional bike stencils or chevrons but not sharrows) and green colour treatment. Elephants feet markings are reserved for crossriders at intersections **(1.5-10m stencil spacing, 1.5-15m sharrow spacing)**	See Chapter 5 pg.99-100 for examples of bicycle facilities crossing intersections, including recommendations about designs and pavement markings
Coloured pavement markings		See Intersection Crossing Markings - Coloured pavement may be used for increased visibility within conflict areas or across entire intersections See Also Coloured Pavement Material Guidance		See Section 4.7.2 - Notes that green coloured pavement marking can be used at select locations or the entire length of a bicycle facility - does not specifically give advice about using it in intersections	See above, green coloured markings through intersections are recognized as potential treatments	See Chapter 5 pg.99-100 for examples and see Chapter 6 - pg. 123 for recommendations and guidance on coloured pavement marking materials
Signals						
Bicycle activated signals		See Signal Detection and Actuation - push-button activation shall be located so bicyclists can activate the signal without dismounting. If used, push buttons should have a supplemental sign facing the bicyclist's approach to increase visibility.		See Section 4.12.5 pg. 4-47 - Detection for bicycles at traffic signals, outlines the different types of technology to detect cyclists at intersections	See Section 5.8.2 pg. 147 - Recommends looking at OTM Book 12 - Traffic Signals for design guidance on bicycle signal heads, signal timing and detector loops.	See Chapter 5 pg. 96 for a general discussion of traffic signals and cyclists
Leading bicycle intervals		See Bicycle Signal Heads - Leading bicycle intervals are part of typical applications of bicycle signal heads	See pg. 126-128 for signalization principles		See Section 5.8.2 pg. 147 - Recommends looking at OTM Book 12 - Traffic Signals for design guidance on bicycle signal heads, signal timing and detector loops.	See Chapter 5 pg. 96 for a general discussion of traffic signals and cyclists

Cycling Guidelines - Other North American Organizations

		Manuals and Guidelines				
Design Characteristics		**NACTO - Urban Bikeway Design Guide**	**NACTO - Urban Street Design Guide**	**AASHTO Bike Guide**	**Ontario OTM Book 18 Bicycle Facilities**	**VeloQuebec - Planning and Design for Pedestrians and Cyclists**
Separate signal phase		See Bicycle Signal Heads - Separate signal phases are part of typical applications of bicycle signal heads		See Section 4.12.4 - brief discussion on separate bicycle and pedestrian signal phases	See Section 5.8.2 pg. 147 - Recommends looking at OTM Book 12 - Traffic Signals for design guidance on bicycle signal heads, signal timing and detector loops.	See Chapter 5 pg. 96 for a general discussion of traffic signals and cyclists
Bicycle specific signal heads		See Bicycle Signal Heads - The bicycle signal head shall be placed in a location clearly visible to oncoming bicycles. - An adequate clearance interval (i.e., the movement's combined time for the yellow and all-red phases) shall be provided. If the bicycle signal is used to separate through bicycle movements from right turning vehicles, then right turn on red shall be prohibited when the bicycle signal is active. - There are currently no national standards for determining the appropriate clearance intervals for bicycle signals.			See Section 5.8.2 pg. 147 - recommends looking at OTM Book 12 - Traffic Signals for design guidance on bicycle signal heads, signal timing and detector loops.	See Chapter 6 pg. 124 for general discussion of bicycle specific signal heads
Intersection restrictions		Recommendations provided based on facility type - see also section on Bicycle Signals			Touched on throughout	See Chapter 5 for discussion of right turn on red discussions
Transit integration		**See One Way Protected Cycle Tracks** - A raised median, bus bulb or curb extension may be configured in the cycle track buffer area to accommodate transit stops. Bicyclists should yield to pedestrians crossing the roadway at these points to reach the transit stop (Optional) - At transit stops consider wrapping the cycle track behind the transit stop zone to reduce conflicts with transit vehicles and passengers. Bicyclists should yield to pedestrians in these areas. At intersection bus stops, an extended mixing zone may be provided with signage directing bicycles to yield to buses and loading passengers. Cycle tracks may be configured on the left side of a one-way street to avoid conflicts at transit stops (Optional)	See transit street pg. 57 for some examples of incorporating bicycle facilities on streets with transit service	See Section 2.7 pg. 2-27. There are four main components of bicycle-transit integrations: 1. Facilitating bicycle access on transit vehicles 2. Offering bicycle parking at transit locations; 3. Improving bikeways to transit and 4. Promoting usage of bicycle and transit program	See Section 5.4.2 Transit Stops on some guidance pertaining to transit stops and bicycle lanes	See Chapter 7 for some guidelines specific to transit and cycling integration including bicycle parking importance of providing cyclists access as well as cross sections and images of integrating buses, and LRT with bicycle lanes
Other						
Retrofitting streets for bicycle lanes		See throughout		Retrofitting tips are provided for many of the bicycle facility types in Chapter 4	See Section 5.2.1 and 5.2.2 pg. 122 - 124	See Chapter 5 pg. 79 - Adding a bicycle lane and See Chapter 5 pg. 110 for guidelines and a description of a road diet and pg. 112 for horizontal and vertical road shifts
Signage		Included through out document specific to facility		Signage recommendations and guidelines are provided based on facility type and are found in each section	Providing throughout the document in each facility specific section	See Chapter 6 pg. 121 for some general information on signage
Pavement markings		Included through out document specific to facility		Pavement marking recommendations and guidelines are provided based on facility type and are found in each section. In addition see Section 7.2.6	Guidelines for bicycle facility specific pavement markings are provided throughout the report	See Chapter 6 pg. 122 for guidance marking materials, pavement marking examples and some dimensions provided throughout
Maintenance		Included through out document specific to facility		See Chapter 7		See Chapter 8 - For bicycle facility maintenance
Wayfinding		See Bike Route Wayfinding Signage and Marking System		See Section 2.5.3 pg. 2.20 also refers to Part 9 of MUTCD - see also Route Signs Section 4.11 which provides examples of signage options	Some recommendations for locations of wayfinding guidance etc. are featured throughout	See Chapter 6 pg. 119 for guidance on guide and information signs

Cycling Guidelines - North American City Specific

		Manuals and Guidelines				
Design Characteristics		**Fundamentals of Bicycle Boulevard Planning & Design**	**NCHRP Report 766 - Recommended Bicycle Lane Widths for Various Roadway Characteristics**	**City of Edmonton - Complete Street Guidelines**	**City of Calgary - Complete Streets Guide**	
Bicycle Facilities						
Off Street Pathways						
Multi-Use				See Shared use paths adjacent to Roadways Section 4.3.7 pg. 70 - Standard width 3.0m and constrained width 2.5m **(3.0m standard, 2.5m constrained)**	See pg. 35 - Minimum permitted width is 3.0m and 4.0m along rivers, creeks and valleys (3.0m standard, 4.0m rivers)	
Separated Pedestrian and Bicycle Facilities						
Cycle Tracks						
One -way Cycle Tracks				See Section 4.3.6 pg. 68-69 - One way cycle track through zone - Standard width 2.1 m constrained width for short distances is 1.5 m **(min 1.5m)**	See pg. 35 - Provides definition only - See pg. 36 Section 3.3.3 for guidelines. A min 1.0m buffer or physical separation should be provided when any of the following criteria is met: a)Truck volumes are >10 percent of total vehicle volumes b) design speed is >60km c) Two way traffic volumes exceed 20,000 vehicles d) Speed differential between cyclists and motor vehicles is too great	
Two- way Cycle Tracks				See recommendations for multi-use pathway - Standard width 3.0m and constrained width is 2.5m See section 4.3.6 pg. 68-69 (min 3.0m typical, min 2.5 constrained)	See pg. 35 - Provides definition only see above for recommendations on separating	
Curb/Median Protected Cycle Tracks				See pg. 68-69 re: raised median curb protection	See pg. 35 - Provides definition only	
Elevated Cycle Tracks				See pg.68-69 - Raised cycle track - adjacent to travel lanes, a raised cycle track may use a 0.5m mountable curb, raised to intermediate or sidewalk level **(0.5m high curb)**		
Parking Protected Cycle Tracks					See pg. 35 - Provides definition only	
Bollard Protected Cycle Tracks					See pg. 35 - Provides definition only	
Bicycle Lanes						
Painted bicycle lanes (no on-street parking)			See Pg. 57 & Pg. 61 - For streets without on-street parking, as long as the adjacent travel lanes is at least 10-ft wide and the bike lane is 4 to 5 ft. in width, most bicyclists will position themselves in the effective bike lane, and the effective bike lane will be equivalent to the width of the marked bike lane **(1.2-1.5m typical)**	See Section 4.3.4 pg. 64-65 - Standard width 1.8m, constrained width 1.5m max width 2.1m width based on vehicle volumes and type of vehicle. Bicycle lanes of 2.1 - 3.0m width should be configured as buffered bicycle lanes - See also Section 4.6 Complete Streets Context Illustrations **(1.8m standard, 1.5m constrained, 2.1m high volume)**	See Chapter 3.3 pg. 35 and 36 Min bicycle lane width is 1.5 m free of obstructions and obstacles (1.2 m may be permitted in retrofit projects) - collector streets carrying more than 3.000 vehicles a day shall include dedicated bicycle lanes **(min 1.5m)**	

