Duncan Area Active Transportation Plan

Design Guide

April 2014

alta
PLANNING + DESIGN

Design Guidelines

1.1 Introduction

The purpose of the Duncan Area Active Transportation Plan Design Guidelines is to identify resources that are available to transportation professionals that will guide the planning, design, and implementation of safe, comfortable, and convenient pedestrian and cycling infrastructure. The guidelines build on existing local practice as well as current best practice in the region, nationally, and internationally. The resources used to compile these guidelines include:

- Transportation Association of Canada's (TAC) *Geometric Design Guide for Canadian Roads*, *Bikeway Traffic Control Guidelines for Canada*, and *Guidelines for the Design and Application of Bicycle Pavement Markings*
- British Columbia Ministry of Transportation and Infrastructure's (BC MOTI) *Manual of Standard Traffic Signs & Pavement Markings*.
- Guidelines from other Provinces and the United States, including the Association of State Highway and Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities*.
- The Capital Regional District's (CRD's) *Pedestrian and Cycling Masterplan* developed in 2010 that provides comprehensive guidelines for the planning and design of a range of bicycle and pedestrian facilities.
- The National Association of City Transportation Officials' (NACTO) (United States) *Urban Bikeway Design Guide* in 2011, which explores best practices for innovative bicycle and pedestrian planning.
- Guidance from Europe including the CROW *Design Manual for Bicycle Traffic*, published in 2007 provides.

A complete list of Design Guideline References is provided in **Appendix G**.

1.2 How to Use this Guide

These design guidelines are intended to provide a consistent and comprehensive reference for the implementation of walkway and bikeway networks in Duncan, North Cowichan and Cowichan Tribes lands.

The guide is structured to provide context to the planning considerations for pedestrian and bikeway facilities and provides specific guidance for various facility types. Each treatment is described in terms of its intended purpose, typical use, and intended benefits. An image is provided along with specific design guidance including minimum dimensions, typical clearances, etc. Reference to additional resources is also provided.

Throughout these guidelines, on-street measurements are taken from the edge of the gutter pan, rather than the edge of curb. Over time, the interface between the pavement surface and the gutter pan can form a lip that poses a hazard to cyclists if located within the bikeway. In addition, TAC and other design guidelines use dimensions exclusive of the gutter pan. Typically, gutter pans are approximately 0.2 metres wide to allow adequate drainage.

In a number of places, these design guidelines provide "minimum" and "recommended" dimensions. Whilst "recommended" dimensions are preferred, "minimum" dimensions provide tolerance for applications in constrained environments.

1.3 Guiding Principles

The following are key principles that should be considered in the planning of pedestrian and cycling facilities in both the public and private realm:

The walking and cycling environments should be safe. Sidewalks, multi-use trails, crossings, and cycling routes should be designed and built to be free of hazards and to minimize conflicts with external factors such as noise, vehicular traffic and protruding architectural elements as well as conflict between cyclists and pedestrians. Design should reflect the sustainable transportation hierarchy.

The pedestrian and cycling network should be accessible. Sidewalks, multi-use trails, and crosswalks should ensure the mobility of all users by accommodating the needs of people regardless of age or ability. Cyclists have a range of skill levels and facilities should be designed for the use of experienced and inexperienced cyclists to the greatest extent possible. In areas where specific needs have been identified (for example, near schools) the needs of appropriate types of pedestrians and cyclists should be accommodated.

The pedestrian and cycling network should connect to places people want to go. The pedestrian and cycling network should provide continuous direct routes and convenient connections between destinations, including homes, schools, shopping areas, public services, recreational opportunities and transit.

The walking and cycling environment should be clear and easy to use. Sidewalks, multi-use trails, and crossings should be designed so people, including those with or without mobility, sensory, and cognitive \ impairments, can easily find and navigate the route. All roads in Duncan, North Cowichan and on Cowichan Tribes land are legal for the use of bicyclists meaning that they should be designed, marked and maintained accordingly.

The walking and cycling environment should provide good places. Good design should integrate with, and support the development of complementary uses, and should encourage preservation and construction of art, landscaping, and other items that add public value. These components might include open spaces such as plazas, wayfinding, signing, courtyards, and squares and amenities including street furniture, banners, art, plantings and special paving, which, along with historical elements and cultural references, should promote a sense of place. Public activities should be encouraged and commercial activities such as dining, vending and advertising may be permitted when they do not interfere with safety and accessibility. A complete network of on-street bicycling facilities should connect seamlessly to the existing and proposed multi-use trails to complete recreational and commuting routes around Duncan.

Cycling and pedestrian improvements should be economical. Bicycle and pedestrian improvements should be designed to achieve the maximum benefit for their cost (capital and maintenance) as well as reduce reliance on more expensive modes of transportation. Where possible, improvements in the right-of-way should stimulate, reinforce and connect with adjacent development. Maintenance that minimizes should be considered as part of good design.

Design guidelines should guide the development of context sensitive solutions. Specific National and Provincial guidelines are identified in this document, as well as design treatments that may exceed these guidelines. It is recognized that statutory and regulatory guidance may change. For this reason, and others, the guidance and recommendations in this document are meant to complement the other resources considered during the design process. In addition, land use and other planning initiatives impact walkability and bikeability, and should complement the techniques outlined in this document.

1.4 Design Needs of Pedestrians

Pedestrian facilities should be designed to comfortably accommodate pedestrians and should consider expected types and volumes of pedestrians. High volume pedestrian include places like downtown recreational facilities, bus stops, and schools. Universal design and accessibility should be a priority – particularly where vulnerable and disabled pedestrians are expected. Pedestrian facilities should:

- Provide an unobstructed, continuous and safe circulation system that serves the same destinations as are served by the road system.
- Provide convenient access to local land uses and transit.
- Reduce motor vehicle speeds when in locations where pedestrians are expected. Motor vehicle/pedestrian crashes at 30 km/hr result in fatalities about five percent of the time, while collisions at 45 km/hr are fatal about 45 percent of the time and 85 percent of collisions at 60 km/hr result in death.
- Provide a buffer for pedestrians and adjacent properties from motor vehicle impacts such as volume, tail-pipe emissions and noise.
- Provide visual interest and support community interaction through open space and other public activity space achieved through details in design of public and private sides and buildings where they interact with public areas.
- Safely accommodate people of all ages and abilities.
- Support environmental goals through the integration of green infrastructure.
- Maximize the interaction between pedestrians and drivers, e.g. by maintaining effective sight lines at intersections and driveways. Additional pedestrian treatments for mixed-use streets are shown in **Table 4**.

Table 1. Treatments for Pedestrian Priority Areas

Element	Usage
Corridor Treatments	
Sidewalks	Both sides of street along all routes. Minimum clear width 1.8m 2.3m preferred, furnishing zone 1.0m. (page 5)
Boulevards	Recommended, particularly along major roads; 3.0m (arterial) or 2.0m (collector/local streets). (page 5)
Intersection Treatments (page 24 – 28)	
Marked crosswalks	Standard treatment at intersections.
Advance warnings	At marked crossings/pedestrian signals along collector and arterial roadways.
Raised median	At marked crossings/pedestrian signals along collector and arterial roadways.
In-street "yield to pedestrian" signs/flashers	At marked crossings along high pedestrian volume roads.
Curb extensions	At intersections with streets that have high motor vehicle speeds and/or volumes or poor visibility.
Median refuge islands	At intersections with streets that have high motor vehicle speeds and/or volumes.
Minimizing curb radii	Locations with high percentage of right-turning motor vehicle traffic and through-pedestrian traffic.
Parking control	At high-use locations, where on-street parking is allowed.
Advance stop bars	At high-use locations, where on-street parking is allowed.
Accessible curb ramps	At all intersections. Use with detectible warnings.
Bicycle/pedestrian traffic signals	At unsignalized locations where high numbers of pedestrians cross a major road, such as by a school or along a trail.
Pedestrian push-buttons	At all signalized intersections, if the pedestrian phase is not automatic. Automatic signals are recommended unless pedestrian presence is occasional.
Countdown signal	At all signalized intersections.
Audible pedestrian signal	At major intersections or where vulnerable pedestrian groups (young or elderly) are likely to cross.
Leading pedestrian interval	At major intersections or where vulnerable pedestrian groups (young or elderly) are likely to cross.
Pedestrian Elements	
Pedestrian scale lighting	Along all routes.
Pedestrian amenities	Along commercial corridors.
Yellow paint	To highlight curb drops or other areas that require pedestrian caution.

1.4.1 School Routes

School routes may receive priority to ensure safety of students. These routes should enhance the visibility of pedestrians and provide clear and convenient facilities that encourage appropriate use. Specific treatments may include: high visibility-crosswalks, in-pavement flashers, signage, warning beacons, etc.

