



Cycling Network and Greenway Plan

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SUMMARY

This document presents a Cycling Network and Greenway Plan for the District of West Vancouver. The plan is based on a network of bicycle routes, of which the key feature is the Spirit Trail greenway between Horseshoe Bay and the Lions Gate Bridge. The greenway is the “spine” of the cycling network, which incorporates a combination of on-street routes and pathways radiating out from the greenway, and connecting all major destinations and all neighbourhoods within the District. The greenway and cycling network also provide connections to North Vancouver and across the Lions Gate Bridge, and connections to regional transit services.

In addition to the network of bicycle routes, the Cycling Network and Greenway Plan identifies supporting awareness, encouragement and education programs, a staged implementation strategy, a funding strategy and cost estimates, and guidelines for designing, constructing and maintaining bicycle facilities.

Several community consultation activities were undertaken in developing the plan, including three public workshops, a public open house, and a meeting with representatives of Canadian National Railway. The intent of these consultation activities was to ensure that the Cycling Network and Greenway Plan reflects the needs and desires of cyclists and others in West Vancouver.

Goals

The two key goals of the Cycling Network and Greenway Plan are:

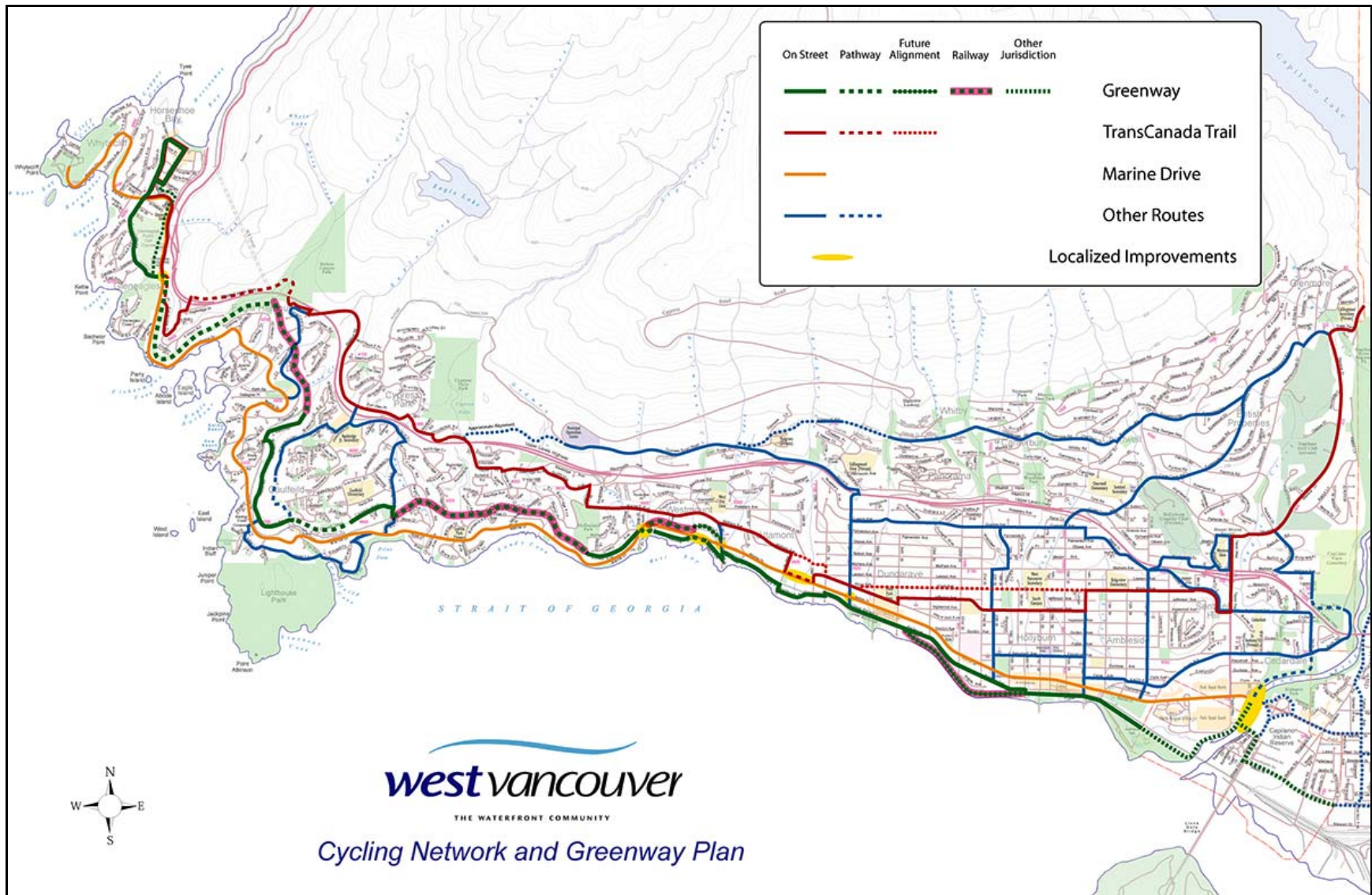
- **Increase bicycle and walking trips.** The primary goal of the Cycling Network and Greenway Plan is to increase bicycle use and walking in West Vancouver. Developing the Spirit Trail greenway and more bicycle routes will increase the number of bicycle and walking trips, and will increase the share of all vehicle trips made by bicycle and on foot.
- **Improve safety** for cyclists and greenway users. A significant deterrent to cycling is “fear of traffic.” Improving safety by improving the design of bicycle facilities will not only help to minimize conflicts between cyclists and other road users and reduce injuries, but will also reduce the fear of traffic for many cyclists and potential cyclists, increasing the number of bicycle trips.

The Cycling Network and Greenway Plan

The Cycling Network and Greenway Plan is illustrated on the accompanying map, which is reproduced in Figure S.1 on the following page. The plan incorporates:

- The Spirit Trail greenway, which will be the “spine” of the network. The greenway will provide a continuous, relatively flat connection between Horseshoe Bay and the Lions Gate Bridge and North Vancouver, using traffic-free pathways and low-traffic roads, examples of which are illustrated in Figure S.2.

Figure S.1 — Cycling Network and Greenway Plan



- On-street bicycle routes radiating out from the greenway to provide connections to other areas in the District. This network of routes will follow residential streets, collector and arterial roads, and new and improved pathways. It includes the existing TransCanada Trail, as well as Marine Drive. On-street routes will be improved over time through road network upgrades as well plans for new areas. As well, bicycle facility design guidelines will be incorporated into the municipality’s road design standards to ensure that cyclists are accommodated on new roads.

Figure S.2 — Greenway Examples



Priority Improvements

It will take the District many years to implement all of the bicycle routes identified in the Cycling Network and Greenway Plan. Consequently, the recommended approach to implementing the plan focuses on implementing several priority improvements in the short-term. These priority improvements are those which provide the greatest “return on investment” in terms of achieving the goals of the plan — to improve safety and encourage more cycling and walking. The priority improvements include the Spirit Trail greenway and several localized improvements, as described below.

The Spirit Trail greenway has broad appeal. Because it will be off-street away from traffic or on-street on low-volume roads, it will be an attractive facility for many cyclists and potential cyclists, as well as pedestrians, in-line skaters and others. At stakeholder workshops conducted during preparation of the Cycling Network and Greenway Plan, the greenway was the most-requested bicycle route. In recognition of its broad appeal and strong support within the community, the Spirit Trail greenway is identified as the highest priority for implementation.

Usage of the Spirit Trail greenway will be higher at the eastern end of the greenway, in Ambleside and Dundarave. This is because there is a greater population in the eastern part of the District (as well as in North Vancouver), and there are more locations to access the greenway.

For this reason, and because the costs of implementing the greenway will be lower in the eastern end than to the west where the terrain is more challenging, development of the greenway should begin in the eastern end, to provide the greatest “return on investment.”

Costs

Cost estimates for all priority improvements are summarized in Table S.1. These estimates are based on costs for recent construction projects in the Greater Vancouver region, and incorporate a contingency of up to 30%. District staff preparing budgets and project estimates can use these costs to provide order-of-magnitude cost estimates. More accurate cost estimates can later be developed based on engineering designs and recent bids.

Table S.1 — Capital Cost Estimates for Priority Improvements (2007 dollars)

Improvement		Estimated Cost
Spirit Trail Greenway	Park Royal to 31 st Street	\$2.0 million
	31 st Street to Piccadilly North	\$2.4 million
	Piccadilly North to BCR Tunnel	\$1.8 million
	BCR Tunnel to Horseshoe Bay	\$2.2 million
	<i>Subtotal</i>	<i>\$8.4 million</i>
Localized Improvements	Marine Dr., 28 th St. – 29 th St., pathway	\$400,000
	Marine Dr. @ 26 th St., crossing and ramp	\$200,000
	Marine Dr. @ Orhill Rd., pathway and crossing	\$200,000
	Other localized improvements	\$800,000
	<i>Subtotal</i>	<i>\$1.6 million</i>
Total		\$10 million
<i>Note: Cost estimates exclude property, utility relocation and environmental mitigation costs</i>		

Funding

The District’s share of the costs identified above would amount to a total of as much as \$5 million. The District’s funds could be supplemented with funding from other sources, including:

- TransLink — “major road network” (MRN) funding and Bicycle Infrastructure Capital Cost Sharing Program (BICCS) funding.
- Provincial programs, including the Cycling Infrastructure Partnerships Program (CIPP), LocalMotion, and other programs.
- Federal programs such as Infrastructure Canada programs which provide funding for environmental and local transportation infrastructure projects.
- The Federation of Canadian Municipalities’ Green Municipal Fund.
- ICBC’s Road Safety Program and Safer City Program.
- Developers and other private sector corporations.
- Contributions from the public, such as deeds, donations and dedications.

1. INTRODUCTION

This document presents Cycling Network and Greenway Plan for the District of West Vancouver.

The plan is based on a network of bicycle routes, of which the key feature is the Spirit Trail greenway between Horseshoe Bay and the Lions Gate Bridge. The greenway is the “spine” of the cycling network, which incorporates a combination of on-street routes and pathways radiating out from the greenway, and connecting all major destinations and all neighbourhoods within the District. The greenway and cycling network also provide connections to North Vancouver and across the Lions gate Bridge, and connections to regional transit services.

In addition to the network of bicycle routes, the Cycling Network and Greenway Plan identifies supporting awareness and education programs, an implementation strategy, a funding strategy and cost estimates, and guidelines for designing, constructing and maintaining bicycle facilities.

1.1. Goals

This section describes the goals which it is intended that the Cycling Network and Greenway Plan achieve, as well as several supporting objectives.

The two goals of the plan are:

- **Increase bicycle and walking trips.** The primary goal of the Cycling Network and Greenway Plan is to increase bicycle use and walking in West Vancouver. Developing more bicycle routes and facilities — combined with awareness and education activities — will increase the number of bicycle trips and increase the share of all vehicle trips made by bicycle. Developing the Spirit Trail greenway through the District will also increase the number of walking trips and other non-motorized trips.
- **Improve safety** for cyclists and greenway users. A significant deterrent to cycling is “fear of traffic.” Improving safety by improving the design of bicycle facilities will not only help to minimize conflicts between cyclists and other road users and reduce injuries, but will also reduce the fear of traffic for many cyclists and potential cyclists, increasing the number of bicycle trips.

Specific objectives in support of the goals of the Cycling Network and Greenway Plan to increase bicycle use and improve safety include:

- Identify improvements to existing routes.
- Identify new routes and connections to add to the cycling network.
- Determine priorities for implementation.
- Prepare order of magnitude cost estimates for priority improvements.
- Develop design guidelines to address a wide range of circumstances, including “interim” conditions for on-street facilities, off-street pathways, crossings, signage, pavement markings.

1.2. Principles

The Cycling Network and Greenway Plan is based on several fundamental principles of bicycle and pedestrian planning, as described below. These principles are based on experience in communities in British Columbia and across North America, and are consistent with current planning practices.

- **The cycling network should accommodate all cyclists.** This means cyclists of all skill levels, riding for all purposes. This includes children and adults, novice and experienced cyclists. It includes cyclists commuting to work and school, cyclists riding to the store or a medical appointment, for example, and recreational cyclists, including mountain bikers riding to trails.
- **The cycling network should incorporate different types of bicycle facilities.** Skill levels, physical capabilities, trip purposes and needs vary widely among cyclists, and consequently different cyclists require or are attracted to different types of bicycle facilities. An experienced commuter cyclist may be comfortable riding along a high-volume arterial road such as Marine Drive, and may prefer to ride along such a road in order to minimize travel times. On the other hand, a less experienced cyclist new to cycling may not feel comfortable riding along major roads, and may prefer the greenway, other pathways and local streets. To accommodate all types of cyclists, a range of different types of bicycle facilities are needed.
- **Cyclists should be accommodated on roadways wherever possible.** This means that unless it is extremely difficult to do so, space should ultimately be provided for cyclists on all arterial and collector roads. This approach recognizes that cyclists fare best when they are treated as vehicles and integrated with other vehicle traffic. Studies of crashes and safety issues indicate that cyclists are generally safer riding on roadways than on pathways. The reason for this is that cyclists share pathways with pedestrians and many other types of users, which can increase the potential for conflicts and crashes. In addition to safety considerations, travel times for cyclists are usually minimized when cyclists travel on roadways.
- **Off-street pathways should complement — not replace — on-street bicycle facilities.** Because the potential for conflicts and crashes is higher on a pathway, and because pathways do not serve all destinations to which cyclists wish to travel, many cyclists will end up riding on the roadway, either by choice or by necessity. Constructing pathways as an alternative to on-street bicycle facilities means that in many cases there would be no space for cyclists and motorists to safely share the roadway, and as a result, the safety of cyclists would be compromised. Instead, pathways should be provided as a complement to on-street bicycle facilities, thereby ensuring that facilities are provided for all cyclists.
- **Crossing treatments are essential.** Crossings where bicycle routes along local streets and pathways intersect arterial and collector roadways are where the majority of crashes — and the most severe crashes — occur. To maximize safety for cyclists, and to avoid creating

barriers to cycling within the bicycle network, a range of crossing treatments should be used at arterial and collector road crossings.

- **The cycling network should serve all important destinations.** Just as the road network provides access to commercial, office, institutional, cultural and recreational destinations throughout the District, so should the bicycle network.
- **The “quality” of the cycling experience is important.** The “quality” of the cycling experience is determined by perceptions of safety, traffic volumes, noise and aesthetics. Although providing a direct route and avoiding steep grades are important, some cyclists will prefer a longer route or one with steeper grades if it is perceived as significantly safer, has lower traffic volumes, and provides a more enjoyable cycling experience.
- **The greenway and other pathways should accommodate all possible users.** This means, for example, that grades on the Spirit Trail greenway and other pathways should not be so steep as to prevent use by persons in wheelchairs. Similarly, pathway surfaces should not be so uneven as to prevent use by in-line skaters. Pathways should be planned and designed to accommodate all forms of non-motorized transportation.

