APPENDIX B

Infrastructure Design Guide

INFRASTRUCTURE DESIGN GUIDE

Supporting the CVRD Regional Active Transportation Plan

bunt & associates

September, 2023

OUR VISION

All communities are healthy and connected in equitable and sustainable ways.

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1 DESIGNING FOR DIFFERENT USERS

A core component for designing All Ages and Abilities (AAA) facilities is prioritizing safety for the diversity of users that will be using the facilities. Though traditionally multi-use trails have primarily focused on pedestrians and cyclists, an increasingly diverse set of users are enjoying these amenities including people on skateboards and scooters (both electric and human-powered). Each of these users may have unique needs and interact with each other differently.

1.1 SPEED

At a basic level, speed is the primary consideration when mixing different users on the same path or trail. The typical speeds for different users are illustrated below.

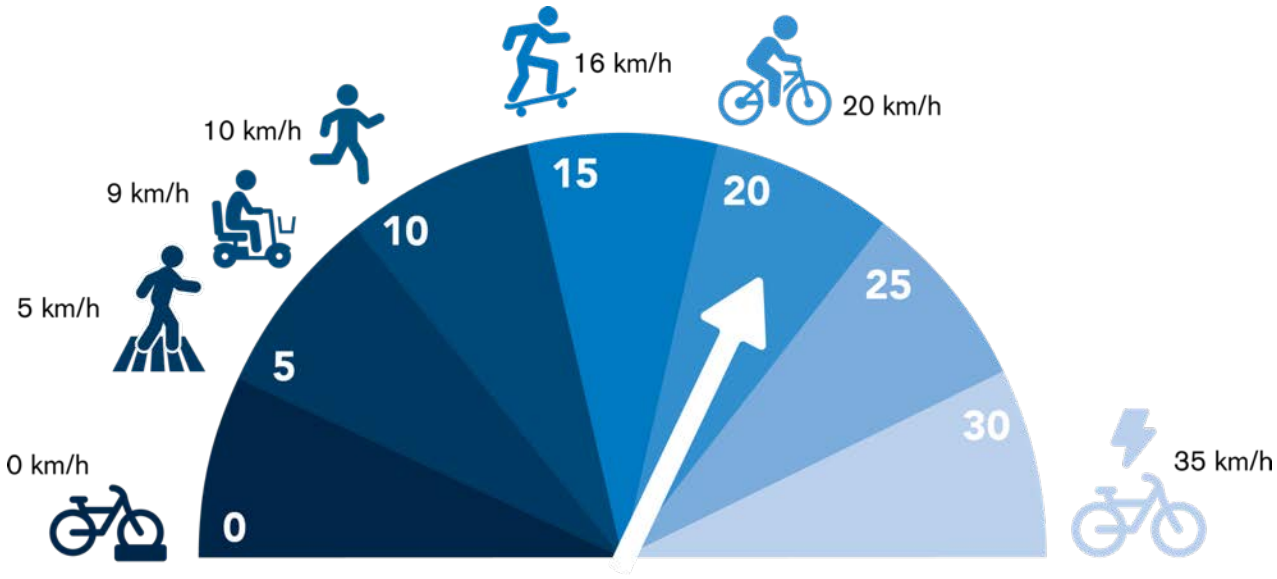


Figure 1.1 Typical Speeds for Different Users
Source: Content by BC Active Transportation Design Guide

1.2 SHARED SPACE FACILITY DESIGN CONSIDERATIONS

Maximize safety and enjoyment where a variety of users share space by:

- Considering all potential users when designing a facility
- Separating cyclists and pedestrians when possible
- Mixing rollers (skateboard/scooter) with cyclists rather than pedestrians
- Increasing shared facility widths where separate pedestrian facilities are not feasible or desired
- Maintaining a consistent set of rules for all users while understanding diverse needs

The BC Active Transportation Guide provides further contextual guidance on the specific needs of different users.

1.3 UNIVERSAL DESIGN PRINCIPLES

Universal Design principles should be applied to the design of all infrastructure and programs to reach the goal of accommodating a variety of users and providing an equitable environment. These principles ensure that all levels of ability are considered in shaping CVRD's built environment and helps reduce the barriers that some people face in navigating their community.

PRINCIPLE	GUIDELINES
1 Equitable Use Design is useful and marketable to people with diverse abilities	• Provide the same means of use for all users: identical whenever possible; equivalent when not • Avoid segregating or stigmatizing users • Provisions for privacy, security, and safety equally available to all users • Make the design appealing to all users
2 Flexibility in Use Design accommodates a wide range of individual preferences and abilities	• Provide choice in methods of use • Accommodate right- or left-handed access and use • Facilitate the user's accuracy and precision • Provide adaptability to the user's pace
3 Simple and Intuitive Use Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level	• Eliminate unnecessary complexity • Be consistent with user expectations and intuition • Accommodate a wide range of literacy and language skills • Arrange information consistent with it's importance • Provide effective prompting and feedback during and after task completion
4 Perceptible Information Design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities	• Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information • Provide adequate contrast between essential information and it's surroundings • Maximize "legibility" of essential information • Differentiate elements in ways that can be described (e.g. make it easy to give instructions or directions) • Provide compatibility with a variety of techniques of devices used by people with sensory limitations
5 Tolerance For Error Design minimizes hazards and the adverse consequences of accidental or unintended actions	• Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded • Provide warnings of hazards and errors • Provide fail safe features • Discourage unconscious action in tasks that require vigilance
6 Low Physical Effort Design can be used efficiently and comfortably and with a minimum of fatigue	• Allow user to maintain a neutral body position • Use reasonable operating forces • Minimize repetitive actions • Minimize sustained physical effort
7 Size and Space for Approach and Use Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility	• Provide a clear line of sight to important elements to seated of standing users • Make reach to all components comfortable for any seated or standing user • Accommodate variations in hand and grip size • Provide adequate space for the use of assistive devices or personal assistance

Figure 1.2 Typical Speeds for Different Users
Source: Content by BC Active Transportation Design Guide

2 EMERGING TRENDS

2.1 SHARED MICRO-MOBILITY

Micro-mobility refers to several small, one-person vehicles. The term is used primarily for electric scooters and shared bicycles. Many companies have begun providing shared dockless electric scooters in cities worldwide. The province of British Columbia is undergoing electric kick-scooter pilot projects in several municipalities, including the City of Nanaimo, City of Kelowna, City of Vernon, City of Vancouver, City of Richmond, District of North Vancouver, City of North Vancouver, and District of West Vancouver.

The introduction of dedicated cycling facilities has been shown to reduce e-scooter collisions by 90%.

Information and articles of interest in relation to micro-mobility pilot programs in British Columbia can be viewed at [BC Active Transportation Pilot Projects | B.C. Government.]

2.2 ELECTRIC BICYCLES

The market share of electric bicycles has grown significantly in the last five years. This growth is due both to new users and some adaptation of non-electric bicycles. Electric bicycles increase distances that riders are willing to cycle and attract users that would not be typically interested in cycling. As e-bicycle usage grows, it is anticipated that cycling usage in total will also grow.

2.3 EVOLVED BICYCLES

A wide range of bicycles are available to accommodate varied needs. These include:

Recumbent

A recumbent cycling position may put less strain on the rider's back and joints.

Long-tail

An elongated tail is provided which is commonly used to seat one to three children and/or cargo. The bicycles are longer and heavier than standard bicycles.

Cargo

Used by businesses to deliver goods and parents to transport children. They range in size and weight but are always wider than standard bicycles.

Trailer

Fitted with a trailer, these bicycles are often used by parents to transport their children but can also be used to move goods.

Handcycle

Handcycles can come as one piece or as a 'clip-on' attachment for a wheelchair.

Tandem

Tandems are designed for two people to ride together.

