Active Transportation Design Guide for Yukon Highways

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Yukon

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- Carcross
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- Pelly Crossing
- Carcross Tagish First Nation
- Liard First Nation
- Whitehorse

Yukon Government

- Community Development, Sport, and Recreation
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- Transportation Engineering
- Transportation Maintenance
- Transportation Planning

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Cover Photo Credit: John Howland

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Section A.
Introduction

A1. Context

Active transportation is an important means of transportation and recreation for people across the Yukon. Yukoners are a more active population than the average Canadian, with activity levels approximately 15% higher according to the Canadian Index of Wellbeing. People enjoy getting outside during all seasons to walk, cycle, roll, snowshoe, kicksled, cross-country ski, and use motorized recreational vehicles to explore the traditional territories of the 14 different First Nations that cover almost all of land in the Yukon.

Designing infrastructure for active transportation means thinking about people first. In the Yukon today, the highway is the dominant transportation infrastructure and there is limited active transportation infrastructure outside the City of Whitehorse, the capital city and service hub. Yet many Yukoners rely on active transportation to travel around their communities. There is also a lack of guidance for transportation practitioners in the Yukon related to the planning, design, operation, and maintenance of active transportation infrastructure within predominately rural highway rights-of-way. Some practitioners working on projects in the Yukon may refer to other design guides that lack important local context, such as winter maintenance. This can result in lower-quality active transportation infrastructure that could be more accessible, comfortable, and safe year-round.

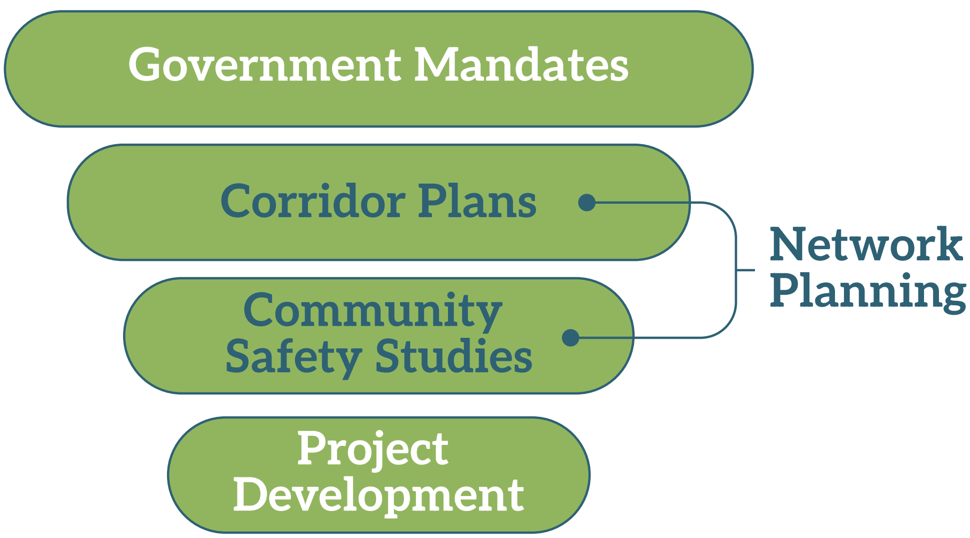
To promote better quality active transportation infrastructure, the Yukon Government worked with Urban Systems to develop a design guide that builds on national and international best practices in active transportation, but reflects the climate, geography, and active modes relevant to the Yukon.

A2. What is a Design Guide?

Network plans typically determine where highway trails should be located, then design guides provide recommendations on how to build highway trails.

For example, a community may work with the Yukon Government to create a corridor plan or community safety study that identifies the need for a highway trail to the local school. At the project development stage, the design guide would help engineers and planners decide on trail details, such as how wide it should be, how far it should be set back from the highway, and what kind of surface materials should be used.

Design guides are living documents that are regularly updated to reflect the leading practices in engineering and planning. They typically provide a range of recommendations to reflect different circumstances. Desirable or recommended treatments should be used in most circumstances, in order to create higher quality active transportation infrastructure that maximizes user safety, comfort, and accessibility. Constrained treatments are only acceptable in circumstances with limited right-of-way and challenging site conditions.



Design guides are flexible because the development of active transportation infrastructure is contextual. Designers must use their judgement to ensure projects respond to site-specific conditions and enhance safety and comfort for all travel modes, particularly vulnerable road users such as people walking and cycling. No single document can address the range of situations encountered during a design process.

Purpose

The purpose of the *Active Transportation Design Guide for Yukon Highways* is to:

- **Elevate quality** of infrastructure that is safer, more comfortable, and accessible for active transportation users
- **Clarify expectations** for designers across the Yukon to strive for a consistent level of quality
- **Offer "Made in Yukon" guidance** so that it's possible to build and maintain highway trails year-round for communities of different sizes and contexts.

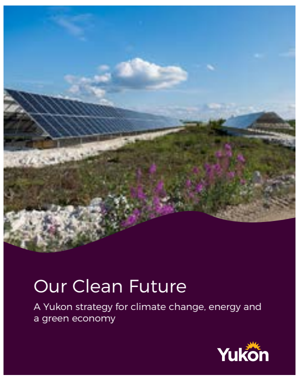
Scope

This Design Guide was developed specifically for new or retrofitted active transportation infrastructure within highway rights-of-way. The primary audience for the Design Guide is design practitioners in the engineering, planning, landscape architecture, and architecture fields, but it may also be a valuable resource for elected officials, community groups, and the general public.

The Design Guide is not intended to provide detailed guidance for motor vehicle-related design elements such as medians, travel lane widths, or parking lane widths. Guidance for these elements can be found in other documents, including municipal, territorial, and national standards and guidelines.

The Design Guide is focused on providing recommendations for more rural communities where right-of-ways typically have shoulders and ditches. In more urban communities where right-of-ways typically have curbs and gutters, designers should refer to the *City of Whitehorse Type 1 Trails Design Guide*.

A3. Relationship to Territorial Initiatives



Our Clean Future (2020)

This Design Guide was developed to align with and advance the goals of Our Clean Future: the Yukon strategy for climate change, energy, and a green economy. One of the actions of Our Clean Future is increase the use of active and public transportation, which is one of the steps towards reducing the Yukon's emissions to 45 percent below current levels by 2030. Highways and Public Works is committed to support this by incorporating active transportation into the design of highways and other Government of Yukon transportation infrastructure near communities. Increasing the number of people who walk, bike and use public transit is a key way to lower greenhouse gas emissions. By reducing the number of people driving vehicles, investments in public and active transportation also reduce congestion, improve air quality and help people lead active, healthy lives. Making it easier to get around without a vehicle can also contribute to more inclusive communities by providing an accessible and affordable way to get from one place to another.

Yukon Active Living Strategy (2012)

The Yukon Active Living Strategy seeks to improve health outcomes and quality of life for people across the territory by promoting physical activity. The 2012 update builds on the original vision with principles of health equity, informed decision-making, and collaboration. Recommendations are organized into strategic directions, including leadership, community capacity, enabling environments, social marketing, programs, and evaluation. Within the "enabling environments" category, the strategy recommends creating communities designed to encourage physical activity through walking, cycling, transit, and other forms of active transportation.

Yukon Motor Vehicles Act (MVA) - 2002

The MVA outlines the laws that govern the operation of all Yukon road users (including people driving motor vehicles, walking, cycling, and using other active modes), and defines the rules of the road and related offenses and sanctions. Any facility under the territorial government's jurisdiction shall comply with the Yukon MVA. At the time this Design Guide was released in 2025, the MVA was being updated to the become the new Traffic Safety Act that would recognize vulnerable road users. Timelines for implementation of the new Traffic Safety Act are not known at this time, therefore this guide presumes the existing MVA regulations, where trails are not defined separately from highways and people cycling must follow most of the same rules of the road as motor vehicles. Some leading treatments were not defined in the Yukon MVA, such as cross-ride pavement markings and bicycle signal head traffic controls. When the new regulations under the Traffic Safety Act comes into effect, the Design Guide will need to be reviewed and possibly updated to ensure compliance.

A4. Relationship to Existing Standards & Guidelines

The Design Guide does not outline mandatory standards or requirements. Rather, it provides recommended guidelines to assist the design practitioners in applying best practices to the planning, selection, design, implementation, and maintenance of active transportation facilities. The Design Guide is meant to supplement – not replace – any existing local, territorial, or national guidelines, standards, and regulations.

Furthermore, many local and regional governments rely on the reference documents listed below.

The Design Guide reflects a synopsis of the existing best practices and research that has been compiled with the applicability of the Yukon context in mind as of the time of publication in 2025. In general, the recommendations in the Design Guide align with the current national guidelines set out by the Transportation Association of Canada (TAC) and other provincial guidelines. The Design Guide goes beyond the existing guidance in places where appropriate for the Yukon's context, adding new material and covering some material in greater depth.

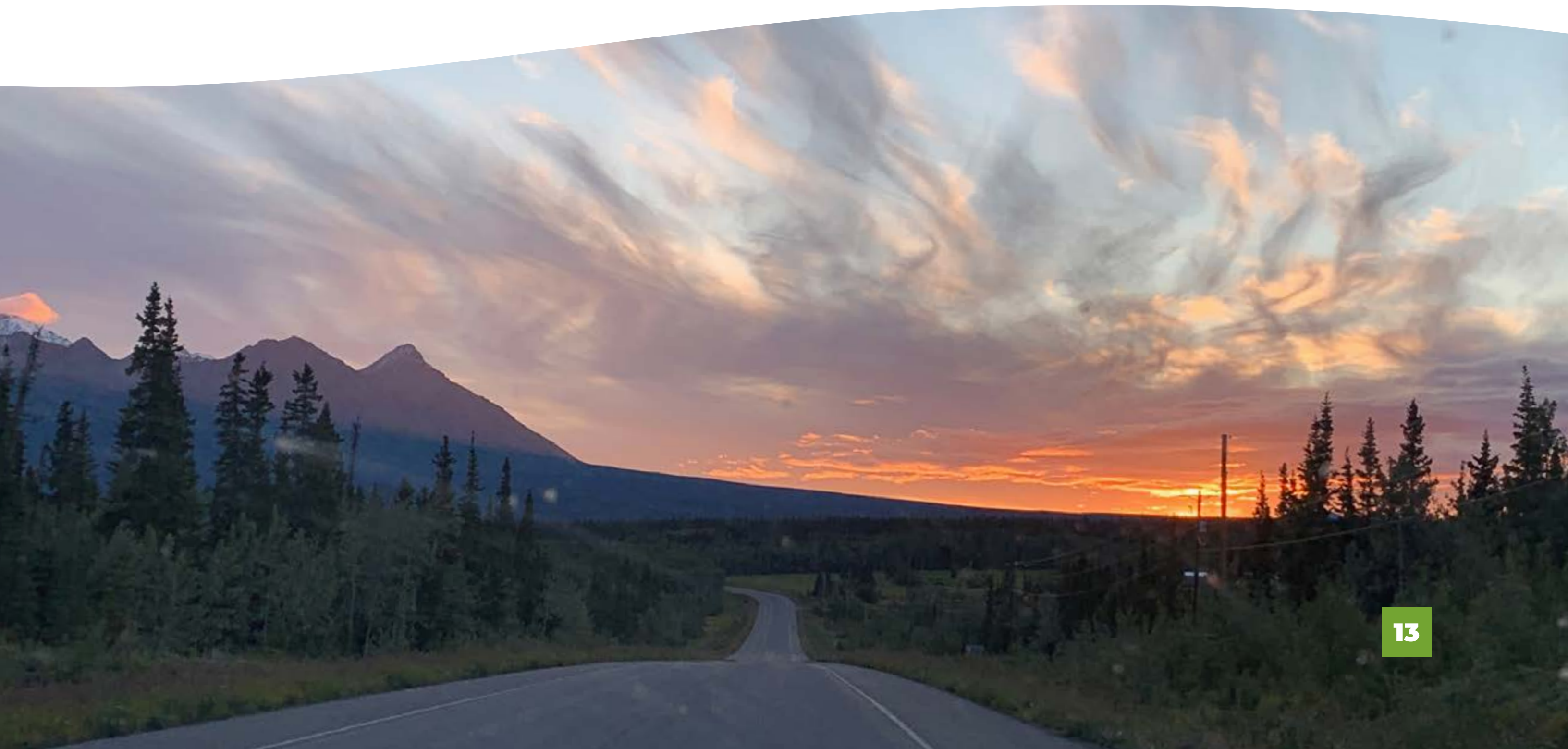
Basis of Design Guidance

The recommendations are intended to build upon existing pedestrian, bicycle facility, and trail design guidance provided at the national level in Canada by the Transportation Association of Canada (TAC) through a range of documents, including:

Document	Year
Pedestrian Crossing Control Guide	2018
Canadian Guide to Traffic Calming: Second Edition	2018
Geometric Design Guide for Canadian Roads	2017
Manual of Uniform Traffic Control Devices for Canada (MUTCDC): Sixth Edition	2021
Traffic Signal Guidelines for Bicycles	2014
Bikeway Traffic Control Guidelines for Canada – Second Edition	2012
Guide for the Design of Roadway Lighting	2006

The recommendations also draw upon experience and lessons learned from other design guidelines and resources from Canada and around the world:

Organization	Document	Year
BC Ministry of Transportation & Infrastructure	*British Columbia Active Transportation Design Guide*	2019
TransLink	*BC Parkway Intersection Design Guidelines*	2019
National Association of City Transportation Officials (NACTO)	*Don't Give Up At the Intersection – Designing All Ages and Abilities Bicycle Crossings*	2019
Government of Alberta	*Alberta Bicycle Facilities Design Guide*	2020
Canadian Standards Association (CSA)	*B651-18 – Accessible Design for the Built Environment*	2018
Michigan Department of Transportation	*Sidepath Intersection and Crossing Treatment Guide*	2018
Netherlands CROW	*Design Manual for Bicycle Traffic*	2016
Federal Highway Administration (FHWA)	*Small Town and Rural Multimodal Networks*	2016
Federal Highway Administration (FHWA)	*Separated Bike Lane Planning and Design Guide*	2015
Massachusetts Department of Transportation (MassDOT)	*Separated Bike Lane Planning & Design Guide*	2015
Alberta Transportation	*Trails in Alberta Highway Rights-of-Way Policies, Guidelines, and Standards*	2015
City of Toronto	*Toronto Multi-Use Trail Design Guidelines*	2015
National Association of City Transportation Officials (NACTO)	*Urban Bikeway Design Guide*	2014
Ontario Traffic Manual (OTM)	*Book 18: Cycling Facilities*	2014
City of Oulu	*Winter Maintenance Guidelines*	2024



In addition to these national and international guidelines, the Design Guidelines also build upon a number of Yukon Government plans, policies, and guidelines including but not limited to the following:

Organization	Document	Year
Yukon Government	*Public and Active Transportation Best Practices in Remote and Cold-Climate Jurisdictions*	2019
Yukon Government	*Yukon Supplement to the Pedestrian Crossing Control Guide and Pedestrian System Connectivity Assessment Guide*	2014
Whitehorse	*Type 1 Trail Design Guidelines*	2014
Haines Junction	*Trail Planning Process: What We Heard Report from*	2018
Alaska	*Statewide Active Transportation Plan*	2019
Fairbanks	*Non-Motorized Active Transportation Plan*	2021

A5. Design Guide Organization

The Design Guide is divided into six chapters:

Section A introduces the context, purpose, and scope of the Design Guide.

Section B describes the framework for network planning in the Yukon.

Section C provides overall guidance on key design parameters, including the target user, highway context, and seasonal conditions.

Section D provides more detailed guidance on specific design treatments, including physically-separated facilities, visually-separated facilities, and mixed-traffic facilities.

Section E provides guidance on the elements of safe, comfortable, and accessible intersections, signals, driveway crossings, grade-separated crossings, and roundabouts.

Section F provides guidance on temporary conditions, including rapid implementation and construction zones.

Section B.
Network & Planning Framework

B1. What is Active Transportation?

Active transportation can take many forms and is continually evolving as new technologies emerge. Active transportation most commonly refers to "human-powered" travel, such as people walking, cycling, rolling, and using winter-based modes. People who use active transportation are often referred to as vulnerable road users, because they are disproportionally killed and injured by collisions with motor vehicles. To improve safety for all road users, people using active transportation need special consideration when designing highways.

Modes of Active Transportation

Walking includes people walking alone or with friends, family, or pets, people jogging, and people using mobility devices such as wheelchairs, walkers, and strollers.

Cycling includes all people travelling by bicycle using a full range of types of bicycles such as bicycles with trailers, children's bicycles, recumbent bicycles, cargo bicycles, electric bicycles, unicycles, adult tricycles, fat tire bicycles, and bicycles built for people with mobility challenges.

Rolling includes people skateboarding, longboarding, scootering, in-line skating, and roller skiing.

Winter-based modes include modes that require conditions only available during colder winter months such as cross-country skiing, dogsledding, fat-tire biking, ice skating, kicksledding, and snowshoeing

People using small, one-person electric vehicles known as **micromobility devices** such as e-scooters, electric skateboards, hoverboards, segways, and self-balancing electric unicycles.

Mobility for All Ages, Abilities, & Seasons

Design professionals should aspire to create highway trails that are accessible, comfortable, and safe for most people, regardless of age or ability. This is often referred to as 'All Ages and Abilities', 'AAA', or 'Triple A' facilities in active transportation design. Planning and designing for people of all ages and abilities is a national and international best practice that should be aspired to for all active transportation facility design and network implementation. Further, availability of highway trails at all times of day, in all seasons, and in all weather conditions help to encourage use of the trails year-round and helps to make for reliable travel time for users from one day to another. For a trail to be available during all seasons, maintenance and operations must considered at the outset of the planning and design process and on an ongoing basis.

Active Transportation in the Yukon

Common Challenges for Design

Auto-Oriented Context: Much of the Yukon's transportation network consists of rural, two-lane, chipseal highways designed for motor vehicles, making travel less safe for people using active transportation.

Constrained Terrain: The mountainous topography and abundant watercourses of the Yukon, along with decentralized community design, mean that highway trails are often physically constrained. This creates challenges in designing safe, protected active transportation facilities, as these trails are frequently disconnected and feature steep alignments, making separation from motor vehicles more difficult.

Crossings: The lack of safe crossing opportunities can discourage active transportation users and create barriers when the highway travels through a community.

Heavy Vehicles: The Yukon's highways serve as goods movement routes. Over-sized, heavy, slow moving vehicles using the highway, along with intersections over-sized to accommodate wide-turning vehicles, make it more difficult for designers to reduce risk for vulnerable road users.

Trail User Mix: There is demand for highway trails from both people using active transportation, people using motorized recreation vehicles, and sometimes people on horses, requiring designers to consider how to safely manage speed differences.

Wildlife: The Yukon is home to large species of wildlife that are drawn to roadsides for grazing, requiring designers to consider how to mitigate surprise encounters on highway trails.

Winter Conditions: The long Yukon winter increases the need for lighting, snow clearance, and maintenance on highway trails, but the resources to meet these needs are limited, especially when combined with year-round maintenance needs such as gravel removal and vegetation trimming.

Common Benefits of Active Transportation

Around the world, communities are realizing the substantial benefits of investing in active transportation. These investments create a more balanced, accessible, and equitable transportation system that also helps to reduce costs. Globally, active transportation is recognized for improving quality of life, promoting health, enhancing safety, and stimulating local economies. These worldwide benefits hold significant value for the Yukon as well, where similar investments could build more connected, resilient, and vibrant communities.

Common Benefits

Equity benefits. Accessibility, affordability, and safety barriers can make it difficult to reach daily needs and participate in community life. Active transportation supports a more equitable transportation system, by providing an option for people who do not want to drive or cannot drive, such as children, youth, older adults, people with disabilities, recent immigrants, and people with low income.

Environmental benefits. Transportation is the largest contributor to greenhouse gas (GHG) emissions in the Yukon, according to the Our Clean Future (Yukon's strategy for climate change, energy, and green economy). Active transportation can help to reduce motor vehicle trips, congestion, air pollution, and GHG emissions. Promoting active transportation also helps with efforts towards climate change mitigation while supporting the protection and improvement of the natural environment.

Economic benefits. Active transportation, as part of a balanced transportation system, is one of the drivers of success for economic diversity and prosperity. Communities that are attractive for people using active transportation can draw more visitors, who can in turn become patrons of local services and amenities. Active transportation also provides more choices for people travelling to work, school, services, and other daily destinations, which is essential for Yukoners who would prefer to spend less on transportation or who do not have access to motor vehicles or transit.

Health benefits. A significant body of research has found links between investments in active transportation and increased rates of physical activity and healthier communities. Regular physical activity reduces the risk of early death and numerous chronic diseases. Physical activity has been proven to improve psychological well-being and prevents health complications from weight gain. While the benefits of physical activity have been well documented, low levels of physical activity in children and adults is still prevalent and continues to increase. Active transportation is one of the most affordable and accessible ways for Yukoners to add exercise to a daily routine.

Societal benefits. Active transportation encourages social interaction, creating opportunities for face-to-face interactions with members of the community and building trust, respect, understanding, and a sense of co-operation among members of the community. These social connections are found to be particularly important for youth, as they can develop sustainable travel patterns at an early age that can continue later in life. Social connections are also important for older adults, enabling them to stay active for longer and maintain physical and mental health.

Road Safety benefits. Enhancing the safety of the Yukon's highways is essential, and well-designed active transportation facilities play a crucial role in this effort. By providing dedicated, visible spaces for pedestrians and cyclists, these facilities not only reduce collision risks but also encourage more people to choose active transportation, leading to fewer vehicles on the road and less traffic congestion. In this way, mode shift towards active transportation creates a safer, more efficient transportation system that benefits all road users.

Active Transportation in Yukon First Nations

In addition to the equity, environmental, economic, health, societal, and road safety benefits listed earlier, active transportation offers some unique benefits distinct to Indigenous people, who make up approximately 25% of the population in the Yukon.

Benefits distinct to Indigenous People

Connection to Land and Culture. It is important for Indigenous people to maintain a connection with the past, present and future on their lands. Active transportation can be a way to recognize, preserve, and celebrate this connection between people and land by providing continued access to traditional resources and cultural practices. Trails, signage, and rest areas can improve access to important community sites, help share information about Indigenous history, and create opportunities for gathering and storytelling.

Tourism and Economic Development. People from all around the world travel to the Yukon to enjoy the outdoors and try different forms of active transportation, such as bike touring, kicksledding, paddling, trekking, and mountain biking. Some Indigenous communities have used the growing interest in outdoor tourism to create economic development opportunities for their members. For example, Carcross Tagish First Nation launched the Single Track to Success program in 2006 with the aim to build an unparalleled network of single-track trails on Montana Mountain. The program was successful in increasing access to a sacred site for the community and providing local youth with summer jobs.

Justice. Providing access to safe and connected active transportation routes for Yukon First Nations is an act of justice. Indigenous peoples should be able to safely travel to and from self-governed lands, traditional lands, neighbouring Indigenous communities, and neighbouring settler communities. The lack of transportation options and safe active transportation facilities can lead to serious collisions, injuries, fatalities, and threats to personal safety. The Yukon Government created its own strategy dedicated to Missing and Murdered Indigenous Women, Girls and Two-Spirit+ People, entitled “Changing the Story to Upholding Dignity and Justice.” The Implementation Plan identifies transportation as a key action area and calls for safe and affordable transportation options to and between Yukon communities.

B2. Planning Considerations & Network Principles

Network Planning Principles

Designers should strive to develop highway trails that contribute to safe, inclusive, direct, and cohesive active transportation networks. Networks of highway trails that are strategically connected to other active transportation facilities and end-of-trip facilities enable people to walk, cycle, or roll throughout their community.

Given the Yukon's small population, it is very possible that typical minimum thresholds or warrants may not be met for a given facility type or a crossing location. Even in areas with low levels of observed demand, there may be higher levels of latent demand from people who are interested in walking or cycling more, if there were higher quality infrastructure available. With this in mind, planners and design practitioners should consider how an active transportation facility may support overall network continuity.

The following guiding principles will help designers:

- **Safe:** Routes minimize the risk of injury and death for vulnerable road users.
- **Inclusive:** Routes meet the needs of different ages and abilities.
- **Direct:** Routes provide convenient access to community destinations
- **Cohesive:** Routes are predictable, recognizable, and consistent, making them intuitive for users of all modes.
- **Attractive:** Routes create an enjoyable experience by incorporating landscaping, public art, and amenities.

Network Planning Process

Before designing individual active transportation facilities, it is important to first ensure that a long-term plan for developing the active transportation network along with support programs and policies is in place. This plan can take the form of an active transportation plan, community safety study, and/or be part of an integrated multi-modal corridor plan, which includes considerations for active transportation, driving, goods movement. A list of high-level planning steps is provided below in order to assist planning and design practitioners in beginning the process of developing a plan to promote active transportation.

1. Assess existing conditions

- Collect data (e.g. active transportation volumes) and conduct technical analysis to understand existing baseline conditions for active transportation.
- Work with the community, project partners, and rights-holders (e.g. First Nations governments, local governments, accessibility groups, active transportation advocacy groups, and motorized recreational vehicle groups) to identify issues and opportunities.
- Identify connections that are missing or requiring improvement.

2. Establish a vision and goals

- Work with the community, project partners, and rights-holders to confirm aspirations, priorities, and goals.
- Consider local and regional connections.
- Develop a vision statement with supporting goals and measurable targets.

3. Develop a long-term plan

- Identify significant destinations and desire lines, considering existing conditions and future land development.
- Explore all relevant local and regional plans and policies.
- Consider the transportation network as a whole, including multi-modal and regional connections.
- Assess local needs and draft recommendations.
- Work iteratively with the community, project partners, and rights-holders to achieve community validation and establish a preferred network.

4. Develop an implementation plan

- Analyze network scenarios.
- Assess the cost and timelines of each individual improvement.
- Create a project schedule, prioritizing short, medium, and long-term priorities, including identifying immediate needs that could be addressed through rapid implementation solutions.
- Identify key project partners and departments who are responsible for implementing specific parts of the plan.
- Develop a monitoring and evaluation plan: Establish a plan for gathering data and feedback once construction begins Utilize the data and feedback in an iterative process to update the plan and improve the active transportation network.

Photo Credit: John Howland

Context-Sensitive Design

The planning and design of active transportation facilities can differ substantially depending on whether they are located in a remote or community context. These contexts tend to have different road users, trip purposes, land uses, neighbourhood designs, distances between destinations, road classifications, and community expectations. In all contexts, safety for active transportation users is a key consideration that should be prioritized in all planning and design work.

Remote-Context Highways: Highways that pass through areas with limited social or economic links to regional centres, with large distances between communities and destinations. There may be less demand for active transportation in these areas.

Community-Context Highways: Highways that pass through or near communities with concentrations of residents, services, businesses, and community destinations. In some communities, a territorial highway is also the primary main street. The highway mandate of safely and efficiently moving people and goods may conflict with the local community's desire for facilitating active transportation, commerce, and community activity.

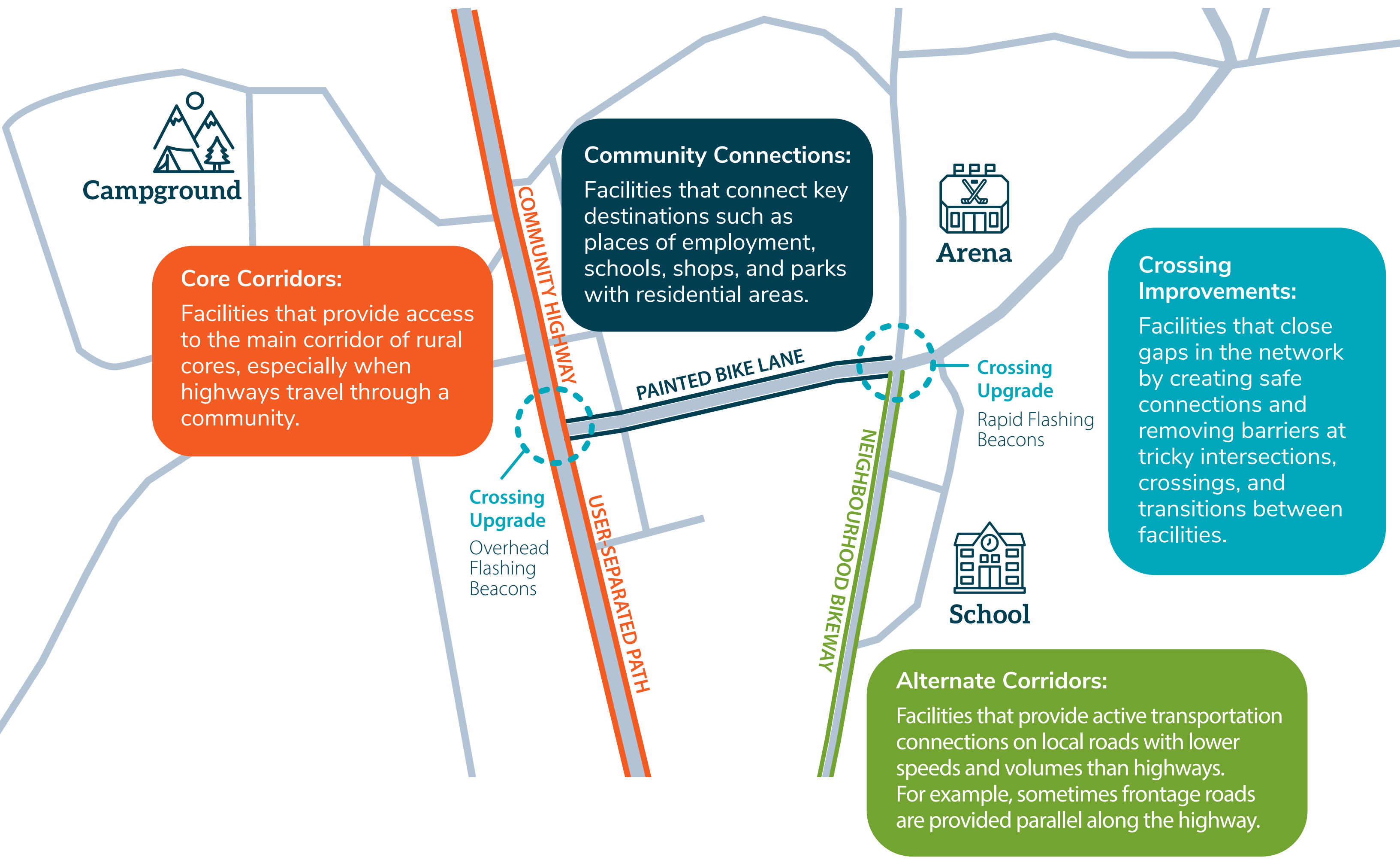
Local Roads Connected to Highways: While this Design Guide is focused on highways, sometimes local roads connect to highways that run through rural communities. The shorter trip distances, diversity of amenities, and concentration of population can make rural communities with developed centres ideal for active transportation. As a result, it's important for designers to consider how to create active transportation connections between homes, schools, shops, and other important community destinations.