1.3. Consultation

Several community consultation activities were undertaken during the development of the Cycling Network and Greenway Plan. Input was solicited from cyclists, residents, decision-makers and other stakeholders regarding issues affecting cycling in West Vancouver, opportunities for new and improved bicycle routes and facilities, priorities for implementation, and ways to fund improvements. The intent of these consultation activities was to ensure that the Cycling Network and Greenway Plan reflects the needs and desires of cyclists and others in West Vancouver.

Consultation activities included:

- **Two stakeholder workshops** were held on December 7 and 12, 2006. The first workshop was held at municipal hall, and the second was held at Glen Eagles Community Centre. Cyclists, residents and other stakeholders were invited to attend whichever workshop was more convenient in terms of date and location. Approximately 20 persons attended the two workshops. Each workshop began with a presentation regarding the purpose and scope of the Cycling Network and Greenway Plan, followed by a working session in which participants identified issues affecting cycling and opportunities to improve the cycling network.
- **A workshop with Council** was held on February 7, 2007. The purpose of the workshop was to describe the goals of the Cycling Network and Greenway Plan, and highlight the features of the resulting plan, particularly the Spirit Trail greenway.

- **A stakeholder workshop** was held on February 7, 2007. Stakeholders who had attended the workshops in December were invited to this workshop, which focused on the elements of the proposed Cycling Network and Greenway Plan, and the approach to implementing the plan. Approximately 12 persons attended this workshop.
- **An open house** was held on February 28, 2007, at the Seniors' Activity Centre. Several display boards described the purpose and scope of the Cycling Network and Greenway Plan. A questionnaire was used to solicit feedback from attendees. Over 40 persons attended the open house, and twelve written responses were received.
- **A meeting with CNR representatives** was held on April 5, 2007, together with representatives from the City and District of North Vancouver and the Squamish Nation. The purpose of the meeting was to discuss proposals for the Spirit Trail greenway across the North Shore. CNR representatives indicated support for the greenway and a willingness to work with District staff to implement sections of the greenway within the railway right-of-way through West Vancouver.

2. ELEMENTS OF THE PLAN

This section describes the elements of the Cycling Network and Greenway Plan, which is illustrated in Figure 2.1 and on the attached map. The elements of the plan include:

- The Spirit Trail greenway (illustrated in Figure 2.1 and on the attached map in green).
- The existing TransCanada Trail (illustrated in Figure 2.1 and on the map in red).
- On-street bicycle routes, including enhanced crossings and pathway connections (illustrated in blue in Figure 2.1 and on the map).
- Connections to the Lions Gate Bridge, and bicycle routes in North Vancouver and the Squamish Nation.

In addition to these routes, cyclists are permitted to use the Upper Levels Highway and Sea-to-Sky Highway through West Vancouver. These highways are not indicated on Figure 2.1 as they are the jurisdiction of the Ministry of Transportation, and consequently are beyond the scope of the Cycling Network and Greenway Plan.

2.1. Spirit Trail Greenway

The Spirit Trail greenway will be the “spine” of the West Vancouver cycling and pedestrian network. It will provide a low-level, relatively flat connection from Horseshoe Bay to the Lions Gate Bridge and North Vancouver. It will link commercial areas, community centres, parks, schools and many other destinations. Bicycle routes will radiate out from the greenway to provide connections to other areas in West Vancouver.

Another important feature of the Spirit Trail greenway is that many sections will be off-street and traffic-free, and other sections will follow low-traffic residential streets and roads paralleling Marine Drive. Figure 2.2 provides an example of what an off-street pathway section of the greenway might look like.

Some off-street sections of the Spirit Trail greenway will be located within the railway right-of-way, adjacent the railway tracks. This will be necessary in areas where it is not possible to provide a continuous route via residential streets and roads parallel to Marine Drive. The greenway would be separated from the railway tracks by a fence or other barrier, as illustrated in Figure 2.3.

The Spirit Trail greenway will cross numerous creeks. Although some creek crossings can be accomplished on existing residential streets and other roads, several will require new pedestrian-bicycle bridges, such as the example shown in Figure 2.4.

Figure 2.1 — Cycling Network and Greenway Plan

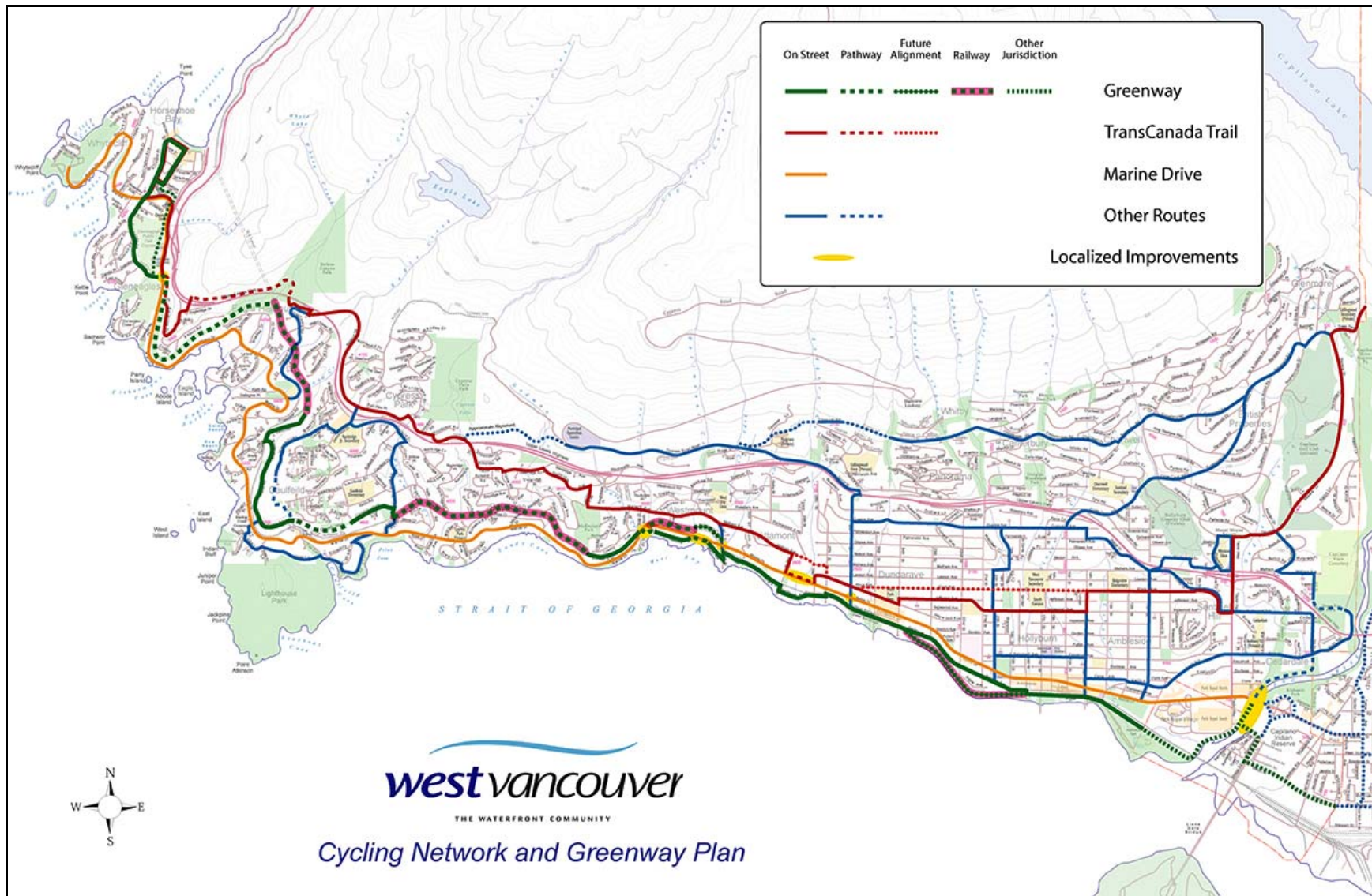


Figure 2.2 — Greenway



Figure 2.3 — Pathway Adjacent an Active Railway



From east to west, the Spirit Trail greenway alignment will incorporate the following:

- Welch Street and Bridge Road, providing a connection between the Capilano River and the District of North Vancouver's bicycle route along First Avenue. Although they pass through the Squamish Nation, Welch Street and Bridge Road are currently the jurisdiction of the District of West Vancouver. It should be noted that this alignment will likely change as the Squamish Nation proceeds with development of their lands.

Figure 2.4 — Bridge on Pathway



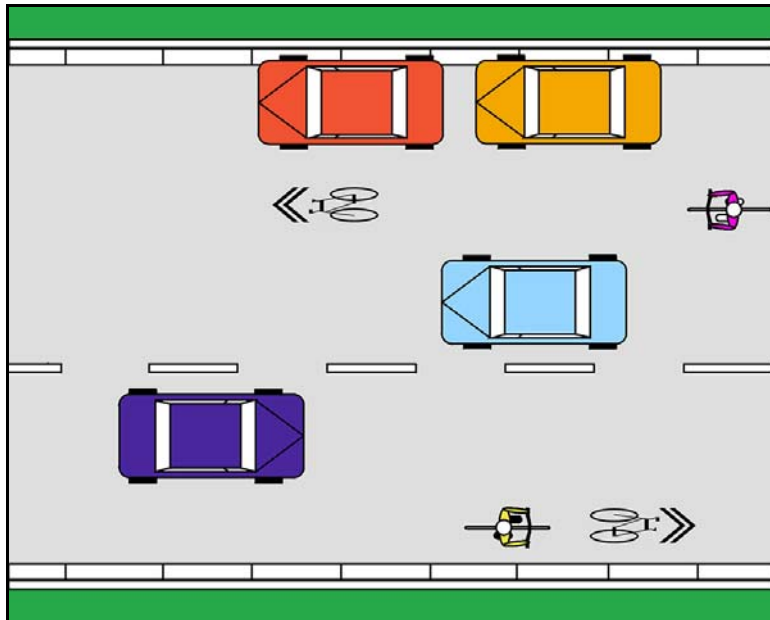
- The existing pathway through Ambleside Park. Optionally, the greenway could follow a new pathway connection along the south side of Park Royal, connecting to Ambleside Park to the west.
- The network of parallel roads to the south of Marine Drive, between Ambleside and West Bay. Optionally, the greenway would follow a new pathway along the north side of the railway tracks between 18th and 24th Streets, within the railway right-of-way.
- At Oxley Street, the greenway would cross Marine Drive. Between Sunset Avenue and Picadilly North, the greenway would follow a new pathway located within the railway right-of-way, as there is no continuous low-level connection through the Bayridge area other than Marine Drive.
- Through the Caulfield area west of Piccadilly North, the greenway would follow Clovelly Walk (including an improved pathway) and Keith Road.
- Above Eagle Harbour, the greenway would follow a new pathway located within the railway right-of-way between Keith Park and the railway tunnel at Nelson Creek.
- From the railway tunnel to Orchill Road, the greenway would follow an improved pathway along the old BC Rail alignment, which is now a public right-of-way.
- Initially, the greenway would continue to Horseshoe Bay along Orchill Road and Nelson Avenue. The longer-term alignment would follow a new and improved pathway along the eastern edge of the Gleneagles golf course and Gleneagles Elementary school, and through Tantalus Park to Royal Avenue.

2.2. On-Street Bicycle Routes

As described in Section 2.1, the Spirit Trail greenway will be the “spine” of the cycling network, providing a continuous route across West Vancouver. A network of on-street bicycle routes will radiate out from the greenway, to provide connections to other areas of the District.

These bicycle routes follow residential streets, and collector and arterial roads. Different types of bicycle facilities would be implemented on these roads, depending on traffic volumes and available road widths and right-of-way widths. In some cases it would be appropriate to and would be possible to implement bicycle lanes or marked wide travel lanes (which are illustrated in Figure 2.5). In many cases, however, the steep terrain and constrained rights-of-way would preclude widening the road to provide additional space for cyclists. In these situations, cyclist and motorists would share the road space, and it would therefore be desirable in key locations to post advisory “share the road” signs, as illustrated in Figure 2.6.

Figure 2.5 — Marked Wide Travel Lanes



On-street routes will be improved over time through road network upgrades as well plans for new areas. As well, bicycle facility design guidelines will be incorporated into the municipality’s road design standards to ensure that cyclists are accommodated on new roads.

Figure 2.6 — Share the Road Sign



Notable bicycle routes include:

- The TransCanada Trail between Horseshoe Bay and Cleveland Dam. This is the only existing designated bicycle route in the District. The only change to this route would be to “straighten” the alignment by continuing along Kings Avenue between 14th and 26th Streets. This would involve a pathway connection through the West Vancouver Secondary School property, and would make use of an existing bridge over McDonald Creek. Options for crossing Rodgers Creek are discussed in detail in Section 3.2.
- Marine Drive is identified as a bicycle route between the Capilano River and Horseshoe Bay. Marine Drive is used by many cyclists, as it is a popular recreational cycling route, as well as the only predominantly flat route through some areas. However, along much of Marine Drive there is no additional road space for cyclists. In many sections, widening Marine Drive to implement bicycle lanes or marked wide travel lanes would be quite costly, particularly in the narrow sections where widening would be most beneficial.

2.3. Crossings

At some point, most on-street bicycle routes and off-street greenways and pathways must cross major roads such as Marine Drive. At these locations, special crossing treatments are usually required, as described below.

- *Marked crossings* are used on lower-volume roadways, where there is a need to identify the crossing to motorists. Crosswalk signage and pavement markings can be supplemented with enhancements such as overhead internally-illuminated signs, which also shine light onto the crossing area. Marked crossings on collector roads and local streets can also be enhanced with raised crossing, as illustrated in Figure 2.7.

Figure 2.7 — Raised Pathway Crossing



- *Signalized crossings* are used where the number of persons crossing the roadway is higher, and where traffic volumes and speeds are higher. Signalized crossings can be configured as a pedestrian signal, or with flashing amber lights. Signals can be activated by pushbuttons (as illustrated in Figure 2.8), by detectors embedded in the roadway, or with “high tech” means such as microwave or video detection.
- *Grade-separated crossings* — overpasses and underpasses — are expensive, and consequently are used only where there is a high volume of high-speed motor vehicle traffic, with no opportunity for a signalized at-grade crossing. The only locations in West Vancouver where grade-separated crossings are required is across the Upper Levels Highway. The Cycling Network and Greenway Plan makes use of existing overpasses and underpasses on the Upper Levels Highway.

Figure 2.8 — Cyclist Pushbutton at Signal



3. IMPLEMENTATION

This section describes a recommended approach to implementing the Cycling Network and Greenway Plan. This approach recognizes that it will take the District many years to implement all of the bicycle routes identified in the plan, and consequently the approach focuses on implementing several priority improvements in the short-term. These priority improvements are those which provide the greatest “return on investment” in terms of achieving the goals of the Cycling Network and Greenway Plan — to improve safety and encourage more cycling and walking. The priority improvements include the Spirit Trail greenway and several localized improvements, as described below.