Tricycle

Has three wheels and offers good stability. They also exist in tandem and recumbent versions.

3 PEDESTRIAN FACILITIES

The design of sidewalks and pedestrian crossings have a significant impact on the safety, accessibility, and overall quality of experience for those walking or rolling. In line with the principles of Universal Design, it is essential that the future design of pedestrian facilities consider the needs of those who may have visual or mobility impairments.

3.1 TYPES OF PEDESTRIAN FACILITIES

Figure 3.1 Types of Pedestrian Facilities
Source: Content by BC Active Transportation Design Guide

3.2 SIDEWALK WIDTHS

A notable requirement for sidewalk design in terms of accessibility, as well as comfort and usability for all pedestrians is the overall clearway width and treatment at driveways. Design of sidewalks that allow people to walk side-by-side and easily pass oncoming walkers (including parents with strollers and people in wheelchairs or with other mobility aids), is important to create a safe and welcoming pedestrian environment. The guidelines in the **Table 3.2** set out the recommended minimum sidewalk type and widths.

Table 3.2: Sidewalk Clearway Width Contextual Selection

Land Use	Road Type	Separation (Boulevard)	Widths	
			Desirable (m)	Minimum (m)
Residential	Local	Non-Separated or Separated	1.8	1.5
	Collector/Arterial	Separated	2.1	1.8
Industrial	Any	Separated	2.1	1.8
Commercial	Any	Separated	2.4 – 3.0	1.8

3.3 SIDEWALK DESIGN PRINCIPLES

> Provide non-separate sidewalks only if necessary due to constraints. If provided, ensure a level clearway of greater than 1.5m at driveways and ideally buffer with on-street parking

> Separate sidewalks on Arterial Streets with a minimum 1m planted boulevard to improve safety

> Locate street furniture outside clearway width

> Provide straight paths to minimize walking distances

3.4 CROSSING DESIGN PRINCIPLES

Safe and accessible pedestrian crossings are crucial to ensuring all ages and abilities can navigate the transportation network.

> Provide curb/wheelchair ramps at all intersection corners to allow access for all users

> Enhance crosswalk markings at key locations like schools and Downtown, through use of zebra or decorative crosswalk markings

> Provide curb extensions at intersections to shorten crossing distances and improve visibility. Curb extensions can also help reduce vehicle speeds

> Consider raised crosswalks at key crossings near schools

4 ROLLING AND CYCLING FACILITIES

Creating a network of rolling and cycling facilities that accommodates users of all ages and abilities requires a breadth of options that reflect the surrounding environment.

4.1 BIKEWAY/ROLLING PLANNING AND DESIGN PRINCIPLES

The following five principles of good bikeway planning and design (CROW 2016) reflect the unique challenges and needs of those riding:

1. SAFETY: Perceived and real, road users should feel that they have enough space to ride, conflicts are minimized, and outcomes of crashes are not severe.

2. COMFORT: Surfaces should be smooth, turn angles and gradients gentle, with minimal obstructions.

3. DIRECTNESS: Alignments should be competitive with the driving network, have as few turns as possible, and minimal stops.

4. COHERENCE: Facilities and routes should be intuitive in their design and direction, and also integrate seamlessly with other transportation systems.

5. ATTRACTIVENESS: Routes should be enjoyable, relatively quiet, and connect to points of attraction.

While many people enjoy cycling, it has been found that a large part of the population would enjoy riding a bicycle more often if a safe and convenient network was readily available. Understanding what types of facilities those on bikes find comfortable is important to encourage increased ridership.

4.2 TYPES OF BIKEWAY/ROLLING FACILITIES

Cycling or rolling facilities can be broadly categorized into separated and shared.

Separated Facilities

AAA quality routes with physical rolling/cycling separation from vehicles. These routes provide the highest quality active transportation network. Due to their higher capital and operating costs, these routes are typically provided on roadways with the highest vehicle volume or speeds and where separation provides the highest benefit. Separated routes are encouraged in areas with higher vehicle and pedestrian volumes such as in village centers or urbanized areas. They are also encouraged to be primary choice for rural roadways in the form of an adjacent Off-Street Pathway or a Multi-Use Path (MUP) when they are determined to be feasible.

Shared Facilities

On-street routes that are signed but do not have physical separation between rollers/cyclists and vehicles. Traffic calming initiatives can be considered on these routes to reduce vehicle speeds. Shared routes are typically lower-cost options. In the CVRD rural area context, these types of facilities are anticipated to be widened roadway shoulders.

4.3 TYPES OF BICYCLE FACILITIES

MULTI-USE PATHWAY

Typically located outside the road right-of-way and, in parks or other green spaces. These facilities are designed to support bi-directional users: pedestrians, cyclists, runners, in-line skaters and skateboarders etc. Users are expected to share the space on the path and follow organizational markings.

PROTECTED BICYCLE LANE

Dedicated cycling facility separated from motor vehicle traffic by a physical vertical barrier (curb, planter boxes, etc.). This facility can be designed for one-way or two-way travel. Users are expected to share the space on the path and follow organizational markings.

LOCAL STREET BIKEWAY

Facility where cyclists share the road with motorists on a street with low traffic volumes and speeds. These bikeways often have traffic calming measures to reduce speed and volume (30km/h, ≤ 1,000 average daily traffic volume). Where bikeways meet collector or arterial roads, signals or other design measures provide for safe crossing.

PAINTED BUFFERED BICYCLE LANE

Typically located outside the road right-of-way and in parks or other green spaces. These facilities are designed to support bi-directional users (pedestrians, cyclists, runners, in-line skaters, skateboarders, etc.). Users are expected to share the space.

PAINTED BICYCLE LANE

Facility where a portion of the roadway is designated for exclusive use by cyclists with pavement markings and regulatory signage. Motorists are typically not permitted to enter the bicycle lane to park, stand or drive, however, they are permitted to mix when performing a turn at an intersection.

Figure 4.1 Types of Bicycle Facilities

The graphic below illustrates the continuum of bicycle facilities based on the perceived level of comfort. These examples demonstrate the range of cycling facility types where higher levels of separation from vehicles equates to higher levels of comfort. Increased comfort not only provides safer routes; it also increases the potential cyclist demographic to include the large percentage of people who would consider cycling if it were more comfortable.