Photo Credit: John Howland

Creating Continuous Rural Networks

Outside Whitehorse, many smaller communities across the territory have limited active transportation infrastructure. Every project creates an opportunity for designers to redesign or retrofit highways to support active transportation in rural and remote communities. Over time, each new project will create a new link in the network. Here are a few sample projects that can create rural networks.

Figure 1. Potential Rural Active Transportation Network



Adapted from US DOT Small Town and Rural Multimodal Networks (2016)

Project Development Process

Active transportation infrastructure projects require thoughtful planning and design, just like motor vehicle infrastructure projects. After the network planning process is complete, design practitioners can initiate the project development process to design and construct a highway trail. A list of high-level project development steps is provided below, adapted from the BC Supplement to TAC. Planning and design practitioners should also adhere to project requirements of First Nations governments, local governments, and the Yukon Government.

1. Engage with project partners

- Communicate regularly with external project partners (e.g. First Nations governments, local governments, accessibility groups, active transportation advocacy groups, and motorized recreational vehicle groups) as well as internal partners (e.g. maintenance, sports and recreation, road safety) throughout the project development process to gather feedback.
- Refer to Yukon Government's public engagement strategy and consider how different project partners may have different desired levels of engagement. For example, the broader community may be informed about the project, while directly impacted First Nations and local governments may be directly consulted or involved in decision-making.

2. Assess existing conditions

- Review available background information (e.g. active transportation volumes, traffic volumes, collision data, roadway geometry, pavement condition, network plans, community land use plans, etc.)
- Draft problem statement based on the existing highway conditions

3. Assess future conditions

- Conduct technical analysis to determine anticipated highway conditions based on future highway traffic, land use, and other factors that impact active transportation
- Update problem statement based on desired future highway conditions

4. Develop and screen options

- Establish design criteria and develop options for active transportation infrastructure
- Screen options based on their ability to address problem statement, using tools such as Multiple Account Evaluation (MAE)
- Complete risk assessment for preferred option, including property, environmental, geotechnical, contingency, archeological, and cultural heritage considerations

5.

Prepare preliminary, conceptual, and functional designs

- Confirm design criteria and prepare design drawings (see **Appendix B**)
- Refine preferred options iteratively, progressing to a finer-scale and higher-level of technical detail to confirm feasibility
- Initiate detailed technical studies when appropriate, such as field surveys, site surveys, archeological, cultural heritage, and geotechnical studies
- Prepare tender drawings, specifications, and other documents required for construction

Micromobility

E-bikes and other forms of micromobility are rapidly growing in popularity, thanks in part to a popular rebate program offered by Yukon Government that has seen uptake across the territory, including Dawson City, Beaver Creek, Old Crow, and Whitehorse. In rural contexts, e-bikes have the potential to replace motor vehicle trips and attract new riders, because they reduce the effort required to cycle, flatten hills, and enable longer travel distances. From a design perspective, the uptake of micromobility has implications for highway trail design, including:

- **Parking:** End-of-trip facilities for conventional bikes may not be suitable for e-bikes and other micromobility devices with different dimensions and charging needs.
- **Speed:** Conflicts for micromobility devices are unique due to their relative speed and spatial relationship with motor vehicles, bicycles and pedestrians.
- **Surface quality and roadway hazards:** Potholes, debris and wet weather conditions are particularly dangerous for micromobility vehicles with small wheels.
- **Visibility:** Some micromobility devices may be less visible due to their lower profile, lack of taillights, and faster speed.

There are a wide range of e-bikes available with different operating characteristics. As of 2024, the Yukon MVA definition of e-bikes includes limits on motor power. Designers should review local and territorial e-bike regulations at the beginning of projects.

For example, the City of Whitehorse's E-bike Bylaw permits Class 2 and Class 3 e-bikes on some active transportation facilities, but not others. The below table describes the different classes of e-bikes, as adapted from the City of Whitehorse.

Table 1. E-bike Classification

	Motor Actuation	Max. Continuous Watts	Max. Speed Before Motor Cutoff	Aligns with Yukon MVA E-Bike Definition
Class 1	Pedal-assist	500	32 km/hr	Y
Class 2	Pedal-assist or throttle	500	32 km/hr	Y
Class 3	Pedal-assist or throttle	750	45 km/hr	N

Multi-Modal Integration

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

- **Safe Connections:** Where sidewalks, bicycle facilities, or other active transportation infrastructure is present nearby, ensure there are safe crossings and that those facilities provide a continuous connection to the bus stop, ferry terminal, or airport.
- **End-Of-Trip Facilities:** Provide end-of-trip facilities to encourage both travellers and employees to travel to and from the by bicycle. The facilities may include short-term bicycle parking (e.g. bicycle racks), long-term bicycle parking (e.g. lockers or bicycle room), showers, changing rooms, repair stands, tools, and maps and related information.
- **On-Board Storage:** Make it easy for travellers to bring their mobility aids and active transportation gear with them on the trip by providing on-board storage options. This could look like front-mounted bicycle racks on buses, designated seating for people with mobility aids on buses, dedicated bike racks inside buses and ferries, transit vehicles capable of at grade-boarding for strollers, wheelchairs, and other mobility aids, and offering boxes for packing bikes at airports.

B3. Accessible Active Transportation

Universal Design

Universal design means creating highway trails that are accessible, welcoming, and usable for people of different ages and abilities. Designers should aim to accommodate diverse needs from the outset of a plan or project, because when the built environment is designed to be inclusive, everyone benefits. For example, curb ramps were primarily intended to provide access for people that use wheelchairs, but they also benefit parents with strollers, people pulling luggage or delivery carts, small children cycling, seniors using walkers, and many others who may not have been the priority user for the design.

Promising practices for inclusive design treatments and accessible active transportation are constantly evolving. To stay up to date, designers should learn from people with lived experience – they are the experts when it comes to their own accessibility needs.

Designing for Different Needs

Universal design is not simply about mobility (such as wheelchair access) – there are other physical, sensory, and cognitive needs that should be considered. It is important to understand the capabilities and traits of a facility's expected users in order to determine how to best to meet their needs. Context-specific trade-offs and considerations may be necessary in order to achieve the highest possible level of accessibility for active transportation facilities. However, designers should strive to ensure that when a barrier is removed for one group, a new barrier is not being introduced to a different group.

Mobility

Mobility challenges are common, especially among older demographics. This group includes:

- People who use mobility devices such as wheelchairs and mobility scooters;
- People who can walk but require an aid such as a cane or walker; and
- People who may walk without an aid but require frequent rests.

For people with mobility challenges, it's essential for active transportation infrastructure to include accessible slopes and grades, shorter crossing distances, firm, non-slip surface materials, facility widths comfortable for passing, pathways clear of obstructions, regular and seasonal maintenance. Snow accumulation can be a major barrier for people using mobility devices.

Strength and Dexterity

Many people experience challenges related to reaching, stretching, dexterity, and strength, frequently as a result of arthritis, muscular dystrophy, or nervous system complaints. Strength and dexterity challenges can influence the design of pedestrian amenities and accessibility treatments. Examples of designs to avoid include pedestrian signals with pressure resistance on call buttons and non-graspable handrails.

Sight

Sight loss exists on a spectrum from completely blind to partially-sighted, with variations including limited field of vision, loss of central vision, loss of peripheral vision, night blindness, and loss of overall acuity (blurriness).

Sight loss reduces a person's ability to see or identify objects that are necessary for navigating the road, including traffic signs and signals, crosswalks, obstructions, and other road users. Sight loss may impact depth perception, the ability to judge the speed of bicycles and motor vehicles, and the ability to see colour or visual contrast. This can make it challenging to identify tripping hazards and different pavement materials. Sight loss can also affect a person's ability to negotiate movement with other road users, as interactions between users are often communicated through eye contact, hand gestures, and other visual forms of communication.

Hearing

Hearing impairments may be mild, moderate, severe, or profound. People who are 'deaf' typically have profound hearing loss, which implies little or no ability to hear. Hearing impairments make it more difficult for people to communicate with each other as they travel and to detect other road users, such as fast-moving bicycles and motor vehicles.

Comprehension

People with cognitive or learning disabilities may encounter difficulties interpreting signage, wayfinding, and other complicated information or using machines such as transit ticket machines. The same may be true for people with language barriers. Active transportation facilities should be designed to be intuitive and easy to navigate, with layers of information provided to aid navigation without too much complexity in colour patterns.

Universal Design Treatments

There are a wide variety of design treatments that can make highway trails more accessible and inclusive. These elements are introduced in the below table and have been embedded in the recommendations throughout the Design Guide.

Table 2. Universal Design Treatments by Section

Design Treatment	Section	Priority User
Slopes and grades	Section C	People with mobility needs
Crossings	Section E	People with mobility needs
Surface materials	Section D	People with mobility needs
Facility widths	Section D	People with mobility needs
Maintenance	Section C	People with mobility needs
Tactile walking surface indicators (TWSIs)	Section E	People with sight loss
Pavement markings	Section D	People with sight loss, hearing loss, and comprehension needs
Signage	Section D & Section E	People with sight loss, hearing loss, and comprehension needs
Audible signals	Section E	People with sight loss

Section C.
Design Considerations

C1. User Characteristics

The design of highway trails is contextual. Designers should exercise every effort to comply with the guidelines where possible; however, design flexibility is needed to reflect site-specific conditions and to enhance safety and comfort for all travel modes, particularly vulnerable users such as people walking and cycling. It is critical that the guidelines contained in this document are applied by a design professional exercising sound professional judgement. In some cases, not all recommendations of the guidelines will be achievable, and/or there may be trade-offs required between various modes of transportation. Where a trade-off is required, designers should aim to protect the vulnerable users.

The "design user" or "design vehicle," refers to the assumed user dimensions and speed potential that are used to establish the minimum design requirements for a given facility. Designers must consider the range and volume of different design users that are expected to use the highway trail.

Horizontal and Vertical Operating Envelopes

Figure 2 shows the typical horizontal and vertical operating envelopes for trail users, including wheelchair users, pedestrians, cyclists, in-line skaters, and MRVs, and snowmobiles. These dimensions will be used to determine appropriate trail widths, as well as the vertical clearance. Eye level is an important consideration for determining sightlines, and is provided for each user.

Although a recommended minimum is provided as the default, the width of AT facilities should consider additional factors during the design phase including:

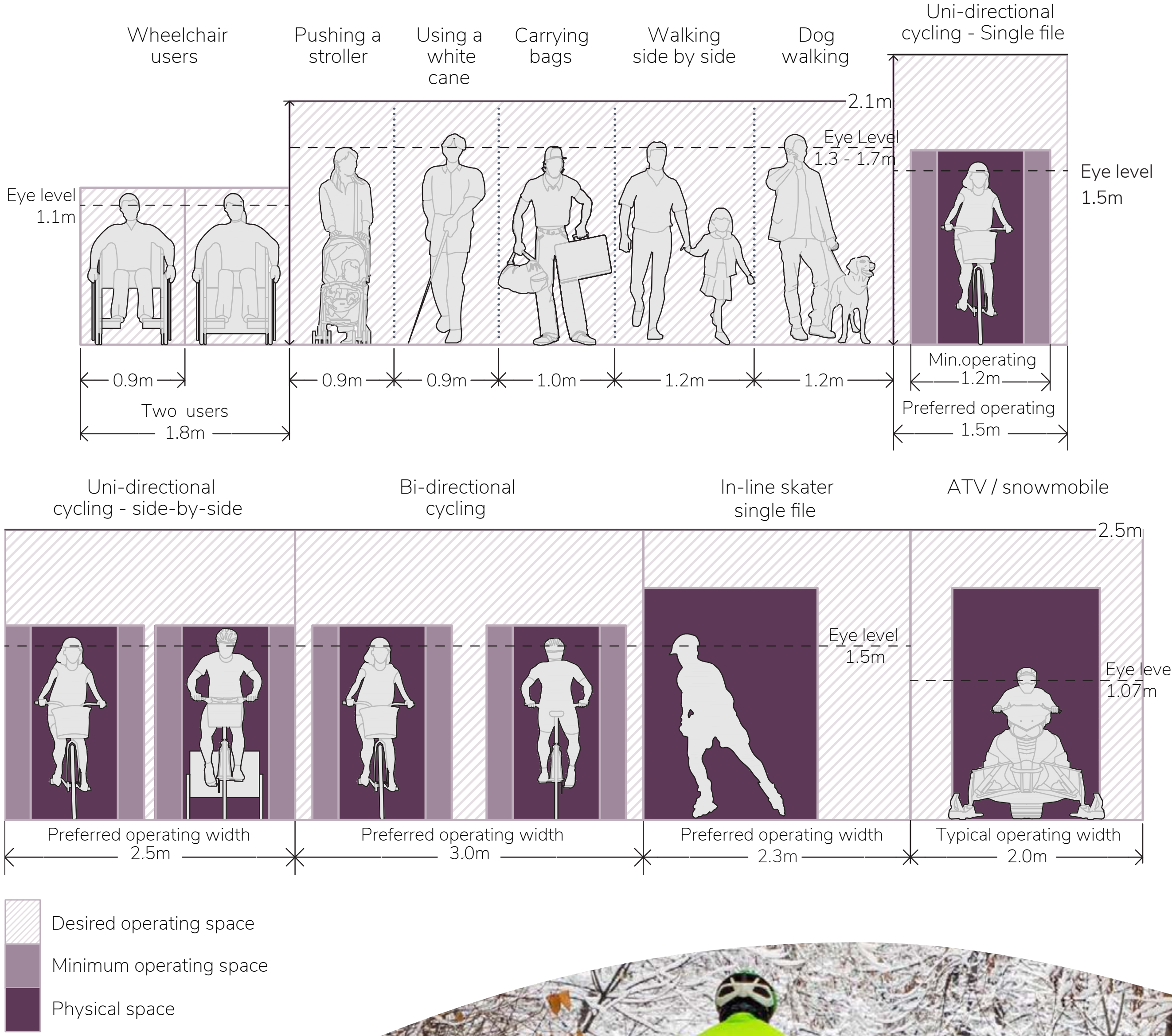
The human element – family members may wish to walk or ride side-by-side, either for social purposes or when a parent is helping to guide or teach a young child. Facilities should be wide enough to accommodate occasional side-by-side walking/riding, while permitting comfortable passing opportunities.

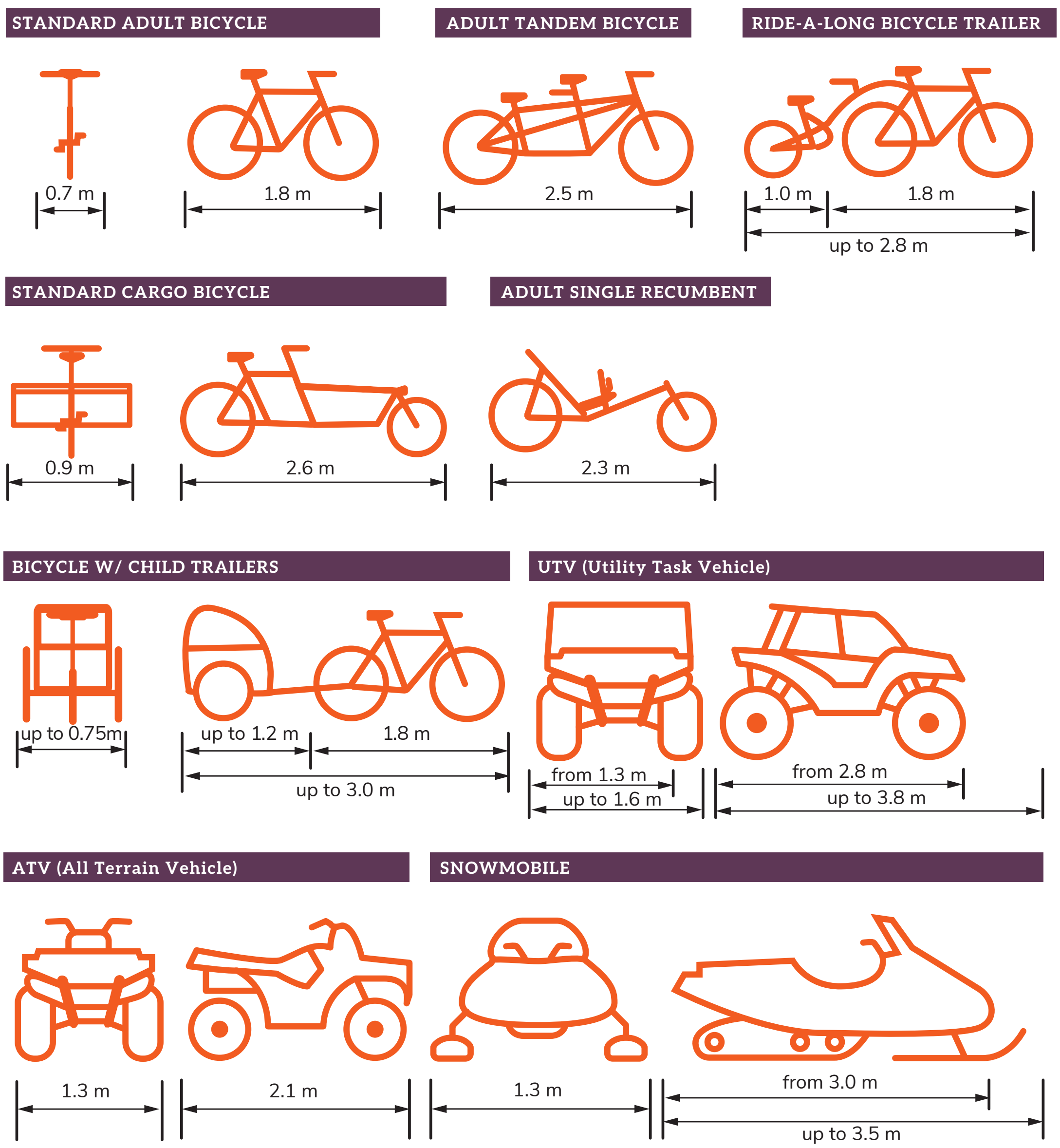
Differential speed of users – Highway trails often attract a variety of users, some of which may operate at slower speeds. As a result, providing sufficient space to pass others is an important consideration.

Planning for highway and trail maintenance – this includes consideration of snow storage and the width of maintenance equipment, such as sweepers, snowplows, and trail grooming equipment.

Topography – as the Yukon has variable topography, downhill speeds, uphill side-to-side movement, and stopping distances need to be accommodated.

Figure 2. Typical Operating Space and Device Dimensions




STANDARD ADULT BICYCLE
0.7 m
1.8 m
ADULT TANDEM BICYCLE
2.5 m
RIDE-A-LONG BICYCLE TRAILER
1.0 m
1.8 m
up to 2.8 m
STANDARD CARGO BICYCLE
0.9 m
2.6 m
ADULT SINGLE RECUMBENT
2.3 m
BICYCLE W/ CHILD TRAILERS
up to 0.75m
up to 1.2 m
1.8 m
up to 3.0 m
UTV (Utility Task Vehicle)
from 1.3 m
up to 1.6 m
from 2.8 m
up to 3.8 m
ATV (All Terrain Vehicle)
1.3 m
2.1 m
SNOWMOBILE
1.3 m
from 3.0 m
up to 3.5 m

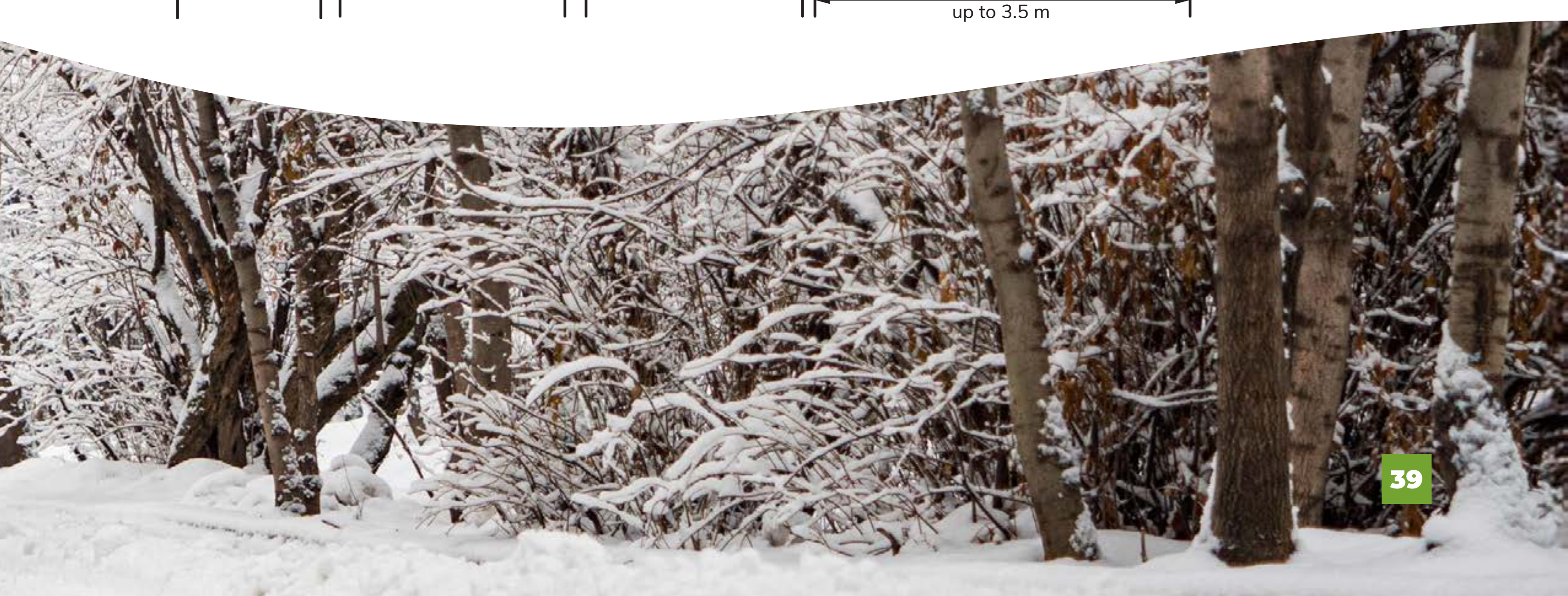


Figure 3. Horizontal and Vertical Clearance

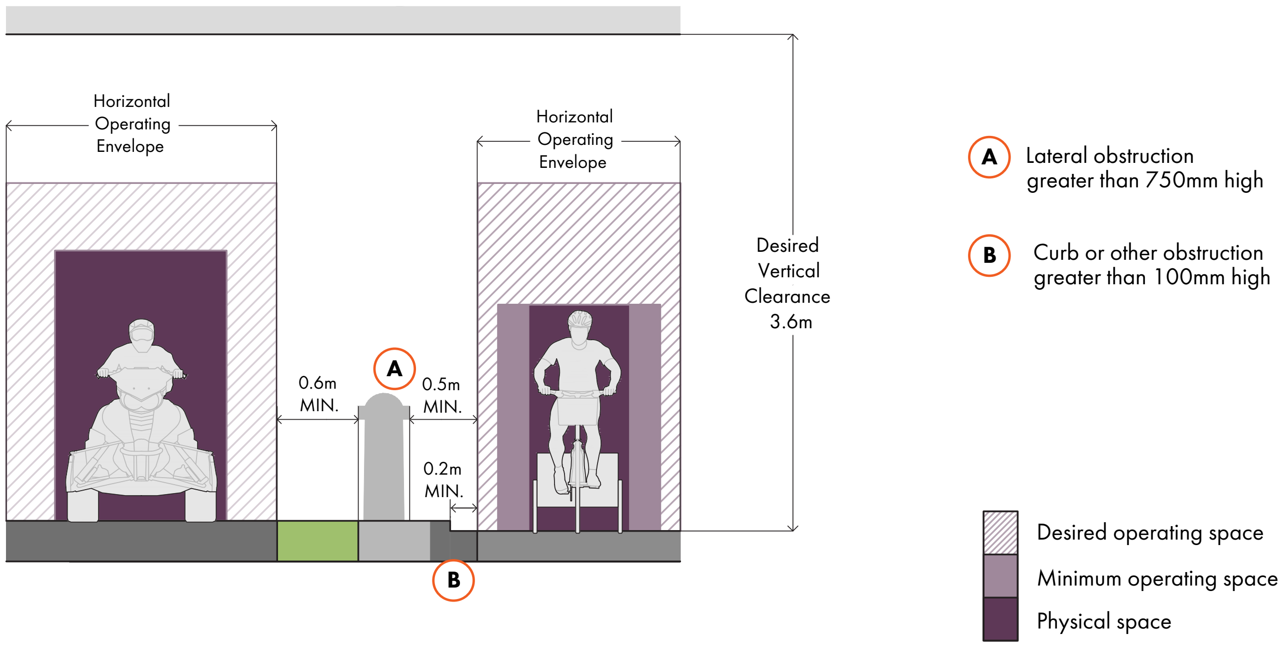


Figure 2 shows additional bicycle and motorized device dimensions. A bicycle with a trailer can be up to 3 m long, which should be factored into the design of facilities such as median refuge islands.

In addition to different types of bicycles, snowmobiles can range in length from 3.0 to 3.5 m, and MRVs have a typical length of 2.1 m for ATVs, up to 3.8 m for UTVs.

It is important to note the height of pedals and handlebars, as these can catch lateral objects if insufficient space is provided. **Figure 3** shows the minimum horizontal clearance from curbs and lateral objects (e.g. sign posts, light standards, retaining walls and railings).

Design Speeds

Typical trail user speeds are used to establish design speeds and basic geometric design requirements for stopping sight distance, horizontal and vertical alignment, and cross slopes. Higher speeds demand more conservative design elements to ensure safety and usability for all users. Designing to these standards also ensures that the facility will comfortably accommodate slower trail users, including children, seniors, and less confident users. Ultimately, design speed influences key trail design treatments (see **Section D.**)

A trail user's speed is dependent on a number of factors, including the mode of transportation, the physical condition of the user, the type and condition of the user's equipment, the purpose of the trip, the number of users on the trail, and the trail condition and design.

There is a wide range of potential trail user speeds in the Yukon, for example:

- The typical adult travels at average speeds of 15 km/h to 30 km/h on flat level terrain.
- Most electric bicycles can provide pedal or throttle assist up to a maximum of 32 km/h.
- Motorized recreation vehicles can travel at speeds up to 100 km/h.

While there is no single design speed that works for all contexts, the design speed of 30 km/h is generally sufficient for most active transportation trail users and is consistent with recommendations for shared streets in the *TAC Geometric Design Guide for Canadian Roads.* While MRVs are capable of travelling much faster, the *Trails in Alberta Highway Rights-of-Way: Policies, Guidelines, and Standards* cautions against designing highway trails for maximum speeds, and instead recommends using a similar design speed for both motorized and non-motorized users to promote an enjoyable experience for all trail users.

In multi-use trail settings, designers should include speed management treatments to mitigate potential conflicts between of faster and slower trail users. This can include separating pedestrians and cyclists, separating active transportation users from motorized recreational vehicles, having wider pathway widths, adding trail etiquette signage telling users to slow down, adding horizontal and vertical curvature to the trail, or adding an uphill grade.

Additional speed-reducing elements that can be applied to trails include textural surface contrast, transverse paint lines, yield markings, and warning signage along the trail.

In areas of hilly terrain and long steep grades, the design speed should be based on the anticipated travel speed of cyclists traveling downhill. Upright cyclists are generally considered the critical users on most trails with respect to design speed guidelines. In most cases, 50 km/h is the maximum design speed that should be used.

The minimum design speed should be no lower than 20 km/h, except in rare circumstances where the context and user types support a lower speed, such as:

- Using 1 m/s as the design speed for intersection crossings will account for slower AT users who need more time to cross intersections, such as children and seniors, and should be used for signal timing.
- For highway trails that pass through communities with a variety of users and frequent conflicts or constraints, a lower design speed should be used (15 km/h). Geometric design and traffic control devices should be included in the design to reduce the speeds of bicycle users and motor vehicles at conflict points.
- Areas where multiple conflict zones occur, such as driveways, intersections, and there is a mix of users.

C2. Design Domain

The *TAC Geometric Design Guide for Canadian Roads* uses a Design Domain, to provide a range of values that a design element, such as the width of a pedestrian or bicycle facility, might take. This Design Guide uses four levels within the Design Domain – Minimum, Recommended Minimum, Recommended Maximum, and Maximum.