3.1. Spirit Trail Greenway

The Spirit Trail greenway has broad appeal. Because it will be off-street away from traffic or on-street on low-volume roads, it will be an attractive facility for many cyclists and potential cyclists, as well as pedestrians, in-line skaters and others. At stakeholder workshops conducted during preparation of the Cycling Network and Greenway Plan, the greenway was the most-requested bicycle route. In recognition of its broad appeal and strong support within the community, the Spirit Trail greenway is the highest priority for implementation.

- **First priority.** Usage of the Spirit Trail greenway will be higher at the eastern end of the greenway, in Ambleside and Dundarave. This is because there is a greater population in the eastern part of the District (as well as in North Vancouver), and there are more locations to access the greenway. For this reason, and because the costs of implementing the greenway will be lower in the eastern end than to the west where the terrain is more challenging, development of the greenway should begin in the eastern end, to provide the greatest “return on investment.”

Through Ambleside and Dundarave, in the interim the Spirit Trail greenway will follow Bellevue Avenue and the pathway through Ambleside Park. The long-term objective is to construct a pathway within the railway right-of-way between 18th Street and 24th Street, on the north side of the railway tracks.

- **Second priority.** The section of the Spirit Trail greenway between Horseshoe Bay and Eagleridge Drive is also part of the TransCanada Trail. For this reason, this section is identified as the second priority for development of the greenway. This includes an improved pathway connection and crossing enhancement at Orchill Road, as described in Section 3.2.
- **Third priority.** Between West Bay and Eagle Harbour, three sections of the greenway are proposed within the railway right-of-way, where there are no options to use residential streets or public rights-of-way. One section extends from the west end of Dickinson Crescent to Oxley Street. A second section extends from the west end of Sunset Avenue at McKechnie Park to Picadilly North and includes three creek crossings. The third section extends from Keith Road at Keith Park to the rail tunnel at Nelson Creek, and also includes three creek

crossings. Development of these sections of the greenway could be costly and time-consuming, and are therefore a lower priority.

3.2. Localized Improvements

In addition to the Spirit Trail greenway, a number of localized improvements have been identified as priority improvements. Each of these localized improvements is limited to a small area — an intersection or a short section of a bicycle route. What makes each of these improvements important is that they overcome gaps in the cycling network, which would otherwise make it difficult for cyclists to use bicycle routes, and create safety concerns for cyclists due to a lack of bicycle facilities in the gaps.

3.2.1. Marine Drive at 26th Street

26th Street is an important proposed bicycle route, as it provides a connection between the Spirit Trail greenway, the TransCanada Trail and bicycle routes above the Upper Levels Highway. Because 26th Street is a residential street with relatively low traffic volumes, no specific bicycle facility improvements are required along 26th Street — except at Marine Drive, where a crossing treatment is required to assist cyclists in crossing Marine Drive.

Options for crossing treatments at the Marine Drive/26th Street intersection include a flashing crossing and a pedestrian signal. A flashing crossing treatment incorporates amber flashing lights at the side of the road (and optionally overhead) to alert motorists to the presence of cyclists and pedestrians crossing the road. A pedestrian signal incorporates traffic signals which display a red indication to approaching motorists, requiring them to stop. Both treatments are activated by cyclists and pedestrians.

In addition a flashing crossing or pedestrian signal, a ramp with a desirable maximum grade of 5% is required on the north side of Marine Drive to provide a connection up to 26th Street.

3.2.2. Marine Drive between 28th and 29th Streets

The existing TransCanada Trail follows an on-street route between Horseshoe Bay and the Cleveland Dam. Much of the route is along residential streets with relatively low traffic volumes. One short section is along Marine Drive, however, where traffic volumes and speeds are significantly higher than on other parts of the route. The reason that the TransCanada Trail is on Marine Drive is that it is the only at-grade crossing of Rodgers Creek between 28th and 29th Avenues. This section of the TransCanada Trail creates an obstacle for cyclists who might not be comfortable riding on Marine Drive, particularly for cyclists travelling eastbound who would have to cross Marine Drive twice.

A long-term option to provide a connection across Rodgers Creek would be to construct a pedestrian/bicycle bridge over the creek, within the Mathers Avenue right-of-way, as illustrated in Figure 3.1. Such a bridge would be costly, however, and might not even be feasible due to the steep grades on either side of the creek.

Figure 3.1 — Connections Across Rodgers Creek between 28th and 29th Avenues



A less expensive option which does not have any significant feasibility issues is to construct a pathway along the north side of Marine Drive, between 28th and 29th Avenues, to accommodate cyclists travelling both eastbound and westbound. As illustrated in Figure 3.1, this pathway could be constructed entirely within the existing road right-of-way, avoiding any property impacts or costs. The pathway would be at least 3 m wide, and would be separated from Marine Drive by a “buffer zone” 1 m wide. An example of a similar pathway adjacent a major road is illustrated in Figure 3.2.

Figure 3.2 — Pathway Adjacent Road

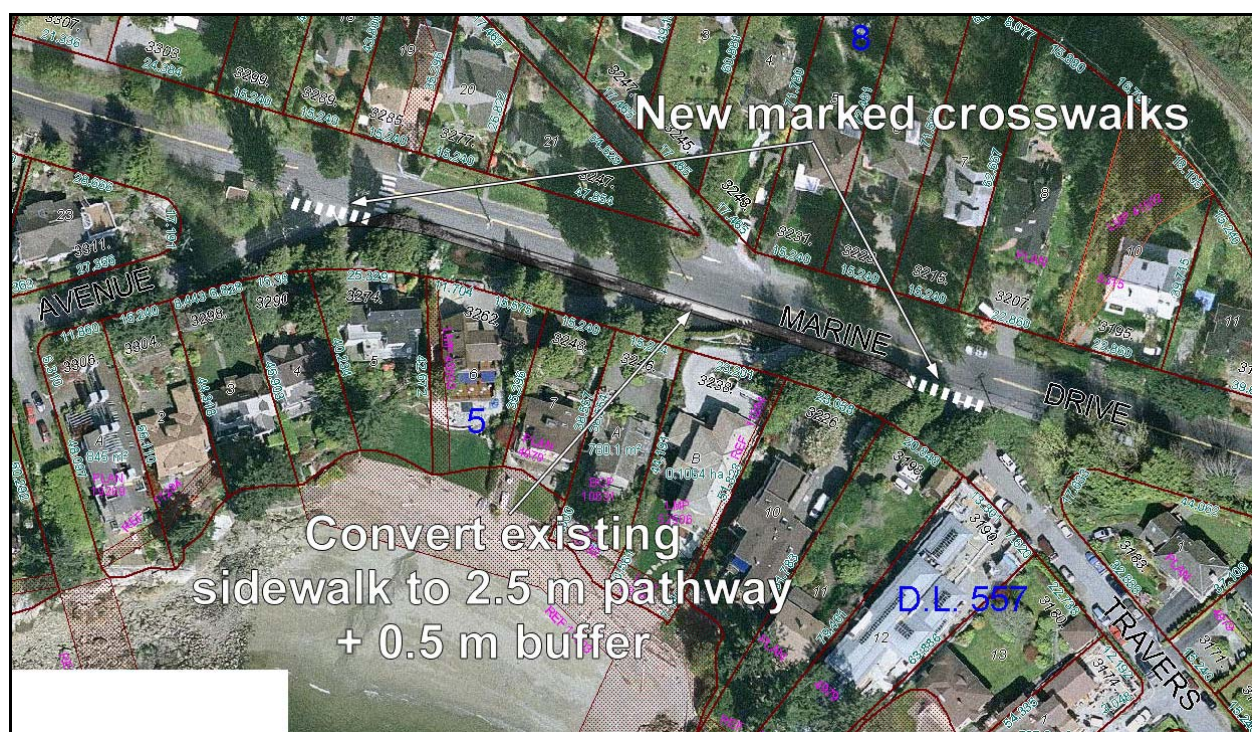


3.2.3. Marine Drive between Travers and Radcliffe Avenues

Between Oxley Street and 31st Street, there are two options for the alignment of the greenway, one which involves the use of the railway right-of-way. The other option follows residential streets south of Marine Drive. In two locations, however, there are gaps in the network of residential streets. The first gap is between Travers and Radcliffe Avenues, where the only low-level road connection is along Marine Drive.

To connect the Spirit Trail greenway through this section, a pathway could be constructed along the south side of Marine Drive, between Travers and Radcliffe Avenues, to accommodate cyclists and other greenway users travelling both eastbound and westbound. As illustrated in Figure 3.3, this pathway could be constructed entirely within the existing road right-of-way, which would avoid property acquisition costs. Design work would be necessary to identify a means of widening the existing sidewalk to create a pathway, while minimizing any impacts to adjacent residents.

Figure 3.3 — Pathway Adjacent Marine Drive between Travers and Radcliffe Avenues



3.2.4. Marine Drive at Oxley Street and West Bay Park

At West Bay, one option for the Spirit Trail greenway follows Radcliffe Avenue to the east of Oxley Street, and Sunset Avenue to the west. The connection between Radcliffe Avenue and the greenway alignment west of Oxley Street and north of Marine Drive would involve a connection through West Bay Park and across Marine Drive, as illustrated in Figure 3.4.

The connection through West Bay Park would be a pathway at least 3 m wide, with ramps or switchbacks as necessary to maintain the grades on the pathway at 5% or less. The connection across Marine Drive would be a flashing crossing treatment at the existing marked crosswalk on the west side of the Oxley Street intersection.

3.2.5. Marine Drive between Orchill Road and Eagleridge Drive

South of Eagleridge Drive, the Spirit Trail greenway will follow Seaview Walk, which is located within a public right-of-way (the old BC Rail corridor). To the north, the greenway will follow Orchill Drive to Horseshoe bay. In the longer-term, an off-street pathway connection could be developed branching north from Orchill Road along Larson Creek and through Tantalus Park. A localized improvement would provide a connection along Marine Drive between Eagleridge Drive and Orchill Road, and across Marine Drive at Orchill Road, as illustrated in Figure 3.5.

Figure 3.4 — Connection Through West Bay Park and Across Marine Drive

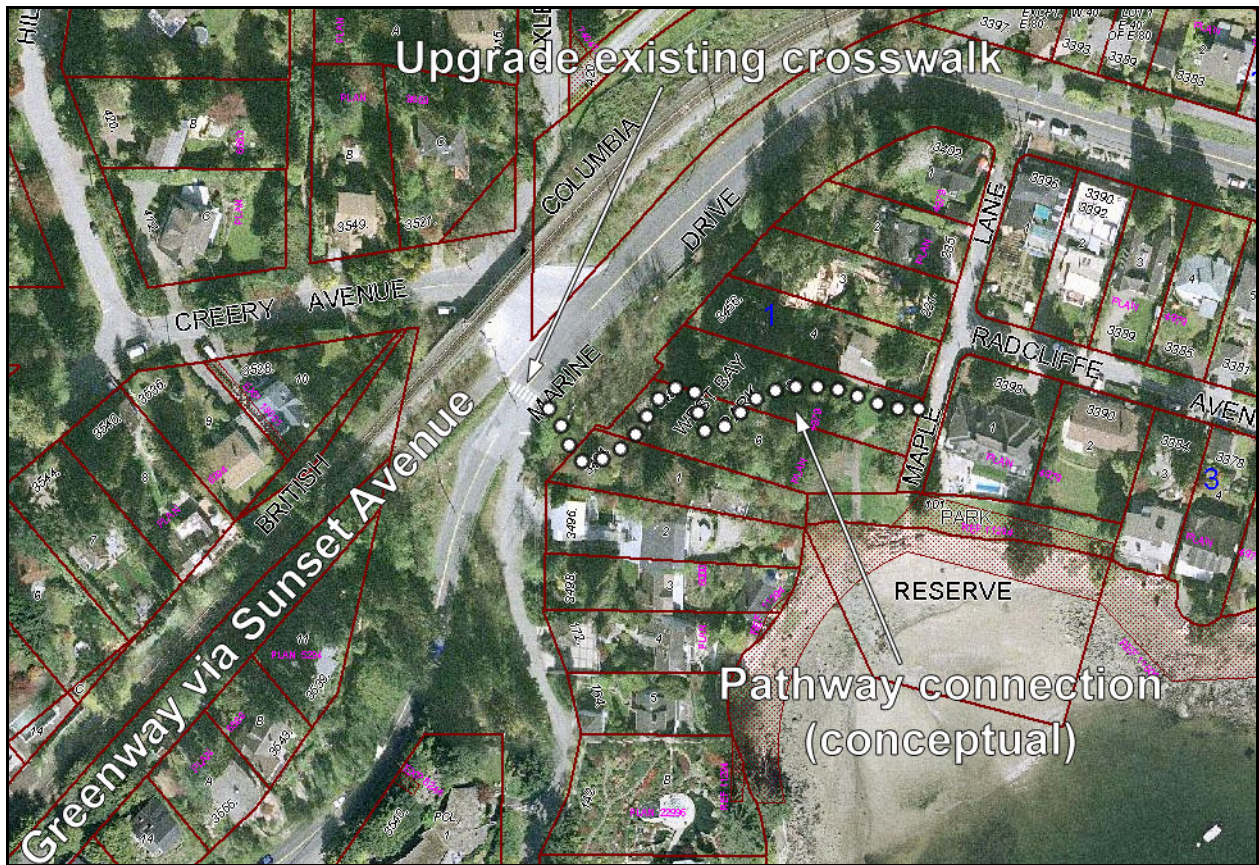


Figure 3.5 — Connection between Orchill Road and Eagleridge Drive



To connect the Spirit Trail greenway through this section, a pathway would be constructed along the east side of Marine Drive, between Orchill Road and Eagleridge Drive, to accommodate cyclists and other greenway users travelling both northbound and southbound. As illustrated in Figure 3.5, this pathway could be constructed entirely within the existing public rights-of-way, avoiding any property impacts and costs.