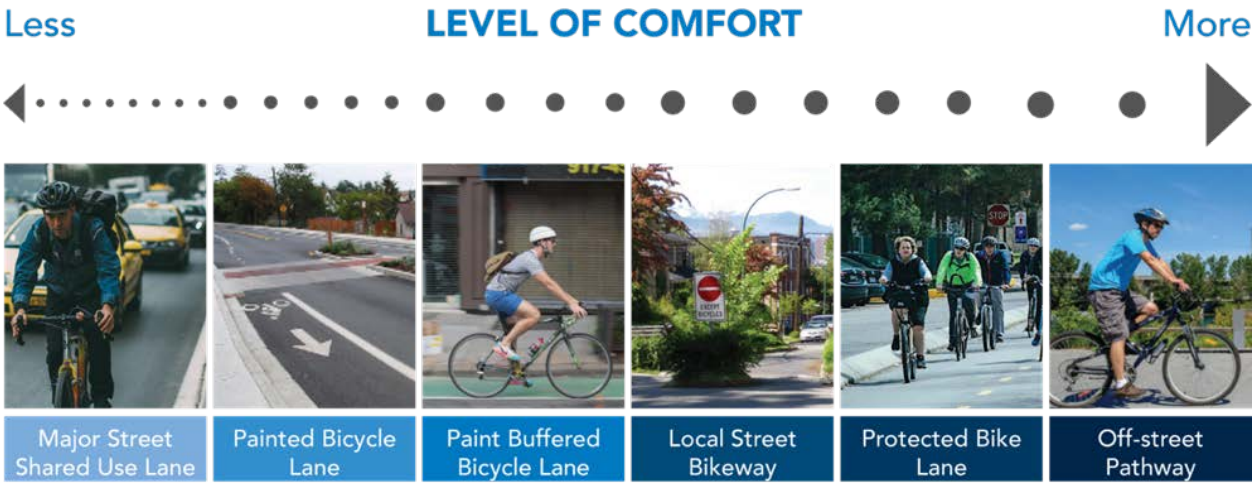
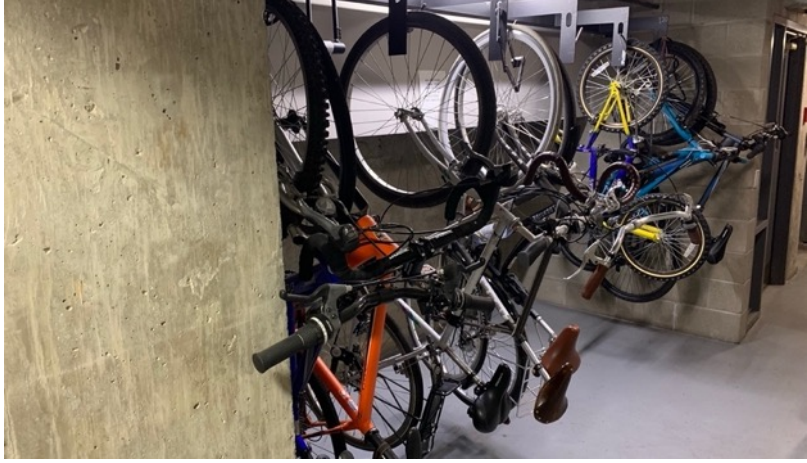


Figure 4.2 Bicycle Facilities Level of Comfort



4.4 BICYCLE PARKING CLASSIFICATION

There are two categories of off-street bicycle parking.

Short-term

A parking space for bicycles parked for a short period (i.e. less than 4 hours) in locations that are easily accessible.

Long-term

A parking space for bicycles parked for longer periods (i.e. more than 4 hours), typically requiring more secure parking.

4.5 BICYCLE PARKING LOCATION & ACCESS

Increased uptake in cycling as a viable travel mode may not reach its full potential if bicycle parking security is not considered at the planning and design stages. Bicycle parking should consider all types of bicycles and be designed to meet the needs of All Ages and Abilities (AAA). To that end, there are several fundamental guiding principles that influence how both bicycle parking is located and accessed:

WELL-LOCATED: Convenient, accessible, as close as possible to the destination, and weather protected.

STAIR-FREE ACCESS: Provision of ramps or elevators large enough to accommodate all types of bicycles. Slopes should be limited.

MINIMUM WIDTHS: Appropriate widths shall be provided along all routes required to access bicycle parking facilities, including along ramp accesses, at doorways, and aisle widths in bicycle parking rooms.

SIGNAGE: Integrated, high-quality, and simple bicycle parking signage should be provided to indicate the availability and location of an off-street bicycle parking area.

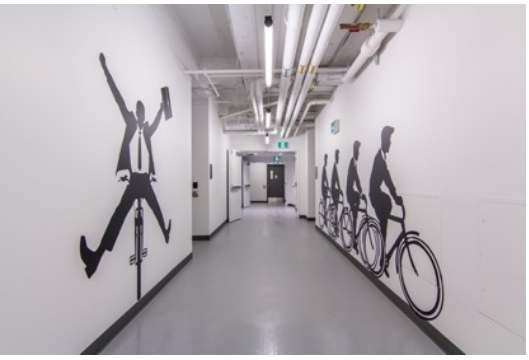
VISIBILITY: The location selected for bicycle parking shall be easily identifiable by cyclists as they are riding. It will also help to reduce theft and vandalism.

BARRIER-FREE: Access to bicycle parking facilities should be direct and free from obstacle to accommodate to all users. Provide breaks in long lengths or span of bicycle racks to allow users a more convenient path for access and egress.

DETECTABILITY: Design should be cognisant of users with physical, sensory, or cognitive impairments and should ensure the facilities are both easily detectable for these users and do not create obstacles.

LIGHTING: Quality lighting shall be provided to ensure facilities are well-lit to improve the overall security of all bicycle parking facilities. Tamper-proof features should be considered to prevent vandalism.

SECURITY: Racks in visible, well-lit places that have high levels of natural surveillance.



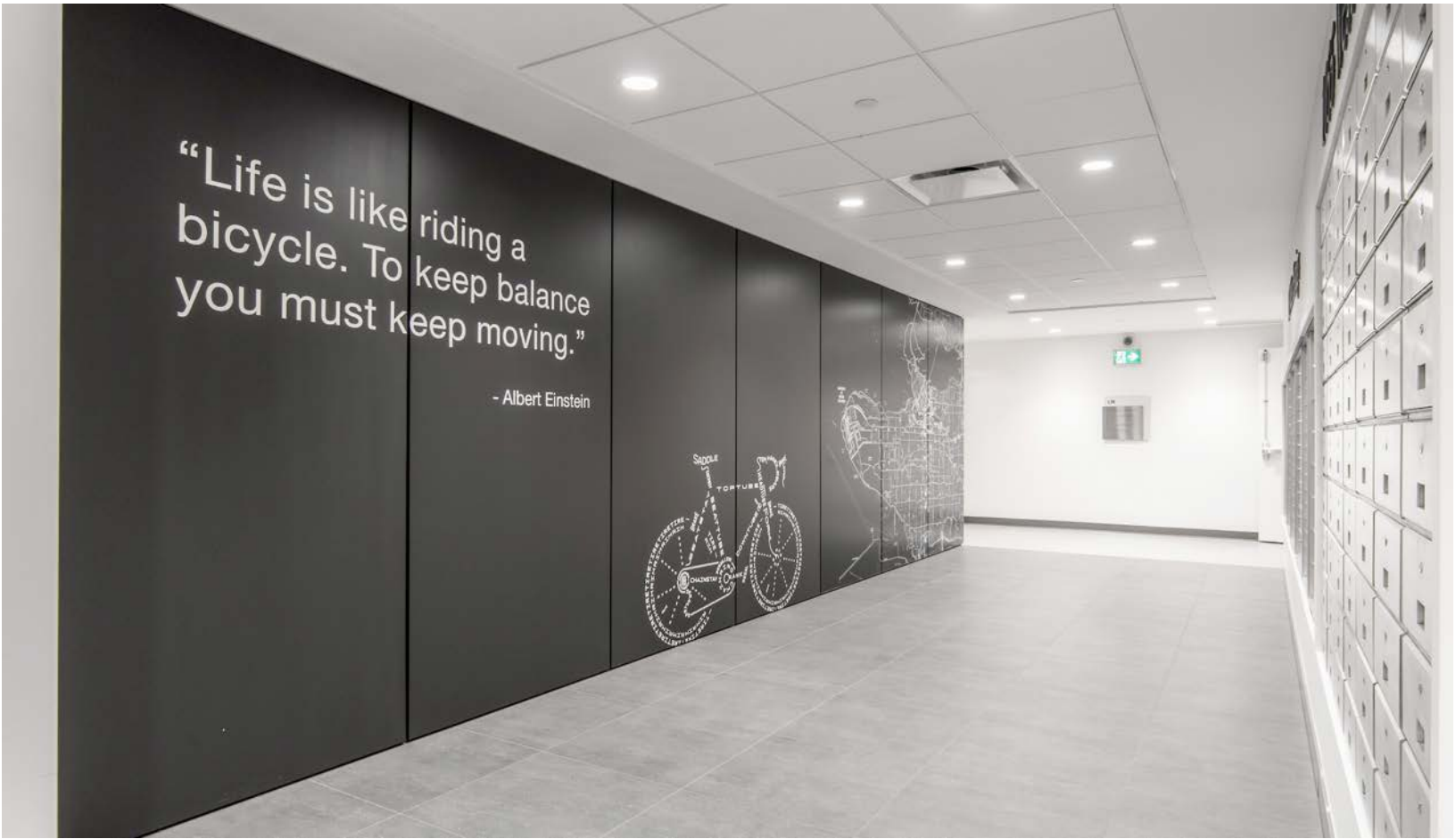


Table 4.1: Sample Bylaw Requirements for Short- and Long-term Bicycle Parking

Note: Bylaw requirements are unique to jurisdictions. The information in this table refers to Coquitlam, BC Bicycle Parking Bylaws.