1.1. Basic Sidewalk Design Summary

Design Summary

Attributes of well-designed sidewalks include the following:

- **Accessibility**: A network of sidewalks shall be accessible to all users.
- **Adequate width:** Two people should be able to walk side-by-side and pass a third comfortably, and different walking speeds should be possible. In areas of intense pedestrian use, sidewalks should accommodate the high volume of walkers.
- **Safety:** Design features of the sidewalk should allow pedestrians to have a sense of security and predictability. Sidewalk users should not feel they are at risk due to the presence of adjacent traffic.
- **Continuity:** Walking routes should be obvious and should not require pedestrians to travel out of their way unnecessarily.
- **Landscaping:** Plantings and street trees within the boulevard should contribute to the overall psychological and visual comfort of sidewalk users, and be designed in a manner that contributes to the safety of people.
- **Social space:** There should be places for standing, visiting, and sitting. The sidewalk area should be a place where adults and children can safely participate in public life.
- **Quality of place:** Sidewalks should contribute to the character of neighbourhoods and business districts.

A well-designed sidewalk provides plenty of pedestrian space.

Discussion

Sidewalks are the most fundamental element of the walking network, as they provide an area for pedestrian travel that is separated from vehicle traffic. Sidewalks are typically constructed out of concrete and are separated from the roadway by a curb or gutter and sometimes a landscaped boulevard. Sidewalks are a common application in urban and suburban environments.

Installing new sidewalks can be costly, particularly if drainage improvements such as undergrounding of roadside culverts and installation of curb/gutter are part of the design. However, fixing short gaps in an existing sidewalk network is important to maximize system continuity, and can be a relatively low-cost fix.

Guidance

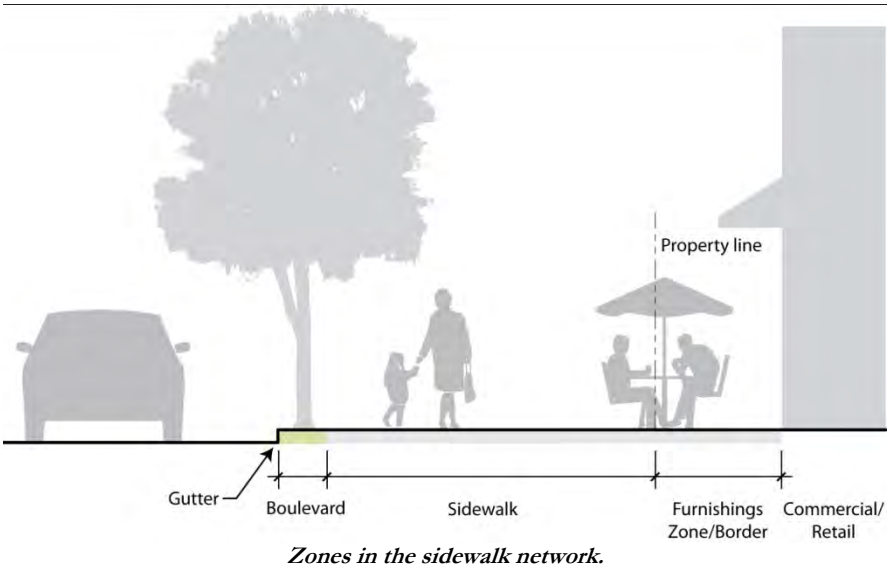
- United States Access Board. (2002). Accessibility Guidelines for Buildings and Facilities.
- United States Access Board. (2007). *Public Rights-of-Way Accessibility Guidelines* (PROWAG).

1.1.1. Zones in the Sidewalk Corridor

Design Summary

The sidewalk corridor is typically located within the public right-of-way between the curb or roadway edge and the property line. The sidewalk corridor contains four distinct zones, which have different purposes.

Recommended and minimum widths are provided following.



Zones in the sidewalk network.

Discussion

The Gutter Zone

Curbs prevent water in the street gutters from entering the pedestrian space, discourage vehicles from driving over the sidewalk, and make it easy to sweep the streets. In addition, the gutter helps define the pedestrian environment within the streetscape, although other designs can be effective for this purpose. At the corner, the curb is an important tactile element for pedestrians who are finding their way with the use of a cane.

The Boulevard Zone

The boulevard buffers pedestrians from the adjacent roadway, and is also the area where elements such as street trees, signal poles, utility poles, street lights, controller boxes, hydrants, signs, parking meters, driveway aprons, grates, hatch covers, and street furniture are properly located. This is the area where people alight from parked cars.

The Sidewalk Zone

The sidewalk is the area intended for pedestrian travel. This zone should be entirely free of permanent and temporary objects.

The Furnishing Zone/Border

The Furnishing Zone allows pedestrians a comfortable "shy" distance from the building fronts, in areas where buildings are at the lot line, or from elements such as fences and hedges on private property.

Guidance

- TAC *Geometric Design Guide for Canadian Roads*, Chapter 2.2: Cross Section Elements, section 2.2.6.1: Sidewalks, Boulevards, and Border Areas.

1.5 Design Needs of Bicyclists

Cyclist behavior, and speed, varies depending on the skill and experience of the cyclist. There are several ways to classify cyclists that are helpful in understanding the range of design parameters, although it is noted that these classifications change over time as more cyclists cycle more often and other interventions (such as a cycling instructional course) change a less confident cyclist to a more confident one. Bicycle infrastructure should be designed to accommodate as many user types as possible and may include parallel facilities that account for different cyclist types.

The following classification system has been adopted for these guidelines:

- **Strong and Fearless** (low percentage of population) – Characterized by bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists typically ride faster, prefer direct routes, and prefer on-street facilities – even if shared with vehicles – over separate, less direct and slower facilities such as multi-use trails.
- **Enthused and Confident** (5-10% of population) -This user group includes 'intermediate' cyclists who are comfortable riding on all types of bicycle facilities but typically prefer low traffic streets or multi-use trails when available. These cyclists may deviate from a more direct route in favour of a preferred facility type. This group includes all kinds of cyclists including commuters, recreationalists, racers, and utilitarian cyclists.
- **Interested but Concerned** (approximately 60% of population) – This user type makes up the bulk of the cycling population and represents cyclists who typically only ride a bicycle on low traffic streets or multi-use trails under favourable conditions and weather. These cyclists perceive significant barriers towards increased use of cycling with regards to traffic and safety. These cyclists may become "Enthused & Confident" with encouragement, education and experience.
- **No Way, No How** (approximately 30% of population) – Persons in this category are not cyclists, and have little to no interest in becoming cyclists or are physically unable to ride. This group is still important from the perspective of encouraging good driving behavior and greater awareness of cyclists as road users.

1.6 On-Street Bicycle Facility Typology

A range of bicycle facilities can be applied in various contexts, providing varying levels of protection or separation from automobile traffic. There are no 'hard and fast' rules for determining the most appropriate type of facility for a particular location; engineering judgement and planning skills are critical elements of this decision. However, consistent use of treatments and application of bikeway facilities allows users to anticipate whether they would feel comfortable riding on a particular facility, and plan their trips accordingly.

1.6.1 User Type Classification

Bikeway class indicates what types of users might feel comfortable on a particular bikeway facility. The Cycling in Cities Program at the University of British Columbia found that the most significant factors influencing bicycle use are motor vehicle traffic volumes and speeds.[1] The study also found that most cyclists have a preference for facilities that are separated from motor vehicle traffic or that are located on local roads with low motor vehicle traffic speeds and volumes. Because off-street pathways are physically separated from the roadway, they are perceived as safe and attractive routes for cyclists who prefer to avoid motor vehicle traffic. A stated preference experiment in Edmonton found that for the typical cyclist, one minute cycling in mixed traffic is as onerous as 4.1 minutes on bike lanes.[2]

The CRD design guidelines identify the following classes of facilities by user type:

- **Class 1 facilities** provide a high degree of separation between cyclists and motor vehicle traffic and which are comfortable for all users including recreational and inexperienced cyclists;
- **Class 2 facilities**, which provide a moderate degree of separation from motor vehicle traffic and offer enhanced traffic calming treatments on local roadways; and
- **Class 3 facilities** generally include on-street facilities with limited physical separation from motor vehicle traffic but which may appeal to commuter cyclists due to their route connectivity.

1.6.2 Levels of Facility Separation

Standards for classifying bikeway types are provided in the Transportation Association of Canada (TAC) *Bikeway Traffic Control Guidelines for Canada* (2010 Draft), *Geometric Design Guide for Canadian Roads*, and *MUTCD-Canada*. The variety of existing facility classifications used in the CRD and member municipalities was synthesized into the categories:

- *Multi-use trails* are physically separated from motor vehicles and provide sufficient width and supporting facilities to be used by cyclists, pedestrians, and other non-motorized users.

[1] http://www.cher.ubc.ca/cyclingincities/survey.html

[2] Hunt and Abraham (2007).

