Design Guide for Bus Stops Adjacent to Cycling Infrastructure

April 2024

TRANSLINK

BRITISH COLUMBIA
Ministry of Transportation and Infrastructure

The Design Guide for Bus Stops Adjacent to Cycling Infrastructure was prepared by Urban Systems for TransLink and the BC Ministry of Transportation and Infrastructure.

April 2024

Technical Project Team: Urban Systems in association with Toole Design Group, Universal Access Design, and BC Barrier Free Design.

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All images courtesy of Urban Systems or Toole Design Group unless otherwise noted.

Cover photo: Esplanade, North Vancouver, British Columbia.

Sixth Street, New Westminster, British Columbia

Acknowledgements

This Design Guide was developed under the direction of TransLink and the BC Ministry of Transportation and Infrastructure (MoTI) with the participation and valuable input of many participants across British Columbia, Canada, and internationally, including people with lived experience and practitioners. The project team recognizes the significant barriers faced by people with disabilities and is grateful for the opportunity to listen and learn from their knowledge and lived experience.

This study was developed with input from the following organizations:

People with Lived Experience Stakeholder Group

- Alliance of Equality of Blind Canadians BC
- Alzheimer Society of BC
- Canadian Hard of Hearing Association
- Canadian National Institute for the Blind
- Council of Senior Citizens' Organizations of BC
- Cycling Without Age
- Disability Alliance BC
- Gateway Navigation CCC Limited
- HUB Cycling
- HUB Cycling Youth Advisory Committee
- Kelowna Area Cycling Coalition
- Inclusion BC
- MOSAIC BC
- Rick Hansen Foundation
- Spinal Cord Injury BC
- TransLink Access Transit Users Advisory Committee (UAC)
- UBC Faculty of Education
- Wavefront Centre for Communication Accessibility

Technical Working Group

- BC Transit
- Canadian National Institute for the Blind
- City of Abbotsford
- City of Burnaby
- City of Coquitlam
- City of Kamloops
- City of Kelowna
- City of Nanaimo
- City of New Westminster
- City of North Vancouver
- City of Penticton
- City of Richmond
- City of Vancouver
- City of Victoria
- City of Surrey
- City of White Rock
- Coast Mountain Bus Company
- District of Lake Country
- District of North Vancouver
- District of Saanich
- Ministry of Transportation and Infrastructure
- Township of Esquimalt
- Township of Langley
- University of British Columbia

We would also like to acknowledge the Canadian National Institute for the Blind (CNIB) and WSP Canada for their open exchange of information through the project as they developed a parallel study, *Cycling Infrastructure and People with Sight Loss – Design Challenges and Opportunities at Transit Stops Across Canada.*

Case Study Interviews

British Columbia

- City of Kelowna
- City of Nanaimo
- City of North Vancouver
- City of Penticton
- City of Vancouver
- City of Victoria
- District of Saanich

Elsewhere in Canada

- City of Calgary
- City of Montreal
- City of Ottawa
- City of Winnipeg

United States

- City of Seattle
- Montgomery County, Maryland
- Massachusetts Bay Transportation Authority
- AC Transit, California

International

- Delft, Netherlands

Pilot Project Communities

- City of Kelowna
- City of Nanaimo
- City of North Vancouver
- District of Saanich
- City of Vancouver

Contents

Navigation Cues

Navigation cues are found in call-out boxes throughout this Design Guide that share relevant insights that have informed the guidance as well as findings from the engagement process. The call-out boxes include:

Insights

There have been key insights understood throughout the development of this Design Guide. These callout boxes will highlight interesting and important insights learned through the development of the project.

Informed input

This Design Guide has been informed by people with lived experience, including surveys, stakeholder workshops, on-site field reviews, and pilot projects. These callout boxes will highlight key learnings from the stakeholder engagement, particularly the pilot projects, and how this informed the recommendations in this Design Guide.

Gorge Road, Saanich, British Columbia

Section 1: Introduction

Clement Avenue, Kelowna, British Columbia

1.1 Setting the Context

Access for Everyone.