Cycling Guidelines - North American City Specific

		Manuals and Guidelines				
Design Characteristics		**Fundamentals of Bicycle Boulevard Planning & Design**	**NCHRP Report 766 - Recommended Bicycle Lane Widths for Various Roadway Characteristics**	**City of Edmonton - Complete Street Guidelines**	**City of Calgary - Complete Streets Guide**	
Painted bicycle lanes (on-street parking)			See Pg. 57 & Pg. 61 - Where a bicycle lane is adjacent to on-street parking, the suggested width for the parking lane is 8 ft. Where space permits, the data suggest that installing a narrower bicycle lane (5ft) with a parking-side buffer provides distinct advantages over a wider bike lane with no buffer. Focus on encouraging cyclists to ride outside of the door zone. See also table 19. **(1.5m)**	See Section 4.3.4 pg. 64-65 - Standard width 1.8 m, constrained width 1.5m max width 2.1 m width based on vehicle volumes and type of vehicles. Bicycle lanes of 2.1 - 3.0 m width should be configured as buffered bicycle lanes - See also Section 4.6 Complete Streets Context Illustrations **(1.8m standard, 1.5m constrained)**	See Chapter 3.3 pg. 35 and 36 - Min bicycle lane width is 1.5 m free of obstructions and obstacles (1.2m may be permitted in retrofit projects) - on wider street facilities 1.5m min lane plys 0.8m min buffer shall be provided adjacent to a parking lane (door zone buffer) **(min 1.5m lane, min 0.8m buffer)**	
Buffered bicycle lanes			See Painted bicycle lanes (on-street parking).	See pg. 66-67 - Standard width of bicycle travel area is 1.5 m minimum width of buffer area is 0.5m, max width of buffer area is 1.5m. If buffer is 0.9 m or wider interior with diagonal or chevron hatching- See also Section 4.6 Complete Streets Context Illustrations **(min 1.5m lane, min 0.5m buffer)**	See pg. 35 & 36 notes that a min 1.0 buffer or physical separation should be provided when any of the following criteria is met: a)Truck volumes are >10 percent of total vehicle volumes b) design speed is >60km c) Two way traffic volumes exceed 20,000 vehicles d) Speed differential between cyclists and motor vehicles is too great **(min 1.0m buffer)**	
Shoulder Bikeway						
Contraflow bicycle lanes		See Pg. 40 - Design recommendations - Avoid use on streets with many driveways or streets that will intersect with the contraflow lane. Allow contraflow lane width of 5 feet or greater, consider physical separation between the contraflow lane and motor vehicle travel lane. Consider physical separation between the contraflow lane and motor vehicle travel lane, consider painted bicycle lane to highlight presence of the contraflow lane to bicyclists and motorists. Post signage indicating cyclists may enter the one-way streets. **(min 1.5m)**		See pg. 64 - Standard width is 1.8m - consider configuration as a buffered bicycle lane for further separation from opposite direction of traffic - See also Section 4.6 Complete Streets Context Illustrations	Mentioned on pg. 35	

Cycling Guidelines - North American City Specific

		Manuals and Guidelines				
Design Characteristics		Fundamentals of Bicycle Boulevard Planning & Design	NCHRP Report 766 - Recommended Bicycle Lane Widths for Various Roadway Characteristics	City of Edmonton - Complete Street Guidelines	City of Calgary - Complete Streets Guide	
Share Use Facilities						
Local Street Bikeways				See Section 4.3.3 pg. 62 best on roadways with <1500 vehicles/day (3000 vehicles max) <40 km/h (50km/h max) - See also Section 4.6 Complete Streets Context Illustrations		
Shared Use Lanes		Bicycle Boulevard Planning and Design is the purpose of this manual all the directions and guidelines provided in the subsequent sections are specific to this type of bicycle facility. The primary characteristics of a bicycle boulevard are: low motor vehicle volumes, low motor vehicle speeds, logical, direct and continuous routes that are well marked and signed, minimal bicyclist delay, and comfortable and safe crossings for cyclists at intersections		See Section 4.3.2 pg. 60-61 - Best on roadways with <4500 vehicles/day (higher volumes may be acceptable for side-by-side operations <40 km/h speed limit (max 50km/h) - See also Section 4.6 Complete Streets Context Illustrations	See pg. 34 - For definition of shared use lanes	
Intersection and Crossing Treatments						
Intersection Approaches						
Mixing zones				See Section 4.3.9 pg. 75 - Best at locations with - low-moderate volumes of turning motor vehicles - insufficient width for separate bicycle lane and right turn lane		
Turning zones				See Section 4.3.9 pg. 74 and 75 provides three design options		
At Intersections						
Advance stop lines		See pg. 26 - Section discusses Bike boxes and advanced stop bar together, bicycle box allows cyclists to stop in advance of other vehicles		See bicycle boxes		
Bike boxes		See pg. 26 - Use of bicycle boxes to reduce the number of right turn (right hook) conflicts - should be 14 feet deep **(4.3m depth)**		See Section 4.3.8 pg. 73 - However, no width dimensions provided		
Two-stage left turn boxes				See Section 4.3.8 pg. 73 - No width dimensions provided		
Median refuges		See pg. 32 - As design features at midblock intersections and pg. 70 which notes that arterial crossings can also be enhanced with median refuges.		See Section 4.1.4 pg. 40-41	Mentioned in the context of pedestrians - See pg. 29-30 for raised crossing islands/medians - the minimum width of a crossing island is 1.8 ms. On higher speed roads a 45 degree bend to the right through the median will help orient pedestrians to the risk they are likely to encounter.	
Roundabouts					See pg.80 - Though not mentioned in the context of cycling	
Traffic circles		See pg. 34 - Outlines traffic circles, cost estimates and design recommendations				
Protected intersections						
Intersection crossing markings				Only provided for shared use facilities street crossings see pg. 71		
Coloured pavement markings		Discussed in the context of bicycle boxes (see pg. 26) - Only				

Cycling Guidelines - North American City Specific

		Manuals and Guidelines				
Design Characteristics		Fundamentals of Bicycle Boulevard Planning & Design	NCHRP Report 766 - Recommended Bicycle Lane Widths for Various Roadway Characteristics	City of Edmonton - Complete Street Guidelines	City of Calgary - Complete Streets Guide	
Signals						
Bicycle activated signals		See pg. 27 - Assists bicyclists crossing signalized intersections by allowing cyclist to call a green signal phase through the use of loop detectors or push-button. Discusses different technologies and provides cost estimates		See Section 4.3.9 pg. 75 Best at locations with - a cycle track or path running parallel to arterial streets - high volumes of cyclists - high number of collisions - a confluence of an off-street bicycle path and a roadway intersection		
Leading bicycle intervals						
Separate signal phase		See pg. 27 - Bicycle signal heads and a separate bicycle signal phase may be considered at intersections with very high volumes of cyclists.				
Bicycle specific signal heads		See pg. 27 - Bicycle signal heads and a separate bicycle signal phase may be considered at intersections with very high volumes of cyclists. See also pg. 29 TOUCAN signals		See bicycle activated signals		
Intersection restrictions		See pg. 44 - Some discussion of restricting intersection turning movements through signage				
Transit integration						
Other						
Retrofitting streets for bicycle lanes		Report discusses how to retrofit existing streets into bicycle boulevards throughout		Some discussion throughout		
Signage		See pg. 18 - Wayfinding and signage specific to Bicycle Boulevard Design				
Pavement markings		See Pg. 23 - Specific to pavement markings on bicycle boulevards		Some discussion throughout see Chapter 4.3 and See also Section 4.6 Complete Streets Context Illustrations		
Maintenance		See Pg. 51 - Maintenance recommendations and potential funding sources				
Wayfinding		See pg. 18 - Wayfinding and signage specific to Bicycle Boulevard Design				