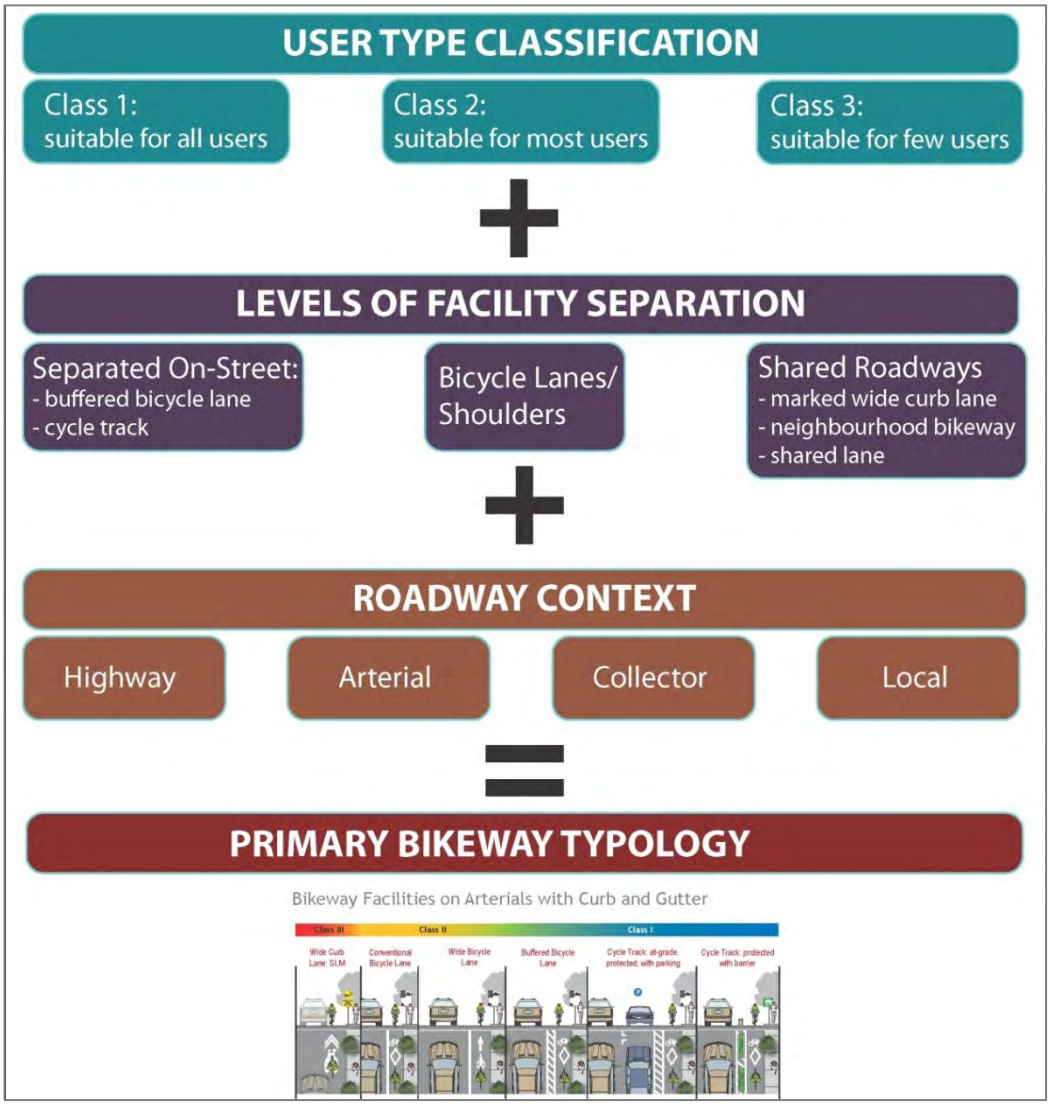
- *Separated on-street facilities* offer physical or spatial separation within the roadway corridor. Facility types include cycle tracks and buffered bicycle lanes.
- *Bicycle lanes/shoulders* are the most common bicycle facility type, providing a separate travel lane for cyclists.
- *Shared roadways* are facilities where cyclists share a single lane of traffic with automobiles, either side-by-side or queuing.

1.6.3 Roadway Context

Context describes conditions on the roadway. Many roadway factors impact the experience of cycling; automobile speeds and volumes, presence of heavy vehicles, trucks, or transit vehicles, roadway width, visibility, adjacent land uses, and urban or rural context all contribute to the context of a bikeway. While all these factors are important, the major indicators of the context are automobile speed and volume. In addition, urban or rural context affects engineering treatments appropriate on a particular roadway. Roadway classification indicates many of these context issues and provides guidance for what types of bikeway facilities are appropriate. Roadway widths may vary by type, but the following general widths are recommended. Width may be varied based on factors such as presence of frequent transit service and heavy truck traffic:

1.6.4 Bicycle Facility Typologies

These elements are combined to provide a typology for bicycle facility selection, as illustrated below.

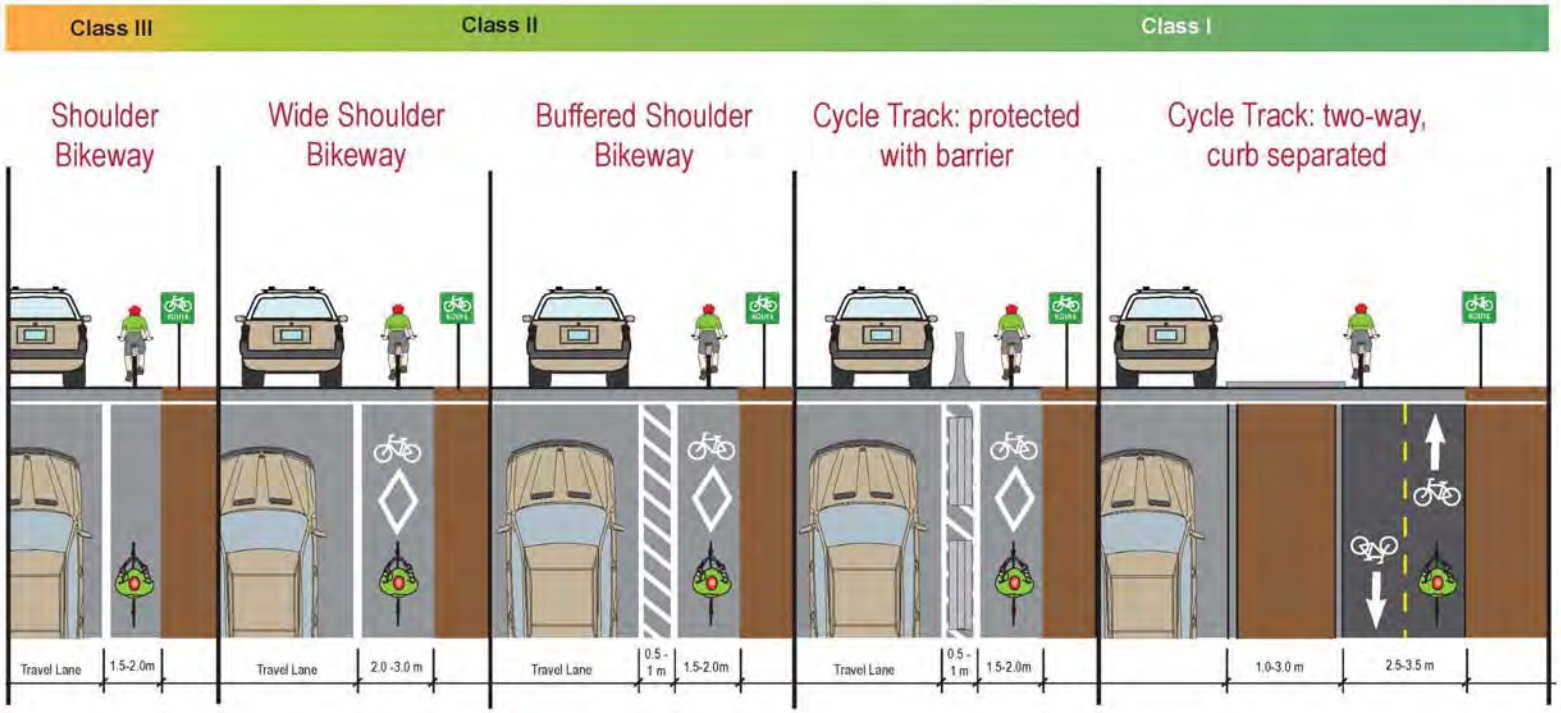


Bicycle Facility Classification

The following continua show the range of bicycle facilities that can be used on roads by classification. Engineering judgment, traffic studies, previous municipal planning efforts, community input and local context should be used to refine facility recommendations for a particular street. In some corridors, it may be desirable to construct facilities to a higher level of development than those recommended in this plan to enhance user safety and comfort. For example, in areas where a paved shoulder is the recommended facility type, there may be an opportunity to build a separated multi-use trail, providing greater separation from the roadway. In other

cases, the recommended level of separation is not warranted by motor vehicle speeds and volumes, and a lesser treatment may be acceptable.