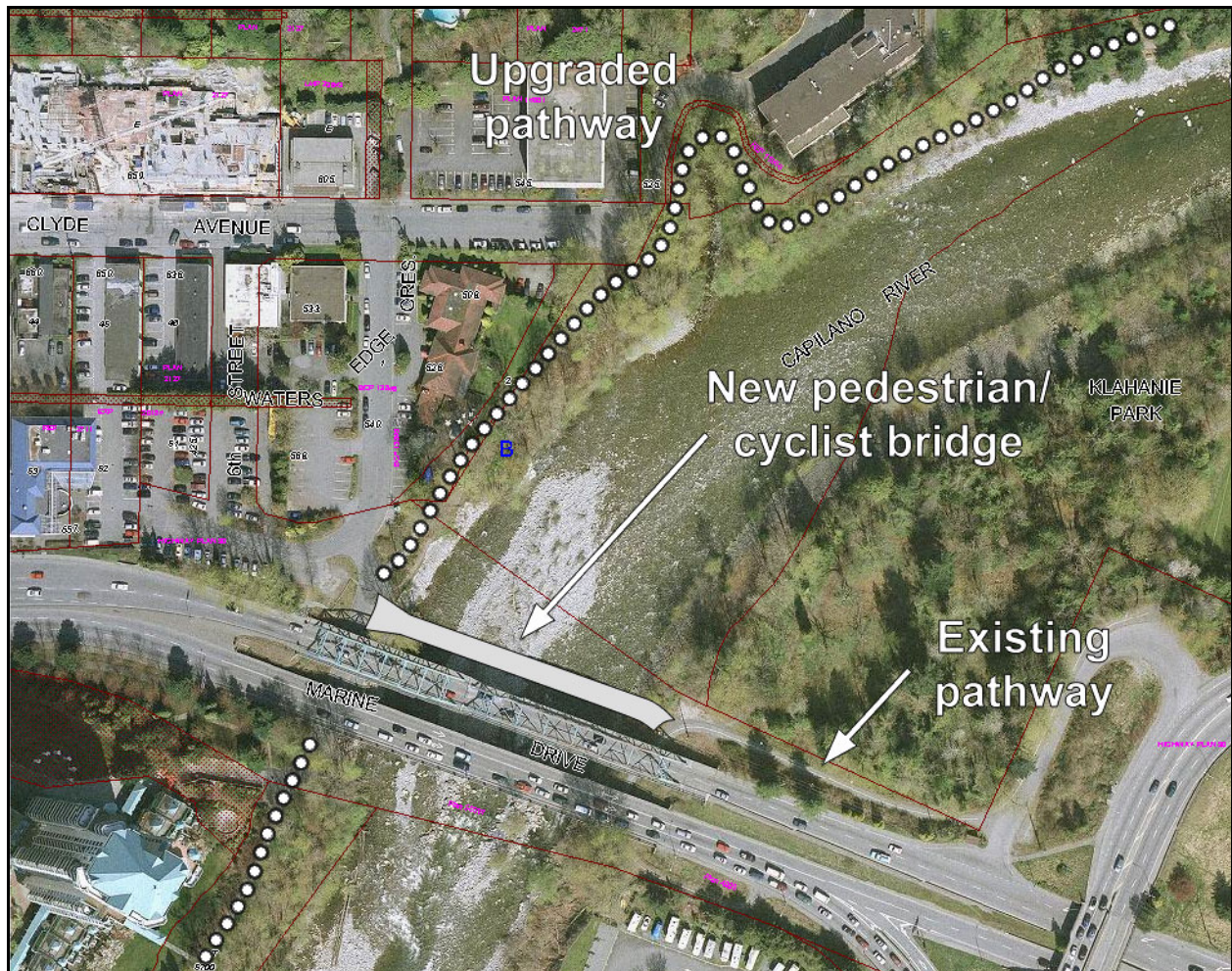
The existing marked pedestrian crosswalk at Orchill Road would be enhanced with either a flashing crossing or a pedestrian signal.

3.2.6. Connection Across Capilano River

The Spirit Trail greenway is intended to provide a continuous route between Horseshoe Bay and Deep Cove. A significant obstacle which the greenway needs to overcome is the crossing of the Capilano River. Currently, the only options available to cyclists and pedestrians are to cross the river on Marine Drive or the Park Royal bridge. Neither option is particularly attractive, particularly for cyclists who are not comfortable riding in traffic. Because this is an important link in the Spirit Trail greenway and provides connections to the Lions Gate Bridge, options should be considered to improve the connection across the Capilano River. Several options are described below.

- Upgrade the Park Royal bridge to accommodate cyclists and other greenway users. This would involve widening the bridge to provide a 4 m wide raised pathway on one side. In addition to upgrading the bridge, crossing treatments would be required at each end of the bridge to improve safety for pedestrians and cyclists using the bridge, and to provide connections to the Lions Gate Bridge. It should be noted that the bridge is owned by the owners of the Park Royal shopping centre.
- The Ministry of Transportation has considered replacing the Marine Drive bridge. If this bridge is upgraded or replaced, it would include an improved pedestrian/bicycle facility.
- Provide facilities for cyclists and pedestrians across a new proposed low level bridge.
- Construct a new pedestrian/bicycle bridge across the Capilano River north of Marine Drive, as illustrated in Figure 3.6. This bridge would connect to pathways on both sides of the river, providing direct connections to the Lions Gate Bridge and bicycle routes in the District of North Vancouver.

Figure 3.6 — Connections Across Capilano River



3.3. Costs

This section presents estimates of the costs of implementing the priority improvements identified above. The estimated costs presented in this section are based on order-of-magnitude estimates, and are intended to provide guidance for budgeting purposes only. Municipal staff should prepare more detailed cost estimates for the Spirit Trail greenway and other bicycle facilities when designs are prepared for these facilities.

3.3.1. Capital Costs

Examples of costs for implementing various types of bicycle facilities are provided in Table 3.1. These unit cost estimates include a contingency of up to 30%, and do not include property costs or other extraordinary costs such as utility relocation. These costs are based on costs for recent construction projects in the Greater Vancouver region. District staff preparing budgets and project estimates can use these costs to provide order-of-magnitude cost estimates. More accurate cost estimates can later be developed based on engineering designs and actual bids.

Table 3.1 — Unit Cost Estimates for Bicycle Facilities (2007 dollars)

Facility	Unit	Cost per Unit
<i>On-Street Routes</i>		
Bicycle route signs and other signs	100 m	\$300
Bicycle route sign, with destination tab	sign	\$250
Other sign	sign	\$250
Bicycle lane stripe and symbols (one direction)	100 m	\$400
Marked wide curb lane symbols (one direction)	100 m	\$250
Lane line	100 m	\$250
Bicycle symbol (non-skid reflective thermoplastic)	symbol	\$200
<i>Pathways</i>		
4.0 m asphalt pathway (excluding site preparation)	100 m	\$50,000
10 m bridge	bridge	\$75,000
<i>Crossings</i>		
Marked crossing	crossing	\$2,500
Flashing lights (solar-powered) at crossing	crossing	\$15,000
Flashing lights and overhead illuminated signs	crossing	\$40,000
Signalized crossing	crossing	\$100,000
Bicycle actuation at existing signal	crossing	\$20,000

The total cost of implementing the priority improvements identified in Sections 3.1 and 3.2 — the Spirit Trail greenway and localized improvements — is estimated to be approximately \$10 million, as summarized in Table 3.2. The District’s share of these costs would amount to a total of as much as \$5 million.

Table 3.2 — Capital Cost Estimates for Priority Improvements (2007 dollars)

	Improvement	Estimated Cost
Spirit Trail Greenway	Park Royal to 31 st Street	\$2.0 million
	31 st Street to Piccadilly North	\$2.4 million
	Piccadilly North to BCR Tunnel	\$1.8 million
	BCR Tunnel to Horseshoe Bay	\$2.2 million
	<i>Subtotal</i>	<i>\$8.4 million</i>
Localized Improvements	Marine Dr., 28 th St. – 29 th St., pathway	\$400,000
	Marine Dr. @ 26 th St., crossing and ramp	\$200,000
	Marine Dr. @ Orchill Rd., pathway and crossing	\$200,000
	Other localized improvements	\$800,000
	<i>Subtotal</i>	<i>\$1.6 million</i>
Total		\$10 million
<i>Note: Cost estimates exclude property, utility relocation and environmental mitigation costs</i>		

3.3.2. Program Costs

Supporting programs such as awareness and education programs are an important component of a comprehensive bicycle program. Awareness programs create awareness of cycling opportunities, and encourage people to cycle. Education programs are intended to show cyclists and motorists how to safely share the road. Supporting programs help to achieve the same objectives of encouraging bicycle use and increasing cyclist safety as bicycle routes do. Consequently, it is just as important to fund supporting programs as it is to fund the bicycle facilities.

Costs for supporting programs vary widely depending on the content and extent of the programs, as well as the extent to which other agencies are involved in providing supporting programs. Rather than attempting to estimate annual costs for supporting programs for which the scope and participation of other agencies is not yet known, the best approach is establish an annual allocation for supporting programs. This allocation would fund the development, implementation and maintenance of supporting awareness and education programs. Initially, an annual allocation of \$25,000 could be used to fund supporting programs as summarized in Table 3.3.

Table 3.3 — Costs of Supporting Programs (2007 dollars)

Supporting Program	Annual Allocation
Web site and e-mail contacts	\$5,000
Bicycle route map	\$5,000
Bicycle counts and surveys	\$5,000
Other awareness and education programs	\$10,000
Total	\$25,000

3.4. Funding Opportunities

The District should pursue all available public sector sources of funding for bicycle facilities and programs, including the programs identified below. It is important to note that to take advantage of many of these public sector funding opportunities requires that the District have previously completed detailed designs and corresponding accurate cost estimates. The costs of preparing detailed designs are typically not eligible for cost share funding — only the capital costs of construction are eligible.

- **TransLink** provides funding for bicycle facility projects through two means — financing of improvements to roads which are included in the regional “major road network” (MRN — generally, these are arterial roads and highways of regional significance), and the Bicycle Infrastructure Capital Cost Sharing Program (BICCS). MRN funding is generally allocated based on the length of MRN roads within a municipality. The BICCS program is intended to encourage municipalities to construct more bicycle routes and remove physical barriers to cycling. Funding is available through the BICCS program in both “block allocations” on a per capita basis, and “regional needs” funding based on a set of criteria including safety,

network contribution, demand and adherence to guidelines. Funding through the BICCS program is typically up to 50% of the project cost.

- **Provincial programs.** The provincial government currently has several programs which provide funds for bicycle-related projects, including:
 - *LocalMotion* is a provincial program intended to improve air quality, improve safety, reduce energy consumption and encourage British Columbians to be more active. The program provides \$40 million for investment in capital projects, including bicycle facilities, pathways and greenways, and projects that improve accessibility for people with disabilities. The District can apply for LocalMotion grants based on a 50/50 provincial/municipal cost-sharing basis, with a provincial contribution of up to \$1 million a year. The total \$40 million is available over four years. The District was recently awarded \$2 million in LocalMotion funding towards the costs of implementing the Spirit Trail greenway.
 - *The Cycling Infrastructure Partnerships Program (CIPP)*. Through this program, the Ministry of Transportation provides up to 50% cost-sharing (to a maximum of \$250,000 per project) for new and improved bicycle facilities on secondary highways and classified arterials. Under the roads section of the Provincial Revenue Share Act, grants are awarded to assist in the development of major municipal roads, and bicycle facilities are eligible under this program.
- **Infrastructure Canada** manages several programs which provide funding for environmental and local transportation infrastructure projects in municipalities across Canada. Typically, the federal government contributes one-third of the cost of municipal infrastructure projects. Provincial and municipal governments contribute the remaining funds, and in some instances, there may be private sector investment as well.
- **Green municipal funds.** The Federation of Canadian Municipalities manages the Green Municipal Fund, with a total allocation of \$550 million. This fund is intended to support municipal government efforts to reduce pollution, reduce greenhouse gas emissions and improve quality of life. The expectation is that knowledge and experience gained in best practices and innovative environmental projects will be applied to national infrastructure projects
- **Other federal programs.** At any given time, there are usually one or more federal grant programs for which bicycle facilities would be eligible. As an example, in the past, Environment Canada provided grants through the Environmental Partners Fund for bicycle-related projects which demonstrated a benefit to the environment and which formed partnerships with the community.

It is important to note that eligibility for some federal programs is limited to not-for-profit organizations. By forming partnerships with local not-for-profit organizations, the District can access a number of alternative funding sources and grant programs for bicycle projects.

It is important to note that because the primary applicant for funds is the not-for-profit group, they are nominally in charge of the project.

Other sources of funding that can be considered for financing of bicycle facility projects and bicycle programs include:

- **ICBC** has in the past provided funding for bicycle facilities, particularly where these have the potential to reduce crashes and claims costs to ICBC. Funding is available through ICBC's Road Improvement Program and Safer City Program.
- **Developments.** As part of new developments, the municipality can negotiate with developers to provide pathways and other pedestrian and bicycle facilities.
- **Private sector.** Mountain Equipment Co-Op is an example of a business which provides funding that could be applied to bicycle and pedestrian facilities and programs. To protect the environment in areas having significant recreational value, and to facilitate public access and recreational use of areas, Mountain Equipment Co-Op supports applications from member groups and not-for-profit organizations. Similarly, VanCity provides funding through its Environmental Fund.

Many corporations wish to be good corporate neighbours — to be active in the community and to promote environmentally-beneficial causes. A bicycle network is well-suited to corporate sponsorship, and has attracted significant sponsorship both at the local level and throughout North America. Examples in B.C. include Construction Aggregates in Sechelt, which constructed an overpass over a gravel conveyor to provide a link for pedestrians and cyclists, and 7-Eleven and Molson Breweries which have sponsored multi-use pathways in Vancouver, Burnaby and New Westminster.

- **Deeds, donations and dedications.** In many communities, multi-use pathways have been funded in part and in whole by local residents who purchased “deeds” to sections of the pathway. For example, development of a greenway along Mission Creek in Kelowna was partially funded through community donations. Similar to park bench dedication programs, a dedication program can be set up for residents and corporations to donate bicycle facilities, such as bicycle racks or lockers. In many cases, these deeds, donations and dedications are tax-deductible where they are administered by a not-for-profit agency.
- **Advertising.** There are several options for obtaining funding for bicycle projects from advertising revenues. The costs of producing and distributing a bicycle route map can be partially or fully offset by selling advertising space on the map. Advertising on bicycle racks can reduce the costs of providing bicycle parking. Potential advertisers include bicycle stores, commercial recreation operators, hotels, restaurants and transportation services.

3.5. Monitoring

A monitoring program is essential to ensure that the Cycling Network and Greenway Plan is implemented as intended, and to determine whether the plan is achieving the goals of improving safety and encouraging more cycling and walking. A monitoring program will also enable District staff to justify continued expenditures and allocation of resources for bicycle facilities and programs. Monitoring also provides a means of identify changing conditions which would require changes to the Cycling Network and Greenway Plan.

Monitoring should be undertaken on an annual basis. The first year of monitoring will establish baseline conditions, against which information collected in subsequent years will be compared. After data have been collected and summarized in the first year, it will also be possible to establish targets to be achieved within a specific time period.

Monitoring should be conducted by District staff, as part of on-going data collection and management activities such as traffic counts and community surveys. Other agencies and volunteers can be recruited through the Vancouver Area Cycling Coalition and other cycling organizations to assist in monitoring, as a means of increasing the scope of the monitoring program, and minimizing costs.