Principles	Short-Term	Long-Term
General Location	▪ Provide at-grade ▪ Locate within 15.0m of pedestrian building access points	▪ Locate in a private parking area, private garage or bicycle room ▪ Provide at-grade or located no lower than the first complete parking level below grade, where possible
Access & Clearance	▪ Provide wheel ramps, as required, if stairs are provided ▪ Access routes with a minimum clear width of 2.0m ▪ Automated door openers shall be installed along the entirety of the access route	
Weather Protection	▪ Provide for all bicycle parking (either incorporate into the building design or a standalone structure)	
Visibility	▪ Well-lit at all times	▪ Both the room and the access route shall be well-lit
Add-ons	▪ N/A	▪ Equipped with electrical outlets

Table 4.2: Design Principles Specific to Short- and Long-Term Bicycle Parking

Principles	Short-Term	Long-Term
Access & Clearance	▪ Level access required with no stairs ▪ Where a grade change is inevitable, a slope of 6% or less is preferred by cyclists ▪ Additional buffer space (min., 0.5 m) shall be considered if the access route is next to a wall or railing ▪ Provide sufficient minimum overhead clearance (2.1m) ▪ Aisle widths within bicycle parking rooms should have a minimum width of 1.5m, except for aisles adjacent to stacked bicycle racks where the minimum width shall be increased to 2.1m	
Visibility & Signage	▪ Locate near active entries and public amenity spaces ▪ Provide signage as needed for usage	▪ Place in clear visible locations ▪ 'Tamper-proof' lighting should be considered ▪ Directional signage should be provided along the route
Other	▪ N/A	▪ If approved, bicycle parking at Level P2 or below should have a designated bicycle parking elevator (with at least one interior dimension of 1.8m) ▪ If access is shared with vehicles, delineators should be provided to separate bicycles from vehicular traffic where space permits

4.6 BICYCLE PARKING SPACE DESIGN PRINCIPLES

Design principles are similarly important in terms of making bicycle parking attractive to the user, not only from an aesthetic perspective but also regarding the security and safety that is offered as part of the facility.

SUPPORT: The rack should provide two points of contact with the bicycle frame and keep it upright without putting stress on the wheels.

INTUITIVE RACK USE: The rack should be recognizable as bicycle parking and should be easy to use without the need for written instructions.

EFFICIENT USE OF SPACE: Available space is often a constraint, but the choice of bicycle parking should not be dictated by space alone. Racks should allow a good number of bicycles to be parked in a small area while providing adequate space between bicycles to facilitate parking and locking.

LONGEVITY: Weather- and corrosion-resistant materials should be used in the construction of the bicycle parking racks, while appropriate maintenance should be completed regularly to ensure the longevity and attractiveness of facilities.

SECURITY: Racks shall be in secured private or indoor spaces, or in visible, well-lit places that have high levels of natural surveillance.

LARGER SPACES: Ensuring the availability of spaces for larger models and reserving allocated spaces for users with accessibility requirements.

VARIETY: Long-term parking facilities should anticipate the presence of a variety of bicycles and accessories.

DESIGN & ATTRACTIVENESS: The design and aesthetic quality of bicycle parking facilities should reflect the surrounding neighbourhood and environment to attract users without compromising their functionality.

EXAMPLES OF POOR BICYCLE PARKING DESIGN

Racks that do not meet the design principles or universally designed to accommodate a variety of common bicycle types are presented below.

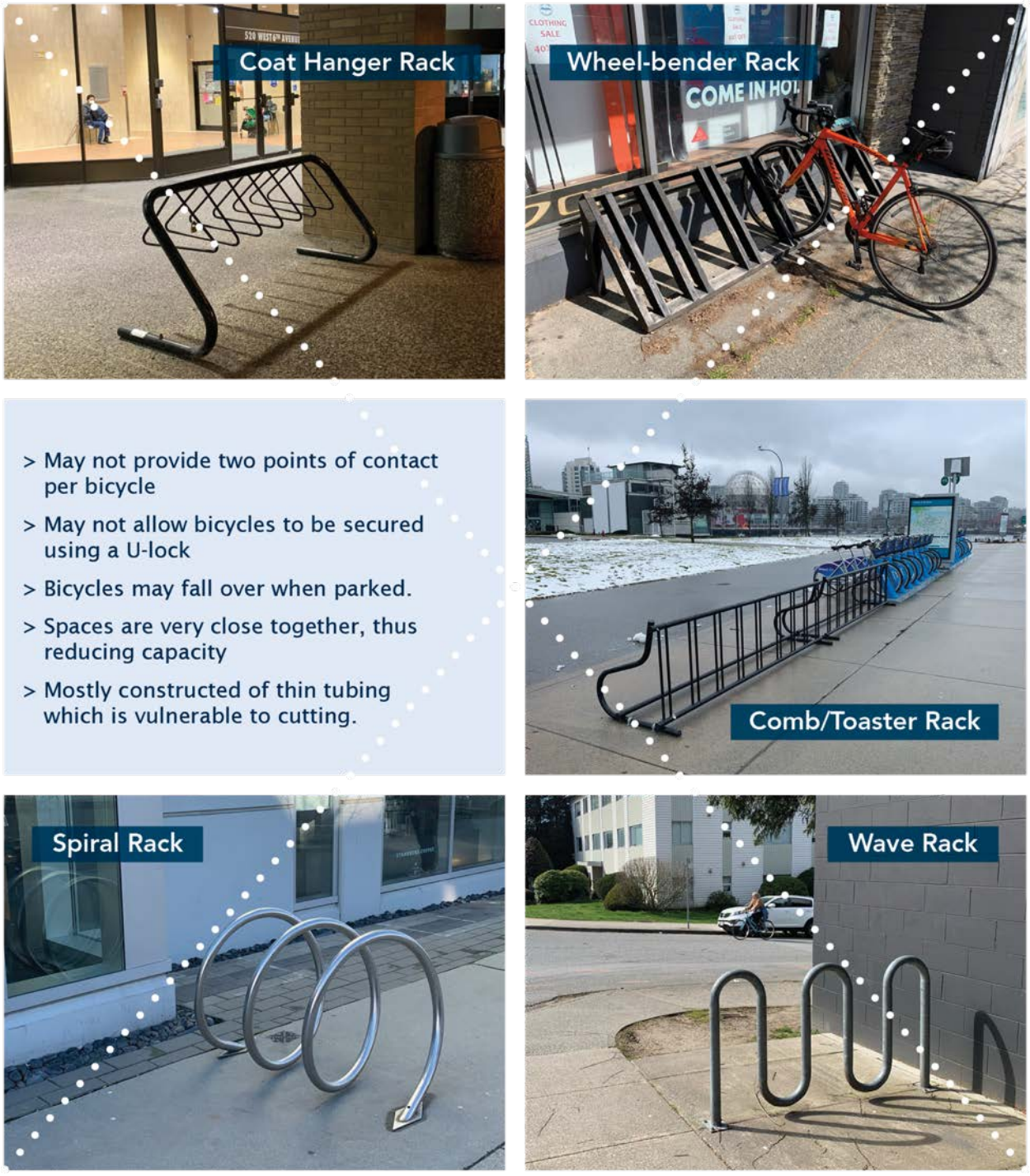


Figure 4.1: Examples of Poor Bicycle Rack Design

5 FACILITY SELECTION + DESIGN

Identifying the appropriate pedestrian or cycling facility type for a given location is largely a factor of the traffic environment. Illustrated on the following pages are the framework for identifying the appropriate facility type based on the traffic environment (speed and volume) and the corresponding design considerations.