Cycling Guidelines - European

		Manuals and Guidelines		
Design Characteristics		**Cycling Embassy of Denmark - Collection of Cycle Concepts 2012**	**Netherlands Crow Design Manual**	
Bicycle Facilities				
Off Street Pathways				
Multi-Use		See Pg. 75 - Segregated paths are established for the sole use of cyclists and walkers.	See pg. 139 - Combined track - not really a multi use pathway but a short segment of the road where cyclists and pedestrians share the space (usually elevated from the road) but no physical separation between pedestrians and cyclists	
Separated Pedestrian and Bicycle Facilities			See pg. 137-138 - Recommends constructing a space reserved for pedestrians and cyclists at the same height separated only by a sunken curb or marking. This can also be done through the use of different types of pavement markings.	
Cycle Tracks				
One -way Cycle Tracks		See pg. 63 - 2.2m is the recommended width for a one way cycle track, this width will allow for two lanes (min 1.7m). The two lane cycle track as capacity of 2,000 cyclists/hour. Each new lane means an extra 1,500 cyclists/h, a 3.0 m width one way cycle track will be able to accommodate 3,500 cyclists/h. Additional details provided in Chapter 9 see pg. 82-83 **(min 1.7m)**	See pg. 119 - see also pg. 173 - Width of one-way cycle track is based on rush hour intensity in one direction (number of bicyclists (b/h)) - 0-150 b/h width 2.0 metres, 150-750 b/h 3.0 (2.5m) and >750 4.0 (3.5m) **(min 2.0-3.5m)**	
Two- way Cycle Tracks		See pg. 64 - Two-way cycle tracks along the road should only be used to a limited extent in urban areas and only after careful consideration. The are often the only used in the countryside where there are few intersecting roads. Minimum two-way cycle track width in Denmark is 2.5 m. A width of 3.0-3.5 can prove necessary with high cyclist volumes. See also pg. 85 **(min 2.5m typical, 3.0-3.5m high volume)**	See pg. 120 see also pg. 173 - Width of two-way cycle track based on b/h 0-50b/h 2.50 m, 50-150 b/h 2.5m-3.0m and >150 3.5m-4.0m **(min 2.5m typical, min 3.0-4.0m high volume)**	
Curb/Median Protected Cycle Tracks		See Two-way Cycle Track	See pg. 179 - 181 and provides a combination of options based on the height of the curb and the elevation of the road. Cycle track	
Elevated Cycle Tracks		See pg. 82-86	See pg. 179 - 181 and provides a combination of options based on the height of the curb and the elevation of the road. Cycle track	
Parking Protected Cycle Tracks		See pg. 84 - On sections where there is a high demand for waiting and parking, a longitudinal island can be placed between the carriageway/parking lane and the cycle track, with a recommended width of 1.0m **(min 1.0m buffer)**		
Bollard Protected Cycle Tracks		See pg. 83	See bollards as a option for cycle track design see pg. 173-174	
Bicycle Lanes				
Painted bicycle lanes (no on-street parking)		See pg. 77 - A cycle lane is marked on the carriageway by a 0.3m wide, solid white line and painted cycle symbol. Cycle lanes should be at least 1.5m wide including a 0.3m solid white line. A more acceptable width to allow for passing is 1.7m **(min 1.5m-1.7m)**	See pg. 117 - 118 - It is only advisable to build cycle lanes if the width requirement (at least 1.5m, no more than 2.5m) is met. See also pg. 166-170 **(min 1.5m - max 2.5m)**	
Painted bicycle lanes (on-street parking)		See pg. 78 - Parking should be prohibited on roads with cycle lanes when there is a large turnover of parked cars. When the parking area is placed between the cycle lane and the carriageway, a 2-2.5m wide cycle lane enables cyclists to overtake safely and makes it easier for them to dodge open car doors and pedestrians. A 1.0 metre wide island or painted barrier should be established between the cycle lane and the parking lane if possible. Parking between the cycle lane and the pavement requires a wide parking lane of 2.5 metres so drivers do not open the car doors into the cycle lane. Only parallel parking should be permitted. **(2.0-2.5m)**	See pg. 117 - 118 - Bicycle lanes are not recommended in combination with parking bays, because opening car doors form a source of danger. If parking is really necessary, a critical reaction strip is recommended (width > 0.05m) or if a cycle track would be a better solution. See also pg. 166-170	
Buffered bicycle lanes		See above: Discussion of buffered bicycle lanes in the context of bicycle lanes with parked cars	See pg. 118 and comments above re: critical reaction strip. See also pg. 166-170	
Shoulder Bikeway		See pg.65 - Shoulder lanes are primarily used in the countryside. They resemble cycle lanes but are usually narrower and cars are allowed to park on them - See also pg. 80 In rural areas the guideline width for a shoulder lane is 1.2m including the line (line -0.3m), but should be no narrower than minimum 0.9m. Line should not be used unless the should lane in min 0.9 metres wide. Shoulder lane width has a crucial safety impact in rural areas. On roads with cycle tourists and roads over 100 cyclists over a 24 hour period the shoulder lane should be 1.5m wide **(min 1.2-1.5m)**		

Cycling Guidelines - European

Design Characteristics		Manuals and Guidelines		
		Cycling Embassy of Denmark - Collection of Cycle Concepts 2012	Netherlands Crow Design Manual	
Contraflow bicycle lanes		See pg. 104 on one way streets the cycle track should be 1.7 m wide as a minimum, while the cycle lane should be 1.5m wide. If cars are parked immediately outside the cycling facility, the cycling facility should be at least 2.0 m wide **(min 1.5m typical, min 2.0 with parked cars)**		
Share Use Facilities				
Local Street Bikeways		While this document does not specifically discuss local street bikeways it does have a section on pg.101 that discusses pedestrian areas, squares and other urban spaces that have been designed to encourage pedestrian and cyclist activity. Including slow speed zones and living streets as well as bicycle streets	See pg.113 - Does not specifically discuss local street bikeways, instead discusses cycle streets. The cycle street is a functional concept: an estate access road that forms part of a main cycle route whose design and layout is recognizable as such, but where motorized traffic does occur to a limited extend and as subordinate traffic. See also pg.152.	
Shared Use Lanes			See also Cycle Streets re: local street bikeways above	
Intersection and Crossing Treatments				
Intersection Approaches				
Mixing zones		See pg. 97 - As approaches to signalized intersections with mixed traffic, a short, narrow (1.5m) cycle lane may be established the last 20-50 metres before the intersections. Cyclists thus have their own area for entering the intersection, which makes the area more easily passable and makes cyclists feel more secure. **(1.5m)**		
Turning zones		See pg.97 - Cycle lane between motorists' right turn lane and the land for straight ahead traffic. At large signalized intersections a cycle lane may be established between the motorists' lane for straight ahead traffic and the right turn lane. The idea is to replace the conflict between right turning cars and cyclists going straight ahead with a less dangerous merging situation before the intersection.	See Chapter 6 pg. 197 and 240-241 - These treatments allow for safe moving of vehicles and cyclists, two options are provided. See also 256-263	
At Intersections				
Advance stop lines		See pg. 96 - It is recommended that for all signalized intersections to set motor vehicle stop lines in all traffic lanes 5 metres back from the pedestrian crossing or the cyclist stop line to increase cyclist and pedestrian visibility. **(5m recommended)**	See also bicycle boxes below - pg. 208-209 also pg. 265-266	
Bike boxes		See pg. 98 - Bike boxes may be established at signalized intersections by painting the cycle symbol in front of the motorist stop line in turning lanes	See pg. 208-209 also pg. 265-266 Table V53 - Length of stacking area should be 4.0 to 5.0 metres **(4.0-5.0m depth)**	
Two-stage left turn boxes		Some left turn options are discussed throughout the document particularly Chapter 9	See pg. 208 and pg. 264 - Width of area is dependent on the number of cyclists width should be >1.2 metres **(min 1.2m)**	
Median refuges		Some discussion on median refuges and islands in Chapter 5, see pg. 87-88	See examples of treatments with median refuge islands on pg. 228-230 (crossings with a central traffic island)	
Roundabouts		See pg. 99 - Section discusses both roundabouts in rural environments and in urban areas. Including bicycle facility types based on the number of vehicles.	See pg. 201 - At relatively quiet roundabouts cycling facilities are not required, if bicycle facilities are incorporated into a roundabout cycle tracks are preferred, cycle lanes are not recommended in roundabouts. See also pg. 246-255	
Traffic circles		See pg. 101 - Discusses mini roundabouts which are similar in ways with traffic circles. In mini roundabouts it is often possible to drive over the central island and are recommend on streets with up to 15,000 cars per 24 hours	See Roundabouts	
Protected intersections			See example to simplify cyclist crossings pg. 231-234 See also pg. 258-259	
Intersection crossing markings		See pg. 97 - A cycle crossing my be established when it is deemed necessary to draw attention to potential conflicts between cyclists going straight ahead and turning motorists. This treatment clearly indicates the conflict area it also visually separates cyclists going straight from motorists. In Denmark there are four types of cycle crossings, one is blue, others consist of white dashed 0.3m wide lines. Cycling crossing are always marked with cycle symbols. **(0.3m wide lines)**	See Chapter 6 recommendations throughout for specific intersection treatments	
Coloured pavement markings		See pg. 78 and pg. 97 also noted throughout document	See notes on coloured pavement markings throughout Chapter 6 and 7 See specifically section 7.1.5 pg. 304	

Cycling Guidelines - European

		Manuals and Guidelines		
Design Characteristics		**Cycling Embassy of Denmark - Collection of Cycle Concepts 2012**	**Netherlands Crow Design Manual**	
Signals				
Bicycle activated signals		See pg. 94 - The optimal solution for cyclists is both a magnetic loop and a separate, manual cyclist pushbutton, which should be mounted on a low post at the stop line.	See Chapter 6 - Intersections are discussed in Chapter 6 there are some recommendations specific to bicycles at intersections including the use of bicycle activated signals they are recommended on direct access roads with between 10,000 and 30,000 pcu/day - Chapter also provides tips on how to improve wait times at intersections for cyclists including some of the features noted below	
Leading bicycle intervals		See note under Bicycle specific signal heads and see pg. 93 - Why cyclists have their own signal head they can also have their own signal phase, this gives cyclists who have been waiting for red a head start in relation to motor vehicles, rendering them more visible.	See Chapter 6 pg. 208-210 see pg. 267-281	
Separate signal phase		See note above	See Chapter 6 pg. 208-210 see pg. 267-281	
Bicycle specific signal heads		See pg. 93 - At intersections where cycle tracks or cycle lanes continue to the stop line, a separate cyclist signal may be installed. In this way cyclists have their own signal phase, wholly or practically.	See Chapter 6 specifically Section 6.3.3.2	
Intersection restrictions		Some mention of intersection restrictions throughout, particularly Chapter 5	See Chapter 6 intersection restrictions are discussed throughout this chapter	
Transit integration		See recommendations throughout Chapter 9 on recommendations of integrating transit with bicycle facility designs.	See Section 5.5 pg. 128 which focuses on providing solutions for integrating public transportation and bicycles	
Other				
Retrofitting streets for bicycle lanes		Not overly detailed and very few specific examples	No specific reference	
Signage		See Chapter 11	See Section 7.4 plus some examples of signing throughout the document	
Pavement markings		Some discussion throughout and Chapter 11	See throughout document Chapter 5 provides examples of pavement markings based on facility types i.e.. pg. 170 and Chapter 6 provides information on materials used see section 7.1.4	
Maintenance		See Chapter 12	See Chapter 7 throughout	
Wayfinding		See Chapter 11	See signage above - Section 7.4	