Everybody should have the right to be able to travel safely and comfortably however they choose to do so and regardless of their ability. However, each person has unique needs and preferences, and some people face unique challenges and barriers that prevent them from accessing the transportation system. TransLink, Metro Vancouver's regional transportation authority, and the Province of British Columbia, are both committed to ensuring accessibility throughout the Metro Vancouver region and the Province, respectively. This means supporting the needs of people of all abilities and recognizing people have a diverse range of physical, cognitive, intellectual, psychological, and sensory abilities.

TransLink's new 30-year transportation strategy for Metro Vancouver – *Transport 2050* – provides a bold vision of *Access for Everyone*, where every person in Metro Vancouver can easily connect to the opportunities they need to thrive. Dedicating more streets to walking, rolling, cycling, and transit is a key action to meet this vision. In addition, the Province recently passed the *Accessible BC Act*, which was designed to help make British Columbia more inclusive for people with disabilities. The Act creates new rules to make governments and organizations more accessible and will remove barriers that people with disabilities face.

According to the Rick Hansen Foundation, one in seven Canadians currently live with a disability that impacts their mobility, vision, or hearing. As the population ages, this number is predicted to rise to one in five within the next twenty years. Therefore, creating transportation infrastructure and services that is universally accessible will help to create access for everyone.

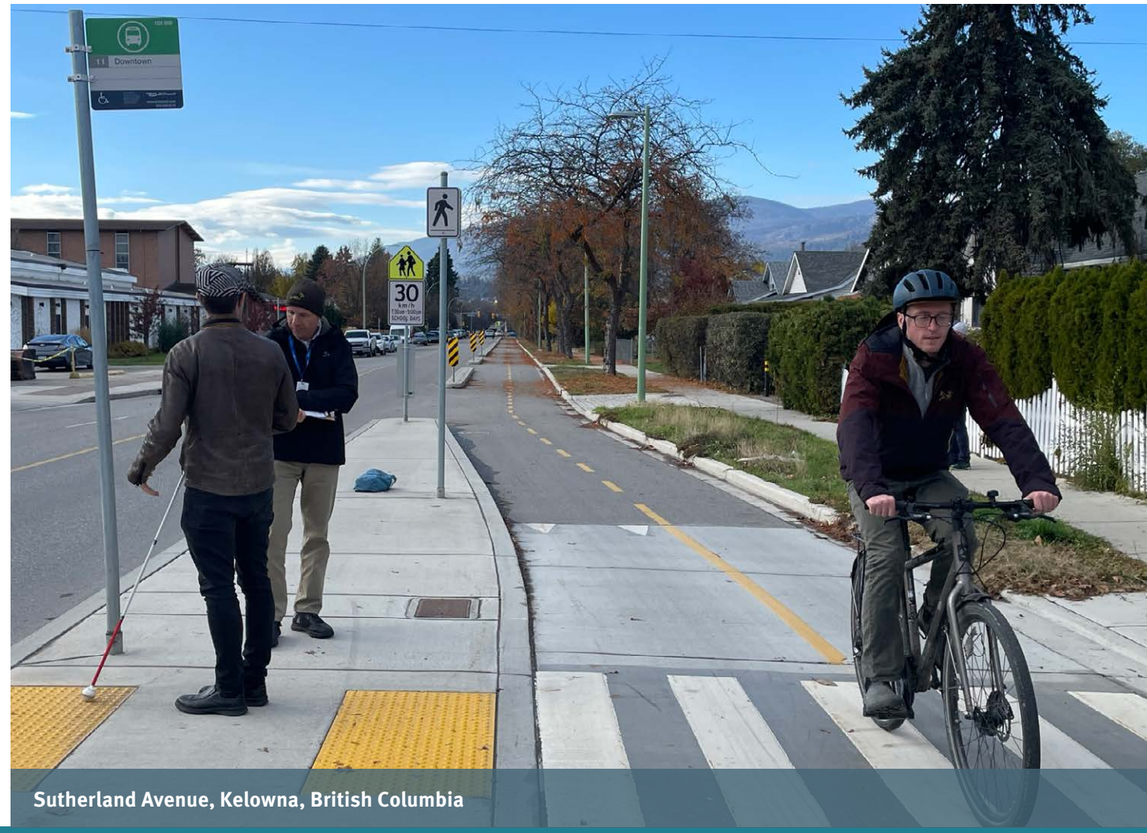
Sustainable forms of transportation such as walking, rolling, cycling, and transit can work together to help address a range of urgent challenges facing our communities.