3.5.1. Measures of Success

In order to clearly and reliably gauge the success of the Cycling Network and Greenway Plan, the monitoring program should collect data which can be used to calculate the following performance measures:

- **Mode share.** Data available from TransLink indicate that the bicycle mode share — the proportion of all trips which are made by bicycle — in West Vancouver is currently 0.4%. A trend increase in the bicycle mode share will be a key indicator of the success of the Cycling Network and Greenway Plan.
- **Usage of routes.** Annual counts of bicycles at selected locations on the bicycle network — including on-street routes and pathways — will provide an indication from year-to-year of the increase in bicycle use. A trend increase in the numbers of cyclists will be a key indicator of the success of the Cycling Network and Greenway Plan.
- **Kilometres of routes.** The number of kilometres of bicycle routes — on-street and off-street — should be recorded each year. Over time, this will provide a measure of the expansion of the bicycle network.
- **Cyclist satisfaction.** Bi-annual surveys of cyclists should be used to indicate satisfaction with bicycle facilities and various features of the bicycle network, and to identify major issues. Satisfaction should be rated on a scale of 1-to-5, where 1 indicates very unsatisfied, 2 indicates somewhat unsatisfied, 3 indicated neutral, 4 indicates somewhat satisfied and 5

indicates very satisfied. Continued increases in satisfaction ratings will be a key indicator of the success of the Cycling Network and Greenway Plan.

- **Bicycle crashes.** Although bicycle crashes are typically not reported, and even when reported are often poorly recorded, a year-to-year summary of numbers and locations of bicycle crashes can be useful in identifying safety-related issues and trends.

3.5.2. Data Collection

To provide the data needed to calculate the performance measures described above, the following data should be collected each year:

- **Bicycle counts** should be undertaken on a cordon basis so that shifts in bicycle travel to a new or improved route do not skew usage calculations. For consistency, counts should be undertaken at the same locations each year, and at the same times of the year and the same times during the day. The optimum time to undertake counts is in late September/early October (avoiding the Thanksgiving holiday), as schools and post-secondary institutions are in session at this time, and the weather is generally good.

Bicycle counts should be undertaken at approximately a dozen locations throughout West Vancouver. In addition to bicycle counts, any traffic counts undertaken by the District should record bicycles separately from motor vehicles and pedestrians.

- **Bicycle surveys** should be undertaken bi-annually to determine cyclists' travel patterns, to identify key origins and destinations, to measure cyclists' satisfaction levels, to identify bicycle network needs and priorities, and to collect other data needed to calculate the performance measures described above. These surveys could be conducted on-line and/or via survey forms distributed along bicycle routes, through bicycle stores and through local employers.

These data should be supplemented with travel data available from TransLink and Statistics Canada. TransLink conducts a regional trip diary survey every five years, which provides information regarding bicycle mode shares, origins and destinations, trip lengths and other travel characteristics. Statistics Canada conducts a census every five years, which provides information regarding bicycle mode shares for trips to work.

4. DESIGN GUIDELINES

This section presents a comprehensive set of guidelines for the design, construction and maintenance of bicycle facilities. These guidelines are intended to supplement current design guidelines published by the Transportation Association of Canada (TAC), and consequently current TAC guidelines (such as guidelines related to signage and pavement markings) are not repeated in this section. The design guidelines presented in this section are based on state-of-the-art guidelines used in B.C. and elsewhere in North America, and address situations not encompassed in the TAC guidelines. In particular, considerable information is provided regarding the design of multi-use pathways, as TAC guidelines address only the basic aspects of pathway design.

4.1. On-Street Facilities

On-street facilities described in this section include shared bicycle routes, marked wide curb lanes, conventional bicycle lanes and paved shoulders. Crossings are discussed separately in Section 4.3.

The guidelines presented in this section identify minimum or “desired” dimensions for on-street bicycle facilities. They also include “interim” guidelines where applicable. The intent of these interim guidelines is to indicate minimum acceptable conditions for on-street facilities in situations where these are retrofit to existing roads — which will be the majority of cases. It is expected that at some time in the future when the opportunity arises (such as through road reconstruction or redevelopment of adjacent land uses, for example), an on-street facility constructed to interim guidelines would be upgraded to meet the “full” guidelines described in this section.

Guidelines are not provided regarding signing of bicycle routes, as signage is adequately addressed by TAC guidelines. One issue which is not addressed by TAC, however, is the approach to naming bicycle routes. Some municipalities assign names to each route, but these are often confusing as they refer to street names which parts of the route may not follow, or theme names which say little about the destinations served by the route. Other municipalities number routes, but this creates problems when new routes are created and the numbering scheme must be revised to accommodate these routes. The preferred approach is not to name or number routes, but rather to simply indicate with signs which streets are designated bicycle routes. Signs used for this purpose include bicycle route signs and bicycle symbols on street name signs, as illustrated in Figure 4.1. Supplementary tabs installed below bicycle route signs should be used along a bicycle route to indicate major destinations, as illustrated in Figure 4.2.

Figure 4.1 — Street name sign with bicycle symbol



Figure 4.2 — Bicycle route sign with destination signing



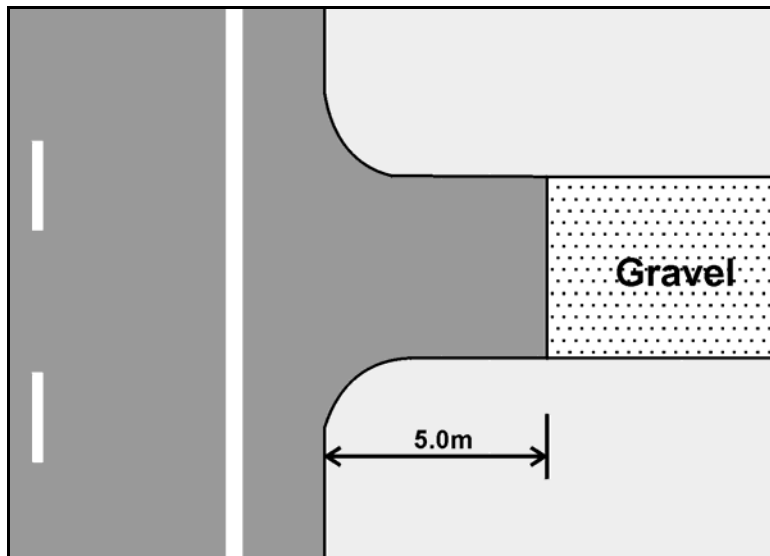
4.1.1. Shared Bicycle Routes

Shared bicycle routes make use of collector roads and local streets with low traffic volumes. Because fewer motor vehicles use these roads, bicycles and motor vehicles can safely share the road space. Consequently, it is not necessary to provide extra width for bicycles or designate specific areas of the roadway for bicycle use. All that is required is "bicycle route" signage.

Facility design guidelines which apply to shared bicycle routes (and to other on-street bicycle facilities) include:

- When a roadway which is a designated bicycle route is reconstructed, widened or overlaid, gravel driveways with significant traffic should be paved to a minimum of 5.0 m from the road edge, as illustrated in Figure 4.3, to prevent loose gravel from spilling onto the side of the roadway. It is generally not necessary to pave gravel driveways to single-family residential dwellings, as traffic on these driveways is low.
- Openings in catchbasins should be oriented at an angle to the direction of bicycle travel, so that bicycle wheels are not caught in the openings.
- Pavement overlays should taper into drainage outlets and manhole covers so they do not cause an abrupt edge. The pavement elevation should match or be within 6mm of the gutter elevation to create a smooth joint.

Figure 4.3 — Paved driveway apron



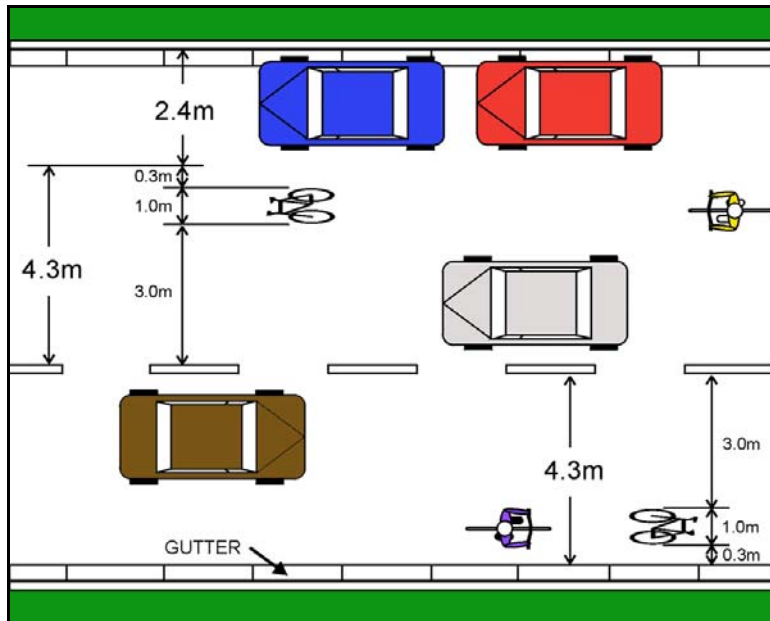
4.1.2. Marked Wide Travel Lanes

A marked wide travel lane is wider than a standard travel lane, to provide sufficient width for an automobile to safely overtake a bicycle, without crossing over into the adjacent or oncoming traffic lane. A marked wide travel lane incorporates bicycle symbols stencilled on the right side of the lane at regular intervals. Unlike a conventional bicycle lane, marked wide travel lanes do not include a white line separating bicycles from other traffic.

Key design guidelines regarding marked wide travel lanes include:

- A width of 4.3 m (not including the gutter) is recommended, as illustrated in Figure 4.4. A width of 4.3 m allows a motor vehicle to safely pass a cyclists without having to cross into the adjacent travel lane. Where on-street parking is provided, this standard also allows enough width for cyclists to avoid conflicts with opening car doors. The width of a marked wide travel lane should not exceed 4.5 m, however, as this would enable vehicles to pass other vehicles on the right.

Figure 4.4 — Marked wide travel lane dimensions



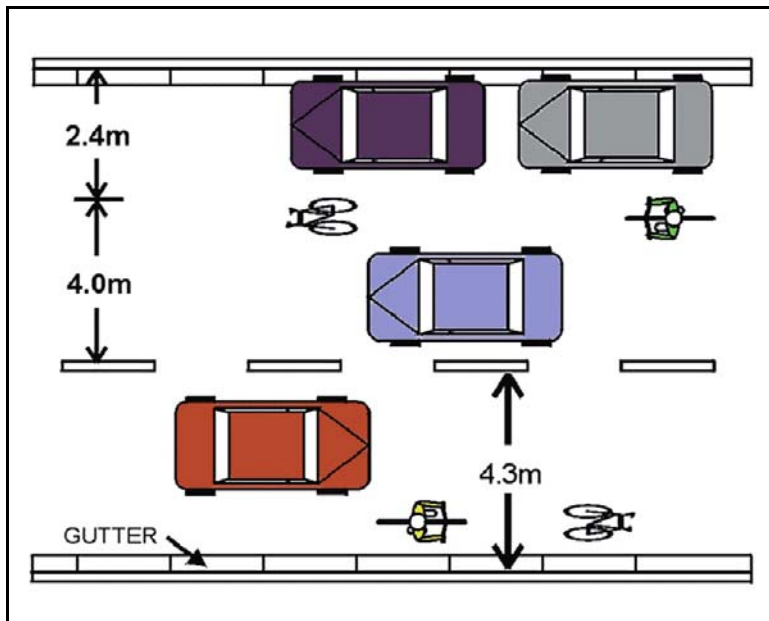
- It is important that the width of the gutter is not included in the 4.3m width. For safety reasons, cyclists will not ride in the gutter or even within 20 cm to 30 cm of the gutter. Gutters typically collect debris, the surface of the gutter is often not level with the asphalt road surface, and joints in the concrete gutter create bumps. An option to minimize the overall road width is to use a narrower gutter than the typical 300 mm or 400 mm gutter. In the example in Figure 4.5, the gutter is only 150 mm wide and catchbasins are inset into the curb face.

Figure 4.5 — Bicycle-friendly gutter and catchbasin



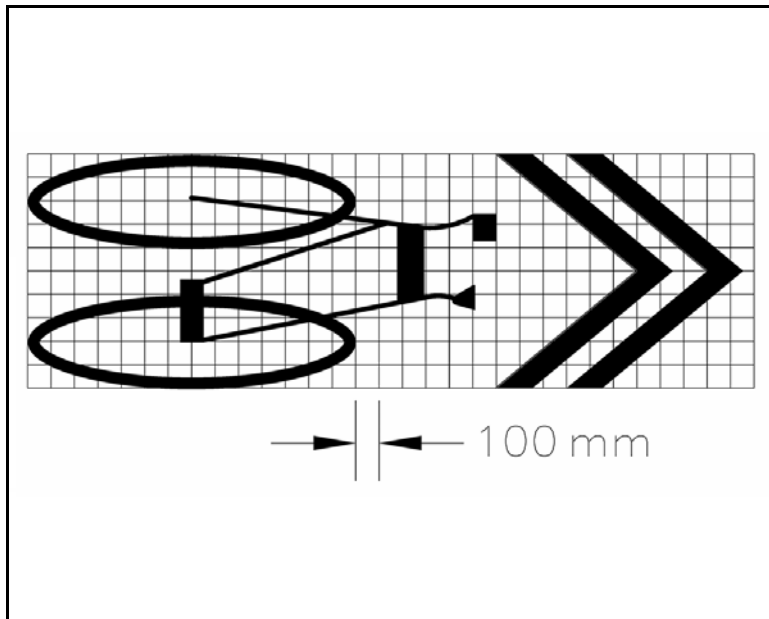
- If on-street parking exists along the route, a width of 2.4 m should be allowed for parked vehicles, in addition to the 4.3 m required for the wide curb lane with stencils. As illustrated in Figure 4.4, the 2.4 m width of the parking lane includes the gutter.
- Bicycle symbols should be placed every 200 m along the road, as well as in advance of all intersections and major driveways. In cases where marked wide travel lanes are provided and on-street parking is not permitted, the bicycle stencils should be placed on the pavement next to the gutter. Where on-street parking is provided, the bicycle stencils should be placed on the right side of the travel lane, adjacent the parking lane. Figure 4.4 illustrates the placement of bicycle symbols in marked wide travel lanes.
- In situations where marked wide travel lanes are constructed as interim facilities to be replaced at a later date by an improved bicycle facility, the following minimum dimensions apply:
 - Minimum 4.3 m including the gutter, as illustrated in Figure 4.6.
 - Minimum 4.0 m adjacent on-street parking as illustrated in Figure 4.6.
 - Minimum 4.0 m adjacent a shoulder provided as a pedestrian facility.
 - Minimum 4.5 m adjacent a wall, railing or other barrier over 150 mm in height.

Figure 4.6 — Dimensions for interim marked wide travel lanes



- The Transportation Association of Canada is proposing to introduce a new pavement marking symbol to be used for marked wide travel lanes, as illustrated in Figure 4.7.