Choosing values at the lower end of the domain may result in designs that are less efficient or may have safety implications, but may be less costly to construct, while choosing values at the upper end may cost more and may have safety implications in other aspects such as higher speed usage on wider trails. While all values within the range of Design Domain are acceptable, some may be better than others for a given situation. For cases where one or more design elements fall outside the recommended Design Domain values, a design exception may be required.

Highway Zones

Highways can be divided into a series of zones that each serve a dedicated purpose. **Figure 4** shows the range of zones in a setting where a highway passes through a community, while **Figure 5** shows the range of zones in a remote highway between communities setting. These are examples only – not all highways will contain each zone, and there are many different designs in both community and remote settings. The placement and the geometry of the zones is flexible and dependent on available right-of-way, highway classification, and land use. The various street zones are described below.

Figure 4. Highway Zones under Desirable Conditions

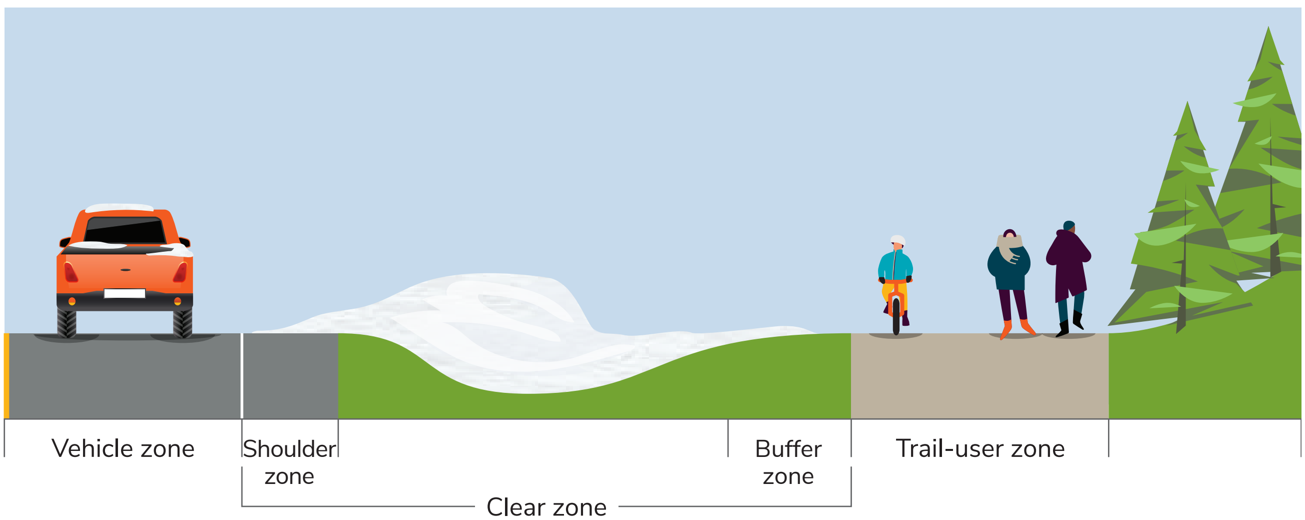
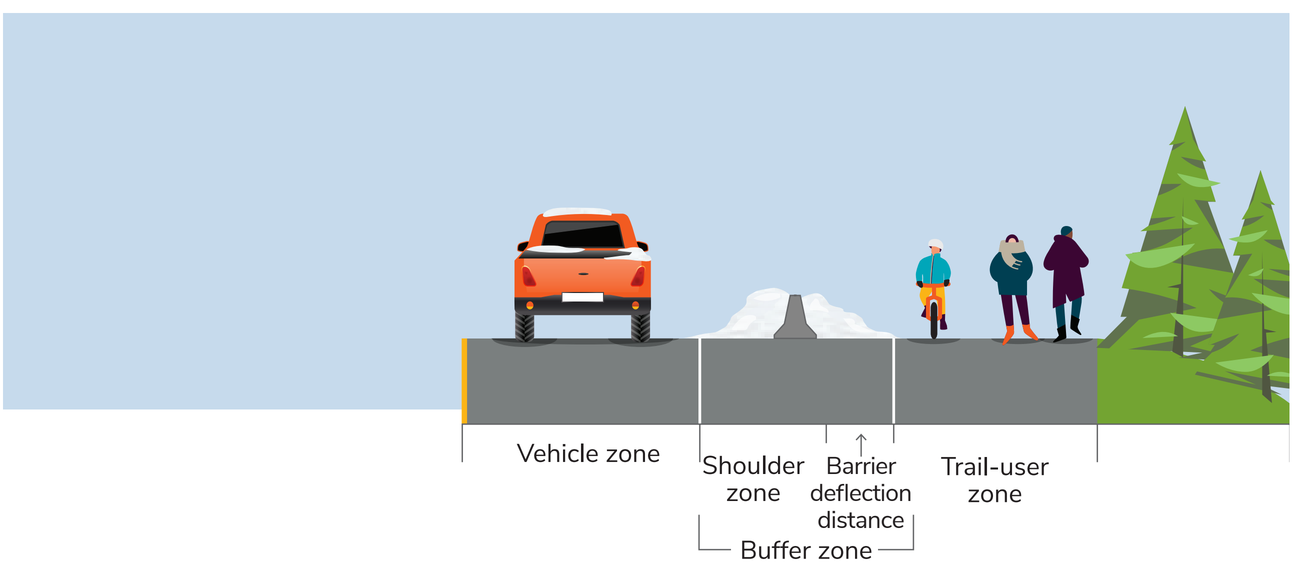


Figure 5. Highway Zones under Constrained Conditions



Highway Zone Descriptions

The Trail User Zone is the most important area of the highway for safe, accessible, and efficient movement of people walking, cycling, and rolling. The width of this zone depends on the highway context and the volume of activity anticipated for the corridor. This area should be entirely free of permanent and temporary objects.

The Buffer Zone is a space between the Trail User Zone and the Traffic Zone that can also provide space for snow storage for the trail, landscaping, utilities, and trailside amenities. Designers should ensure fixed objects located in the Buffer Zone meet the minimum recommended horizontal offsets from the Trail User Zone, such as illustrated in **Figure 4**. Refer to the Section 5.5.5 of the *TAC Geometric Design Guide for Canadian Roads* for more guidance on horizontal offsets.

The Clear Zone. In highway design, design professionals shall consider roadside safety, which encompasses the area outside the travelled portion of the roadway (e.g. the Traffic Zone). This includes the shoulder, the side slopes, ditches, and any fixed objects and water bodies that could present a serious hazard to the occupants of a motor vehicle leaving the roadway. The Clear Zone is the most important element of roadside safety design. The Clear Zone consists of the Shoulder Zone, a recoverable slope, a non-recoverable slope, and/or a clear runout area, and sometimes a Buffer Zone. The desired width is dependent upon the design traffic volume and speed and on the roadside geometry. The Clear Zone can also facilitate roadside drainage and snow storage from the highway. Chapter 7.3 of the *TAC Geometric Design Guide for Canadian Roads* provide further design guidance for the Clear Zone.

The Shoulder Zone. In highway contexts where there are no curbs, paved and/or unpaved shoulders may be present. The Shoulder Zone is the part of a roadway contiguous with the Traffic Zone intended for emergency stopping, and/or lateral support of the roadway structure. The Shoulder Zone is primarily intended to support motor vehicle needs but can be designed to allow walking and cycling in some contexts. In rural areas, gutters are often located within the Shoulder Zone.

The Traffic Zone accommodates users travelling through a highway or accessing destinations along the highway. Traffic Zone uses can include motor vehicle through traffic, transit, goods movement, and bicycle travel. The Traffic Zone can be divided into multiple lanes that are shared by multiple users or dedicated to certain vehicles (such as exclusive transit lanes). Medians and refuge areas can also be included within this zone.

Longitudinal Grade

Table 3 summarizes the design domain for longitudinal grade along highway trails. Longitudinal grade is an important consideration for both accessibility and drainage. A Minimum grade of 0.6% is required in order to facilitate drainage.

The Recommended minimum is also 0.6%, as a flatter trail is easier to navigate for a trail user. The Recommended maximum for the longitudinal grade of a highway trail is 5%.

Table 3. Longitudinal Grade Guidance for Highway Trails

Facility	Minimum (%)	Recommended Minimum (%)	Recommended Maximum (%)	Maximum (%)
Trail	0.6*	0.6	5.0	8.0**
*	May be reduced to zero where surface drainage is provided by adequate cross-slope and lateral slope of the ground away from the trail surface.			
**	Steep slope warning sign; Must account for greater speed differential in users – additional width; pull-out refuges; separation of modes; separation of travel direction Design speed is 50 km/hr			

Steep Grades & Rest Areas

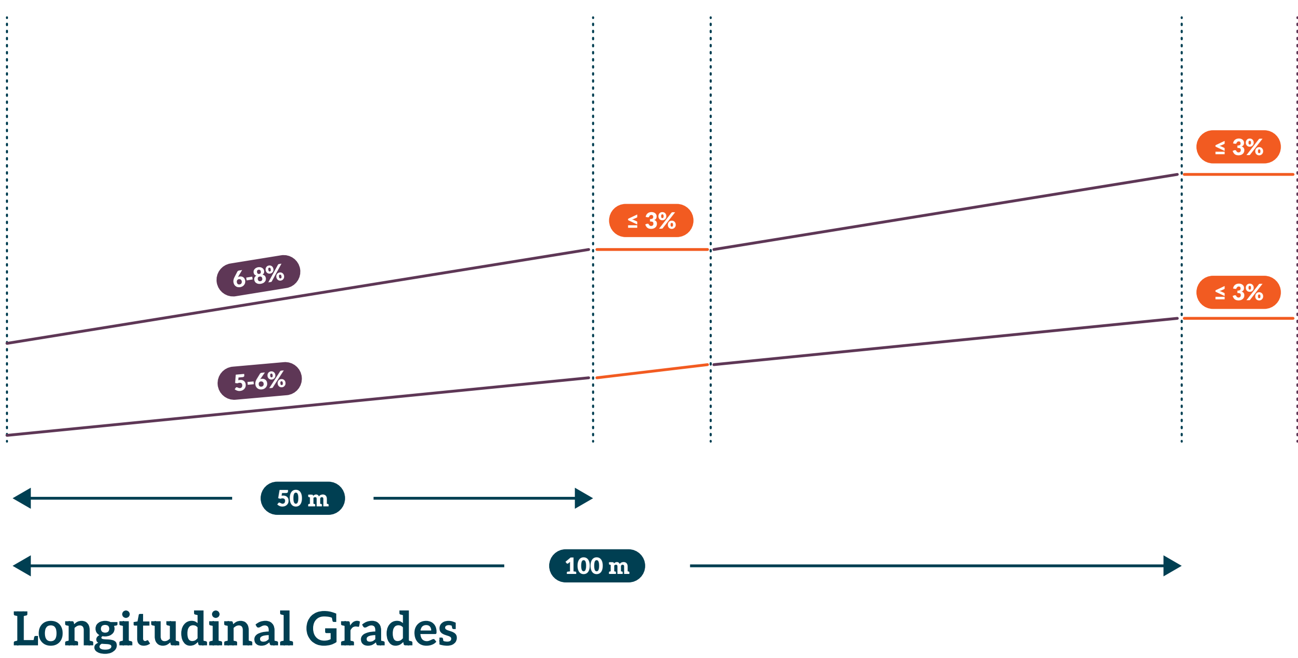
Ideally, grades should be kept to 5% or less as much as possible. Steeper grades can create challenges for people with mobility, strength, and dexterity challenges, as well as younger, older, and less experienced trail users. The City of Vancouver *Transportation Design Guidelines for All Ages and Abilities Cycling Routes* recognizes that facilities can still be considered AAA if steep grades are limited to short distances, as described below:

- Less than 500m, for grades between 5% and 7%
- Less than 150m (about a block), for grades between 7% and 8%
- Less than 30m, for grades above 8%

Where the grade exceeds 5% for more than 100 m, the trail width should be increased by 1 m and flatter resting spots should be provided at set intervals, depending on the severity of the longitudinal grade. For trails with grades between 5% and 6%, a relatively flat area of grade (i.e. 3% or less) should be provided every 100 m (see **Figure 6**). For trails with grades between 6% and 8%, a relatively flat area of grade (i.e. 3% or less) should be provided every 50 m.

Where a trail has grades steeper than 8%, alternatives should be explored, such as widening the trail for prolonged steep slopes. Other alternatives include providing pull-out refuges, separation of modes or separation of direction of travel, including switch backs, or locating the trail along a flatter route. The route should be marked on maps with a "steep hill" designation, and signage along the trail should warn users of steep grade.

Figure 6. Guidance for the Resting Spots Along Steep Grades



Cross Slope

Table 4 summarizes the design domain for cross slope grade along a highway trail. A cross slope of 2% ensures adequate drainage and will be accessible for people in wheelchairs or with other mobility challenges. The Maximum is 5%, which should only be used for short distances, such as across driveways. Typically, the cross slope should angle in one direction, as this design is easier for maintenance and snow removal.

Surface material can influence drainage, therefore designers should consider slightly steeper cross slopes for gravel highway trails. The shoulder on either side of the highway trail should have a cross slope matching that of the highway trail. See Section 5.5 of the *TAC Geometric Design Guide for Canadian Roads* for more information on cross slopes.

Table 4. Cross Slope Guidance for Highway Trails

Facility	Minimum (%)	Recommended Minimum (%)	Recommended Maximum (%)	Maximum (%)
Trail	2.0	2.0	2.0	5.0

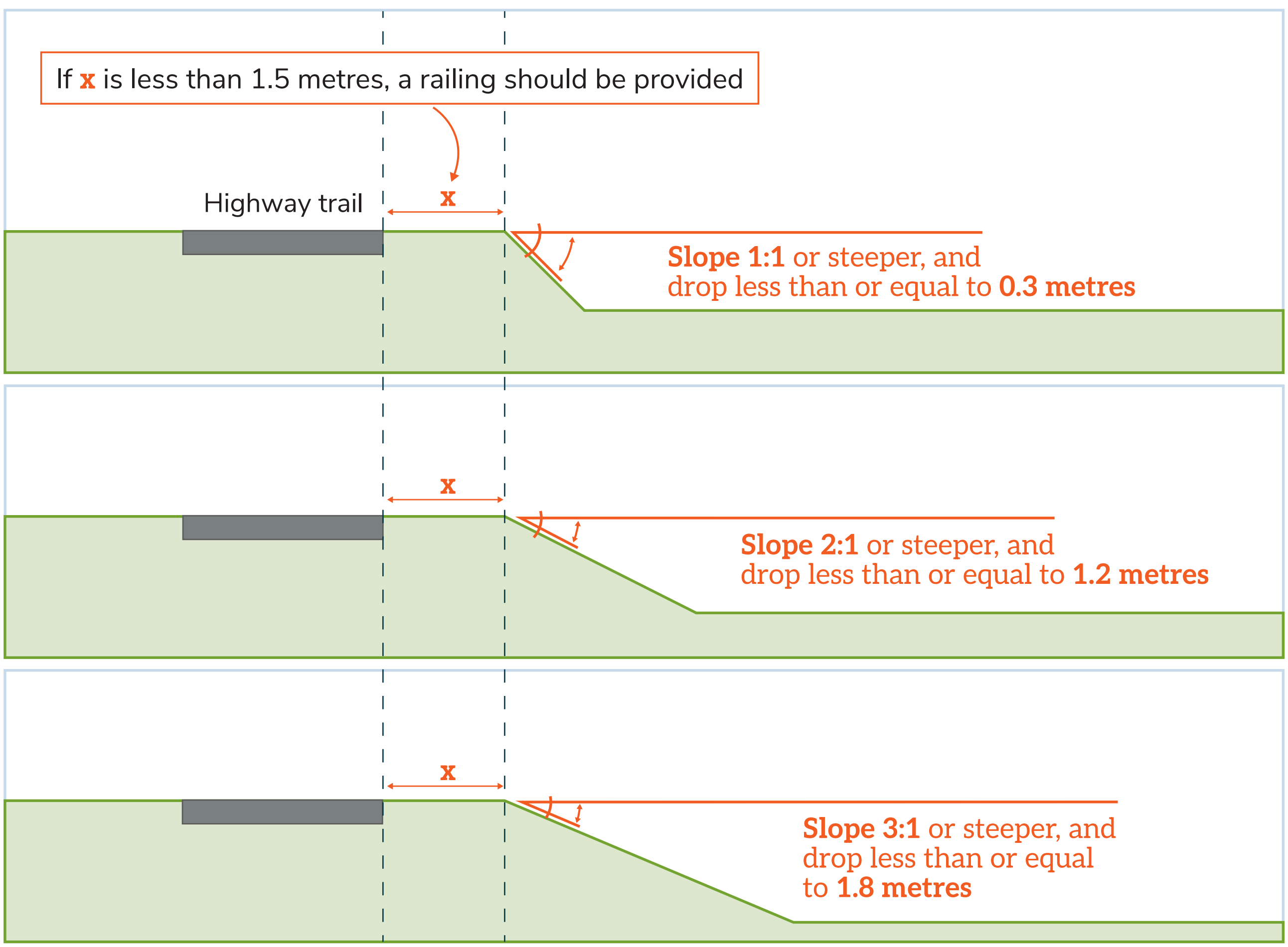
Side Slope

The side slope alongside a highway trail can present a hazard to trail users when the slope reaches certain steepness and has a certain drop depth. For example, a highway trail may run alongside a ditch, which could cause injury if a trail user were to fall off the trail and into the ditch. To help mitigate potential hazards, a railing with minimum height of 1.2 m should be provided, or an offset of at least 1.5 m should be added from the top of the slope in any of the follow scenarios (see X, where 'X' is the shoulder width):

- Side slope of greater than 1:1 and a drop off greater than or equal to 0.3 m;
- Side slope of greater than 2:1 and a drop off greater than or equal to 1.2 m; or
- Side slope of greater than 3:1 and a drop off greater than or equal to 1.8 m.

See Section 5.5 of the *TAC Geometric Design Guide for Canadian Roads* for more information.

Figure 7. Side Slope Thresholds Requiring Design Treatments for Hazard Mitigation



Adapted from Alberta Transportation Trails in Alberta Highway Rights-of-Way (2015)

Drainage

Ensuring proper drainage along highway trail is important in providing a safe facility for all users and for maintaining the trail's integrity over time. Appropriate drainage is particularly important in Northern contexts such as the Yukon, because it minimizes ice, reduces water pooling, and extends the longevity of the highway trail. Additional design considerations should be given to highway trails located in drainage ditches and/or low-lying areas to mitigate deterioration from weather events and annual precipitation. Overland drainage (surface runoffs) should be designed such that water does not run across the trail, as this can lead to pooling or ice formation on the trail. In addition, the overland drainage should not be directed such that it compromises the trail subgrade, in particular during freeze-thaw cycles.

General drainage principles for highway trails

- Ensure that surface water flows away from the trail by angling side slopes down and away from the edge of the trail;
- Ensure that the subsoil drains away from the trail edge by placing and compacting subgrade in such a way that water flows down and away from the area directly beneath the trail;
- Prevent water from becoming trapped in the subsoil by using a sandy/gravelly subsoil; when this is not possible, take extra precaution to ensure that surface run off does not run across the trail;
- Where ditches are implemented, the ditch bottom should be maintained at a lower elevation than the aggregate base layer;
- Prevent stormwater from running across the trail surface by intercepting water with a ditch and locating the ditch bottom as far away from trail edge as possible, outside of the shoulder;
- Design the drainage depth and width to allow for mechanical removal of weeds and invasive species; and
- Keep water moving off the trail by providing a cross-slope on the trail, as described in Table 4.

If drainage grates are required, they should be placed outside of the travel path for highway trail users. If grates must be placed on the trail, they must be bicycle-friendly, including grates that have horizontal or diagonal slats on them or no grate, so that bicycle tires and assistive devices do not fall through the vertical slats.

Culverts may be required to ensure that the drainage pattern of a road or highway is maintained where a trail is constructed into a side slope, with an embankment, or at ditch crossings. A stormwater runoff review should be conducted to determine the appropriate culvert design. Sections 4.1.7.2 and 5.1.7.2 of *Trails in Alberta Highway Rights-of-Way Guidelines* provide more detailed guidance on design of drainage for trails.

Sight Distance

Appropriate sight distance allows the trail user to recognize an obstruction such as debris, other trail users, and intersections, and to take the appropriate action. Similarly, it allows motorists to recognize trail users at crossings/intersections and to make the appropriate action. This section focuses on appropriate sight distance for users along the trail.

Stopping Sight Distance

Stopping sight distance provides adequate space for users to react to and make a fully controlled stop before encountering a conflict. This can be calculated based on a user's speed, the coefficient of friction between a vehicle's tires and the trail surface, and the vertical grade of the trail. Section 5.5.2 of the *TAC Geometric Design Guide for Canadian Roads* includes the following equation that should be referenced to determine stopping sight distance for highway trails.

$$SSD = 0.694V + \frac{V^2}{255\left(f + \frac{G}{100}\right)} \qquad (5.5.1)$$

Where: SSD = stopping sight distance
V = design speed or velocity (km/h)
F = coefficient of friction
G = grade (m/m; % upgrade is positive and downgrade is negative)

As indicated in **Section C1**, highway trails should be designed for a maximum speed of 30 km/h. The recommended stopping sight distance is therefore 35 m on a flat trail. On highways with a slope of up to 8%, trails should be designed for a maximum speed of 50 km/h. If the stopping sight distance cannot be achieved, advanced warning signage of upcoming crossings and requirements to stop should be installed.

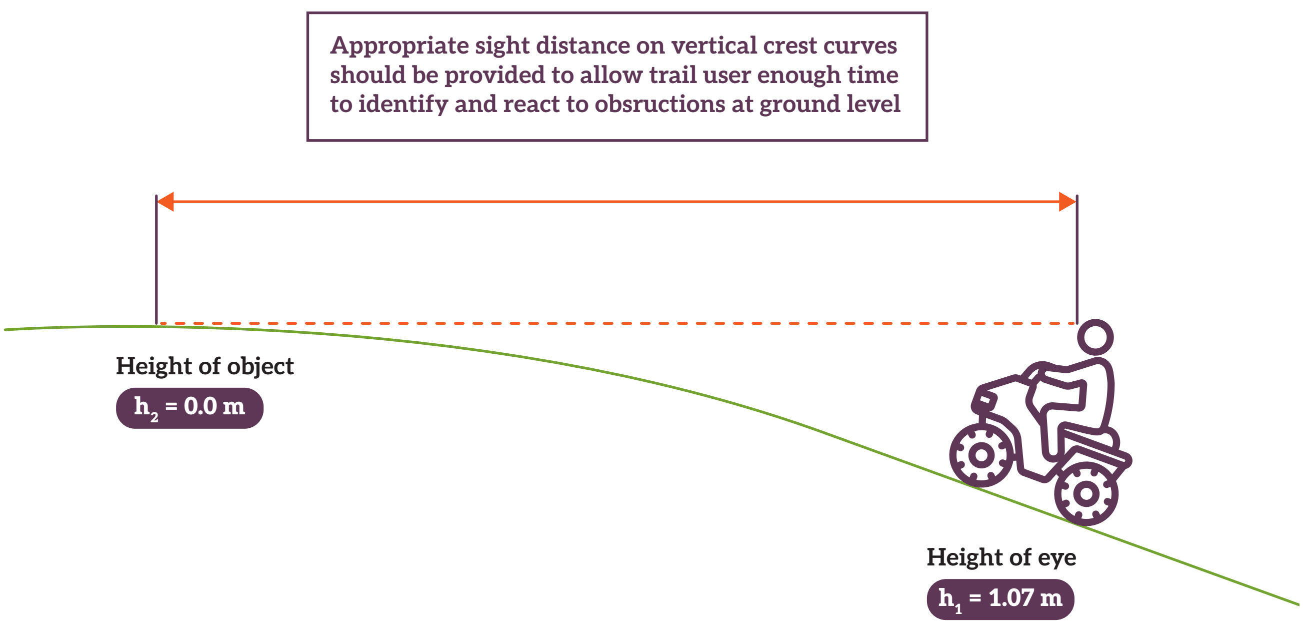
Sight Distance on Vertical Crest Curves

Vertical crest curves can pose limitations on available sight distance and make it difficult for trail users to identify hazards at ground level, even if the vertical curve is small. The sight distance of a trail user on an upward slope depends on the height of the trail-users eyes and the slope of the hill.

Eye height of drivers of snow mobiles and ATV's are lower than that of adult cyclists and pedestrians (see **Figure 8**).

Therefore, on motorized highway trails, Section 5.1.6.2 of Alberta Transportation's 2015 *Trails in Alberta Highway Rights-of-Way Guidelines* should be used to calculate the sight distance on vertical crest curves. On non-motorized trails, the equation in Section 5.5.4.2 of the 2017 *TAC Geometric Design Guide for Canadian Roads* should be used. If it is anticipated that a significant number of users will be children, a lower eye height may be appropriate.

Figure 8. Sight Distance on Vertical Crest Curves



Adapted from Alberta Transportation Trails in Alberta Highway Rights-of-Way Guidelines (2015)

Table 5. Minimum Length of Vertical Crest Curve Based on Stopping Sight Distance Requirements of Typical Motorized Recreation Vehicle (MRV)

A (%)	S = Stopping Sight Distance (m)																		
	10	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**
2														43	53	63	73	83	93
3									29	39	49	59	69	79	89	99	109	119	129
4							27	37	47	57	67	77	87	97	120	135	151	169	187
5					17	27	37	47	57	67	84	99	114	131	150	169	189	211	234
6				14	24	34	44	54	70	85	101	118	137	158	179	203	227	253	280
7			9	19	29	39	52	66	82	99	118	138	160	184	209	236	265	295	327
8			13	23	33	46	60	76	93	113	135	158	183	210	239	270	303	337	374
9			16	26	38	52	67	85	105	127	151	178	206	237	269	304	341	380	421
10		9	19	29	42	57	75	95	117	141	168	197	229	263	299	338	379	422	467
11		11	21	32	46	63	82	104	129	155	185	217	252	289	329	371	416	464	514
12		12	22	35	50	69	90	114	140	170	202	237	275	315	359	405	454	506	561
13		14	24	38	55	74	97	123	152	184	219	257	298	342	389	439	492	548	607
14		15	26	41	59	80	105	132	164	198	236	276	321	368	419	473	530	590	654
15	6	16	28	44	63	86	112	142	175	212	252	296	343	394	449	506	568	633	701
16	7	17	30	47	67	92	120	151	187	226	269	316	366	421	479	540	606	675	748
17	7	18	32	50	71	97	127	161	199	240	286	336	389	447	508	574	643	717	794
18	8	19	34	53	76	103	135	170	210	254	303	355	412	473	538	608	681	759	841
19	9	20	36	55	80	109	142	180	222	269	320	375	435	499	568	641	719	801	888
20	9	21	37	58	84	114	150	189	234	283	336	395	458	526	598	675	757	843	935
21	10	22	39	61	88	120	157	199	245	297	353	415	481	552	628	709	795	886	981
22	10	23	41	64	93	126	164	208	257	311	370	434	504	578	658	743	833	928	1028
23	11	24	43	67	97	132	172	218	269	325	387	454	527	605	688	777	871	970	1075
24	11	25	45	70	101	137	179	227	280	339	404	474	550	631	718	810	908	1012	1121
25	11	26	47	73	105	143	187	237	292	353	421	494	572	657	748	844	946	1054	1168

When S > L
$$L = \frac{200(\sqrt{h_1} + \sqrt{h_2})^2}{A}$$

When L > S
$$L = \frac{AS^2}{200(\sqrt{h_1} + \sqrt{h_2})^2}$$

Shaded area represents $L > S$

L = length of vertical curve in metres (m)
S = stopping sight distance (m)

A = algebraic difference in grades in percent
h_1 = height of eye above roadway surface
h_2 = height of object above roadway surface

Adapted from Alberta Transportation Trails in Alberta Highway Rights-of-Way Guidelines (2015)

Horizontal Sightline Offset

The horizontal sightline offset (HSO) is the minimum lateral clearance that should be provided for line-of-sight obstructions at the inside of horizontal curves. Objects found to be between the centerline of the inside of a curve and the HSO limit are considered a sightline obstruction to trail users and should be eliminated where feasible. Examples of obstructions that may be found within the HSO include barriers, bridges, cut slopes, and trees or brush. On narrower trails, highway trail users will likely travel closer to the centerline of the trail, creating a higher chance of collisions occurring on curves.

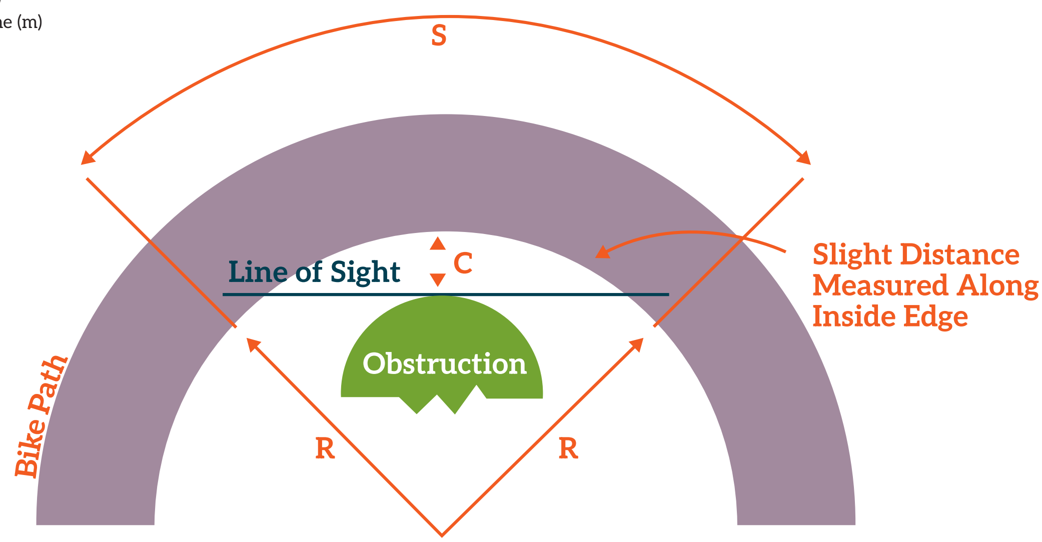
Where feasible, it is recommended that the HSO be calculated based on the summation of the individual stopping sight distances of trail users traveling in both directions along the curve. Section 5.5.3.2 of the 2017 *TAC Geometric Design Guide for Canadian Roads* includes an equation that should be applied to determine the appropriate horizontal sightline offset, which is based on stopping sight distance.

