H

AMENITIES + INTEGRATION

Public bike share docking station at Olympic Village Canada Line Station, Vancouver, B.C.

H.1

MULTI-MODAL INTEGRATION

Effectively integrating active transportation with other modes of transportation facilitates multi-modal trip making and provides an attractive alternative to motor vehicle travel. This is particularly important for regional travel or longer distance trips where walking, cycling, and other forms of active transportation may not be practical for the entire trip distance, but offer a means to get to and from public transit, ferries, and airports as the primary means of completing the trip. Successfully integrating active transportation to complete the 'first and last mile' as part of a longer distance trip increases the attractiveness of multi-modal trips as an alternative to motor vehicle travel.

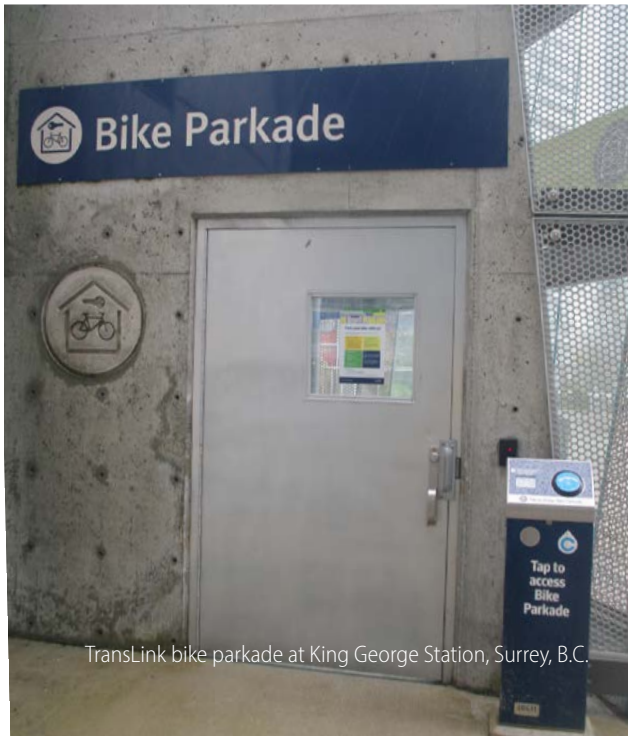
The opportunities for multi-modal integration that are the focus of this chapter include:

- Active transportation and public transit;
- Transit stops and exchanges;
- Bicycles on transit vehicles;
- Ferries and ferry terminals;
- Airports; and
- New mobility.

ACTIVE TRANSPORTATION AND PUBLIC TRANSIT

Public transit extends the range of travel for people walking or cycling, making longer or time-constrained trips more feasible. Walking and cycling also extend the reach of transit trips by providing 'first- and last-mile' opportunities to complete the trip by active transportation by and increasing the number of destinations easily accessible by bus or train. Connecting active transportation networks to transit routes – with a focus on high frequency transit – extends the reach of both modes. These 'first- and last-mile' opportunities and ability to make longer trips can be further enhanced by electric bicycles and bike sharing programs, as discussed in **Chapter H.5**.

An important consideration when planning and designing active transportation facilities is the opportunity for integration with transit and ensuring that continuous, seamless connections to transit are created. This can help to ensure that walking, cycling, and transit are mutually supportive. This includes considerations such as planning and designing pedestrian and cycling facilities so they connect directly to transit stops and ensuring that most residents have access to a bus stop desirably within a five-minute (400 metre) walking distance.



TransLink bike parkade at King George Station, Surrey, B.C.

TRANSIT STOPS AND EXCHANGES

This section discusses opportunities to integrate cycling at transit stops and exchanges.

Bicycle Parking at Transit Stops and Exchanges

Adequate bicycle parking at transit stops and exchanges is required to make cycling an effective 'first- and last-mile' solution for public transit and to facilitate multi-modal trips. Bicycle parking at transit stops and exchanges typically takes one of three forms:

1. **Short-term bicycle parking** may be provided at the transit stop or exchange through the use of bicycle racks to allow bicycle parking for short durations. These facilities should include shelter, lighting, and adhere to the design guidance contained in **Chapter H.2.**
2. **Long-term bicycle parking lockers** may be provided at the transit stop or exchange to facilitate long-term bicycle parking. These facilities are typically offered on a subscription basis.
3. **Long-term bicycle parking rooms or bicycle parkades** may be provided at transit stops or exchanges with a high volume of bicycles, and typically include a secured bicycle parking area and supporting amenities.

Bicycle parking should be considered at all high activity bus stops as well as transit exchanges, park-and-rides, and rapid transit stations. Bicycle parking should be highly visible and provided at convenient locations close to the bus stop or close to the entrance to the transit station to ensure seamless integration with public transit. Bicycle parkades have recently been provided at several SkyTrain stations in Metro Vancouver (refer to the case study on page H6).

Bicycle Integration at Transit Stops and Exchanges

In addition to providing bicycle parking and supporting amenities, consideration should be given to designing transit stops and exchanges in such a way that the transition between nearby cycling infrastructure and the transit stop or exchange is direct, intuitive, and easily navigated. The following should be considered in the design of transit stops and exchanges:

Grade

Conventional staircases and escalators are not an effective means for bicycle users to navigate grade or travel from floor-to-floor of a transit station, and therefore other means are necessary. The following options can be considered:

1. **Elevators** provide the opportunity for a person cycling to travel from floor-to-floor. Although they can introduce friction between pedestrians and bicycles – particularly where there is a high volume of either group – proper planning and design of the elevator boarding and alighting areas and the elevator itself can ensure that sufficient space is provided for both user groups. Consideration should be given to the size and operating characteristics of a bicycle (refer to **Chapter B.2**), with allowances for additional space where particularly high volumes of pedestrians and/or bicycles are anticipated.
2. **Staircases with a bicycle ramp** to enable bicycle circulation up and down the staircase. This is typically a flat or grooved area at the edge or centre of the staircase, with paint markings and/or signage indicating the space is intended for bicycle circulation.
3. An **inclined escalator** is similar to a conventional escalator except for the absence of built-in steps which allows a bicycle to be walked up or down the device. An inclined escalator typically benefits from a longer span as compared to a conventional escalator to allow for a gentler grade.

Doorways

Ineffectively designed doorways impede bicycle travel. Where possible, doorways should be designed to include a sensor, push-button, or FOB strike in advance of the doorway to allow a person cycling to travel through with minimal disruption and without dismounting their bicycle. Consideration should be given to providing sufficient doorway width to accommodate a range of users and types of bicycles, particularly where high volumes of pedestrians and bicycles are anticipated, and/or if two bicycles are intended to pass in opposing directions. Based on the dimensions and operating characteristics of bicycles and other active modes (see **Chapter B.4**), the doorway width should have a desirable width of 1.6 metres and a minimum width of 1.2 metres.

Design and dimensions for doorways must also adhere to the *B.C. Building Code* and *B.C. Fire Code*.

Wayfinding

Effective wayfinding is important to ensure continuity between bicycle infrastructure and transit vehicles, particularly where transit stops or exchanges are being retrofitted to better accommodate bicycles. Consideration should be given to reflecting the wayfinding/graphic standards of both the transit agency and local or regional government, and ensuring the signs and pavement markings used are as continuous as possible between the two.

Wayfinding, signage, and pavement markings are explored in detail in **Chapter H.4**.

Case Study

TransLink Bicycle Parkades, Metro Vancouver, B.C.

TransLink is the regional transportation agency for Metro Vancouver, operating an extensive bus system throughout the region, SkyTrain rapid transit, SeaBus passenger ferries, West Coast Express commuter rail, and HandyDART for passengers who are unable to use conventional transit. TransLink also has a multi-modal mandate that includes funding and delivering the Major Road Network and a network of walking and cycling facilities. As part of this mandate, TransLink offers three different types of bicycle parking at SkyTrain stations, bus exchanges, and West Coast Express stations throughout Metro Vancouver, including bicycle racks, bicycle lockers, and, most recently, bicycle parkades.

TransLink's bicycle parkades are located at the Main street–Science World, King Edward, Commercial–Broadway, and Joyce–Collingwood SkyTrain stations. The facilities are glass-walled, lit 24-hours per day, and are equipped with video cameras for additional security. Access is provided seven days a week. Space is first-come, first-serve and parking costs $1/day, with fees capped at $8/month. Only customers who enroll to use the bicycle parkades can access the facilities. Enrollment is completed for free on-line – customers must first register for a Compass Card (TransLink's reloadable transit pass) if they do not already have one. Once registered, the Compass Card can be used to unlock the bicycle parkade entrance using the same technology as the SkyTrain and bus onboarding process.

TransLink has produced a short video explaining how to register for, gain access to, and park bicycles in the bicycle parkade using the high-density two-tiered racks. Each bicycle parkade also has informative posters showing how to use the racks.

BICYCLES ON TRANSIT VEHICLES

Bicycles are an effective 'first- and last-mile' solution when effectively integrated with public transit. Some bicycle users may prefer to lock their bicycle at a bus stop or transit exchange and complete the remainder of their trip by transit or walking, while others may prefer to bring their bicycle on transit so that it may be used for the subsequent portions of the trip. This requires dedicated, well-designed bicycle parking on transit vehicles.

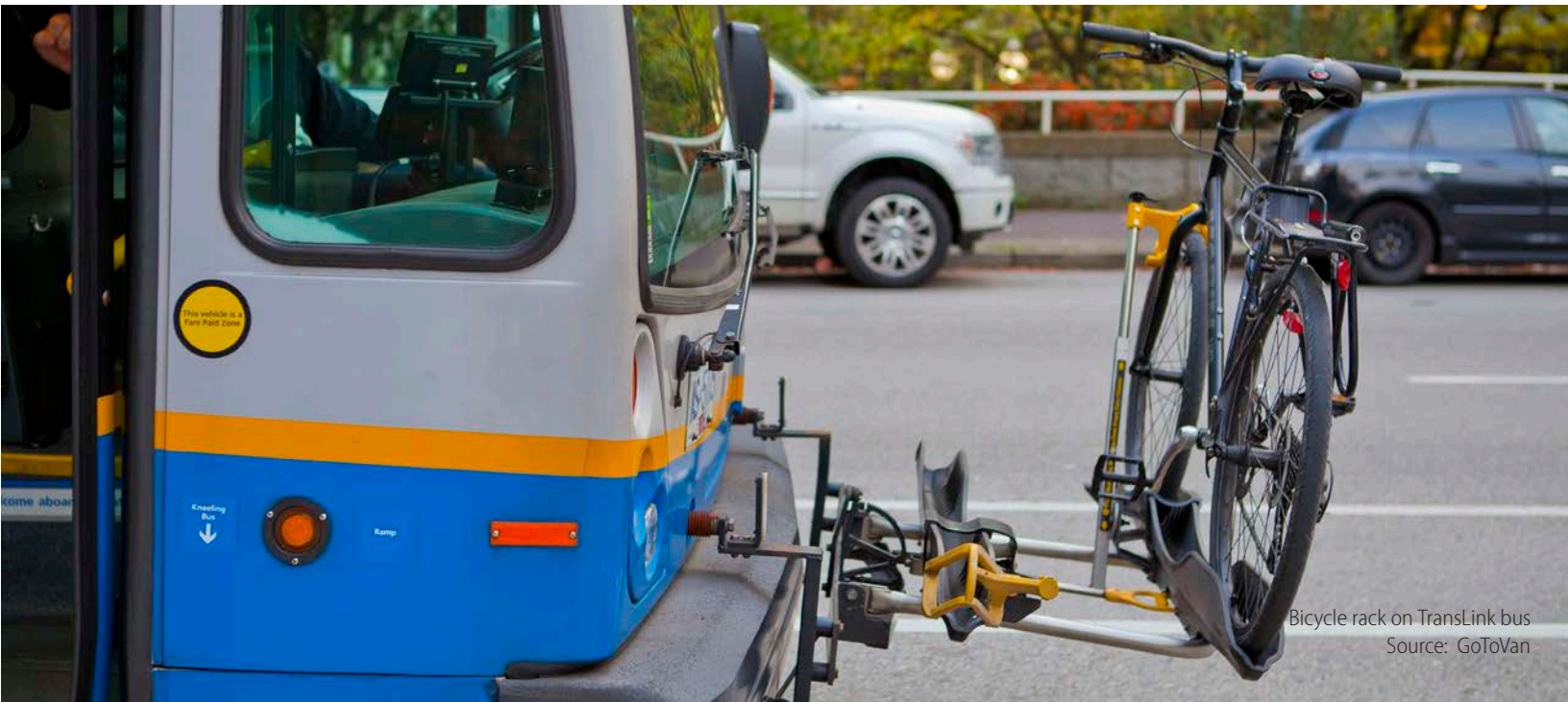
Buses

The most prevalent means of accommodating bicycles on buses in B.C. are front-mounted bicycle racks. These devices most commonly have capacity for two bicycles and are external to the bus, thereby not impacting passenger capacity. They require that the bicycle user fold down the rack, place the bicycle, and secure it with an attachment. This process is relatively simple, but can result in a short delay to the bus service. This type of bicycle rack is typically sized for conventional bicycles and cannot accommodate larger bicycles such as cargo bicycles and tricycles. The capacity is typically limited to two bicycles, and may therefore result in prospective riders being 'passed up' when the rack is full.

The majority of the buses in the B.C. Transit and TransLink systems already have front-mounted bicycle racks with capacity for two bicycles. The practice of outfitting buses with front-mounted bicycle racks should be continued to aid in multi-modal trip making. Both B.C. Transit and TransLink also allow folding bicycles inside a transit vehicle, provided they are in a folded position and in a protective case.

While bicycle racks on buses is an effective means of encouraging multi-modal trips, the following are opportunities to address some of the current limitations and further expand the appeal and uptake:

- **Capacity:** The majority of bus-mounted bicycle racks in B.C. are limited to no more than two bicycles. While this is typically sufficient, there are noted 'pass ups' of prospective transit riders that are required to wait for the next bus when the front-mounted rack is at capacity. As cycling increases in future, consideration may be given to increasing on-board bicycle capacity to address this issue. Other jurisdictions have implemented bus-mounted bicycle racks with capacity for more than 2 bicycles.



Bicycle rack on TransLink bus
Source: GoToVan

- **Large Bicycles:** Currently, bicycles in excess of 50-pounds, with tires larger than 40 centimetres in diametre, and cargo bicycles or tricycles with an atypical wheelbase cannot utilize bicycle racks on B.C. Transit or TransLink vehicles. Consideration may be given to altering bicycle rack type to better accommodate larger bicycles as the proportion of atypical bicycles – such as cargo bicycles and tricycles – continues to increase.
- **E-Bikes:** Electric bicycles (e-bikes) are becoming more prevalent as bicycle infrastructure improves and the cost of e-bikes decreases. TransLink does not currently allow e-bikes on front-mounted bicycle racks, and B.C. Transit only allows them if the battery is removed. Consideration may be given to eliminating this barrier to facilitate use of e-bikes for multi-modal trips.

It should be noted that public transit vehicles in B.C. are typically part of the B.C. Transit or TransLink fleets. While local or regional governments may have influence, transit vehicles are typically the responsibility of B.C. Transit or TransLink and the local operators.

Rapid Transit and Commuter Rail

Bicycles are currently permitted on the SkyTrain, West Coast Express, and SeaBus services at no additional cost. Some of these vehicles / vessels include dedicated bicycle parking areas, while others simply allow bicycles to be brought on-board. This is an effective means of increasing the geographic catchment area of potential transit riders and facilitating multi-modal trips.

The following are opportunities to address some of the current limitations of accommodating bicycles on rapid transit and commuter rail to further expand the appeal and uptake:

- **Time / Capacity Restrictions:** Time-of-day and capacity restrictions introduce a level of uncertainty for individuals seeking to bring a bicycle on public transit. In Metro Vancouver, bicycles are currently permitted at all times of day on the Canada Line, SeaBus, and West Coast Express, but are restricted on the Expo and Millennium Lines during specified peak periods. Capacity is also limited to one bicycle per car on the Canada Line, and two bicycles per car on the Expo and Millennium Lines and the West Coast Express, and may be limited during rush hour when passenger capacity is limited.
- **On-Board Storage:** The provision of on-board bicycle storage varies between vehicles and services. Consideration should be given to ensuring all new rapid transit vehicles have dedicated bicycle storage that is functional, attractive, and represents an effective use of space. Effective bicycle parking types and dimensions are explored in detail in **Chapter B.2**.
- **Large Bicycles:** Large bicycles such as cargo bicycles, bicycles with trailers, and tricycles are not effectively accommodated on rapid transit or commuter rail services due to their large size and impact on passenger capacity. On SkyTrain, as an example, bicycles are limited to no more than 183 centimetres in length and bicycle trailers of any kind are not permitted. Consideration may be given to altering operating procedures to better accommodate larger bicycles and/or selecting future commuter rail vehicle types that better accommodate larger bicycles.
- **At-Grade Boarding:** Vehicles that accommodate at-grade boarding are strongly preferred where bicycles are intended to be accommodated on-board. At-grade boarding is also preferred to better accommodate strollers, mobility scooters, and other mobility aids.

Roll on bicycle racks, such as those provided on the Canada Line, can accommodate a wide range of bicycle types and do not require as much physical ability to use, since the bicycle can be rolled into place and does not have to be lifted. Roll on bicycle racks

are best suited to multi-car trains with level boarding. However, roll on racks take up passenger standing space, which can be an issue on crowded vehicles.

Although not implemented yet in B.C., some transit agencies in other jurisdictions have used vertical or hanging bicycle racks installed inside the vehicle to accommodate bicycles on transit. Though able to fit more types of bicycles and not delay the transit vehicle while securing the bicycle, vertical racks can still be a challenge for some people to use and does not accommodate some bicycle types. Vertical racks also take up some passenger standing room, which can be an issue if the vehicle is near capacity on its run.

Roll on racks are generally recommended instead of hanging onboard bicycle racks due to concerns of equity and ease of use.

SkyTrain on-board bicycle area with roll on bicycle rack

TRANSIT STOP DESIGN

Transit stop design must include a variety of considerations and design strategies, including:

- **Pedestrians and Universal Accessibility**
  - *When considering floating transit stops (as discussed in further detail below), the preferred transit stop design requires bicycle facilities to be shifted to directly adjacent to the Pedestrian Through Zone at sidewalk grade. The lack of grade separation and close proximity of people cycling through the transit stop creates an increased potential for a conflict. Specialized design treatments are required to ensure that all people, including those with visual and mobility impairments, can safely and comfortably access the transit stop.*
- **People cycling**
  - *In some cases, providing bicycle facilities on the left side of a one-way road can be a strategy to eliminate conflicts between bicycle users and transit vehicles.*
  - *Conflicts between all modes on a multi-modal corridor can be minimized by exploring opportunities to remove, consolidate, or relocate transit stops.*
  - *When transit conflicts cannot be eliminated or minimized, design options that separate people cycling from the transit stop should be explored.*
  - *Carefully designed transit stops on multi-modal corridors can provide people cycling with a safe bypass of the transit stop by considering floating transit stops (as discussed in further detail below).*
- **Efficient Transit Flow**
  - *Transit stop design that separates cycling facilities from the curbside boarding and alighting area improves bus travel speeds by reducing conflicts between people walking and cycling with buses. By separating cycling*

facilities from the motor vehicle lane, the 'leap-frogging' effect of buses and people cycling constantly passing each other as the bus stops is eliminated, improving both safety and bus travel speeds.

- **Road Design**
  - *The motor vehicle travel lanes adjacent to the transit stop should be of sufficient width to accommodate transit vehicles. In general, 3.3 metres is considered the desirable with for vehicle lanes to accommodate buses, although 3.0 metres can be considered in constrained circumstances. The local transit agency should be consulted during the design process to confirm acceptable lane widths.*
- **Improved Pedestrian and Cycling Connections to Transit**
  - *To enable people to travel greater distances and in all weather conditions by active transportation requires integration of cycling and walking facilities with transit stops. Considerations are needed to ensure proper placement and amenities exist to make multi-modal travel desirable and efficient.*

Defining Context Zones

The various context zones for transit are shown in **Figure H-134** and described below.

1 **Pedestrian Through Zone**: As introduced in **Chapter C.2**, this is the area intended for pedestrian movement, where people walk, interact with each other, and access destinations along the corridor. The Pedestrian Through Zone should be kept clear of obstructions at all times, with the minimum width maintained the length of the corridor and through all crosswalks.

2 **Furnishing Zone**: As introduced in **Chapter C.3**, this area provides space for utilities, street furniture, bicycle racks, landscaping, street trees, transit shelters, and snow storage. This zone is flexible and can be eliminated at floating transit stops if adequate right-of-way width does not exist.

3 **Bicycle Through Zone:** As introduced in **Chapter D.1**, this area is reserved for the bicycle facility. In the case of a floating transit stop, the bicycle facility in this zone is re-routed behind the transit stop to bypass the transit boarding and alighting area. In this application, this zone is located between the Furnishing Zone and the Floating Transit Stop Zone and is recommended to be elevated to sidewalk grade.

Floating transit stop, Burrard Road, Vancouver, B.C.

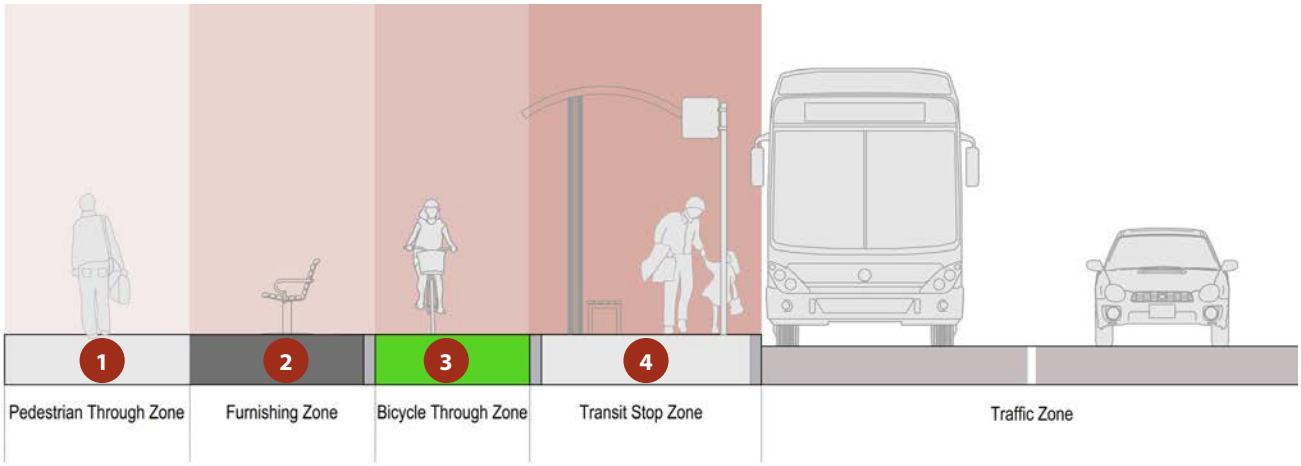


Figure H-134 // Transit Stop Zone

4 **Transit Stop Zone**: This is the zone where transit passengers wait for transit vehicles and also serves as a dedicated space for passengers boarding and alighting. The Transit Stop Zone must maintain a clear space large enough to accommodate bus ramps and lifts, as well as sufficient space for people with mobility aids to navigate boarding and alighting.

Transit Stop Design Principles

This section provides an overview of key principles related to transit stop design. Further details are provided in the following documents:

- TransLink *Bus Infrastructure Design Guidelines*
- BC Transit *Infrastructure Design Guidelines*
- MOTI *B.C. Supplement to TAC Geometric Design Guide* (Section 960)

Stop Location and Placement

Transit stops can be placed in one of three typical locations along a road in relation to intersections (See **Figure H-135**):

- **Far-side stops** are located directly after an intersection;
- **Near-side stops** are located in advance of an intersection; and
- **Mid-block stops** are located between intersections.

The specific location and placement of the transit stop should be coordinated with the local transit agency.

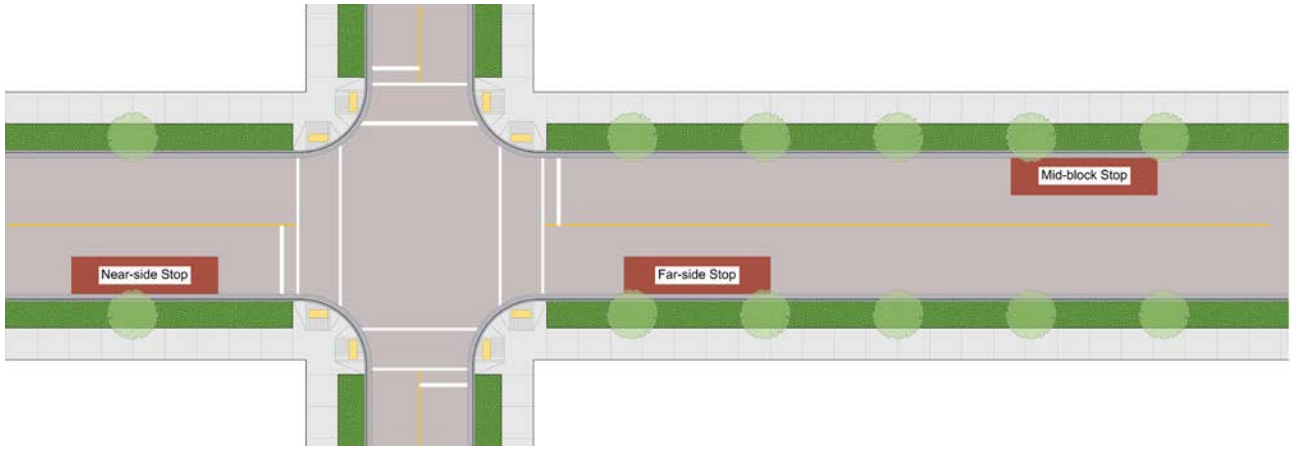


Figure H-135 // Transit Stop Locations

Far-side transit stops are typically preferred both from an active transportation and traffic flow perspective. Far-side transit stops allow transit vehicles to move more efficiently along a corridor, prevent stopped buses from obstructing sightlines, and encourage pedestrians to cross at the rear of the bus.

Occasionally, transit stops are needed to be located at the near-side or mid-block along a corridor to accommodate physical and transit route constraints. Near-side stops are generally used when far-side stops are impractical or unsafe, or if the stop serves multiple routes that change directions at the intersection.

Mid-block stops are used in locations with long blocks and should include a crosswalk at the rear of the stop when designed.