Communities across British Columbia and around the world increasingly recognize the importance of promoting sustainable forms of transportation, including walking, rolling, cycling, and transit. These forms of sustainable transportation can work together as a critical tool to achieve local, regional, and provincial goals to address the climate emergency by reducing greenhouse gas (GHG) emissions. These sustainable forms of transportation can also help address a wide range of urgent issues facing our communities, including social inequity, public health, road safety, and congestion.

TransLink's *Transport 2050* set a target that by 2050, active transportation and transit account for at least half of all passenger trips in Metro Vancouver. Similarly, *Move. Commute. Connect., BC's Active Transportation Strategy*, set a goal of doubling the percentage of trips taken with active transportation in British Columbia by 2030. In 2021, the provincial *CleanBC Roadmap to 2030* set a new target to increase the share of trips made by walking, rolling, cycling, and transit to 50% by 2050. Similarly, local governments across Metro Vancouver and throughout British Columbia are also broadly supportive of walking, rolling, cycling, and transit.

To meet these targets, communities are increasingly committed to providing cycling infrastructure that is **comfortable for most people**. Research has found that the majority of the population is "interested but concerned" about cycling, and that people in this group would like to cycle more but are concerned about the safety of cycling on busy roads with higher traffic volumes and speeds and large vehicles such as buses. By providing cycling infrastructure that is safe and comfortable for the "interested but concerned" segment of the population, more people will likely chose cycling as a transportation choice.

Just as there is a wide range of people with disabilities, there is also a wide range of people who cycle. Focusing on the 'interested but concerned' segment of the population and making cycling comfortable for most people results in a diverse array of people who choose to cycle, including children, seniors, women, and people with disabilities. In fact, a sizeable number of people with disabilities also use a bicycle. Many people with disabilities find cycling easier than walking, with many using their bicycle as a mobility aid, just like a wheelchair or mobility scooter. A study conducted by Transport for London (U.K.) in 2018 found that 15% of people with disabilities cycle regularly or occasionally, compared to 18% of people without a disability.



Sutherland Avenue, Kelowna, British Columbia

Effectively integrating cycling infrastructure and transit can create complex challenges.

Many communities across North America, including communities throughout British Columbia, have integrated dedicated cycling infrastructure along corridors with transit service since, in most cases, people want to have access to the same destinations, whether they are travelling as pedestrians, cyclists, or by transit. In these cases, there is a need to accommodate transit users as well as people cycling, along with other road users.

In many cases, this integration is driven by a common desire, of all users, to access important destinations within the same space, street, or area. However, this has created complex challenges integrating cycling infrastructure with bus stops while ensuring they accommodate people with disabilities. A design solution that has often been used involves an "island platform bus stop" which routes the protected cycling infrastructure behind the bus stop to maintain physical protection for people cycling while providing a platform for boarding and alighting transit users as well as those waiting for a bus.

This design helps to eliminate bus-bicycle "leapfrogging" conflicts at bus stops, where buses are required to merge across the cycling infrastructure at bus stops, which results in bicycles needing to merge into general purpose traffic to pass the stopped bus, only to be passed again as the bus accelerates. This bus-bicycle leapfrogging presents significant safety issues and is not comfortable for most people. With island platform bus stops, both buses and bicycles can safely proceed straight at the stop, in their own dedicated space.

However, this design has resulted in creating conflicts between people cycling and pedestrians accessing the bus stop, as this design requires pedestrians to cross over the bicycle lane to access the bus stop. This has introduced complex issues and challenges and has created significant barriers, particularly for people with disabilities – including people with sight loss – to accessing the transit system.

The design of bus stops adjacent to cycling infrastructure can create barriers, limit access to transit, and create safety concerns for many people. This is why design guidance is needed.