Bikeway Facility Continuum: **Highways**



- Increases safety and promotes proper riding
- Reduces possibility that motorists will stray into bicyclists' path
- Visual reminder of bicyclists' right to the road
- Can include pavement markings and signs

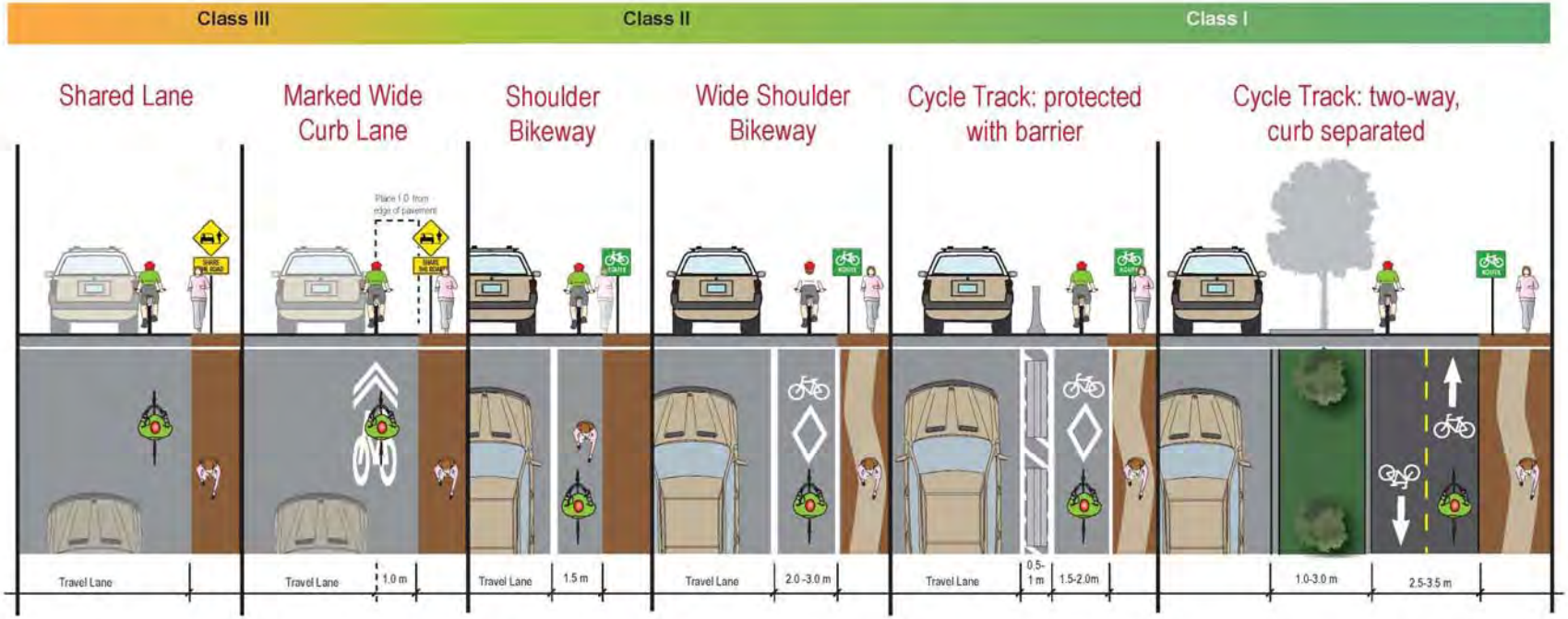
- Increases motorist shy distance from cyclists in the shoulder bikeway more than a conventional shoulder
- Includes pavement markings and signs to increase visibility
- Enables cyclists to pass each other and avoid obstacles without encroaching into the travel lane
- Shoulder bikeways wider than 3.0m may encourage vehicle parking or traveling in the lane

- Provides cushion of space to mitigate friction with motor vehicles
- Allows cyclists to pass one another without encroaching into the travel lane
- Increases motorist shy distance from cyclists in the shoulder bikeway
- Requires additional roadway space and maintenance

- Best used on roads with long distances between intersections and driveways
- Innovative bicycle-friendly design needed at intersections to reduce conflicts between turning motorists and bicyclists
- Maintenance of the cycle track requires specialized sweepers

- Sufficient separation between cyclists in cycle track and vehicles in the roadway
- Where cyclists may enter or leave the cycle track, and at intersections, the curb should be mountable with a small 45 degree ramp
- Provide safe transitions to bike lanes or popular destinations to reduce wrong-side riding
- A narrower buffer is appropriate to improve visibility of cyclists at intersections

Bikeway Facility Continuum: **Arterials without Curb & Gutter**



- No special accomodation for pedestrians
- "Share the Road" and /or "Bike Route" signs identify the road as a bikeway
- Not comfortable for many cyclists

- Visibly reminds motorists to expect bicyclists on the roadway
- Increases motorist shy distance from cyclists sharing a lane
- Not comfortable for many cyclists
- No specific accomodation for pedestrians

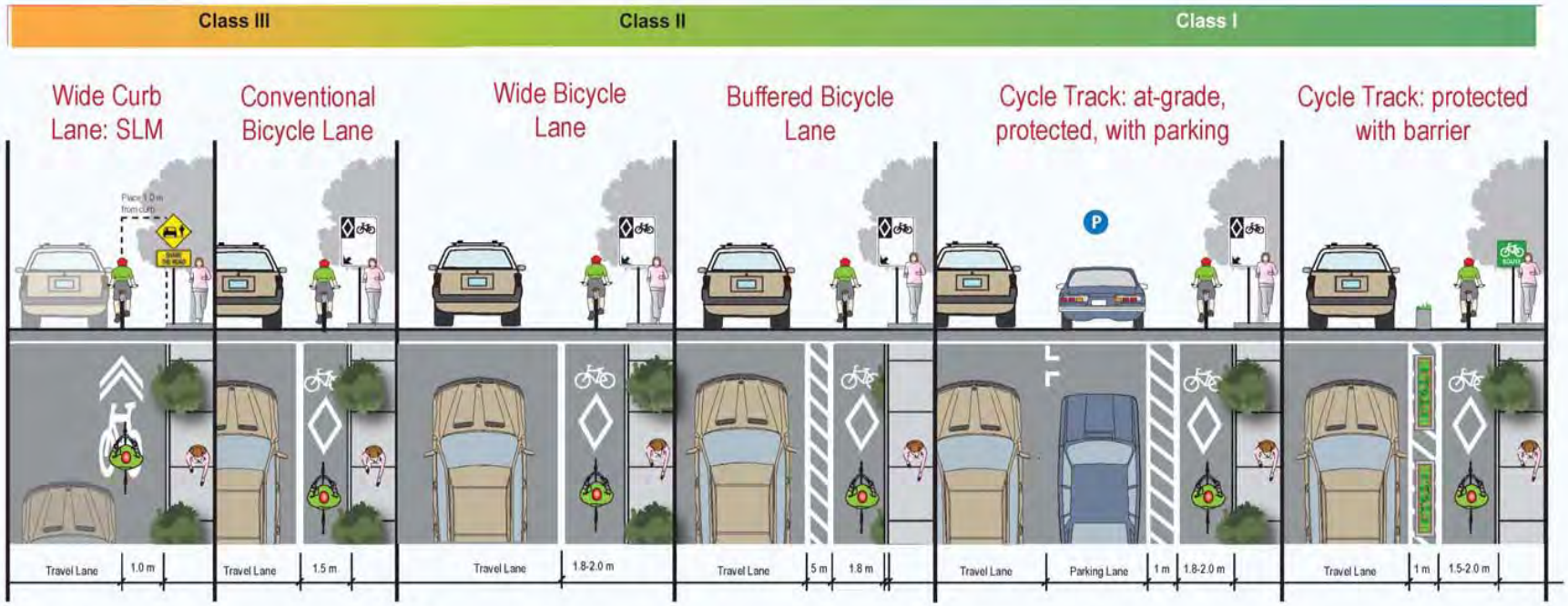
- Can be shared bicycle/ pedestrian space
- Reduces possibility that motorists will stray into bicyclists' path
- Visual reminder of bicyclists' right to the road
- Can include pavement markings and signs
- Can be used for emergency vehicle parking

- Increases motorist shy distance from cyclists more than a conventional shoulder; a buffer may be provided as well
- Enables cyclists to pass one another and avoid obstacles without encroaching into the travel lane
- Mark a shy line from the pavement end
- Can be used for emergency vehicle parking

- Can be shared bicycle/pedestrian space, ideally separated where high levels of use
- Best used on roads with long distances between intersections and driveways
- Innovative bicycle-friendly design needed at intersections to reduce conflicts between turning motorists and bicyclists
- Barrier options include extruded curb, jersey barriers, bollards, and grade separation.