Cycling Guidelines - Australia

	Manuals and Guidelines	
Design Characteristics	**VicRoads Supplement to the Austroads Guide to Road Design**	**NSW Bicycle Guidelines**
Bicycle Facilities		
Off Street Pathways		
Multi-Use	See Section 7.5 for recommended sidewalk design widths - minimum of 1.8m - 2.0m In each direction. Additional information available in VicRoads Cycle Note No. 21: Widths of Off-Road Shared Use Paths **(1.8-2.0m typical)**	See Section 6 Bicycle facilities off-road and not within road reserves. Table 6.2 shows recommended width of 2.5m - 4.0m, see table for additional design notes (operating speed, horizontal curvature, clearances, gradient etc.) **(2.5-4.0m typical)**
Separated Pedestrian and Bicycle Facilities	Section 7.5 describes the capacity of a 1.5m wide path in one direction is in the order of 150 cyclists per hour. Additional information available in VicRoads Cycle Note No. 21: Widths of Off-Road Shared Use Paths **(min 1.5m one-way)**	See Section 6 Bicycle facilities off-road and not within road reserves. Table 6.2 shows recommended width of 1.5 one-way, 2.5 two-way, see table for additional design notes (operating speed, horizontal curvature, clearances, gradient etc.) **(min 1.5m one-way, min 2.5m two-way)**
Cycle Tracks		
One -way Cycle Tracks		See Section 5.2.1 - One-and two-way off-road bicycle path, Figure 5.10 shows recommended width of 1.5 - 2.0m for one-way bicycle path with 1.0m min buffer with parking and 0.4m min without parking. **(min 1.5-2.0m)**
Two- way Cycle Tracks		See Section 5.2.1 - One-and two-way off-road bicycle path, Figure 5.11 shows recommended width of 2.0 - 3.5m for one-way bicycle path with 1.0m min buffer with parking and 0.4m min without parking.
Curb/Median Protected Cycle Tracks		See Figure 5.9 - Recommended width of 0.4 - 1.0m buffer **(min 0.4-1.0m buffer)**
Elevated Cycle Tracks		
Parking Protected Cycle Tracks		See Figure 5.9 - Recommended width of 1.0m min buffer with parking and 0.4m min without parking. **(1.0m buffer with parking, 0.4m without parking**
Bollard Protected Cycle Tracks		Figure 6.2 - Physical prevention of illegal parking, illustrates use of bollards and design notes in Section 6.4 discusses usage
Bicycle Lanes		
Painted bicycle lanes (no on-street parking)	Additional information available in VicRoads Cycle Note No. 12: Design Standards for Bicycle Facilities	See Section 5.1.1 Bicycle lanes, references Austroads - Part 14 (Section 4.4.1) for detailed info. Figure 5.1 shows recommended width of 1.4 to 2.5m **(1.4-2.5m)**
Painted bicycle lanes (on-street parking)	Additional information available in VicRoads Cycle Note No. 12: Design Standards for Bicycle Facilities	See Section 5.1.1 Bicycle lanes, references Austroads - Part 14 (Section 4.4.1) for detailed info. Figure 5.1 shows recommended width of 1.4 to 2.5m and 1.0m clearance from curbside parking **(1.4-2.5m lane, 1.0m buffer)**
Buffered bicycle lanes		
Shoulder Bikeway		See Section 5.1.2 Bicycle shoulder lanes, Figure 5.2 shows bicycle shoulder lane cross section, referencing Austroads 14 Table 4-1 for widths.
Contraflow bicycle lanes		See Section 5.1.4 Bicycle contra-flow lanes, references Austroads - Part 14 (Section 4.4.3) for detailed info. Figure 5.8 shows recommended width of 1.4 to 2.0m. **(1.4-2.0m)**
Share Use Facilities		
Local Street Bikeways	Additional information available in VicRoads Cycle Note No. 12: Design Standards for Bicycle Facilities	See Section 5.3 - Mixed traffic streets, discussion on three types of mixed traffic profiles - wide cross section roads, narrow cross section roads, and critical cross section roads.
Shared Use Lanes	Additional information available in VicRoads Cycle Note No. 12: Design Standards for Bicycle Facilities and No. 13 Wide Curbside Lane Markings	See Section 5.3 - Mixed traffic streets, discussion on three types of mixed traffic profiles - wide cross section roads, narrow cross section roads, and critical cross section roads.
Intersection and Crossing Treatments		
Intersection Approaches		
Mixing zones		See Section 7.0 - Bicycle facilities at intersections for coverage of unsignalised intersections, signalized intersections, and off-road-bicycle path road crossings
Turning zones		See Section 7.0 - Bicycle facilities at intersections for coverage of unsignalised intersections, signalized intersections, and off-road-bicycle path road crossings

Cycling Guidelines - Australia

		Manuals and Guidelines		
Design Characteristics		**VicRoads Supplement to the Austroads Guide to Road Design**	**NSW Bicycle Guidelines**	
At Intersections				
Advance stop lines		Refers to AGRD Part 4, Section 9 - Cyclist Crossings. Additional information available in VicRoads Cycle Note No. 5: "Head Start" Storage Areas at Intersections	See Section 7.3.4 & Figure 7.18 - Shows the vehicle stop line 2.0m set back from the bike lane stop line. **(2.0m typical)**	
Bike boxes		Additional information available in VicRoads Cycle Note No. 5: "Head Start" Storage Areas at Intersections	See Section 7.3.4 - Head start and expanded storage boxes for various applications and design notes, and Figure 7.15b and 7.18 for design options.	
Two-stage left turn boxes			Some left turn options are discussed throughout the Section 7.3.1 and 7.3.6. Figure 5.14 illustrates two-stage crossing option.	
Median refuges			See Section 7.4 - Bicycle path mid-block road crossings - Figure 7.21 shows 2.0m min (2.5m preferred) median refuge to assist bicycle crossing where road has more than two traffic lanes or high volumes. See Figure 7.7 for refuge design. **(min 2.0m)**	
Roundabouts		Additional information available in VicRoads Cycle Note No. 15: Providing for Cyclists at Roundabouts	Section 7.2.6 - Bicycle lane at roundabouts and 7.27 Mixed traffic intersections - Figure 7.9 and 7.11 provide examples of recommended roundabout treatments at single lane roundabouts.	
Traffic circles		Additional information available in VicRoads Cycle Note No. 15: Providing for Cyclists at Roundabouts	Section 7.2.6 - Figure 7.8 provide examples of recommended roundabout treatments at small single lane roundabouts.	
Protected intersections			Section 7.3.6 - Discusses left-turn through-access at signals and Section 7.3.1 illustrates off-road bicycle paths at signals	
Intersection crossing markings		Refer to VicRoads Cycle Note No. 8: Providing for Cyclists at Signalized Intersections	See Section 7.2 and 7.3 - For recommendations throughout for specific intersection treatments	
Coloured pavement markings		Refer to VicRoads Cycle Note No. 14: Coloured Surface Treatments for Bicycle Lanes for guidance	See Section 8.1.3 - Use green surface colouring through intersection only when bicycle facility has priority over traffic movements from other directions. See notes on coloured pavement markings at intersections throughout Section 7.2 and 7.3.	
Signals				
Bicycle activated signals			Section 7.3 - Intersections with traffic signals - Design notes discuss signal activation button in a convenient location close to the crossing approach or holding line- Photo 7.6 and Figure 7.12	
Leading bicycle intervals			Section 7.3 - Intersections with traffic signals mention consideration on waiting times and coordination of crossing signals	
Separate signal phase			Section 7.3.1 - Discusses possible introduction of green bicycle phase, or use of slip lanes when passing through major intersections	
Bicycle specific signal heads			Section 7.3.1 - Discusses possible introduction of green bicycle phase. Figure 7.12 illustrates additional bicycle signal lamps, and photo 7.5 illustrates bicycle signal lamps.	
Intersection restrictions			See Section 6.5 - Preventing illegal vehicle access and Section 7 for general intersection treatments.	
Transit integration		Additional information available in VicRoads Cycle Note No. 19: Providing for Cyclists within Bus Lanes and Note 20: Providing for Cyclists at Bus Stops	See Section 5.1.3 - Bicycle lanes and bus lanes for application and design notes, and Section 11 Bicycle parking and access to public transport interchanges.	
Other				
Retrofitting streets for bicycle lanes		Additional information available in VicRoads Cycle Notes 09 and 18	See Section 8.1 - Surface treatments for bicycles	
Signage		Additional information available in various documents in VicRoads Cycle Notes	See Section 9 - Signage and network information	
Pavement markings		Additional information available in various documents in VicRoads Cycle Notes	See Section 8.1.3 - Use of coloured pavements, and 8.2 Line marking bicycle facilities	
Maintenance			See Section 10 - Maintenance and provision at worksites	
Wayfinding			See Section 9 - Signage and network information	