5.1 AAA BICYCLE AND PEDESTRIAN FACILITY SELECTION

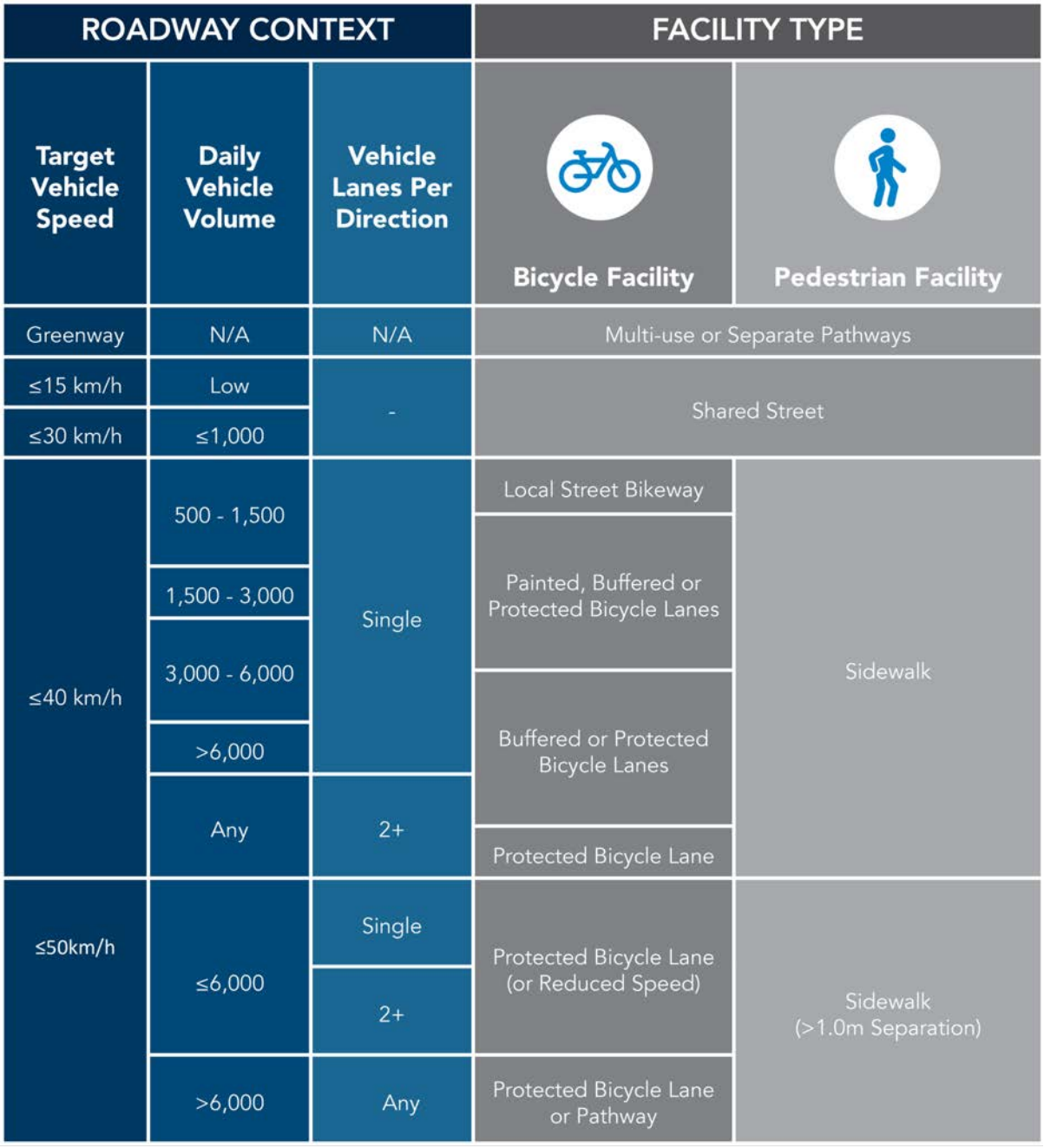


Figure 5.1: AAA Bicycle and Pedestrian Facility Selection

5.2 MULTI-USE PATHWAYS

While Multi-Use Path (MUP) facilities are often used for recreational purposes, they also have the potential to play an important role in a multimodal transportation system. Generally, MUP's are wide enough trails to accommodate two-way travel of both pedestrians and rollers. CVRD has various MUP's that create an important network through the region. They are the preferred active mode infrastructure typology as they separate pedestrians and rollers from the noise and dangers of vehicle traffic. MUP's can be placed along one side of a roadway or in a non-roadway context as shown in **Figure 5.2**.

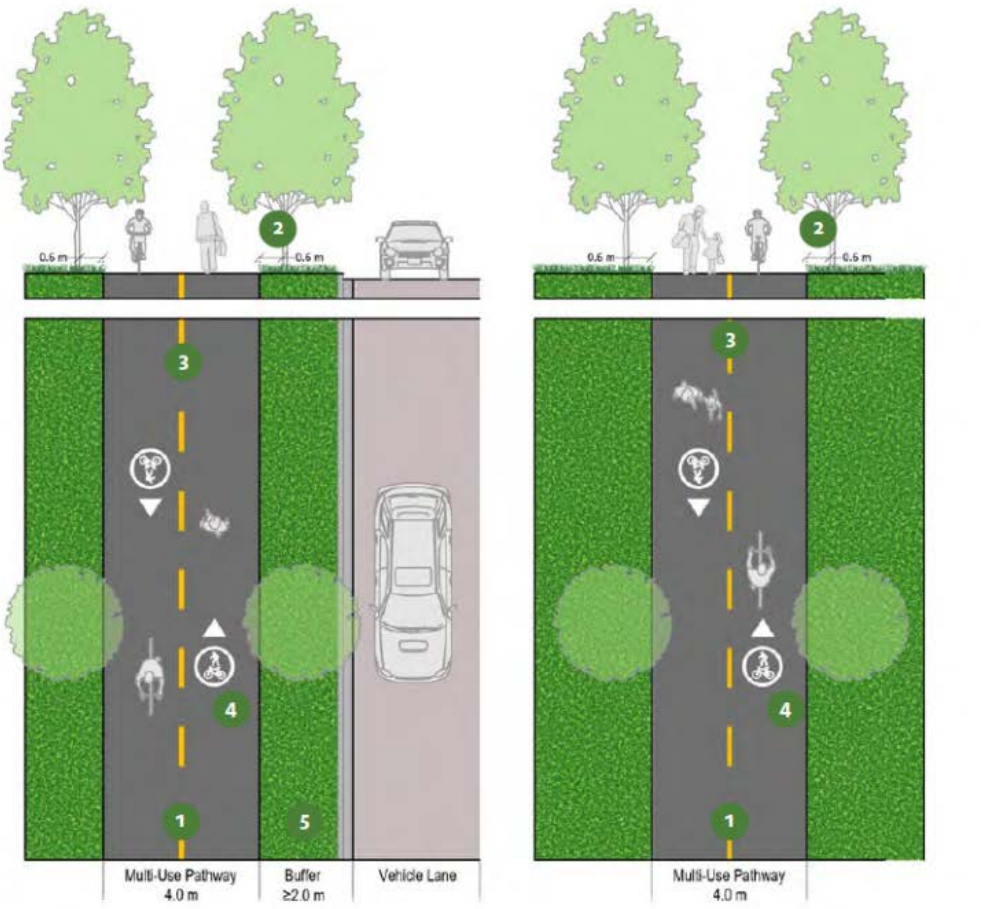


Figure 5.2: Multi-use Pathway Design
Source: BC Active Transportation Design Guide