Figure 4.7 — Marked wide travel lane symbol



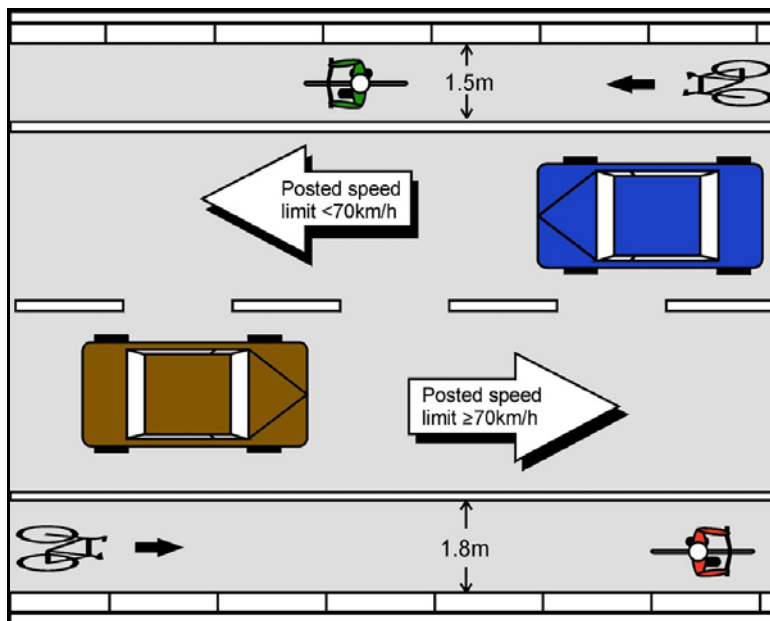
- Where a marked wide travel lane ends and the travel lane is reduced to a width of less than 4.0 m, a “Road Narrows” warning sign (TAC code WA-23 or WA-23R) should be posted in advance to inform cyclists of the road narrowing.

4.1.3. Bicycle Lanes

Bicycle lanes are separate travel lanes on the roadway for cyclists, identified with a solid white line that is dashed at intersections to indicate where motor vehicles may cross the lane for turning movements. Specific guidelines for bicycle lanes include:

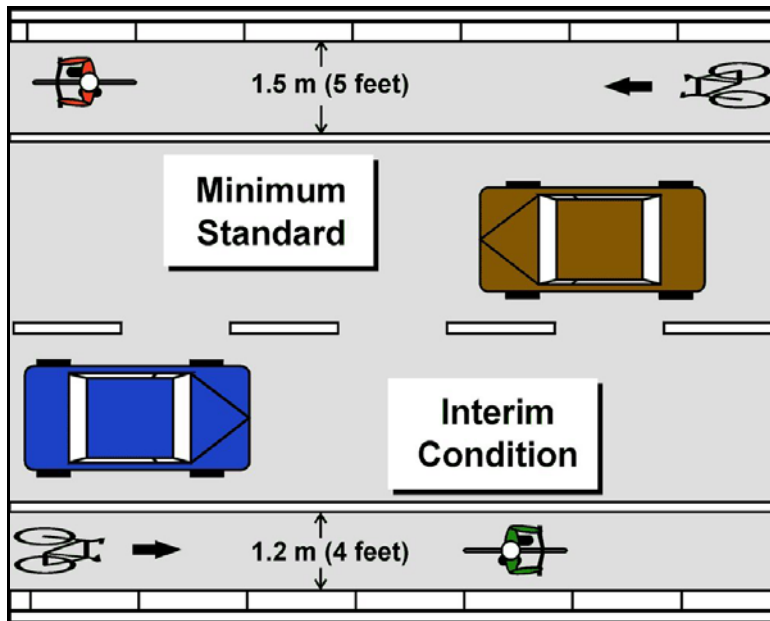
- Bicycle lanes should never be planned for two-way travel – cyclists should always travel one-way in the direction of travel of adjacent traffic.
- At a minimum, bicycle lanes should be 1.5 m wide, excluding the gutter as illustrated in Figure 4.8. On roadways with posted speeds of 70 km/h or more, bicycle lanes should be 1.8 m wide, excluding the gutter. Bicycle lanes should not be wider than 1.8 m, as this encourages two-way bicycle travel and encourages motorists to park in the lane.

Figure 4.8 — Bicycle lane dimensions



- Where bicycle lanes are provided adjacent to on-street parked vehicles, the combined width of the bicycle/parking lane should be at least 3.9 m. This provides 2.4 m for the parking lane and 1.5 m for bicycles, and provides adequate clearance for cyclists to avoid opened car doors.
- In situations where bicycle lanes are constructed as interim facilities to be replaced at a later date by an improved bicycle facility, the following minimum dimensions apply:
 - Minimum 1.2 m excluding the gutter, as illustrated in Figure 4.9. With a typical gutter width of 300 mm, this means that an interim bicycle lane is a minimum of 1.5 m wide including the gutter.
 - Minimum 1.5 m excluding the gutter on roadways with posted speeds of 70 km/h or more.

Figure 4.9 — Dimensions for interim bicycle lanes



- Bicycle lanes should be continuous between intersections. If a section of road between two intersections is improved to provide sufficient width for a bicycle lane without improvements to the remaining sections of road, the lane should not be marked or otherwise identified until the remaining sections are improved to provide sufficient width for the bicycle lane.
- Bicycle lane lines should be dashed for a distance of 15m in advance of intersections. This allows a cyclist to exit from the bicycle lane to make a left turn, and allows right-turning vehicles to merge into the bicycle lane. The bicycle lane line should be discontinued through the intersection.
- Bicycle lanes should be identified with a painted bicycle symbol and may include an arrow indicating the direction of travel. Bicycle lane symbols should be spaced at approximately 350 m intervals for roadways with a posted speed limit of 50 km/h. Additional symbols should be located immediately after intersections with major roads, to alert drivers and cyclists turning onto the road of the existence of the bicycle lane.

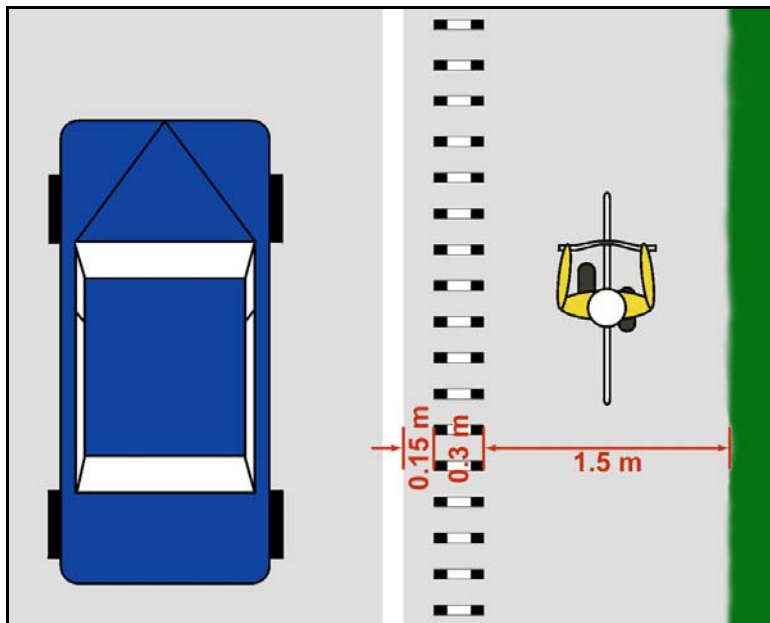
4.1.4. Paved Shoulders

On roads with rural cross sections, where there are no curbs or gutters, cyclists are accommodated on paved shoulders. Specific design guidelines regarding paved shoulders include:

- Paved shoulders should never be planned nor designated for two-way travel – cyclists should always travel one-way in the direction of travel of adjacent traffic.
- Non-emergency parking or stopping should be prohibited on the shoulder at all times.

- Shoulders should be a minimum of 1.5 m in width. On roadways with a posted speed in excess of 70 km/h and daily traffic volumes greater than 5,000 vehicles, a paved shoulder width of 2.0 m is desirable. For roadways with posted speeds in excess of 80 km/h and daily traffic volumes greater than 10,000 vehicles, a minimum width of 2.5 m is desirable.
- Shoulders should be paved and free of obstructions, such as drainage aprons. If rumble strips are used to prevent motor vehicle drive-off accidents, they should be located on the far left of the shoulder, within 150 mm of the white fog line, and should be a maximum of 300 mm wide, as illustrated in Figure 4.10. The remainder of the shoulder should be a minimum of 1.5 m wide.

Figure 4.10 — Paved shoulder with rumble strip



- Shoulders should incorporate a 2.0% crossfall to provide adequate drainage. The crossfall of the shoulders should not exceed 5%.

4.2. Greenways and Pathways

The design guidelines in this section address off-street facilities — greenways and pathways. Generally, greenways and pathways are hard-surfaced — using concrete or asphalt — which means that all non-motorized users can be accommodated, including pedestrians, runners, in-line skaters, skateboarders, persons in wheelchairs, equestrians, persons pushing strollers, and persons walking dogs, for example. Greenways and pathways may be located within a road or rail right-of-way, or parallel to a road.

These design guidelines do not address trails, which are typically narrow, winding and steep, with soft natural surfaces, and are used primarily for recreational purposes — hiking, mountain

biking and horseback riding. Pathways with crushed aggregate surfaces are distinguished from trails by wider cross-sections, gentler grades and straighter alignments, and are used for commuter trips as well as recreational trips.

There are several key considerations in the design of off-street greenways and pathways:

- Width
- Surface materials
- Horizontal alignment
- Crossings at intersections with major roads
- Grades
- Clearances
- Illumination

The most important consideration is the width of the pathway. Width has a significant effect on the potential for conflicts between pathway users, and as a result has a significant effect on the safety and attraction of a pathway. The second-most important (and most-overlooked) consideration is crossings where pathways intersect major roads. Crossings — or more accurately, the lack of crossings — also have a significant effect on the safety and attraction of a pathway.

These pathway design guidelines recognize that in many cases, pathways will be retrofit within existing road right-of-ways and utility corridors, and in these locations constraints may mean that some design guidelines cannot be met. In recognition of this, these guidelines also include “interim” guidelines where applicable. The intent of these interim guidelines is to indicate minimum acceptable conditions for pathways in retrofit situations. It is expected that at some time in the future when the opportunity arises, a pathway constructed to interim guidelines would be upgraded to meet the “full” guidelines described in this section.

4.2.1. Width

Width is the most important design consideration for off-road pathways. In order to minimize the potential for conflicts between pathway users, the width of a pathway should be sufficient to accommodate the numbers and types of expected users. Applicable guidelines include:

- The minimum desired width for a multi-use pathway is 4.0 m.
- Widths of 6.0 m or more may be necessary on high-use pathways. A reduced width of 3.0 m is acceptable on low-use pathways with less than 200 persons per hour during peak periods. A constrained width of as little as 2.4 m is acceptable for short sections where there are physical constraints on the pathway width, such as trees, rocks and other objects.
- Where multi-use pathways are expected to accommodate significant numbers of in-line skaters, a minimum width of 4.0 m is required, regardless of the usage of the pathway. The

width required by an in-line skater reflects the width of the skating stride as well as a manoeuvring allowance.

- As an interim condition, for pathways constructed in a retrofit situation, pathway widths of 3.0 m are acceptable. In low-use applications, widths of 2.5 m are acceptable as an interim condition.
- Shoulders a minimum of 0.5 m wide should be provided adjacent multi-use pathways.
- Pathways should be designed for two-way travel, as it is difficult to ensure compliance with one-way designations. Separated pathways should be avoided. In communities which have attempted to separate users, pedestrians frequently use the pathways designated for cyclists and in-line skaters, and vice-versa, defeating the purpose of separated pathways. The preferred approach is to construct a single pathway of sufficient width to accommodate all users.
- Painted centrelines should not be used to separate directions of travel on a multi-use pathway. Centrelines can contribute to conflicts which arise when faster-moving pathway users cross the centreline to pass slower-moving users. Many pathway users also disregard centrelines, which also creates conflicts. The use of centreline should be restricted to horizontal curves with limited sight distances.
- An adjacent, soft-surfaced trail can be provided to accommodate runners, pedestrians, equestrians and others. For pedestrians, an aggregate or crushed bark trail a minimum of 1.0 m wide should be provided.

4.2.2. Surface

The choice of the pathway surface is important, as it determines whether or not some people will be able to use the pathway. Generally, multi-use pathways should be hard-surfaced — using asphalt or concrete — as hard surfaces accommodate all users, including persons in wheelchairs and in-line skaters. Compacted aggregates can be used where porous surfaces are necessary to address environmental issues. It is important to recognize that aggregates prevent use by in-line skaters, cyclists with narrow tires, and some persons with disabilities.

Applicable guidelines regarding pathway surfaces include:

- Dimensions for pathway structures are summarized in Table 4.1. Indicated minimum dimensions are sufficient to accommodate occasional use by lightweight vehicles such as automobiles and pick-up trucks for which single axle loads do not exceed 1000 kg. If a pathway is to be used by heavier service vehicles, dimensions should be increased as indicated.

Table 4.1 — Pathway structure guidelines

	Asphalt	Concrete
Minimum requirement	50 mm asphalt 100 mm crushed stone Compacted subgrade	100 mm concrete 100 mm sand Compacted subgrade
Medium trucks (single axle load < 3,000 kg)	75 mm asphalt 150 mm crushed stone	125 mm concrete 150 mm sand
Heavy trucks (single axle load < 6,000 kg)	100 mm asphalt 150 mm crushed stone	150 mm concrete 150 mm sand

- Shoulders should be constructed using 20 mm minus crushed stone, with a minimum 50 mm depth, as illustrated in Figure 4.11.

Figure 4.11 — Aggregate pathway shoulder



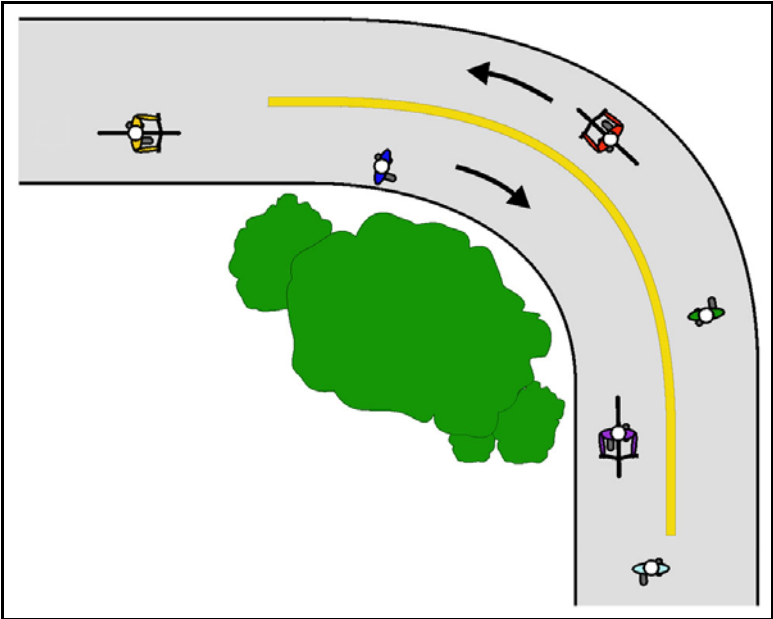
4.2.3. Alignment

The horizontal alignment of a pathway determines sight distances along the pathway, and as a result has a significant effect on the potential for conflicts between pathway users. Applicable guidelines include:

- Pathway alignments should be determined based on design speeds of 35 km/h for pathways on level ground, and 50 km/h for pathways with grades of more than 4%. These speeds reflect the maximum speeds which cyclists on pathways can be expected to attain.