APPENDIX D

Detailed Design Guidelines - Pedestrian Facilities

Pedestrian Guidelines - TAC and North American Manuals

		Manuals and Guidelines							
Design Characteristics	**TAC Documents**	**TAC - Geometric Design Guide for Canadian Roads**	**TAC - Pedestrian Crossing Control Guide**	**North America**	**NACTO - Urban Street Design Guide**	**VeloQuebec - Planning and Design for Pedestrian and Cycling**	**Ontario OTM Book 15 Pedestrian Crossing Facilities**	**AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities**	
Pedestrian Facilities									
Sidewalks									
Width (Pedestrian Through Zone)		See Section 2.2.6.5 - The typical minimum clear sidewalk width is 1.5 m. Where the sidewalks are placed directly again the curb, the sidewalk width is normally increased by a min of 0.5m. 2.0m min near hospitals and nursing homes, 2.4m min in commercial areas, 3.0m min near bus bays **(min 1.5m typical min 3.0m commercial)**			See sidewalks pg. 37 - Prevailing design guidelines recommend a minimum sidewalk cross-section of 5 feet, exclusive of other amenities and large enough for two people walking side by side. Pedestrian through zone should be 8–12 feet wide in downtown or commercial areas. Where a sidewalk is directly adjacent to moving traffic, the desired minimum is 8 feet, providing a minimum 2-foot buffer for street furniture and utilities. **(min 1.5m typical, min 2.4m commercial)**	See pg. 67 - A minimum obstacle-free width of 1.5m is recommended for sidewalks, although 1.8m is more appropriate for ensuring comfort of pedestrians especially when there is no buffer **(min 1.5 m - 1.8 m)**		Section 3.2.3 pg. 58-59 - A minimum clear width of 1.2m with 1.5m passing spaces provided at reasonable intervals. Sidewalks in the central business district need 1.8m-2.4m with planting strip- otherwise 3.0m is desired. High pedestrian volumes prefers 3.0m-4.5m width. **(min 1.5m typical, min 1.8m commercial)**	
Surface Material						See pg. 66 - Sidewalks are generally made of concrete to distinguish them from asphalt roadways and the addition of granite curbing protects sidewalks from damage caused by snow clearing and de-icing operations		Section 3.2.10 pg. 64 - Preferred materials are Portland cement concrete and asphaltic concrete.	
Cross-Slope		See pg. 2.2.6.7 - The normal cross-slope on a sidewalk is 0.02 m/m (the typical acceptable range of cross-slope values is 0.01 m/m to 0.05 m/m - for pedestrian safety and in consideration of persons in wheelchairs or walking impairments, the normal sidewalk cross slope of 0.02 m/m should not be exceeded **(max 2%)**				See pg. 69 - Cross slope must be limited to 2% or even 1% where the concrete finish is smooth **(max 1% - 2%)**		Section 3.2.7 pg. 62 - Cross slope must not exceed 1V:48H (2%) - See also pg. 61-62 for guidance specific to driveways **(max 2%)**	
Buffered sidewalks		See pg. 2.2.6.1 - 2.2.6.2 for discussion on sidewalks with a boulevards: desirable boulevard widths on arterial streets are 3.0m on collector and local streets the width is 2.0m **(min 2.0m - 3.0m typical)**			See Sidewalk pg. 37 - The enhancement/buffer zone is the space immediately next to the sidewalk that may consist of a variety of different elements. These include curb extensions, parklets, stormwater management features, parking, bike racks, bike share stations, and curbside bike lanes or cycle tracks.	See pg. 70 - the width of the sidewalk buffer is determined based on the type of street. For low density residential streets it should be 1.5m. For medium density neighbourhoods it should be between 2.0 and 3.0 metres. And for high density areas, it should be 3.0 m or more. A minimum width of 1.5m is required for the installation off tree grates. (min 1.5m residential, min 2.0-3.0m medium to high density)		Section 3.2.3 & 3.2.4 pg. 58-59 - Ideal width is 1.8m without on-street parking or bike lane. Desirable landscape buffer widths at local streets: 0.6-1.2m, at major streets: 1.5-1.8m. See also pg. 68 **(min 0.6-1.2m residential, 1.5-1.8m commercial)**	
Furnishing Zone		See discussion on usable pedestrian space Section 3.3.2.2			See Sidewalks pg. 37 - The street furniture zone is defined as the section of the sidewalk between the curb and the through zone in which street furniture and amenities, such as lighting, benches, newspaper kiosks, utility poles, tree pits, and bicycle parking are provided. The street furniture zone may also consist of green infrastructure elements, such as rain gardens or flow-through planters.	Some mention of width and location of street furniture in Chapter 6 pg. 126-127		See also pg. 65 - Street Furniture and other obstacles for specific location details	

Pedestrian Guidelines - TAC and North American Manuals

		Manuals and Guidelines							
Design Characteristics	**TAC Documents**	**TAC - Geometric Design Guide for Canadian Roads**	**TAC - Pedestrian Crossing Control Guide**	**North America**	**NACTO - Urban Street Design Guide**	**VeloQuebec - Planning and Design for Pedestrian and Cycling**	**Ontario OTM Book 15 Pedestrian Crossing Facilities**	**AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities**	
Frontage Zone		See discussion on usable pedestrian space Section 3.3.2.2 - notes that the building face with window display reduces the usable pedestrian width by 0.9m.			See Sidewalks pg. 37 - The frontage zone consists of both the structure and the facade of the building fronting the street, as well as the space immediately adjacent to the building.			See pg. 59 - The provision of shy distance along building fronts is 0.6m **(0.6m typical)**	
Pathways									
Multi Use						See Chapter 4 - Minimum recommended width is 3.0 metres - design speed 30 km/h. Minimum walking width is 1.8 metres - Also has a section specific to pathways at intersections pg. 42 **(min 3.0m)**	Only definition provided	See pg. 55 Shared Use Paths - see AASHTO Guide for the Development of Bicycle Facilities. See also Section 3.2.14 pg. 70-71 Recommended paved with of 3.0m, with 3.6m recommended in areas with higher user volumes	
Pedestrian Only						See Chapter 4 pg. 30 - A pedestrian path must be at least 1.2m wide to accommodate two people walking toward each other in the opposite direction. For paths with heavier pedestrian traffic, a width of 1.8m is preferred. In terms of wheelchair accessibility a lane 0.9m wide is the recommended minimum, by 1.2m per lane allows for even greater freedom of movement. A total width of 2.1m lets a pedestrian and a wheelchair user cross paths with ease, while 2.4m is recommended to accommodate two wheelchairs travelling in the opposite direction **(min 1.2m)**			
Stairways		See Section 3.3.3 and pg. 3.3.3.1 - 3.3.3.3 - The minimum width of a stairway is normally 1.1m the max vertical rise without provision of a landing is normally 3.7m **(min 1.1m width, max 3.7m rise)**				See Chapter 4 pg. 32 - When the grade of a surface exceeds 8% over a 2m vertical drop or more and no alternative pathway is available, it is advisable to build successive flights of stairs, with 3 to 5 steps each and landings in between. If the grade exceeds 35% a continuous stairway is recommended		See Section 3.2.8 pg.63 - Must follow current ADAAG requirements	
Shared Spaces - ex. Woonerf					See Shared Streets - Residential or commercial	See Shared Roadways pg. 25 and pg. 72 re: woonerfs		See pg. 55 - Shared Streets description, directs readers to Pedestrian Facilities User Guide	
Intersections and Crossing Treatments									
Midblock Crossings			Throughout the document the recommended crossing types can be used at midblock crossings and at intersections.		See midblock crosswalks pg. 114 - Install a midblock crosswalk where there is a significant pedestrian desire line. Frequent applications include midblock, bus stops, and transit stations - include lighting, Stop lines at midblock crossings should be set back 20–50 feet, Stripe the crosswalk, regardless of the paving pattern or material, Medians or safety islands create a 2-stage crossing, consider raising the crosswalk **(6.0-15.2m stop line set back)**	Some discussion of mid block crossing and traffic calming on pg.109	Provides treatments that can be used at midblock crossings. See in particular Section 3.2.2	See Section 3.4 pg. 89-93	