PATH WIDTH & KEY FEATURES

Path design plays an important role in the safety and satisfaction of users. Though pathways are found to be more comfortable by users, their generally circuitous design and poor sightlines have shown to have problematic safety impacts. To continue to capture the inherent comfort and enjoyment of MUPs while improving safety, the following measures are recommended:

> Minimum 3m width with 4m preferred
> Avoid circuitous routing
> Maintain clear sightlines, particularly at corners, by clearing vegetation or physical obstructions
> Avoid bollards or other obstacles
> Apply centre line along path to improve visibility for users at night
> Consider delineating space for pedestrians and cyclists where high volumes of users are expected

Key Features of a Roadside MUP

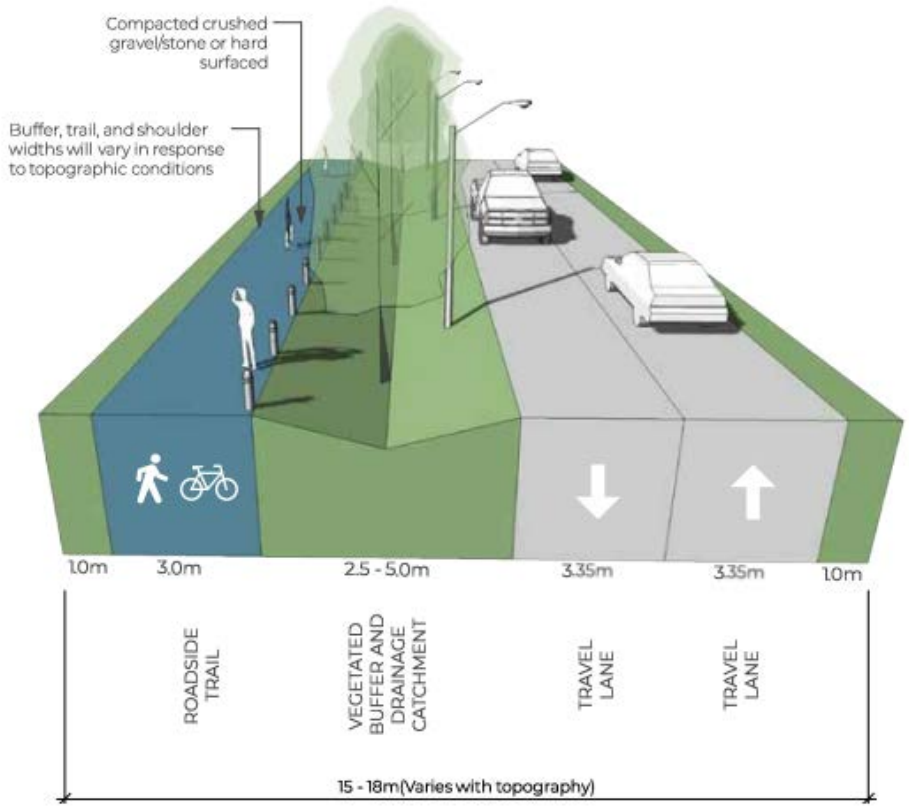


Figure 5.3: Potential MUP Cross Section
Source: Bell McKinnon Local Area Plan, 2018

5.3 RURAL ROADWAY SHOULDERS

Rural roadway shoulders are often used for active transportation. In the CVRD many rural roadways have shoulders often delineated with a white fog line. In the CVRD many rural roadways have shoulders that are well below width guidance. Many others have no shoulders or fog lines at all, therefore active mode participants must share the roadway with vehicles.

As presented in the table below, the minimum width for pedestrian and bicycle accessible shoulders on roadways under provincial jurisdiction, according to BC MoTI supplement to TAC Geometric Design Guide is 1.5 metres. Bicycle accessible shoulders are not recommended for design speeds greater than 70km/hr or on roadways with seasonally adjusted daily traffic volumes greater than 5,000.

All relevant rural roadways in the CVRD fall into the first category with typical posted speeds of 50km/hour, therefore a consistent minimum design width of 1.5 metres is recommended for rural roadways in the CVRD.

Table 5.1: Pedestrian and Bicycle Accessible Shoulder Widths
Source: TAC Geometric Design Guide

Condition	Shoulder Width in Metres
Design for most cases except as below	1.5
For Design Speeds ≥70 km/h and SADT > 5000	2.0
For Design Speeds ≥80 km/h and SADT > 10,000	2.5
All Freeways and Expressways	3.0

5.4 DESIGN OPTIONS

RUMBLE STRIPS

The BC Active Transportation Design Guide describes rumble strips as milled sections of the pavement along a roadway that provides feedback to motorists through noise and vibrations in the steering wheel, notifying them when they have deviated from the travel lane into the shoulder. Rumble strips are intended to clearly delignate the shoulder area and ensure the additional road width does not lead to higher vehicle operating speeds.

> Shoulders should have a minimum width of 1.5 metres to ensure adequate smooth shoulder area.

> Rumble strips can be milled into new or existing asphalt.

There is an existing standard practice in BC for the application of rumble strips, including installing 15 metres of rumble strips with a 3.5 m gap pattern. This is done to allow people cycling a regular opportunity to leave the shoulder area without passing over the rumble strips.

The BC Active Transportation Design Guide recommends the rumble strips be place within the shoulder area and as close to the fog line as possible to minimize interference with cyclists.

Rumble strip width guidance ranges from 10 - 30 cm (4 - 12 inches). Narrower 15 - 20 cm (6 - 8 inch) width are recommended in the CVRD context to retain smooth shoulder surface area and maximize buffering impact.

Raised rumble strips or road texture is not recommended due it being subject to damage during snow cleaning and MOTI regular practice maintenance.

Rumble strips on the Malahat by MOTI in CVRD.
Used to protect shoulder area and to traffic calm.

TWO FOG LINES

Two fog lines help to create a buffer area between the shoulder area and the vehicle travel lane. Shown below this can help to differentiate the shoulder area as an area for cyclists and pedestrians. Should be supported with signage as shown here or with Share the Road sign.

5.5 RAIL WITH TRAIL

The E&N rail corridor extends north/south through the CVRD, linking with the Capital Regional District and Regional District of Nanaimo.

The CVRD has developed multi-use pathways as "rail with trail" within the E&N rail corridor through the communities of Electoral Area G/Saltair, Gulf Islands, Municipality of North Cowichan, City of Duncan and Electoral Area B/Shawnigan Lake. There is the opportunity to further develop "rail with trail" within the corridor.

The Shawnigan Village Rail Trail concept diagram illustrates a Rail with Trail initiative in the CVRD. This route provides a MUP amenity within the existing E&N Rail Corridor linking Old Mill Park to Masons Beach.

To preserve a rail right-of-way, 5 metres distance is required between the rail line and a MUP. If the available space between the rail line and a MUP is 3 to 5 metres, a fence would be required along the MUP.