In a 2020 decision, the BC Human Rights Tribunal (HRT) determined that by installing island platform bus stops, the City of Victoria discriminated against the complainant and members of the Canadian Federation of the Blind (CFB) who wished to use transit in the City of Victoria (see 2020 BCHRT 197). The complainant raised concerns with respect to the design of four bus stops installed adjacent to a bi-directional protected bicycle lane on Pandora Avenue and one on Wharf Street in the City of Victoria. It was alleged that the design of these island platform bus stops created safety issues for people with sight loss as they had to cross the bicycle lane to access the bus stops and, in doing so, may not be able to hear the sound of oncoming bicycles over ambient traffic noise.

The following key issues were raised by the complainant during the HRT hearing:

- People with sight loss are not necessarily able to reliably sense an approaching person cycling, including whether that person has stopped;
- Ambient noise clutters the soundscape, which eliminates the ability to effectively hear an approaching bicycle, and makes it more difficult for a person with sight loss to judge when it is safe to enter a pedestrian crossing; and
- It is challenging for a person with sight loss to clearly communicate to a person cycling their intention to cross the street or a bicycle lane.

These issues were exacerbated in this context because the protected bicycle lane was bi-directional, which increased the challenges and complexities noted above by not being able to know which direction bicycles were approaching from. Various design interventions to improve the safety of these bus stops were explored during the HRT hearing. As a result of the HRT's decision on this matter, the City of Victoria installed pedestrian activated audible flashing lights at the existing island platform bus stops along Pandora Avenue (the City had prior to the HRT's decision already installed audible flashing lights at the Wharf Street island platform bus stop). The HRT determined that the installation of pedestrian controlled audible flashing lights was a reasonable accommodation at that point in time, but with the acknowledgement that this is "not the full answer" and future technological advancements may provide improved alternative solutions.

Alignment with Canadian National Institute for the Blind (CNIB) Report

This Design Guide was developed in parallel with a related Canadian National Institute for the Blind (CNIB) report that was recently published – Cycling Infrastructure and People with Sight Loss – Design Challenges and Opportunities at Transit Stops Across Canada ("CNIB Report"). While the two studies have a different scope and mandate, the CNIB Report provides valuable research and recommendations that helped inform this Design Guide. Based on extensive research, including a literature review and field research at five sites across Canada, the CNIB Report identifies five key challenges that people with sight loss identified along with recommendations to address each challenge. The five key challenges and associated recommendations included:

- Finding the bus stop;
- Orienting and navigating to and from the island platform;
- Detecting people cycling who are approaching;
- Negotiating right-of-way with people cycling who are approaching; and
- Boarding and alighting.

The issues described above, along with the associated recommendations identified in the CNIB Report, are consistent with those identified in this Design Guide. The recommendations identified in the CNIB report have all been incorporated into this Design Guide.

Esplanade, North Vancouver, British Columbia

What is an island platform bus stop?

There are many different terms used in communities around the world to describe cases where cycling infrastructure is routed behind bus stops, including “floating bus stops”, “island bus stops”, “bus boarding islands”, and “bus stop bypasses,” among others. The CNIB report uses the term “island platform” bus stops. For the purpose of this project, and to work towards a consistent naming convention to help build a common understanding, the term **“island platform bus stop”** is used. Regardless of the name used, the goal is that, if island platform bus stops are used, that they be designed to maximize accessibility and to accommodate the broadest range of accessibility needs in all designs and contexts.

1.2 Purpose of this Guide

There is currently limited design guidance available for transportation professionals in British Columbia on how to effectively design bus stops adjacent to protected cycling infrastructure. TransLink, in partnership with the BC Ministry of Transportation and Infrastructure (MoTI), has created this Design Guide to provide updated guidance for communities in Metro Vancouver and elsewhere in British Columbia on how to design bus stops when located adjacent to protected cycling infrastructure.

It should be noted, however, that this study is not an extension of the HRT hearing process and has been developed independent of that process based on extensive stakeholder engagement and technical review. While the impetus for this study was the HRT hearing and the issues raised by people with sight loss, this Design Guide is intended more broadly to ensure design solutions address the needs of all road users as best as possible, which includes considering a range of accessibility needs as well as the needs of people cycling. This Design Guide provides guidance to local governments to help create bus stops adjacent to protected cycling infrastructure while minimizing barriers to people with disabilities.