Pedestrian Guidelines - TAC and North American Manuals

		Manuals and Guidelines							
Design Characteristics	**TAC Documents**	**TAC - Geometric Design Guide for Canadian Roads**	**TAC - Pedestrian Crossing Control Guide**	**North America**	**NACTO - Urban Street Design Guide**	**VeloQuebec - Planning and Design for Pedestrian and Cycling**	**Ontario OTM Book 15 Pedestrian Crossing Facilities**	**AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities**	
Crossing Channelized Turn Lanes		See Section 2.3.6.5 for traffic islands in general see pg. 2.3.6.11 - 2.3.6.12	Notes that the list of crossing treatments may be applicable for use at channelized turn lanes, but limited examples		See Major intersections pg.94 - notes that channelized right turns and other features create unsafe, high--speed turns. Recommends they be removed and replaced with extended curbs	See pg. 101 - An island separating the auxiliary turning lane from through-lanes can serve as a refuge for pedestrians, allowing them to cross the roadway in two stages	See Section 3.5 - There are two general approaches to pedestrian crossing treatments at right-turn channels. The area of a triangular island should be preferably 10 m2 (some agencies prefer 15 m2) however the acceptable minimum standards are:: • 4.5 m2 for urban intersections • 7.0 m2 for rural intersections	See pg. 78 - The pedestrian crossings should be at 90 degrees across the turn lane and placed where the motorists can easily see the pedestrian crossing ahead	
Intersection Crosswalks		See Section 2.3.14 Pedestrian Crossings at Grade - Crosswalk widths of 3.0 to 4.0m are typical in urban areas with significant pedestrian activity; widths less than 2.5 m are generally avoided. See Section 3.3.4.6 for pedestrian crossing treatments including material options and design elements **(3.0-4.0m commercial)**	The main focus of this document is on intersection crosswalks - See Section 2 and intersection layouts in particular to see how treatments can be used. Little information on widths or markings - information provided is specific to the intersection treatment options		See Crosswalks and Crossings pg. 109 - Conventional Crosswalks - Intersection crossings should be kept as compact as possible, facilitating eye contact by moving pedestrians directly into the driver's field of vision. Critical Stripe all signalized crossings to reinforce yielding of vehicles turning during a green signal phase. Critical Stripe the crosswalk as wide as or wider than the walkway it connects to. Critical High--visibility ladder, zebra, and continental crosswalk markings are preferable to standard parallel or dashed pavement markings. Critical - Accessible curb ramps are required. Recommended An advanced stop bar should be located at least 8 feet in advance of the crosswalk to reinforce yielding to pedestrians.	See pg. 98 - crosswalks are designated by pavement markings - A single white line on both sides of the crosswalk is all that is required by stands, wide perpendicular stripes painted along the crosswalk provide better visibility where there are no stop signs or traffic signals, white painted strips contrast well with black asphalt, also discusses decorative crosswalks	See Section 3.1.1 pg. 16-18 - Including chart outlining the decision process for selecting pedestrian crossing control at intersections. See also section 3.2.5.5	See Section 3.3.4 pg. 80-82 - The width for marked crosswalks should not be less than 1.8 m. In the central business districts of larger cities, a 3.0m or wider crosswalk may be more appropriate as determined by an engineering study. **(min 1.8m typical, min 3.0 commercial)**	
Crossing Distance		Some discussion about the importance of providing narrowing crossings, provides some alternatives to reduce crossing distance in section 3.3.2.3 and section 3.3.2.4	Throughout the document the importance of crossing distance is discussed as it is an important component of providing safe crossing and is determined by lane width. See pg. S2-11 & A-3		Discussed throughout - see curb extensions pg. 45 and street design principles particularly phases of transformation pg. 6	See Chapter 5 pg. 109-110 see also pg. 107 for traffic calming options that reduce roadway width at crossings points including a discussion on road diets	Crossing distance is an important component of this document and is discussed throughout, in terms of crossing treatments, signal timing, accessibility etc.	See Section 2.6.2 pg. 43-45 - For a general discussion on tools to decrease crossing distance. See also pg. 51 for information on roadway widths	
Raised Crosswalks					See midblock crossings pg. 114 see also Speed Table - should be accompanied by warning signs. Slopes should not exceed 1:10 or be less steep than 1:25. **(min 1:25 - max 1:10 slope)**	See pg. 99 - Noted as an alternative to curb cuts. Provide continuously even surface for pedestrians to walk on simultaneously slowing roadway traffic see also pg. 113	See pg. 52 - For general discussion on raised crosswalks	See pg. 45 - For general discussion on raised crosswalks	
Curb Extensions		See section 3.3.2.3 specific to widening the boulevard into the roadway at intersections re: Figure 3.3.2.2			See Curb Extension - A curb extension should generally be 1–2 feet narrower than the parking lane, recommended to combine curb extensions with stormwater management features such as bioswales or rain gardens **(0.3-0.6m narrower than parking lane)**	See pg. 107 - A curb extension 2.0m to 2.3m wide occupies the same amount of space as a parking lane and ensures a continuous path for cyclists **(2.0-2.3m)**	See pg. 51 - Curb extensions are typically installed on local or collector streets with urban cross-sections. Curb extensions are most appropriate with on street parking or where on-street parking is to be implemented. Minimum setbacks are recommended to ensure optimum sight distance.	See pg. 41 and 44 - For general discussion on curb extensions See also 3.3.2 pg. 74 on curb extension design, in general a curb extension should extend the width of the parking lane, approximately 1.8 m from the curb **(1.8m)**	

Pedestrian Guidelines - TAC and North American Manuals

		Manuals and Guidelines							
Design Characteristics	**TAC Documents**	**TAC - Geometric Design Guide for Canadian Roads**	**TAC - Pedestrian Crossing Control Guide**	**North America**	**NACTO - Urban Street Design Guide**	**VeloQuebec - Planning and Design for Pedestrian and Cycling**	**Ontario OTM Book 15 Pedestrian Crossing Facilities**	**AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities**	
Raised Intersections					See Intersections - Minor Intersections - Raised intersections pg. 96 - Raised intersections are flush with the sidewalk and ensure that drivers traverse the crossing slowly. Bollards along corners keep motorists from crossing into the pedestrian space. Bollards protect pedestrians from errant vehicles.	See pg. 108 - Grade of the elevation is based on target vehicle speed: 4% to 6% for target speed of 50km/h and up to 10% for 30km/h **(4-6% for 50km/h, max 10% for 30km/h)**		See pg. 45 - For description of raised intersections	
Median refuges		See some reference of median islands in Section 2.3.6.5 pg. 2.3.6.7 & 2.3.6.8 Larger islands (min 10m2) are required to accommodate requirements such as wheelchair ramps	Some discussion of raised refuges throughout see pg. S1-6, S2-3, S2-10, S3-4, A-4 as well as intersection layouts		See Pedestrian Safety Islands - pg. 116 Pedestrian safety islands should be at least 6 feet wide, but have a preferred width of 8–10 feet. Where a 6--foot wide median cannot be attained, a narrower raised median is still preferable to nothing. The minimum protected width is 6 feet, based on the length of a bicycle or a person pushing a stroller. The refuge is ideally 40 feet long. The cut--through or ramp width should equal the width of the crosswalk. **(min 1.8m wide, min 12.2m long)**	See pg. 99 and also pg. 108. - An island or median that is more than 1.5 m wide can also service as a refuge for pedestrians **(min 1.5m wide)**	See pg.49-50 - The smallest desirable island is one that has a minimum area of 20 m2. The refuge island area should be wide enough to accommodate a person pushing a stroller or walking a bicycle (with a child trailer attached) or at least 1.8 metres.	See pg. 75-76 - Depending on the signal timing crossing islands should be considered where the crossing distance exceeds 18.3m. The width of a newly constructed crossing island should be 1.8m or more to provide space for a wheelchair user.. Existing 1.2m medians may be retained but medians should be widened to 1.8m or more in recognition projects. Where practical, a width of 2.4m may be provided. See also pg.. 91 for median islands specific to midblock crossings **(min 1.8m wide)**	
Corner Radius		Not specific to pedestrians			See Corner Radii pg. 117- A smaller curb radius expands the pedestrian area, allowing for better pedestrian ramp alignment. Turning speeds should be limited to 15 mph or less. Minimizing turning speeds is crucial to pedestrian safety, as corners are where drivers are most likely to encounter pedestrians crossing in the crosswalk	See pg. 107 - A 3.0 metre radius is usually adequate in urban areas **(3.0m typical)**	Only discussed in terms of channelized right turn lanes pg. 55	See Section 3.3.1 pg. 73-74 Curb radii - where there is little turning truck traffic, it is recommended that a 3.0 to 4.5m street corer radius be used. Where there are trucks the turning radius may in increased **(3.0-4.5m typical)**	
Signals			See Section 2 for detailed discussion on the different types of pedestrian crossing control devices - including signals but also crossing control devices at unsignalized intersections		See Traffic Signals Section pg. 125	See pg. 93 for right of way and crossing treatments and signalized and un signalized intersections	See Section 3.2 pg. 18-40	See Section 4.1 pg. 101-109	
Pedestrian Activated Signals			See pg. S2-3 - This includes half signals but can also include other crosswalk features that are activated by pedestrians. Including special crosswalks		See Signalization Principles pg.126 - In coordination with traffic signal timing, designers must consider spacing between traffic signals, looking at desirable crossing intervals to achieve a pedestrian-friendly environment. Fixed time signals are recommended in urban areas	See pg. 94 - 96 - Pedestrian signals are used to indicate a specific phase for pedestrian or provide a longer clearance interval that is allotted to vehicles by the yellow light. See also pedestrian detection and traffic signal operations which outlines the differences between automatic mode, manual detection and active detection	See Section 3.2.2 pg. 27-29 - The control of pedestrian signals is by pedestrian actuated two phase operation; pedestrian signal indications are used for crossing the main street and regular traffic control signals on main roadway approaches. Both control types require that main road traffic be fully signalized, while for IPS crossings, the side road must be controlled with stop signs,	See Section 4.1.4 pg. 106-107 - Pedestrian signal controls should be located within reasonable proximity of the curb ramp - buttons for different crossings should be clearly indicated - pedestrians in wheelchairs should be able to operate the button (therefore should be a 0.9mx1.2m level ground surface centered on each control for a forward or side approach, as appropriate. To ensure the bar or button is mounted within allowable reach ranges a max height of 1.05m is recommended (max 1.05m height)	