If the stopping distance cannot be achieved, efforts should be made to remove obstructions, improve sightlines, reduce design speed, and/or post warnings.

Figure 9. Horizontal Sightline Offset

$$C = R\left[1 - \cos\left(\frac{90S}{\pi R}\right)\right] \quad (5.5.3)$$

S = stopping sight distance (m)
R = radius of inside lane (m)
C = distance from inside lane (m)



NOTE: Formula applies only when ‘S’ ≤ length of circular curve

Source: *TAC Geometric Design Guide for Canadian Roads*, Figure 5.5.1

Table 6. Lateral Clearance for Bicycles on Horizontal Curves

Lateral Clearance on Horizontal Curves (m)										
Radius (m)	Stopping Sight Distance									
	10	20	30	40	50	60	70	80	90	100
10	1.2	4.6	9.3	-	-	-	-	-	-	-
15	0.8	3.2	6.9	11.5	-	-	-	-	-	-
20	0.6	2.4	5.4	9.2	13.7	18.6	-	-	-	-
25	0.5	2.0	4.4	7.6	11.5	15.9	20.8	-	-	-
30	0.4	1.7	3.7	6.4	9.8	13.8	18.2	22.9	27.9	-
35	0.4	1.4	3.2	5.6	8.6	12.1	16.1	20.5	25.2	30.0
40	0.3	1.2	2.8	4.9	7.6	10.7	14.4	18.4	22.8	27.4
45	0.3	1.1	2.5	4.4	6.8	9.6	12.9	16.6	20.7	25.0
50	0.2	1.0	2.2	3.9	6.1	8.7	11.8	15.2	18.9	23.0
55	0.2	0.9	2.0	3.6	5.6	8.0	10.8	13.9	17.4	21.2
60	0.2	0.8	1.9	3.3	5.1	7.3	9.9	12.8	16.1	19.7
65	0.2	0.8	1.7	3.1	4.7	6.8	9.2	11.9	15.0	18.3
70	0.2	0.7	1.6	2.8	4.4	6.3	8.6	11.1	14.0	17.1
75	0.2	0.7	1.5	2.7	4.1	5.9	8.0	10.4	13.1	16.1
80	0.2	0.6	1.4	2.5	3.9	5.6	7.5	9.8	12.3	15.1

Note: No Value is shown where deflection angle exceeds 180° (stopping sight distance > R)

Source: *TAC Geometric Design Guide for Canadian Roads*, Table 5.5.3

Corridor Lighting

Lighting is an important element to consider when planning and designing trails. Lighting is important for pedestrians and cyclists because it enhances the aesthetics of the built environment, increases comfort and safety, and helps with wayfinding, navigation, and observation. Lighting also helps to enhance the visibility of road and trail surfaces, the surrounding environment, and motorized trail users. Lighting can provide significant value in enhancements to both real and perceived comfort and safety. Contextually appropriate lighting design can complement and enhance the design of highway trails.

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

Lighting at Intersections

The *2006 TAC Guide for the Design of Roadway Lighting* provides guidance and specifications for trail lighting. Section 16 of that guide notes that, as a minimum requirement, lighting is recommended on off-street facilities a minimum of 25 m in advance of an intersection. This lighting should be provided on either side of the intersection so that pedestrians and cyclists can see the road and are clearly visible to drivers. This applies to both lit and unlit roads. If the road is unlit, transitional lighting should be provided leading up to the intersection so that drivers' vision can adjust to the illuminated intersection.

Lighting Along Highway Trails

Trails that are intended primarily for recreational use during the summer may not require full illumination along the extents of the entire route, especially if the facility is located in a remote context. Due to limited daylight during the Yukon winters, trails with high usage during winter months may require lighting through both the day and evening, especially if the facility is located in a community context. Illumination along the entire route may not be practical or appropriate within the environmental context.

Lighting design should consider the location and design of the trail on which it is located. Light posts should be placed strategically to maintain horizontal clearances and reduce risk of collisions with motor vehicles, maintenance vehicles, and trail users. The provision of lighting is often dependent on the volume of trail users, which can vary between community and remote settings. Additional restrictions may be considered in areas with dark sky zones. Dark sky zones are areas designated by municipalities that have Dark Sky compliant lighting to minimize light pollution and preserve natural lighting within a designated portion of the community.

Lighting Staging and Implementation

If the highway trail is further than 5 m from an adjacent road, it is recommended that the off-street facility has its own independent lighting system. The post height for off-street dedicated pedestrian and cycling facilities should range between 3.0 to 6.0 m away from adjacent roadways, as this helps to limit glare while still illuminating the highway trail.

Providing lighting along the length of a facility may be cost prohibitive and may require additional maintenance. Furthermore, accessing power may be challenging – some remote areas lack access to power, with communities relying on alternative sources of power in places (such as solar, wind, generators, and others). Some of these alternate sources of power may be considered for powering lighting, but this is not always feasible.

The lack of power can present a large challenge towards providing lighting along a trail. In circumstances where the provision of lighting appears to be infeasible, design practitioners should consider future proofing the facility by installing conduits along the trail, ensuring that lighting can be added relatively easily if and when funds and/or power become available. Future proofing the facility will prevent having to remove and reconstruct a facility in order to add lighting.

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

C3. Yukon-Specific Design Considerations

Access Controls

Access controls are often used at locations where highway trails intersect with other roads. These controls restrict access by unauthorized motorized vehicles while still accommodating access for emergency and maintenance vehicles. Although unauthorized motorized vehicle entry can be hazardous and disruptive, it typically happens infrequently and is usually due to ignorance rather than intent.

Thoughtful design can deter unauthorized access by making it clear that the path is a trail for AT users, not a road for motorized vehicles. The default approach should be to use signage and no barriers. If problems are reported, progressively stronger controls should be considered until the issues are resolved to an acceptable level.

- Signage & no barriers (default condition)
- Median island with low landscaping (moderate control)
- Strategic Snow Storage (moderate control, only feasible during winter conditions)
- Flexible Bollard (moderate control)
- Rigid Bollards (strict control, discouraged)
- Maze/offset gates (strict control, discouraged)

The use of rigid bollards or maze gates for speed control is not recommended, as their slowing effect creates a potential safety hazard to trail users. Bollards and other obstructions placed within the operating space of a trail have been shown to present a significant injury risk to bicycle users.

If bollards are deemed necessary, they should be implemented based on the following guidance:

Bollard Guidance

- Bollards should be made highly visible using bright paint colours and reflective materials (see MUTCDC for more guidance).
- If possible, consider using flexible delineators or spring-mounted bollards in order to reduce potential injuries from crashes.
- The hardware that is used to hold a bollard should be flush with the trail surface or recessed into the trail in order to minimize additional hazards for bicycle tires. Removable bollards should be fully removable and a permanently-affixed cap that is flush without collar should cover the open hole when the bollard is removed.
- The recommended spacing between bollards is 1.5 m (minimum 1.2 m, maximum 2.0 m). Designers should always review spacing to ensure bollards do not restrict access for people with disabilities and allow passage by all users who are legally permitted to use the trail.
- Adequate sight distance should be provided for approaching trail users when determining bollard placement.
- Bollard placement should not coincide with other major decision points for bicyclists, as this creates a multiple-part decision process for bicyclists that may cause additional safety concerns. If bollards are necessary at intersections, they should be sited at least 1.0 m from the back of the sidewalk and 3.0 m from edge of highway crossing.
- Pavement markings and signage on both sides of the bollards should be used to provide advance warning to the presence of the bollards. Pavement markings can include the directional dividing line marking in advance of the bollard to raise awareness of the upcoming bollard, and ensure bicyclists stay to one side of the bollard.

If gates are deemed absolutely necessary, they should be implemented based on the following guidance:

Gate Guidance

- Gates should be made highly visible using bright paint colours and reflective materials (see MUTCDC for more guidance).
- It is important to mark the gates at several locations including the ends of gates and all upright posts.
- Trail narrowing signs or gate-ahead signs are appropriate in advance of the gates.
- Additional pavement markings, such as a series of horizontal lines, should be added to denote a mixing zone.

If the above strategies prove unsuccessful and unauthorized users continue to enter highway trail, further field review and data collection may be necessary to evaluate the reasons why unauthorized users may be entering the highway trail at a specific location, and determine whether changes to the trail design farther from the point of entry would effectively eliminate the problem. In some circumstances, targeted surveillance and enforcement may be appropriate.

Landscaping in Northern Climates

Landscaping is key for creating an attractive and functional highway trail. The Buffer Zone is the ideal place to add vegetation to the highway trail. Landscaping in the Buffer Zone typically consists of grass and trees, but can also include a range of shrubs, bushes, flowers, and other plants. The following guidelines for landscape design, planting, and vegetation were adapted from the *Edmonton Winter Design Guidelines* and *Whitehorse Type 1 Trail Design Guidelines*:

- Give preference to native plants, grasses, shrubs and trees that are colourful and/or look attractive covered with snow. Refer to the Highway Right-of-Ways section of the *Yukon Revegetation Manual* for more detailed species recommendations.
- Select vegetation for landscaping near roadways that can withstand exposure to gravel, sand, and salt. Vegetation should be able to withstand snow loads, wind and require little maintenance throughout the year.
- Avoid plantings with berries or fruit that could be wildlife attractants.
- Set plantings back from highway trails to accommodate snow storage and consider using raised beds to lessen damage due to snow-clearing equipment, gravel, sand, and salt. Within snow storage areas, plantings may be subject to damage and poor growth due to compaction and pollutants, and possibly poor drainage.
- Roots can cause damage to the trail surface. To reduce cracking and heaving, trees should be located at least 1.5 to 2.0 m from the Trail User Zone. Root barriers can be installed during construction as a preventative measure to mitigate surface damages and hazards caused by plant roots.

Maintenance

While providing new infrastructure to promote walking, cycling, and other modes of active transportation is often seen as a top priority, ongoing rehabilitation and maintenance of existing infrastructure needs to be an equally important focus. Providing a high level of maintenance throughout all seasons ensures that communities that invest in highway trails can anticipate that many people will choose motorized or non-motorized trail use year-round.

Winter Maintenance Best Practices

People will be more willing to use active transportation year-round if high-quality facilities are built and maintained through the winter, preserving network connectivity. The City of Oulu, Finland stands out as a leading winter cycling city, with 9% cycling mode share in the winter (along with a 33% cycling mode share in the summer). Oulu has a well-established bicycle network, but it also prioritizes bicycle facilities when completing winter maintenance, ensuring that the bicycle network is reliable all year round.

Snow and ice accumulation can make the trail surface too rough or soft, narrower, and more difficult to navigate for all users. This can make a routine trip difficult to complete, if not a complete barrier to people with mobility challenges, pushing strollers, rolling, and cycling. Snow and ice control on the active transportation network should be prioritized similar to the remainder of the highway network, with the highest demand facilities receiving the highest priority treatment, followed by treatment on other routes depending on their network importance. The highest priority route(s) should result in a connected network for active transportation users in order to be effective.

For highway trails in Northern Contexts, the best practice is to establish a layer of compacted snow. To prevent ice formation, maintenance crews should avoid exposing bare pavement as much as possible in the winter. Maintenance vehicles should use a grooved blade to create a textured surface and add traction to the compacted snow. Sand and and grit can create dangerous conditions for active transportation users due to reduced traction, difficulties breaking, and potential damage to the bicycle, therefore it should only be applied as a last resort directly to ice patches, not on snow.

Winter Maintenance Vehicles

The best practice is for jurisdictions to dedicate resources to winter maintenance for highway trails. The Yukon Government is currently responsible for snow removal on the highway itself, whereas the maintenance of trails along the highway falls under the jurisdiction of the Municipal Government or First Nation government. Designers should consider the type of winter maintenance vehicle required to clear a given facility early in the project development process to ensure that they will be able to maintain that new facility in a cost-effective manner.

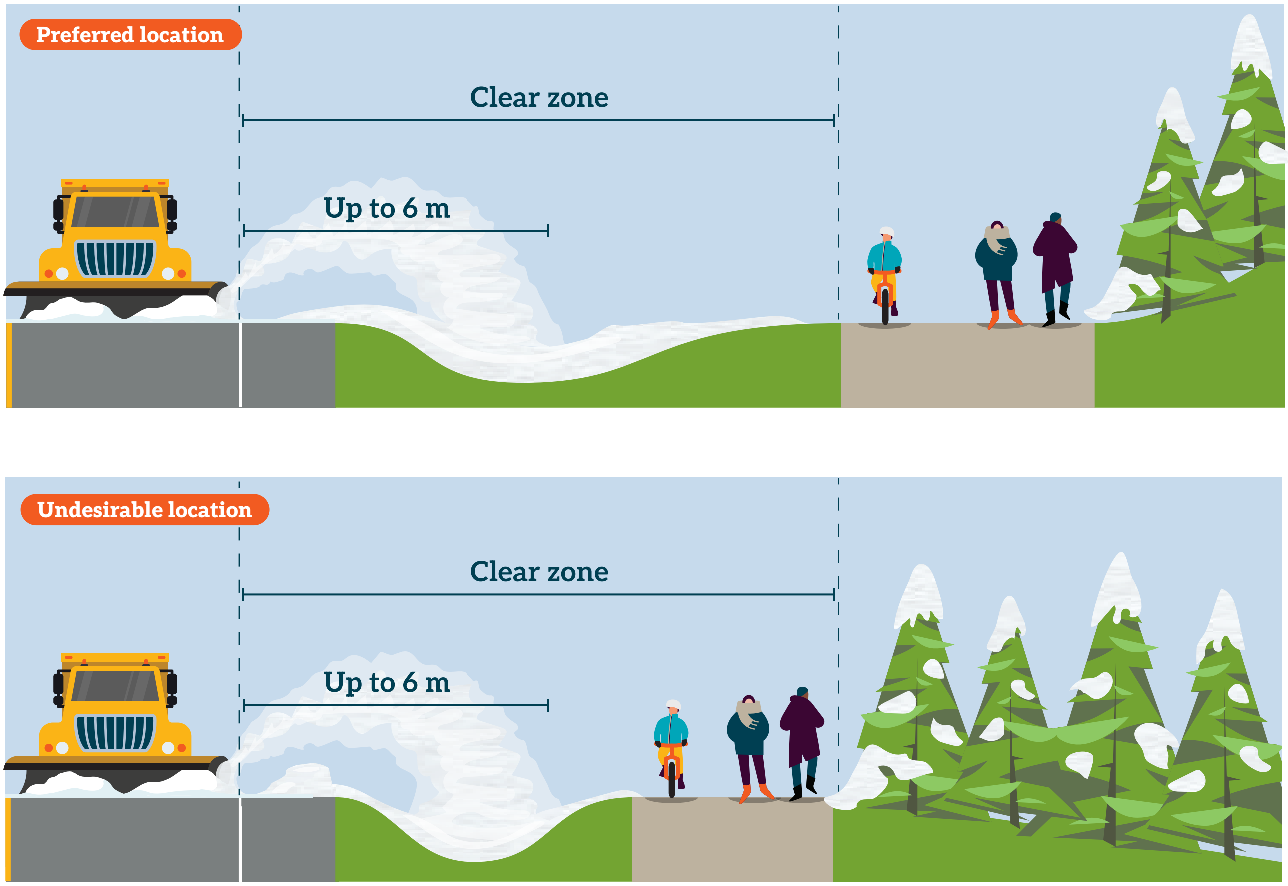
For example, the Yukon Government's Transportation Maintenance Branch uses trucks to push snow off the highway including the 'speed plow' that can throw the snow up to 6m away. There are different methods for avoiding snow throw on to the highway trail:

- The preferred method is locating the Trail User Zone on the edge of the right-of-way, as far away from the Traffic Zone as possible (see **Figure 10** on the next page).
- In constrained circumstances or areas with wildlife habitat, highway trails may not be located on the edge of the right-of-way. Speed plows must slow down when passing highway trails, in line with existing Yukon Government practices, where operators are required to slow down when people are observed on highway trails.
- The least preferred method is installing a snow fence high enough to prevent snow throw, because they were designed to prevent blowing snow and it's unclear how effective they would be. Snow fences also reduce the visibility of trail users from the highway and create concerns for personal safety.

For narrower active transportation facilities, many jurisdictions with winter climates have a fleet of small, specialized snow clearing vehicles and attachments that can be mounted to All-Terrain Vehicles (ATVs) or other small utility vehicles. Some vehicles can serve both as snow clearing equipment during the winter and street sweepers throughout the rest of the year. For highway trails in Whitehorse, the City typically uses smaller equipment to remove snow from the trails and sometimes partners with local snowmobile organizations to groom select motorized trails.

While these specialized vehicles can be useful for clearing protected or narrower facilities, they hold a disadvantage in that they require special training to operate, they typically operate slower than truck mounted plows, and they require a motor vehicle to transport them to the snow clearing or removal site. The preferred practice is to design enhanced shoulders and highway trails so that half-ton truck-mounted plows can clear them. In order to do this, it is desirable to have a Buffer Zone of 8.0 m for highway trails, or 2.0 m when constrained. See **Section D** for further guidance on widths.

Figure 10. Guidance for Locating Highway Trails



Snow Storage

Snow piles should be stored sufficiently away from the trail and care should be taken to ensure that snow melts do not lead to ponding or icing on the trail. Gaps in the snow piles may be required periodically to allow for drainage, or in some areas snow removal may be required. Snow removal policies should account for maintaining clear sightlines with changing winter conditions.

The best practice in Northern contexts is to design trails with dedicated space for snow storage in both the Clear Zone (for snow cleared from the highway) and the Buffer Zone (for snow cleared from the trail). Another alternative in constrained situations is to reduce the highway trail width to the Recommended Minimum to provide room for snow storage.

Routes planned for winter maintenance should be designed accordingly. **Section D** provides further guidance on designing highway trails with adequate Clear Zone and Buffer Zone widths to accommodate snow storage and winter maintenance vehicles.

Facility Sweeping

To ensure highway trails are safe, comfortable, and attractive for people, they must be kept clear of debris. Gravel, broken glass, leaves, or other debris can act as a barrier to both walking and cycling. They can create a slipping or collision hazard, puncture bicycle tires, and be blown or be kicked up by users. Facility sweeping is particularly important in the Spring, when gravel and sand from winter maintenance on highways may be pushed onto highway trails, creating dangerous conditions for active transportation. Trails are typically maintained by a separate team than those sweeping and clearing the highways. Therefore, a separate inspection and maintenance program may need to be developed for highway trails.

Surface Conditions

Cracks, potholes, depressions, catch basin grates, and ponding can be hazardous to all trail users and create challenging barriers for people with mobility challenges. Recommended guidance for surface conditions includes the following:

- Maintain a smooth surface clear of cracks, potholes, depressions, or bumps to reduce hazards for all users;
- Establish a spot improvement program for trails that allows people to report specific problems using a smartphone app, website, and/or by texting or calling a dedicated number;
- Include extra width on new trails in locations that are prone to surface quality issues such as potholes, cracks, or frequent debris, to allow people to avoid problem areas;
- Ensure facility surfaces are clear of water and have proper drainage;
- Resurfacing should maintain/correct surface drainage issues.
- Ensure all new drainage grates be bicycle-friendly, including grates that have horizontal or diagonal slats on them or no grate, so that bicycle tires and assistive mobility devices do not fall through the vertical slats. Consider creating a program to inventory all existing drainage grates and replace hazardous grates as necessary. Catch basins should be regularly cleared of debris so that drainage is not compromised.

Hazards that cannot be fixed immediately should be marked with highly visible paint and, where appropriate, temporary signage be placed warning of trail narrowing or uneven surfaces.

Vegetation Management

Landscaping and vegetation management is important along highway trails, as they can become inaccessible due to overgrown vegetation. It is important to ensure that all landscaping is designed and maintained to ensure compatibility with the intended users. The Yukon Government and its maintenance partners should monitor trails to ensure they are clear of encroachment by vegetation, such as overgrown grass, bushes, or tree branches. Trees and limbs should routinely be pruned to maintain the vertical and horizontal clearances over the trail and shoulders. Tree limbs and branches should be pruned to maintain clear trail shoulders to a height of at least 3.0 m. Trees and bushes planted along the trail should provide sufficient openness so that perception of safety and being-seen is not compromised. Placement of trees and shrubs at intersections should maintain sight-lines.

Signage, signal heads, and sightlines should not be obstructed by vegetation. After major damage incidents such as a flood or major storm, highway trails should be checked, and debris should be removed as quickly as possible.

Trail User-Mix and Separation

Highway trails in the Yukon are used year-round by a diverse mix of users. Potential conflicts between higher speed users and more vulnerable lower speed users should be considered throughout the design process. The anticipated purpose of the highway trail (recreational vs utilitarian), the anticipated volume of users (higher volumes on highway trails through communities vs lower volumes between communities), seasonality, and the user type (active transportation vs motorized recreational vehicle), should be considered to determine where separation of users would be necessary now and in the future.

On low volume highway trails, user conflict should be sufficiently low that mixing motorized recreation vehicles and active transportation users are appropriate. Section 5.3.1.4 of the *TAC Geometric Design Guide for Canadian Roads* provides guidance on when to consider separating users on a non-motorized highway trail. No similar guidance was found to inform when separation of motorized and non-motorized users would be appropriate.

When users are separated, best practice design is to place the most vulnerable trail user furthest from motor vehicle traffic. It is recognized that this is not always the practice in the Yukon, but it is recommended that any new trails and retrofits follow this best practice.

An option may be to provide adequate room in the corridor for future parallel and separated trails for active transportation and motorized recreational vehicle trails. Motorized use does not necessarily require a paved pathway - a level, graded, gravel trail is acceptable for motorized use. The design should follow the recommended practice that the motorized trail is closest to the roadway, and the non-motorized trail farthest from the roadway. It is a good practice to provide space between the two pathways for snow storage and signage.

To permit user segregation in the future, the width of the highway trail should be considered. Initially, a highway trail satisfying the Recommended Minimum can be constructed, with additional trail width or user separation added as required with increased volumes or conflicts.

Wildlife on Highway Trails

The Yukon is home to a rich diversity of wildlife, including large animals such as grizzly bears, moose, and wolves. Sometimes highway trail users will encounter wildlife on trails. To mitigate potential conflicts between highway trail users and wildlife, there are different strategies that can be employed during the design, operations, and use of highway trails.

Design

- Avoid locating new trails in areas with wildlife attractants, such as existing game trails, berry patches, water sources, and salmon runs.
- Where highway trails pass by dense vegetation, consider locating the trail further away from the edge of the right-of-way, to create space between the forest and the highway trail. Designers should weigh the trade-off of decreasing potential wildlife encounters and increasing exposure to fast moving vehicles on the highway.
- Add design features that reduce speeds and improve sightlines, especially on tight turns and blind crests, where surprise encounters are more likely.
- Add lighting in areas with higher potential for wildlife encounters, such as tight turns, blind crests, and areas with wildlife attractants.

Operations

- Trim vegetation regularly to maintain sightlines.
- Provide bear-resistant waste receptacles at regular intervals along busy highway trails.

Trail User Behaviour

- Make noise to make your presence known, particularly when you are running, biking, or travelling at higher speeds near areas with poor sightlines or wildlife attractants.
- Keep dogs on leash. Dogs can alert trail users when wildlife is nearby, but may elicit aggressive responses from wildlife.
- Pack out garbage and don’t leave wildlife attractants near highway trails.

Section D.
Design Treatments

D1. Facility Selection

The facility selection process is complex. The choice between facility types is not always simple, because different factors need to be weighed against one another, based on the context and site specific characteristics. The final decision regarding the selected type of active transportation facility will depend in part on the experience and professional judgment of a qualified practitioner.

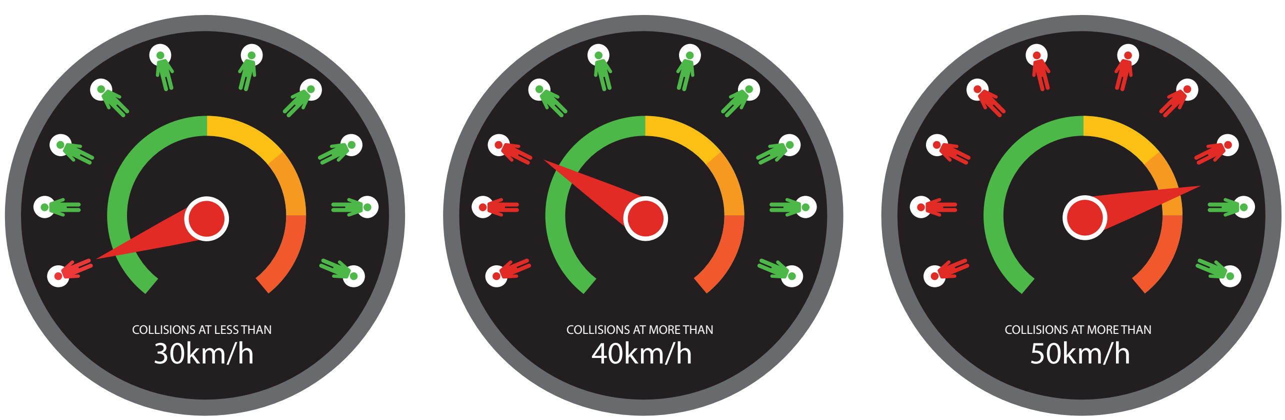
Safety

The largest safety risk associated with active transportation is the potential for collisions between motor vehicles and people walking, cycling, or using other forms of active transportation. In a collision, the risk of serious injury and death is directly correlated to the speed, weight, and size of the parties involved. When speeds are greater and there is a larger speed or weight differential, the likelihood of serious injury or death increases.

Research has shown that the severity of collisions involving vulnerable road users and motor vehicles increases greatly with motor vehicle speed and size. The likelihood of pedestrian fatality when hit by a motor vehicle increases as speeds increase. Collisions at 30 km/h or less correlate with a lower probability of death (5%), whereas at motor vehicle speeds above 40 km/h, the probability of death increases significantly.[1] Furthermore, collisions between pedestrians and light trucks have an additional severity equivalent to being hit by a passenger car travelling approximately 10% faster.[2] Finally, the risk of collisions increases with speed, because people have less time to react but need more time to brake and stop safely.[3]

Designers should also consider potential collisions between people walking and faster-moving active transportation users such as people cycling, especially as e-bike and other micromobility devices become more popular. While the risk of severe injury and death is much lower than when motor vehicles are involved, the speed and mass differential between people cycling and people walking can still be significant. Separating slower and faster active transportation users can help prevent or reduce severity of collisions.

Figure 11. Relationship Between Motor Vehicle Speed and Pedestrian Fatality Risk in a Collision



[1] *Hussain et al, The relationship between impact speed and the probability of pedestrian fatality during a vehicle-pedestrian crash: A systematic review and meta-analysis (Accident Analysis & Prevention, 2019).*

[2] *Dewan Karim, Narrower Lanes, Safer Roads (Regina Institute of Transportation Engineers, 2015).*

[3] *Fact sheet: The relationship between speed and crashes (SWOV Institute for Road Safety Research, 2019).*

Motor Vehicle Speed and Volume

One of the biggest factors influencing the use of active modes of transportation is motor vehicle speed and traffic volume. For people walking, separation from motor vehicles is always preferred. For people cycling, different types of facilities are appropriate in different road environments. For example, on roads with low motor vehicle speeds and volumes, facilities such as neighbourhood bikeways are most appropriate. As motor vehicle speeds and volumes increase, there is an increasing preference for separation from motor vehicle traffic. Alternatively, different treatments may be used to reduce motor vehicle speeds and volumes where appropriate (e.g., traffic calming elements).

Users

Wherever feasible, active transportation facilities should be inclusive, accommodating the full spectrum of potential users with all levels of experience. Facility design should also consider the full range of active transportation devices that must be accommodated on that facility. Consideration should be given to the skills, needs, and preferences of the types of users who are anticipated to use the facility. For example, facilities near parks, schools, and residential neighbourhoods are likely to attract a higher percentage of recreational users and children, who prefer a greater degree of separation from high motor vehicle speeds and volumes.

Road Width

Available right-of-way and road width can influence the type and design of an active transportation facility. The most cost-effective facilities in retrofit situations are implementable within the available road width and do not require any road widening. However, in new construction or reconstruction situations, it may be possible to widen the road, allowing for a more comfortable facility to be built that accommodates all users.

Heavy Vehicles

The presence of trucks, buses, and other large, heavy vehicles can cause unique challenges for active transportation users, especially people cycling. On trucking routes, designers should consider increasing buffer zones or physically-separating trail users from motor vehicles, or providing alternative routes for active transportation.

Conflict Points

Intersections, crossings, and transition points present potential conflict points between users. A high percentage of collisions involving active transportation users occur at these conflict points; therefore, it is vital to give careful design consideration to mitigating these conflicts. Facility selection should consider strategies to minimize exposure to conflicts wherever possible. Some facility types, such as bi-directional protected bicycle lanes and off-road facilities, are less appropriate where there are a high number of crossing points.