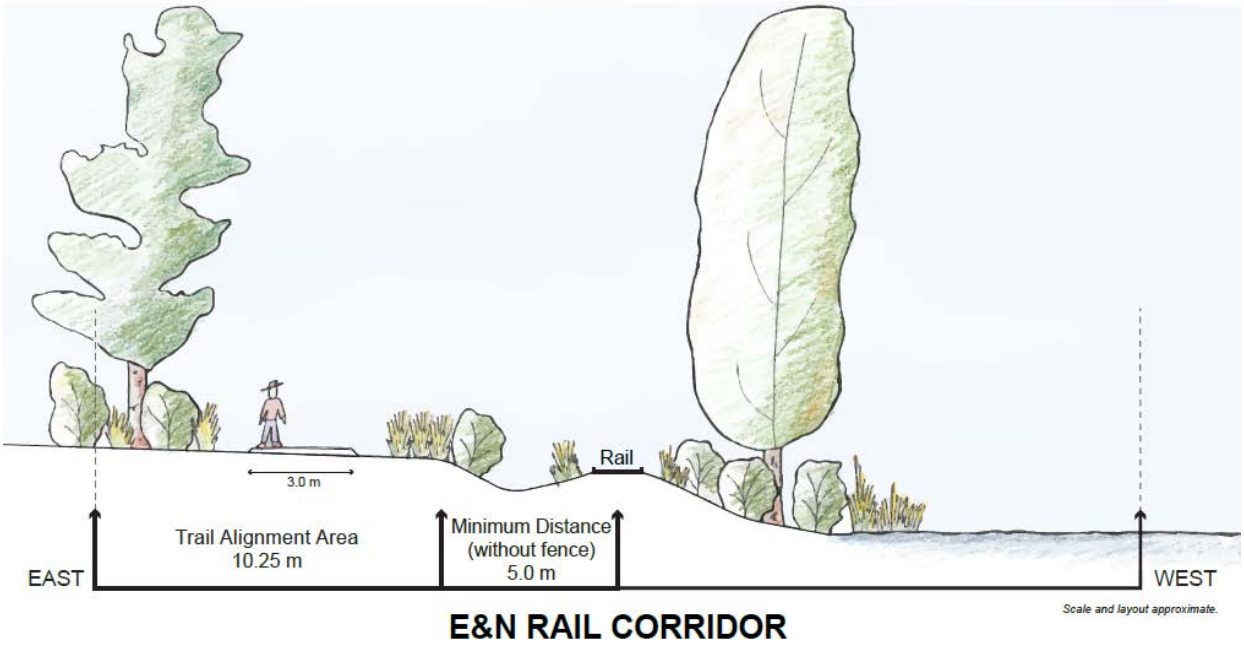


Figure 5.4: Example of Rail with Trail Cross Section
Source: https://www.cvrd.ca/DocumentCenter/View/89178/3_SVRT_elevations?bidId=

5.6 TRAIL TERMINUS

Where a trail or MUP terminates at a roadway, and where no connecting off-street facility is present, it is important to provide a design treatment that allows for users (particularly cyclists) to transition smoothly to/from the roadway without the need to use an adjacent sidewalk. This ensures that the connection between facilities is obvious and does not require a detour or dismounting of a bike.

Recommended Trail Terminus Features

> All trail termini should have an accessible curb ramp to the roadway
> Curb cuts should be as wide or wider than the approaching facility
> Provide cyclist crossings on higher volume collector or arterial roads
> Install a TAC approved trail crossing sign (e.g., WC-32) along the intersecting roadway
> Ensure all transitions are as smooth as possible

5.7 PAVEMENT MARKINGS

Providing clear and consistent pavement markings is important to communicate facility information to all road users. As MUPs and trails are multimodal facilities, it is important to communicate this when they cross the roadway so that drivers can expect users crossing at different speeds than if it were only a pedestrian crossing.

Recommended Pavement Marking Features

> Provide a mixed crossing where pedestrians and cyclists are mixed, illustrated in **Figure 5.4**
> Use elephant's feet markings to denote a bicycle crossing, illustrated in **Figure 5.5**
> Use a green surface treatment to increase the conspicuity of the crossing in locations with high bicycle volumes or high vehicle turning, illustrated in **Figure 5.5**

Figure 5.4 Combined Crossing
Source: OTM Book 18

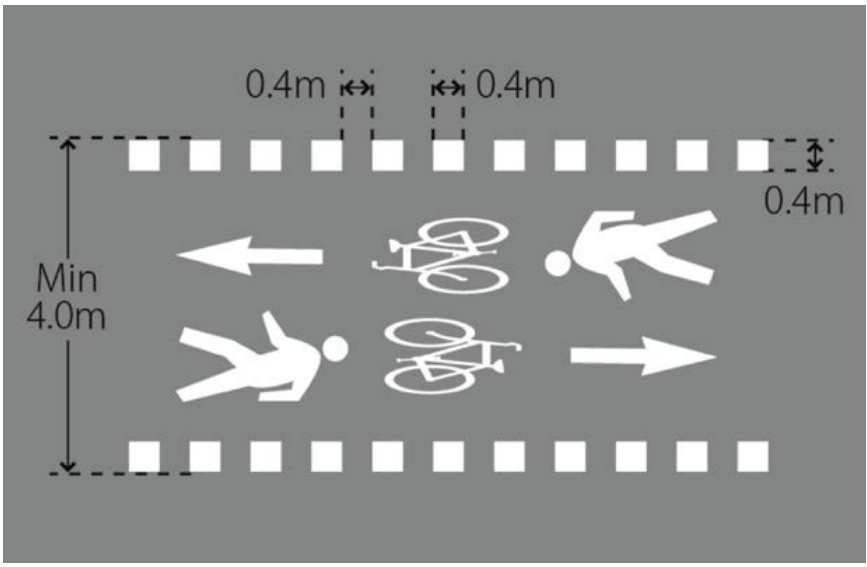
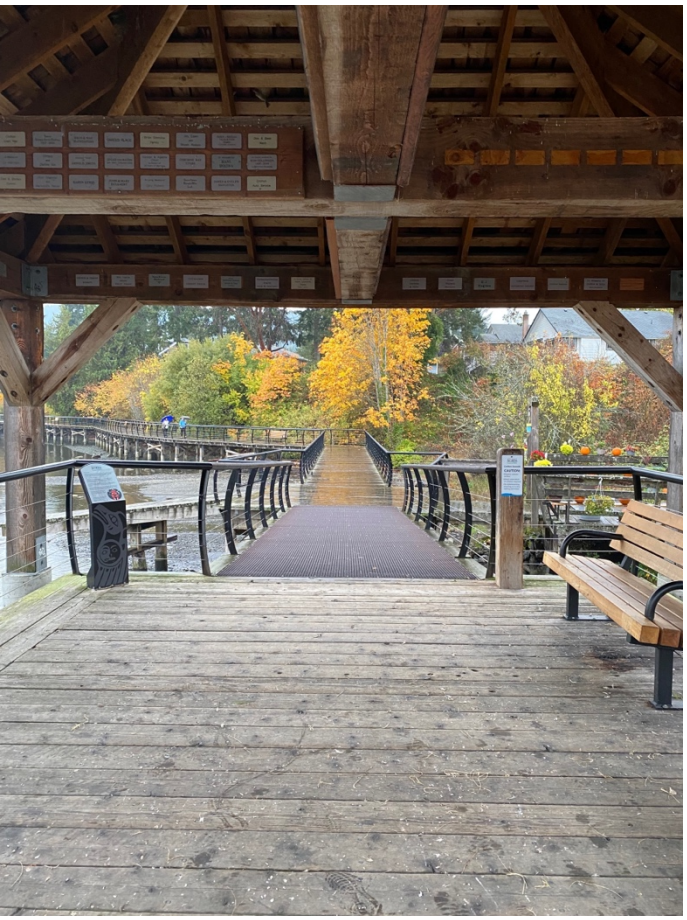


Figure 5.5 Combined Crossing with Green Pavement Markings

5.8 SUPPORTING AMENITIES



Common active transportation infrastructure amenities include benches, bike racks, bicycle repair stations, water fountains, garbage/recycling bins, temporary shelters (in case of rain), wayfinding signage, and educational materials. The presence and location of these amenities can significantly improve the experience for all users. While the design of individual elements may be subject to site-specific context, the following design principles are considered useful:

> Maintain a consistent look and feel, to deliver a sense of continuity throughout the trail system.