- Can be shared bicycle/pedestrian space, or have a parallel softsurface pedestrian route
- Sufficient separation between cyclists in cycle track and vehicles in the roadway
- Where cyclists may enter or leave the cycle track, or where motorists cross at a driveway, the curb should be mountable with a small 45 degree ramp, allowing cyclist turning movements
- Provide safe transitions to bike lanes or popular destinations to reduce wrong-side riding

Bikeway Facility Contiuum: **Arterials with Curb and Gutter**



- "Share the Road" and /or "Bike Route" signs identify the road as a bikeway
- Shared lane markings increase safety and promote proper riding
- Reduces possibility that motorists will stray into bicyclists' path
- Visual reminder of bicyclists' right to the road

- Dedicated space for cyclists increases comfort and safety of cyclists
- Cyclists must encroach into the travel lane to pass one another

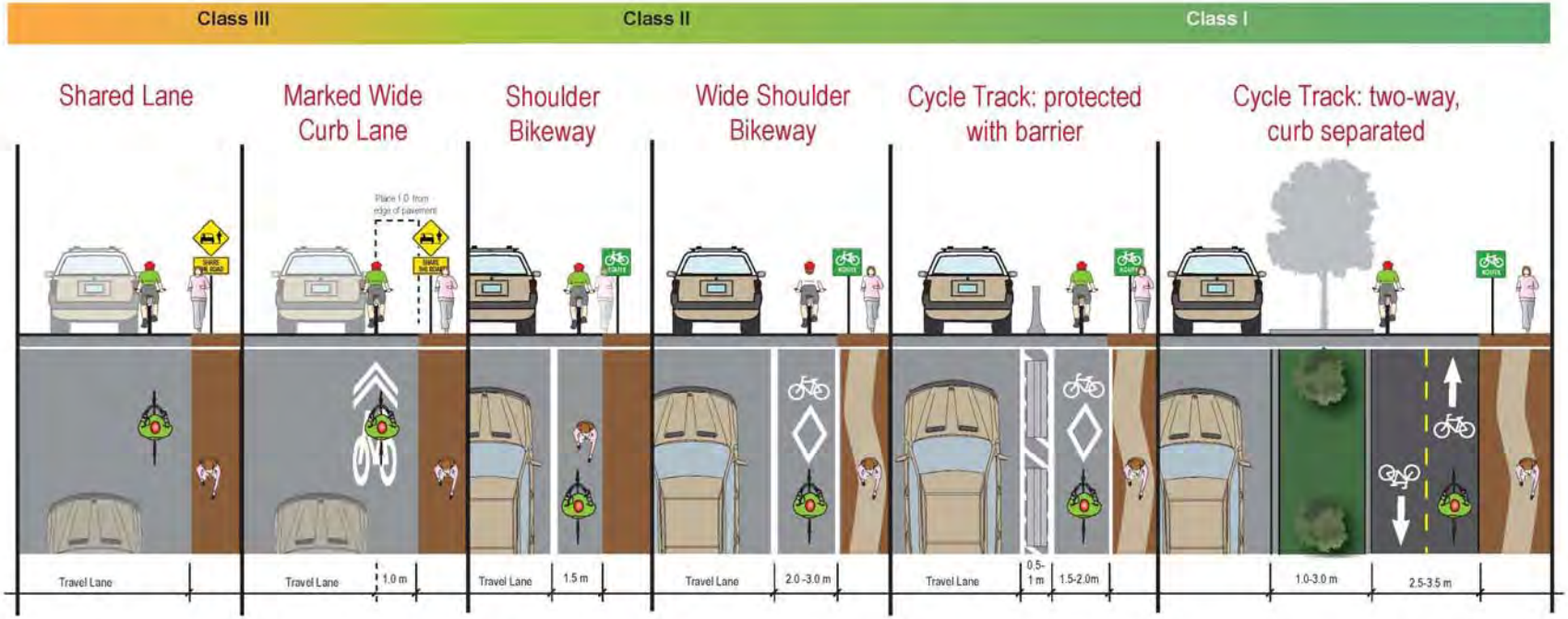
- Increases motorist shy distance from cyclists in the bike lane more than a conventional bike lane
- Enables cyclists to pass one another without encroaching into the travel lane
- Bike lanes wider than 2.0m may encourage vehicle loading in bike lane

- Provides cushion of space to mitigate friction with motor vehicles on streets with narrow bike lanes
- Allows cyclists to pass one another without encroaching into the travel lane
- Increases motorist shy distance from cyclists in the bike lane
- Requires additional roadway space and maintenance

- Dedicates and protects space for bicyclists and improves perceived comfort and safety
- Reduces risk of 'dooring' compared to a bike lane, and eliminates of the risk of a doored cyclist being run over by a motor vehicle
- Low implementation cost through use of existing pavement using parking lane as a barrier
- Apply along roadways with high motor vehicle volumes and/or speeds
- Best on streets with parking lanes that stay mostly occupied

- Barrier options include extruded curb, bollards, and grade separation.
- Best used on roads with high speeds and long distances between interesections and driveways
- Innovative bicycle-friendly design needed at intersections to reduce conflicts between turning motorists and bicyclists
- Maintenance of the cycle track requires specialized sweepers
- Width should never be taken from the pedestrian zone to make room for a cycle track

Bikeway Facility Continuum: **Arterials without Curb & Gutter**



- No special accomodation for pedestrians
- "Share the Road" and /or "Bike Route" signs identify the road as a bikeway
- Not comfortable for many cyclists

- Visibly reminds motorists to expect bicyclists on the roadway
- Increases motorist shy distance from cyclists sharing a lane
- Not comfortable for many cyclists
- No specific accomodation for pedestrians

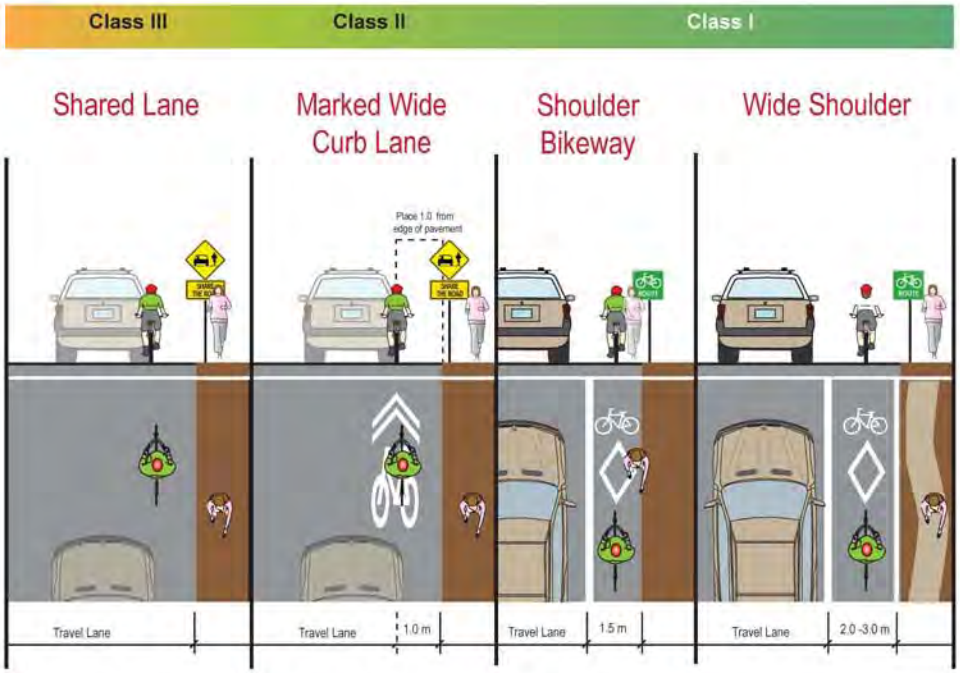
- Can be shared bicycle/ pedestrian space
- Reduces possibility that motorists will stray into bicyclists' path
- Visual reminder of bicyclists' right to the road
- Can include pavement markings and signs
- Can be used for emergency vehicle parking

- Increases motorist shy distance from cyclists more than a conventional shoulder; a buffer may be provided as well
- Enables cyclists to pass one another and avoid obstacles without encroaching into the travel lane
- Mark a shy line from the pavement end
- Can be used for emergency vehicle parking

- Can be shared bicycle/pedestrian space, ideally separated where high levels of use
- Best used on roads with long distances between intersections and driveways
- Innovative bicycle-friendly design needed at intersections to reduce conflicts between turning motorists and bicyclists
- Barrier options include extruded curb, jersey barriers, bollards, and grade separation.

- Can be shared bicycle/pedestrian space, or have a parallel softsurface pedestrian route
- Sufficient separation between cyclists in cycle track and vehicles in the roadway
- Where cyclists may enter or leave the cycle track, or where motorists cross at a driveway, the curb should be mountable with a small 45 degree ramp, allowing cyclist turning movements
- Provide safe transitions to bike lanes or popular destinations to reduce wrong-side riding