Stop Layout

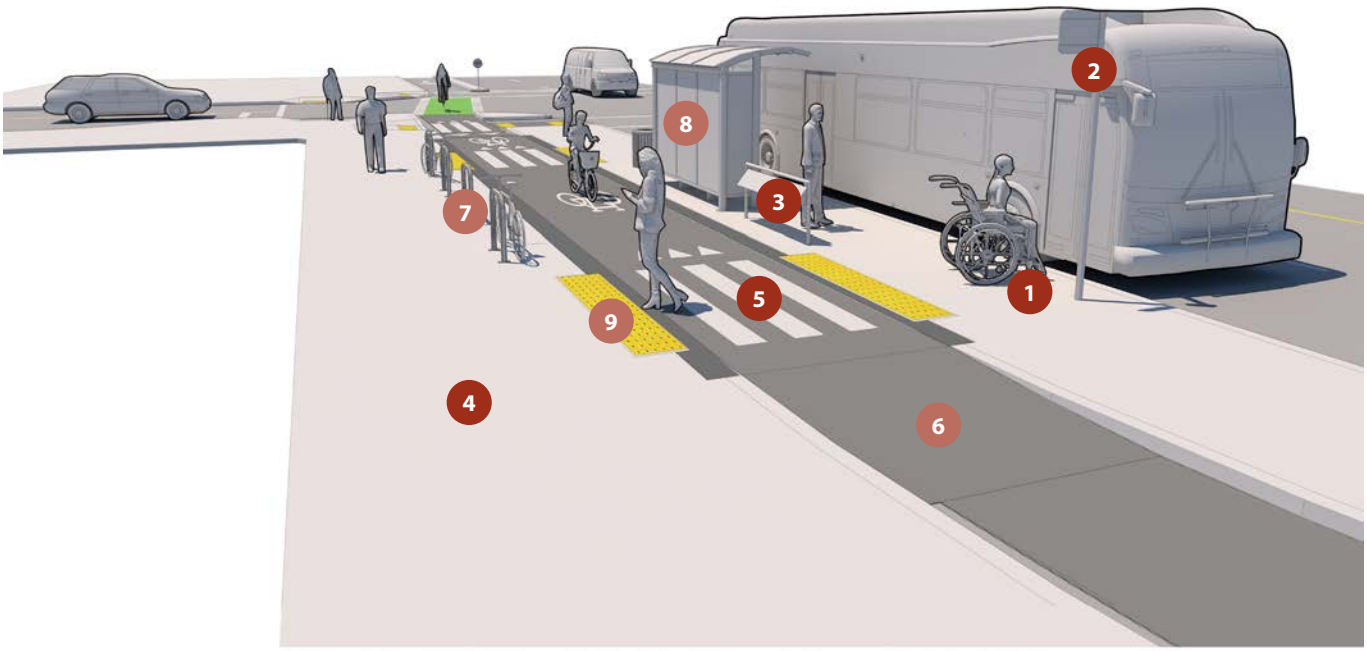
Transit stop layout is determined by the type of vehicles that will be using the stop and the facility type provided. Consideration is needed for the location of both the front and rear doors of any transit vehicles that will be using the stop, to ensure clear zones are maintained for boarding and alighting as well as the wheelchair lift or ramp. B.C. Transit and TransLink both provide guidance on their fleet of vehicles including dimensions to both the front and rear doors. The local transit agency should be consulted in the design process to confirm the design vehicles to be used for the design.

Four general sizes of buses currently operate on B.C. roads, including conventional buses, articulated buses, double-decker buses, and community shuttles. The following layout considerations are needed to accommodate each vehicle type.

- **Conventional bus**
  - *12.4 metre vehicle*
  - *Minimum 9 metre bus stop length*
  - *Greater than 0.45 metre clearance for the route identification pole*
  - *Preferred 3 metre long by 3 metre wide (2.5 metre minimum) clear zone at the front door to accommodate the wheelchair ramp/lift*
- **Articulated bus**
  - *Minimum 15 metre bus stop length*
  - *Greater than 0.51 metre clearance for the route identification pole*
  - *Preferred 3 metre long by 3 metre wide (2.5 metre minimum) clear zone at the front door to accommodate the wheelchair ramp/lift*
- **Double-decker bus**
  - *Minimum 9 metre bus stop length*
  - *Greater than 0.45 metre clearance for the route identification pole*
  - *Preferred 3 metre long by 3 metre wide (2.5 metre minimum) clear zone at the front door to accommodate the wheelchair ramp/lift*
  - *Overhead clearance of 4.8 metres or greater plus a minimum of 0.25 metre lateral clearance for the entire 4,8 metre height*
- **Community Shuttle**
  - *Minimum 8 metre bus stop length*
  - *A minimum 3 metre long by a preferred 3 metre wide clear zone is required at the rear of the bus stop*

Transit Stop Elements

All transit stops should be designed to consider the comfort and safety of all transit passengers as well as all other modes travelling past the stop. This section outlines the design elements that can be used, the zone where they should be sited, and classifies them as minimum, desired, or optional (see **Figure H-136**). Minimum transit stop elements are the typical treatments required to accommodate transit passengers, people walking, and people cycling. Desired transit stop elements will create a higher level of service and comfort for all modes. Optional design elements are context specific and should be reviewed with the transit agency prior to installation.



Minimum Design Elements

1. Accessible Landing Pad
2. Transit Route Identification Pole
3. Rear Clear Zone
4. Pedestrian Connection
5. Crosswalk

Desired Design Elements

6. Ramp Grade
7. Bicycle Parking
8. Shelters, Benches, and Garbage Receptacles
9. Tactile Walking Surface Indicators

Figure H-136 // Transit Stop Elements

Minimum Design Elements

1 Accessible Landing Pad

Located in the Furnishing Zone or in the Floating Transit Stop Zone

Accessible landing pads are required at all transit stops to allow passengers using mobility devices to board and alight the bus via the mechanical ramp or lift that is deployed from one of the bus doors. A concrete 3 metre by 3 metre space with no more than a 2% slope is preferred to allow people using mobility devices to navigate around the deployed ramp or lift. The accessible landing pad must be free of all obstructions and amenities.

2 Transit Stop Route Identification Pole

Located in the Floating Transit Stop Zone or the Furnishing Zone

A route identification pole is required to mark the stop location and communicate to riders the routes that use the stop. The route identification pole should be located a minimum of 0.5 metres from the face of the curb to ensure buses have adequate clear space when leaving the stop.

3 Rear Clear Zone

Located in the Floating Transit Stop Zone or the Furnishing Zone

This area is where the rear doors of the bus unload passengers and additionally serves as the loading area for community shuttle buses wheelchair lifts. The clear zone is required to be 4.5 metres long and 1.5 metres wide for standard, articulated, and double-decker buses and 3.0 metres wide for mini buses or community shuttles.

4 Pedestrian Connection To / From the Bus Stop

The Pedestrian Through Zone

Transit users need a pedestrian connection between the bus stop to their origin and destination. An effective transit system is served by a robust pedestrian network that allows transit users easily navigate the vital first and last legs of their journeys on foot.

5 Crosswalks to Cross the Bicycle Zone (required for Floating Bus Stops only)

Located in the Bicycle Through Zone

Crosswalks direct people walking to cross the Bicycle Through Zone at a designated point, helping to ensure yielding of right-of-way by people cycling past the transit stop. Crosswalks should be located at points that provide clear sightlines for people walking, cycling, and driving to prevent collisions. At least two crosswalks are preferred to minimize congestion from people boarding and alighting through both the front and rear doors. When adequate width of a floating transit stop exists, additional amenities such as a shelter, or bench can be sited between the two crossings to direct pedestrians to the preferred crossing locations. An additional crosswalk is desirable at all mid-block transit stops to improve connectivity for pedestrians walking on the other side of the road.

Desired Design Elements

Bicycle Lane Elements

Located in the Bicycle Lane Zone

- **Bypass zone:** A bypass zone shifts the bicycle facility behind a floating transit stop. Careful design considerations are required to ensure the bypass is safe and comfortable for people cycling that minimizes any potential conflicts with pedestrians. The bypass zone can constrict the bicycle lane width to a minimum of 1.5 metres. Design professionals should consider visually and physically narrowing the bicycle facility at locations where people cycling might be travelling at high speeds, to encourage people cycling to slow down. Additional signage or pavement markings may be effective at managing the speed and yielding behaviour of people cycling.

6 **Ramp grade:** The bicycle lane should transition to sidewalk grade for the length

of the floating transit stop to provide a level crossing for people accessing the transit stop. To create a comfortable transition from a street level bicycle lane to a sidewalk level bicycle lane that bypasses the floating transit stop, the maximum ramp grade slope should be 1:12. Drainage considerations are required to ensure water does not pool in the bicycle lanes in transition points.

- **Taper:** To create a comfortable transition from a curbside bicycle lane or protected bicycle lane to a bicycle lane that bypasses the floating transit stop, the desired taper should be 1:12 with a maximum taper of 1:5 in constrained environments.
- **Surface treatment:** The bicycle lane surface treatment should create a visual contrast from the adjacent floating transit stop and sidewalk. The asphalt surface treatment should continue from the curbside or protected bicycle lane through the floating transit stop, with optional green pavement markings to create additional contrast. A detectable edge treatment should be applied along the length of the sidewalk grade bicycle lane that bypasses the floating transit stop to provide tactile warning for people who are visually impaired. Consider installing yield pavement markings in advance of the crosswalk locations.

8 Benches

Located in the Furnishing Zone or the Floating Transit Stop Zone

Benches are preferred at all transit stops to provide a comfortable place for passengers to wait for the bus. Benches should be located in the Furnishing Zone, while maintaining a Pedestrian Through Zone of 1.8 metres. Benches can also be located in the Floating Transit Stop Zone when adequate width exists to maintain 1.5 metres clear from the leading edge of the bench to the curb. Benches can be sited under transit shelters or free standing when no shelter exists.

7 Bicycle Parking

Located in the Furnishing Zone or the Floating Transit Stop Zone

Bicycle parking should be installed at transit stops to encourage multi-modal trips. Bicycle parking at transit stops allows passengers additional choices for their 'first- and last-mile' connections. All bicycle racks should ensure that a minimum 1.8 metre Pedestrian Through Zone is maintained as well as a minimum 0.5 metre clear space between the bicycle lane and the rack. Further bicycle parking guidance can be found in **Chapter H.2**. Bicycle parking at transit stops should consider both the needs of people using bike share and traditional individually owned bicycles. Refer to **Chapter H.2** for further guidance on bicycle and scooter share parking considerations.

8 Shelters

Located in the Furnishing Zone or the Floating Transit Stop Zone

Transit shelters are a preferred design element at all transit stops to provide waiting passengers a safe, comfortable and dry space to wait. Transit shelters should be sited so they do not impede pedestrian circulation and are a maximum of 9 metres from the route ID post to ensure efficient boarding. Shelters should provide both seating and a 1 metre wide clear space for a person in a wheelchair. Lighting should be provided to illuminate the interior of the shelter either through its own light source or adjacent road lights. Shelter design should be simple to allow easy maintenance and maintain clear sightlines to create a safe environment for waiting passengers.

9 Tactile Walking Surface Indicators

Located in the Furnishing Zone and the Floating Transit Stop Zone

Tactile walking surface indicators (TWSIs), as discussed in **Chapter B.3**, are used to alert passengers that they are approaching an area that is used by a different mode. TWSIs are desired to delineate either side of the bicycle lane where pedestrians are directed to cross

the cycling facility. Additionally, longitudinal tactile warning strips can be used to direct passengers to the front door of the bus.

Lighting

Located in the Furnishing Zone or the Floating Transit Stop Zone

Lighting is important to create a safe and secure environment for passengers waiting for transit during night time operation. Lighting ensures visibility is maintained for all modes. Adequate lighting can be achieved with installation of pedestrian-scale lighting on or around the shelter or through road lights in close proximity to the transit stop.

8

Garbage Receptacles

Located in the Furnishing Zone or in the Floating Transit Stop Zone

To keep transit stops clean and comfortable, garbage receptacles are desired at stops with higher ridership, stops with shelters, and in commercial areas. Garbage receptacles can be used to direct passengers boarding and alighting to the crosswalks across the bicycle lane.

Optional Design Elements

Advertisement Board

Located in the Furnishing Zone or in the Floating Transit Stop Zone

Many communities have advertising agreements that require transit shelters to display advertisement panels. The placement and orientation of these panels is important as the opaque panel will block people's sightlines as they are boarding and alighting the bus. When the transit shelter is sited in the Floating Transit Stop Zone, it is preferred for the advertisement panel to be separated from the shelter to maintain sightlines of both people walking and cycling through the bus stop area.

Railings or Lean Bars

Located in the Floating Transit Stop Zone

Railings or lean bars can be used to provide a place for waiting passengers to rest and to direct passengers towards the preferred crossing locations of bicycle lane. Similar to all other amenities located in the Floating Transit Stop Zone, a minimum of 0.5 metres clear space is required from edge of the bicycle lane to the railing or lean bar.

Street Trees

Located in the Furnishing Zone

When properly sited, street trees can create a more desirable waiting area at the transit stop. Street trees need to be located so they do not impact the sightlines of any modes of transportation and do not infringe into the required clear operating space for all transit vehicles.

TRANSIT STOP TYPES

Floating Transit Stop

Floating transit stops are the preferred treatment at transit stops along corridors with bicycle facilities. Various floating transit stop configurations can be considered depending on the bicycle facility type along the corridor, but many design elements are consistent across all floating transit stops. The consistent elements include: the dimensions of the floating transit stop island, the bicycle lane ramp and taper, required and desired amenities, and accessibility requirements that ensure the stop is safe and comfortable for all modes and users.

Description

Figures H-137 to **H-139** show different configurations of far-side floating transit stops transitioning from a protected bicycle lane, curbside bicycle lane, and parking protected bicycle lane. These are the preferred treatments for corridors with each of these facility types. The back of the transit stop must be located a minimum of six metres from the crosswalk at the nearest intersection.

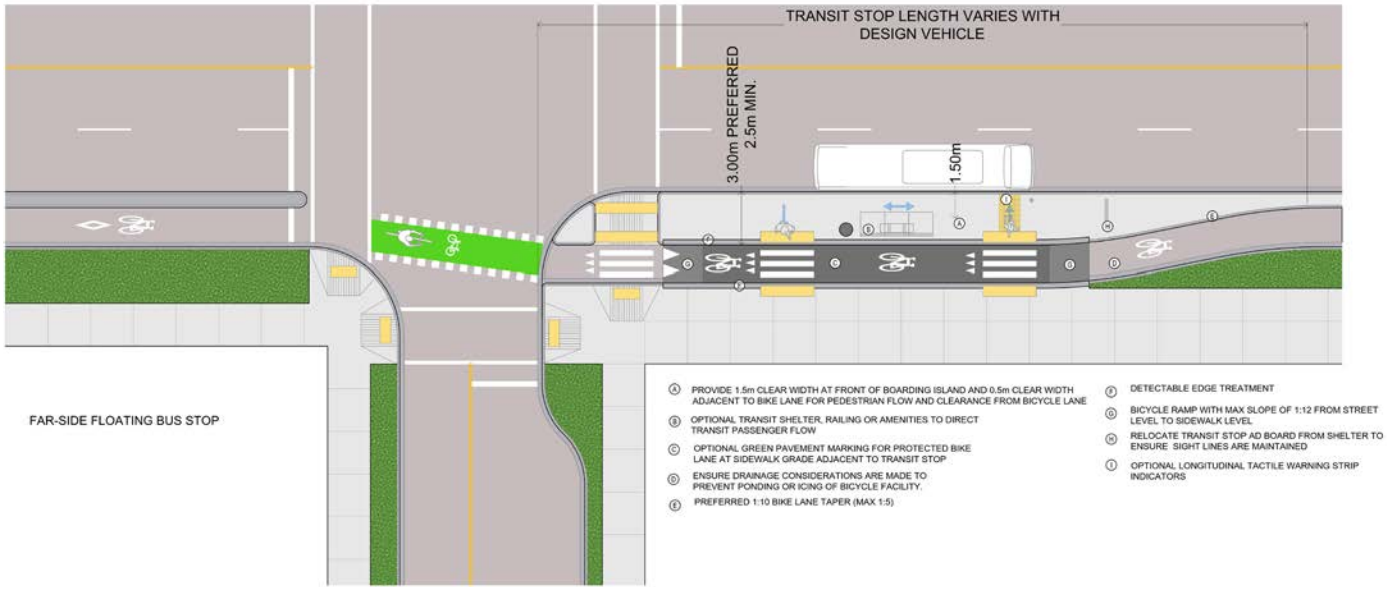


Figure H-137 // Protected Bicycle Lane Floating Transit Stop

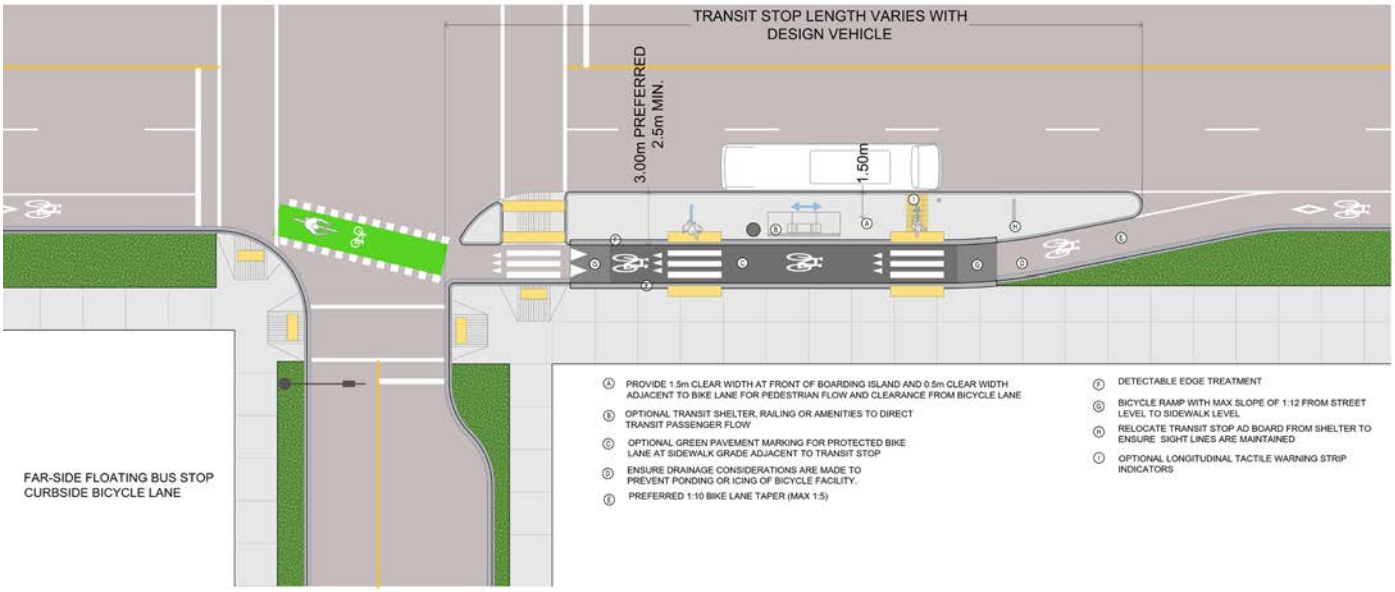


Figure H-138 // Curbside Painted Bicycle Lane Floating Transit Stop

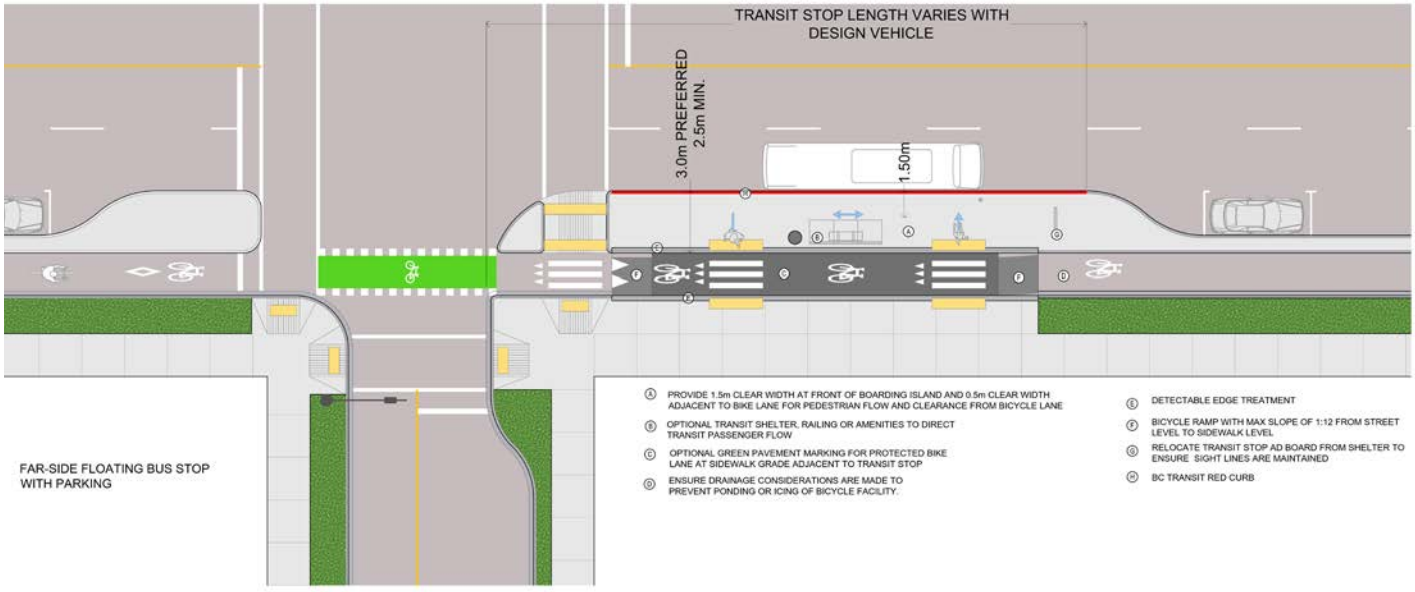


Figure H-139 // Parking Protected Painted Bicycle Lane Floating Transit Stop

Mid-Block Floating Transit Stop

Figure H-140 shows a mid-block floating transit stop where a bicycle lane transitions to the bicycle bypass to separate people cycling from the motor vehicle lane.

Application

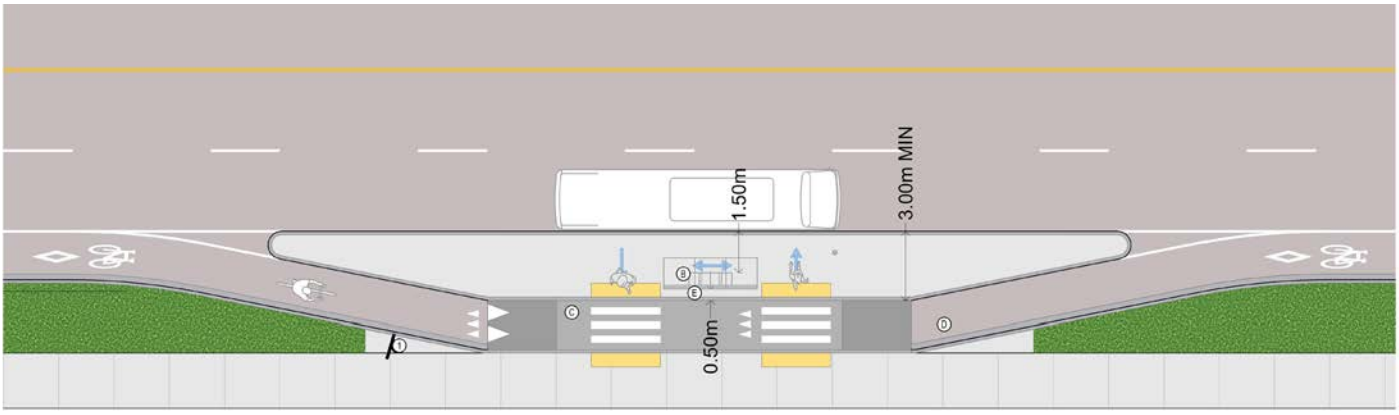
- Not preferred on high speed roadways (>60km/h)
- Low frequency transit stops

Design Guidance

- Dimensions
  - *Floating transit stop island dimensions – 3 metres wide preferred, 2.5 metres minimum; length determined by stop usage.*
  - *Transit stop dimensions – 6 metre minimum clearance from the nearest crosswalk*
  - *Bicycle lane dimensions:*
    - *Unidirectional bicycle facility:*
      - *Width - 2.5 metres preferred, 1.2 metres minimum*
      - *Taper – 1:10 preferred, 1:5 minimum*
      - *Ramp grade – 1:12 slope maximum*
    - *Bi-directional bicycle facility:*
      - *Width - 4 metres preferred, 2.4 metres minimum*
      - *Taper – 1:10 preferred 1:5 minimum*
      - *Ramp grade – 1:12 slope maximum*
  - Additional signage:
    - *Add Yield to Pedestrians sign (MUTCDC RB-39) for people cycling approaching the floating transit stop.*

Curbside Transit Stop (With Bicycle Facility)

Curbside transit stops along corridors with bicycle lanes are less desirable from both a comfort and safety standpoint for people cycling as well as from a transit speed and operation perspective. All others options including stop relocation, constrained floating transit stop, and stop consolidation should be considered before designing a curbside transit stop adjacent to a bicycle lane.



① YIELD TO PEDESTRIANS RB 39

Ⓐ PROVIDE MIN 1.5m CLEAR WIDTH AT FRONT OF FLOATING TRANSIT STOP

Ⓑ TRANSIT SHELTER

Ⓒ OPTIONAL GREEN PAVEMENT MARKING FOR CONFLICT AREA

Ⓓ ENSURE DRAINAGE CONSIDERATIONS ARE MADE TO PREVENT PONDING OR ICING OF BICYCLE FACILITY.

Ⓔ MIN 0.5m CLEAR WIDTH ADJACENT TO BIKE LANE FOR PEDESTRIAN FLOW AND CLEARANCE FROM BICYCLE LANE

Figure H-140 // Mid-block Floating Transit Stop

Description

Curbside transit stops require transit vehicles to stop to board or alight within the bicycle lane, requiring people cycling to either stop and wait or to pass the transit vehicle in the motor vehicle lane. The increased interactions between people cycling and the transit vehicles can have a negative impact on the operation of the transit route due to the 'leap-frogging' effect of people cycling passing the stopped transit vehicle when boarding and alighting and getting passed by the transit vehicle between stops. This operation additionally increases the risk of collisions with motor vehicles for bicycle users passing stopped transit vehicles.

Application

- Roads with posted speed limits of 50 km/h or less.
- Low frequency transit stops that do not serve as timing points for the route.
- Consider for locations with constrained space and limited available funding.

Design Guidance

- All minimum design elements required.
- Transition the solid bicycle lane line to a dashed line treatment throughout the length of the transit stop. The dashed line treatment should be a minimum of 30 metres in length and should allow the required bus pull-in/pull-out taper without crossing the solid line. The local transit agency should be consulted regarding the transit vehicles operating on the route when designing the start and end points of the dashed line treatment.
- A minimum width of 5.8 metres is required for the combined width of the bicycle lane and adjacent motor vehicle lane for a two-lane bidirectional road. This minimum width ensures that motor vehicles are able to pass on the left side of stopped transit vehicles.
- Optional sharrow pavement markings can be placed in the bicycle lane in the transit zone.