Funding

Facility selection will normally involve a cost analysis of alternatives, and the availability of funding may limit the types of facility that can be considered. The decision to implement an active transportation facility should be made with a commitment to properly design and construct the facility, in addition to a conscious, long-term commitment to proper maintenance. When funding is limited, lower-cost improvements such as signage, pavement markings, and low-cost traffic calming measures may be more feasible and should be considered instead of not providing facilities.

Facility Type Overview

Table 7 outlines which active transportation facilities may be appropriate within different land-use contexts, as described in **Section B**. The active transportation facility types that are most preferred are those that are physically separated from the highway. It is important to note, however, that as discussed above, there are other considerations beyond land use that factor into facility selection.

Table 7. Guidelines for Selecting Facility Types for Different Contexts

Facility Type	Facility	Local Roads Connected to Highways	Community Highway	Remote Highway	AAA
Physically-Separated	User-Separated Trails	Y	Y	Y	Y
	Multi-Use Trails	Y	Y	Y	Y
Visually-Separated	Painted Bicycle Lanes	Y	Depends on Speed & Volume	Depends on Speed & Volume	N
	Enhanced Shoulder	Y	Depends on Speed & Volume	Depends on Speed & Volume	N
Mixed-Traffic	Neighbourhood Bikeways	Depends on Speed & Volume	N	N	Y
	Yield Roadways	Depends on Speed & Volume	N	N	N

D2. Physically-Separated Facilities

Most physically-separated facilities are comfortable for people of all ages and abilities, when appropriate steps are taken to mitigate potential conflicts at crossings and conflicts between trail users travelling at different speeds. Multi-use and separated trails allow families and friends to enjoy active transportation together for recreation, create opportunities for outdoor tourism, and help less experienced active transportation commuters build confidence. As a result, physically-separated facilities along or adjacent to territorial highways are the preferred facility type wherever feasible, based on the available right-of-way and clear zone space.

D2.1 User-Separated Trails

If the required space is available, it is recommended to provide separation between different trail users based on speed. This can help to enhance safety and make the trail more comfortable for all users. The decision to separate trail users travelling at different speeds is based on a number of factors including right-of-way width available, the total volume of current and anticipated trail users, and the ratio of pedestrians to all other users. See **Section C** for more guidance on mitigating potential conflicts between trail users travelling at different speeds.

Figure 12. User-Separated Trail Cross-Section

User-Separation Treatments

Signage and pavement markings are the recommended user-separation treatments for Yukon trails, because:

- They provide a visual cue for trail users that the space is designated for different users based on their speed.
- They have minimal impact on the overall width of the facility.
- They allow the same winter maintenance vehicle to service trail, as opposed to treatments that physically separate trail users such as curbs, boulevards, and medians.
- Rumble strips can be used adjacent to pavement markings in order to increase detectability.

See Chapter E.3 of the *BC Active Transportation Design Guide* for more guidance on user-separated facilities.

Widths

For uni-directional bicycle paths, the desirable width of this component of the user-separated trail is 2.0 m to allow for two bicycles to pass each other or for side-by side cycling. If cyclist or MRV volumes are anticipated to be higher, a width of 2.5 to 3.0 m may be more appropriate. The constrained limit width of a uni-directional bicycle pathway is 1.8 m. The absolute minimum width is 1.5 m and should only be used for segments of the pathway that are less than 100 m in length.

For bi-directional bicycle paths, the desirable width is 4.0 m with a constrained width of 3.0 m.

If cyclist or MRV volumes are expected to be higher, a width of 4.5 m may be more appropriate. The absolute minimum width of a bidirectional bicycle pathway is 2.4 m and should only be used for segments of the pathway that are less than 100 m in length.

Pedestrian pathways should be designed to be bidirectional and allow people to travel side-by-side and for passing users travelling in the opposite directions.

Table 8. Facility Width Guidance for User-Separated Trails

User-Separated Trail	Desirable (m)	Constrained (m)
Trail User Zone: Uni-Directional Bicycle Path	2.0 – 3.0	1.8
Trail User Zone: Bi-Directional Bicycle Path	4.0 – 4.5	3.0
Trail User Zone: Bi-Directional Pedestrian Path	2.4 – 3.0	1.8 m
Separation Treatment (pavement markings)	0.6	0.3
Buffer Zone (includes Snow Storage for Trail)	8.0	2.0
Snow Storage for Highway	2.4	0.9
Snow Storage for Highway Trail	1.8	0.9
Clear Zone	Depends on Design Speed, AADT, and Slopes – refer to Section 7 of *TAC Geometric Design Guide for Canadian Roads*	

The recommended widths for snow storage are based on the *Winter Bike Lane Maintenance White Paper* prepared by Alta Planning and Design. In extremely constrained situations, the Buffer Zone may also include the Shoulder Zone and barrier deflection distance, but this may lead to snow storage difficulties.

If the constrained width for snow storage cannot be achieved for both the highway and highway trail, additional resources should be allocated for regular snow removal.

D2.2 Multi-Use Trails

Multi-use trails are off-highway facilities that are physically separated from motor vehicle traffic. Typically, multi-use trails accommodate bi-directional travel for people walking, rolling, and cycling. Multi-use trails may also be referred to as multi-use paths or shared pathways.

Figure 13. Multi-Use Trail Cross-Section (Desirable Conditions)

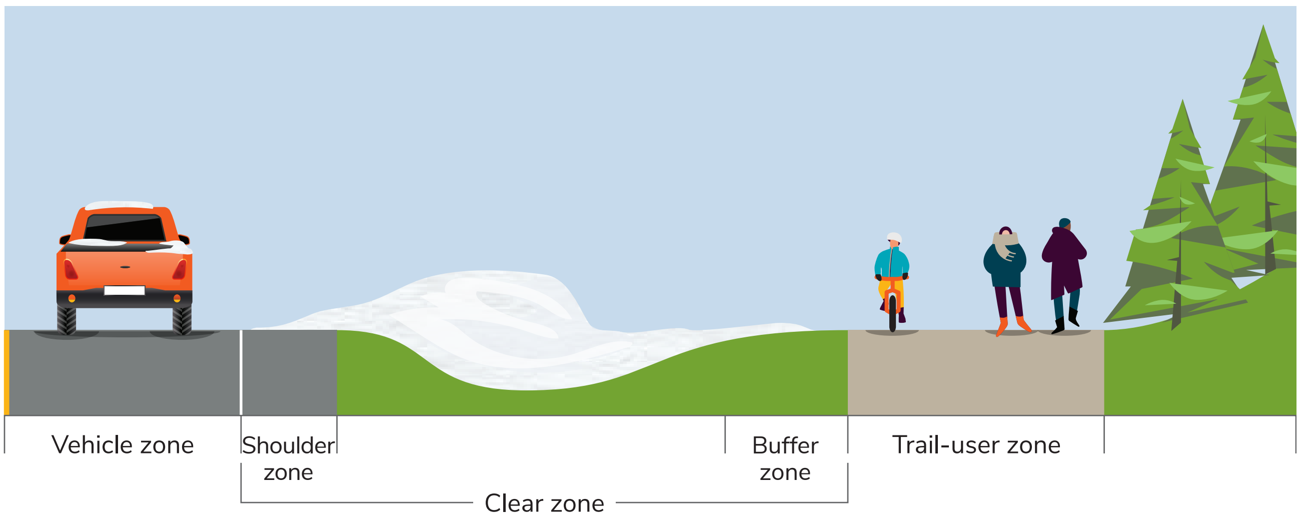
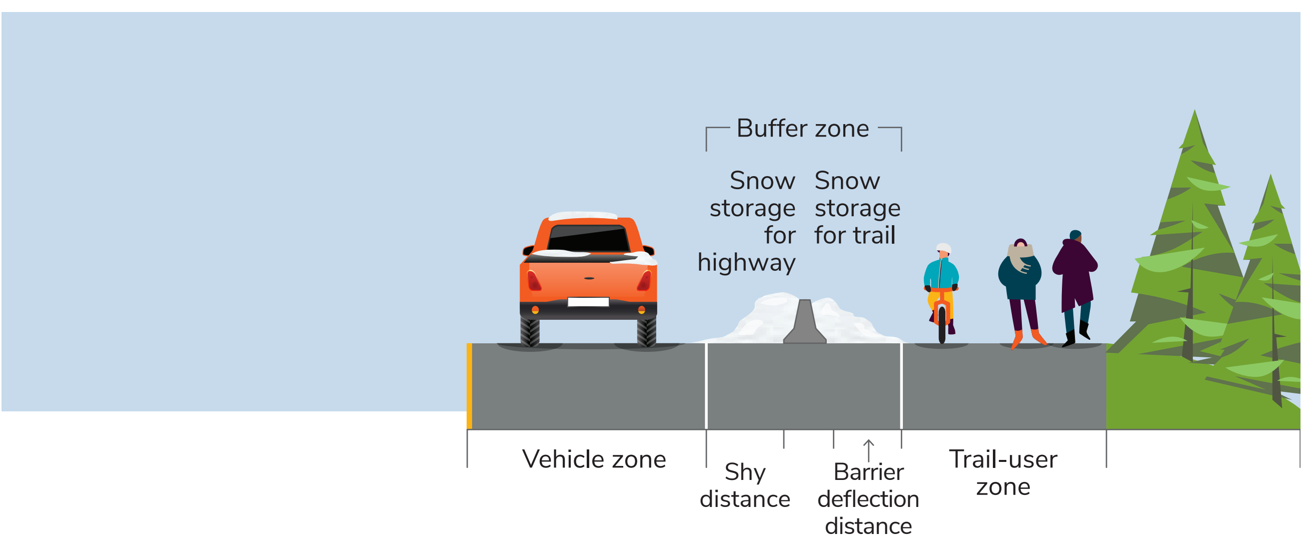


Figure 14. Multi-Use Trail Cross-Section (Constrained Conditions)



Width

Trail User zones should be designed to accommodate the operating envelope of various potential trail users, such as people in wheelchairs passing each other in opposite directions. To improve safety and comfort, the width of the Buffer Zone should be wider on highways with higher design speeds.

Wider buffers also offer the benefits of additional space for snow storage, landscaping, and trailside amenities.

The recommended widths for snow storage are based on the *Winter Bike Lane Maintenance White Paper* prepared by Alta Planning and Design.

Table 9. Facility Width Guidance for Multi-Use Trails

Multi-Use Trail	Desirable (m)	Constrained (m)
Trail User Zone	4.0	3.0
Buffer Zone (includes Snow Storage for Trail)	8.0	2.0
Snow Storage for Highway	2.4	0.9
Snow Storage for Highway Trail	1.8	0.9
Shy Distance Barrier Deflection Distance Clear Zone	Depends on Design Speed, AADT, and Slopes – refer to Section 7 of *TAC Geometric Design Guide for Canadian Roads*	

Barriers

Trails should be placed outside of the clear zone wherever possible. In constrained situations where the trail is placed within the clear zone, appropriate separation treatments must be added to improve safety and comfort. The *BC Supplement to TAC Geometric Design Guide for Canadian Roads* suggests using barriers when the separation between the edges of the outside travel lane and the trail is less than 2.1 m (including the Shoulder Zone).

The shy-distance (or shy-line offset) can be described as the distance between the front of the barrier and edge of the motor vehicle lane. Higher design speeds typically require larger shy-distances. However, shy-distance is less critical for longer, continuous stretches of barriers, especially if the barriers are introduced outside the shy-distance and incrementally placed closer towards the road. Designers should refer to Section 7.6.2.8 of the *TAC Geometric Design Guide for Canadian Roads* for more details.

The offset between the trail and the back of the barrier should be greater of the Barrier Deflection Distance or the minimum horizontal clearance between cyclists and the vertical obstruction (0.5 m for objects >0.75 m in height). Barrier Deflection Distance is variable and depends on the design speed of the roadway and barrier system used. Refer to Section F of the *BC Active Transportation Design Guide* for more guidance.

Some large vehicles such as commercial vehicles, trucks, and SUVs may overtop the barrier during collisions, so designers should avoid placing fixed objects near the barrier. Refer to the Zone of Intrusion (section 7.6.2.6) of the *TAC Geometric Design Guide for Canadian Roads* for more details.

Constrained Widths

In some cases, not all recommendations will be achievable, and there may be trade-offs required. Where a trade-off is required, designers must apply sound judgement and aim to protect vulnerable road users.

Wherever possible, width for snow storage should be allocated separately from the shy-distance and barrier deflection distance. Under constrained situations, snow cleared from the highway may have to be stored within the shy distance. Additional resources should be allocated for regular snow removal when the constrained widths for snow storage cannot be achieved.

Surface Materials

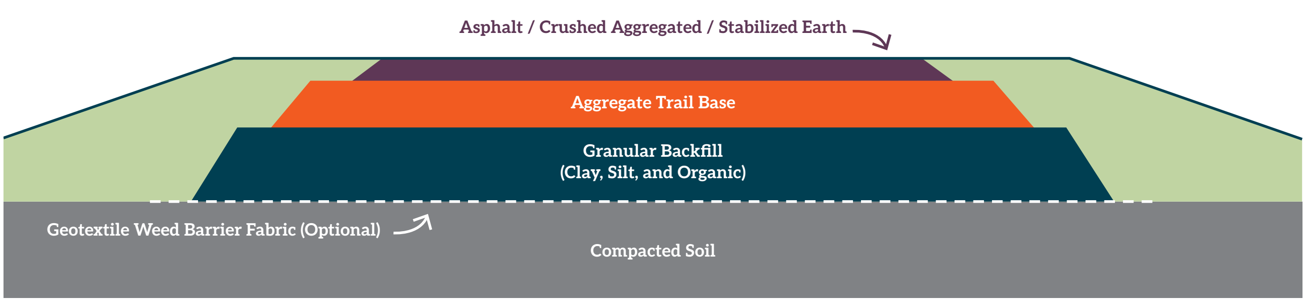
Asphalt surface treatment is the preferred surface material, because it provides a smooth continuous surface that is accessible for all user groups. Other durable, hard surface treatments such as sawcut concrete and chipseal can be acceptable alternatives.

Chipseal is the most common surface material for highways in the Yukon because it lowers maintenance costs, but the textured surface can be uncomfortable for people using devices with smaller wheels, such as bicycles, skateboards, wheelchairs, and walkers.

Unpaved trails with compact aggregate, paving stones, or stabilized earth tend be less expensive. However, these surface materials can be challenging for those with limited mobility or visual impairments, people using mobility aids, and can cause discomfort for people cycling by creating additional vibrations.

Roots can cause damage to the trail surface. To reduce cracking and heaving, trees growing along the trail should be located at least 1.5 to 2.0 m from the trail. Root barriers can be installed during construction as a preventative measure to mitigate surface damages and hazards caused by plant roots.

Figure 15. Typical Structural Component of a Highway Trail



Adapted from Alberta Transportation Trails in Alberta Highway Rights-of-Way Guidelines (2015)

Pavement Markings

Winter maintenance is an important consideration for trail pavement markings. Recessing pavement markings has been shown to increase marking life expectancy in cold weather climates, especially for thermoplastic or preformed markings. The markings are recessed by milling the area of the pavement, 3.0 mm in depth, where the pavement markings are applied. While this method results in more expensive installation costs, it may save in long-term maintenance costs while helping to preserve safety conditions along the trail.

User Symbols

Multi-use trail symbols along the trail can be used to supplement signage and enhance awareness of the shared-use function of the trail. If multi-use trail symbols are being installed along the trail, markings should be placed every 100 to 200 m, depending on the context. Tighter spacing may be considered near sharp corners and in areas of high conflict. Multi-use trail symbols should also be used at trail entrances and on the far side of crossings.

Centreline Striping

Centreline striping is generally not recommended along multi-use trails. Although the use of a centreline can reduce the possibility of a conflict between users travelling in different directions, it can contribute to conflicts that arise when faster moving trail users cross the centreline to pass slower moving users. Many trail users also disregard centrelines, which can create conflicts. In addition, a centerline implies a ‘rule’ that is likely to generate complaints but not be enforced.

However, in certain scenarios, centreline striping may provide safety and wayfinding benefits. Centreline striping is recommended when multi-use trails are located on hills with a grade steeper than 5%, at locations where passing is dangerous due to space constraints and limited visibility, and/or as a way of wayfinding and demarcating the trail at locations such as trail access points and at intersections. The wayfinding benefits can be especially important where the trail is not lit. Centreline striping is also recommended at locations where trails experience high bi-directional volumes and where a trail is commuter-oriented or a high volume of commuters are present, as the centreline may help to delineate space and minimize conflicts.

Hazard Striping

Longitudinal or traverse hazard striping should be added around objects on the trail to guide users away from the hazard.

Edge Line Striping

Longitudinal or traverse edge line or fog line striping may be added to help delineate the edge of a trail. This is especially applicable when the trail is adjacent to a hazard such as a fence or drop off, or where the trail is not well lit. Edge line striping will require increased maintenance to ensure that the lines are visible in all seasons.

D2.3 Signage for Highway Trails

Trail User Mix Signs

- The Shared Trail sign (MUTCDC RB-93) indicates that both cyclists and pedestrians are permitted to use the path and that pedestrians have priority.
- The Yield to Pedestrians (MUTCDC RB-39) sign may be used where cyclists are required to cross or share a facility used by pedestrians and are required to yield to pedestrians.
- The Pathway Organization (MUTCDC RB-94L/R) sign indicates to cyclists and pedestrians how to share a path where users are separated and there is a designated area provided for each.

See **Appendix C** for signage information.

When highway trails pass through communities, designers should review the sign guidance of the local jurisdiction. For example, the City of Whitehorse has custom signage for Type 1 Trails to ensure trail users are aware of the potential presence of MRVs.

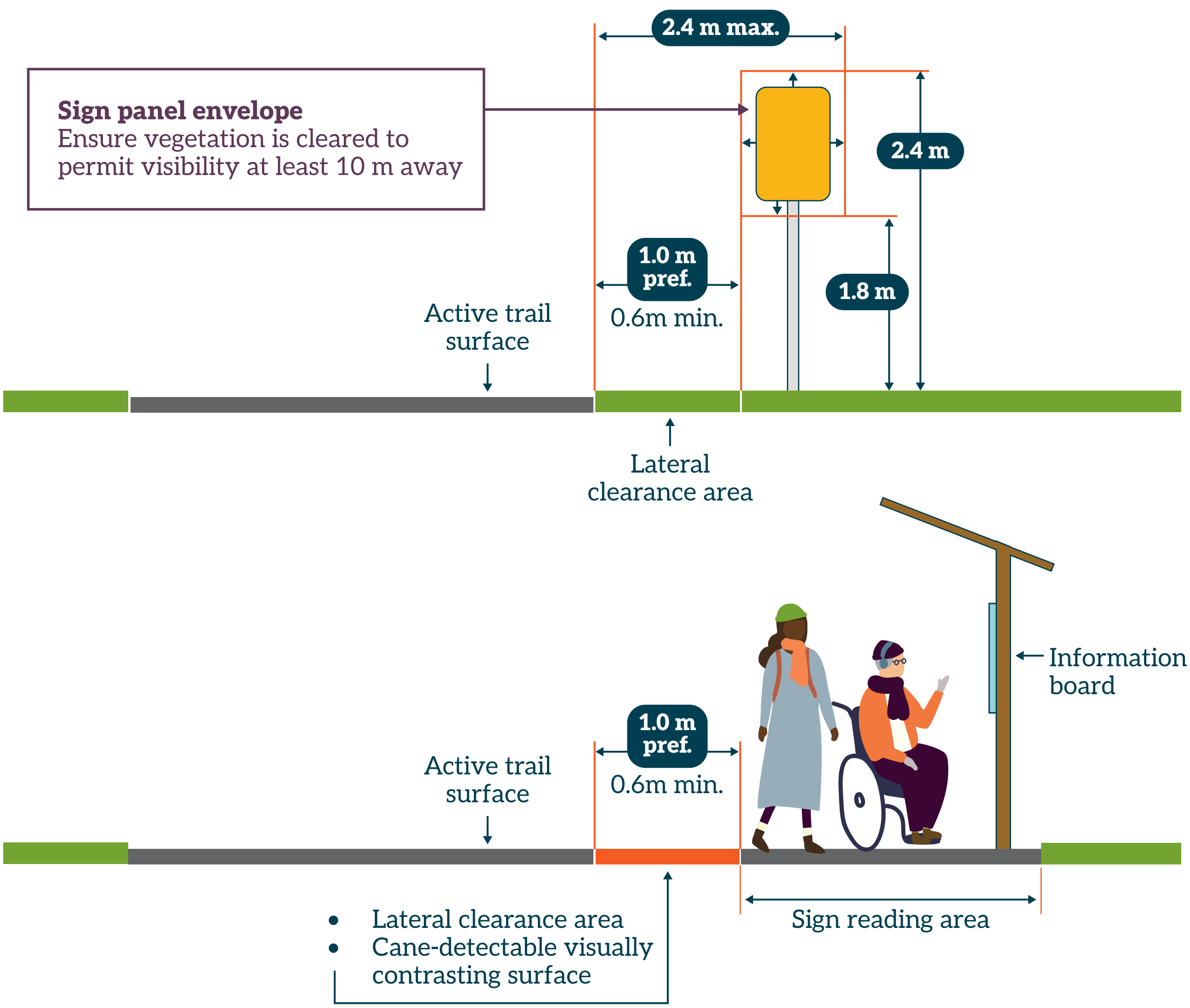
Trail Etiquette

Signage can help educate people on how to safely share trails and enhance the overall trail user experience. Many jurisdictions create custom trail etiquette signage tailored to the local context and issues, such as yielding right-of-way, passing safely, and leashing pets. For trails with a high volume of MRVs, maximum speed signs may be added to support trail etiquette signs.

Wayfinding Signage

A seamless, consistent, and easy-to-understand system of wayfinding can make a community's active transportation network easier to navigate. Additional guidance on wayfinding can be found in Chapter H.4 of the *BC Active Transportation Design Guide*. The *TAC Bikeway Traffic Control Guidelines for Canada* provides guidance on regulatory signage and the *TAC MUTCDC* may also be referenced for wayfinding signage options in instances where signage customization is not feasible.

Figure 16. Typical Placement of Signs and Information Boards on Highway Trails



Adapted from Toronto Multi-Use Trail Design Guidelines (2015)

Decision Signage

- On the approach of a decision point (typically an intersection), decision signage provides direction to select destinations through the use of directional arrows.
- Decision signage is particularly important when trail users require different information than motorists, such as different destinations that may be of more interest to non-motorists or bicycle route decision. Decision signage should not repeat information provided on signs for motorists to avoid information overload. To manage the amount of information provided on one sign, decision signs will typically contain up to three destinations.
- Decision signage should be located at a safe stopping distance before the turn. On routes where speed is likely to be high, decision signs can be repeated ahead of the turn.
- Decision signage should also include accessibility information, such as a description of the anticipated conditions ahead.

Confirmation Signage

- Confirmation signage is placed after decision points. These signs provide confirmation, reassure people cycling of their direction, and confirm additional destinations reached along the route. Confirmation signs will also provide information about other destinations that may be reached on the route.
- Confirmation signs should be located at 20–30 m after turns and should be repeated for reassurance every 400 m in communities and every 800 m in remote areas.
- Because confirmation signs are located after turns where the information load is less distracting, it is possible to include more information about destination names and distances. Typically, three to four destinations would be shown in ascending order.

Off-Network Signage

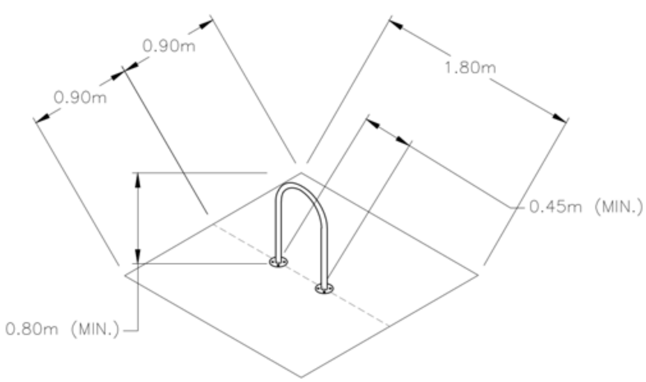
When highway trails end and there is no continuous connection to another active transportation facility, signage can be used to guide people to the active transportation network. Off-network signage should only be used for short linkages between designated active transportation routes and other highways, roads, or trails. The design should make it clear this is not a designated active transportation route. Wherever possible, designers should work towards providing continuous connections between highway trails and other active transportation facilities, in line with the Networking Planning Principles described in **Section B**.

D2.4 Amenities for Highways Trails

Amenities can enhance the experience for all trail users, including people commuting to work or school, local recreationalists, and visitors exploring the Yukon. Areas with higher volumes of trail users are ideal for amenities, such as trailheads, trail intersections, rest stops, and viewing areas. Designers should seek to use durable materials that are easy to maintain and resistant to vandalism wherever possible. Designers are also encouraged to seek opportunities to collaborate with local business organizations and community groups on the design and maintenance of trailside amenities. The following list provides high-level considerations for trailside amenities, but designers should always check to see if local jurisdiction and maintenance team has their own specifications.

Benches allow trail users to stop for breaks. They should be placed facing the trail on a hard surface, but should not encroach onto the Trailer User or Shoulder Zone. The bench pad should be wide enough to permit a wheelchair or stroller to park beside the bench and should have a grade of not more than 2%.

Bike racks are useful for short-term parking while trail users shop, eat, or hike, while lockers or cages are useful for long-term parking while trail users go to work, school, or complete other activities.



Bike racks should be oriented parallel to the highway trail outside of the Trailer User and Shoulder Zone on a hard surface. The recommend style of bike rack is Inverted U or Post and Ring, because they have two contact points with the bicycle frame, they can support two bicycles per rack, and they can be installed alone or in a series on rails. Bike parking should be setback from the Trail User Zone, so that parked bicycles and people locking their bicycles do not encroach on the Trail User Zone. In communities with high uptake of electric bicycles, designers should consider providing bike racks suitable for oversized or long bikes, as well as charging outlets.

Public art can educate trail users on the natural environment, local history, and Indigenous culture. Designers should look for opportunities to incorporate public art trailside amenities, without compromising accessibility, functionality, or safety.

Repair stations allow trail users to complete minor repairs with pumps, allen keys, wrenches, screwdrivers, spoke tools, and tire levers. Anti-theft versions are preferred, because vandalism can be common.

Shelters with covered roofs can provide shade and protection from the elements, during both summer and winter conditions. Designers should consider locating bike racks inside covered shelters, where there is enough space.

Waste receptacles can help prevent littering and control wildlife attractants. They should be bear-resistant and placed so that they do not impact sightlines. Priority should be given to locations that are convenient for regular maintenance.

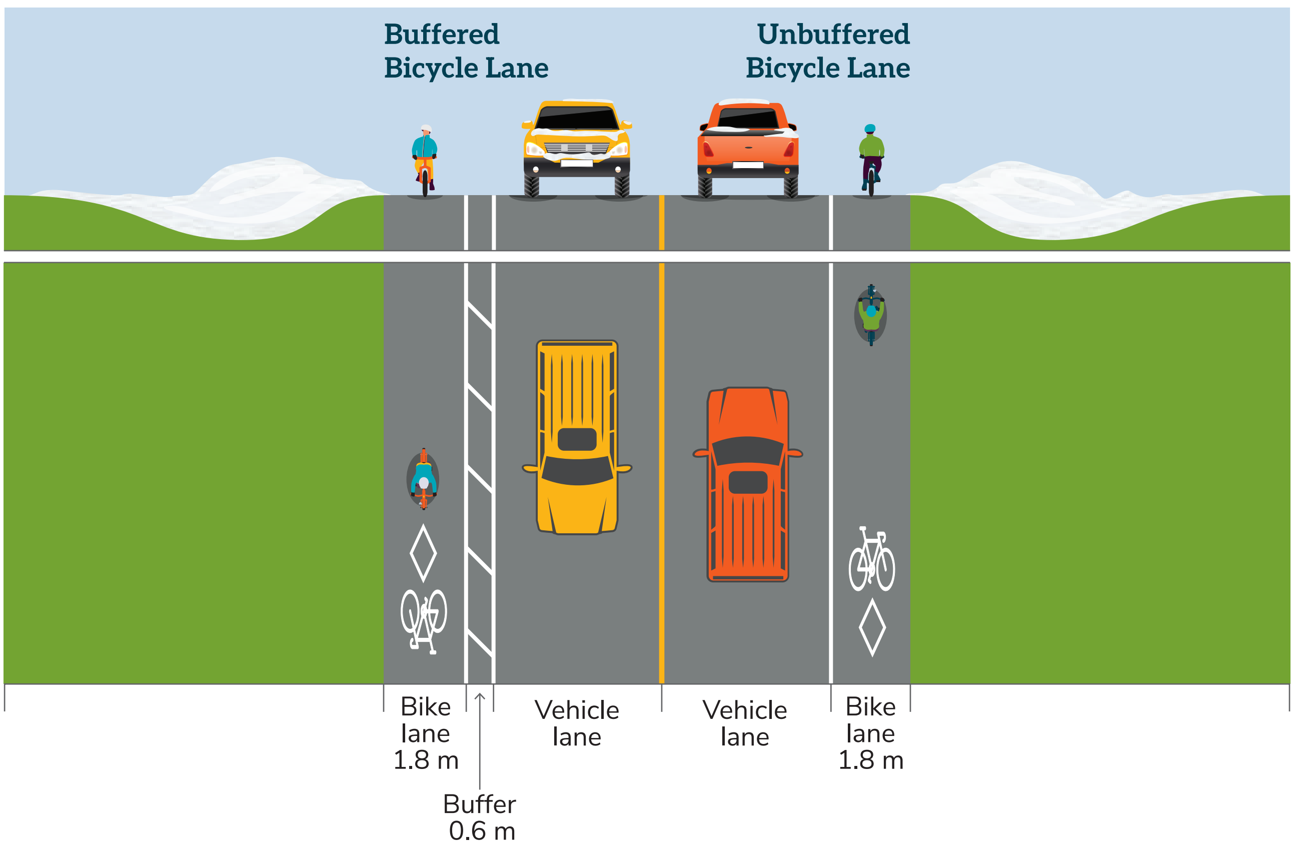
D3. Visually-Separated Facilities

Visually-separated facilities are not preferred for Yukon highways because they expose active transportation users to motor vehicles travelling at high speeds. As a result, they are not considered safe and comfortable for all-ages-and-abilities. However, visually-separated facilities can be effective for linking local roads with highway trails that run through communities. This Section was included to support First Nations governments and local governments looking for ideas to support active transportation in their communities.