> Place amenities well outside the clear zone of the pathway, to ensure users are engaging with the amenities but do not obstruct other trail users (e.g., place benches ≥1m from edge of the pathway so those sitting are a comfortable distance from passing users); and to reduce the likelihood of users colliding with amenities.

> Ensure amenities do not obstruct sightlines of trail users to reduce safety challenges associated with blocked sightlines.

ACTIVE TRANSPORTATION SIGNAGE

Active transportation focused signage serves various functions. It can calm traffic by warning motorists of potential vulnerable road user presence. It can also be used to inform vulnerable road users if they should share the road's shoulder area or if they should share the vehicle travel lane. Signage is also vital for route wayfinding.

Shared Pathway

A sign currently used on CVRD roads that have shoulders along the existing CVT route. It is used to indicate the shoulder is shared space for both pedestrians and cyclists.

Share the Road

A sign suggesting to share the road between all users. It is used on rural roadways that have no shoulders or have inadequate shoulders to indicate travel lanes are to be shared.

A sign suggesting that cyclists and pedestrians to use shoulder area. Matches recommended CVRD road with improved shoulder cross-section with illustration of fog line.

Cyclist on Roadway

A sign warning both motorists and cyclists that both users may be present on the roadway. It can be used where the presence of cyclists would be unexpected by the motorist or where there is heavy volume of cycling traffic on the route. This signage is not preferred for rural roadway shoulders as it omits pedestrians.

W-130 BC MOTI

Bike Route

A sign that can be used on designated bicycle routes. Route specific branded signage is preferred such as signage specific for CVT and East Route.

Sharrow

A sign to be used on roadways without shoulders where cyclists are to share the vehicle travel lane with vehicles. They can be applied to roadways that do not have shoulders or have inadequate shoulders. They can be used on lower speed roadways, often in an urban context.

Pavement Markings
Sharrows with Bike Stencil

Source: BC Ministry of Transportation and Highways 2000, Manual of Standard Traffic Signs & Pavement Markings

6 SAFETY + TRAFFIC CALMING

Wide travel lanes often correlate with faster vehicle speeds.

6.1 DRIVING LANE WIDTHS

Vehicles can operate within lanes as narrow as 3.0 metres. However, buses and trucks typically require a lane width of 3.3 metres. NACTO design guidance identifies:

> Lane widths of 10 feet (3.0m) generally provide adequate safety in urban settings while discouraging speeding. Cities may choose to use 11-foot (3.3m) lanes on designated truck and bus routes
> Lanes greater than 11 feet (3.3m) should not be used as they may cause unintended speeding and assume valuable right of way at the expense of other modes

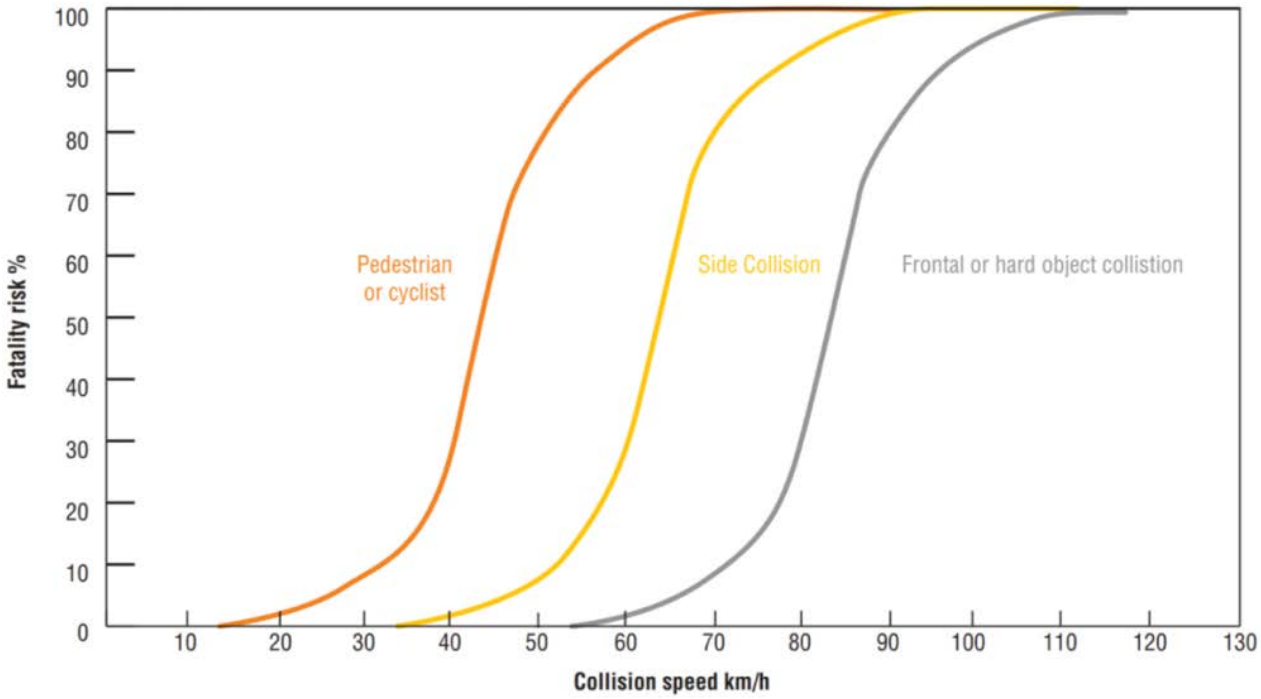
The recommended maximum driving lane width is 3.3 metres on Collector roadways. While snow can reduce driving lane widths during the winter season, this can be addressed through use of boulevards to store snow outside the driving area.

6.2 SPEED LIMIT

COLLISION IMPACTS

The graph below provides the likelihood of a fatality due to a collision at various vehicle speeds. For pedestrians and cyclists, the greatest change in fatality occurs between 30 km/h and 50 km/h. Small changes in vehicle speeds in this range can have significant impact on collision outcomes.

Cumulative Probability of Collision Fatality



Source: NATCO

Posted Speed Reduction Impacts

While engineering changes are necessary to provide the largest reduction in vehicle speeds, NACTO[1] identifies that *"Even changing the posted speed limit sign creates safety benefits and allows cities to provide more and better safety treatments and improve overall quality of life."*

6.3 ROADWAY CROSSINGS AND INTERSECTIONS

Intersections present the primary conflict points between pathway users and motor vehicle traffic. This makes their design a priority for ensuring a consistently safe and comfortable network of facilities.

Trails and MUPs are unique in terms of bicycle and pedestrian facilities in that they function for both cyclists and pedestrians in two directions. This context results in an increased safety risk at intersections with the roadway as drivers must look out for users traveling in two directions and at varying speeds. Compared to unidirectional bike facilities, MUPs and bidirectional facilities are found to be ~50% less safe at intersections. These risks can be mitigated through design that highlights the presence of the facility and reduces conflicts by slowing turning vehicles and providing optimal signal phasing where applicable.

RECOMMENDED SAFETY FEATURES

- Differentiate crossings from the main roadway with alternative pavement colouring or set back crossings from the intersection
- Provide leading or protected bicycle/pedestrian signal phases where feasible
- Raise crossings at minor intersections and driveways
- Provide high-conspicuity pavement markings and/or signage
- Provide refuge island (≥3m in width) on uncontrolled collector and arterial streets, when possible, to allow pedestrians and cyclists to deal with one direction of traffic at a time and help slow drivers

Pedestrian Refuge Island

Corner Bulges and Curb Extensions

Raised crosswalk and Intersection

THANK YOU!

Questions? Please Contact Us.

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