Bikeway Facility Continuum: **Collectors without Curb & Gutter**



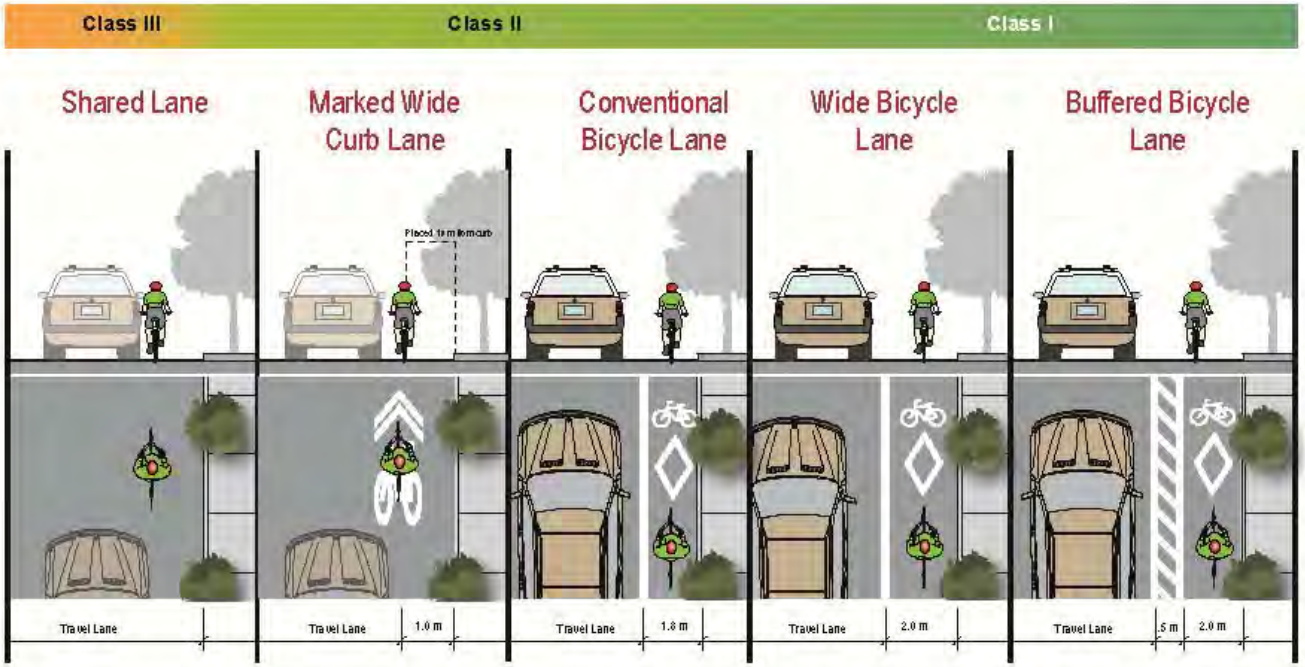
- No special accomodation for pedestrians
- "Share the Road" and /or "Bike Route" signs identify the road as a bikeway
- Not comfortable for many cyclists

- Visibly reminds motorists to expect bicyclists on the roadway
- Increases motorist shy distance from cyclists sharing a lane
- Not comfortable for many cyclists
- No specific accomodation for pedestrians

- Can be shared bicycle/pedestrian space
- Reduces possibility that motorists will stray into bicyclists' path
- Visual reminder of bicyclists' right to the road
- Should include pavement markings and signs
- Can be used for emergency vehicle parking

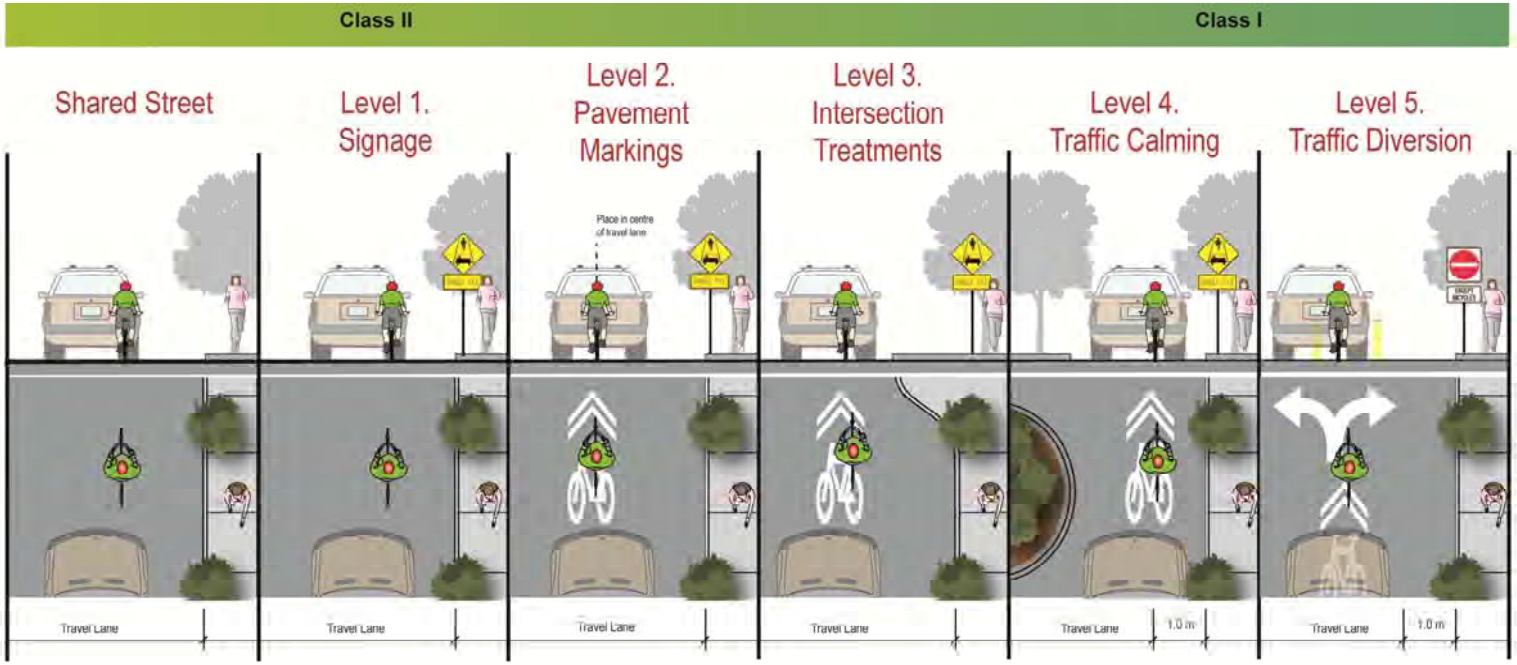
- Dedicated space for cyclists and pedestrians
- Increases motorist shy distance from cyclists more than a conventional shoulder
- Enables cyclists to pass one another and avoid obstacles without encroaching into the travel lane
- Mark a shy line from the pavement end
- Can be used for emergency vehicle parking

Bikeway Facility Continuum: **Collectors with Curb and Gutter**



- No specific bicycle accomodation
- Increases safety and promotes proper riding
- Reduces possibility that motorists will stray into bicyclists' path
- Visual reminder of bicyclists' right to the road
- Can be used with on-street parking; place 3.4 m from curb where parking is present
- Increases safety and promotes proper riding
- Reduces possibility that motorists will stray into bicyclists' path
- Visual reminder of bicyclists' right to the road
- Can be curb-tight or adjacent to on-street parking. Where parking is permitted, the lane should be at least 1.5m due to conflicts with car doors
- Increases motorist shy distance from cyclists in the bike lane more than a conventional bike lane
- Enables cyclists to pass one another without encroaching into the travel lane
- Bike lanes wider than 2.1m may encourage vehicle loading in bike lane
- Provides cushion of space to mitigate friction with motor vehicles on streets with narrow bike lanes
- Allows cyclists to pass one another without encroaching into the travel lane
- Increases motorist shy distance from cyclists in the bike lane
- Requires additional roadway space and maintenance

Bikeway Facility Continuum: **Local Streets** (with or without curb & gutter)



- No specific bicycle accomodation, although many cyclists feel comfortable riding on local streets
- Warning signs inform cyclists that they are on a designated bicycle route and remind motorists to watch for cyclists
- Wayfinding signs provide valuable information for cyclists about key destinations and route finding. They also create a coherent identity for the regional bikeway network
- Encourages cyclists to take the lane on streets that are too narrow for an automobile to pass a cyclist within the travel lane
- Highlights that the roadway is intended for use by cyclists and that automobiles must pass with caution
- At a minimum, stop-control all intersections; preferably stop cross traffic
- At minor intersections, use curb ramps, pavement markings, and bicycle forward stop bars to increase visibility of cyclists
- At intersections with larger streets, provide medians, refuge islands, or bicycle-actuated half-signals
- Reduces vehicle speeds so they generally match cyclists' operating speeds (20-25 kmh), enabling motorists and cyclists to safely co-exist on the same facility
- Treatments include chicanes, mini traffic circles, and speed humps
- Maintains through-bicycle travel on a street while physically restricting through-vehicle traffic
- Reduces motor vehicle volumes on the bikeway

1.7 Bicycle and Pedestrian Facility Reference

1.7.1 On-Street Bicycle Facilities

Facility Type	Example	Discussion	Design Summary	Guidelines
Cycle Track		Cycle tracks provide space that is exclusively or primarily for bicycles, and are separated from motor vehicle travel lanes, parking lanes and sidewalks. Cycle tracks provide the following benefits: Increased comfort for bicyclists Fewer conflicts between bicycles and parked cars as cyclists ride outside the door zone	*One-way:* 1.5-2m track width 0.5 -1.0 m buffer zone width *Two-way:* 2.5-3.5m track width 1-3m buffer zone width Improve visibility at intersections Separation options: pavement markings/ colouring, bollards, curbs/ medians or a combination Sign with TAC sign IB-23	CRD Section 1.5.1 NACTO p 58-104 Alta Planning + Design CROW Guide Vélo Québec
Buffered Bicycle Lanes		Buffered bike lanes increase the space between the bike lanes and the travel lane or parked cars. Buffered bike lanes provide: Greater separation between cyclists and motor vehicles Additional space for cyclists to avoid door openings Space for cyclists to pass one another without encroaching into the travel lane	1.5-2.0m Bicycle lane width 0.5-1.0m Buffer width Green paint can be used to increase visibility and highlight that the space is intended for bicycle use Use only where posted speeds do not exceed 100km/hr Sign with TAC sign RB- 90	CRD Section 1.5.2 NACTO p 18-30 City of Portland, OR