D3.1 Bicycle Lane

Bicycle lanes are typically located on the right side of the highway adjacent to the shoulder with signage, pavement markings, and sometimes buffers. Bicycle lanes are reserved for the exclusive use of bicyclists, unlike enhanced shoulders (see D3.2). Bicycle lanes are not considered suitable for all-ages-and-abilities, because they do not provide physical-separation from motor vehicles.

Figure 17. Bicycle Lane Cross-Section



Buffer Treatments & Widths

An **Unbuffered Bicycle Lane** includes only a white longitudinal line running parallel to the alignment of the highway to visually separate the bicycle lane from the motor vehicle and/or parking lanes.

Table 10. Facility Width Guidance for Unbuffered Bicycle Lanes

Unbuffered Bicycle Lane	Desirable (m)	Constrained (m)
Trail User Zone	1.8*	1.5**

*For any width greater than 1.8 m, a buffer should be provided to avoid the bicycle lane being mistaken or used for other purposes, such as parking or motor vehicle travel.

**The absolute minimum width of an unbuffered curbside bicycle lane is 1.2 m. A bicycle lane width between 1.2 m and 1.5 m should only be considered for short distances (less than 100 m) in constrained areas and when reasonable consideration has been given to an alternate design.

A **Buffered Bicycle** Lane provides additional visual-separation between the bicycle lane and the motor vehicle travel lane and/ or parking lane by way of an additional white longitudinal line that runs parallel to the bicycle lane. Depending on the width of the buffer space, the buffer space can be defined with additional markings such as hatched striping. A buffer may be used to visually narrow the bicycle lane width to reduce the perception that a wider bicycle lane may be used as a motor vehicle parking or travel lane. Where motor vehicles speeds are 50 km/h or greater, adding a buffer is strongly recommended.

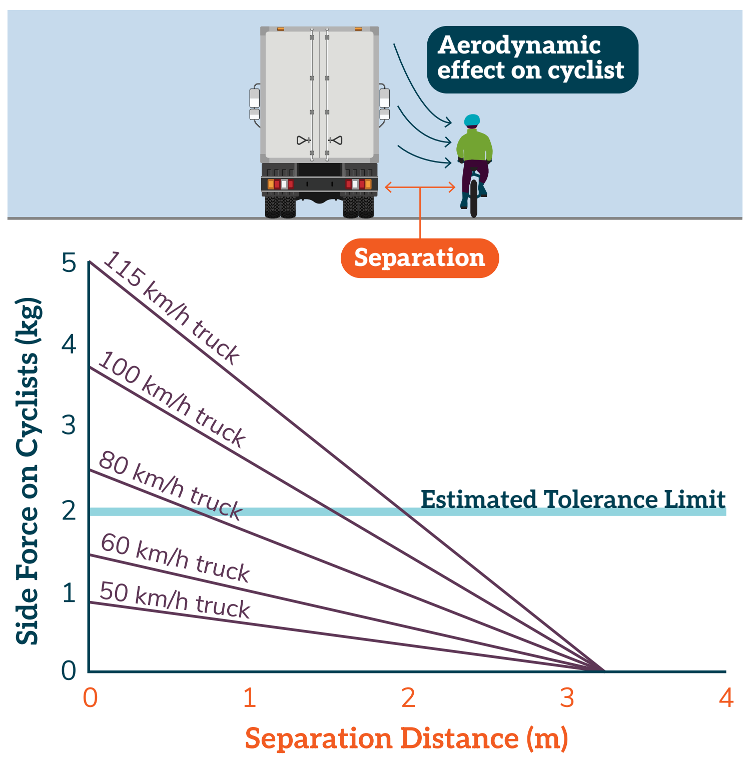
Refer to the *TAC Geometric Design Guide for Canadian Roads* (Section 5.7.5) and *Ontario Traffic Manual Book 18* (Section 4.3.1) for detailed guidance on selecting separation treatments based on context, costs, and benefits.

Table 11. Facility Width Guidance for Buffered Bicycle Lanes

Buffered Bicycle Lane	Desirable (m)	Constrained (m)
Trail User Zone	1.8	1.5
Buffer Zone	0.6	0.3

Where heavy vehicles make up more than 5% of motor vehicle traffic, consideration should be given to providing increased buffer zones or physical-separation between people cycling and motor vehicles or providing alternative routes for active transportation. This is due to the push/ pull of air from a large vehicle passing at speed, which is a real and perceived safety risk for cyclists.

Figure 18. Aerodynamic Effect of Truck Passing



Adapted from Queensland Transportation Guidelines (2006)

Signage

The Reserved Bicycle Lane sign (MUTCDC RB-90) should be installed continuously along the length of the bicycle lane. In a community context, signs should be placed after every intersection and spaced mid-block at least every 400 m. In a remote context, signs should be placed after every intersection and spaced mid-block at least every 400 to 600 m. Signs can also be used in areas where there is frequent non-compliance with parking in bicycle lanes where bylaw restrictions are in place.

The Reserved Bicycle Lane Ends sign (MUTCDC RB-92) should be installed at the end of the reserved lane denoting the end of the bicycle lane. However, designers should use caution when installing signage to ensure to not result in reduced effectiveness of existing signage.

Pavement Markings

Edge Line Striping

Bicycle lanes are delineated by one to two longitudinal lines that border a designated area for bicycle use. The longitudinal line(s) directs motor vehicle and bicycle traffic into appropriate lanes and provides clarity for safe use of the road.

Bicycle lane lines are typically solid, except in locations where motor vehicles are permitted to cross the bicycle lane to complete turning movements.

At these locations, dashed white line markings are used. The dashed white line segments should consist of a minimum 1.0 m long line segment with a 1.0 m gap between the segments. Refer to the Section 7 of the *TAC Bikeway Traffic Control Guidelines for Canada (2012)* for more guidance.

Buffer Pavement Markings

Where a buffer is provided, the buffer is also delineated with two solid white lines and can be located between the bicycle lane and the motor vehicle or parked motor vehicle lane or both. One white line is shared with the bicycle lane. The buffer lines should be a width of 100 mm. Buffer markings can be enhanced with hatching to decrease ambiguity of the space. If the buffer is greater than 0.6 m, hatching should be considered. For buffers greater than 0.9 m hatching recommended to deter improper use of the space.

User Symbols

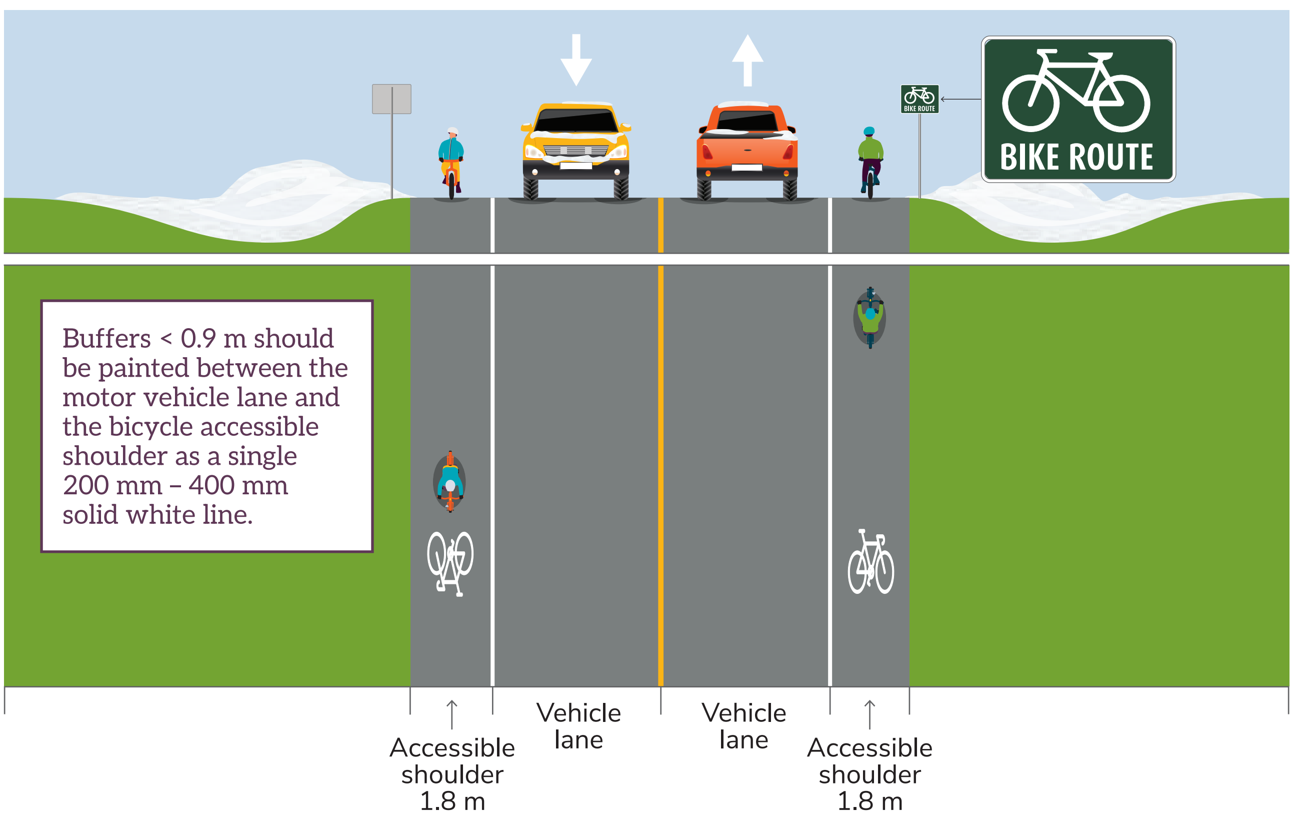
Dedicated bicycle lanes also need to include the white bicycle and reserve lane diamond pavement marking symbols. These symbols may be supplemented by directional arrow markings to denote the bicycle lane movement.

D3.2 Enhanced Shoulders

Enhanced shoulders can be the most practical way to accommodate people riding their bicycles, walking, and rolling along remote highways, because they are relatively low cost. However, enhanced shoulders are not a AAA facility given the lack of physical separation, exposure to vehicles moving at higher speeds, and the fact that they are not dedicated exclusively to people cycling. Enhanced shoulders can be distinguished from regular shoulders based on the following characteristics:

- Pavement markings to separate the shoulder from motor vehicle traffic
- Sufficient operating space for active transportation users
- Smooth, paved surface
- Regular snow clearance and sweeping

Figure 19. Enhanced Shoulders Cross-Section



Shoulder Zone Width

Table 12. Facility Width Guidance for Enhanced Shoulders

Posted Speed	Desirable (m)	Constrained (m)
< 50 km/hr	1.8	1.5
>50 km/hr	2.0	2.0
>60 km/hr	2.5	2.0
70 km/hr	3.0	2.5
>70 km/hr	*Provide physically-separated facility instead, if possible*	

Signage

Regulatory signage is not required on enhanced shoulders. However, information signs may be provided to assist in wayfinding and to raise motorists' awareness of people cycling on the highway. Information signs are recommended for enhanced shoulders that are used during winter conditions because pavement markings may be less visible.

Additional directional and confirmation signage should also be used at intersections and junctions to provide guidance to people using active transportation and motorists.

Rumble Strips

The *TAC Geometric Design Guide for Canadian Roads* recommends the use of rumble strips between the Highway Zone and Shoulder Zone, particularly on highways with higher posted speed limits. Rumble strips are milled out sections of the pavement along a highway that provide feedback to motorists through noise and vibrations in the steering wheel, notifying them when they have deviated from the travel lane.

When people riding their bicycles in the shoulders need to access the motor vehicle lane because of debris or other riding impediments in the shoulder, they would need to cross the rumble strip. It can be hazardous to ride over rumble strips at higher speeds because of the uneven surface which may cause a loss of control. As such, if rumble strips are used, their design and placement must be properly considered to ensure the safety of all users. The US Federal Highway Administration recommends designers include recurring short gaps in rumble strips to accommodate cyclists. For every 12-20 m of rumble strip, they suggest a gap of 4 m.

Pavement Markings

Enhanced shoulders are delineated by a solid white longitudinal line along the side of the travelled lane. A solid white line of 100 to 200 mm is recommended to delineate the lane edge line and separate motor vehicle travel lanes from the shoulder.

When placed in conjunction with a bicycle route information sign, the stencil should be located within 10 m of the sign location, preferably in advance of the sign. Bicycle stencils should be installed after every signalized intersection.

Supplementary symbols may also be placed between intersections. On rural shoulders, it is recommended they are spaced every 2 km. The typical pavement marking used to identify bicycle routes should be the standard TAC bicycle pavement marking. This elongated bicycle symbol is 1.0 m wide by 2.0 m tall.

D4. Mixed-Traffic Facilities

Mixed-traffic facilities are not recommended on Yukon highways, because they expose active transportation users to motor vehicles travelling at high speeds. However, mixed-traffic facilities can be effective for linking local roads with highway trails that run through communities. This Section was included to support First Nations governments and local governments looking for ideas to support active transportation in their communities.

Neighbourhood Bikeways

Neighbourhood bikeways (also referred to as bicycle priority streets, local street bikeways, or greenways) are streets with low motor vehicle volumes and speeds that have been enhanced to prioritize bicycle traffic. Neighbourhood bikeways can be considered suitable for all-ages-and-abilities, when the appropriate design treatments have been implemented for the traffic context. They are typically most suitable for more urban communities, where right-of-ways typically have a curb and gutter. Neighbourhood bikeways should not be considered on roads with posted speed limits greater than 50 km/hr and volumes higher than 500 vehicles/day.

A basic treatment level can be applied on roads that already have low motor vehicle volumes and speeds, where the only required measures consist of bicycle route signage and pavement markings, along with intersection treatments to aid bicycle users in crossing major roads. Where existing traffic speeds or volumes are higher, treatments may also include a range of traffic calming measures designed to reduce motor vehicle speeds, and traffic diversion measures designed to reduce motor vehicle volumes while maintaining full access for people walking and cycling. Each of these different treatments builds upon the last, adding to the level of prioritization for active transportation users.

See the *BC Active Transportation Design Guide* (Chapter D.2) for more detailed guidance on Neighbourhood Bikeways.

Yield Roadways

Yield roadways accommodate two-way travel for people walking, cycling, and driving motor vehicles within the same slow-speed, low-volume lanes. These roadways are intentionally designed with narrow lanes, no centre line, and no sidewalk. Typically, people walking should face oncoming traffic, while people on bicycles should travel the same direction as traffic. Yield roadways are most suitable for more rural communities, where right-of-ways typically have a shoulder and ditch. They are not appropriate for roadways with posted speed limits greater than 40 km/hr or volumes of 100 vehicles or more per day.

While Yield Roadways are common in many rural and remote communities, they can create accessibility challenges, especially for people with sight loss who may experience difficulties detecting oncoming traffic and orienting themselves. Unless volumes and speeds are very low, most active transportation users are not comfortable using yield roadways, therefore they are not considered suitable for all-ages-and-abilities. Wherever possible, communities should look to provide another facility type instead. For cases where communities are considering yield roadways, refer to the US Federal Highway Administration's Small Town and Rural Multimodal Networks for design guidance.

Section E.
Intersections & Crossings

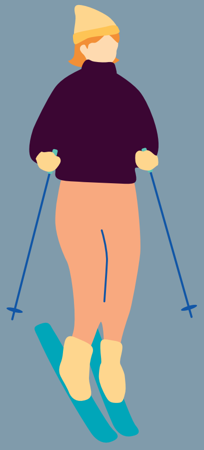


Photo Credit: John Howland

E1. Safe & Comfortable Intersections & Crossings

Design Principles for Intersections and Crossings

Intersections and crossings tend to be where the most collisions occur between trail users and motor vehicles. Design practitioners need to take steps to mitigate these conflicts wherever possible.

The following design principles should be considered in order to provide accessible, comfortable, and safe intersection and crossing treatments for all users:

Safe Crossings Design Principles

- **Design for all ages and abilities:** People of all ages and abilities should be able to safely and comfortably navigate an intersection, crossing, or transition area.
- **Minimize conflicts between users:** Conflicts can be minimized by separating different users in space and/or time. Providing dedicated spaces and/or protected phasing for active modes through intersections and crossing points increases the predictability of movements and supports more compliant behaviour. Minimizing exposure between active transportation users and motor vehicle traffic can also help to reduce conflicts.
- **Ensure clarity of right-of-way:** Providing clear and consistent traffic control devices and visual cues that indicate which user is expected to yield and/or stop ensures clarity of right-of-way. Priority of right-of-way needs to align with municipal bylaws and the Yukon MVA and associated regulations. Right-of-way at intersections and crossings should be intuitive for all users.
- **Reduce speed at conflict points:** Reducing the speed differential between different road users helps to reduce the potential for collisions and reduce the severity of injury when collisions do occur. This can include using signage, pavement markings, and geometric design elements such as reducing corner radii and raised crossings to encourage reduced speeds for motor vehicles and people cycling.
- **Ensure clear sightlines:** Sightlines appropriate for the intersection approaches and crossing areas must be provided for all users. Providing clear sightlines ensures that all users have sufficient decision and reaction time to stop or yield to conflicting traffic. Sightlines are especially important at uncontrolled intersections to ensure that all users can see each other upon approaching and entering the intersection.
- **Make intersections as compact as possible:** Compact intersections can enhance safety for active transportation users by improving visibility for all modes, reducing trail user exposure to motor vehicles through shorter crossing distances, and slowing motor vehicle speeds at conflict points. Winter maintenance vehicles can be used as control vehicles in intersection design, but ultimately designers should prioritize vulnerable road user safety.

Crossing control devices and warrants

There are three levels of crossing control that can be applied at intersections and crossing points:

- Uncontrolled;
- Stop or Yield control; and
- Signal control.

The choice of crossing control depends on a number of factors, including: road geometry, road classification, collision history, sightlines, motor vehicle volumes, and the number of people walking and cycling. The TAC *MUTCDC* and *Pedestrian Crossing Control Guide* have established warrants (selection criteria) for the use of various traffic control devices. These warrants provide decision support (typically in the form of numeric criteria) for whether or not a traffic control device is justified in a given context and, if justified, what type of control should be used. Yukon specific guidance is also provided in the *Yukon Supplement to Pedestrian Crossing Control Manual*.

Warrants help to promote consistency in design and installation. However, warrants are not a substitute for professional judgement. Sometimes warrant thresholds may not be appropriate for the Yukon context, therefore designers will have to apply their local knowledge. For example, safe crossings should be prioritized in areas with vulnerable road users, such as schools and health services, regardless of warrant results. Furthermore, the installation of a warranted device does not guarantee an active transportation user's safety, and sometimes additional treatments may be necessary. In order to provide flexibility in decision making, a holistic and systematic approach to choosing traffic controls that incorporates both numeric criteria and qualitative engineering judgement is recommended.

Accessible crossings

The *Canadian Standards Association Accessible Design for the Built Environment* provides detailed guidance on pedestrian crossings. There are a number of design elements that design practitioners can incorporate to make intersections and crossings more inclusive, safe, and comfortable for users of all ages and abilities, including:

Accessible Crossing Elements

- **Ramps:** Provide smooth, graded transitions between the trail and the roadway or driveway. Ramps should be aligned with the centre of the crossing to create a direct line of travel for trail users.
- **Tactile Walking Surface Indicators:** Use TWSIs to help people with sight loss navigate crossings by placing tactile attention indicators (TAIs or truncated domes) before crossings and conflict zones. TWSIs should be made of durable materials with high-visual contrast. Many winter communities use cast-iron plates that are cast to improve durability.
- **Audible Pedestrian Signals:** Provide APS that make sounds to indicate when to cross a road are designed to help people with vision loss to safely navigate intersections.
- Signal timing: Ensure trail users have enough time to make the crossing safely and comfortably.
- **Crossing distance:** Use curb extensions and median islands to reduce the crossing distance for pedestrians. See Section F more details on rapid implementation techniques.
- **Push buttons:** Place push buttons at the appropriate height for the trail user and at the same orientation of the direction of the crossing.

E2. Access Road & Driveway Crossings

In the Yukon, there are many bi-directional highway trails that create more potential for conflicts at access road and driveway crossings. Where possible, the number of access road and driveway crossings should be limited through the network planning process. Where access roads and driveway crossings exist, designers should use geometric design, signage, pavement markings, and other tools to minimize potential conflicts. **Figure 20** shows a multi-use highway trail crossing an unsignalized access road. The below treatments are suitable for similar contexts, where a highway trail crosses an access road/driveway with a low posted speed limit, low volumes, and two lanes.

Using Signage to Communicate Right-of-way

As of 2025, the Yukon MVA recognized pedestrians as vulnerable road users, but treated cyclists and motorized trail users similarly to motor vehicles. As a result, pedestrians, cyclists, and motorized trail users have different requirements and responsibilities at crossings. The type of signage required at crossings will depend on which user has the right-of-way: the motor vehicle driver, or the trail user.

Motorist-facing stop signs are typically recommended before the crossing to assign right-of-way to pedestrians.

Trail-facing yield signs may be used in certain contexts, to alert cyclists and motorized trail users that they need to slow down to a speed that is reasonable for the existing conditions and stop when necessary to avoid interfering with conflicting traffic.

Use of trail-facing yield signs should be assessed based on location specific context, taking into account sightlines or other safety issues that cannot be mitigated through alternative design.

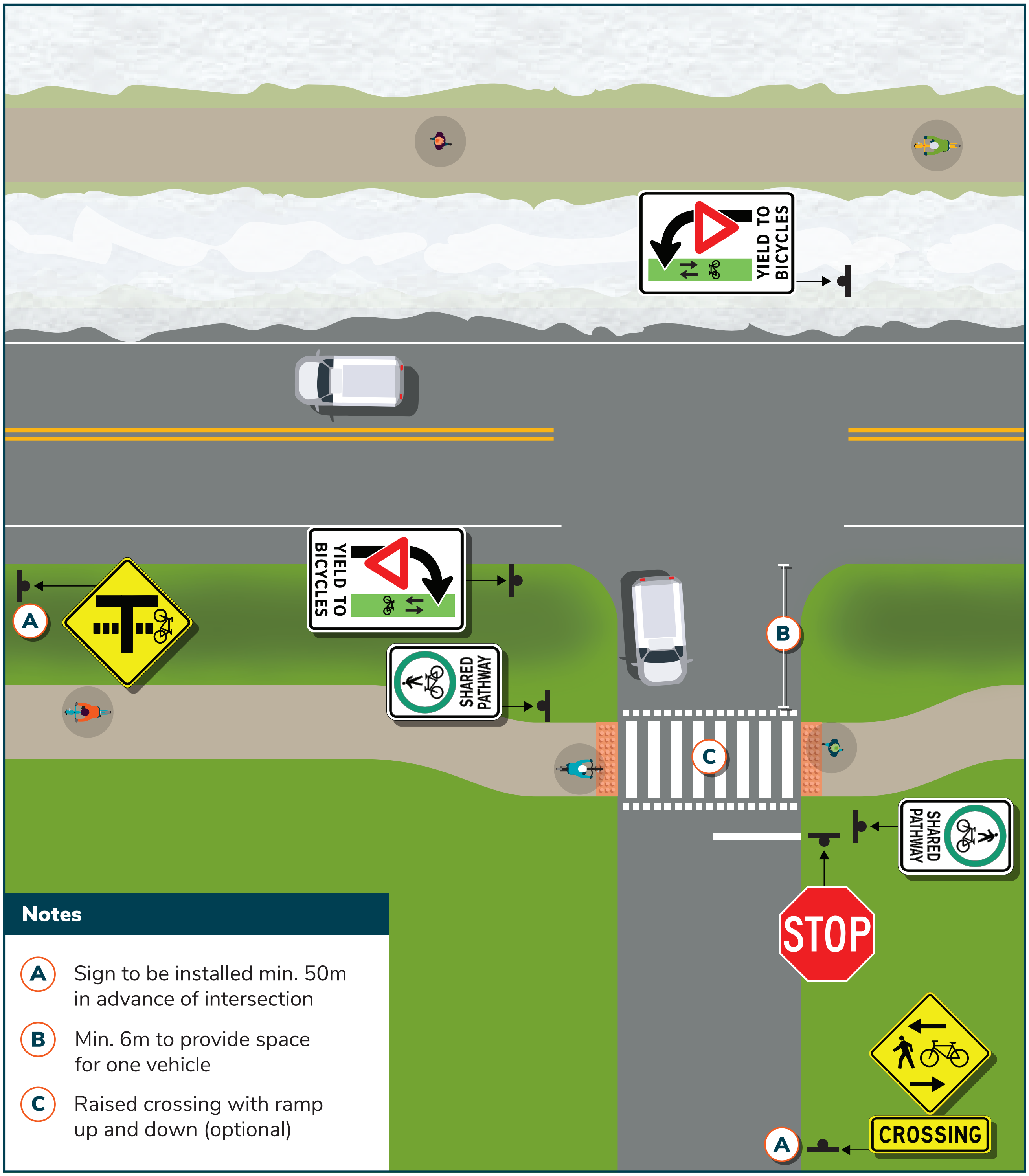
Trail User Approach

- **Bend-Out:** The highway trail is shown bending away from the parallel highway. Bend-out crossings are generally preferred over bend-in alignments because they offer more safety benefits, including: additional reaction time for turning motorists, improved sightlines by allowing turning motorists to orient the vehicle perpendicular to the trail, and reduced trail user speed before crossing through horizontal deflection. Section 5.6.3.1 of the *TAC Geometric Design Guide for Canadian Roads* provides more detailed guidance on the taper ratio of the alignment shift.
- **Tactile Attention Indicators** (TAIs) are shown on either side of the crossing to warn people with sight loss about the conflict zone. Cast iron plates are recommended to improve winter durability. The *Canadian Standards Association Accessible Design for the Built Environment* provides more details on the dimensions and placement of TAIs.
- **Crossride:** Dashed pavement markings (also known as elephant's feet) are shown on either side of the crosswalk to indicate that people on bicycles can cross without dismounting. Where crossride markings are extensions of a bicycle facility across an intersection, they reinforce the right-of-way of the bicycle over turning traffic. For user-separated trails, separate crossride markings should be provided adjacent to the crosswalk. See Section G.5 of the *BC Active Transportation Design Guide* for more details.
- **Shared Pathway Sign** (RB-93) is recommended to indicate that both cyclists and pedestrians are permitted to use the trail. On motorized highway trails, designers should use a customized sign.

Motorist Approach

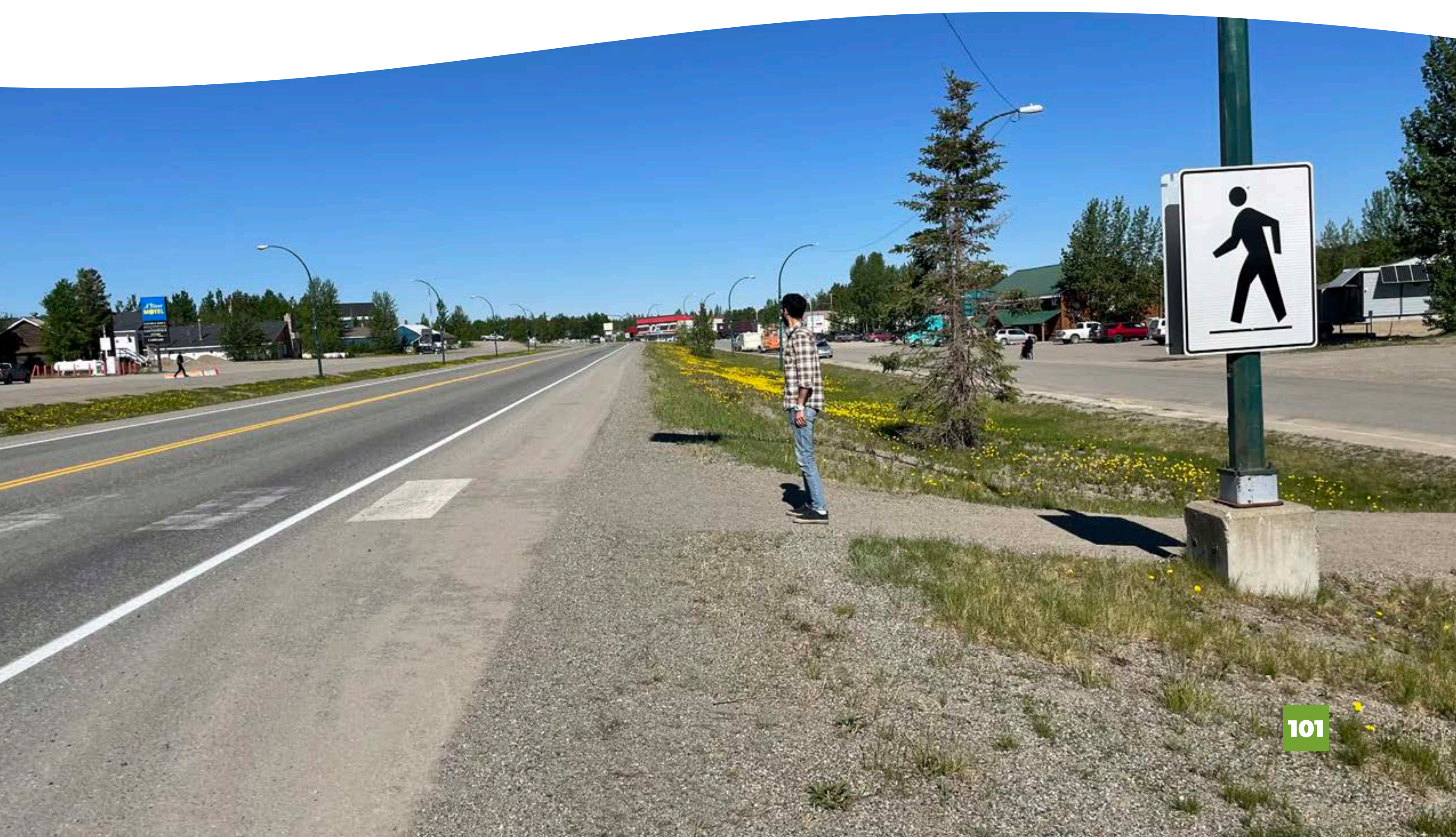
- **Warning Signs** are recommended to alert motorists of the presence of the trail crossing in advance (WC-46 or WC-44) and remind them to look for trail users travelling in both directions (Customized WC-46). See **Appendix C** for more sign details.
- **Stop Signs** are recommended before the crossing to assign right-of-way to trail users.
- **Raised Crossings** are optional treatments designers can use to highlight to motorists they are crossing a trail and slow motor vehicles down. The surface material and grade of the highway trail should be maintained across the access road or driveway. Raised crossings generally are more suitable for roadways with curb and gutter. If applied to locations with shoulders and ditches, consider defining the edge of road with elements such as delineators and paint.
- **Yield to Bicycles Sign** are used to mark conflict zones where turning motorists are required to yield to people using the highway trail travelling in both directions (Customized RB-37). See **Appendix C** for more details.