- Where minimum sight distances cannot be achieved at horizontal curves, a centreline should be painted on the pathway with arrows indicating that pathway users are to stay to the right, as illustrated in Figure 4.12. As appropriate, "Limited Visibility" signs can also be used to alert pathway users of visibility limitations and potential hazards.
- Where horizontal curves are less than the required minimum radius, the pathway should be widened by at least 1.0 m through the curve so as to provide additional room for pathways users to manoeuvre through the curve.

Figure 4.12 — Centreline on curve with limited sight distance



4.2.4. Grades

Grades on pathways create the potential for some wheeled pathway users to gain speed or lose control, and consequently pathway grades should be minimized and steep grades avoided.

- Maximum uphill grades on hard-surfaced pathways should not exceed 3% for sustained sections, or 10% in any sections, as indicated in Table 4.2. A maximum 3% grade for aggregate surfaces helps to avoid instability for users and minimize erosion.

Table 4.2 — Maximum grades for multi-use pathways

Hard surface	3%	For sustained sections
	5%	For sections 30m or less
	10%	For sections 15m or less
Aggregate surface	3%	For all sections

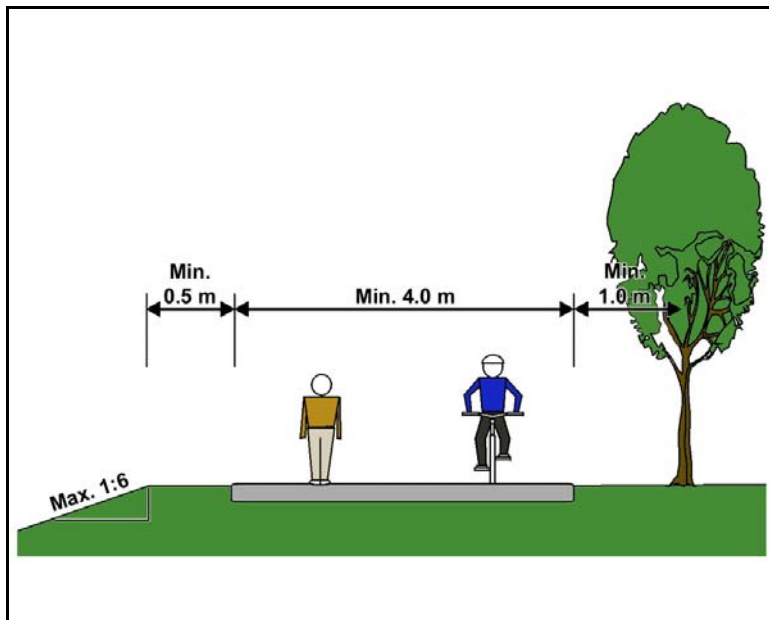
- Where grades exceed the maximum grades specified in Table 4.2, "Steep Hill" warning signs (TAC code WA-41) should be placed at the top of a steep section to advise pathway users travelling downhill of the steep grade. No part of a pathway should exceed a 15% grade.
- A minimum 0.6% grade should be incorporated in the design of a pathway if no crossfall or drainage facilities are provided.

4.2.5. Clearances

Pathways should be designed to be free of obstructions within and adjacent the pathway, both in terms of horizontal and vertical clearances.

- The horizontal clearance from the edge of a pathway to a fixed object greater than 150 mm in height (a tree or signpost, for example) should be a minimum of 1.0 m, as illustrated in Figure 4.13.
- Next to side slopes, a minimum of 0.5 m clearance is required from the edge of the pathway to the top of the slope, as illustrated in Figure 4.13. The area between the pathway and the side slope should be no steeper than 1:6.

Figure 4.13 — Pathway clearances



- As an interim condition, for pathways constructed in a retrofit situation, horizontal clearances of 0.5 m are acceptable.
- A minimum 0.5 m horizontal clearance is required adjacent a railing, wall or other barrier. Thus, a pathway that is 4.0 m wide with railings on both sides would have a clear width of 5.0 m from railing to railing.

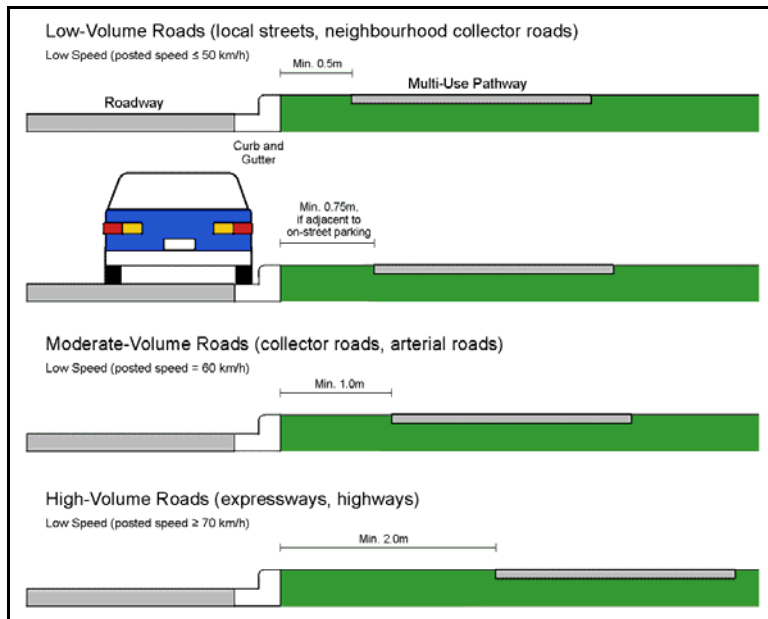
- Where a side slope exists adjacent a pathway, a minimum of 0.5 m clearance is required, as illustrated in Figure 4.13.
- The desirable maximum slope of a side slope is 1:6. For side slopes steeper than 1:4, the pathway edge should be a minimum of 1.5 m from the top of the slope, and safety railings should be used as illustrated in Figure 4.14. To provide adequate horizontal clearance, safety railings should be a minimum of 0.5 m from the edge of the pathway.

Figure 4.14 — Safety railing adjacent steep side slope



- Pathways adjacent roads with urban cross-sections (roads with curbs) should be separated from the roadway by the distances indicated in Figure 4.15 and described below:
 - Minimum 0.5 m separation adjacent on roads with low traffic volumes and posted speeds of 50 km/h or less
 - Minimum 0.75 m separation adjacent roads with parked vehicles
 - Minimum 1.0 m separation adjacent roads with moderate traffic volumes and posted speeds of 60 km/h
 - Minimum 2.0 m separation adjacent roads with high traffic volumes and posted speeds of 70 km/h or more

Figure 4.15 — Pathway clearances from roadway



- The separation area between a pathway and road may be grass, crushed stone or other aggregate, or a hard surface. If a hard surface is used, colour and texture (such as coloured, stamped asphalt) should be used to differentiate the separation area from the pathway. Signs, utility poles, trees and other objects should not be placed in the separation area between pathway and road.
- Pathways adjacent roads with rural cross-sections (roads with shoulders rather than curbs) should be separated from the edge of the paved portion of the roadway by a minimum of 3.0 m, where the posted speed on the road is 60 km/h or less. A minimum 7.0 m separation should be provided where posted speeds are 70 km/h or greater.
- Horizontal separation requirements for rural roads can be reduced to the dimensions for curbed roads with the addition of a concrete curb 150 mm in height, anchored to the edge of the road.
- The vertical clearance to tree branches and other objects should be a minimum of 2.5 m above the multi-use pathway surface. In underpasses and under structures more than 2.0 m in length, the minimum vertical clearance should be 3.0 m. A minimum 3.0 m vertical clearance is required for equestrians.

4.2.6. Illumination

Generally, illumination of multi-use pathways is not necessary, and may not be considered desirable by residents adjacent to a pathway. Locations where illumination is essential include intersections with roadways, underpasses and locations where night time security is considered an issue.

The following illumination levels are recommended for multi-use pathways. Horizontal illumination is measured at pavement level, and the uniformity ratio is calculated by dividing the average illumination level by the minimum illumination level.

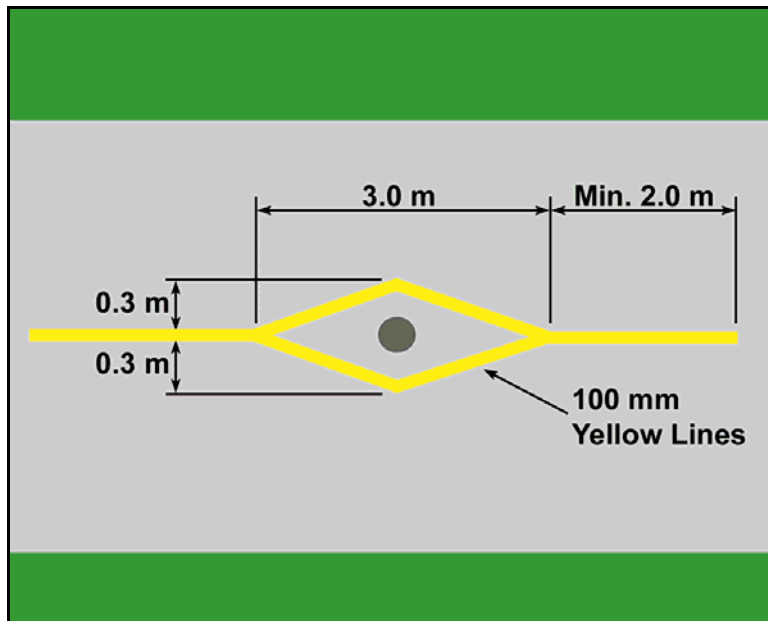
- Multi-use pathways should have a minimum average horizontal illumination level of 5 lux, with a minimum uniformity ratio of 6:1.
- Light standards should be located no closer than 1.0 m to the edge of the pathway, and if positioned over the pathway, should provide a minimum 2.5 m vertical clearance.
- Pathways should be illuminated for a distance of 25 m on either side of intersecting roads.
- At intersections with arterial and collector roads, illumination levels should be increased to a minimum average horizontal illumination level of 15 lux, with a minimum uniformity ratio of 4:1.
- Illumination levels in underpasses should be a minimum average horizontal illumination level of 45 lux, with a minimum uniformity ratio of 4:1.

4.2.7. Other Pathway Design Considerations

Other design considerations include the use of barrier posts, special considerations for bridges, and designing stairs to accommodate bicycles, as follows:

- Barrier posts — also known as bollards — are used to obstruct motor vehicle access to a pathway. They may be tubular or square, and should be 100 mm to 150 mm in diameter. Barrier posts should not incorporate any protrusions.
- A single barrier post is preferred in the centre of a pathway. Where multiple barrier posts are used, they should be used in odd numbers and spaced far enough apart (a minimum of 1.5 m apart) to allow passage by cyclists, bicycle trailers and wheelchair users. The use of odd-numbered posts ensures that pathway users travelling in opposite directions pass through different gaps between barrier posts, rather than attempting to pass through the same centre gap as would occur with an even number of posts.
- When barrier posts are installed at locations where multi-use pathways intersect roadways, they should be set back a minimum of 7 m from the roadway to allow service vehicles to park at the entrance of the pathway to avoid removal of the bollards or encroachment onto the adjacent roadway.
- Barrier posts should be painted with bright, light colours for visibility. Pavement markings should be used to divert pathway users away from barrier posts, as illustrated in Figure 4.16.

Figure 4.16 — Pavement markings for barrier post



- To accommodate service vehicles, one or more barrier posts may be removable. These removable barrier posts should be padlocked or otherwise secured to prevent unauthorized access.
- Railings on bridges should be a minimum of 1.4 m in height. For existing railings, a height of at least 1.1 m height is acceptable.
- Railings on bridges should incorporate a rub rail, as illustrated in Figure 4.17. The purpose of a rub rail is to prevent bicycle handlebars from catching on vertical supports of railing. A rub rail should be 200 mm high, and be installed between the elevations of 0.9 m and 1.1 m. A rub rail should provide a smooth surface along the length of the railing, and should be designed to function as a handrail for pedestrians.
- Railings at the end of a bridge should be continued a minimum of 2.0 m beyond the bridge end, and should be flared as illustrated in Figure 4.18.

Figure 4.17 — Railing with rub rail



Figure 4.18 — Railing flared at bridge end



- Where cyclists would be required to climb or descend stairs to reach a pathway, a ramp should be provided on both sides of the stairs to enable cyclists to roll their bicycle up or down the stairs, as illustrated in Figure 4.19. Handrails should be provided as specified in the BC Building Code, and should be located so as to avoid obstructing cyclists rolling their bicycles up or down the ramp.

Figure 4.19 — Bicycle ramp on stairs



4.3. Crossings

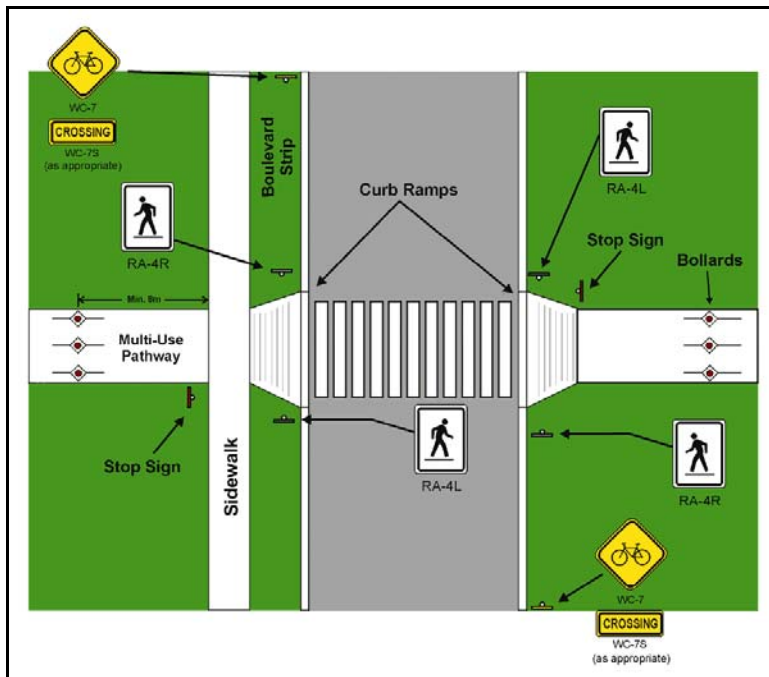
The critical locations on a bicycle route or pathway are where these facilities intersect major roads. Crossing treatments can be used to assist cyclists, pedestrians and others in crossing major roads, and to minimize potential conflicts with motor vehicles. The type of crossing treatment depends on the width of the intersecting road, the volume of motor vehicle traffic, and the number of cyclists, pedestrians and others using the crossing. This section provides an overview of crossing treatments — including marked/signed crossings, median islands, signalized crossings, grade-separated crossings and railway crossings — that can be applied throughout the bicycle network.