Facility Type	Example	Discussion	Design Summary	Guidelines
Standard Bicycle Lane		Bicycle lanes are separated from vehicle travel lanes. Bicycle lanes can increase safety and improve road user etiquette by: Defining road space for bicyclists and motorists Discouraging cyclists from riding on the sidewalk Reminding motorists that cyclists have a right to the road	Recommended width: 1.8 m Min width : 1.4m Where volumes > 6,000 AADT or if trucks >10% of traffic volumes: 2.0 m If speed >=100 km/h on rural highways: 2.5 m Use a bicycle symbol and diamond symbol Sign with TAC sign RB- 90	CRD Section 1.6.2 NACTO p 4-17 TAC *Geometric Design* & *Bikeway Traffic Control*
Shoulder Bikeway		Shoulder bikeways are paved roadways with striped shoulders wide enough for bicycle travel. Shoulder bikeways are appropriate in rural areas on roads without curbs and gutters. They can discourage parking on the side of the roadway if signed and enforced. Separated pedestrian pathways may also be provided.	Min: 1.5 m wide recommended; 1.2 m accepted If speed ≥ 70 km/h and volumes >5,000 AADT: 2.0 m If speed ≥80 km/h and volume >10,000 AADT: .2.5 m Highways: 3.0 m preferred May use "Share the Road" sign (TAC WC-47 & WC-47S) and/or "Bike Route" signs (TAC sign IB-23) May include pavement markings	CRD Section 1.6.1 BC MOTI TAC *Geometric Design* Sections 3.4.3.2 & 3.4.6.2
Marked Wide Curb Lane		Wide curb lanes are marked with high-visibility shared lane markings ("sharrows"), which help position bicyclists within the travel lane. These markings are often used on streets where dedicated bicycle lanes are desirable but are not feasible due to physical or other constraints.	Use on roads with speeds < 60 km/h and lane widths >4.0m Place marking 3.5 m min from face of curb on streets with on-street parking or >1.0 m from face of curb on streets without on-street parking Place markings after an intersection, 10 m before the end of the block, and at intervals <75 m Sign with "Share the Road" signs (TAC signs WC-47 & WC-47S); and "Bike Route" signs (TAC sign IB-23)	CRD Section 1.7.1 NACTO p 273-287 TAC *Bikeway Pavement Markings*

Facility Type	Example	Discussion	Design Summary	Guidelines
Shared Lane		Designated 'shared routes' are bikeways where cyclists and motorists physically share a standard travel lane, often with insufficient space for the automobile to pass a cyclist without merging into the opposite lane. They are indicated with signs and few other treatments.	Min width for unmarked parking/travel lane: 4m Sign with "Bike Route" signs (TAC sign IB-23) Can include pavement markings, wayfinding, or 'Share the Road" signs (TAC WC-47 & WC-47S)	CRD Section 1.7.2 TAC *Geometric Design*
Neighbour-hood bikeway		Neighbourhood bikeways ("bicycle boulevards" or "local street bikeways") are low-volume streets where motorists and bicyclists share the same space. Basic treatments include pavement markings and signs. Traffic calming and diversion treatments can also be used to reduce vehicle speeds or volumes.	Use "Bike Route" (TAC sign IB-23)and wayfinding signs Use shared lane markings Use traffic calming treatments to maintain low speeds (< 50 km/h). Treatments include speed humps, traffic circles, curb extensions, etc. Use traffic diversion to maintain low motor vehicle volumes (<3,000 vpd, ideally <1,500 vpd). Minimize delay for bicyclists and provide safe and convenient street crossings.	CRD Section 1.7.3 NACTO p 239-254 and pending Alta Planning + Design and IBPI – Bicycle Boulevard Design Guidebook City of Berkeley

1.7.2 Intersection Design Guidelines

Facility Type	Example	Discussion	Design Summary	Guidelines
Bike Boxes		Bike boxes allow bicyclists to move to the front of the traffic queue on a red light and proceed first when that signal turns green. Motor vehicles must stop behind the white stop line at the rear of the bike box. Bike boxes are used to reduce conflicts between right-turning motorists and cyclists continuing straight through the intersection.	Minimum depth: 2.75 m. Recommended depth: 4.0 m deep to allow for bicycle positioning. Right turns on red should be prohibited.	CRD Section 1.6.2.8 NACTO p 106-121
Coloured Bicycle Lanes at Conflict Areas		Coloured bicycle lanes can be extended through the bicycle/vehicle conflict zone (e.g., at intersections or merge areas) to increase visibility and warn motorists to expect bicyclists.	Bicycle lane pocket min width: 1.2 m; 1.5 m preferred Use coloured pavement through entire merge area Dashed lines can be used to indicate that automobiles are crossing the bicycle lane	CRD Section 1.6.2.10 NACTO p 254-272 TAC *Coloured Bike Lanes* Portland Office of Transportation
Shared Bicycle/ Right Turn Lane		The shared bicycle/right turn lane places a standard-width bicycle lane on the left side of a dedicated right turn lane. A dashed strip delineates the space for bicyclists and motorists within the shared lane. This treatment includes signage advising motorists and bicyclists of proper positing within the lane.	Min shared lane: 3.7 m Min pocket bicycle lane: 1.2 m; 1.5 m preferred Shared lane markings can indicate cyclists' route Colouration can be used (see above)	CRD Section 1.6.2.9 NACTO p 181-109 TAC *Coloured Bike Lanes Simulator Testing Report*

Facility Type	Example	Discussion	Design Summary	Guidelines
Bicycle and Pedestrian Traffic Signals		All demand-responsive signals, particularly those along designated bikeways, should be capable of detecting bicyclists and pedestrians. Signal enhancements can include audible and countdown signals and leading pedestrian intervals bicycle detection/and or push buttons.	Pedestrian phases can be triggered with automatic signals or push buttons Bicycle actuation includes loop detectors, cameras, and push-buttons	CRD Section 3.8 -3.9 NACTO p 204-237 ITE *Guidance for Bicycle—Sensitive Detection and Counters*
Accommodating Bicyclists at Roundabouts		Research indicates that while single-lane roundabouts may benefit bicyclists and pedestrians by slowing traffic, multi-lane roundabouts may present greater challenges and significantly increase safety problems for these users. Truck apron can provide adequate clearance for longer vehicles.	25 mph maximum circulating design speed. Design approaches/exits to the lowest speeds possible. Signing to encourage bicyclists navigating the roundabout like motor vehicles to "take the lane." Provide separated facilities for bicyclists who prefer not to navigate the roundabout on the roadway	AASHTO. (2012). Guide for the Development of Bicycle Facilities. TRB. (2010). Roundabouts: An Informational Guide, Second Edition. NCHRP 672

Pedestrian Facilities

Facility Type	Example	Discussion	Design Summary	Guidelines
Sidewalks		Sidewalks provide an area for pedestrian travel that is separated from vehicle traffic. Sidewalks are typically constructed out of concrete and are separated from the roadway by a curb or gutter and sometimes a landscaped boulevard. Sidewalk clear width is exclusive of the curb and obstructions. Recommended widths enable two pedestrians to walk side-by-side or to pass each other comfortably.	Sidewalk zone clear widths: o Local roads: 1.5 m min o Major roads: 1.8 to 2.4 m o Highways and downtown roads: 2.4 to 3.7 m o Increase by 0.5 m+ where sidewalks are curb-tight or near hospitals and nursing homes Planting strip: 1.2 m on highways; 0.4 m on major roads Sidewalk surfaces should be smooth and continuous	Duncan OCP Bylaw 8.4.5 and Appendix 6 CRD Section 2.2 TAC *Geometric Design Guide* United States Access Board
Marked Crosswalks		Marked crosswalks improve visibility of pedestrians crossing the street and direct pedestrians to optimal crossing locations. Crosswalk enhancements can improve visibility through high-visibility markings, flashing lights, advance warning signs, or a raised median. At long intersections, reduce crossing distance with curb ramps and minimize vehicle turning radii.	Intersection frequencies: o 60 – 90 m where blocks are longer than 120 m o Generally not more frequent than 45 m o Do not prohibit for more than 120 m Use zebra striping to increase visibility, such as at a school	CRD Section 3.1 TAC *Geometric Design Guide* MoTI *Pedestrian Crossing Control Manual*