Figure 20. Driveway Crossing Diagram



E3. Mid-Block Crossings

Mid-block crossings are essential for connecting trail users with important destinations. In remote contexts, mid-block crossings could help people with a park on the other side of the highway. In community contexts where the highway also functions as the main street, mid-block crossings could connect people to businesses, schools, and health services. When there is no intersection or mid-block crossing nearby, people might cross illegally to reach their destinations, creating safety issues for all road users. **Figure 21** shows an unsignalized mid-block crossing between a multi-use highway trail and low-speed, low-volume section of the highway with two lanes. The below treatments are suitable for similar contexts.



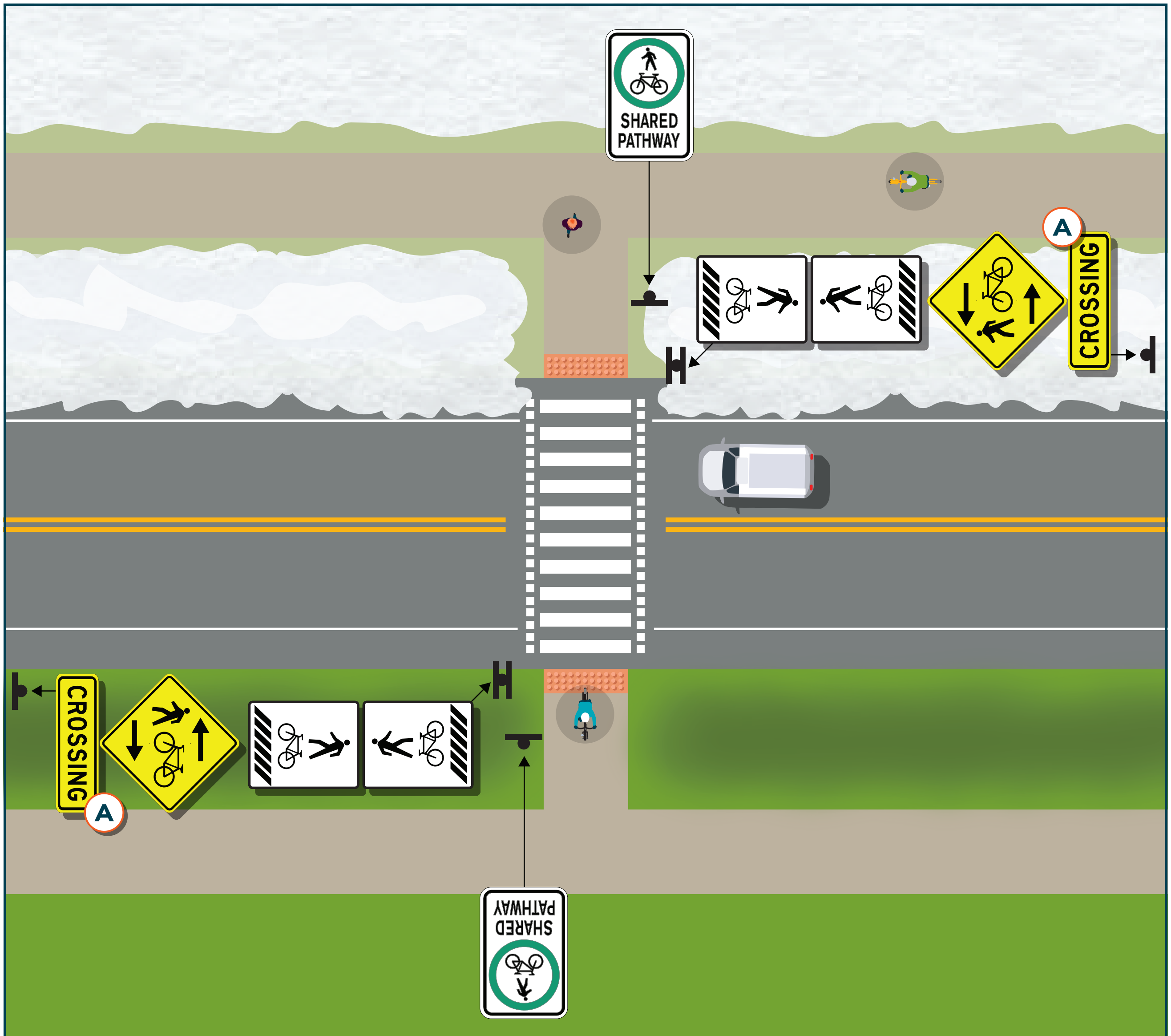
Trail User Approach

- **Alignment:** At mid-block crossings, the trail should be as close to perpendicular as possible to the highway that is being crossed. The trail on each end of the crossing should be aligned with one another.
- **Tactile Attention Indicators** (TAIs) are shown on either side of the crossing to warn people with sight loss about the conflict zone. Cast iron plates are recommended to improve winter durability. The *Canadian Standards Association Accessible Design for the Built Environment* provides more details on the dimensions and placement of TAIs.
- **Crosswalk:** Zebra or ladder markings are recommended to make the crossing more visible, compared to Twin Parallel Line Crosswalk markings.
- **Crossride:** Dashed pavement markings (also known as elephant's feet) are shown on either side of the crosswalk to indicate that people on bicycles can cross without dismounting. For user-separated trails, separate crossride markings should be provided adjacent to the crosswalk. See Section G.5 of the *BC Active Transportation Design Guide* for more details.
- **Shared Pathway Signs** (RB-93) are recommended to indicate that both cyclists and pedestrians are permitted to use the trail. On motorized highway trails, designers should use a customized sign.

Motorist Approach

- **Sightlines:** Mid-block crossings should be installed only where adequate sight distances for both motorists and trail users are available. Section 5.6.3.2 of the *TAC Geometric Design Guide for Canadian Roads* provides a calculation for determining the appropriate sightlines required for mid-block crossings. For any widths or speeds not shown in the table, the formula shown in **Figure 22** may be used to calculate the required sight distance.
- **Warning Signs** are recommended to alert motorists of the presence of a bi-directional trail crossing in advance (Customized WC-46). See **Appendix C** for more details on signs.
- **Regulatory Signs** are recommended to assign right-of-way to trail users at the crossing (Customzied RA-4). See **Appendix C** for more details on signs.
- **Rectangular Rapid Flashing Beacons** (RRFBs) and Overhead Flashing Beacons are optional treatments to enhance the visibility of crossing and improve yielding behaviour from motorists. When activated by pedestrians, flashing amber lights alternate back and forth. For additional information, refer to the *TAC Pedestrian Crossing Control Guide* and *Yukon Supplement to the Pedestrian Crossing Control Guide*.
- **Curb extensions** are optional treatments to improve accessibility, comfort, and safety for trail users. They reduce the overall crossing distance, slow vehicles down by narrowing the travel lane or reducing the corner radii, and increase trail user visibility by bringing people closer to the crossing. As an added benefit, curb extensions also create extra space at crossings that can be used for trail user queuing, trailside amenities, and landscaping. See **Section F** more details on rapid implementation techniques.

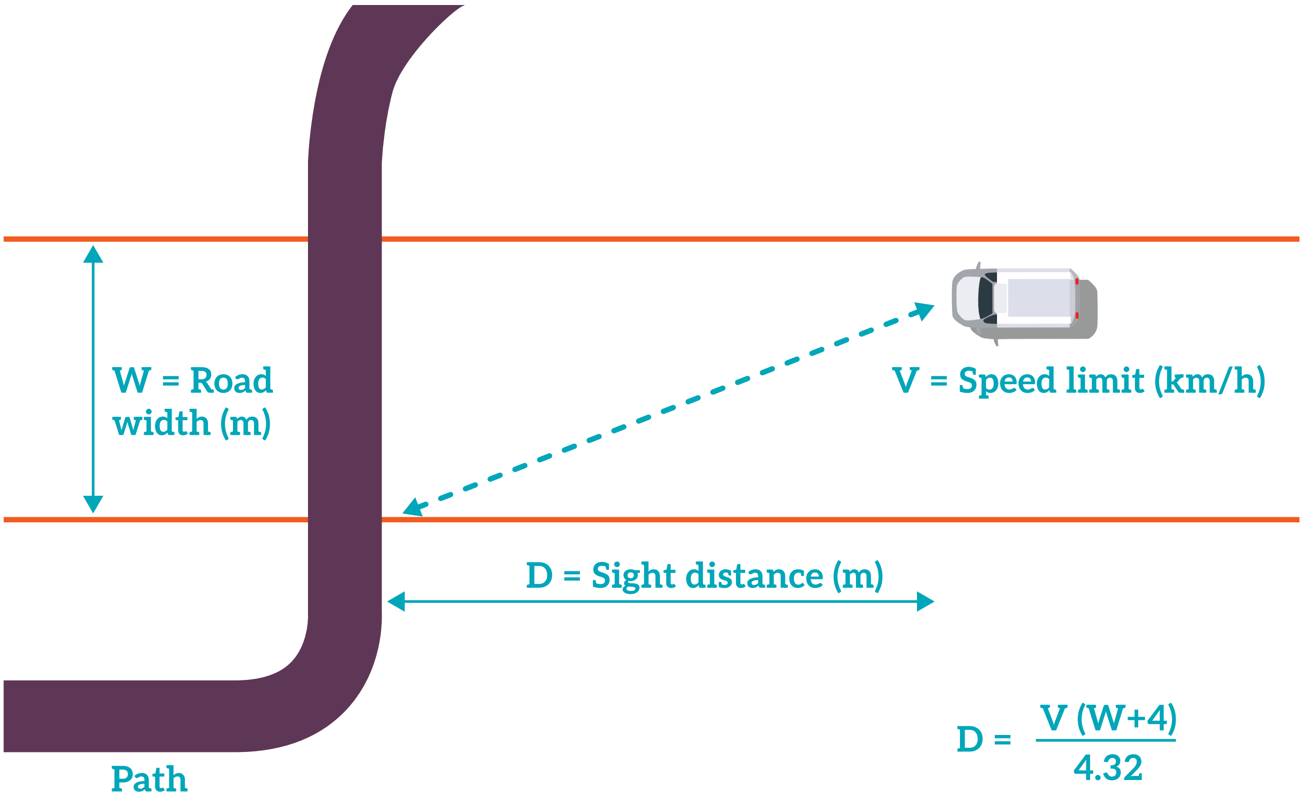
Figure 21. Mid-Block Crossing Diagram



Notes

Ⓐ Sign to be installed min. 50 m in advance of intersection

Figure 22. Minimum Sight Distance for Multi-Use Path Crossing



Source: *TAC Geometric Design Guide for Canadian Roads*, Figure 5.6.12

Table 13. Guidance for Minimum Sight Distance for Highway Trail Crossing

Minimum Sight Distance (D) to Approaching Vehicle (m)

Width of Roadway - W (m)	Roadway Design Speed (km/h)			
	50	**60**	**70**	**80**
7.0	130	150	180	200
10.5	170	200	230	270
14.0	210	250	290	330
17.5	250	300	350	400
21.0	290	350	410	460

Source: *TAC Geometric Design Guide for Canadian Roads*, Table 5.6.1

E4. Roundabouts

A roundabout is a type of circular intersection in which vehicles travel counter-clockwise, and where vehicles entering the roundabout must yield to circulating traffic. The *Yukon MVA* did not provide direction on roundabouts when this Design Guide was released in 2025. The design guidance provided below assumes that trail users have the right-of-way, because they are the more vulnerable road user. Refer to the *TAC Canadian Roundabout Design Guide*, *CNIB Clearing Our Path Version 2.0*, and *Whitehorse Type 1 Trail Design Guidelines* for more details.

Trail User Approach

- **Transitions:** Visually-separated facilities should transition to physically-separated facilities in advance of roundabouts, to provide a crossing that is more suitable for trail users of all ages and abilities.
- **Geometric Design:** The approach between the highway trail and motor vehicle lane crossing should be 3.0-5.0 m in width to provide trail users space to manoeuvre and improve sightlines between trail users and motorists.
- **Splitter Island:** Splitter island widths should be a minimum 3.0 m (measured from curb face to curb face) to accommodate for all bicycle lengths. The bicycle crossing should be at-grade across the splitter island.
- **Tactile treatments** should be installed to aid people with sight loss to navigate crossings by placing tactile attention indicators (truncated domes) before crossings and conflict zones.
- **Signage:** For separated paths with designated travel lanes for trail users on wheels and trailer users on foot, yield markings should be applied to the bicycle facility on the approach to the sidewalk, along with Bicycle Yield to Pedestrians signs (MUTCD RB-39).
- **Traffic Calming:** Consider raised crossing areas for trail users to bring additional awareness to the crossing and to slow down vehicles. Additional distance to the circulatory street from the raised crossing will be required to ensure adequate space for motor vehicles to queue after ramping back down.

Motorist Approach

- **Queuing Area:** The space between the edge of the trail user crossing area and the outside edge of the highway should be a minimum of 6.0 m to allow for a motor vehicle to queue before the crossing on the exit, and to queue following the crossing before entering.
- **Lanes:** Single lane motor vehicle exits for the roundabout can improve safety as sightlines are not obstructed by a second lane of traffic.
- **Signage:** Install advanced Pedestrian and Bicycle Crossing Ahead signs (MUTCD WC-46) on the motor vehicle entry and exit lanes, a minimum of 50 m in advance of the crossings.
- **Pavement Markings:** Add yield lines for the motorist in advance of the bicycle and pedestrian crossings.
- **Landscaping** around the outside of the roundabout should be limited and less than 0.6 m tall to ensure adequate sightlines between trail users and motorists are maintained, as motor vehicle headlights are typically 0.6 m in height. A detailed sight distance analysis should be completed to confirm placement.
- **Signals:** In areas where there may be multi-lane exits, additional measures to increase motorists yielding compliance may be considered, including trail user actuated signal devices such as RRFBs. Actuated devices would need to be installed on all approaches and exits for consistency in motorists' expectation.
- **Lighting:** Ensure appropriate lighting at crossing areas and on the central island.

E5. Grade Separated Crossings

Separating highway trails from motor vehicle traffic allows for improved safety and uninterrupted flow of people using active modes. This separation, however, requires additional space, higher costs for construction and maintenance of the crossing facility, and does not provide as direct a route for the trail users, which can be a deterrent to use. Additionally, safety is a major concern with both overcrossings and underpasses. In both cases, trail users may be temporarily out of sight from public view and may have poor visibility themselves. The following should be considered when designing grade-separated crossings:

Grade-separated Design Considerations

- Consider safety concerns and evaluate the risk at an at-grade crossing, considering potential exposure for the volume of trail users expected, and the potential delay for trail users at an at-grade crossing.
- Use in higher speed (70 km/h or greater) and higher traffic volume locations where at-grade crossings cannot be achieved safely and comfortably. Such locations include rail crossings, high speed on/off ramps, high speed roadways with mid-block desire lines, interchanges, highways, and other geographic barriers.
- Use where high volumes of people walking and cycling exist or are planned. Grade separation may be considered where it would not be safe to stop the through road.
- Overpasses are most applicable where the topography allows for a structure that has little grade change for people on bicycles and walking, such as when the roadway is lower than the trail. Overpasses have a greater visual impact on the landscape but can be designed as an architectural feature.
- Underpasses are generally lower cost for construction than overpasses, except in areas with high groundwater, and are most applicable when the design allows for an open and accessible crossing that feels safe and secure. Underpasses provide better protection from weather, but because of their shelter effect, they can also lead to loitering. Other issues can arise with underpasses, including drainage, snow clearance, lighting, and perceived safety.

General Guidance for all Grade-separated Crossings

- Ensure the crossings accommodate persons of all ages and abilities through the use of ramps. Ramps should be designed so that they are not too steep for wheelchair users or a deterrent for people on bicycles. See Section 6.5.2.1 of the *TAC Geometric Design Guide for Canadian Roads* for details about accessible ramps.
- In situations where large grade differences exist, and stairs are unavoidable, bicycle channels should be installed.
- At-grade access and connectivity to other facilities must be maintained.
- Minimize crossing distances to encourage use. If the at-grade crossing distance is significantly shorter, the grade separated crossing may be poorly used.
- Entrances and exits should be clearly visible and accessible.
- Facility crossing width should remain consistent, except at entrances and exits where additional widths can better facilitate movements between different users.
- Minimum lateral clearance to obstacles should be provided; 0.2 m to obstructions that are 100 mm to 750 mm high, and 0.5 m to obstructions that are greater than 750 mm high.
- Provide flat landing area with less than 2% slope for turns, at prior to intersections, and following any steeper grades.

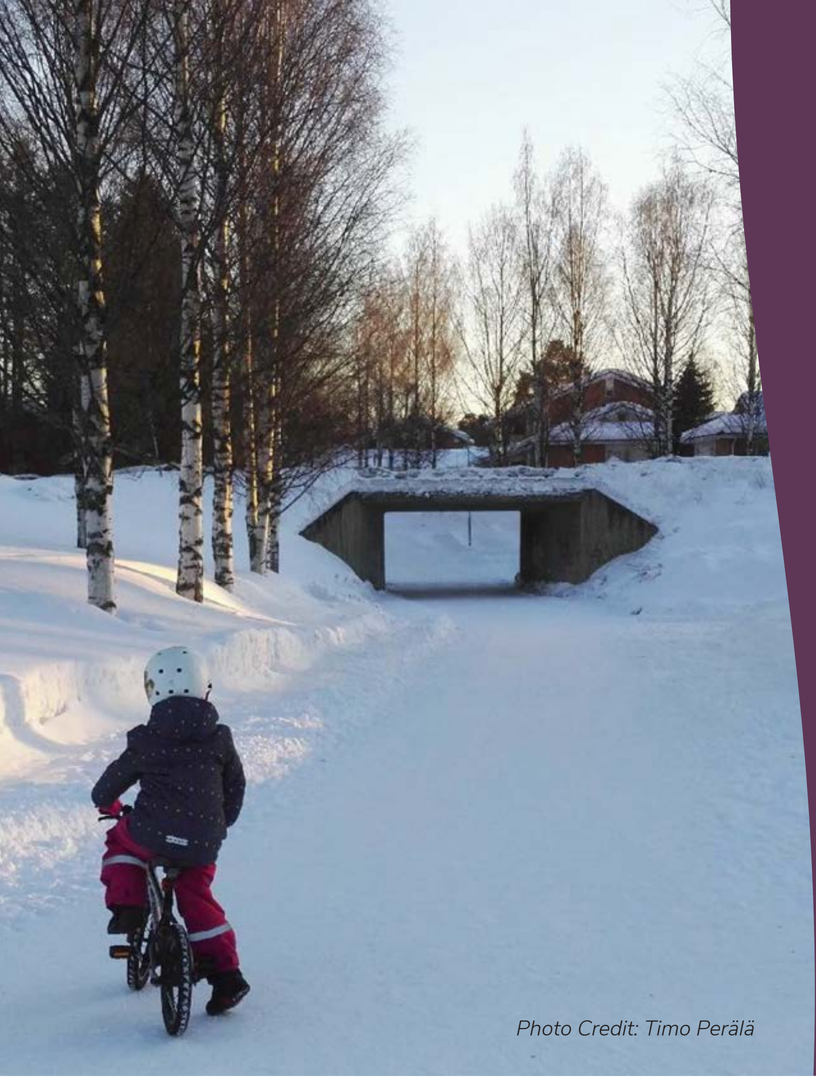


Photo Credit: Timo Perälä

Grade-Separated Crossings In Northern Contexts

In 2024, the Cycling Association of the Yukon commissioned a best practices scan of underpasses in winter communities including Whitehorse, Canmore, Alberta, Boulder, Colorado, and Oulu, Finland. The study found that embedding winter maintenance into underpass design reduces capital expenditure and ensures facilities can be used year-round. The key recommendations for designers included allocating space for snow storage and providing reliable drainage systems to prevent ice formation. Potential design solutions for drainage included adding a central pump located in the middle of the underpass's length and dedicating shoulder areas for drainage. Snow storage areas should be graded to direct run-off away from travel areas.

Overpasses and Bridge Specific-Guidance

- The minimum width for overpasses to accommodate two-way travel with lateral clearance is 5 m. If the trail is to be maintained in the winter, additional space is required on either side for snow clearing.
- Protective railings should be a minimum of height of 1.2 m.
- Signage is recommended to advise of slope/grade, the cross street below the bridge and whether the bridge is maintained in the winter.
- If the existing width of the bridge is insufficient to accommodate active transportation, modifications to the structure may be required to add cantilevers.
- The *FHWA Small Town and Rural Multimodal Networks (2016)* provides guidance on potential bridge configurations that include active transportation in both constrained and desirable conditions.

Underpass and Tunnel Specific-Guidance

- Ensure design is well lit to increase the sense of security for users. Wide openings increase natural light; light coloured underpass walls increase brightness and reflectivity of additional lighting
- Minimum width for underpasses that accommodate two-way travel with lateral clearance is 5 m. Consider increasing width of facility if length of underpass is greater than 20 m to allow for more opportunity to pass and improve sightlines for people using the trail.
- Minimum vertical clearance is 2.7 m, with a desirable clearance of 3.6 m, which allows for a small service motor vehicle to use the underpass. The clearance is measured from the surface of the Type 1 Trail to the underside of the structure.
- Underpasses work best when designed to feel open and accessible. If the underpass length exceeds 20 m, additional width should be provided.
- Installation of help point phone systems can be considered to provide a way to communicate with first responders in case of emergencies.
- Water drainage is critical – both from within the underpass and from the roadway above the underpass. Water draining from the roadway should be directed away from the trail surface. The trail surface should be well drained with the addition of ditches or a well-drained ballast to raise the trail above standing water
- Signage is recommended indicating clearance heights, the above cross street, alternative routes and any other hazards.

Section F.
Temporary Conditions

F1. Rapid Implementation

Rapid implementation or quick build approaches can be used to slow traffic at highway crossings and create a safer environment for highway trail users at a lower cost than traditional methods. They can also have additional benefits, such as alerting drivers of the upcoming crossing, creating better sightlines, and reducing the crossing distance for trail users.

Rapid implementation projects typically have three key elements:

Fast: Rapid implementation projects can be implemented relatively quickly, often in a matter of days or weeks. Because they often do not require significant capital construction, they may not require time-consuming design and tendering processes and can often be installed by government crews. This can also help minimize construction impacts on a community.

Low Cost: Rapid implementation projects make use of lower cost materials such as flexible delineator posts, curbs, or concrete barriers. These projects are typically implemented within the available right-of-way and with minimal capital construction by reallocating surplus road space from other uses, such as on-street parking or motor vehicle lanes.

Flexible: Materials used for rapid implementation projects are flexible and adjustable. This approach recognizes that designers do not always have all the answers and embraces the opportunity to pilot, monitor, and adjust designs as needed, based on lived user experience.

Rapid implementation is a powerful tool for quick and effective change, but it also has the potential to be disruptive or negatively impact certain users and services if not properly planned. To make rapid implementation projects run as smoothly as possible, there are several planning and design considerations to follow. These considerations are important for mitigating risks and ensuring the creation of accessible, safe, and comfortable spaces for all road users.

- **Accessibility:** Rapid implementation projects should prioritize inclusive design at every stage of planning and design to prevent adverse impacts and ensure accessibility. Accessibility community leaders and advocacy groups should be engaged with early and frequently during the planning and design process
- **Communication and Engagement:** Ongoing communications with First Nations, local governments, community members and other interest holders are important through each phase of the project. Rapid implementation projects serve as a form of communications and engagement, with input received from users helping to inform adaptations and ultimately the permanent design.
- **Essential Access and Services:** Corridor selection should consider the needs of all highway users, including emergency vehicles, public transit, goods movement, waste management, and deliveries. Where possible, rapid implementation projects should avoid conflicts with these other users. If impacts are unavoidable, it is critical to engage with these road users to ensure their operational needs are maintained.
- **Geometric Design and Safety:** Projects should refer to the *TAC Geometric Design Guide for Canadian Roads* and TAC Canadian Guide to Traffic Calming to ensure appropriate design criteria are used.
- **Operations and Maintenance:** Local staff are the experts in maintaining highway trails and should be engaged throughout the planning, design, and post-implementation processes.
- **Posted Speed Limit:** Rapid implementation projects are best suited for highway trails that cross access, local, or collector roads with posted speed limits 60 km/hr or less.

Sample Rapid Implementation Project: Curb Extensions

Curb extensions are typically implemented to improve the accessibility, comfort, and safety for trail users. They reduce the overall crossing distance, slow vehicles down by narrowing the travel lane or reducing the corner radii, and increase trail user visibility by bringing people closer to the crossing. As an added benefit, curb extensions also create extra space at crossings that can be used for trail user queuing, trailside amenities, and landscaping. Curb extensions are recommended at mid-block crossings, but can also be used to reduce corner radii at minor intersections and crossings with access roads and driveways. They are particularly suitable for longer crossing distances and near schools, healthcare facilities, and other destinations with children, older adults, or other vulnerable road users. Designers can consider pairing curb extensions with other treatments such as median islands to enhance the benefits for trail users.

Figure 23 shows a rapid implementation curb extension at an unsignalized mid-block crossing using traffic calming curbs. The below treatments are suitable for similar contexts, where a multi-use highway trail crosses a low-speed, low-volume section of the highway with two lanes.