Curbside Transit Stop (Without Cycling Facility)

Curbside transit stops are the typical transit stop design for roads that do not have bicycle facilities. At these stops, transit passengers board and alight at stops identified by stop identification poles. All transit stop amenities are located within the Furnishing Zone. When designing a curbside transit stop, design professionals should consider the speed limit and laning configuration of the road of interest.

Description

Three curbside transit stop configurations can be selected from when designing transit stops along corridors without bicycle facilities. The options to consider include:

- **Bus Bulge**: where the transit stop is located on a widened section of the sidewalk that protrudes into the parking lane;
- **Bus Bay**: where the transit stop is located within a pull-over zone that removes the stopped transit vehicle from the adjacent motor vehicle lane; and
- **Basic Curbside**: where the transit stop is located on the curb of the motor vehicle lane.

Application

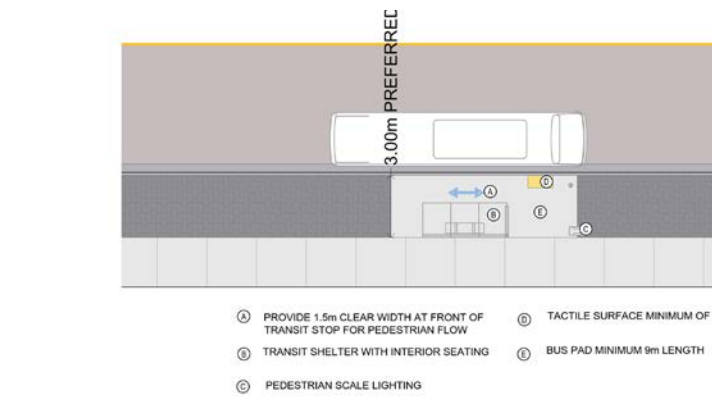
Urban Application

- **Bus Bulge**
  - *Preferred design to provide increased visibility for transit passengers.*
  - *Limits the amount of on-street parking removal required.*
  - *Provides additional space for transit stop amenities.*
  - *Reduces transit route delays since the bus does not need to re-enter the motor vehicle travel lane.*

- **Bus Bay**
  - *Preferred design on highways or arterials with a posted speed limit of 60 km/h or greater.*
  - *Recessed bus bay allows transit vehicles to wait at a stop location out of the motor vehicle travel lane, which makes bus bays desirable at timing points along a route*
  - *May increase transit delays since the bus is required to pull-off and re-enter the motor vehicle travel lane.*
- **Basic Curbside (see Figure H-141):**
  - *Constrained locations where space does not exist to provide a bus bulge or bay.*

Rural Application

- **Rural Transit Stop (see Figure H-142):**
  - *Rural transit stops are located along rural roadways and highways that typically do not have sidewalks. For rural transit stops to be wheelchair accessible and allow the deployment of a transit ramp or lift, a waiting area that is elevated 150 millimetres is required. The transit stop pad is typically built within the existing shoulder, with curb letdowns at either end.*



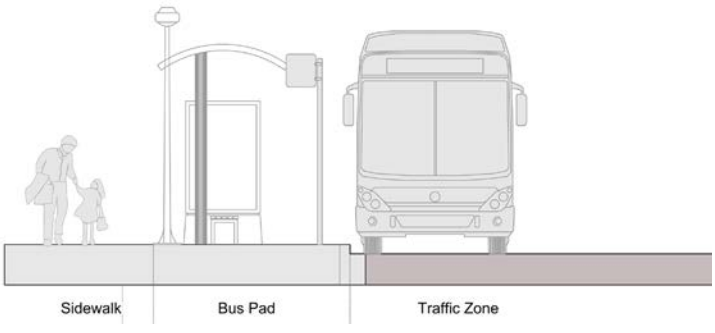
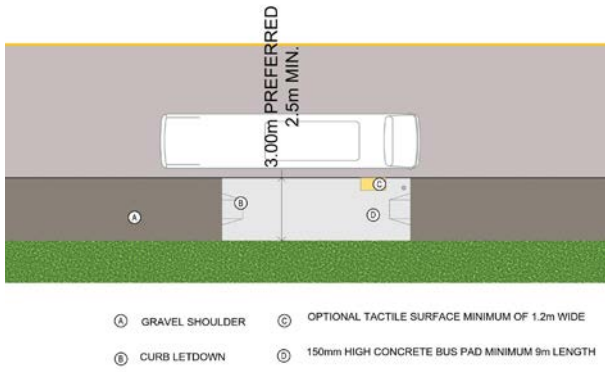


FIGURE H-141 // URBAN BASIC CURBSIDE ACCESSIBLE TRANSIT STOP



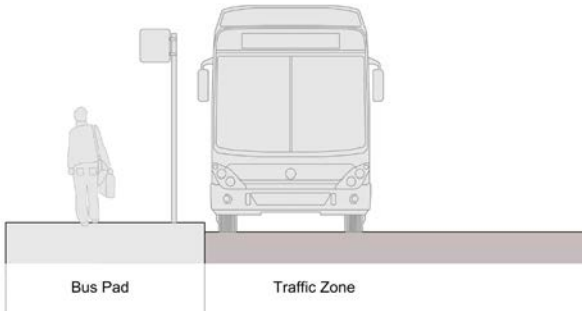


FIGURE H-142 // RURAL ACCESSIBLE TRANSIT STOP

FERRIES AND FERRY TERMINALS

Ferry services provide an important link for regional travel between many B.C. communities, both coastal and inland. These services facilitate commute and errand/service trips as well as bicycle tourism, which is a significant economic driver in a number of B.C. communities. Better accommodation of active transportation at ferry terminals and on ferry vessels helps support local economies, while facilitating active and sustainable transportation throughout the province.

This section identifies opportunities to better accommodate walking, cycling, and other active transportation modes in the planning and design of ferry terminals and on ferry vessels.

Ferry Terminals, On-Site

Ferry terminals are the interface between ferries themselves and the surrounding transportation networks. Effectively planned and designed active transportation facilities that connect points of arrival and departure with off-site active transportation facilities ensures that walking, cycling, and other forms of active transportation are desirable options to travel to and from ferry terminals. The most common opportunities to facilitate active travel to and from ferries include:

1. Walk to and from ferry terminal, and walk on and off the ferry;
2. Bicycle to the ferry terminal, park the bicycle at the ferry terminal, and walk on the ferry; and
3. Bicycle to the ferry terminal and board the ferry with the bicycle.

All terminal planning and development is undertaken by the organization with jurisdiction over the terminal, most commonly with provincial and local or regional governments involved in the process as a stakeholder. While the ultimate responsibility for terminal design lies with the ferry jurisdiction, the following guidance is provided to better understand how to plan and design effective ferry terminals that encourage walking, cycling, and other forms of active transportation to travel to and from ferry terminals.

- Provide bicycle and pedestrian facilities that provide a direct, intuitive connection between active transportation facilities outside the terminal area and the points of arrival and departure within the terminal.
- Mark crossings and conflict zones with appropriate pedestrian crossing control markings and/or bicycle conflict zone markings. Refer to **Section G** for further guidance on crossing treatments.
- Consider adding physical protection where a pedestrian and/or bicycle facility is adjacent an area of high motor vehicle speed.
- Consider measures to prevent motor vehicles from blocking or temporarily impeding walking and/or bicycle facilities where motor vehicle parking or queuing is near an active transportation facility. Conversely, pedestrian management measures (such as signals or gates) may be required to manage conflicts with vehicles during loading / unloading periods.
- Utilize wayfinding to strengthen the connection between on- and off-site active transportation facilities, which may include signs, surface markings and other visual queues.

Ferry Terminals, Off-Site

The provision of safe and comfortable active transportation facilities leading to and from ferry terminals facilitates walking, cycling, and other forms of active transportation, thereby broadening the travel options available to individuals completing regional trips and further supporting trip making via healthy, sustainable travel modes.

The following guidance is provided to ensure active transportation facilities nearby ferry terminals are appropriately designed and provide strong connectivity to the ferry terminal. Guidance is directed at the organization with jurisdiction over transportation corridors – commonly the provincial government or the respective local or regional government – but may also be referenced by BC Ferries or other ferry operators to understand how ferry terminals may integrate with off-site networks.

- Provide a direct, intuitive connection between nearby active transportation facilities and the arrival / departure areas, vehicle drop-off / pick-up areas, and bus stops.
- Reference and consider reflecting the ferry service provider's sign and pavement marking standards for active transportation routes to and from ferry terminals to create a consistent treatment and aid in pedestrian and cycling wayfinding.
- Consider providing an information kiosk oriented at bicycle users exiting the ferry terminal that includes maps and supporting information directing bicycle users on preferred routes to destinations in the region. This is particularly important for bicycle tourists.
- Active transportation facility planning and design nearby ferry terminals should include BC Ferries or other ferry operators as a stakeholder to ensure integration of active transportation facilities in ferry terminals with nearby facilities

Ferry Vessels

The type, model, and design of ferry vessels is the responsibility of the ferry operator. There is therefore limited ability for local or regional governments or the provincial government to influence the provision of active transportation facilities on ferry vessels.

Given that encouraging active transportation is a province-wide objective, it is important that existing ferries are retrofitted to the extent possible and that the procurement of new ferries include provision of basic facilities that facilitate active transportation.

Pedestrian travel is generally well accommodated on ferries by way of clear corridors, elevators as an alternative to stairways to accommodate mobility devices, and directional and wayfinding signs to on-board amenities.

Bicycle lane to access Duke Point Ferry Terminal
Source: Brian Burger

The level of bicycle accommodation on ferries varies based on the type, age, and route of the vessel. While bicycles are well accommodated on some vessels they are not as well-accommodated on others. The following bicycle accommodation measures should be considered:

- Bicycle parking areas should be provided that include bicycle-specific racks or locking areas. The number of bicycle parking spaces should accommodate summer months when demand for bicycle parking is highest. Consideration may be given to 'fold away' bicycle parking racks that can be collapsed while not in use.
- Bicycle parking should be well designed to address concerns over bicycle damage and bicycle / bicycle parts theft during sailings. The design / layout guidance for bicycle parking provided in **Chapter H.2** should apply. Design related to bicycle stability is particularly important given the potential for movement during ferry sailings.
- Hooks and/or lockers may be provided adjacent to bicycle parking so that bicycle users can store helmets, bags and/or clothing.
- Wayfinding signs should be provided that direct people cycling where to park.

AIRPORTS

There are upwards of 40 airports in B.C. that are significant generators of travel in communities throughout the province. Generally, airports are located in outlying areas due to the need for large areas of land to accommodate airport activities. Some are in major urban centres with access to a variety of travel options (such as Vancouver, Victoria, and Kelowna), while most provide access to very remote communities with limited travel options, such as Masset and Texada/Gilles Bay.

While the bulk of trips to and from airports are made by motor vehicles, as well as taxis, shuttles and public transit at larger airports, there can be a role for active transportation for a portion of trips to and from airports to further support community-wide active transportation uptake and to help reduce the demand for motor vehicle parking and drop-off/pick-up space for taxis and shuttles on airport sites. The following are opportunities to integrate active transportation facilities at airports:

- **Network Integration**: Where sidewalks, bicycle facilities, or other active transportation infrastructure is present nearby an airport, ensure that those facilities provide a continuous connection to the airport site and terminal building. Jurisdiction over airports in B.C. may be federal, provincial, municipal or private, and the ability and/or interest in building bicycle infrastructure on airports lands may vary from site to site.
- **Bicycle Station**: Create an on-site bicycle station to encourage both travellers and airport employees to travel to and from the airport by bicycle. The bicycle station may include short-term bicycle parking (e.g. bicycle racks), long-term bicycle parking (e.g. lockers or bicycle room), and end-point amenities such as a repair stands, tools, and maps and related information.
- **Pedestrian Integration**: Enhance pedestrian facilities between the terminal building and on-site travel options such as taxis and shuttles to prioritize these modes over private motor vehicle use.

Case Study

Airport Bicycle Parking, Victoria, B.C.

To facilitate cycling to/from the airport and consistent with Victoria's status as the 'cycling capital of Canada', the Victoria International Airport (YYJ) has created a bicycle station in the short-term parking area immediately adjacent the terminal arrivals area. The bicycle station includes secure bicycle parking available at $2 per day (as opposed to $16 to per day to park a vehicle), short-term bicycle parking racks, and a repair stand and tools for basic bicycle maintenance.

NEW MOBILITY

New mobility refers to new or emerging travel modes, typically made possible by advances in technology and/or telecommunication. Relevant new mobility forms include active travel modes such electric bicycles, electric scooters and bikeshare that are explored in detail in **Chapter H.5**, as well as other new mobility forms such as electric vehicles, carshare and ride-hailing.

The following are opportunities to encourage integration between active transportation facilities and the various new and emerging new mobility options:

- **Short-term bicycle parking** may be located adjacent to carshare vehicle parking locations to allow carshare users with bicycles to access the carshare vehicle;
- **Carshare vehicles** may be mounted with a bicycle rack that allows carshare users to bicycle to/from the carshare parking location to access the vehicle, as well as use a carshare vehicle to transport a bicycle to a recreational cycling location; and
- **Establish ride-hailing pick-up points at** key trip origins to facilitate passenger pick-up once ride-hailing becomes widespread in B.C.

Bicycle parking along Fort Street protected bicycle lane, Victoria, B.C.

H.2

END-POINT FACILITIES

In order for active transportation to be an attractive and competitive transportation option, it needs to be as convenient as possible. Providing end-point facilities such as short-term and long-term bicycle parking, showers, change rooms, repair facilities, and parking for other active modes is an important way to accommodate active modes of travel for everyday trips.

BICYCLE PARKING OVERVIEW

Providing convenient, safe, and secure bicycle parking is key to encouraging cycling as a mode of transportation. Design professionals must consider a number of factors when providing bicycle parking, including the bicycle parking type, placement, quantity, and installation method. There are two main categories of bicycle parking: short-term and long-term bicycle parking. Each of these categories of bicycle parking are described in further detail below.

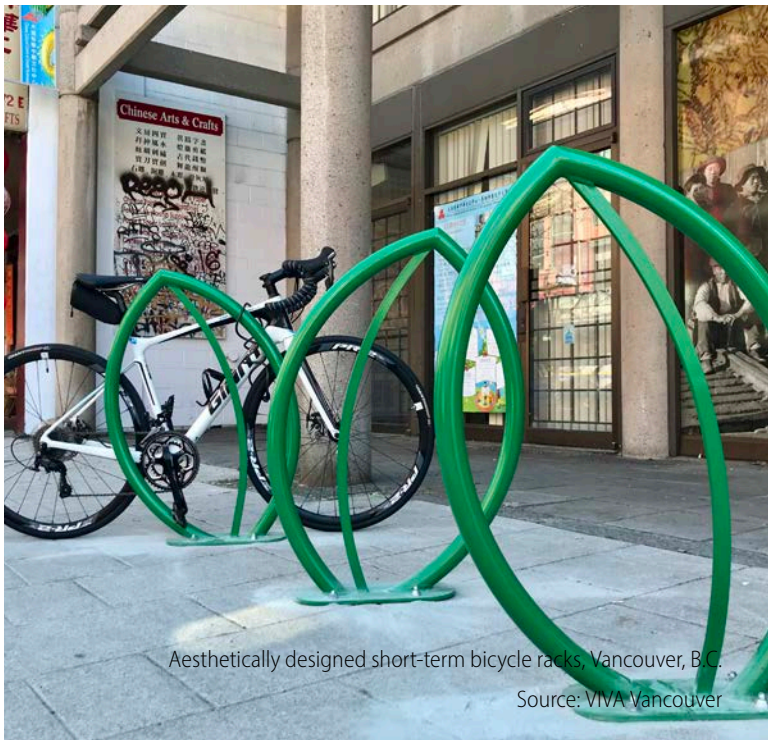
Bicycle Parking Programs and Policies

Local governments play a key role in ensuring that ample and high-quality bicycle parking is available in their communities. Insufficient, inefficiently located, and/or low-quality bicycle parking may result in bicycle theft, sidewalk clutter, as well as damage to street furniture and property.

To mitigate these issues and encourage cycling as an active and sustainable form of transportation, local governments should develop bicycle parking programs that support the provision of bicycle parking in public places such as sidewalks, on-street parking stalls, and at parks and other civic spaces. Local governments can also introduce short- and long-term bicycle parking requirements for private developers and employers, covering both new developments and retrofits. In B.C., municipalities can regulate the provision of bicycle parking for new developments and retrofits in their development regulations. Municipalities should establish bicycle parking regulations that designate both the quantity and design / layout of bicycle parking, providing clear standards for bicycle rack configuration, design, placement, and installation.

Bicycle parking regulations should be context-specific, with local jurisdictions outlining the minimum number of required bicycle parking spaces for both short-term and long-term use. Factors that influence the number of bicycle parking spaces include land use, number of residents or employees, floor area, site planning requirements, and/or bicycle parking design specifications. Land uses that typically generate shorter visits such as commercial, retail, dining, recreational, and civic uses should provide sufficient short-term bicycle parking. Likewise, long-term bicycle parking should be required for high activity transit stops, workplaces, and multi-family residential developments.

Similar to parking requirements for motor vehicles, a certain amount of bicycle parking can be required based on the number of units or the floor space of a development. In both short-term and off-road, long-term bicycle parking facilities, it is recommended that 10% of all bicycle parking spaces be able to accommodate larger, non-standard bicycles such as cargo bicycles. Additionally, a number of electric bicycle charging spots should be provided. It is recommended that 50% of long-term and 10% of short-term bicycle parking be designed to accommodate e-bikes by providing an electrical outlet.



Aesthetically designed short-term bicycle racks, Vancouver, B.C.
Source: VIVA Vancouver

Case Study

Bicycle Parking Requirements and Strategy, Victoria, B.C.

The City of Victoria has regulations and guidelines in place to ensure that high-quality bicycle parking is provided both on- and off-road throughout the city. These guidelines ensure that all new development includes adequate and appropriately designed bicycle parking and continues to contribute to making Victoria one of the most bicycle-friendly communities in Canada. Schedule C of the City of Victoria's Zoning Bylaw sets out the minimum number of required short-term and long-term bicycle parking spaces for a range of residential, commercial, institutional, and industrial land uses. Generally, the recommendations are based on the number of dwelling units for residential buildings and the total floor area for other land use classes.

The bylaw also sets out bicycle parking installation requirements for both short-term and long-term bicycle parking. For example, it indicates how far away short-term bicycle parking can be located from the destination building, as well as the proper spacing between bicycle racks to ensure they can meet their capacity without impeding pedestrians or building entrances. For long-term bicycle parking, the bylaw set outs minimum bicycle room dimensions, rack specifications, and access requirements.

Victoria's Zoning Bylaw is supported and informed by the City of Victoria's 2011 Bicycle Parking Strategy, which presented the importance of proving bicycle parking and provided design guidance for on-street and off-road bicycle parking facilities. The Bicycle Parking Strategy also provides guidance on end-of-trip facilities, maintenance, management, advertising potential, and emerging bicycle parking technologies. Documents such as this strategy and the Zoning Bylaw clearly define expectations and guidelines for both government planners and private developers to provide excellent bicycle parking in all developments.

BICYCLE PARKING GUIDING PRINCIPLES

The following guiding principles apply to both short- and long-term bicycle parking. These guiding principles help to select the appropriate type and location of bicycle parking and are key to ensuring that bicycle parking is convenient, accessible, and secure for all types of bicycle and for people of all ages and abilities.

- **Convenience:** Bicycle parking should be located in convenient and intuitive locations, near building entrances (no more than 15 metres away), and at common destinations such as parks and sport fields. Bicycle racks should be easily visible from adjacent bicycle routes or, in the case of off-road parking especially, have signage and wayfinding that helps people cycling locate the bicycle parking. Bicycle parking should also be plentiful enough that people cycling can be confident of finding a parking spot in close proximity to their destination, as this will reduce the number of bicycles locked to street furniture such as parking metres, railings, and sign posts. Weather protection should be provided wherever possible to help encourage all-season cycling.
- **Safety and Secure:** Bicycle parking should be located in a well-lit and highly-visible location with passive surveillance from pedestrians, retail activity, and/or building windows; otherwise, other security measures should be taken. Passive and active surveillance help to discourage theft and vandalism and also make people cycling feel safer. Bicycle parking should be built to resist being cut or detached using bolt cutters, piper cutters, or other devices. Bicycle racks should be firmly anchored to the ground or building structures.
- **Functional:** Bicycle parking designs should be intuitive and functional for a wide range of bicycle types, including longer, taller, and wider models (e.g. recumbent bicycles, cargo bicycles, bicycles with child trailers, etc.). Bicycle parking should also accommodate bicycles with attachments such as baskets and other accessories. Bicycle parking should also be designed so that people of all ages and abilities can safely and easily park a bicycle without having to lift the bicycle onto a rack. Proper bicycle parking placement is crucial to ensuring functionality. Clearance from buildings and other features is a significant component of functionality. Even if bicycle racks are well designed, they become less functional if they are installed with insufficient clearance from buildings, street furniture, vegetation, and other bicycle racks. Finally, proper maintenance, especially in winter climates where snow clearing is necessary, is crucial to ensuring that on-street bicycle racks remain accessible and functional in all seasons.
- **Accessible:** Bicycle parking should not conflict with other transportation modes, including motor vehicles and pedestrians. On-street bicycle parking should not be placed in a way that results in either bicycle racks or parked bicycles impeding transit vehicles or users, people opening the door of a parked car, or pedestrians in the Pedestrian Through Zone of the sidewalk. Bicycle racks must be easily detectable by a visually impaired person using a cane to navigate. Bicycle racks should not present a tripping hazard or have sharp edges, and protrusions above 0.7 metres tall should not overhang by more than 0.3 metres.
- **Aesthetics:** Bicycle parking design can be coordinated to match or enhance the surrounding streetscape and other street furniture using certain designs, colours, branding, and even custom shapes. However,

design functionality must be prioritized over aesthetic appeal. Both on- and off-street bicycle parking should receive ongoing maintenance to check for unsecured racks and keep the parking free of debris, vandalism, and abandoned bicycles or locks.

SHORT-TERM BICYCLE PARKING

Short-term bicycle parking is generally intended for people stopping for two to four hours or less to run errands, shop, have a meal, or partake in any other short-term activity. Short-term bicycle parking is generally appropriate for commercial and retail areas, office buildings, health care and recreational facilities, and institutional developments such as libraries and universities. Short-term bicycle parking typically consists of on-street bicycle racks, bicycle corrals, or covered bicycle parking in commercial, institutional, and recreational areas and at key community destinations. Key considerations for short-term bicycle parking include proximity to destination, ease of use, and winter maintenance.

Bicycle Racks

Bicycle Rack Selection

Bicycle racks are the most common and versatile type of short-term bicycle parking. Bicycle racks come in a variety of styles that vary greatly in functionality. This section outlines some of the most common types of bicycle racks, although this list is not exhaustive. Bicycle rack selection and installation should be consistent with local design standards, using tested and approved rack types, attachments, and mounting surfaces. All bicycle racks should meet the following performance criteria:

- **Supportive**: Supports the bicycle in an upright position, providing at least two points of contact with the bicycle frame. In order to support a wide range of bicycle types, bicycle racks should be a minimum of 80 centimetres tall and 45 centimetres wide.

Well-used short-term bicycle parking, Tofino, B.C.

- **Lockable**: Allows the frame and at least one wheel to be securely locked to the rack using a U-lock.
- **Flexible**: Accommodates a variety of bicycle types and attachments by providing appropriate clearances and avoiding rack designs that restrict the length, height, or width of bicycles or attachments.
- **Intuitive**: Is simple and intuitive to use and is recognizable as a bicycle rack. The user should not have to lift the bicycle or move another bicycle to use the bicycle rack.
- **Secure**: Is both secure and durable due to context-appropriate materials and installation methods.

Bicycle Racks for All Applications:

The bicycle rack designs in **Table H-36** meet the performance criteria and are generally appropriate for all applications:

Table H-36 // Bicycle Racks for All Applications

RACK TYPE	NOTES
Inverted U (Also called loop or staple rack) 	• Can support two bicycles per rack. • Can be installed alone or in a series on rails. • Many variations are available. • Can be efficiently located within the Furnishing Zone of a public right-of-way.
Post and Ring 	• Can support two bicycles per rack. • Products exist to retrofit certain parking metres to create custom post and ring racks. • Can be efficiently located within the Furnishing Zone of a public right-of-way.

Bicycle Racks for Non-Standard Bicycles:

Many non-standard bicycles are longer, wider, and heavier than a typical bicycle, making them challenging to park using conventional bicycle racks. However, these bicycles are typically self-standing (such as tricycle) or have a stand (such as cargo bicycles), meaning that they may not require a rack that supports the frame of the bicycle in two places. Special bicycle racks designed for non-standard bicycles can both make it easier to lock up non-standard bicycles and dissuade standard bicycles from taking up designated spaces. Users of non-standard bicycles may be more likely to use large chain locks rather than u-locks, which allows greater flexibility in the bicycle rack design.

Bicycle racks for non-standard bicycles are shown in **Table H-37**. Bicycle racks for non-standard bicycle are not recommended for on-street installation along sidewalks. They may be suitable in short-term applications in covered bicycle shelters, parks, or outside community facilities such as recreation centres. They are also suitable for off-street locations such as parkades, bicycle rooms, and bicycle stations (described later in this chapter. These special racks may not be recognizable as bicycle racks and should be marked as such using signage and/or pavement markings. They should be located at grade or accessible via a ramp so that users do not need to lift their bicycles.

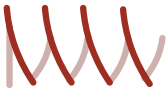
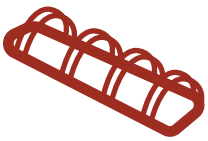
Table H-37 // Bicycle Racks for Non-Standard Bicycles

RACK TYPE	NOTES
Half-Height Stand  Source: Kevin Hickman	•Low enough that it will not support a standard bicycle, helping to reserve it for non-standard bicycles. •No lower than half height (40 centimetres tall), as some users may have difficulty bending down to access the rack. •Can be a tripping hazard; therefore, racks should be clearly marked with signage and/or pavement markings and installed in groups, preferably in a well-lit and sheltered location.
Ground Fixings   Source (both images): VelopA	•Parking bracket that can be flipped up by foot up to provide a secure place to attach a lock. •When not in use, the bracket retracts into the ground, so it is not a tripping hazard. •May not be accessible for people with limited leg or foot control or people with difficulties bending down.
Copenhagenize Bar  Source: Mikael Colville-Anderson	•An emerging technology in Denmark; still in design phase, not in widespread use. •Consists of a movable bar that flips down to secure the bicycle; moving parts would require maintenance. •Could feature a built-in locking mechanism active through a swipe card for subscribers.

Bicycle Racks to Avoid:

It is recommended that the following bicycle rack designs be avoided due to performance concerns as shown in **Table H-38**.