This Design Guide provides a comprehensive set of planning and engineering guidelines offering solutions for the planning, design, operation, and maintenance of bus stops adjacent to protected cycling infrastructure in a range of contexts and applications throughout British Columbia, along with guidance for education and engagement. The guidance applies to new infrastructure and may also be applied to retrofits of existing bus stops adjacent to protected cycling infrastructure. Recognizing the range of contexts across British Columbia, ranging from large urban centres which may have high levels of walking, rolling, cycling, and transit use, to small and rural communities which may have lower levels of walking, rolling, cycling, and transit use this Design Guide provides flexible and context-sensitive guidance for communities of all sizes and types across British Columbia.

Ongoing engagement with people with disabilities is critical

While transportation professionals are encouraged to follow the guidance in this Design Guide, it is essential to note that every situation is unique, and this Design Guide is not a substitute for engaging with people with disabilities in the local planning and design process. People with disabilities, as well as other interested stakeholders, should be meaningfully engaged with during the planning and design process to ensure the design addresses their barriers and accommodates the broadest range of accessibility needs possible within the context of these guidelines.

The primary audience for this Design Guide is professionals in the transportation engineering and planning fields in British Columbia ("transportation professionals"). This Design Guide has been informed by engineering guidelines and standards as well as accessibility and universal design principles and best practices from the municipal, provincial, national, and international levels. It was developed with input from a diverse range of stakeholders from across British Columbia through several phases of engagement.

This Design Guide is a first step and there are areas for further research

This Design Guide is a first step to removing barriers and improving accessibility when bus stops are located adjacent to protected cycling infrastructure by providing guidance to address issues learned through the study. However, it is recognized that there remain some issues that are not fully addressed in this Design Guide and that require further research. Notably, it is recognized that people with sight loss continue to have concerns about their loss of independent mobility and lack of autonomy to make their own travel choices safely since they may not reliably detect an approaching person cycling nor have the confidence that a person cycling has stopped for them. These are complex challenges that extend well beyond just bus stops, and relate to any interaction between people cycling and people with sight loss throughout the transportation network.

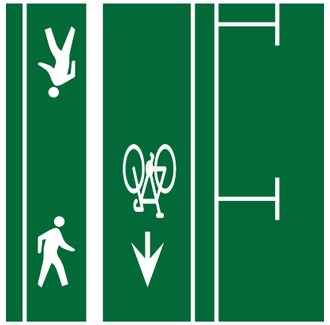
This Design Guide includes some suggestions to address these issues, such as integrating bus stops with signalized intersections whenever possible along with the use of actuated flashing beacons and enhanced and/or dynamic signage in some contexts.

Some stakeholders have suggested additional treatments such as bicycle signals and/or other visual or audible technologies that might help address these issues. However, there are few, if any, existing known products or treatments available that can reliably address these issues, and the efficacy of any such treatments have not been well studied and are not known. Treatments such as these are not known to have been used in this context anywhere in North America to date, and are not recognized in the Transportation Association of Canada (TAC) *Manual of Uniform Traffic Control Devices for Canada* (MUTCD-C), and may not be legal and/or enforceable under British Columbia's *Motor Vehicle Act* (MVA). This is reinforced by the recent CNIB Report, which also stated: *"the project team was unable to identify any successful techniques in practice. Further work should be undertaken by researchers and/or practitioners to identify technology or auditory based solutions."*

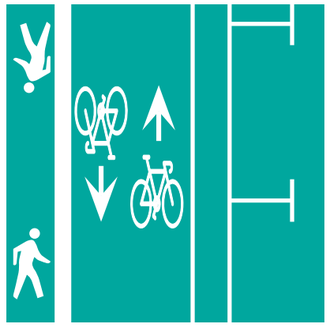
This Design Guide recognizes how significant these issues are for people with sight loss and includes recommendations underscoring that transportation professionals and people with disabilities should continue to work together to better understand the tools and technologies with potential to address these issues along with potential changes to legislation and regulations to support the use of such tools and technologies in the future.