Facility Type	Example	Discussion	Design Summary	Guidelines
Curb Ramps (let-downs)		Curb ramps allow all users to make the transition from the street to the sidewalk. A sidewalk without a curb ramp can be useless to someone in a wheelchair, forcing them back to a driveway and out into the street for access.	• Every ramp should have a landing at the top and at the bottom and be flush with the pavement • Ramp slope1:10 min; 1:15 preferred • Cross slope no more than 1:20, with 1:50 preferred.	Duncan OCP Appendix 6 North Cowichan OCP p. 158 CRD Section 3.6 Standards Council of Canada TAC *Geometric Design Guide* United States Access Board
Curb Extensions (curb bulbs)		Curb extensions minimize pedestrian exposure by shortening crossing distance and give pedestrians a better chance to see and be seen before committing to crossing. They can be used as bus stop locations to improve safety for transit riders.	Extend across the parking lane; stop 30 cm short of the parking zone to provide a space for bicyclists Can be used on one crossing or both Provides space for pedestrian amenities, plantings, and bio swales	CRD Section 3.3 Standards Council of Canada TAC *Geometric Design Guide* United States Access Board
Pedestrian Refuge Islands		Median refuge islands help improve safety by providing a space for pedestrians and cyclists to wait while crossing, allowing users to gauge safe crossing of one direction of traffic at a time. They also act as traffic calming by narrowing lanes and can be used to divert motor vehicle traffic, as in a neighbourhood greenway treatment.	Use where the cross-street is >15 m wide or >4 travel lanes Can be used where distance is less to increase available safe gaps. Use at signalized or unsignalized crosswalks Make accessible, preferably with an at-grade passage through the island rather than ramps and landings	CRD Section 3.3 Standards Council of Canada TAC *Geometric Design Guide* United States Access Board

Facility Type	Example	Discussion	Design Summary	Guidelines
Transit Stop Guidelines		Accessible bus stops ensure that all people can use the bus system. On routes where bi-directional service is provided (as opposed to a loop route), an accessible inbound stop should correspond to nearby accessible outbound stop. A stop should not be deemed fully accessible until this can be achieved.	Min:1.28 m wide x 2.4 m to 3.525 m Maintain 2.1 m by 1.98 m clear for the transit stop-waiting pad to accommodate wheelchair ramp deployment from the bus and to allow for wheelchair movement after clearing the ramp Provide 1.5 m wide paved connections from waiting pad to the sidewalk	CRD Section 2.3 BC Transit Municipal Systems Program

1.7.3 Multi-Use Trail Design Guidelines

Facility Type	Example	Discussion	Design Summary	Guidelines
General Multi-Use Trails		Multi-use trails serve bicyclists and pedestrians and provide attractive routes away from other roadways and/or connecting to major destinations. Elements that enhance multi-use trail design include: Providing frequent access points with directional signs directing users Limiting the number of at-grade crossings with streets or driveways and providing crossing treatments to reduce delay and increase safety Whenever possible, and especially where heavy use can be expected, separate bicycle and pedestrian ways should be provided to reduce conflicts	Min for 2-way multi-use trail: 3.0 m (only recommended for low traffic situations) Min desired:.4.0 m Provide 60 cm+ shoulder on both sides; clear vegetation well beyond that distance to maintain sight lines Clearance to overhead obstructions: 2.5 m min, 3.6 m recommended Min design speed: 30 km/h	CRD Section 4.2 BC Parks *Trail Design and Construction Standards Manual* FHWA. *Designing Sidewalks and Trails for Access*

Facility Type	Example	Discussion	Design Summary	Guidelines
High-Use Trails		As cycling and walking increase in popularity, conflicts can arise between faster-moving bicyclists and slower bicyclists, as well as pedestrians and other users. To mitigate these issues, provide a separate (adjacent) pedestrian path, stripe a centerline, and/or post trail etiquette signage. Trail capacity is based on expected use (e.g., destinations served and population adjacent to the trail), terrain, and types of users expected.	High concentrations of multiple users: .6.0 m^+ recommended Stripe a centerline to divide users Provide a separate ped. path adjacent to the main path Post trail etiquette signs	CRD Section 4.2.1 BC Parks *Trail Design and Construction Standards Manual* FHWA. *Designing Sidewalks and Trails for Access*
Soft surface Trails		In locations where environmental sensitivity or the characteristics of the trail environment do not make a paved trail appropriate, many options exist for soft-surface trails. Soft surfaces such as gravel and dirt are less jarring on the joints than concrete.	Width: 30 to 90 cm Maintain clear area of 30 cm+ on either side of trail Avoid grades in excess of 12% to minimize erosion Surface with gravel/crusher fines, bark chip/mulch, or native soil	CRD Section 4.2.2 BC Parks *Trail Design and Construction Standards Manual*
Trails along roadways		Also known as "side paths," trails along roadways must be well-designed to maximize safety. Half of the bicyclists ride against the normal flow of motor vehicle traffic, but motorists entering or crossing the roadway may not expect traffic coming from that direction. Cars on cross-streets or driveways trying to turn or cross the main street may block trail crossings.	Avoid constructing trails directly adjacent to roadways where possible or is space is insufficient to provide a sufficient buffer Provide a1.5 m min buffer between the trail and the roadway edge or install a physical barrier	CRD Section 4.2.6 AASHTO

Facility Type	Example	Discussion	Design Summary	Guidelines
Trail/Roadway Crossings		While at-grade crossings create a potentially high level of conflict between trail users and motorists, well-designed crossings have not historically posed a safety problem for trail users.	At-grade trail/roadway crossings generally fit into categories based on amount of separation from traffic and trail user visibility: o Marked/unsignalized unprotected crossings o Marked/enhanced unsignalized intersections o Route users to existing signalized intersection o Signalized/controlled o Grade-separated crossings	CRD Section 4.3 TAC *Bikeway Traffic Control Guidelines* BC Parks *Trail Design and Construction Standards Manual*

1.7.4 Wayfinding Standards and Guidelines

Facility Type	Example	Discussion	Design Summary	Guidelines
On-Street Traffic Control Signs		**Regulatory signs** indicate the traffic regulations which apply at a specific time or place. **Warning signs** indicate conditions that will normally require caution and may require a reduction in speed. **Guide and information signs** indicate information for route selection, for locating off-road facilities, or for identifying geographical features or points of interest.	• TAC signs WC-47 and WC-47S should be used in shared lanes • Use TAC Sign IB-23 "Bike Route" on all bikeways • TAC sign RB-91 is used to indicate bicycle lanes	• CRD Section 5 • MUTCD-C • TAC *Bikeway Traffic Control Guidelines*

On-Street Wayfinding Signs		Wayfinding signs help users find the best bicycle route to their destinations. Benefits of wayfinding signs include: • Passively marketing the network by providing unique and consistent imagery • Helping address misperceptions about time and distance • Visually cueing to motorists that they are driving along a bicycle route and should use caution	• Sign key destinations including: other on-street bikeways, commercial centres, parks and trails, public transit hubs, and other civic and community destinations • Use TAC and MUTCD-C standards for signs along the roadway	• Duncan OCP 6.2.6 • CRD Section 5.1.2
Multi-Use Trail Signs		Directional signs provide orientation to the trail user and emphasize trail continuity. Street names should be called out at all trail intersections with roadways. Users' rights and responsibilities of trail usage should be stated at main trail access points. Interpretive signs enrich the trail user experience, focus attention on the unique attributes of the local community, and provide educational opportunities.	• Signage style and imagery should be consistent to provide a sense of continuity, orientation, and safety • Where possible, incorporate signs into vertical elements such as bollards	• CRD Section 5.1.1 • CVRD *Parks and Trails Master Plan* Section 7.6

1.7.5 Maintenance and Construction

Facility Type	Example	Discussion	Design Summary	Guidelines

Access Through Construction Areas		Safety of all roadway users should be considered during road construction and repair. Only in rare cases should pedestrians and bicyclists be detoured to another street when travel vehicle lanes remain open. Contractors performing work for Duncan should be made aware of the needs of bicyclists and be properly trained in how to safely route bicyclists and pedestrian through or around work zones.	• Efforts should be made to provide bicycle access via a separated path or signed shared lane • Do not obstruct t bicyclists' or peds' paths with construction signs • Use signs indicating "share the lane" or "single file" as appropriate • Minimize or mitigate obstructions in the travel way and sign as appropriate	• CRD Section 7.1 • TAC *Bikeway Traffic Control Guidelines* • MoTI *Traffic Control Manual for Work on Roadways* • Worksafe BC
Sidewalk Maintenance		Sidewalk damage primarily occurs due to tree roots. See sidewalk accessibility standards for guidelines on mitigating surface damage. It is particularly critical that the interface between a curb ramp and the street be maintained. Winter snow removal on pedestrian routes should be a priority.	• Minimize barriers for peds., particularly with mobility and sensory impairments, by providing a level surface with min of 7 mm grade changes • Tree well grates can be used, but grates shall have openings no greater than 15 mm in width • Trim tree limbs to leave at least 2.5 m of clear space above the sidewalk	• CRD Section 7.2
Bikeway Maintenance		Shoulders and bike lanes can fill with gravel, broken glass and other debris. In addition, cyclists are more sensitive to subtle changes in roadway surface than motor vehicles. Maintaining a relatively smooth pavement surface significantly benefits cyclists. Snow should be cleared from bike facilities when the roadway is plowed.	• Establish a seasonal sweeping schedule that prioritizes roads with major bicycle route • Maintain an even surface on bike routes; check for compaction and settlement and use the smallest chip seal possible when maintaining roads. • Provide bicycle-safe drainage grates • Maintain signs, repaint stripes, and cut back vegetation regularly	• CRD Section 7.3 • MUTCD-C • TAC *Bikeway Traffic Control Guidelines*