Table H-38 // Bicycle Racks to Avoid

RACK TYPE	NOTES
Wave 	•Only supports frame at one location and can require lifting wheel to park bicycle. •Often fails to provide advertised capacity.
Spiral 	•Only supports frame at one location and can require lifting wheel to park bicycle. •Often fails to provide advertised capacity.
Coat Hanger 	•Top bar limits the height of bicycles that can be accommodated. •Thin 'coat hanger' loops are less durable than the thicker posts on other rack types.
Schoolyard 	•Only supports frame at one location and can lead to wheel damage. •Does not allow locking of frame to bicycle rack.
Wheelwell  	•Presents a tripping hazard when not in use. •Only supports frame at one location and can lead to wheel damage. •Does not allow locking of frame to bicycle rack.
Bollard 	•Similar to Post and Ring rack, but narrower design typically does not support bicycle at two locations
Swing arm secured 	•Only accommodates limited bicycle designs. •Moving parts create maintenance complications.

Custom Bicycle Racks

Bicycle racks can be custom-made to include branding, colour, and custom shapes that serve as public art and enhance the aesthetic quality of the streetscape. Custom bicycle racks can be designed with the help of community members through contests such as the City of Vancouver's Bike Rack Design Contest. However, local governments should be cautious when considering custom bicycle racks and must ensure that all custom bicycle racks meet the performance standards listed above.

Bicycle Rack Materials and Installation

Bicycle racks are typically constructed of carbon steel or stainless steel. There are a range of coatings and finishes that can be applied, with varying costs and maintenance requirements. Local conditions and preference should be considered when choosing the material. Square tubing is typically more theft-resistant than round tubing, which can more easily be cut with a hand-held pipe cutter.

Bicycle rack installation methods vary depending on the surface material. The ideal installation surface is concrete, which allows the rack to be securely fastened using concrete spikes or wedge anchors. Concrete spikes are tamper proof but can damage the surface upon removal, whereas concrete wedge anchors allow for removal but require security nuts to make them theft resistant. If pouring a new concrete pad, bicycle racks can be embedded directly into the concrete, although the rack material, location, placement, and quantity should be carefully considered as removal is costly and complicated. Surfaces such as asphalt, pavers, earth, and mulch are too soft to hold concrete spikes or wedges. In this case, bicycle racks should be embedded into the ground or installed as a free-standing on rails, which can then be secured with landscape nails.

Custom bicycle rack in Tofino, B.C.

Custom bicycle rack in Tofino, B.C.

Custom bicycle rack in Tofino, B.C.

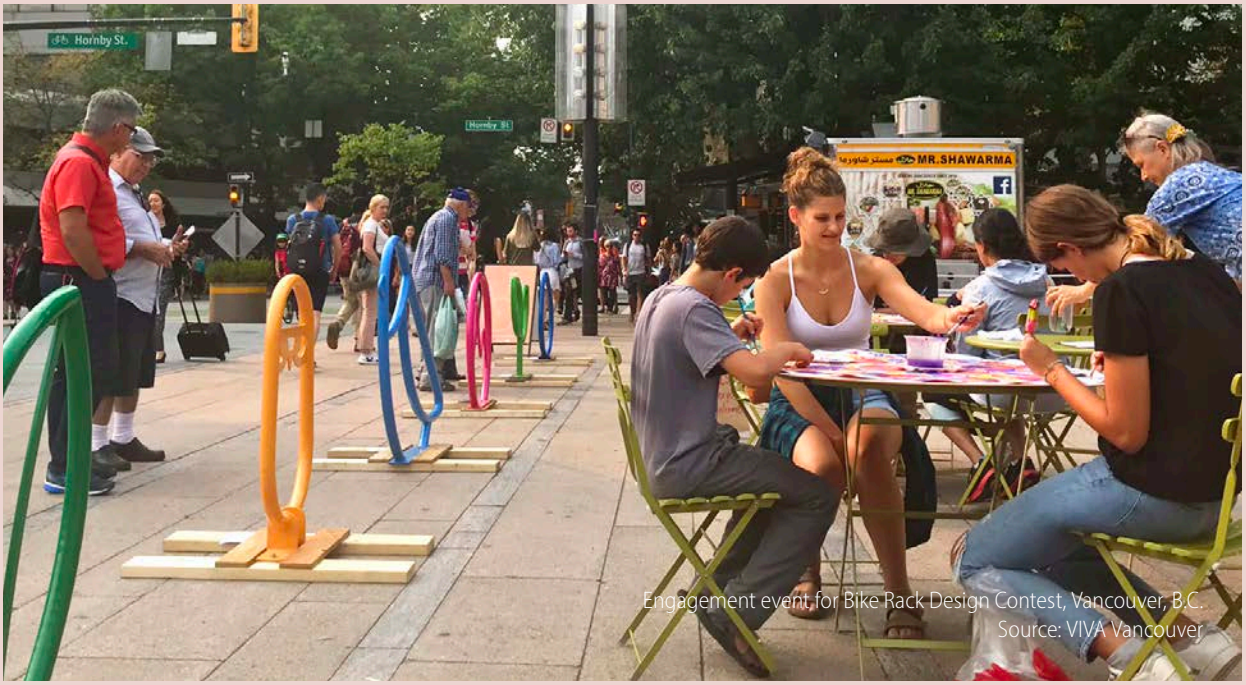
Case Study

Bike Rack Design Contest, Vancouver, B.C.

In the spring and summer of 2018, the City of Vancouver held a Bike Rack Design Contest, encouraging anyone living, working, or going to school in Vancouver to submit fun and functional bicycle rack designs. The basic requirements were that the bicycle rack should hold two bicycles, could be fabricated and installed by the City in a cost-effective way, and would reflect Vancouver in a creative and original way. The objective was to end up with one or more new bicycle rack designs that could be added to the City's existing inventory, with winning entries installed around Vancouver wherever new bicycle parking is needed.

To guide the contest, City staff conducted best practice research and created a visual and easy to read design guide for contestants, covering key rack design criteria such as functionality, security, durability, cost, and accessibility. The contest was promoted primarily via social media, in additional to posters distributed to community centres, libraries, bike shops, schools, and cafes. The City also held two 'Design Jams' where participants were encouraged to design a bicycle rack with support from city staff.

In total, the City received over 450 submissions, which were then shortlisted to 30 designs by an independent jury comprising cycling advocates, artists, and transportation professionals. The design concepts were displayed to the public at an event in the summer, where community members could vote for the 'People's Choice Award.'



Engagement event for Bike Rack Design Contest, Vancouver, B.C.
Source: VIVA Vancouver

The designs were also assessed internally by the City's Equipment Services team for affordable constructibility, reviewing aspects such as the amount of material, number of welds, and complexity of the bends, with the goal of finding fun but feasible designs. The Equipment Services team then built six designs that met their feasibility criteria.

These six designs were showcased at another series of events, where people were able to test them out and vote for a second 'People's Choice Award.' The jury ultimately selected four winning designs based on the competition design criteria as well as aesthetics, safety, and fabrication cost. Each winning designer received a $2,000 prize, as did the designer of the 'People's Choice Award' bicycle rack. Ten to 20 of each winning design will be built and installed throughout Vancouver. After installation, the City will review the designs for final cost and functionality. The contest was very well received by the public, and the resulting bicycle racks will add local flair to Vancouver's streetscape.

Prototype bicycle racks
Source: VIVA Vancouver

Bicycle Rack Placement

When installed within the public right-of-way adjacent to a sidewalk, bicycle racks should be placed in the Furnishing Zone alongside other street furniture such as street trees and parking metres. If there is insufficient width in the Furnishing Zone, bicycle racks can be installed in other areas where additional space is available, such as curb extensions. The Pedestrian Through Zone must remain unimpeded by bicycle racks and parked bicycles. In some contexts, where sufficient width exists, bicycle racks may also be installed in the Frontage Zone and on private property adjacent to building entrances, as long as building entrances are not impeded. A certain number of bicycle racks should be weather protected. This may be achieved simply by locating bicycle racks under existing awnings.

Inverted U and Post and Ring racks are two of the most common and functional bicycle racks to be placed in the public right-of-way adjacent to sidewalks. **Figure H-143** shows the minimum rack dimensions and the space required to park a bicycle.

Table H-39 and **Figure H-144** show the minimum clearance required between bicycle racks and from other sidewalk elements such as the curb, the Pedestrian Through Zone, and sidewalk furniture. Bicycle racks should be oriented so that bicycles are positioned parallel to the curb. They should not be placed in fire zones, loading zones, bus zones, taxi zones, adjacent to accessible on-street parking spaces, or in any other area where pedestrians will require frequent access. When placed next to on-street motor vehicle parking, bicycle racks should be located between stalls in order to avoid obstructing the door zone. Bicycle racks should be a minimum of 1.5 metres from fire hydrants and bus stops.

Table H-39 // Bicycle Rack Placement Dimensions

CLEAR SPACE REQUIRED BETWEEN:	DESIRABLE WIDTH (M)	CONSTRAINED LIMIT WIDTH (M)
Bicycle racks in series (parallel to curb)	1.8	1.8
Bicycle racks in series (perpendicular to curb)	1.2	0.9
Bicycle racks in series (angled)	0.7	0.7
Bicycle rack and face of curb	0.9	0.6
Bicycle rack and street furniture and utilities*	1.2	0.9
Bicycle rack and multi-modal conflicts (curb ramps, driveways, crosswalks, loading zone, bus stops)*	1.2	1.2

*1.5 metres required from fire hydrants and bus stops. 1.5 metres recommended for crosswalks.

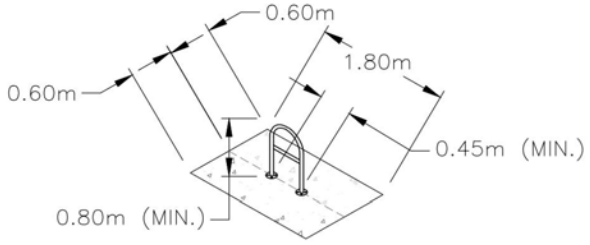


Figure H-143 // Bicycle Rack Dimensions

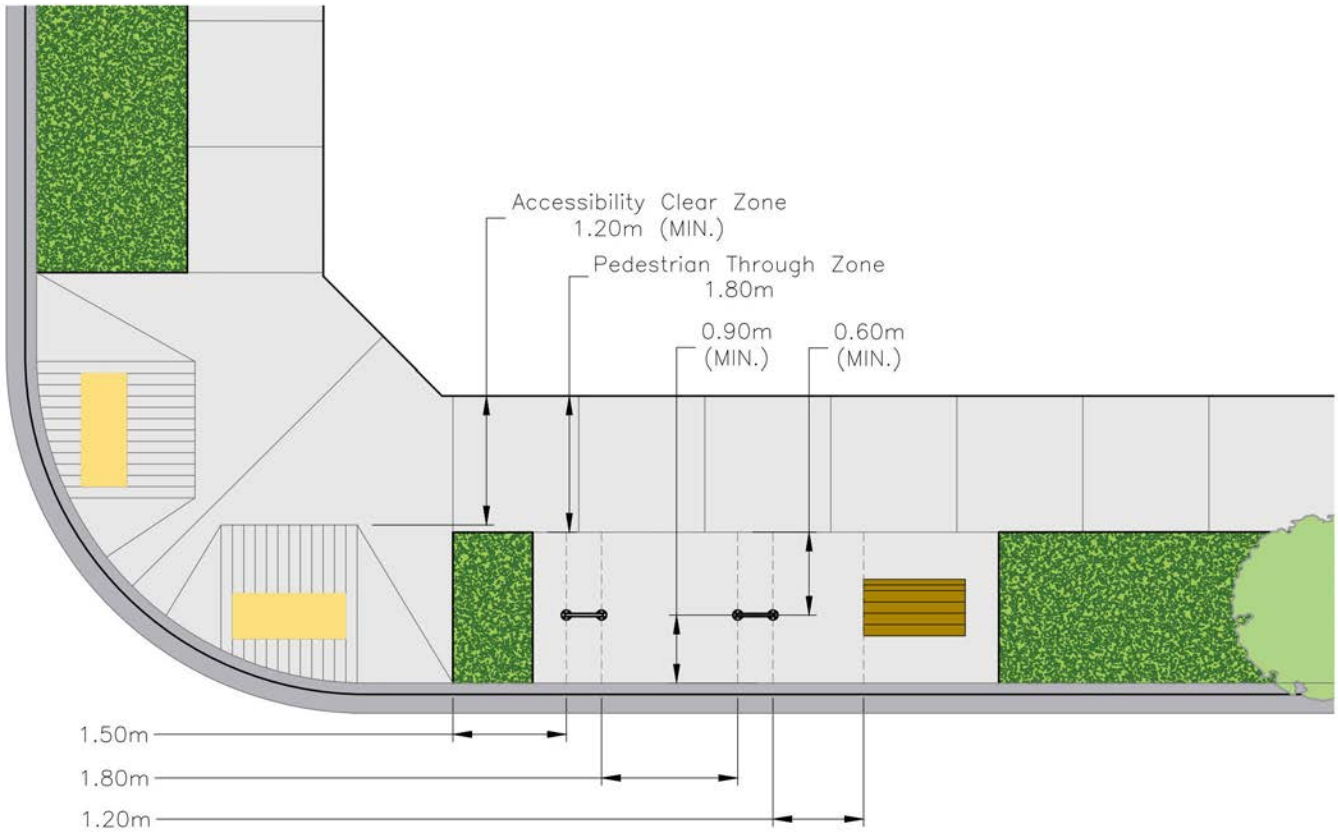


Figure H-144 // Bicycle Rack Placement on Sidewalks

Bicycle Corrals

Bicycle corrals (also known as in-road bicycle parking) consist of bicycle racks grouped together in a common area on-street within the public right-of-way traditionally used for motor vehicle parking, providing relatively inexpensive high-volume bicycle parking. Typically, one or two on-street motor vehicle parking spaces are converted into bicycle corrals, with each motor vehicle parking space providing capacity for approximately six to 10 bicycle parking spaces. Both parallel and angle parking spaces can be converted. This treatment is beneficial as it moves bicycle storage off the sidewalk, leaving more space for pedestrians and sidewalk furniture. It may be possible to locate bicycle corrals in 'no parking' zones close to intersections or crosswalks. However, when selecting a bicycle corral location, safety of all road users must be considered. This includes considering the visibility needs of motorists and motorist expectations at intersections.

Bicycle corrals are applicable where there is moderate to high demand for short-term bicycle parking, in areas with high pedestrian demand and where there is limited space in the Furnishing Zone for bicycle racks, and where there is ample on-street motor vehicle parking. They are suitable in major commercial and retail areas and may be requested by the business community where demand is high, such as in front of coffee shops and restaurants. Maintenance is an important consideration when planning bicycle corrals, as they can present challenges in terms of road sweeping and snow removal. In some cases, local governments have established maintenance agreements with nearby businesses who requested the bicycle corral.

Figure H-145 shows a typical bicycle corral configuration. Bicycle corrals installed in the road can be protected from motor vehicles with physical barriers such as curbs, curb stops, bollards, planters, or by applying other unique surface treatments. A 1.5 metre maneuvering area is recommended on either end of the bicycle corral to allow people cycling to enter and exit the parking area. Adjacent motor vehicle parking can provide an additional buffer for the bicycle corral. Parking stalls next to curb extensions provide excellent locations, as the curb extension serves as protection for one side of the corral. Bicycle corrals can also be installed adjacent to protected bicycle lanes, with the protected bicycle lane buffer offering protection to parked bicycles. Bicycle corrals can be visually enhanced using planters and vegetation as buffers. Signage should be provided to inform users that the corral is for bicycle use only.

Bicycle corral, Victoria, B.C.

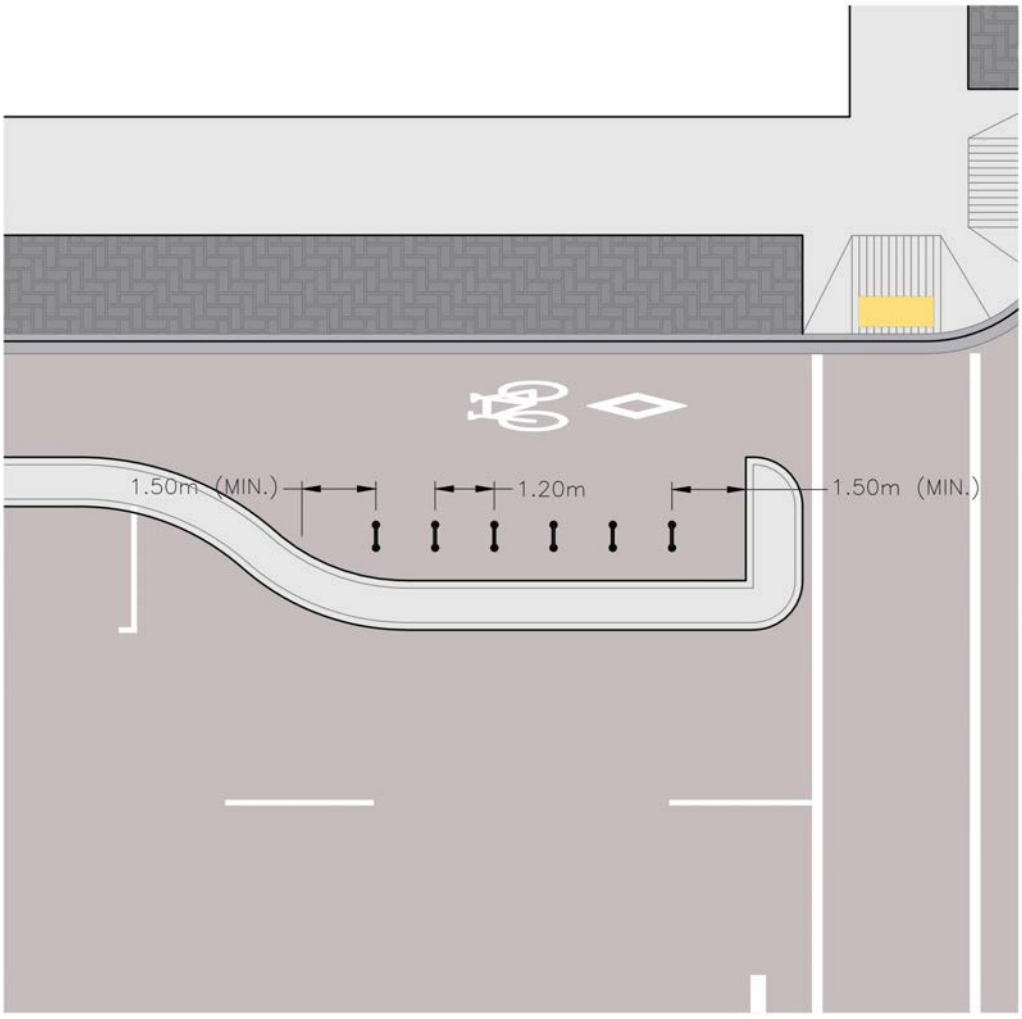


Figure H-145 // Bicycle Corral Adjacent to Protected Bicycle Lane

Covered Bicycle Parking

Where space permits, providing covered short-term bicycle parking can improve the experience for bicycle users and encourage all-weather cycling by providing shelter from rain, snow, and sun. Covered bicycle parking is warranted anywhere that bicycle racks may be located, but is most appropriate in a variety of locations, including major commercial centres, areas with sufficient space on the sidewalk or in plazas, and where there is demand for longer-term bicycle parking, such as at schools, universities, recreation centres, community centres, and heavily used transit stops or stations.

There are a variety of designs for covered or freestanding covered bicycle parking structures. Components such as shelters, racks, and roofs may be enhanced with different shapes, colours, and materials. The space needed is dependent on the shelter design and the amount of bicycle parking provided; typically, it is similar to other short-term bicycle parking types, with additional considerations for shelter walls or posts and access aisles if required. The recommended shelter height is 2.5 to 3.5 metres, with a roof area of 3.5 to 4.5 metres to provide adequate weather protection.

Temporary Bicycle Parking at Events

A unique type of short-term bicycle parking is temporary event parking, often called a 'bike valet' service. Bike Valets provide temporary secure, supervised bicycle parking at concerts, sporting events, festivals, and other community events which would normally overwhelm existing short-term bicycle parking supplies. This enables event-goers to travel by bicycle, helping to reduce event-related road and transit congestion. Bike Valet services are often provided by non-profit or community organizations with support from local governments and/or event organizers. The service is typically free for people to use or may accept payment by donation.

Bike Valet organizers coordinate with event organizers to choose a visible site near the event entrance that is large enough to accommodate the estimated number of Bike Valet users. They will then set up a secure enclosure using temporary fencing and fill the enclosure with temporary 'triathlon-style' valet racks. Upon arriving at the Bike Valet, event-goers trade in their bicycle for a numbered ticket and Bike Valet staff or volunteers park the bicycle, similar to a coat check. The numbered ticket must be redeemed after the event to recover the bicycle. Bicycles do not need to be locked to the temporary bicycle racks as they are inside a supervised enclosure, facilitating a faster drop off and return process. Bike Valets may also accept bicycle accessories and personal bags, which are often prohibited inside large events.

Covered bicycle parking, University of Victoria, Victoria, B.C.

Temporary event parking, Vancouver, B.C.
Source: Mike Zipf

LONG-TERM BICYCLE PARKING

Long-term bicycle parking is generally intended for destinations where people cycling will be stopping for two to four hours or longer, including schools and workplaces, multi-family residences, high activity transit stops, and other areas of high cycling activity. Long-term bicycle parking is designed to offer increased security, weather protection, and often higher bicycle parking capacity, but may be less convenient than short-term bicycle parking. On-street long-term bicycle parking can include bicycle lockers and bicycle cages, while off-street long-term bicycle parking can include bicycle cages, bicycle rooms, bicycle shelters, and full-service bicycle stations. Some long-term bicycle parking is public, such as at transit stations, whereas some is located on private property and is only available for residents, employees, or other defined user groups.

Bicycle Lockers

Bicycle lockers are large metal or plastic stand-alone boxes that offer high-security, weather-protected bicycle parking. They are suitable for daily and overnight long-term bicycle parking at locations such as universities and transit stations. In addition to providing secure bicycle parking, bicycle lockers can also securely store gear and other accessories along with the bicycle, giving people cycling more flexibility in their travel arrangements. A flat, level surface is required for installation. They should be installed close to building entrances or on the first level of a parking garage.

Bicycle lockers take up more space than short-term bicycle parking. Bicycle lockers should be a minimum of 1.2 metres tall and 1.9 metres deep, with a minimum opening of 0.8 metres. One bicycle locker typically provides storage space for two bicycles, with a separating partition and separate doors to maintain security. Bicycle lockers are designed to allow the user to roll their bicycle into the locker. Models exist that require bicycles to be hung vertically, which may not be appropriate for people of all ages and abilities. Bicycle lockers do not typically accommodate larger, non-standard bicycles, so additional bicycle parking should be provided.

When planning the layout for bicycle lockers, access to front and back of the lockers must be maintained since they are designed to be accessed from both sides. A minimum clearance of 1.8 metres is recommended between the bicycle locker entrance and any walls or barriers, and a minimum of 2.4 metres is recommended between the entrance and pedestrian flow. Where bicycle lockers are installed facing one another, a minimum of 2.1 metres of clearance is recommended between the two sets of lockers.

Bicycle locker, Kelowna, B.C.

Traditionally, bicycle lockers have been available on a sign-up basis, where a single user is given a key or a code to access a particular locker. Newer computerized on-demand systems offer increased flexibility by allowing subscribers to check for available lockers or sign up on-line. Some models allow keyless access to the locker with the use of a cell phone or SmartCard. Though not required for their use, bicycle locker use can be monitored remotely using the internet. These programs typically have fewer administrative costs because they simplify or eliminate key management, inspection, and locker assignment. Lockers that are available on-demand for one-time use have the advantage of serving multiple riders a week. Monthly rentals, by contrast, provide assurance to renters that their own personal locker will always be available and allows the flexibility of using the space for transitory items required on various days.

Bicycle Rooms, Cages, and Parkades

Unlike bicycle lockers, which only accommodate one or two bicycles, there are several options for secure, high capacity bicycle parking. Bicycle rooms, cages, and parkades are types of off-road, long-term, higher capacity bicycle parking designed for increased security, weather protection, and capacity. They can be built as standalone structures or added to existing buildings or motor vehicle parkades. These facilities are suitable at post-secondary educational institutions, transit stations, and dense commercial or residential buildings. Each of these facilities consist of enclosed structures containing bicycle racks and secured with a locked door. These facilities vary by enclosure type, capacity, level of security, means of access, and other features. Some bicycle rooms and parkades also include other end-of-trip amenities. The following design considerations can be applied to bicycle rooms, cages, and parkades.

Safety and Security

Bicycle theft is one of the most significant deterrents to bicycle use, particularly for bicycles that are parked for an extended period of time. Long-term use of bicycle parking facilities requires a high level of safety and security both for parked bicycles and for the bicycle users themselves. It is recommended that bicycle rooms and parkades have solid opaque exterior walls from floor to ceiling, while bicycle cages should have an exterior structure made of expanded metal mesh from floor to ceiling. The door and frame should be constructed of steel and have tamper proof hinges.

Off-street bicycle parking facilities should be well lit, and a window may be provided in the door to provide permanent visual access. Additionally, an emergency help button can be installed in bicycle rooms and parkades. Surveillance is key for ensuring both user and bicycle safety, so parking facilities should be located in

Bicycle room, Victoria, B.C.

a monitored area. If the bicycle parking is located in an attended parking facility such as a parking garage, the bicycle parking should be located within 30 metres of an attendant or a security guard, or alternatively, the bicycle parking must be visible by other users of the parking facility.

Access and Convenience

Often, high capacity facilities can be located in parkades or basements, which can present access challenges. Bicycle parking facilities should be located no lower than the first level below grade to ensure that the facility is easily accessible, convenient, and that there are fewer potential conflicts between bicycles and motor vehicles. Access to the bicycle facilities should either be directly from the road or via an approach that people cycling can access without having to dismount. If the bicycle parking is located on a separate level, access should be provided by installing a ramp, elevator, or stairway with bicycle channels to avoid requiring people to carry bicycles up or down stairs. Ideally, the ramp access should be separated from motor vehicles.

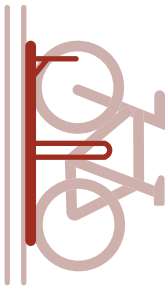
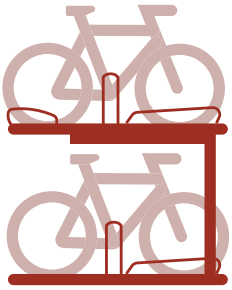
Access to the bicycle room, cage, or parkade can be provided through security cards, non-duplicable keys, transit cards, or pass code access. Where there is a high demand for bicycle parking, several small compounds or rooms provide more security than one larger room, as the number of people who have access to each compound or room is reduced. Requiring a key or a code in order to access the bicycle parking facilities is a barrier to incidental use, and this method of access is most suitable to facilities that are for designated user groups, such as employees.

Access to Translink bicycle parkade

High Density Bicycle Racks

The bicycles racks described in **Table H-40** can be used inside an enclosure to provide suitable off-road, long-term bicycle parking. However, in applications where parking density is a top priority, alternative bicycle racks may be considered **(Table H-40**). High density bicycle racks often fail to meet the full set of bicycle parking performance criteria, such as universal accessibility. A minimum of 50% of all bicycle parking spots in any off-street, long-term bicycle parking facility should be basic, on-ground bicycle racks that serve all ages of abilities, with high density bicycle racks providing additional capacity as needed.