1.3 Scope of this Guide

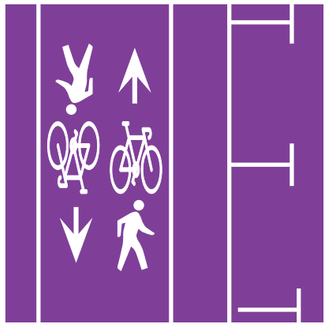
The scope of this Design Guide is to provide transportation professionals with guidance for planning, designing, operating, and maintaining bus stops adjacent to protected cycling infrastructure along with guidance for education and engagement. Specifically, this Design Guide provides recommended treatments in scenarios where transit users must cross protected cycling infrastructure to access the bus stop. For the purposes of this Design Guide, this includes design treatments where bus stops are adjacent to one of three types of protected cycling infrastructure:



Uni-directional Protected Bicycle Lanes



Bi-directional Protected Bicycle Lanes



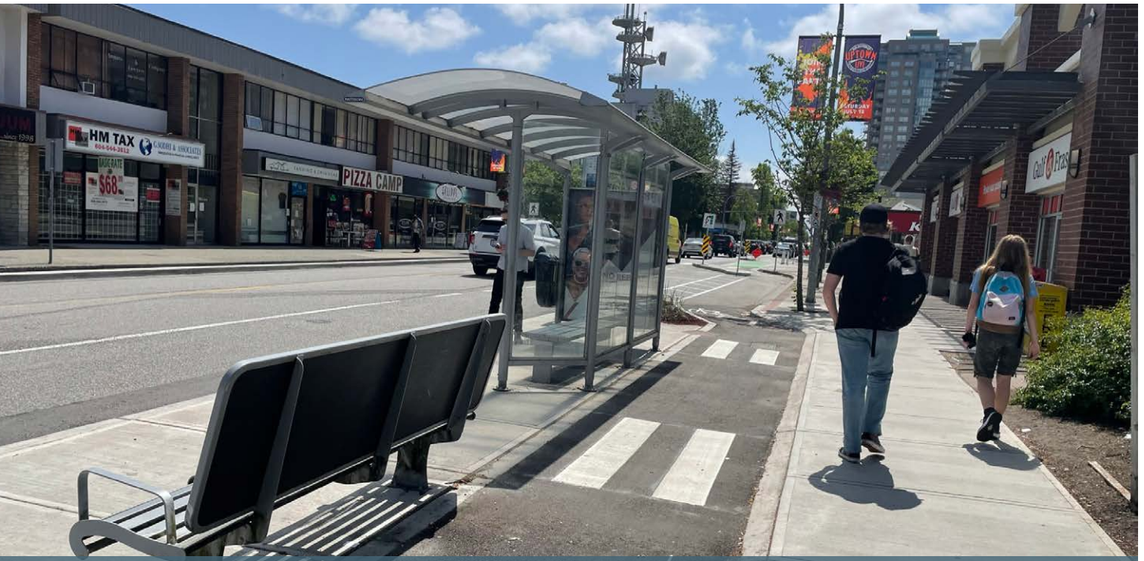
Multi-use Pathways

The term "bikeway" is used as a general term throughout this Design Guide to refer to any of these types of protected cycling infrastructure.

Design guidance for conventional bus stops adjacent to cycling infrastructure

This Design Guide does not provide design guidance for where bus stops are adjacent to unprotected cycling infrastructure such as painted bicycle lanes, paved shoulders, or shared use lanes, as these do not meet the goals of this Design Guide outlined in **Section 2.3**. However, if transportation professionals determine that it is not necessary or desired to provide protected cycling infrastructure adjacent to bus stops, and if unprotected cycling infrastructure is determined to be acceptable, transportation professionals can consider design treatments with a conventional design where the bus stop remains curbside and where buses must merge across the cycling infrastructure. However, it should be emphasized that these design treatments are not considered comfortable for most people cycling.

Where further guidance is needed for the design of conventional bus stops adjacent to unprotected cycling infrastructure, transportation professionals are encouraged to seek guidance from other technical documents, including the *BC Active Transportation Design Guide* and the Transportation Association of Canada (TAC) *Geometric Design Guide for Canadian Roads*.



Sixth Street, New Westminster, British Columbia

1.4 How this Guide was Developed

This Design Guide was developed through an iterative process, including a review of literature and existing design guidelines and standards from across Canada and internationally, information gathering from local government practitioners, and comprehensive stakeholder engagement at all phases of the project.