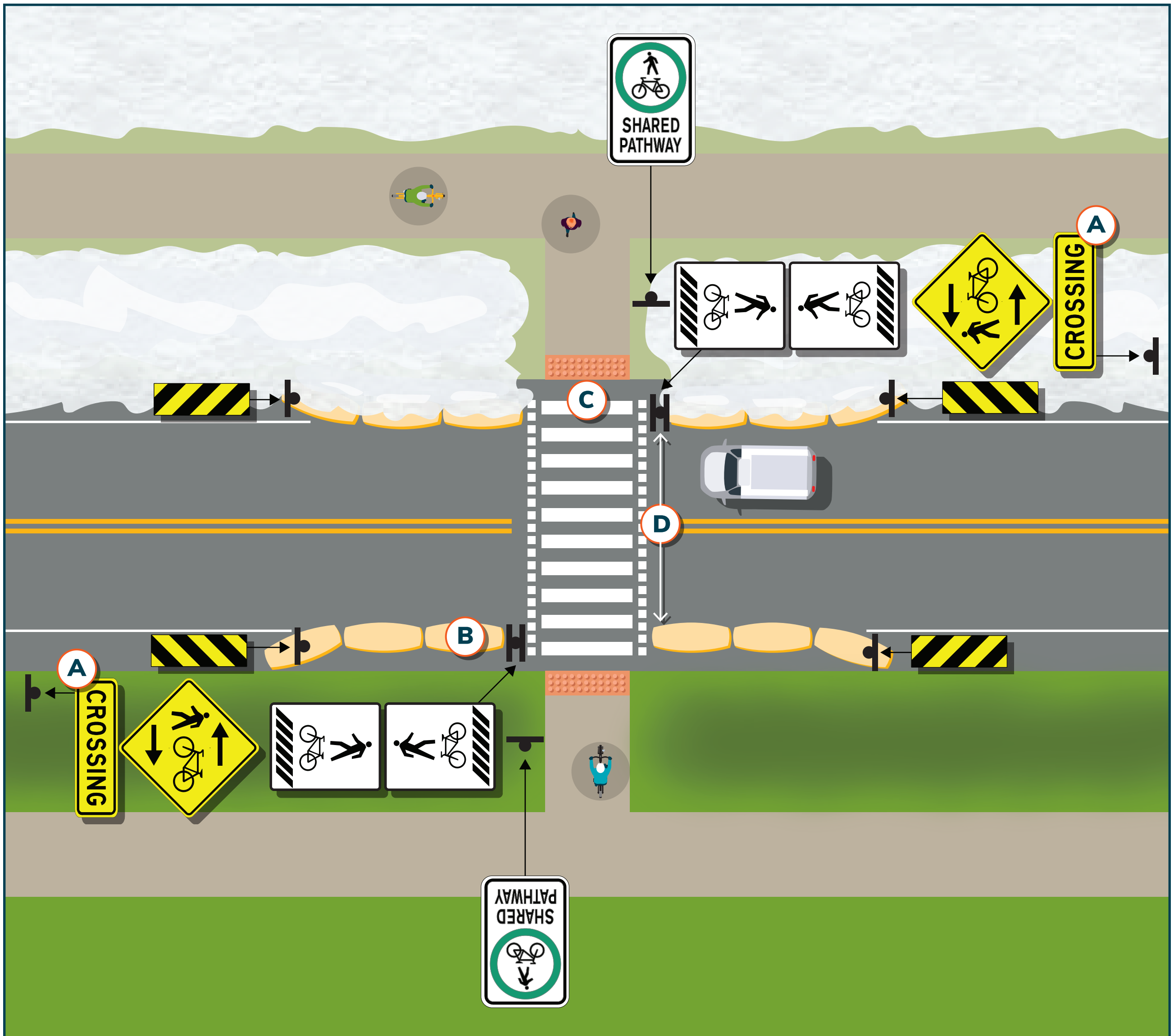
Trail User Approach

- **Alignment:** At mid-block crossings, the trail should be as close to perpendicular as possible to the highway that is being crossed. The trail on each end of the crossing should be aligned with one another.
- **Tactile Attention Indicators** (TAIs) are shown on either side of the crossing to warn people with sight loss about the conflict zone. Designers can consider relocating the TAI to align with the shorter crossing distance. Cast iron plates are recommended for winter durability, but temporary TAIs are also available. The *Canadian Standards Association Accessible Design* for the Built Environment provides more details on the dimensions and placement of TAIs.
- **Crosswalk:** Zebra or ladder markings are recommended to make the crossing more visible, compared to Twin Parallel Line Crosswalk markings.
- **Crossride:** Dashed pavement markings (also known as elephant's feet) are shown on either side of the crosswalk to indicate that people on bicycles can cross without dismounting. For user-separated trails, separate crossride markings should be provided adjacent to the crosswalk. See Section G.5 of the *BC Active Transportation Design Guide* for more details.
- **Shared Pathway Signs** (RB-93) are recommended to indicate that both cyclists and pedestrians are permitted to use the trail. On motorized highway trails, designers should use a customized sign.

Motorist Approach

- **Traffic Calming Curbs:** These pre-cast concrete slabs were designed by City of Calgary transportation staff for rapid implementation projects. They tend to have lower manufacturing and installation costs, as well as greater flexibility for temporary or permanent projects compared to traditional construction methods that pouring concrete in place. Yellow concrete or yellow paint is recommended to increase visibility for motorists and maintenance vehicles. If the shoulder is being used as an unofficial bike lane and no other cycling facility exists, introducing TC curbs might force cyclists into the roadway. Engineering judgment should be applied. Refer to Section 4.4.1 of the *TAC Canadian Guide to Traffic Calming* for more details on geometric design.
- **Object Marker Signs** (WA-36) are recommended to alert motorists about the presence of the Traffic Calming Curbs in advance. Flexible delineator posts can also be mounted to the curbs to increase the visibility for motorists and maintenance vehicles.
- **Warning Signs** are recommended to alert motorists of the presence of a bi-directional trail crossing in advance (Customized WC-46). See Appendix C for more details on signs.
- **Sightlines:** Mid-block crossings should be installed only where adequate sight distance for both motorists and trail users is available. Section 5.6.3.2 of the *TAC Geometric Design Guide for Canadian Roads* provides a calculation for determining the appropriate sightlines required for mid-block crossings. For any widths or speeds not shown in the table, the formula shown in Figure 22 may be used to calculate the required sight distance.
- **Regulatory Signs** are recommended to assign right-of-way to trail users at the crossing (Customzied RA-4). See Appendix C for more details on signs.
- **Rectangular Rapid Flashing Beacons** (RRFBs) and **Overhead Flashing Beacons** are optional treatments to enhance the visibility of crossing and improve yielding behaviour from motorists. When activated by pedestrians, flashing amber lights alternate back and forth. For additional information, refer to the TAC Pedestrian Crossing Control Guide and Yukon Supplement to the Pedestrian Crossing Control Guide.

Figure 23. Rapid Implementation Curb Extension Diagram



Notes

- **A** Sign to be installed min. 50 m in advance of intersection.
- **B** Reduce crossing width using median curbs. Refer to Chapter F for treatment options. Temporary traffic calming curbs shown.
- **C** Reallocate shoulder as a protected refuge area.
- **D** Narrow crossing to 7.0 – 7.5 metres.

Sample Rapid Implementation Project: Median Islands

Median islands can be added to improve accessibility, comfort, and safety for trail users. They allow trail users to cross only one direction of traffic at a time and provide physical protection for waiting trail users. Median islands are recommended for mid-block crossings with longer distances and near schools, healthcare facilities, and other destinations with children, older adults, or other vulnerable road users. Designers can consider pairing median islands with other treatments such as curb extensions to enhance the benefits for trail users.

Figure 24 shows a rapid implementation curb extension at an unsignalized mid-block crossing using traffic calming curbs. The below treatments are suitable for similar contexts, where a multi-use highway trail crosses a low-speed, low-volume section of the highway with two lanes.

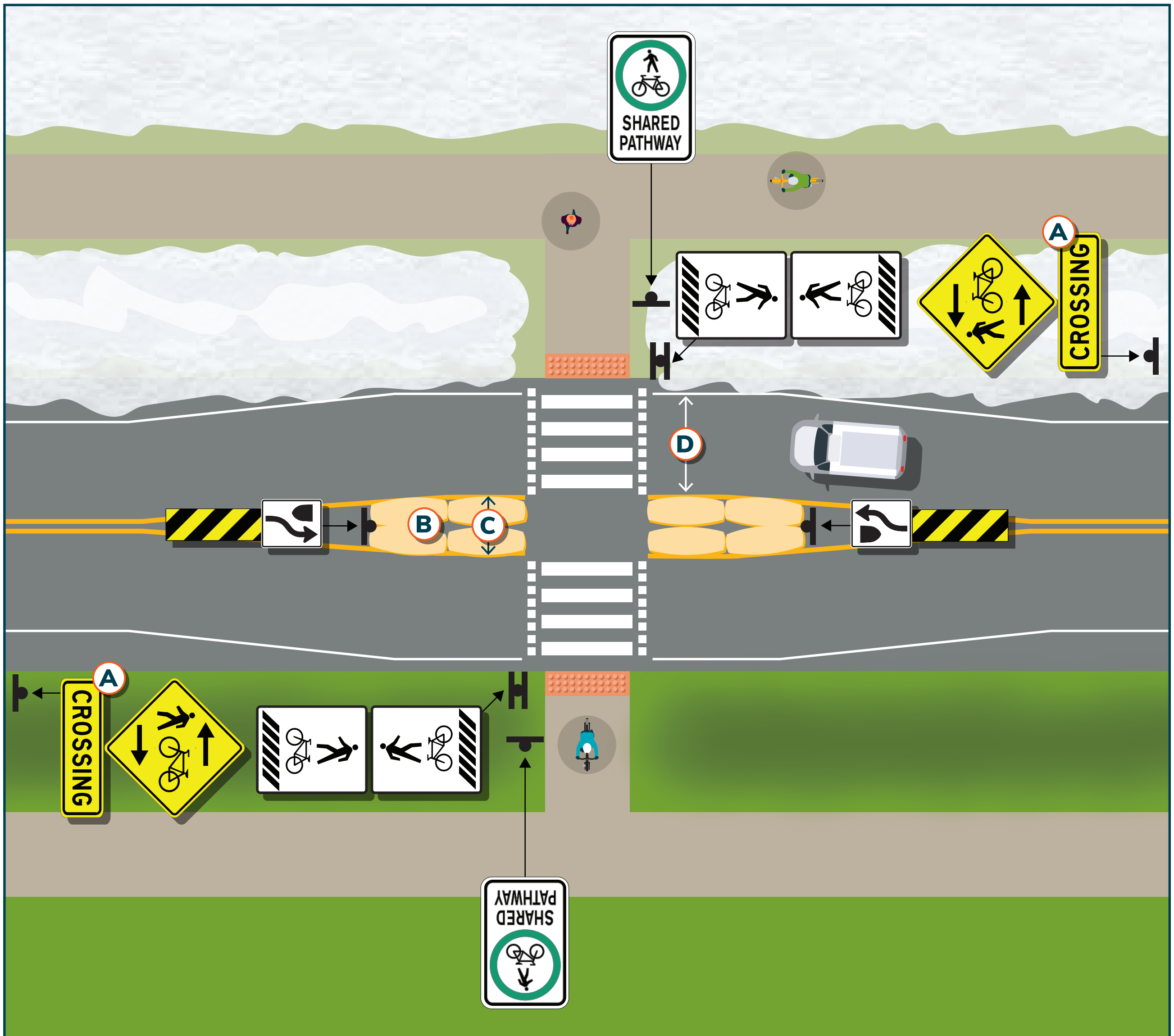
Trail User Approach

- **Alignment:** At mid-block crossings, the trail should be as close to perpendicular as possible to the highway that is being crossed. The trail on each end of the crossing should be aligned with one another.
- **Tactile Attention Indicators** (TAIs) are shown on either side of the crossing to warn people with sight loss about the conflict zone. Designers can consider adding TAIs to median island as well, to indicate the crossing can be completed in two stages. Cast iron plates are recommended for winter durability, but temporary TAIs are also available. The *Canadian Standards Association Accessible Design* for the Built Environment provides more details on the dimensions and placement of TAIs.
- **Crosswalk:** Zebra or ladder markings are recommended to make the crossing more visible, compared to Twin Parallel Line Crosswalk markings.
- **Crossride:** Dashed pavement markings (also known as elephant's feet) are shown on either side of the crosswalk to indicate that people on bicycles can cross without dismounting. For user-separated trails, separate crossride markings should be provided adjacent to the crosswalk. See Section G.5 of the *BC Active Transportation Design Guide* for more details.
- **Shared Pathway Signs** (RB-93) are recommended to indicate that both cyclists and pedestrians are permitted to use the trail. On motorized highway trails, designers should use a customized sign.

Motorist Approach

- **Sightlines:** Mid-block crossings should be installed only where adequate sight distance for both motorists and trail users is available. Section 5.6.3.2 of the *TAC Geometric Design Guide for Canadian Roads* provides a calculation for determining the appropriate sightlines required for mid-block crossings. For any widths or speeds not shown in the table, the formula shown in **Figure 22** may be used to calculate the required sight distance.
- **Traffic Calming Curbs:** These pre-cast concrete slabs were designed by City of Calgary transportation staff for rapid implementation projects. They tend to have lower manufacturing and installation costs, as well as greater flexibility for temporary or permanent projects compared to traditional construction methods that pouring concrete in place. Yellow concrete or yellow paint is recommended to increase visibility for motorists and maintenance vehicles. Refer to Section 4.4.3 of the *TAC Canadian Guide to Traffic Calming* for more details on geometric design.
- **Object Marker Signs** (WA-36) are recommended to alert motorists about the presence of the Traffic Calming Curbs in advance. Flexible delineator posts can also be mounted to the curbs to increase the visibility for motorists and maintenance vehicles.
- **Keep Right/Left Signs** (RB-25) are recommended to indicate to motorists which direction they are required to pass the median.
- **Warning Signs** are recommended to alert motorists of the presence of a bi-directional trail crossing in advance (Customized WC-46). See **Appendix C** for more details on signs.
- **Regulatory Sign** are recommended to assign right-of-way to trail users at the crossing (Customzied RA-4). See **Appendix C** for more details on signs.
- **Rectangular Rapid Flashing Beacons** (RRFBs) and **Overhead Flashing Beacons** are optional treatments to enhance the visibility of crossing and improve yielding behaviour from motorists. When activated by pedestrians, flashing amber lights alternate back and forth. For additional information, refer to the *TAC Pedestrian Crossing Control Guide* and *Yukon Supplement to the Pedestrian Crossing Control Guide*.

Figure 24. Rapid Implementation Median Island Diagram



Notes

- **A** Sign to be installed min. 50 m in advance of intersection
- **B** Median island made with traffic calming curbs
- **C** Minimum width: 1.5 metres. Desired width: 3 metres
- **D** Minimum lane width: 3.5 metres

F2. Construction Zones

During construction and maintenance work, it is imperative that people walking and cycling are adequately accommodated to ensure facilities are still accessible. Jurisdictions should consider developing a Road Maintenance Management Plan to accommodate people walking and cycling during these events.

Route closures and major detours for people walking and cycling should be avoided wherever possible. Instead, the walking and/or cycling facility should be continued through the affected area using temporary designated facilities. It is not recommended to divert people walking and cycling to other corridors or even requiring them to cross the road. Temporary facilities should maintain the constrained limit width of the Trail User Zone.

For highway reconstruction projects in rural areas, pilot cars are typically used to escort drivers through the construction site. These construction sites can be extremely uncomfortable for people walking and cycling, therefore pilot cars should be capable of transporting pedestrians and cyclists through a construction zone when necessary.

If the affected area involves a construction site with hoarding, the hoarding structure should be constructed to accommodate people walking and cycling in separate facilities. If this is not possible, it may result in multi-use conditions, where people cycling, and walking may need to share the highway trail. In such cases, signage should be provided to indicate to people walking and cycling that conditions have changed, and their behaviour needs to change. This includes signage indicating that people walking and cycling should share the space, and advising people cycling to travel slowly or to dismount.

If constrained limit widths cannot be achieved to accommodate people walking and cycling, Dismount and Walk signage (MUTCDC RB-79) can be considered. However, it should be recognized this may result in low compliance. The *TAC Bikeway Traffic Control Guidelines for Canada* indicates that the Dismount and Walk sign should only be used in exceptional circumstances.

If route closures cannot be avoided, people must be warned of these closures in advance and given adequate detour information to bypass the closed section. Users should be warned using standard signage approaching each affected section. For example, Bicycle Lane Closed Sign (MUTCDC TC-68) accompanied by Bicycle Lane Detour Markers (MUTCDC TC-7) where appropriate), including information on alternate routes and dates of closures. Signage should never be placed within the highway trail, as this forces people cycling to use the road or shoulder.

Photo Credit: John Howland

Appendix A
Glossary

Appendix A. Glossary

Term	Definition
Absolute Minimum Width	The lowest end of a design domain value for a bicycle facility component (e.g. lane, buffer), beyond which a bicycle facility component would be rendered unsafe and unusable. The absolute minimum should only be used for short distances, when reasonable consideration has been given to local context, and if maintenance equipment is able to fit within this width.
All Ages and Abilities (AAA)	Active transportation facilities that are considered safe and comfortable for people of all ages and abilities. A range of bicycle facility types may be considered to be AAA facilities, depending on their design and the surrounding context.
Buffer Zone	The space between the Trail User Zone and the Traffic Zone that can also provide space for snow storage for the trail, landscaping, utilities, and trailside amenities.
Clear Zone	The roadside area immediately adjacent to the outer travelled lane, clear of hazards. The Clear Zone consists of the Shoulder Zone, a recoverable slope, a non-recoverable slope, and/or a clear runout area, and sometimes a Buffer Zone. The desired width is dependent upon the design traffic volume and speed and on the roadside geometry.
Constrained Width	The lower end of a design domain value for a bicycle facility component (e.g. lane, buffer), for use when providing the desired width is not feasible. The constrained limit width is likely to offer inferior operational performance and user experience as compared to the desired width, but it may be less costly to construct, and it provides design flexibility.
Confirmation Signage	These signs provide confirmation, reassure people cycling of their direction, and confirm additional destinations reached along the route. Confirmation signs will also provide information about other destinations that may be reached on the route.
Cross-Ride	Cross-rides (also known as elephant's feet and cross-bikes) are the bicycle equivalent of a crosswalk. They are intended to alert all street users of a bicycle crossing. Cross-rides consist of a series of white squares laid out in parallel lines across a street. They can be enhanced by adding the bicycle symbol and/or applying a green surface treatment. Cross-rides are not currently defined in the Yukon. MVA, meaning that they have no legal status. However, First Nations and local governments may enact bylaws that define cross-rides and permit them on local streets.
Decision Signage	On the approach of a decision point (typically an intersection), decision signage provides direction to select destinations through the use of directional arrows.
Design Speed	A speed selected for purposes of design and correlation of the geometric features of a road.

Term	Definition
Design Vehicle	The vehicle whose dimensions and speed potential are used to dictate the minimum design requirements for a given street or facility. When designing a jogj facility, the bicycle is used as the design vehicle. Bicycles are not uniform in size or operating style, so variations in bicycle design must be considered.
Desired Width	The recommended design domain value for a bicycle facility component (e.g. lane, buffer) that is likely to provide optimum operational performance and user experience. Design professionals are encouraged to design highway trails using the desired width whenever feasible.
Enhanced Shoulder	A roadside shoulder area that contains pavement markings to separate motor vehicle traffic from the shoulder, smooth surfaces, sufficient space for active transportation users and regular snow clearance.
Frontage (Service) Road	A roadway contiguous to a through roadway so designed as to intercept, collect and distribute traffic desiring to cross, enter or leave the through roadway and to furnish access to property.
Geometric Design	The selection of the visible dimensions of the elements of a roadway.
Grade Separation	Vertical separation of two intersecting roadways or a roadway and a railway.
Motorized Recreational Vehicle (MRV)	Motorized recreationists use off-highway MRVs such as dirt bikes, quads (ATVs), side by sides (UTVs) or road legal vehicles for off-road travel.
Neighbourhood Bikeway	Neighbourhood bikeways (also known as bicycle boulevards, bicycle priority streets, local street bikeways, and neighbourhood greenways) are streets with low motor vehicle.
Pedestrian	A person walking, including people using mobility aids such as canes, walkers, manual wheelchairs, electric wheelchairs, and mobility scooters.
Posted Speed	A speed limitation introduced for reason of safety, economy, traffic control and government regulatory policy aimed at encouraging drivers to travel at an appropriate speed for surrounding conditions.
Rumble Strip	Milled out sections of the pavement along a highway that provide feedback to motorists through noise and vibrations in the steering wheel.
Shoulder Zone	That part of a roadway contiguous with the travelled way intended for emergency stopping, and/or lateral support of the roadway structure. It may also be configured to be accessible for bicycle travel.

Term	Definition
Tactile Attention Indicators (TAI)	A tactile walking surface indicator comprising truncated domes that alert people of an impending change in elevation, conflicts with other transportation modes, and other potential hazards.
Tactile Direction Indicators (TDI)	A tactile walking surface indicator that uses elongated, flat-topped bars to facilitate wayfinding.
Tactile Walking Surface Indicators (TWSI)	A warning treatment that alerts the pedestrian to the presence of a street crossing through a tactile surface and/or contrasting colour. TWSIs may also enhance the sidewalk-crosswalk interface by guiding pedestrians with visual or other disabilities to and from the crosswalk with directional grooves. Examples of TWSI materials include truncated domes and elongated bars.
Traffic Control Device	A sign, signal, line, metre, marking, space, barrier or device placed or erected by authority of the minister responsible for the administration of the B.C. Transportation Act, the council of a municipality or the governing body of a Treaty First Nation or a person authorized by any of them to exercise that authority.
Traffic Control Signal	A traffic control device, whether manually, electrically or mechanically operated, by which traffic is directed to stop and to proceed.
Traffic Zone	A street zone that accommodates users travelling through a road or accessing destinations along the road. Traffic Zone uses can include motor vehicle through traffic, transit, goods movement, and bicycle travel. The Traffic Zone can be divided into multiple lanes that are shared by multiple users or dedicated to certain vehicles. Medians and refuge areas can also be included within this zone.
Trail User Zone	Area of the highway for safe, accessible and comfortable movement of people walking, cycling and rolling.
Universal Design	The design of products, environments, programs, and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.
Vertical crest curves	Curves that connect inclined sections of a roadway. They can pose limitations on available sight distance and make it difficult for trail users to identify hazards at ground level.
Warrant	A criterion that identifies a potential need for a physical feature, such as a traffic barrier, extra lane, or other item.
Yield Roadway	Narrow lanes that accommodate two-way travel for people walking, cycling, and driving motor vehicles within the same slow-speed, low-volume lanes.

Appendix B
Design Drawing Requirements

Appendix B. Design Drawing Requirements

Design drawings for Highway Trails should include the following:

1. Permitted users, including motorized and non-motorized users

2. Standard trail corridor cross-section showing the following:

a. Trail surface;

b. Trail sub-subsurface;

c. Trail User Zone width;

d. Shoulder Zone widths;

e. Buffer Zone widths;

f. Landscaping and irrigation; and

g. Drainage.

3. Plan view map and drawing of the proposed facility showing the following:

a. Land ownership;

b. Posted speed limit of parallel streets and cross-streets;

c. Transit stop locations (if any);

d. Other active transportation facilities (sidewalks, bicycle facilities, neighbourhood trails);

e. Connections to exiting trails, sidewalks, and other bicycle facilities;

f. Direction of cross-slope;

g. Location of drainage ditches, culverts, bridges, and underpasses;

h. Location of retaining walls and/or railings;

i. Longitudinal slopes at all intersections;

j. Longitudinal slopes, resting spots, and locations with path widening;

k. Horizontal and vertical crests that affect sight lines;

l. Signage and pavement markings;

m. Trail amenities such as lighting, benches, and waste receptacles; and

n. Locations of deviations in the standard trail corridor cross- section, including:

   i. Notes on the rationale for the deviation requirement

   ii. Mitigation measures

Appendix C
Signage

Appendix C. Signage

The information provided in this section is based on the 5th edition of the *Manual of Uniform Traffic Control Device of Canada (MUTCDC)* and the *2012 TAC Bikeway Traffic Control Guidelines for Canada*, and custom signage developed by the City of Whitehorse. All pavement markings and signage should reflect the most current edition of the *MUTCDC* and *2012 TAC Bikeway and Traffic Control Guidelines*.

Table 14. Regulatory, Warning, and Wayfinding Signs

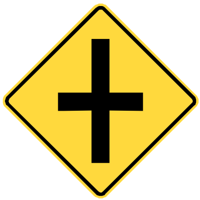
Regulatory Signs

Sign Image	Sign Code	Description
	RA-1	**Stop Sign** Use of stop signs on Highway Trails should be assessed based on location specific context, taking into account sightlines or other safety issues that cannot be mitigated through alternative design. When used on a Highway Trail, the Stop sign indicates to cyclists (and motorized Highway Trail users where applicable) that they must stop before entering the intersection and must not proceed until it is safe to do so. The Stop sign should be placed to avoid displaying the stop message to vehicles on the through road. This sign should be used in conjunction with a stop bar on the Highway Trail. The minimum horizontal and vertical dimensions are 300mm when used on a Highway Trail.
	RA-2	**Yield Sign** When used for roadway, the Yield sign indicates to drivers that they must yield the right-of-way, before entering the intersection or roundabout, and must not proceed until it is safe to do so. When used on a Highway Trail, the Yield sign indicates to cyclists (and motorized Highway Trail users where applicable) that they must yield the right-of-way, stopping, if necessary, before entering the intersection, and must not proceed until it is safe to do so. Yield sign control should be considered when the basic right-of-way rule does not provide for safe and efficient traffic movement, and a Stop sign is considered to be too restrictive. The minimum side dimensions are 450mm when used on a Highway Trail.

Sign Image	Sign Code	Description
	RA-4	**Pedestrian Crosswalk Sign** The Pedestrian Crosswalk sign is used to indicate the location of a pedestrian crosswalk. The sign should be installed on both sides of the road. The right and left versions (RA-4R, RA-4L) is used as appropriate so that the pedestrian symbol on each sign is walking toward the centre of the road.
	RA-5	**Special Crosswalk Overhead Sign** The Special Crosswalk Overhead sign indicates the location of a Special Crosswalk. This sign must be installed over the road.
	CUSTOM	**Maximum Speed Sign** The maximum speed sign indicates the maximum legal vehicle speed that is permitted under ideal driving conditions on the road section where the signs are installed.
	RB-1	**Parking Prohibited Sign** The Parking Prohibited sign indicates that parking is prohibited at all times on all days, in the direction(s) of the arrow(s).
	RB-51	**Stopping Prohibited Sign** The Stopping Prohibited sign indicates that stopping is prohibited at all times on all days, in the direction(s) indicated by the arrow(s).
	RB-55	**Turning Vehicles Yield to Trail Users Sign** The Turning Vehicles Yield to Bicycles sign may be used at conflict zones where motorists are required to cross a cyclist facility and are required to yield to the cyclist. The sign should incorporate the type of cycling facility present in the conflict zone (e.g. dashed bicycle lane lines, green paint, direction of travel etc.). The RB-37 is intended for use for one-way bicycle facilities. A custom sign should be used that shows the two-way operation of the Highway Trails.
	RB-37	Customized versions of the RB-37 sign showing two-way operation with a supplemental 'Yield to Bicycles' tab have been developed by other municipalities (e.g. City of Vancouver) for improved visibility and readability.

Sign Image	Sign Code	Description
	CUSTOM (TBD)	Customized versions of the RB-37 sign showing two-way operation with a supplemental ‘Yield to Bicycles’ tab have been developed by other municipalities (e.g. City of Vancouver) for improved visibility and readability.
	RB-94L, RB-94R	**Pathway Organization Sign** The Pathway Organization sign indicates to cyclists and pedestrians how to share a path on which there is a designated area provided for each. This sign should be used sparingly if the facilities are separated (i.e. sidewalk and a Highway Trail and the facilities have different snow clearing practices (i.e. if the sidewalk is not cleared in the winter, suggest a custom sign where months are added to the sign, or “when cleared”).
	RB-39	**Yield to Pedestrians Sign** The Yield to Pedestrians sign may be used where cyclists are required to cross or share a facility used by pedestrians and are required to yield to pedestrians. This sign can be used on a Highway Trail that crossed a Transit stop area.
	RB-93	**Shared Pathway Sign** The Shared Pathway sign indicates that both cyclists and pedestrians are permitted to use the path and that pedestrians have priority.
	CUSTOM	**All Motorized Vehicles Prohibited Sign** This sign indicates that all motorized vehicles are prohibited, and the trail is strictly reserved for non-motorized use only.

Warning Signs

Sign Image	Sign Code	Description
	WA-11 to WA-15	**Intersection Warning Signs** Intersection Warning signs are installed only in advance of crossroads or intersecting bikeways where the vision triangle is inadequate, and where the cross roads or intersecting bikeways are concealed to the extent that a motorist or bicyclist would not be adequately prepared for turning movements or cross traffic.
	WB-1	**Stop Ahead Sign** The Stop Ahead sign indicates the presence of a Stop Sign (RA-1) ahead. Limited visibility due to conditions such as horizontal and vertical curves, parked vehicles, foliage, and/or high approach speeds should be considered in determining the need for these signs. In some cases, the advance sign may be used due to poor performance of the Stop sign.
	WB-2	**Yield Ahead Sign** The Yield Ahead sign indicates the presence of a Yield Sign (RA-2) ahead. Limited visibility due to conditions such as horizontal and vertical curves, parked vehicles, foliage, and/or high approach speeds should be considered in determining the need for these signs. In some cases, the advance sign may be used due to poor performance of the Yield sign.
 	WA-26, WA-27	**Low Clearance Signs** The Low Clearance signs indicate the maximum amount of overhead clearance at low bridges, underpasses, and under other structures.
	WA-36	**Object Marker** The Object Marker is used to mark obstructions adjacent to or within the road or bikeway, such as bridge piers and traffic islands. The left or right version is used as appropriate to mark obstructions to the left or right side of the trail.

Sign Image	Sign Code	Description
	**WA-41**	**Hill Sign (Bicycle)** The Hill Sign for Bicycles (WA-41) is used on bikeways in advance of a down-grade of 10% or more where the length of the downgrade is 50 m or more. It is also used where the grade is on a horizontal curve which makes higher speeds dangerous.
	**WC-44**	**Bicycle Trail Crossing Side Street Sign** The Bicycle Trail Crossing Side Street sign indicates to drivers that a bicycle path, which runs parallel and in close proximity to the through road, intersects crossroad such that insufficient distance is available on the crossroad between the bicycle trail crossing and the through road for proper siting of the WC-7 or WC46 signs. The left or right version is used as appropriate. The temporary Trail Crossing tab sign (WC-44T) is used for educational purposes.
	**WC-46**	**Pedestrian and Bicycle Crossing Ahead Sign** The Pedestrian and Bicycle Crossing Ahead sign indicates to drivers that they are approaching a location where a Highway Trail crosses the road. The WC-7S Crossing Supplementary tab sign must be used to convey the meaning of the Bicycle Crossing Ahead sign.
	**CUSTOM**	A custom variation of the WC-46 sign to include two- way arrows to remind drivers that the Highway Trail is bi-directional is recommended for the Highway Trail application.
	**WC-7S**	**Crossing Supplementary Tab** The Crossing Supplementary tab sign must be used to convey the meaning of the Bicycle Crossing Ahead sign.
 	**CUSTOM**	**Motorized Trail Sign** Some jurisdictions (e.g. City of Whitehorse) have developed a customized Motorized Trail Sign to make all trail users aware of the potential presence of motorized recreational vehicles (MRVs). An alternative sign is a custom Yield sign with a pedestrian, cyclist and snow machine with arrows (snow machine yields to pedestrians and cyclists, cyclists yields to pedestrians). The MUTCDC Ends Tab supplementary tab sign (RB- 33S2) can be used to indicate the termination of an area where the Highway Trail regulation applies.