Table H-40 // High Density Bicycle Racks

RACK TYPE	NOTES
Vertical 	•Space-efficient and often used for indoor, high-density bicycle parking. •Must allow bicycle frame to be securely locked using a u-lock. •These racks may not accommodate non-standard bicycles and are not accessible to users of all ages and abilities, as they require lifting the bicycle into place. •Additionally, they can cause safety concerns if bicycles are not secured properly. If used to increase bicycle parking density, they should be combined with accessible on-ground parking.
Two-Tier 	•Space-efficient and often used for indoor, high-density bicycle parking. •Must allow bicycle frame to be securely locked using a u-lock. •These racks may not accommodate non-standard bicycles, they require additional maintenance of moving parts, and they may cause safety concerns if bicycles are not secured properly. •In order to increase their accessibility, two-tier bicycle racks should include pneumatic or mechanical lift assist for the upper rack. Two-tier racks should be tested before application as their performance varies significantly between manufacturers.
Staggered Wheelwell-secure 	•A variation of the wheelwell-secure rack that is designed to stagger handlebars to mitigate handlebar conflict and increase parking density. •As with wheelwell-secure racks, they may accommodate fewer bicycle types than Inverted U or Post and Ring racks.

Bicycle Parking Layout

Figure H-146 shows key dimensions for bicycle rooms, cages, and parkades. The entrance to a bicycle room, cage, or parkade must be at least 1.6 metres wide to allow a variety of bicycle sizes to gain access. Consideration should be given to including an automated doorway opening system, similar to an accessible push button, to facilitate convenient entry/exit by bicycle users. Sufficient width should be provided along any hallways or access points to the bicycle parking facility. The enclosure itself must be designed to allow a person to walk beside their bicycle and maneuver the facility to find an available bicycle rack.

If standard on-ground bicycle racks are used and are located perpendicular to a wall, at least 0.6 metres clearance should be provided if the rack has single-side access, or 2.5 metres clearance for a rack with double-sided access. If the bicycle rack is located parallel to a wall, at least 0.6 metres clearance should be provided. Bicycle racks should have at least 1.2 metres of space between them. A clear aisle of at least 1.8 metres should be maintained between bicycle racks holding two bicycles.

Off-street bicycle facilities should have a set percentage of spaces that are required to accommodate non-standard bicycles such as cargo bicycles and bicycles with trailers. Multi-family residential buildings and schools should have the highest proportion of non-standard sizes, followed by commercial and office buildings. These spaces can be marked with a sign or pavement markings identifying their purpose as a spot for non-standard bicycles, in order to encourage compliance.

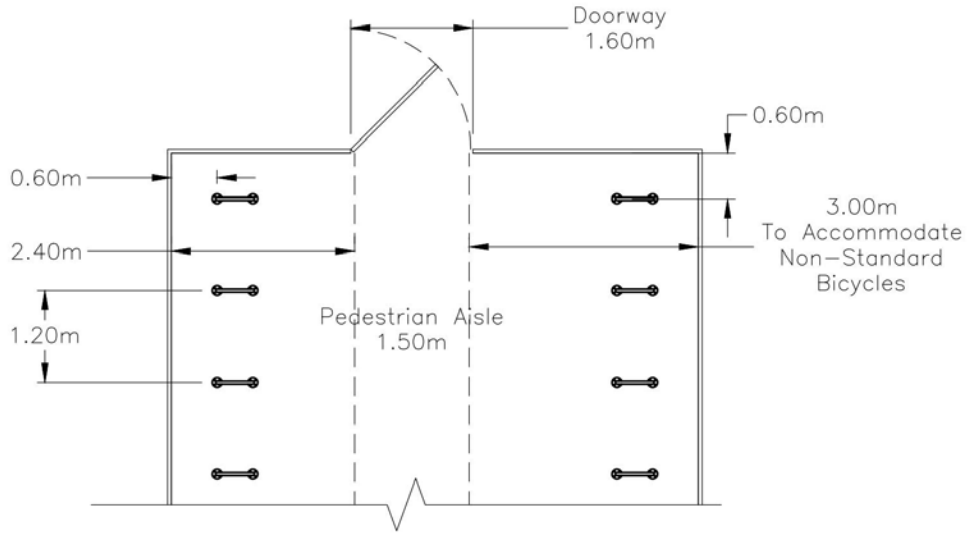


Figure H-146 // Off-Street Bicycle Parking Layout

Bicycle Parking Retrofits

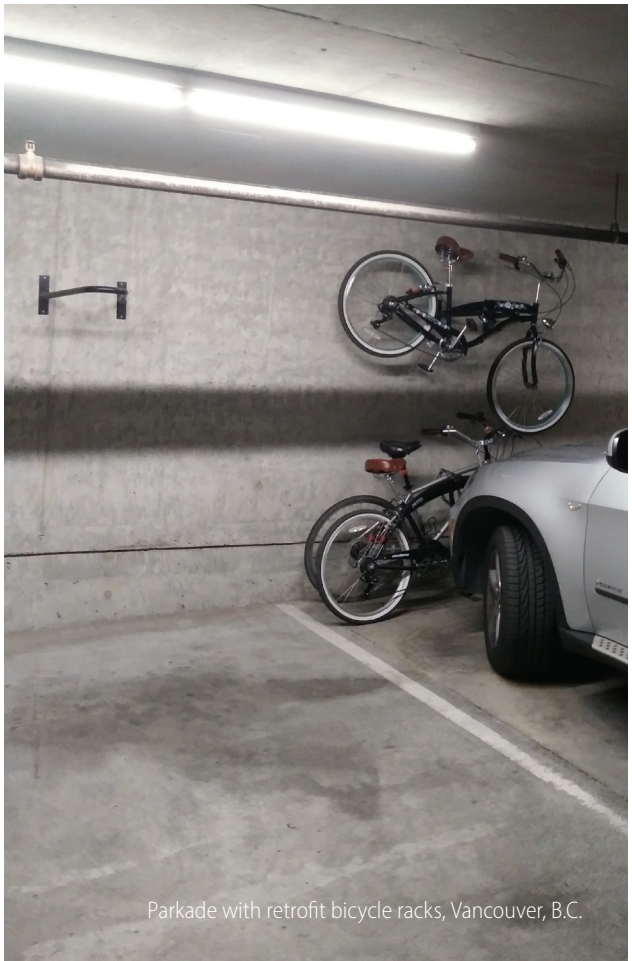
In some existing multi-family and commercial buildings, demand for bicycle parking may exceed the existing supply (if any exists). In some cases, a building may not provide any secure bicycle parking.

In others, the existing bicycle parking may be insufficient, inconvenient, or insecure.

Building owners are strongly encouraged to retrofit their buildings to provide an adequate quantity and quality of bicycle parking. A bicycle room or cage may be constructed as a retrofit, using existing motor vehicle parking spots or other underutilized spaces. However, this may not always be feasible due to cost or space constraints.

In this context, it is still possible to find flexible solutions for long-term bicycle parking. In buildings with parkades, bicycle racks can be installed in private parking spots, either on the ground or in the wall, to provide private bicycle parking without removing any motor vehicle parking. This arrangement works best where parking spots are designated to set individuals and the same person or family owns both the bicycle and the motor vehicle.

The photos shown are from a condominium in downtown Vancouver that has two bicycle cages, both of which are poorly designed and at full capacity. Bicycles are banned inside the building and elevators, prohibiting residents from storing bicycles in their units. Instead, residents are able to install bicycle parking in their privately-owned parking spaces, giving them convenient access and preserving space for their motor vehicles.



Parkade with retrofit bicycle racks, Vancouver, B.C.

Parkade with retrofit bicycle racks, Vancouver, B.C.

Bicycle Stations

Bicycle stations, also known as bicycle hubs or depots, are highly-secure, high capacity, and full-service bicycle parking facilities. Bicycle stations are suitable in high density employment centres with high bicycle parking demand, ideally connected to multi-modal transit facilities. Bicycle stations are staffed, they contain a complete suite of end-of-trip amenities, and they can typically store hundreds or even thousands of bicycles. Bicycle depots or stations are common in Europe and Asia but are increasingly being implemented in North America.

Bicycle station, Potsdam, Germany

Bicycle station, Potsdam, Germany

Bicycle pump and repair stand, Tofino, B.C.

END-OF-TRIP AMENITIES

End-of-trip amenities can support both short- and long-term bicycle parking by making it more convenient to cycle. These amenities help to address challenges or concerns that bicycle users experience, such as needing a place to change or shower after a long ride, store cycling gear, inflate tires, and make minor repairs.

Bicycle Repair Stands

Bicycle repair stands typically include a stand, repair tools, and a tire pump. Anti-theft versions where the repair tools are connected to cables can be provided on-street and in other public places such as parks, transit centres, and post-secondary campuses, especially in places near high-density bicycle parking. Bicycle repair stands can be useful at multi-modal transit stations such as airports and bus terminals to allow people who are travelling with a bicycle to build/reassemble them on-site. They can also be provided off-road in bicycle rooms and bicycle stations. Worksites and other private parties can provide larger repair stations with a workbench and tools within a secured bicycle parking area, although tool theft can be an issue.

Shower and Change Room Facilities

Providing showers and change rooms is a common amenity to encourage bicycle use, particularly for commuter trips, in addition to appealing to employees at office or retail sites who exercise during the work day. Local and regional governments can require these facilities through development regulations and can encourage employers to provide showers in addition to secure bicycle parking as part of a Transportation Demand Management (TDM) program. Short-term lockers or other storage bins can be useful for storing cycling gear that may be needed on a wet or cold ride. It is recommended that lockers are full sized as this allows wet clothing to dry faster.

Shower and change room facilities can also include additional amenities to increase cycling comfort and convenience. For example, in additional to secure

long-term bicycle parking, showers, and a change room, the Cycling Centre at Vancouver General Hospital includes a number of additional amenities, including: a clock, maps, bus timetables, tissues, towel service, a 'member of the month' board, a comments and suggestions box, and even a small lounge with foosball and stretching mats. Additional amenities are certainly not required in all contexts, but they can be an excellent way to encourage cycling.

PARKING FOR OTHER ACTIVE MODES

Bicycle are not the only active transportation devices that need secure parking at destinations. End-of-trip accommodation for devices such as skateboards, scooters, in-line skates, and micro-mobility devices are an important considerations. Some of these devices are small enough to be carried around upon reaching a destination, but others require unique accommodation.

One destination where the accommodation of scooters and skateboards is particularly relevant is at schools, from elementary up to secondary and post-secondary levels. Active school travel has been shown to have a number of positive benefits for students' health and learning, but there is often a lack of secure parking facilities and devices may not be allowed inside classrooms. Specialized racks are available that can securely store and lock scooters and or skateboards. These can be installed either inside or outside, although if installed outside, weather protection is encouraged. Providing secure parking of this nature can help alleviate the concerns of students, parents, and school staff about theft and clutter.

Other active modes such as cross-country skiing, snow shoeing, canoe, kayaking require larger spaces to park, but are less commonly used for regular transportation purposes. Local governments, multi-family residences, offices, institutions, and businesses should note when users have special needs and are travelling using alternative forms of active transportation. For example, some Ottawa residents enjoy skating to work along the Rideau Canal in the winter. Meanwhile, in many coastal B.C. communities, there are residents living on boats that are moored away from shore, so residents require smaller boats to travel to and from shore.

If an existing or desired user group is identified, accommodation can be made. This could include device-specific storage racks, such as canoe or kayak racks, and changing facilities to accommodate people who may be wet or need to change clothing. When proper accommodation is not provided, there can be conflict over parking spaces between modes.

Skateboard rack in a high school, City of North Vancouver, B.C.

Wayfinding signage in Gibsons, B.C.

H.3

WAYFINDING

This chapter summarizes design considerations for wayfinding for active transportation. Wayfinding is a decision-making process related to navigation and is important to provide simple, clear, and intuitive information to help people navigate spaces effectively and intuitively. This helps people identify how they can navigate a city, neighbourhood, or active transportation network effectively from their present location to their destination. Wayfinding can include signage, maps, and other trip planning tools. An important component of wayfinding specifically involves signage and pavement markings. However, the references to signage and pavement markings in this chapter speak specifically to signage and pavement markings only for the purposes of wayfinding, and not for regulatory and warning purposes.

A seamless, consistent, and easy-to-understand system of wayfinding, signage, and trip planning tools for both walking and cycling is important. It can make a community's active transportation network easier to navigate, identify the location of important destinations, and provide information about facility type. Most importantly, wayfinding helps people make decisions about how to navigate a community. Wayfinding typically refers to signage and pavement markings which help to guide users to designated facilities and key destinations, along preferred routes, without the assistance of a smartphone or other mapping tools.

It is important to consider that many residents and visitors may not be familiar with the location of existing active transportation facilities or community destinations. A wayfinding system helps provide information about routes, but also helps to identify destinations that can be accessed via a given route or within a short walking or cycling distance. Wayfinding can also help raise awareness of the distance and time that is required to travel to destinations within a community by walking or cycling.

People walking and cycling have very different needs with regards to wayfinding. A person cycling can travel much further and faster than a person walking for the same effort. This produces large differences in how far away a destination might be reasonably signed from. People walking are also more willing to stop and study information, whereas maps, detailed directions and smaller text are difficult to use while cycling. As with driving, to safely manage the information load, a bicycle wayfinding system must be simple and refrain from including too much text on any one sign.

In B.C., cycling wayfinding guidelines have already been developed by both TransLink and the Capital Regional District to help municipalities prepare wayfinding signage plans specifically for cycling in Metro Vancouver *(Getting There By Bike! – Wayfinding Guidelines for Utility Cycling in Metro Vancouver)* and Greater Victoria *(Cycling Destination Wayfinding Guidelines)*, respectively. These guidelines are available on-line and provide advice and designs for bicycle wayfinding across their jurisdictions[1,2]. In addition, the province has also developed guidance for wayfinding signage and pavement markings on roadways under provincial jurisdiction, including the pedestrian and bicycle sign catalogues in the MOTI *Manual of Standard Traffic Signs and Pavement Markings*.

Guidance regarding regulatory and warning signage is provided in earlier sections and in the TAC *Bikeway Traffic Control Guidelines for Canada*. The TAC *MUTCDC* may also be referenced for wayfinding signage options in instances where signage customization is not feasible. Refer to **Appendix B** for further details regarding signage and pavement marking. This chapter also includes other forms of wayfinding, including mapping and trip planning tools.

1 TransLink, *Getting There By Bike! – Wayfinding Guidelines for Utility Cycling in Metro Vancouver,* September 2013.

2 Capital Regional District, *Cycling Destination Wayfinding Guidelines, Capital Regional District,* June 2014.

Wayfinding in Sidney, B.C.

DESIGN PRINCIPLES

Layout

The layout of information should be duplicated for each sign type and the signage should clearly identify that the information is intended for people walking and cycling. Layout features such as size, style, colours, and font choice, should be the same across the wayfinding network, even if it crosses multiple jurisdictions. This will help to make it clear which user the wayfinding is targeted to. For wayfinding on roadways under provincial jurisdiction, the MOTI *Manual of Standard Traffic Signs and Pavement Markings*.

Simple

The information that is being conveyed should be structured and presented to the intended audience in a clear and logical form. The information provided needs to be read quickly at the desired travel speeds. While people walking may have more flexibility and willingness to stop, people cycling need to be able to maintain an even pace as they take in the information and identify their desired route. For both pedestrian and cycling wayfinding, simple and easily read wayfinding signage should be provided over complex messaging, such as listing too many destinations or providing unnecessary additional text.

Predictable and Consistent

When the information that is being shared is predictable, it can be quickly recognized, understood, and used. Predictability can relate to a number of aspects of wayfinding information, from the placement of a sign to the design of its contents. Predictability also means that understanding can be recalled for use in new situations and unfamiliar areas. In addition to predictable placement and content, the consistent use of an agreed list of road and destination names and references allows for users to confidently use wayfinding signage to reach destinations and follow routes across different jurisdictions. A consistent set of references also helps users trust and learn the system and apply their knowledge to new journeys.

Branding

A consistent brand along a corridor or network that is easily tied to local context is helpful to ensure that users know they are continuing along the same network. In some communities, the municipality's logo is often used to provide local community branding. Trail-specific branding could be considered for regional, provincial, and even national facilities that serve multiple jurisdictions, such as 'The Great Trail' (formerly known as the Trans Canada Trail).

Progression

It is important to provide a manageable amount of information to people at one time, as too much information can be difficult to understand and be unnecessary. Too much information can make decision-making challenging and leave people second guessing themselves. In particular, wayfinding for cycling is similar to guide signing for drivers: information provided to riders who are moving must be provided in advance of where major changes in direction are required, repeated as necessary, and confirmed when the turning movement is complete.

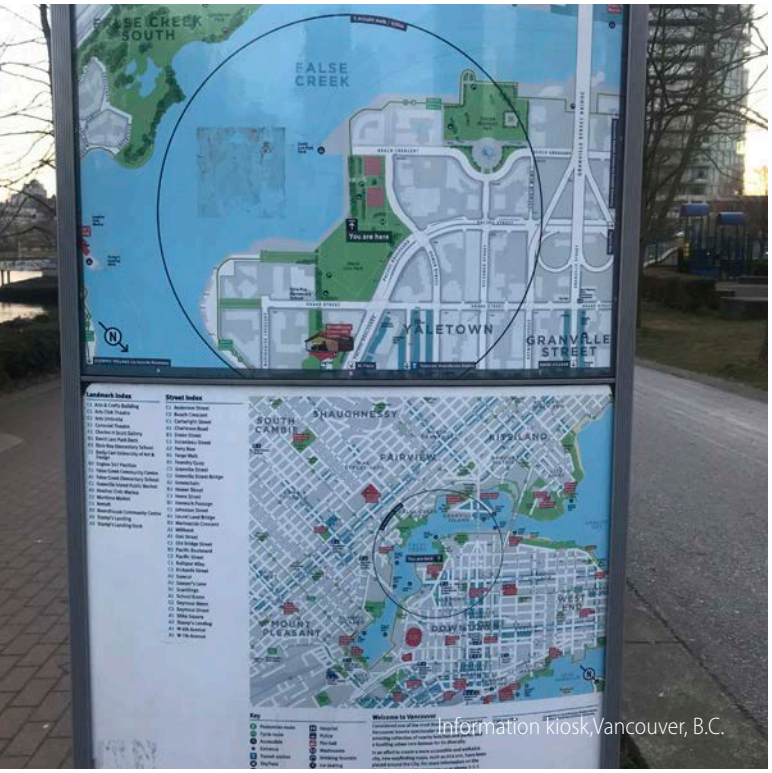
Context

The frequency and type of information that is provided on wayfinding materials will vary depending on the context in which the materials are being used. For example, there will be a difference between wayfinding that is being used along on-street facilities when compared to an off-street pathway. On-street signage, for example, will typically be required at higher frequency due to the prevalence of intersections and opportunities for decision-making. Off-road facilities may require less frequent spacing serving to remind people walking and cycling of the pathway they are on and to communicate choices at intersections or where the pathway branches.

PEDESTRIAN WAYFINDING

People walking and people cycling have very different needs when thinking about wayfinding. The size of the signage and text is an important consideration, as is the information conveyed. As a person cycling often travels at a faster speed and to a further distance when compared to someone walking, the destinations identified need to be within a reasonable travel distance based on the mode of travel. People walking are also more willing to stop and study information, whereas maps, detailed directions, and smaller text are difficult to read while cycling.

Pedestrian wayfinding systems can help residents and visitors better navigate through high activity areas of a community. This can include information kiosks with a 'finder map' that identifies key information such as transit routes, community facilities, and businesses.



Information kiosk,Vancouver, B.C.

They often provide 'you are here' information with a five and/or ten-minute walking distance. The 'finder map' can also include building footprints, local landmarks, and 3D buildings. Wayfinding materials should be simple, easy to read, accessible to all, easy to install and allow residents and visitors to locate key amenities and facilities within a community. In addition to the detailed 'finder map', an overview map that identifies connections to the wider area can be provided., This map can also provide context of the users' location within a larger area and can help to highlight multi-modal connections if wanting to travel outside the five-minute walking distance. All elements of pedestrian wayfinding should be designed to work for a wide range people and be inclusive to people across the spectrum of cognitive, visual, and physical abilities. The height content is mounted, the colours used along with other aspects need to be considered to ensure this information can be used by all.

Pedestrian wayfinding should also try to include, information on the location of accessibility aids, such as ramps and elevators, as well as obstacles that may act as a barrier. As noted, the maps can also include information about connections to other active transportation facilities including cycling and transit routes as well as transit stops.

Before installing pedestrian wayfinding, it is important to develop guidelines that outline protocols for route naming and identification of destinations, as well as consistent design and application of route markings and pedestrian signage.

Information Kiosks and Signage

There are typically three main types of pedestrian wayfinding signage.

- **Pedestrian Monoliths** display a rich amount of information at dwell points and larger public spaces. They typically include the name/ address of the current location, an overview map, and/or a detailed 'finder map' (as described above). In addition to the mapping information, they can include directions to

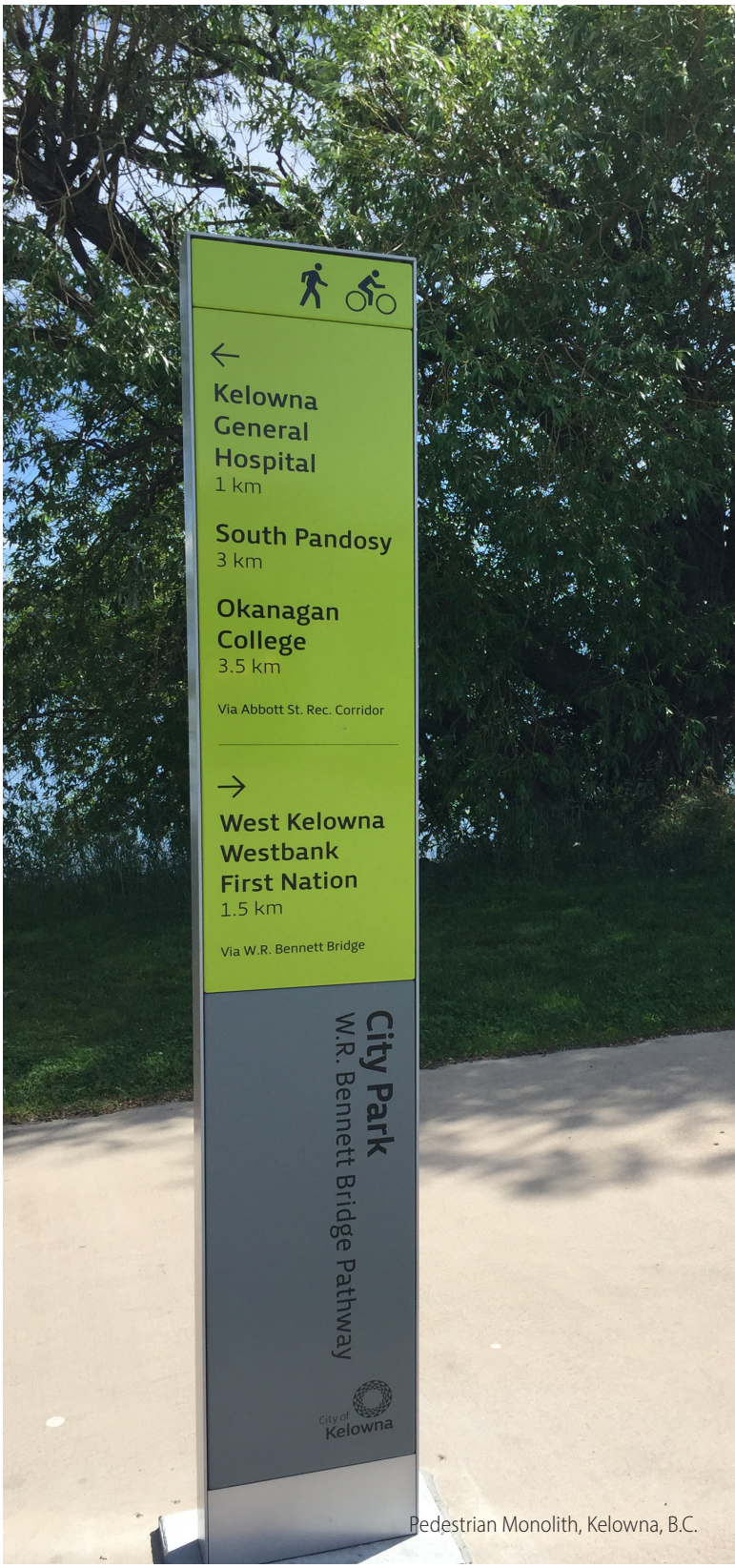
nearby destinations, any other supporting information, and community branding.

- **Pedestrian Monoliths (Small),** sometimes referred to as a monoliths, are narrower than a full-sized monolith. These signs provide support to walkers at key decision points. Similarly to full sized monoliths, they typically include the name/address of the current location, directions to nearby destinations, an overview map, a detailed 'finder map', any supporting information, and community branding.
- **Pedestrian Fingerposts** provide simple directional information to nearby destinations as a final step in a walker's journeys, or where it is simpler to point to everything in one direction rather than providing a map. Times and routing conditions can also be added. These signs should provide visibility from a distance and include recognizable brand identity.
- **Digital Hubs** can also be incorporated into the pedestrian wayfinding program that include interactive maps that can integrate transit information or provide interpretive information.

Placement and Siting

Some high-level considerations on placement and siting note that pedestrian wayfinding facilities should be located:

- Typically, on corridors with high levels of foot traffic;
- At intersections or junction points to help with route decision making;
- Where there is lighting to ensure the information is readable after dark and in winter conditions; and



Pedestrian Monolith, Kelowna, B.C.

- A minimum 0.5 metres from the curb edge and outside of the 1.8 metre clear zone (typically located in the Furnishing Zone).

CYCLING WAYFINDING

Similar to pedestrian wayfinding, cycling wayfinding should be simple, easy to read, intuitive, and provide people cycling with a level of confidence that they are travelling on the most efficient and accessible route. Like pedestrian wayfinding, bicycle wayfinding should be considered a component of a jurisdiction's overall wayfinding system, integrating information into kiosks, printed or digital routing tools, and other resources as applicable – allowing for a seamless wayfinding experience across modes. Making such information available at key community destinations such as parks, transit centres, and major bicycle parking hubs can aide a bicycle user's trip planning. This section outlines important aspects for ensuring wayfinding effectively complements bicycle facilities.

The guidance outlined in this section is consistent with TransLink's *Wayfinding Guidelines for Utility Cycling in Metro Vancouver* and the Capital Regional District's *Cycling Destination Wayfinding Guidelines*. It is recommended that communities or jurisdictions interested in implementing their own bicycle wayfinding program refer to these documents for more detailed information.