4.3.1. Marked Crossings

A marked bicycle crossing resembles a marked pedestrian crossing, with signage and pavement markings identifying the crossing. Applicable guidelines include:

- Marked crossings are appropriate in the following conditions:
 - Relatively low-volume roads up to 5,000 vehicles per day — local streets, neighbourhood collector roads.
 - Posted speed of 50 km/h or less.
 - Consistent gaps in traffic flow.
 - Low number of cyclists and others crossing road.
- Signage requirements for marked crossings are illustrated in Figure 4.20.

Figure 4.20 — Marked crossing signage



- Marked crossings can be supplemented with curb extensions and/or raised crosswalks as illustrated in Figures 4.21 and 4.22, in order to reduce the crossing distance, slow motor vehicles at the crossing, increase motorist awareness of the crossing and increase the visibility of cyclists and pedestrians.

Figure 4.21 — Marked crossing with curb extensions

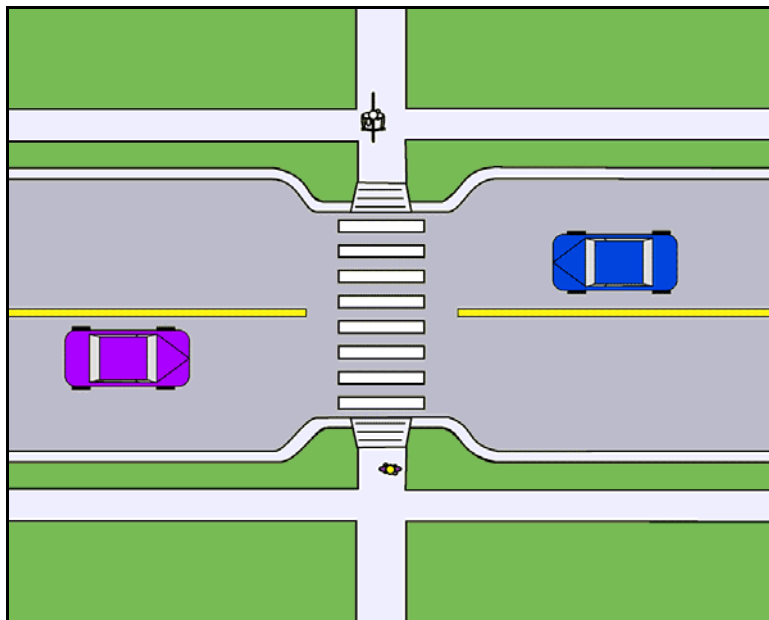


Figure 4.22 — Marked crossing with raised crosswalk



- Yield signs or stop signs should be used to control pathway traffic at marked pathway crossings. Yield signs are generally used at low-volume intersections such as driveways and local streets with little traffic, as illustrated in Figure 4.23.

Figure 4.23 — Yield signs at marked pathway crossing



- Where a pathway parallel to a roadway crosses an intersecting road, the pathway should be aligned so as to direct pathway users to cross in crosswalk, as illustrated in Figure 4.24. This configuration maximizes the visibility of pathway users to motorists. Existing pathways which cross intersecting roadways away from an intersection should be redirected so as to direct pathway users to cross at intersection, as illustrated in Figure 4.25.

Figure 4.24 — Parallel marked pathway crossing

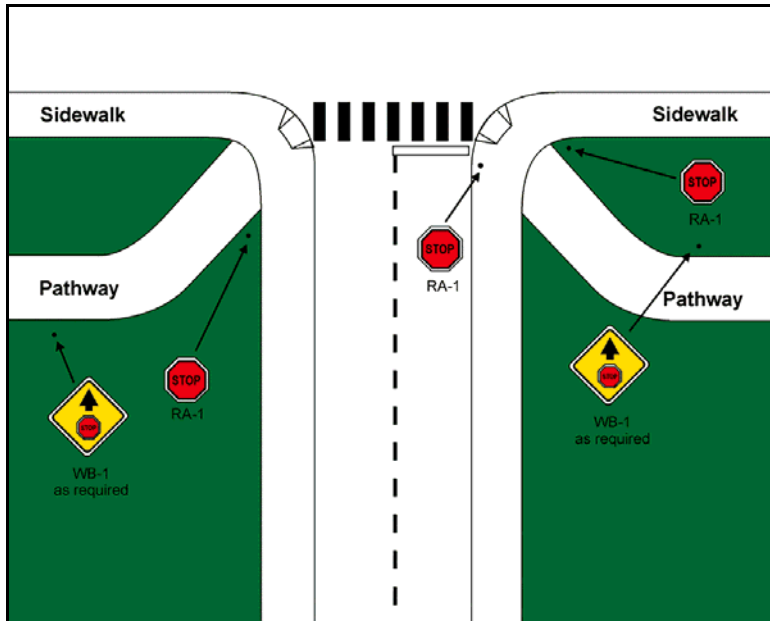


Figure 4.25 — Parallel pathway redirected to intersection

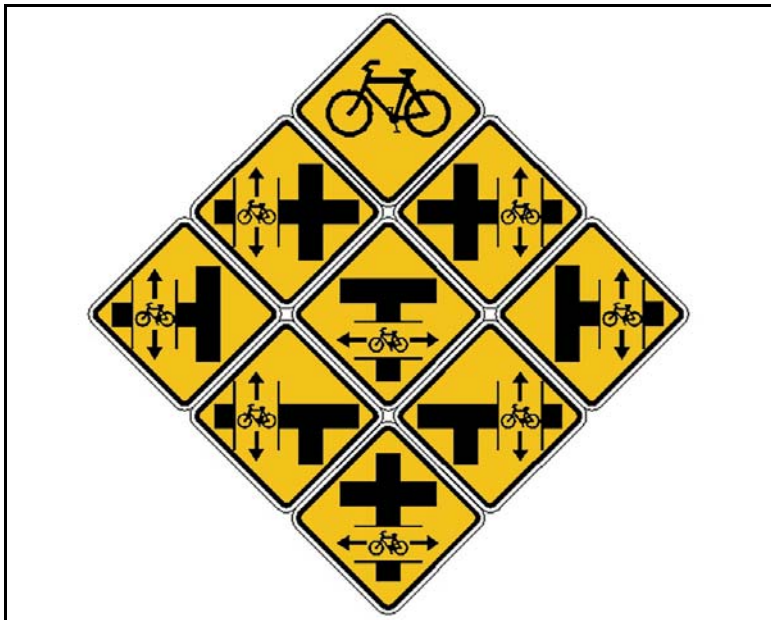


- Where a pathway parallel to a roadway crosses an intersecting road, “Crossing Ahead” signs should be used on the parallel road to alert motorists to the pathway crossing, as illustrated in Figures 4.26 and 4.27.

Figure 4.26 — “Crossing Ahead” sign



Figure 4.27 — “Crossing Ahead” sign configurations



4.3.2. Bike Box

Key design features of a bike box include:

- A bike box should be a minimum of 3 m deep, and desirably 4 m deep. This provides sufficient space for cyclists to manoeuvre within the bike box.
- The bike box should be coloured red. An option for colouring the bike box is an epoxy-based product such as SRM Grip, which is durable and provides skid resistance.
- The stop bar for motor vehicles should be indicated with the sign shown in Figure 4.28.
- At actuated signals, a detector loop should be incorporated within the bike box to provide cyclists the ability to actuate the traffic signals. The loop should be indicated with a bicycle detector pavement marking, as described in Section 4.3.5.

Figure 4.28 — Bike box sign



4.3.3. Median Island

A median island crossing incorporates a raised island located on the centreline of the road, separating opposing directions of traffic. The median island allows cyclists and pedestrians to cross one direction of traffic at a time, thereby reducing crossing delay. Applicable guidelines include:

- Median islands are appropriate in the following conditions:
 - Moderate-volume roads up to 10,000 vehicles per day — collector and arterial roads.
 - Few simultaneous gaps in both directions of traffic.
 - Interruption of traffic flow with signals is not desired.
 - Moderate number of cyclists and others crossing road.

- Gaps may be provided in the island to accommodate pathway users, and can be offset to discourage cyclists from riding across the crossing without checking for on-coming traffic on the far side of the island, as illustrated in Figure 4.31. The offset should be configured so that pathway users turn to the right on the median island to face oncoming traffic.

Figure 4.31 — Offset median island pathway crossing



- Dimensions and signage requirements for median island pathway crossings are illustrated in Figure 4.32. To minimize the potential for signs on the median islands to obstruct motorists' view of pathway users on the island, the length of the island indicated in Figure 4.32 as "varies" should be at least 3.0 m.

4.3.5. Signalized Crossings

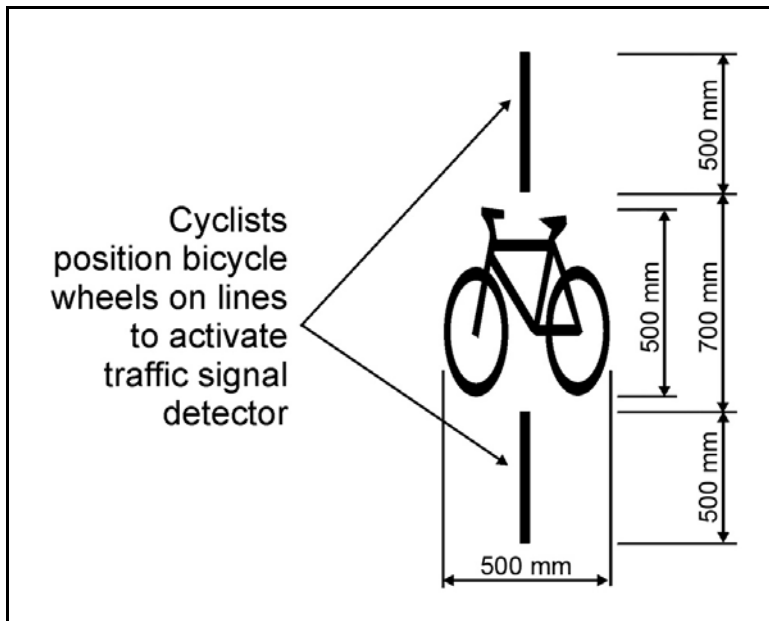
Where high traffic volumes and/or traffic speeds on a major road mean that cyclists and other pathway users cannot safely cross the road, even with a median island, a traffic signal may be required. Applicable guidelines are:

- Signalized crossings are appropriate in the following conditions:
 - Higher-volume roads — arterial roads, expressways and highways.
 - Higher traffic speeds on major road — posted speeds of 50 km/h or more.
 - Consistent flow of traffic with few gaps.
 - High number of cyclists and others crossing road.
 - Greater crossing distance (four or more lanes).
 - Limited visibility of crossing location for motorists.
- Traffic signals can be actuated via pushbuttons, in-ground detectors and/or video detection. Detectors should be marked as illustrated in Figures 4.33 and 4.34 so that cyclists are better able to actuate the detectors. A minimal delay in signal actuation is desirable to minimize cyclists and others crossing in advance of the signals changing.

Figure 4.33 — Bicycle detector pavement marking

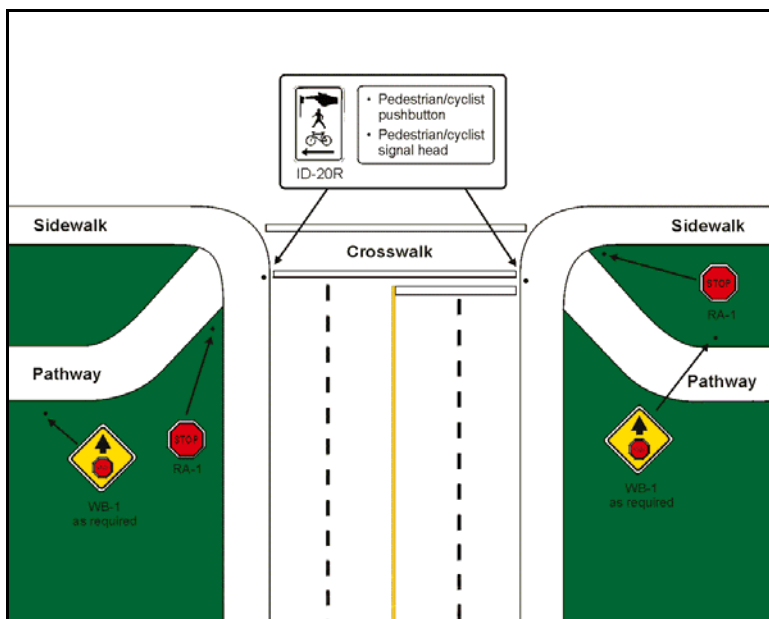


Figure 4.34 — Bicycle detector pavement marking



- Where a pathway parallel to a roadway crosses an intersecting road at a signalized intersection, the pathway should be aligned so as to direct pathway users to cross in the crosswalk, as illustrated in Figure 4.35. This configuration maximizes the visibility of pathway users to motorists.

Figure 4.35 — Parallel pathway signalized crossing



4.3.6. Grade Separation

Grade-separated crossings are provided where it is not possible or desirable to provide an at-grade crossing. Grade-separated crossings include overpasses and underpasses. Due to the relatively high cost (often more than \$1 million), grade-separated crossings are generally used only where no other crossing treatment is possible.

Grade separated crossings are applicable in the following conditions:

- High traffic volumes on major road being crossed.
- High traffic speeds on major road.
- Consistent flow of traffic with few gaps.
- High number of cyclists and others crossing road.
- Greater crossing distance (four or more lanes).
- Limited visibility of crossing location for motorists.
- Interruption of traffic flow with signals is not desired.

Key design guidelines for overpasses include:

- Minimum 4.0 m width.
- 1.4 m railings with rub rails.
- Minimum 5.7 m clearance over roadway.
- Minimum 7.0 m clearance over railway tracks.
- Maximum 5% grade on approach ramps in order to accommodate disabled users. This requirement often means that significant amount of property are required on each side of road for access ramps.

Key design guidelines for underpasses include:

- Minimum 4.0 m width.
- Minimum 3.0 m vertical height.
- Maximum 5% grade on approach ramps.
- A high level of illumination to minimize personal safety concerns.

4.3.7. Railway Crossings

Special care should be taken at locations where a bicycle route crosses railroad tracks at grade. Key guidelines include:

- Rubber or concrete track guards should be used between rails, as illustrated in Figure 4.36. The elevation of the track guard should be the same or within 6 mm of the elevation of the top of the rail.

Figure 4.36 — Rubber track guard at railway crossing



- At-grade crossings of railroad tracks should be designed to allow the cyclists to cross at right angles to the rails where possible. A wide curb lane, paved shoulder or bicycle lane should be widened to permit crossings to approach the tracks at 60 to 90 degrees, as illustrated in Figure 4.37. On spur tracks and other rail lines with speed limits of less than 15 km/h, compressible flangeway fillers can also be used to reduce the risk of a bicycle wheel being caught in the flangeway, as illustrated in Figure 4.38.

Figure 4.37 — Bicycle lane diverted at angled railway crossing



Figure 4.38 — Compressible flangeway filler