Pedestrian Guidelines - TAC and North American Manuals

		Manuals and Guidelines							
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Pedestrian Countdown Timers			See pg. S2-3 - Devices provide a numeric countdown display that indicates the number of seconds remaining for a pedestrian to complete their crossing. The installation of these devices can provide pedestrians with more information to assist them with a safer crossing of the street. General benefits of pedestrian countdown signals include: (1) better information for pedestrians regarding the amount of time left to cross the street; and (2) better accommodation of mobility-challenged pedestrians. General disadvantages include: (1) provision of an accurate countdown for actuated phases; and (2) potential increase in collisions or conflicts due to drivers 'racing the phase termination'.			See pg. 94 & 95 - A countdown timer indicates the number of second that remain to complete the crossing	See Section 3.2.5.1 pg., 34-35 The standard elements of PCS consist of: • Numeric countdown display that is visible to pedestrians entering a crosswalk. • "Separate Countdown Housing" configuration, "Overlap / Countdown Side by Side" configuration or "Separate Countdown Housing with no Overlap" configuration. See Figure 13. • Standard application of the "WALK" symbol and "DON'T WALK" symbol indicators. • Optional PCS information sign, which may be installed adjacent to the pedestrian pushbuttons to inform pedestrians of the use of the Pedestrian Countdown Signal.	See pg. 104-106 re: pedestrian indications	
Audible Pedestrian Signal							See Accessible Pedestrian Signal pg. 36 and pg. 66 For comprehensive guidelines on APS applications, practitioners should refer to TAC's Guidelines for Understanding Use and Implementation of Accessible Pedestrian Signals, May 2008.	See pg. 108-109 for information regarding audible at pedestrian signal head, at pushbutton, vibrotactile and transmitted messages	
Leading Pedestrian Intervals					See Leading Pedestrian Interval pg. 128 - A Leading Pedestrian Interval (LPI) typically gives pedestrians a 3–7 second head start when entering an intersection with a corresponding green signal in the same direction of travel. Through and turning traffic are given the green light. Turning traffic yields to pedestrians already in the crosswalk. **(3-7 sec typical)**	See pg. 95 - refers to protected and unprotected pedestrian signals	See pg. 36 - A leading pedestrian interval is another form of an exclusive pedestrian phase. One form of application includes a walk indication (generally around 4 to 6 seconds in duration) provided in advance of the corresponding vehicle green indication to give pedestrians a head start on turning traffic. Plus additional information in Book 12	See Section 4.1.6 Pedestrian signals in a coordinated signal system	
Pedestrian Scrambles - Separate pedestrian phase						See pg. 95 - Scramble phase allows the simultaneous crossing of pedestrians in any direction	See exclusive pedestrian phase - pg.35-36 including example and important considerations		
Accessibility									
Curb Ramps		See pg. 2.2.6.7 - 2.2.6.9 for examples of slope and flares - max slope is 6%, preferred slope is 5% or less **(max 5-6% slope)**	Throughout the document it is noted that curb cuts and curb ramps are required at all crosswalks and intersections. See reference for Geometric Design Guide for Canadian Roads - for more details		While not given its own specific heading curb ramps and letdowns are recommended at all intersections and crossing locations - Accessible curb ramps are required by the Americans with Disabilities Act (ADA) at all crosswalks.	See Chapter 5 pg. 69 - includes driveway curb cuts as well as curb cuts at intersections. Curb cuts at intersections enable wheelchair users to transition from the sidewalk to the roadway. The grade of the ramp toward the roadway should be no more than 5% and the flared sides of the curb cut should not exceed a slope of 6%. See also pg. 99 **(max 5-6% slope)**	See Pg. 63-65 Curb ramp widths should be sufficiently wide to allow two persons in wheelchairs to pass easily. The minimum width of 1.5 m for curb ramp is prescribed in Clause 5.2.6 of Built Environment Standard. Also provides information on surfaces, running slope, cross slope, curb ramp siders etc.	See Curb Ramps re: Driveways pg. 60-62 Curb ramps are required and shown in all designs - See pg. 84-88 for curb ramp design	

Pedestrian Guidelines - TAC and North American Manuals

		Manuals and Guidelines							
Design Characteristics	**TAC Documents**	**TAC - Geometric Design Guide for Canadian Roads**	**TAC - Pedestrian Crossing Control Guide**	**North America**	**NACTO - Urban Street Design Guide**	**VeloQuebec - Planning and Design for Pedestrian and Cycling**	**Ontario OTM Book 15 Pedestrian Crossing Facilities**	**AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities**	
Wheelchair users		See pg. 2.2.6.3/2.2.6.7 on cross slopes the typical acceptable range of cross-slope values is 0.01m/m to 0.05m/m and pg. 2.2.6.6 on widths appropriate for wheelchair users See also 2.3.14.2 on accommodations for persons with disabilities **(1%-5% cross-slope)**	see note above		While not given its own section accommodating all street users including those in wheelchairs is the focus of this document - Accessible curb ramps are required by the Americans with Disabilities Act (ADA) at all crosswalks.	See Chapter 4 pg. 30 re: pathway width for wheelchair users see also Chapter 2 pg. 9-12 for additional considerations for wheelchair users and other pedestrians with disabilities see also Chapter 5 for sidewalk requirements and recommendations specific to wheelchair users	See Section 5 - pg. 63-67 Provides general information and directs readers to the legislative requirements for the Province of Ontario	See pg. 11-13; A minimum of 1.5m is needed for tow people in wheelchairs to pass one another. A network of sidewalks should be accessible to all users and meet ADA requirements. **(min 1.5m wide)**	
Transit Integration			Some general discussion on providing pedestrians access to transit facilities		Throughout the document there is discussion about the important of integrating pedestrians with transit. See also Transit Streets for considerations on streets with transit service see also Bus Stops and curb extensions	See Chapter 7 for some guidelines specific to walking and transit integration including access to transit stations and stops, sidewalk widths and comfortable waiting facilities	Some general discussion on the influence of transit on pedestrian infrastructure	See Section 3.2.5 pg. 60 for pedestrian amenity recommendations at transit stops	
Conflict Zones and Mixing Zones									
Driveways and alleyways		Some discussion of pedestrian related conflicts in Chapter 3.2 - but minimal. Driveways Section pedestrian considerations Section 3.2.9.12 pg. 3.2.9.14				Some discussion of cross slopes at alleyways pg. 69	Only discussed within the context of pedestrian refuge islands (pg. 50)	Section 3.2.6 pg.60-62 - maintaining a minimum 1.2m continuous path without exceeding a 2% cross slope **(min 1.2m wide, max 2% slope)**	
Shared Use Areas (Elephants Feet)									
Streetscape Guidelines									
Lighting		See Section on pedestrian lighting 3.3.5.3	Throughout the document it is noted that lighting is required at all crosswalks		Lighting is identified as being an important component of all intersections particularly midblock crossings	See Chapter 6 pg. 116-118	Some discussion of lighting in the context of pedestrian refuge islands pg. 49	see Section Traffic Calming on pg. 36, Section 3.1.5 pg.53	
CEPTED									
Street furniture		See Section 3.3.5 on examples of street furniture and other pedestrian amenities			Discussed as a feature that can enhance the pedestrian environment	See Chapter 6 pg. 125-127		See also pg. 65 Street Furniture and other obstacles for specific location details	
Street trees and landscaping		See Section 3.3.4 for landscaping and street trees recommendations and guidelines			See Sidewalks for discussion of street trees, requirements for spacing, slight distance, and clear zone recommendations	See Sidewalk Buffers pg. 70		See pg. 67-68 - trees with large canopies planted between the sidewalk and the street should generally be trimmed up so that the branches are above the sidewalk at least 2.1m high **(branches min 2.1m above sidewalk)**	
Aesthetic and architectural features		Some additional recommendations on features that can enhance the streetscape and the pedestrian environment Chapter 3.3			See interim design strategies for additional temporary design options such as parklets, interim public plazas	See Chapter 3 pg. 20 -25		See pg. 64-72	
Other									
Maintenance		Some maintenance considerations outlined in Section 3.3.5.6			Ensuring facilities are well maintained is a theme throughout	See Chapter 8 - For pedestrian facility maintenance including technologies and techniques	General discussion on maintenance throughout	See Section 4.3 for sidewalk maintenance and for accommodations for pedestrians when maintenance is being conducted	
Wayfinding		Some discussion on wayfinding and signage in Section 3.3.5.4				See Chapter 6 - Though most recommendations are specific to cycling		See Section 4.2 pg. 111-115 for general road signage and discussion on wayfinding and guide signs	

Pedestrian Guidelines - TAC and North American Manuals

		Manuals and Guidelines							
Design Characteristics	TAC Documents	TAC - Geometric Design Guide for Canadian Roads	TAC - Pedestrian Crossing Control Guide	North America	NACTO - Urban Street Design Guide	VeloQuebec - Planning and Design for Pedestrian and Cycling	Ontario OTM Book 15 Pedestrian Crossing Facilities	AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities	
Chicanes					See Curb Extensions pg.45 - Chicane - off set curb extensions - Recommended A chicane design may warrant additional signing and striping to ensure that drivers are aware of a slight bend in the roadway. Optional - Where application of a curb extension adversely impacts drainage, curb extensions may be designed as edge islands with a 1–2-foot gap from the curb.			See pg. 41 and pg. 43 for a description and general discussion of Chicanes	
Pedestrian Speed			See pg. S1-3 Walking speeds and distances, the value of 1.2m/s excludes about 40 percent of older pedestrians and pedestrians with walkers and canes **(1.2m/s typical)**			On flat surfaces, walking speed can be as slow as 0.3m/s for a mobility-impaired person and as fast as 2.4 m/s for someone who is walking fast. Generally speaking seniors and children tend to walk at speeds of 0.9-1.6m/s and adults at speeds of 1.2-2.1 m/s **(0.9-1.6 m/s seniors and children, 1.2-2.1 m/s adults)**	See pg. 24 - The calculation of pedestrian timing is based on crossing distance and pedestrian walking speed assumptions (that may vary between 0.9 m/s and 1.25 m/s).	See pg. 10-11 pedestrian walking speeds range from approximately 0.8 to 1.8m/sec. The MUTCD recommends a normal walking speed of 1.2m/sec for calculating pedestrian clearance intervals for traffic signals **(1.2 m/s typical)**	