Signage is necessary at decision points within the network to guide people cycling to their destination. In most situations, two signs are recommended in each direction at an intersection. These include a decision sign before the turn and a confirmation sign after the turn and/or at regular intervals along a corridor. In some situations, it may also be useful to add turn fingerboards to provide clarity at complex intersections, or waymarkers to highlight routes. To identify their function as bicycle wayfinding signage, bicycle wayfinding signage should include a bicycle symbol, where applicable.

A comprehensive wayfinding system should consist of several types of signage and/or pavement markings to ensure a bicycle user is on the best route to their destination. The two primary categories of bicycle wayfinding signage are described below.

- **Decision Signage:** On the approach of a decision point (typically an intersection), decision signage provides direction to select destinations through the use of directional arrows. Decision signage should not repeat information provided on signs for motorists to avoid information overload. Decision signage is particularly important when people cycling require different information than motorists, such as different destinations that may be of more interest to non-motorists or bicycle route decision. Decision signage should be located at a safe stopping distance before the turn (refer to **Chapter G.1** for safe stopping distances for people cycling). On roadways under provincial jurisdiction, if there are no turn lanes present decision signs should be placed approximately 50 metres in advance of the intersection. It is important that decision signs are located so that it is clear which turn is being referred to. On routes where speed is likely to be high, decision signs can be repeated ahead of the turn. To manage the amount of information provided on one sign, decision signs will typically contain up to three destinations.
- **Confirmation Signage:** The confirmation signage is placed after decision points. These signs provide confirmation, reassure people cycling of their direction, and confirm additional destinations reached along the route. Confirmation signs will also provide information about other destinations that may be reached on the route. Confirmation signs should be located at 20–30 metres after turns and should be repeated for reassurance every 400 metres in urban areas and every 800 metres in rural areas. Because confirmation signs are located

after turns where the information load is less distracting, it is possible to include more information about destination names and distances. Typically, three to four destinations would be shown in ascending order.

- **Special Situation Signage**
  - ***Turn Fingerboard*** *– Optional turn fingerboard signs can be placed after the decision sign, at the point of the turn, to highlight unusual or easily missed turns. Fingerboards are useful for complex turns as the shape of the sign is advantageous because it clearly shows direction.*
  - ***Off-Network Waymarker*** *– Waymarkers can be used on non-designated routes to guide people cycling to the designated cycling network. They are specifically intended to indicate short linkages to designated bicycle routes from other roads or paths. They are not intended to be used to mark the route of a designated bicycle facility.*

Cycling Wayfinding on Roadways Under Provincial Jurisdiction

For wayfinding on roadways under provincial jurisdiction, the province has developed a series of bicycle route markers to identify bicycle facilities (see **Figure H-147**). These signs should be located at key decision points where people cycling can choose between routes (such as intersections), and at other locations where clarification is needed on route direction or continuity. Modification of these decisions signs to suit local conditions is recommended. For example, decision signage can include a highway shield in the lower two thirds of the sign, or this highway shield may be replaced with other relevant information such as 'City Centre' or 'Alternate Route.' If the signage directs bicycle users towards an

Turn Fingerboard, Richmond, B.C.

Confirmation Sign, New Westminster, B.C.

Off-Network Waymarker, Victoria, B.C.

overarching final destination, this information may be placed below the bicycle symbol.

Alternatively, decision tabs may be used to supplement a Bicycle Route guide sign to identify destinations or other locations of interest to cyclists. Generally, the number of destinations listed below the Bicycle Route sign should be limited to three for ease of reading and comprehension while cycling. When located on-street, or where visible to motorists, the destination tabs should always be used in conjunction with the appropriate Bicycle Route guide sign. When located on a separate bicycle facility or multi-use facility that is not visible from a roadway, the destination tabs may be used without a parent guide sign.

Whenever possible, distances should be included with the destination tabs. Typically, distances should be indicated in kilometres and the unit of measurement may be omitted. Distances in metres or minutes may also be used and are more applicable for urban areas. If distances are represented in units other than kilometres, the unit (metres or minutes) should be included on the tab.

Design Sign
Highway Shield

Design Sign with
Additional Destinations

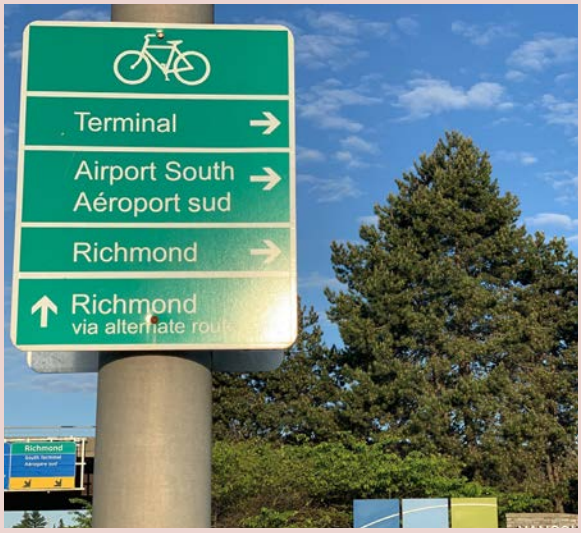
Bicycle Route Sign with Decision Tabs

Figure H-147 // Types of Bicycle Wayfinding Signage (Roadways under Provincial Jurisdiction)

Case Study

Sea Island Cycling Wayfinding Plan, Vancouver International Airport Authority

In 2012, the Vancouver International Airport Authority developed a Cycling Plan for Sea Island, where the airport is located. One of the key actions identified in the Cycling Plan was to improve cycling wayfinding. In 2013, the Airport Authority subsequently developed and implemented a detailed bicycle wayfinding plan for Sea Island, including the identification of specific sign locations and sign content to make it easier for people cycling to navigate through the Sea Island bicycle network. This study was informed by the TransLink *Wayfinding Guidelines for Utility Cycling in Metro Vancouver* with a focus on implementing those guidelines in a manner that reflected the unique context of Sea Island. The Airport Authority has implemented the recommendations of the study throughout Sea Island to make the bicycle network easy to navigate, including decision signs, confirmation signs, and turn fingerboards. A unique component of wayfinding on Sea Island is the inclusion of both official languages on signage due to federal government sign requirements.



Placement and Siting

The frequency of signs and the provision of destination information will depend on the land use context. It is important to ensure that signage is only provided when helpful, without creating sign overload.

Destination Hierarchy

Connecting people to destinations is one of the key principles of providing wayfinding. A hierarchy of destinations allows transportation professionals to prioritize what information to include when all destinations will not fit on a sign. A destination hierarchy should be based on distance, the importance of a destination for riders in an area, and the provincial, regional, or local significance of a location. The TransLink and Capital Regional District documents provide guidance on establishing destination hierarchies. These two guides identify four levels within the hierarchy.

If a wayfinding program is being developed at a regional scale or intended to be consistent across neighbouring municipalities, then all municipalities should agree to the hierarchy.

Level 1 – Centres

These can be regional, municipal, town, or urban centres depending on the context. They are characterized as being major centres of activity that offer a range of attractions and services and provide primary geographic orientation points. Level 1 destinations can be included on signs up to 8 kilometres away.

Level 2 – Local Neighbourhoods

These represent centres of a community with sub-regional/municipal/town importance. Local neighbourhoods provide a mixture of services used by local residents and visitors and should be determined in alignment with local Community Plans. They should be suitable reference points as they are well-known and unambiguous. Level 2 destinations are included on signs up to 4 kilometres away.

Level 3 – Major Attractions

These trip attractors include transit stations and exchanges, major tourist venues, regional parks, and post-secondary education institutions. Level 3 destinations are included on signs up to 2 kilometres away.

Level 4 – Local Destinations

A community may wish to extend the wayfinding system to include local destinations. This may be useful to reflect the nature of lower density areas or to integrate bicycle wayfinding with walking wayfinding on multi-use pathways. They may also be useful if a municipality wishes to provide wayfinding signage on a route that does not connect Level 1–3 destinations. It is, however, important to consider the principles and in particular, the need to keep information simple and consistent. Overloading signs with information often has the unintended effect of making them harder to understand and use. It is not practical to list all the possible local destinations across a community, but the following represents some classifications that may be useful:

- Recreational bicycle facilities;
- Shopping centres;
- Business parks;
- Parks, open spaces and sports facilities;
- High schools;
- Landmarks;
- Healthcare facilities;
- Public washrooms;
- Bicycle repair shops; and
- Civic facilities such as community centres, or libraries.

Level 4 destinations are included on signs up to 2 kilometres away.

Accommodating Differing Audiences

Signage should be legible and useful for a broad range of riders and across different contexts.

- **Cycling Route Signage in Urban Contexts**: Due to the higher number of destinations and bicycle route intersections, signage postings should be every few blocks, or wherever decision points arise.
- **Cycling Route Signage in Recreational Contexts**: Recreational networks tend to be regional in nature, composed of off-street facilities or along less travelled roads. As such, confirmation and decision signage might be spaced at 800 metre intervals, with supportive primary level destination information. Signage intervals may differ based on the network context.
- **Cycling Route Signage on Provincial Roadways**: The province has a list of signage options and guidance on when and where each of the signs should be used (see **Figure H-148**). Decision signs should be located 50 metres in advance of intersections or before the beginning of an off-ramp or the longest turn lane taper. Confirmation signs should be installed approximately 10 metres after an intersection, and spaced approximately 1.5 to 2 kilometres between decision points. Spacing can be reduced to approximately 400 metre spacing in urban areas.

When designing a bicycle wayfinding network, it is important to provide as much information as necessary to give people cycling a detailed sense of their location, particularly on off-road facilities. Including road names on bicycle underpasses or overpasses, helps inform people cycling where they are along a given pathway and will help inform decisions as to where they should exit the pathway. More information on wayfinding for multi-use pathways and trails can be found below.

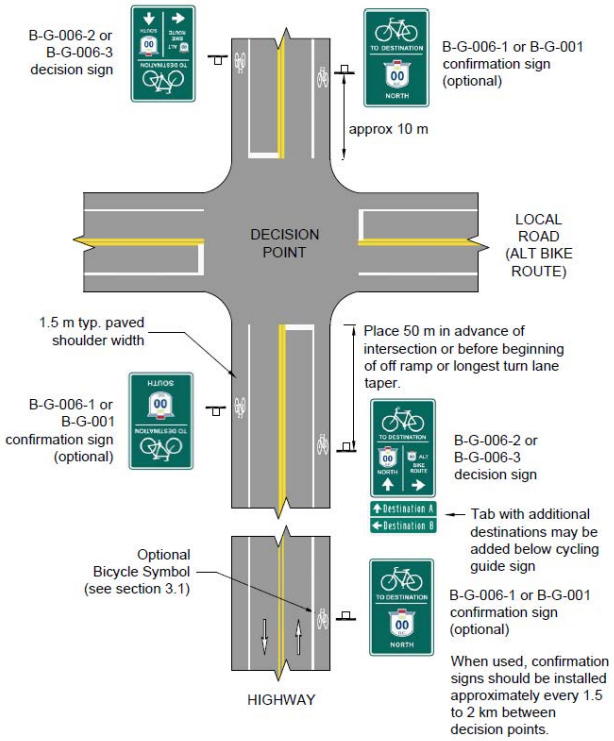


Figure H-148 // Cycling Guide Sign Layout at Decision Point

PAVEMENT MARKINGS

Some communities use pavement markings to supplement the wayfinding network. Such treatments can include coloured striping along the edge of pathways, or symbols that show distances and remind people where the route goes. Shared lane markings (sharrow) can be used on bicycle boulevards to provide confirmation information. Wayfinding pavement markings can also be used at decision points. Wayfinding pavement markings should only be used as a supplement to signage, and not in place of it. It should be noted that there will be additional maintenance costs when using pavement markings for wayfinding, and these should be factored into project life cycle costs.

MULTI-USE PATHWAY AND TRAIL WAYFINDING

Well designed wayfinding and signage allows pathway users to navigate and use off-street pathway networks with ease and efficiency. Wayfinding systems act as visual aids to help users know how to interact with the space and help to ease or prevent potential conflicts between users, the environment, or other hazards to facilitate positive experiences. Wayfinding signage can also communicate important details on the intended use and difficulty of certain pathways. It can also remind users of the etiquette they should be following so they know when to give way to more vulnerable users.

Wayfinding should be consistent with adjacent standards for signage. Many trails within communities are located on federal or provincial Crown land or private land. Parks Canada or the Province, through Recreation Sites and Trails B.C. (RSTBC)[33], have their own signage standards that are well established. Private land owners may choose to have signs that look different as well. It is important to coordinate with adjacent land owners to ensure that wayfinding systems work together. This will typically require confirming the property ownership a trail is located on and coordinating with owners. Examples of wayfinding signage types for off-street pathways and trails is provided in **Table H-41**.

3 'Signs' and 'Kiosks', Infrastructure Drawings, Recreation Sites and Trails BC, accessed June 11, 2019, *http://www.sitesandtrailsbc.ca/about/infrastructure-drawings.aspx*

WAYFINDING SUPPORT PRACTICES

There are a number of other tools and considerations that can help to support the development or maintenance of an existing wayfinding program. For example, an often-overlooked component of wayfinding systems is the internal data and management associated with wayfinding materials. There are also other tools that can help raise awareness of active transportation facilities more generally such as network maps and trip planning tools.

Network Map and Trip Planning

In addition to wayfinding and signage, there are other tools that can help increase awareness of active transportation networks and help users navigate the network. This includes features such as trip planning tools and route maps. These are typically a cost-effective approach that can make people feel safer and more comfortable walking and cycling, while encouraging increased use of active transportation facilities. Communities can individually, or in partnership with neighbouring communities, develop bicycle route maps that identify existing pedestrian and bicycle facilities as well as the level of comfort along designated bicycle routes. These maps can also provide information on the location of bicycle parking, bike share stations, transit stations, community destinations, etc. Route maps should be available on-line or as an easy to carry hard copy and updated regularly. Communities should also look for opportunities to share network information through other emerging technologies as a way of integrating available transportation information. Providing multi-modal trip planning information in one consolidated place can make planning trips by bicycle, foot, and transit convenient and effortless. There are opportunities to work with local researchers and universities/colleges to explore sharing bicycle network and other transportation infrastructure through innovative mobile applications.

Table H-41 // Off-Street Pathway Signage Types

Sign Type	Placement	Components	Purpose
Trailhead Kiosk	Trailheads	• Area map • Safety information • Trail etiquette information • Environmental information	To provide an overview of the trail use area and provide information to trail users regarding safety, the environment, etiquette, and wayfinding.
Trail Direction Sign	Trail Intersections	• Direction • Trail name • Trail difficulty (if applicable) • Trail user (if applicable)	To provide direction information and indicate the difficulty level and user types permitted on a trail.
Property Sign	Where trails cross property lines	Small information sign	To alert users when they are crossing a property line.
Environmental Signage	At points of special environmental consideration	Interpretive sign	To indicate where and explain where environmentally sensitive areas are and to discourage disturbance.
Interpretive Signage	At important historical locations	Interpretive sign	To provide information on historical events or other points of interest.
Hazard Signage	At natural hazards, or busy road intersections	Warning sign	To warn trail users of potential hazards.
Etiquette Signage	At trailheads, trail intersections	Warning sign	To communicate the appropriate rights-of-way for shared trails and to communicate proper trail use.
The Great Trail Signage (formally known as the Trans Canada Trail)	Along the Great Trail	• Great Trail logo • Directional arrows	To indicate the route for the Trans Canada Trail.

Case Study

Creative Pavement Markings, North Vancouver, B.C.

The City of North Vancouver has applied the use of creative wayfinding and pavement markings at several locations along its pathway network. This includes the use of decorative pavement parkings with a distinct recognizable theme of circles along the Spirit Trail, a 35 km pathway that will ultimately extend from Horseshoe Bay to Deep Cove. These pavement markings are used along the pathway and at intersections to make the Spirit Trail a unique, highly visible, and recognizable facility for motorists as well as people walking and cycling.

The City has also applied wayfinding at major destinations such as the Lonsdale Quay to identify destinations with arrowheads and colour, and has also used creative pavement markings on several pathways to make the experience along the pathway fun and inviting for people of all ages.

Signage Inventory

Having an inventory of existing signage is helpful when municipalities are maintaining existing signage and expanding their network. Having a list and/or map that identifies the location of different types of signage can be beneficial. Additional features that could be documented include, but are not limited to, maintenance dates, material type, and any other location details.

Standardized Design Files

Standardized design files associated with the production of symbols for on the road wayfinding, as well as for posted signage, should be documented and saved in an accessible location. This will allow multiple individuals to have access as necessary. In addition, the sharing of this information through open data may allow individuals to develop apps, websites, and other tools which may be of additional use to the cycling public.

Wayfinding signage, Portland, Oregon

Lighting Along Multi-Use Pathway, New Westminster, B.C.

H.4

LIGHTING

Lighting is an important element to consider when planning and designing pedestrian and cycling facilities. Lighting is important for active transportation users because it enhances the aesthetics of the built environment, increases comfort and safety, and helps with wayfinding, navigation, and observation. Lighting also helps to enhance the visibility of road and pathway surfaces, the surrounding environment, and other roadway and pathway users. Lighting can provide significant value in enhancements to both real and perceived comfort and safety. Contextually appropriate lighting design can complement and enhance the design of pedestrian and cycling facilities.

Lighting on pedestrian and cycling facilities is important to help ensure safe, accessible, reliable, and predictable transportation choices throughout all times of day and all seasons. This is especially important for growing and maintaining existing pedestrian and cycling mode share when commuting occurs during periods of low natural light caused by short winter days.

DESIGN PRINCIPLES AND CONSIDERATIONS

Several key principles and considerations should be investigated and analyzed in the design and development of lighting systems for pedestrian and cycling facilities, including the positioning and spacing of the luminaires, local context, safety and security, location and facility type, life-cycle considerations, and all facility users.

Positioning and Spacing of Luminaires

Proper positioning of lighting components will illuminate key features of a pedestrian and cycling facility. Continuous sections of facilities may require lighting as do key features along a facility. Some of the key features that may require illumination include: wayfinding signage, conflict and decision points, and intersections. The position, placement, and angle of luminaires can maximize positive contrast and minimize glare. Consideration should be made to ensure that lighting components are positioned sufficiently away from existing lighting systems to avoid over lighting. Lighting posts and lighting fixtures should also be placed in such a way to minimize impedance to users of pedestrian and cycling facilities.

The spacing between light poles is important because it directly affects the uniformity of the lighting perceived by the user of a pedestrian and/or cycling facility. Uniformity is generally desired as it requires less effort for the user's eyes to readjust to differing lighting levels. Consistent illumination also helps minimize dark patches and shadows along the facility, which is particularly important for helping make pedestrian and cycling facilities more accessible for people with visual impairments.

Local Context

Lighting design should always consider the aesthetic, environmental, safety, security, and social contexts in which a pedestrian or cycling facility is located. The design should simultaneously provide the minimum required lighting to meet desired lighting requirements and address all relevant safety and security considerations, while respecting the local context, minimizing light pollution and trespass, and complementing the built environment.

Lighting can be used to improve the character and attractiveness of the public realm that surrounds pedestrian and cycling facilities. For example, lighting can be used to draw attention to notable buildings, landscapes, and amenities.

Excessive lighting has the potential to negatively impact the natural environment surrounding a pedestrian and/or cycling facility. Lighting that is not active through the night, such as activated lighting systems, (as discussed in further detail below), may impact animal habitat that requires no lighting. Furthermore, lighting along pedestrian and cycling facilities, particularly through large greenspace or urban parks, may further decrease available space for animal habitat and livelihood. As such, impacts to the surrounding environment should be considered in both transportation and lighting design of a pedestrian and/or cycling facility.

Lighting also has the potential to interfere in the community context surrounding a pedestrian or cycling facility. Lighting along pathways may introduce light pollution or trespass to adjacent residential properties. As such, lighting design along pedestrian and cycling facilities should consider impacts to adjacent residential properties.

Safety and Security

Lighting can be used to address safety concerns on pedestrian and cycling facilities since it improves the visibility of the roadway and pathway surfaces, surrounding environment, and other users of a facility, and enables users to anticipate potential conflicts and hazards. This is particularly important for pedestrian and cycling facilities with high variability in user

operating speeds, such as multi-use pathways and bicycle facilities along roadways. Lighting should provide users with sufficient sight distance to observe, navigate around, and avoid slower facility users so as to reduce the potential for collisions and traffic-related conflicts.

Lighting can enhance security and encourage people to gather and use public spaces, including pedestrian and cycling facilities. This may, in turn, create actual security through eyes on – and in – pubic spaces. Security considerations in lighting design should always be further investigated to determine if lighting is needed and would result in actual net security benefits to security. While the installation of lighting will help to enhance the safety and security of a given pedestrian or cycling facility, it cannot eliminate or mitigate all related risks. Other urban and transportation design considerations for safety include: having an open design with clear sightlines, ensuring passive surveillance opportunities, providing access to exit routes, and ensuring the availability of emergency assistance, among others.

Location and Facility Type

Lighting design should consider the location and design of the pedestrian and cycling facility it is intended to support. The provision of lighting is often dependent on the volume of active transportation users, which can vary between urban and rural settings. Additional restrictions may be considered in areas with dark sky zones. Dark sky zones are areas designated by municipalities that have Dark Sky compliant lighting so as to minimize light pollution and preserve natural lighting within a designated portion of the community.

Lighting design should consider whether the design is new or meant to support an existing lighting system. Detailed analysis of lighting may be undertaken to investigate whether existing lighting is sufficient to support a proposed pedestrian and cycling facility.

Future Proofing Facilities for Lighting

Lighting on active transportation facilities provides a number of important benefits. However, it may not always be possible to meet the lighting recommendations set out in the Design Guide in all contexts, especially in basic rural and outer developed rural areas. Providing lighting along the length of a facility may be cost prohibitive and may require additional maintenance. Furthermore, accessing power may be challenging – some rural areas lack access to power, with communities relying on alternative sources of power in places (such as solar, wind, generators, and others). Some of these alternate sources of power may be considered for powering lighting, but this is not always feasible. The lack of power can present a large challenge towards providing lighting along an active transportation facility.

In circumstances where the provision of lighting appears to be infeasible, transportation professionals should consider future proofing the facility by installing conduits along the pathway, ensuring that lighting can be added relatively easily if and when funds and/or power become available. Future proofing the facility will prevent having to remove and reconstruct a facility in order to add lighting.

Furthermore, the implementation of lighting can be staged, with areas of highest importance such as intersections and crossings – or areas with readily available power sources – provided with lighting first, and more lighting added along other parts of the facility in the future. In this way, lighting does not have to be perceived as a barrier to active transportation facility implementation.

Furthermore, lighting design should consider the type of pedestrian and cycling facility proposed, as different facilities have different lighting needs and requirements. Pedestrian facilities, on-street cycling facilities, and off-street facilities each have different lighting needs and requirements, as described in further detail below.

Life-Cycle Considerations

Lighting design should consider the serviceability of a proposed lighting system throughout its intended design life, particularly considerations for energy consumption, maintenance, and vandalism. An adequate lighting design should seek to balance providing optimal lighting while minimizing overall energy consumption. Minimizing energy use can be accomplished using LED lighting fixtures, activated lighting systems, lighting timing, and/or efficient lighting design. Over lighting should be avoided as it causes unnecessary and unwarranted energy consumption for a given facility. Lighting design for pedestrian and cycling facilities should account for long-term maintenance considerations and aim to facilitate maintenance, replacement, and cleaning, and be integrated into a local or regional government's existing maintenance program. Vandalism of lighting and lighting fixtures is of concern, particularly in urban areas. As such, specification of lighting fixtures that minimize and discourage vandalism is encouraged.

Users

Lighting design should always consider all users of a facility, as the users determine the type of lighting used, the lighting illumination levels, and the placement and positioning of lighting infrastructure. Lighting design for pedestrians should seek to provide gradual lighting transitions, provide an appropriate colour temperature, and minimize cast shadows. Specific lighting considerations for people with visual impairments should be considered in high traffic areas and frequent points of interest such as arterial roadways and transit facilities.

Lighting design should consider the intended user(s) of the pedestrian or cycling facility, as each user of a facility has different lighting desires and needs. Lighting design requirements, generally, are categorized into lighting for people walking and lighting for people cycling.

The users of both pedestrian and cycling facilities include children, adults, and seniors who walk or cycle as their main mode of transportation. Users of these facilities, particularly multi-use facilities, may also include users with wheelchairs, scooters, in-line skates, skateboards, and recumbent bicycles. Users of pedestrian and cycling facilities typically operate at different speeds, therefore requiring different lighting needs.

For users of a cycling facility, who typically operate at a higher speed than pedestrians, lighting is important because it enhances the visibility of the roadway and pathway surfaces, the surrounding environment, and other users of the facility. It also helps to anticipate potential conflicts and hazards, and aids in wayfinding and ongoing navigation. Typically, bicycle lights are used to indicate their presence to other facility users. However, bicycle lights are not typically powerful enough to adequately illuminate the riding surface or wayfinding devices, and they do not allow bicycle users to be seen from right-angle approaches. Therefore, lighting design of cycling facilities should consider illumination for people cycling at decision points, where signage is located, potential conflict zones, and roadway intersections.

For multi-use facilities, users can include children, adults, and seniors who walk or cycle as their main mode of transportation. Users of these facilities may also include users with wheelchairs, scooters, in-line skates, skateboards, and recumbent bicycles.

TYPES OF LIGHTING

Many active transportation facilities require different mounting styles of lighting than typical road lighting because of the smaller roadway or pathway surface requiring illumination and the human scale of the users.

Street Lamps

The most common lighting for on-street pedestrian and cycling facilities are street lamps. Street lamps are typically used on on-street facilities to illuminate roadways and surrounding infrastructure, including sidewalks and bicycle lanes. Street lamps may be equipped with secondary, shorter luminaires to enhance lighting in dense tree canopies along tree-lined boulevards, where pruning is not possible.

Pedestrian-Scale Lamps

Pedestrian-scale lamps are small-scale street lamps typically placed on off-street facilities such as multi-use pathways and separated bicycle and pedestrian pathways. While pedestrian lamps are more aesthetically pleasing for off-street facilities, their size makes them more conducive to vandalism.

Miscellaneous Lighting

Other types of lighting for pedestrian and cycling facilities exist, such as illuminated bollards, in-ground lighting, and emerging technologies. These types of lighting are mainly used for wayfinding and decorative purposes as they may not provide sufficient illumination for safety and navigation. These types of lighting do not allow users to make out upper bodies and/or faces. They may also require higher maintenance because of vandalism concerns associated with their ease of access to pedestrian and cycling facilities.

Illuminated bollards are a type of bollard that include a lighting fixture, typically affixed to the top of the bollard. Illuminated bollards are typically considered for off-street pedestrian and cycling facilities.

In-ground lighting consists of lighting fixtures whose bulb covers are placed flush with the ground surface. In-ground lighting systems are typically considered for off-road pedestrian and cycling facilities.

Activated lighting systems are a type of lighting that is triggered upon sensing a person walking or cycling. Activated lighting systems are typically considered for pedestrian and cycling facilities that do not generate sufficient traffic to justify ongoing illumination and/or used as a measure of energy conservation. However, use of activated lighting systems should be reconsidered where potential effects of variable lighting on adjacent animal habit exists.

Decorative Street Lighting, Summerland, B.C.

LIGHTING COMPONENTS

Lighting system components are composed of the base, the post, and the fixture (or lamp). For off-street pedestrian and cycling facilities, lighting posts are typically shorter than road lighting. This is because pedestrian and cycling facilities are smaller in road or pathway surface width and area and therefore require less distribution of light over large areas. Moreover, shorter lamp posts evoke a more human scale of infrastructure.

The post height for dedicated pedestrian and cycling facilities (typically off-road facilities) should range between 4.0 to 6.0 metres (as indicated in *ANSI/IES RP-8-18 Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting*). Mid-block crossings are typically designed with lighting posts that are similar in height to adjacent posts or posts that are specified by the authority having jurisdiction.

DESIGN GUIDANCE

Design requirements for lighting are largely dependent on the walking or cycling facility requiring illumination and the intended users of the facility. Furthermore, many communities or agencies have their own standards for lighting within their jurisdiction. As such, all lighting design should be designed at minimum according to the standards imposed by the jurisdiction. There are some additional resources available that provide specific design guidance for lighting on transportation facilities, including:

- TAC *Guide for the Design of Roadway Lighting* (2006)
- MOTI *Electrical and Traffic Engineering Manual* (2013)
- American National Standards Institute *ANSI/IES RP-8-18 Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting* (2018)
- American Association of State Highway and Transportation Officials *Roadway Lighting Design Guide* (2005)

It is important to note that detailed lighting design is generally conducted with the support of detailed lighting software used by an electrical engineer. The guidance in this chapter is not intended to be a replacement, but rather provide best practice considerations and guidance for lighting design specific to pedestrian and cycling facilities.

LIGHTING BY FACILITY TYPE

Required illumination levels can vary depending on the type of facility and the level of activity. It is recommended to include lighting for off-street pathways and on-street bicycle facilities for all new construction or road upgrades. A pedestrian or cycling facility that is designated an all ages and abilities facility and/or is intended to be used for transportation purposes should have illumination along the entire route regardless of facility type. Illumination along the entire corridor will ensure that the pedestrian and cycling facility is accessible and available for all users at all times of day for transportation use.

Pedestrian and cycling facilities that are intended primarily for recreational use during daylight hours may not require full illumination along the extents of the entire route, especially if the facility is located in a non-urban context. Illumination along the entire route may not be practical or appropriate within the environmental context. However, lighting is required at any intersection, junctions, or if the facility is used after dark and in winter months.

The higher the level of activity, the higher the illuminance level, and thus the higher the potential for conflict between users.

Off-Street Facilities

Off-street pedestrian and cycling facilities are defined by TAC as those areas that are located 5 metres or more away from an adjacent roadway. Generally, lighting along off-street pedestrian and/or cycling facilities serves two main purposes: security and guidance.

For people walking, the primary purpose of providing lighting along off-street facilities is to enhance personal security, since these facilities are generally located far from traffic and the roadways; whereas for people cycling, the purpose of providing lighting along off-street facilities is generally to provide guidance along the pathway, illuminate other users of the trail, and anticipate any hazards and potential conflicts.

Regardless of the purpose of the pedestrian or cycling facility, as a minimum requirement, lighting is recommended on off-street facilities a minimum of 25 metres in advance of an intersection[1] . If the pathway is further than 5 metres from an adjacent road, it is recommended that the off-street facility has its own independent lighting system as outlined in the TAC *Guide for the Design of Road Lighting*, Chapter 16 (Off-Road Facilities) and **Table H-42**.

The post height for off-street dedicated pedestrian and cycling facilities should range between 3.0 to 6.0 metres away from adjacent roadways, as this helps to limit glare while still illuminating the pathway.

Lighting is generally considered a requirement for urban residential parks, tunnels, stairs, and areas where security may be an issue. In addition, off-street facilities that serve as an all ages and ability facility within a community's active transportation network and is used for transportation purposes, should have lighting along the length of the route. Off-street facilities that are for recreational use in a non-urban setting may not require lighting depending on the context and use of the facility length.

Table H-42 // Recommended Illuminance Levels for Walkways and Bikeways

Source: TAC *Guide for the Design of Roadway Lighting* – Volume 2 – Chapter 16 – Table 16.1

AREA	MINIMUM AVERAGE HORIZONTAL ILLUMINANCE (LUX)	MAX. HORIZONTAL UNIFORMITY (AVG. TO MIN. ILLUMINANCE)
Walkways and Bikeways	5.0	10.0:1
Pedestrian Stairs	5.0	10.0:1
Pedestrian and Cyclist Tunnels	43.0	10.0:1

On-Street Facilities

On-street pedestrian and cycling facilities are defined by TAC as areas that are located within 5 metres of an existing roadway. The purpose of lighting for pedestrian and cycling facilities adjacent to a road is safety and hazard detection, reading of signs and building numbers, and landmark recognition.

Generally, use of existing roadway lighting is sufficient for facilities located within the roadway allowance, provided the roadway lighting has properly accounted for the level of pedestrian and vehicle activity. On-street facilities with high levels of pedestrian activity or high potential for pedestrian and vehicle conflict will require additional or supplementary illumination through the use of additional lamp posts, secondary luminaires, or pedestrian-scale lighting. The levels of illuminance for on-street facilities are shown in the tables below (**Table H-43** and **Table H-44**). Generally, where the volume of existing or anticipated active transportation users is high, the level of illuminance

1 Ministry of Transportation of Ontario, *Book 18 Ontario Traffic Manual – Cycling Facilities*, December 2013, pg. 116

should be greater. Pedestrian levels refer to the number of pedestrians per hour at the dusk hour.

The levels of pedestrian activity are defined as:

- **High:** Areas where a significant number of pedestrians are expected to be on the sidewalks or crossing the roads after dark (over 100 pedestrians per hour). Examples of high activity areas are downtown retail areas, near theaters, concert halls, stadiums, and transit terminals.
- **Medium:** Areas where lesser numbers of pedestrians utilize the roads at night (10 to 100 pedestrians per hour). Typical this includes downtown office areas, blocks with libraries, apartments, neighbourhood shopping, industrial, parks, and roads with routes transit.
- **Low:** Areas with very low volumes of night pedestrian usage (10 or fewer pedestrians per hour). These can occur on any type of roadway but are likely to be along local and residential roads with single family dwellings, very low density residential developments, and rural or semi-rural areas.

For more information on levels of lighting required based on pedestrian activity and area, refer to TAC *Guide for the Design of Roadway Lighting – Volume 2 –* Chapter 9 – Table 9.3.

Pedestrian-Oriented LED Lighting, Vancouver, B.C.

Table H-43 // Recommended Illuminance Levels for Pedestrians

Source: TAC *Guide for the Design of Roadway Lighting* – Volume 2 – Chapter 9 – Table 9.3

PEDESTRIAN ACTIVITY	MINIMUM AVERAGE HORIZONTAL ILLUMINANCE (LUX)	MINIMUM VERTICAL ILLUMINANCE AT 1.5M ABOVE PAVEMENT (LUX)	MAX. HORIZONTAL UNIFORMITY (AVG. TO MIN. ILLUMINANCE)
High	20.0	10.0:1	4.0:1
Medium	5.0	2.0:1	4.0:1
Low	3.0	0.8:1	6.0:1

As seen in **Table H-44**, there are two areas that are identified as high conflict areas: 'Mixed Vehicle and Pedestrian' areas, where no physical separation exists between vehicles and pedestrians, and 'Pedestrian Only' areas. For all other areas, the classification is for pedestrian only areas (no mixed vehicle/pedestrian). Areas with a greater level of conflict should have a higher level of illuminance.

CONSIDERATIONS FOR LOCAL ROADS AND NEIGHBOURHOOD BIKEWAYS

Local roads can be very popular routes for walking and cycling as they have lower motor vehicle volumes and speeds which can create a more inviting space for active transportation. Design professionals should note that standard illumination levels along local roads may not be sufficient, particularly if the road is also a designated as a bicycle facility. As a result, neighbourhood bikeways (discussed in **Chapter D.2**) require special consideration when it comes to lighting. These roads are designed to have low motor vehicle volumes and speeds and are designed to be comfortable for people walking and cycling. Adding pedestrian-scale lighting can further enhance the pedestrian environment and can help to communicate to decision-makers and community members that the benefits of neighbourhood bikeways extend beyond cycling.

Design professionals should assess the lighting conditions upon installing a neighbourhood bikeway and, if needed, consider enhancements to the lighting to ensure people cycling are visible, safe, and comfortable riding in all lighting conditions.

Crossings

Potential conflict areas such as intersections, driveways, and alleyway entrances are especially important to illuminate, as all users, especially those at higher operating speeds, need sufficient time to see, assess, and take appropriate action prior to entering the intersection.

Table H-44 // Recommended Illuminance Levels for Pedestrians

Source: RP-8 (2014) - Tables 4, 5 and 6

AREA	PEDESTRIAN ACTIVITY	MINIMUM AVERAGE HORIZONTAL ILLUMINANCE (LUX)	MINIMUM VERTICAL ILLUMINANCE AT 1.5M ABOVE PAVEMENT (LUX)	MAX. HORIZONTAL UNIFORMITY (AVG. TO MIN. ILLUMINANCE)
Mixed Vehicle and Pedestrian	High	20.0	10.0	4.0:1
Pedestrian only	High	10.0	5.0	4.0:1
Pedestrian	Medium	5.0	2.0	4.0:1
Pedestrian	Medium Density Residential	4.0	1.0	4.0:1
Pedestrian	Low Density Residential	3.0	0.8	6.0:1
Pedestrian	Rural/Semi Rural	2.0	0.6	10.0:1

Street lighting, New Westminster, B.C.

Facilities at Intersections

Lighting the intersection helps to make motor vehicle drivers aware of any other users already in the roadway/intersection. At the intersection of an off-street pathway and a roadway, it is recommended that the bicycle facility be illuminated for 25 metres on either side of the intersection so that bicycle users can see the road and are clearly visible to drivers. This applies to both lit and unlit roads. If the road is unlit, transitional lighting should be provided leading up to the intersection so that drivers' vision can adjust to the illuminated intersection.

Signalized Intersections: At minimum, lighting requirements for pedestrian and cycling facilities at signalized intersections should be illuminated to the same levels as that of the intersection. If vertical illuminance is required, then the vertical levels should be equal to or better than required horizontal illuminance levels. When the configuration of an intersection changes, or the classification of a road is modified, the pedestrian conflict level of the intersection (as identified in **Table H-41**) should be revised. When this occurs a lighting evaluation of the entire intersection is recommended to ensure compliance with current standards.

Unsignalized Intersections: Signalized intersections require horizontal and vertical illuminance, whereas unsignalized intersections require only horizontal illuminance. Chapter 12 of the TAC *Guide for the Design of Roadway Lighting* recommends that all pedestrian crosswalks with nighttime pedestrian traffic be illuminated.

Facilities at Mid-Block Crossings

Lighting of pedestrian and cycling facilities at mid-block crossings are important so that vehicle users can anticipate and predict crossing users. To achieve adequate lighting, posts should be strategically placed before and after intersections to ensure positive contrast. Poles should be placed to minimize light pollution to adjacent residences. Mid-block crossings are typically designed with lighting posts that are

similar in height to adjacent posts or posts that are specified by the authority having jurisdiction. For more information on lighting at mid-block crossings refer to TAC *Guide for the Design of Roadway Lighting* - Volume 2 – Chapter 12 – Section 12.5.2.

Other Locations

Tunnels and Underpasses: Tunnels and underpasses should be well lit for the security and comfort of people walking and cycling. Ideally, users should be able to clearly see what is happening throughout the entire tunnel or underpass, though this is dependent on the geometry of the tunnel.

Bridges and Overpasses: Overpasses should be lit to ensure that users can see what is happening on the bridge or overpass and can see any hazards or obstructions as well as other users. There are opportunities to use bridge and overpass lighting to enhance and showcase the structure.

Decision and Conflict Points: Lighting is important wherever wayfinding or warning signs exist along a pedestrian and cycling facility. Lighting warrants, as noted below, are used to determine if and where lighting is required based on security problems, high ridership, or where surrounding land uses are particularly active (such as schools or university campuses).

Laneways: In residential areas, proper illumination in laneways that are designated as a bicycle facility can also be important, as many bicycle users will use them to avoid motor vehicle traffic and enter their home from the back, where bicycle storage is often located.

Warrants

There are cases where communities and jurisdictions may use a warrant process to determine if lighting is required along pedestrian and cycling facilities. These vary by community but often take into consideration the volume of users, likelihood of conflict, and presence of hazards.

Lighting on Protected Bicycle Lane, Vancouver, B.C.

Self-balancing electric unicycle, Victoria, B.C.

H.5

NEW MOBILITY INTEGRATION

The growing trend towards new forms of mobility has seen the increasing popularity of electric bicycles (e-bikes), electric kick scooters (e-scooters), and other small, one-person electric vehicles, as well as the wide-scale proliferation of shared mobility systems such as bike share and e-scooter share in communities throughout North America and around the world. This chapter provides guidance related to these new and emerging small vehicle modes, specifically with regards to where they should be operated, where shared mobility systems should be stored, and whether emerging small, one-person electric vehicles require specific design modifications in relation to cycling facilities, sidewalks, and end-of-trip facilities.

The growing trend towards shared mobility and multi-modal transportation is changing the way people are travelling in communities across Canada and around the world. Increasingly, municipalities are needing to work with various levels of government and with community and corporate partners to ensure new transportation options thrive and to provide individuals with more mobility choices. This can support other community-wide goals including: improved accessibility, equity, safety, health, sustainability, and convenience.

Innovations in active transportation have occurred at the vehicle level as well as at the system level. In relation to vehicles, the past few years have witnessed the increasing popularity of electric bicycles (e-bikes) and electric kick scooters (e-scooters), driven by the ever-reducing cost of batteries. As the diversity of small vehicle types increases, important questions regarding where these vehicles should and should not be operated, how and where they should be stored, and whether new design elements need to be considered, are now being explored.

In addition, the last several years have seen a wide-scale proliferation of shared mobility systems such as bike share and e-scooter share in large and mid-sized communities across the globe, including B.C. Dockless bike share, dockless e-bike share, and dockless e-scooter share have now joined the more traditional docked/station-based bike share model in providing additional mobility options within the transportation system. While these new transportation options provide additional choice in mobility to travel consumers, important questions are now being raised around where to park these vehicles when they are not in use.

This chapter provide guidance in relation to these new and emerging mobility modes, specifically with regards to where they should be operated, where shared mobility systems should be stored, and whether emerging small, one-person electric vehicles require specific design modifications in relation to cycling facilities, sidewalks, and end-of-trip facilities.

NEW AND EMERGING MOBILITY TECHNOLOGY

Electric Bicycles (E-Bikes)

Electric bicycles (e-bikes) are an emerging transportation mode that are gaining popularity worldwide. E-bikes have the potential for increasing the appeal of cycling to a larger group of people and extending the range of destinations that can be reached by bicycle. E-bikes can help communities achieve their greenhouse gas reduction targets and, with supportive cycling infrastructure in place, can substitute many medium-distance trips currently taken by motor vehicles. E-bikes can also make cycling a practical transportation choice for seniors and older adults and others with accessibility limitations by reducing the level of physical effort required.

In B.C., e-bikes are currently defined under the *B.C. MVA* as motor assisted cycles. According to the B.C. MVA, a motor assisted cycle means a device:

- To which pedals or hand cranks are attached that will allow for the cycle to be propelled by human power;
- On which a person may ride;
- To which is attached a motor of a prescribed type that has an output not exceeding the prescribed output;
- That meets additional criteria described below:
  - *The motor must be electric with a continuous power output of not more than 500 watts that is incapable of propelling the motor assisted cycle at a speed greater than 32 km/h on level ground;*
  - *Maximum of three wheels in contact with the ground;*
  - *Must be equipped with a mechanism, separate from the accelerator controller, that:*

- *Allows the driver to turn the motor on and off from normal seated position while operating the motor assisted cycle; or*
- *Prevents the motor from turning on or engaging before the motor assisted cycle attains a speed of 32 km/h*

- *The motor of a motor assisted cycle must turn off or disengage if:*
  - *The operator stops pedalling;*
  - *An accelerator controller is released; or*
  - *The brake is applied.*

Under federal regulations, the motor of an e-bike must be incapable of providing further assistance when the bicycle attains a speed of 32 km/h on level ground, and are limited to and an electric motor output of 500 watts.

ICBC notes that e-bikes 'may be operated on the road like any bicycle, except where municipal bylaws restrict operation.' Additionally, ICBC clarifies that the pedals attached to an e-bike must be usable, stating that the 'motor must be capable of being propelled by muscular power using the pedals, but it is not necessary to always be pedalling.'[1]

Similar to a standard bicycle, provincial legislation requires that e-bike users wear a helmet. A driver's license, vehicle registration, and insurance is not required. Section 182.1 of the *B.C. MVA* requires users to be over 16 years of age to operate an e-bike.

1 'Low-powered vehicles', Vehicle Registration, Insurance Corporation of British Columbia, accessed June 11, 2019, ***https://www.icbc.com/vehicle-registration/specialty-vehicles/Low-powered-vehicles/Pages/Default.aspx***

New Mobility Terminology

- **New Mobility:** A blanket term that includes autonomous vehicles, electric motor vehicles, mobility as a service, shared mobility, electric bicycles, and small, one-person electric vehicles. The Design Guide focuses on the components that have direct relevance to active transportation facilities, including shared mobility, electric bicycles, electric kick scooters, and other small, one-person electric vehicles.
- **Shared Mobility:** Systems that allow people to access a network of shared vehicles that have been spread across a community or portion of a community, as opposed to privately-owned vehicles or vehicle rental companies based in a single location. Shared mobility systems currently include: shared motor vehicles, shared bicycles and electric bicycles (including docked and dockless systems), and shared electric kick scooters. The Design Guide focuses on shared bicycles/electric bicycle systems (currently in operation across B.C.) and shared electric kick scooter systems (which are popular across the United States but are not currently legally permitted in B.C.).
- **Small, One-Person Electric Vehicles:** A category of electric vehicles that includes electric kick scooters, electric skateboards, hoverboards, segways, self-balancing electric unicycles, and other emerging modes. At the time of writing, these vehicles are not permitted on public roadways or sidewalks in B.C. (legality issues are discussed further below). However, some of these vehicles have been observed in operation in communities across the province.

Context for Electric Powered New Mobility: Rapidly Decreasing Cost of Batteries

Electric powered transportation options, such as e-bikes, e-scooters, and electric vehicles (EVs), have become commonplace as the cost of energy storage has decreased (see **Figure H-126**). Battery prices for new mobility devices have fallen since 2010 and are projected to decline even further as manufacturing, and material costs drop. Further near term reductions in costs will likely increase demand for private ownership of electrically powered small vehicles as well as opportunities for profitable shared mobility services.

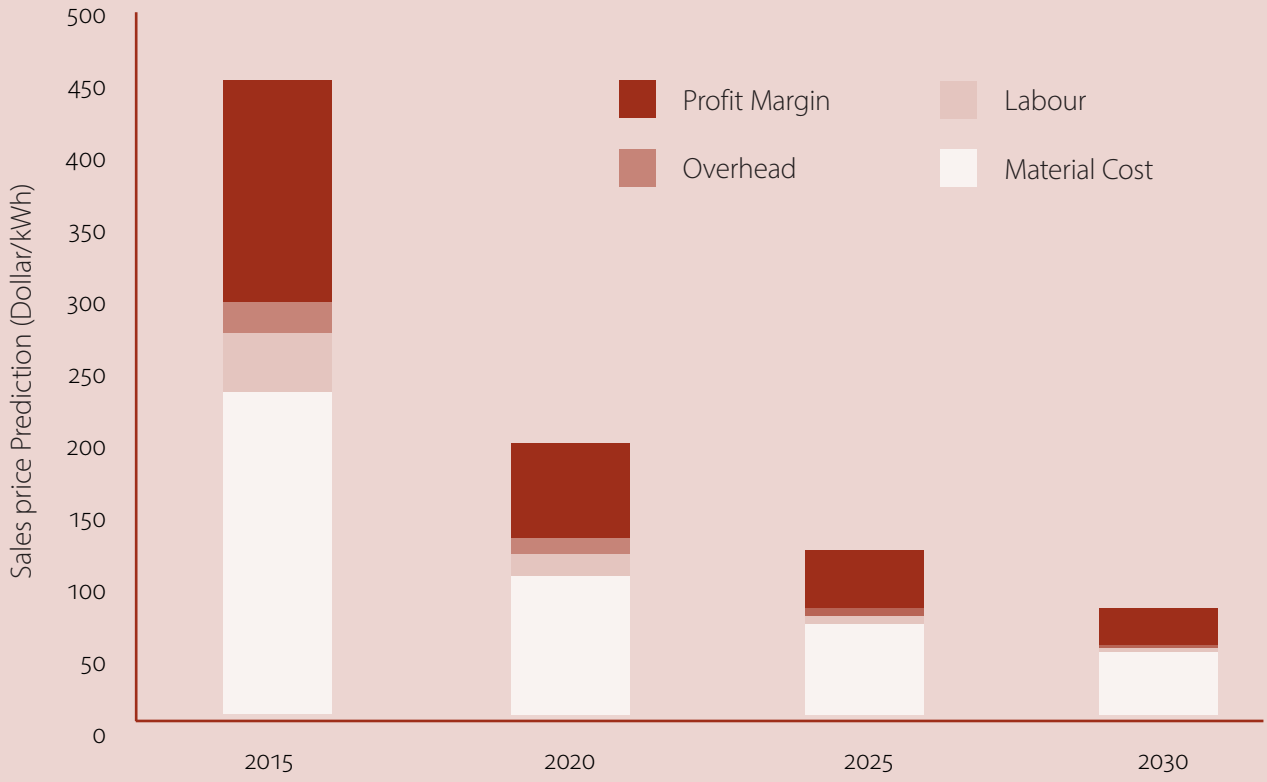


Figure H-149 // Material, Labour and Overhead Costs for Battery Production 2015 to 2030
Source: CB Insights 2019

Electric Bicycle Vehicle Types

E-Bikes, as defined by provincial legislation, encompass a wide-range of vehicle types and can be classed as either *scooter-style e-bikes* or *bicycle-style e-bikes* (see **Table H-45**). Bicycle-style e-bikes are further divided into *powered (throttle controlled) bicycles* and *power-assisted bicycles (pedelecs)*. While all e-bikes have operable pedals, scooter style e-bikes have foot platforms for the rider – similar to Italian Vespa scooters – with pedals offset to the side rendering pedaling optional.

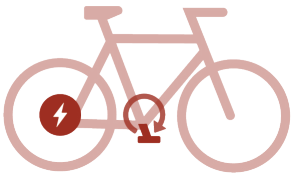
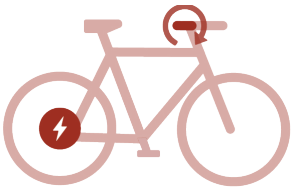
While both vehicle types would be governed to a maximum speed of 32 km/h by law, bicycle-style and scooter-style e-bikes have very different appearances, dimensions, and weights, which may have implications on where they should be operated. Additionally, while pedelecs and throttle controlled bicycle style e-bikes are perceived by the general public as bicycles, a study by the American League of Cyclists (2015) found that nearly three-quarters of respondents did not consider scooter style e-bikes as bicycles.

Safety Considerations and Operating Speeds

E-bike operating speeds are governed by law that the motor must not be capable of propelling the bicycle above 32 km/h on level ground, which falls within the upper range of conventional bicycle operating speeds (see **Chapter B.4**)[2]. The speed of conventional bicycles depends on a number of factors, including: topography, bicycle model, facility type, and rider ability, with typical adults travelling at average speeds of 15 km/h to 30 km/h on flat level terrain. Although within typical range of cycling speeds, the average speed of e-bikes

2 National Association of City Transportation Officials, Global Street Design Guide, 2016.

Table H-45 // Types of Electric Bicycle allowed under the B.C. MVA

	E-BIKE CLASS	NOTES
	Power-Assisted Bicycle (Bicycle Style E-Bike)	Also referred to as pedal electric bicycle (pedalec), electric pedal assist cycle (EPAC), electrically assisted bicycle, or human-powered hybrid.
	Powered Bicycle (Bicycle Style E-Bike)	Also referred to as throttle-assisted bicycle, electrically propelled bicycle, electric bike power on demand (POD), or motorized bicycle.
 Source: Dennis Sylvester Hurd	Scooter Style E-bike	Small pedals and limited top speed allow this vehicle to meet *B.C. MVA* definition of motor assisted cycle.

speed is greater than that of conventional bicycle because, regardless of topography or rider fitness, they can sustain a faster speed over longer distances.

Another consideration is the weight or dimensions of select bicycle types, particularly scooter-style e-bikes, which can weigh up to 120 kg, compared to conventional bicycles which generally range from 10 to 20 kg. Wider frames can also present a potential safety concern when bicycles are attempting to pass one another.

Because of their power motors, a variety of cargo vehicle e-bicycles are now commonly used in last-mile distribution[3]. Last-mile delivery is changing in cities around the world as delivery businesses begin to embrace pedal-assist delivery options, especially in dense urban centres. Some of these delivery vehicles, such as power-assist cargo tricycles, can be more efficient than traditional delivery in select areas as these vehicles can bypass traffic in bicycle lanes, and can park in commercial loading zones, unregulated zones, regular parking spots, and on sidewalks. Some cargo tricycles can even enter buildings to complete deliveries. Cargo tricycles, however, can weigh up to 300 kg and are 1.2 metres in width, and as such present unique safety and operational challenges. While cargo tricycles are primarily used for deliveries at this stage, similar-framed electric bicycles could be used to transport household goods, and/or other passengers, including young children. As the realm of e-bike vehicle types expand, bylaws and active transportation facility designs will need to be continually reviewed to ensure they are up-to-date.

Operating Guidelines

As e-bikes have the potential to support sustainable transportation by providing practical, affordable alternatives to medium- and longer-distance motor vehicle trips, policies for accommodating power-assisted bicycles should be as permissive as possible, with restrictions imposed only where adverse impacts are likely. Under the *B.C. MVA*, e-bikes are currently able to operate anywhere a standard bicycle is legally permitted, unless further restricted by municipal by-law. Circumstances where municipalities may consider restricting or prohibiting e-bike usage may include:

- Multi-use pathways or bicycle pathways;
- Protected bicycle lanes; and
- Unpaved facilities.

Increasingly, communities are differentiating between *scooter-style* and *bicycle-style* e-bikes in their traffic bylaws. For example, Toronto, Ottawa, and Mississauga prohibit scooter-style e-bikes from operating in protected bicycle lanes and multi-use pathways, but permit their operation in conventional bicycle lanes, under the rationale that it is more difficult for scooter-style e-bikes to safely pass slower moving bicycle users in width-restricted facilities but that they can more easily pull out into a motor vehicle lane to pass in a conventional bicycle lane scenario[4]. In the future, further consideration may be required regarding power-assist cargo tricycles and other similar vehicle types.