Pedestrian Guidelines - Other

		Manuals and Guidelines		
Design Characteristics	**Other Documents**	**City of Edmonton - Complete Street Guidelines**	**City of Calgary - Complete Streets Guide**	**Pedestrian and Transit Oriented Design**
Pedestrian Facilities				
Sidewalks				
Width (Pedestrian Through Zone)		See Section 4.2.1 pg. 48-49 - Standard width in residential neighbourhoods 1.5m. Other (non residential) street oriented >1.8m. Other (non residential) non-street oriented 1.5m. Under constrained conditions residential 1.5m - Other (non residential) street oriented or non street oriented 1.5 m **(min 1.5m residentail, min 1.8m commercial)**	See pg. 32 - Separated sidewalks should be a minimum of 1.5m wide (all classifications) - Monolithic sidewalks should be a minimum of 2m wide for improved pedestrian safety and to provide adequate width for snow storage. Sidewalks wider than 2m should be provided along transit routes and connections to transit hubs, connections to schools and near pedestrian activity centres and ultimately determined based on surrounding land uses **(min 1.5m typical, min 2.0m transit routes)**	See pg. 40 - For strolling couples to pass one another without awkward maneuvering takes about 12 feet to clear - an extra 2.5 feet is required for a buffer. An additional 1 to 1.5 feet is required if buildings run up to the sidewalk and an additional 10-15 feet may be warranted at high volume transit stops **(min 3.7m - 4.0m wheelchair)**
Surface Material				
Cross-Slope				
Buffered sidewalks		See Section 4.2.1 pg. 48-49 discussion of the width of the furnishing zone which acts as a buffer for pedestrians (see furnishing zone)	See Chapter 3 - Streetscape Design - while it does not provide specific guidance it recognizes the importance of providing landscaping and furniture within the public realm that makes for a more comfortable and inviting environment	See pg. 45 - 47 minimum buffer/planting strip 2 feet where strips are provided; where not provided sidewalk should be 2 feet wider than normal. **(min 0.6 - 1.2m)**
Furnishing Zone		See Section 4.2.1 pg. 48-49 & 52-53 - Standard width in residential neighbourhoods >1.2m. Other (non residential) street oriented >1.2m. Other (non residential) non-street oriented >1.5m. Under constrained conditions residential 0.9m. Other (non residential) street oriented and non-street oriented 0.9 m **(min 0.9m constrained, min 1.2m - 1.5m residential)**	See pg. 27 for definition of furniture zone. See also pg. 67 in terms of public realm components, note the width of each zone depends on the land use and pedestrian activity levels.	See notes on sidewalk width
Frontage Zone		See Section 4.2.1 pg. 48-49 & 52-53 - Standard width in residential neighbourhoods 0.5 m. Other (non residential) street oriented 0.8 m. Other (non residential) non-street oriented 0.5m. Under constrained conditions residential 0.3 m. Other (non residential) street oriented 0.6 m - Other (non residential) non-street oriented 0.3 m **(0.5 - 0.8m typical, 0.3 - 0.6 constrained)**	See same as above and again pg. 27 for definition of frontage zone. See also pg. 67 in terms of public realm components	See notes on sidewalk width
Pathways				
Multi Use		See Shared use paths adjacent to Roadways Section 4.3.7 pg. 70 - Standard width 3.0m and constrained width 2.5m **(min 3.0m typical, min 2.5m constrained)**	See pg. 35 - Minimum permitted width is 3 metres **(min 3.0m)**	
Pedestrian Only				
Stairways				
Shared Spaces - ex. Woonerf				See pg. 45-46 Woonerf

Pedestrian Guidelines - Other

		Manuals and Guidelines		
Design Characteristics	**Other Documents**	**City of Edmonton - Complete Street Guidelines**	**City of Calgary - Complete Streets Guide**	**Pedestrian and Transit Oriented Design**
Intersections and Crossing Treatments				
Midblock Crossings		See Section 4.2.4 pg. 54 - Brief discussion of mid block crossings. See also pg. 96 Section 4.6.1	See pg. 30 - Midblock crossing should be used when the spacing between intersections is large, there is a need to connected uses on either side of the street, or there is an existing pedestrian route. Curb extensions should always be used in conjunction with mid-block crosswalks	Some general discussion on mid block crossing on pg. 41 & 42
Crossing Channelized Turn Lanes			See pg. 79 & 80 - document notes that right turn lanes should be avoided on livable streets and they are not conducive with pedestrian movements	
Intersection Crosswalks		See Section 4.2.4 pg. 54 - Brief discussion of mid block crossings. See also pg. 96 Section 4.6.1	See pg. 28-31 - Includes design principles for crossing the street and provides information about pavement markings. See Section 3.7 for intersection design.	Some general discussion on intersection crossings on pg. 41 & 45 - pedestrian crossing should be available every 300 feet - all approaches to signal or stop sign controlled intersections should have marked crosswalks to channel pedestrians to common crossing points.
Crossing Distance		See Section 4.2.2 - Curb Extensions	Throughout the document there are recommendations and guidance on how best to shorten the crossing distance see: Corner radii, curb extensions, and pedestrian refuges	There is a general discussion on narrowing crossing distance
Raised Crosswalks			See pg. 30 - For definition and guidance. See also pg. 47 where benefits of raised crosswalks are identified and pg. 48 where raised crosswalks are identified as appropriate measures used on residential and collector streets on roads with 2,000 - 8,000 vpd	See pg. 42 for general discussion on raised crosswalks
Curb Extensions		See Section 4.2.2 pg. 50-51 - Curb extensions occupy the area of the parking lane and are typically 2.2m x 6.0m (min) - Curb extensions require a 0.6 m offset **(min 2.2m x 6.0m)**	See pg. 29 - Where on-street parking is allowed, curb extensions should be considered to replace the parking lane at crosswalks. Curb extensions should be the same width as the parking lane where possible. On collector streets with traffic volumes less than 3,000 vpd and residential streets, a minimum pavement width of 7m between curb extensions should be maintained. Appropriate curb radius should be applied based on information in Section 3.7.2 pg.77 see corner radii and pg. 78 which is curb extension corner radii specific **(min 7.0m residential)**	See pg. 42 for general discussion on curb extensions
Raised Intersections			Identified as a traffic calming measure on pg. 47 and provides information of potential benefits	See pg. 42 for general discussion on raised intersections
Median refuges		See Section 4.1.4 pg. 40-41	See pg. 29-30 for raised crossing islands/medians - the minimum width of a crossing island is 1.8m. On higher speed roads a 45 degree bend to the right through the median will help orient pedestrians to the risk they are likely to encounter. **(min 1.8m wide)**	See pg. 42 for general discussion on raised medians or pedestrian crossing islands
Corner Radius		See Section 4.2.4 pg. 54	See pg. 77 and Section 3.7.2 - notes that smaller corner radii should be used whenever possible - must consider street classification and the land use/vehicle setting.	

Pedestrian Guidelines - Other

		Manuals and Guidelines		
Design Characteristics	**Other Documents**	**City of Edmonton - Complete Street Guidelines**	**City of Calgary - Complete Streets Guide**	**Pedestrian and Transit Oriented Design**
Signals				Very minimal discussion on pedestrian signals - see pg. 42-44
Pedestrian Activated Signals		See Section 4.2.4 pg. 54 for some general discussion on pedestrian signals and signal timing		See pg. 42 for general discussion on pedestrian activated signals. Notes that pedestrian delays at signalized intersections should be kept to a minimum.
Pedestrian Countdown Timers				
Audible Pedestrian Signal				
Leading Pedestrian Intervals		See Section 4.2.4 pg. 54 for some general discussion on pedestrian signals and signal timing		See pg. 43 for general discussion on leading pedestrian intervals
Pedestrian Scrambles - Separate pedestrian phase				Noted briefly on pg. 43
Accessibility				
Curb Ramps		Discussed as a requirement throughout	See pg. 29 and pg. 78	Some discussion of curb ramps and wheelchair users on pg. 44-45
Wheelchair users			See pg. 32 Two directional wheelchair ramps should be installed at all street intersection corners (if corner radii and catch basin locations permit). As a minimum, all arterial, livable, primary collector, collector and activity centre streets should have two wheelchair ramps at each corner See also pg. 26 and section 3.2.2 Access Design Standards	Some discussion of curb ramps and wheelchair users on pg. 44-45
Transit Integration		See Section 4.4 - Transit for information on bus stop location and accessibility, bus stop amenities, transit priority measures	See Section 3.4 Transit Design and considerations throughout	See pg. 32 regarding the location of transit routes. See also pg. 82 Attractive Transit Facilities.
Conflict Zones and Mixing Zones				
Driveways and alleyways			See Section 3.8 Access management for guidance on driveway and alleyway guidance on different types of street classifications	
Shared Use Areas (Elephants Feet)				
Streetscape Guidelines				
Lighting		See Section 4.2.3 pg. 52-53	See throughout See also pg. 23 - Travelled way lighting also pg. 31	See pg. 80-82 on the importance of pedestrian scale lighting
CEPTED				
Street furniture		See Section 4.2.3 pg. 52-53 and furnishing zone	Discussed throughout document	Some discussion of furniture throughout document
Street trees and landscaping		See Section 4.2.3 pg. 52-53 and furnishing zone	Discussed throughout document	See pg. 65-68 for street tree spacing and also Chapter 2
Aesthetic and architectural features		See Section 4.2.3 pg. 52-53 and furnishing zone	Discussed throughout document	See Chapter 2 - Urban Design Qualities re: Enclosure, transparency legibility see also Chapter 4 & 5
Other				
Maintenance			Discussed throughout the document	
Wayfinding				
Chicanes				
Pedestrian Speed				


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