From a planning and design perspective, general improvements to cycling infrastructure, including the construction of a network of all ages and abilities cycling facilities, will improve safety for people on both standard bicycles and e-bicycles and further encourage the uptake of these modes among interested but concerned segment of the population.

Storage Guidelines

Building on the guidelines for end-point facilities outlined in **Chapter H.2**, secure and well-designed bicycle parking intended for conventional bicycles will also appeal to e-bike users. According to the Capital Regional District's *Local Government Electric*

Sylvia Green, 'Designing streets for a new kind of delivery vehicle', February 25, 2019, *http://spacing.ca/vancouver/2019/02/25/designing-streets-for-a-new-kind-of-delivery-vehicle/*

4 City of Toronto, Electric Bikes – Proposed Policies and By-laws, December 9, 2013.

Vehicle and Electric Bike Infrastructure Planning Guide[5], e-bike users consider the following three factors particularly important:

1. **Security**: Increase facility security to address theft concerns. E-bikes are more expensive than conventional bicycles, and as such, require secure facilities to prevent theft. General anti-theft measures can include ensuring all bicycle racks are of material and gauge that cannot be altered, ensuring racks are securely fastened, controlling access to bicycle rooms, and effective lighting. Additional security considerations can include the provision of individual bicycle lockers, locating bicycle parking along busy roads, and installing video surveillance (CCTV) and associated signage near bicycle parking areas.

5 Capital Regional District, *Capital Regional Local Government Electric Vehicle (EV) + Electric Bike (E-Bike) Infrastructure Planning Guide*, November 2018.

Power-assist cargo tricycle in Vancouver, B.C.

2. **Size**: Design larger bicycle parking spaces to accommodate e-bikes (which are often larger in size).
3. **Electrification**: Provide access to an electrical outlet to facilitate charging. Charging infrastructure can be incorporated directly into the bicycle rack itself, or e-bike parking may be located near (no more than 2 metres) a standard 110V wall receptacle. Attention should be given to ensure the placement of the charging receptacle will not result in a tripping hazard or impede bicycle operation.

Bicycle parking that is specifically designed for e-bike users will also benefit users of conventional bicycles. While long-term e-bike parking (and charging) can be accommodated in single detached and semi-detached dwellings that generally have access to external electrical sockets, specific provisions are required to ensure e-bike parking is provided in multi-unit dwellings and commercial developments. The recommended proportion of bicycle parking spaces in new multi-unit residential and commercial buildings that should meet e-bike design criteria is identified in **Chapter H.2**.

Electric Kick Scooters (E-Scooters) and Other Small, One Person Electric Vehicles

Electric kick scooters (e-scooters) are one of many new forms of mobility that have arrived in communities in North America over the past several years, alongside other small, one-person electric vehicles, including: hoverboards, motorized skateboards, self balancing electric unicycles, and pocket motorcycles. More of these low-powered electric devices are likely to appear in the future as further innovations in mobility occur. E-scooters are reviewed here as they have become increasingly common in U.S. cities as shared vehicles.

E-scooters are single occupant vehicles with an integrated battery that have a maximum speed of 24.9 km/h and have a range of approximately 30 kilometres. E-scooters are a relatively new form of transportation.

While non-motorized scooters have been around for decades, it is only recently that e-scooters have begun to show up in the market in any significant number. Similar devices have been around since the early 2000s when the segway was first introduced, but the costs were simply out of reach for most consumers, and their use was not widespread. In recent years, new technological development and a significant decrease in the price of batteries has made it affordable to produce and purchase a wide array of new mobility devices including e-scooters.

Shared e-scooters, Vienna, Austria
Source: Ivan Radic

Legality of E-Scooters and Other Small, One Person Electric Vehicles

At the time of writing, e-scooters (and similar small, one-person electric vehicles such as hoverboards, motorized skateboards, and self balancing electric unicycles) are not permitted on public roadways or sidewalks in B.C.[6] The *B.C. MVA* defines these vehicle types as motor vehicles, but they do not meet provincial equipment safety standards for on-street use. E-scooters and similar vehicle types may only be operated where the *B.C. MVA* does not apply, such as on private property that does not have public vehicle access, and on trails or pathways (if allowed by municipal bylaw).

Despite an unwelcoming policy climate, e-scooter share companies are entering Canada and have posted want ads in Calgary, Vancouver, and Toronto with the hope that the tide may be turning[7]. Many of the laws that ban e-scooters were developed under different mobility contexts. As demand for these technologies and others grow, the policies may need to be updated .

Safety Considerations and Operating Speeds

E-scooters have a reputation for being dangerous that is not unfounded. A study conducted by the City of Portland's Bureau of Transportation found that the injury rate for e-scooters appeared to be more than 40 times the rate for motorcycles, although injuries were usually minor and either did not require medical attention or required very little[8]. Helmets are a safety issue to consider with e-scooters. Many jurisdictions have chosen to encourage or require helmet usage in a similar way to bicycle helmets.

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6 'Motorized scooters and skateboards', Vehicle Registration, Insurance Corporation of British Columbia, accessed June 11, 2019, ***https://www.icbc.com/vehicle-registration/specialty-vehicles/Low-powered-vehicles/Pages/Motorized-scooters-and-skateboards.aspx***

7 Ryan Felton, 'E-Scooter Ride-Share Industry Leaves Injuries and Angered Cities in its Path', February 5, 2019, ***https://www.consumerreports.org/product-safety/e-scooter-ride-share-industry-leaves-injuries-and-angered-cities-in-its-path/***

8 Ibid.

Injuries and safety concerns also arise from e-scooters being used on sidewalks. Without proper policies in place for how e-scooters should be used, some users end up on sidewalks, which causes conflicts with pedestrians. E-scooters have a maximum speed of 24.9 km/h which is much faster than other sidewalk-bound modes, which can present a high risk for pedestrians, especially when approaching corners. The faster e-scooters can come upon other users quickly which can lead to people being pushed out of the way, tripping, or other injuries.

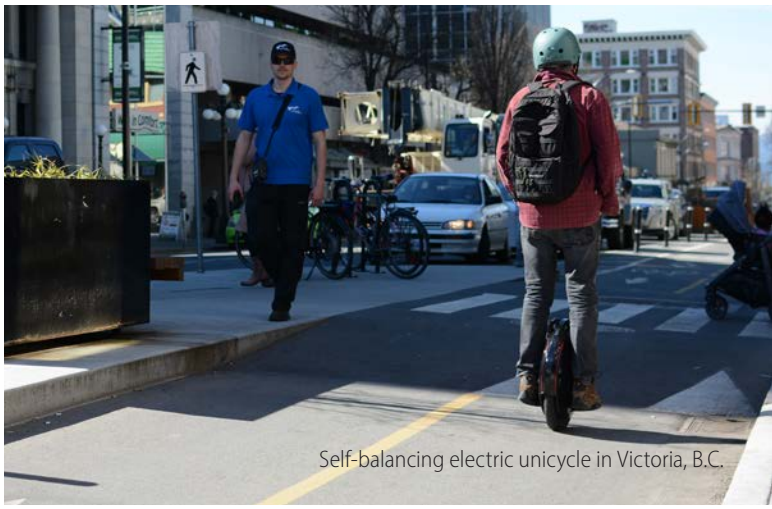
While e-scooters are both significantly narrower (40 – 45 centimetres) and lighter (12.5 kg) than conventional bicycles, they require a similar operating envelope. At maximum operating speeds of 24.9 km/h, e-scooters fall well within the bounds of typical cycling speeds and, as such, operation within designated cycling facilities is well suited. Some groups have begun to call for the re-branding of bicycle lanes as 'narrow lanes' or 'midspeed lanes' to be more inclusive of the range of small, one-person electric vehicle options now available[9].

Operating Guidelines

Under the *B.C. MVA*, e-scooter operation is not currently legal on roadways in B.C. E-scooters may be considered by local governments in non-street applications such as parks and post-secondary institutions, subject to local bylaws and regulations. Similar to e-bikes, e-scooters have the ability to satisfy an inexpensive need for personalized travel, extending the reach of conventional active transportation to a broader user group, and thereby providing affordable alternatives to automobile travel for many.

Storage Guidelines

E-scooters and other electrically powered small personal mobility devices require similar parking considerations as e-bikes – most notably security, infrastructure flexibility, and proximity to an electrical



Self-balancing electric unicycle in Victoria, B.C.

E-scooter in Victoria, B.C.

Man on hoverboard pushing a stroller in Mexico City, Mexico
Source: Paul Sableman

9 Angie Schmitt, 'Is it Time to Redefine the Bike Lane?', August 23, 2018, *https://usa.streetsblog.org/2018/08/23/is-it-time-to-redefine-the-bike-lane/*

outlet. E-scooters can be equipped with a variety of securing devices including cords and locks so they can be locked to traditional bicycle racks.

In multi-unit and commercial developments, long-term e-scooter parking can be accommodated in secure bicycle parking facilities. The recommended design criteria for e-bicycle parking in new multi-unit residential and commercial developments, which recommends that 50% of long-term and 10% of short-term bicycle parking spaces have access to electricity, supports the needs of e-scooters and other small personal mobility devices that require electric charge and secure storage including hoverboards, motorized skateboards, and self-balancing electric unicycles.

Parking guidelines for e-scooter share are addressed separately later in this chapter.

SMALL VEHICLE SHARING

Bike and E-Bike Sharing

Bike and e-bike sharing provides members with temporary access to a bicycle, through payment for short-term rental periods. Bike share systems are part of current trends in transportation towards shared mobility (including carshare and rideshare), and new mobility modes such as e-scooters, both of which are changing the way people are travelling. Bike share systems also make multi-modal transportation a more practical option, providing an important connection option for the first and last kilometre of trips.

Bike shares around the world each have their own blend of unique characteristics which range from a variety of ownership and operation models, user experiences, distribution, and integration with other modes and systems, among other factors. Bike share systems can make it more convenient and enjoyable for those that walk or use transit daily and can also provide an important service for tourists.

To create and plan for these systems, municipalities are working with various levels of government as well as community and corporate partners to ensure these new transportation options complement and support individuals with more mobility choices.

Modern bike share systems are generally operated as either docked or dockless systems:

- **Docked bike share systems** provide users with access to bicycles that are located throughout a sophisticated network of stations within a specified service area.
- **Dockless bike share systems** eliminate the need for docking stations by integrating GPS units and locking mechanism on bicycles, enabling bicycles to be parked anywhere within a designated service area.

A significant evolution in the bike share industry has occurred recently that has redefined the equation for municipalities. As recently as two years ago, bike share systems were most commonly funded in large part by municipalities who often coordinated (with or without the aid of non-profit agencies or corporate sponsors) the acquisition of stations and bicycles as well as the planning and operation of services. By contrast, many emerging bike and e-bike share systems are instead 100% funded and operated by private actors, with minimal to no cost to municipalities, shifting municipalities into the role of a partner and regulator as opposed to a service provider. Much of this recent shift has been the result of a technological evolution that has allowed for a transition away from the more space and cost intensive docked model to a dockless model, or a hybrid of the two. This evolution has also allowed for greater fleet diversity, with e-bikes and e-scooters now available for short-term rentals in some jurisdictions.

As a result of these changes to the industry, Canada has seen a growth in bike share systems from four systems in 2016 to almost 20 today. All but the original four systems are operating as private dockless (or hybrid) systems with little to no cost to the municipalities or universities they operate within. These shifts in the industry have created a significant opportunity for municipalities across the province to initiate bike and e-bike sharing programs, and the accompanied need

for guidance with regards to public parking for these new vehicles.

However, these rapid changes in bike share ownership and operation models over such a short period has resulted in some key lessons and cautionary experiences from other municipalities. The regulation of, and license agreements with, bike share operators are critical to maintaining order, accessibility, equity, and ensuring successful implementation of a system that best serves a community. This is critical to ensure the bike share contributes to the public interest and works in tandem with existing transportation networks and plans. It is also critical to ensure that the city benefit from user data that can be integral to planning and monitoring.

Docked or Station Based Model

Docked bike share systems provide users with access to bicycles that are located throughout a sophisticated network of stations within a specified service area. Typically to serve an effective network, there are dozens to hundreds of docking stations throughout the service network, with more stations being added to locations of high usage, and as system usage grows. Each station has a specific number of docks to secure the bicycles, enabling users to start and end their trip at any station where they find a bicycle or an open dock. A dense network of stations allows users to get closer to their true origin and destination, increasing convenience. From time to time, operators will rebalance bicycles to better distribute them throughout the network.

Docked bike share systems are built and integrated into the existing transportation network. They offer users dependability in knowing where to find bicycles, and are accessed using a membership card, fob, or credit card. Users can generally purchase annual or monthly memberships to the bike share and increasingly can opt to pay per trip. A significant amount of planning goes into the siting and allocation of space for stations, the selection of the number of docks and bicycles at each station, and the overall number of bicycles in a community. The purpose of this planning create

Docked bike share in Vancouver, B.C.

Docked e-bike share in Santa Cruz, California
Source: Paul Wasneski

a reliable network that integrates well with other transportation modes.

Technology in the docking station helps the bike share operator to know how many bicycles are located at each station, and which stations the bicycles travel to. This supports redistribution of the bicycles as well as further planning and expansion. Ownership models vary substantially ranging from publicly owned, non-profit with private contributions, to privately operated. The initial investment in the stations and bicycles is substantial, which can make expanding to accommodate growing demand a challenge. This access to capital is often a limiting factor in the growth model and has prompted a variety of funding partnerships including grants, and sponsorships

Dockless Model

Dockless bike sharing has rapidly emerged as a system type since 2015. Originating in China, the rapid expansion of dockless bike sharing was made possible due to the private ownership of these systems. Substantially more affordable to operate, technology has removed the need for expensive station-based infrastructure, and private operators can access capital to rapidly meet increased demand. Dockless systems offer the user convenience in the ability to generally start and end trips closer to their true destination, with the ability to leave the bicycle where desired. The bicycles are reserved, paid for, and accessed through a user's smart phone app, with users generally paying a per-trip fee based on time. GPS units on both the phone and bicycle provide a great deal of information that can be recorded regarding trip usage and travel patterns, as well as provide customers with a map of all the bicycles they can access nearby.

The convenience of being able to leave a bicycle at the user's true destination has, in certain circumstances, resulted in clutter of public spaces, users leaving bicycles blocking sidewalks, or locking the freestanding bike share bicycles to existing bike parking spaces, thereby reducing the parking for private bicycles. Local governments and private companies are working through unique approaches to deter this behaviour. Some examples include the addition of designated bicycle rack spaces, as well as geo-fenced areas which are programmed into the bike share operators' smart phone app (and often physically painted on the sidewalk) which limit where users can leave the bicycles at the end of their trip. A variety of fees and/or benefits have been implemented to ensure users are leaving the bicycles in these spaces.

Equity and accessibility have also been an evolving factor. Since users mainly access these bicycles by a smart phone app linked to their credit card, more accessible options are being developed to fully accommodate other users who may not have access to either. Municipalities are also requesting in agreements with service providers that they ensure bicycles are present otherwise located.

Dockless ownership models have evolved, growing from strictly private, to partnership options between non-profits focused on operations and membership services, and private companies focused on hardware and software. The system setup and operations of dockless systems are complex and vary in nature, which is why it is critical to enter into agreements and partnerships with a strong understanding of necessary by-laws, local policies, and contractual agreements that benefit both the municipality and the bike share operator.

Dockless bike share parking (Haven), University of British Columbia, B.C.
Source: Alex Taciuk

The attributes of docked and dockless bike share service models, as well as hybrid service models, are summarized in **Table H-46**.

E-Scooter Sharing

E-scooter sharing is a new form of shared mobility being introduced in cities across North America. Initiated by the private sector, e-scooter sharing platforms allow members to unlock e-scooters with their smart phones and use them for point-to-point transport, just like dockless bike and e-bike share systems. Like bike and e-bike sharing, e-scooter sharing can provide cost-effective options for last mile travel and more mobility options for areas poorly served by transit. E-scooters are now being provided for rent by a number of private companies in many U.S. cities. In these cities, e-scooters are generally parked on city sidewalks and are unlocked via a smart phone app. However, as noted above, the operation of e-scooters is not currently permitted within the public right-of-way in B.C. (or any other jurisdiction in Canada at the time of writing). The City of Waterloo initiated a 1-year pilot project for a small area near the University of Waterloo that is limited to private driveways, paths, and campus roads.

Table H-46 // Comparison of Bike Share Service Models

	DOCKED	DOCKLESS	HYBRID
Trip Start / End Locations	Station based – trips start and end at stations	Roaming – Trips start and end closer to their true origins and destinations. Trips can be completed through wheel locking or lock-to attachments in the bicycle which can lock the bicycle to adjacent infrastructure.	Systems that include a mix of both station-based and dockless elements. Users are encouraged to return bicycles to designated stations or hubs through a mixture of incentives and disincentives.
Locking Mechanism	Locks into docking station	Wheel lock or lock to system	Wheel lock or lock to systems
Location Monitoring Systems	Locates where bicycles are picked up and returned: Radio Frequency Identification Devices (RFIDs) Station occupancy rate monitoring through real-time General Packet Radio Service (GPRS)	GPS unit on bicycles and/or user cell phones	GPS unit on bicycles and/or user cell phones
Reservation/Booking System	Reservation made at station using membership card/fob/credit card	Reservation made by cell phone and charged to user credit card	Reservation made by cell phone and charged to user credit card

Small Shared Vehicle Parking

The proliferation of small shared vehicles has implications on parking and curbside management for municipalities beyond their sheer operation. The need for shared vehicle parking adds an additional competing interest to the public right-of-way, which already must accommodate motor vehicle and small vehicle travel, vehicle parking, pedestrian through movement, street furniture, and approaches to and from property.

Docked Bike Share

Docked bike share requires an intricate network of docking stations, typically located 200 to 400 metres apart. Docking stations can be located on public or private land, in parks and on road right-of-way. Typically, docking stations are located in plazas, on wide sidewalks, or in repurposed curbside motor vehicle parking zones.

Dockless Bike, E-Bike, and E-Scooter

Dockless bike, e-bike, and e-scooter share operates under the assumption that public space is available for parking small shared vehicles between uses. Small shared vehicle parking must compete for public right-of-way space with existing uses including space required for pedestrian travel, bicycle lanes, motor vehicle lanes, vehicle parking, building access and egress, and road amenities including street furniture, road trees, outdoor restaurant seating, etc. Ultimately, it is up to municipalities to allocate public space for new shared mobility services within the right-of-way and mitigate against negative externalities including piles of bicycles near popular destinations and bicycles blocking the pedestrian right-of-way.

The Institute for Transportation and Development Policy (ITDP) *Bike Share Planning Guide* provides guidelines to manage public space with the introduction of bike share services. These guidelines have been updated to reflect all shared small vehicle services and, alongside key specifications for designated parking areas, form the core recommendations in this section.

Case Study

E-Scooter Operation, Waterloo, ON

The only jurisdiction in Canada to permit e-scooter rentals is currently the City of Waterloo. The City worked with *Lime* to establish an e-scooter *pilot route* along the Laurel Trail connecting David Johnson Research and Technology Park through Waterloo Park. The city used a geofence – a virtual barrier – to try and keep riders inside that test area – to varying degrees of success. Scooters can only be operated on trails and private driveways in the Waterloo pilot and are not permitted on public roads, in accordance with the *Ontario Highway Traffic Act*. When on the sidewalks, docking stations should be located in the Furnishing Zone, and should not be placed in a location that obstructs pedestrians, building entrances, or existing street furniture. If docking stations are located within the curb-to-curb space, care must be taken to ensure docking stations do not obstruct existing cycling or motor vehicle through traffic.

To manage limited right-of-way space alongside the introduction of a new competing interest, municipalities should (at minimum) consider the following:

- **Fleet Size Caps:** Limit the number of bicycle or scooter operators can have on the road to ensure roads are not over-burdened by new vehicles. A balance needs to be struck between providing a sufficient fleet size to support efficient and effective shared services without overcrowding public space with infrequently used vehicles.
- **Require Timely Response to Parking Complaints:** Service agreements are structured to obligate operators to respond

in a timely manner to poorly parked vehicles (typically 2 hours).

- **User Education:** Operators should include key information about parking protocol on their website and mobile application and may be required to include this information on vehicles themselves.
- **Lock-to requirements:** Lock-to technology requires bikes and e-bikes to be locked to existing infrastructure (bicycle rack, signpost, etc.) for a user to end a ride. This has been shown to reduce instances of tipped-over bikes and bicycle blocking pedestrian rights-of-way, but it requires a robust network of bicycle racks and other infrastructure to function. Not all bike share (and zero scooter share) operators currently support this function.

Dockless Small Vehicle Parking Areas

Unlike docked bike share, where trips can only be ended at defined docking stations, dockless small vehicle sharing technically permits users to end their trips anywhere within a defined service area. This can include on sidewalks, roadways, parks, private property, and building approaches. To ensure small vehicle parking occurs where it is best suited and does not infringe upon other roadway users, the following guidelines should be considered:

- In areas of high demand or where competition for scarce sidewalk space is high, designated shared small vehicle parking zones should be established. In these areas, geo-fencing, or the establishment of virtual perimeters for real-world geographic areas, should be considered to restrict the ability to end a trip outside of a designated zone. Municipalities should be mindful to not over-regulate small vehicle parking areas. While blanket parking restrictions (with accompanying designated shared small vehicle parking zones) will improve the use of designated zones and reduce vehicle clutter, they also reduce the ability of these systems to provide true point-to-point connectivity, reducing their convenience.
- Designated small vehicle parking zones should be sited and installed by the municipality for use by all dockless services (shared bike, e-bike, e-scooter). Establishing mode and company agnostic designated zones allows for a more efficient utilization of scare sidewalk space, provides choice in service provider (and potentially mode) for shared small vehicle service users, improves vehicle availability, and promotes the conscious establishment of network infrastructure. Municipal staff will need to work with operators to ensure the GPS technology on their small vehicles is accurate enough to recognize vehicles parked within the designated areas as complying, and that parking areas are clearly defined across all real-time service maps. Parking area costs can be offset through operator fees.
- Designated small vehicle parking zones should be clearly and consistently signed or marked on the pavement, as depicted in **Figure H-150**.
- Designated small vehicle parking zones should have good visibility to small shared vehicle users, pedestrians, and other roadway users, including motor vehicles.
- Municipalities requiring bicycle share vehicles be locked-to infrastructure should ensure adequate provision of bike racks in designated small vehicle parking bicycle zones or work with operators to override lock-to requirements for designated zones.
- As an option, highly utilized designated small vehicle parking zones could be monitored by CCTV and could include power supply for charging electrically powered small vehicles.
- Where required, designated zones should be located in one of the following areas:

- *On private property (subject to negotiation with the property owner);*
- *On wide sidewalks (minimum width 2 metres) outside the Traffic Zone and Frontage Zone. Designated small vehicle parking zones should not block access to benches or other existing street furniture (excluding lamps) and should not block parking metres. In some contexts, where sufficient width exists, designated parking zones may also be installed in the Frontage Zone and on private property adjacent to building entrances, as long building entrances are not impeded;*
- *In plazas, and wider pathways in unobtrusive areas;*
- *On raised curb extensions / bulb-outs;*
- *In repurposed on-street curbside parking spaces. Distinct colour or shading could be used to clearly differentiate designated small vehicle parking zones from adjacent motor vehicle parking; consideration could be given to protecting and demarcating these zones*
- Outside of restricted parking areas, shared vehicle parking could be permitted in the public right-of-way, under the following conditions:
  - *Shared vehicles may park on public sidewalks that are wider than 2 metres providing that a 2 metre wide Traffic Zone is maintained for sidewalk users. Shared vehicles may not park on sidewalks less than 2 metres wide.*

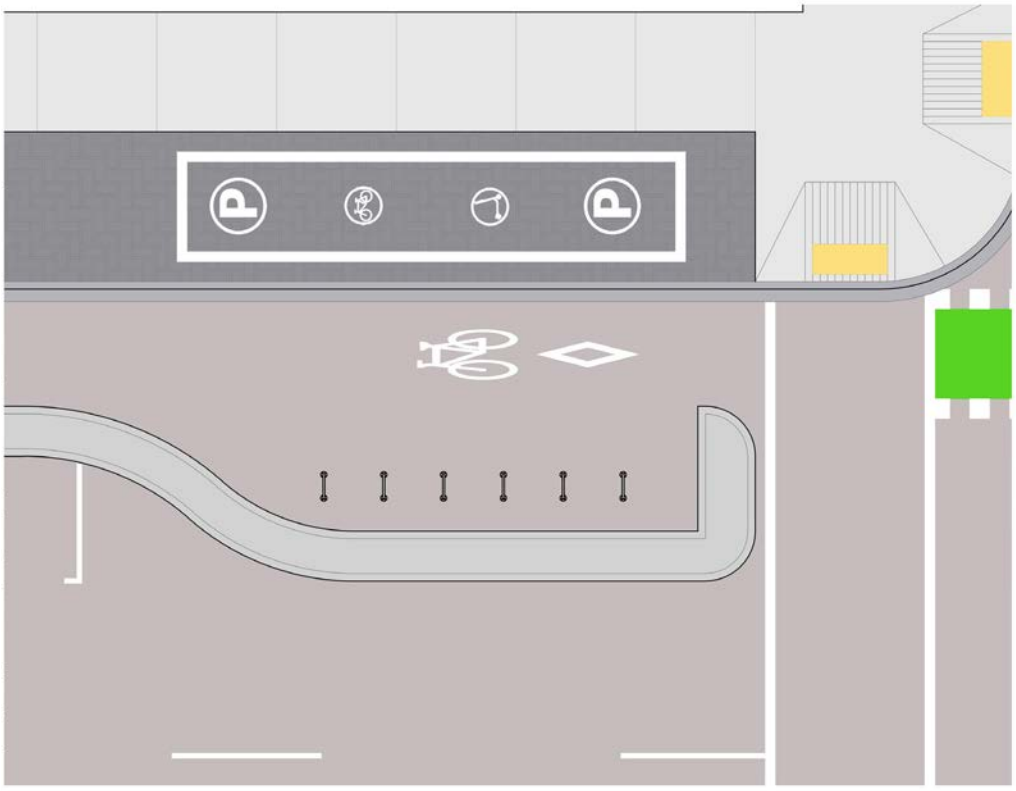


Figure H-150 // Small Shared Vehicle Parking Zone (Demarcated by Pavement Markings)

- *Shared vehicles should park in the Furnishing Zone and must not park in a way that obstructs the Traffic Zone, Frontage Zone, or property access. Shared vehicles must not block curb let-downs, driveways, or street furniture.*
- *Shared vehicles may park on-street in residential areas, wherever a motor vehicle may be legally parked. Shared small vehicles must be parked in a way that does not obstruct motor vehicle passage.*

- Municipalities may or may not permit shared vehicle parking in public parks. Permitting small vehicle parking in parks can increase access to parks but may also encourage the operation of small vehicles on internal park pathways.

Dockless bicycle and e-scooter parking
Source: Austin Transportation