The process included a collaborative, stakeholder-driven process that involved on-going engagement with both transportation professionals and people with lived experience. This included a **Technical Working Group (TWG)** of practitioners from over 20 public agencies across British Columbia, **People with Lived Experience Stakeholder Group** representing people with lived experience, including a wide range of disabilities, and TransLink's **Access Transit Users Advisory Committee (UAC).**

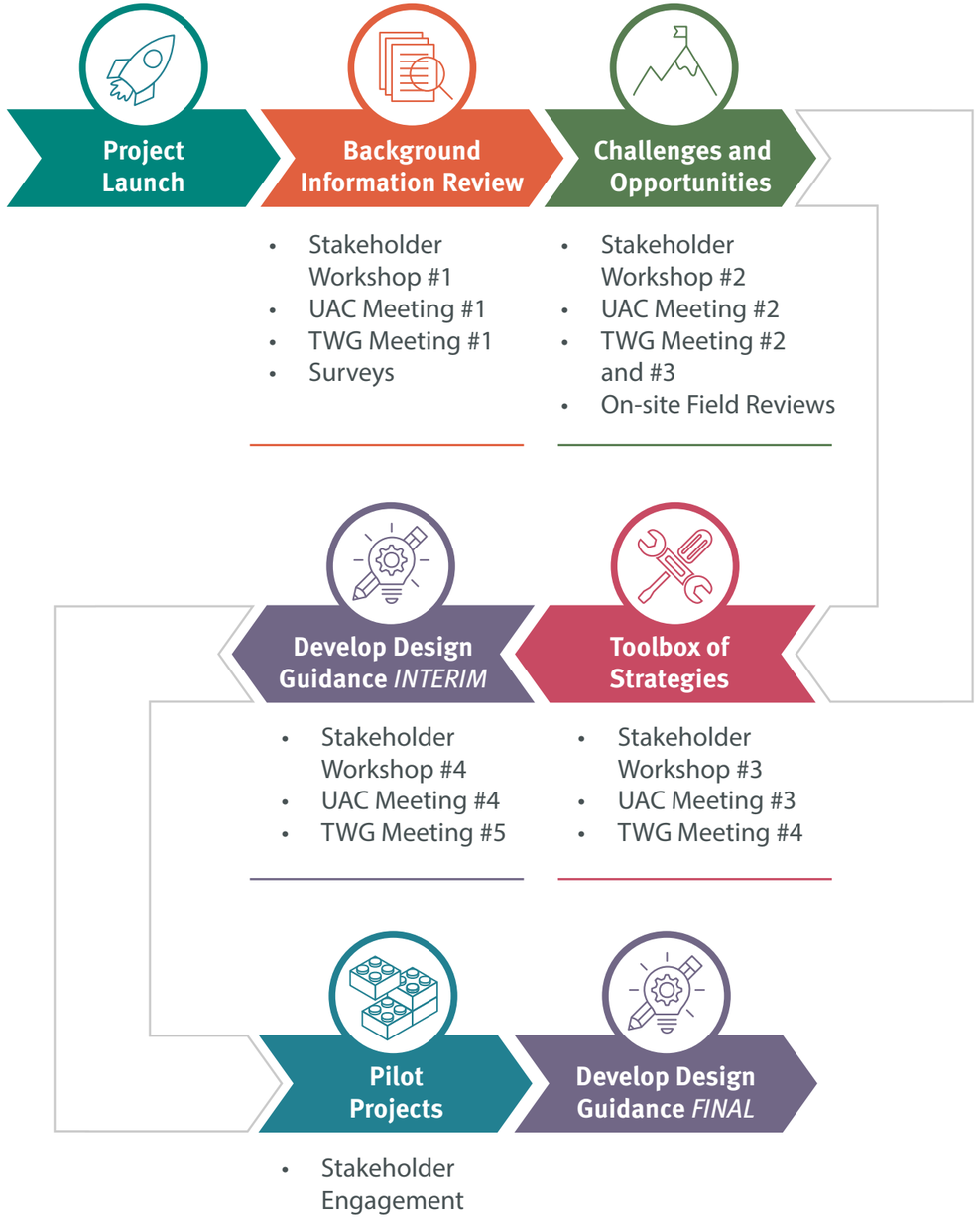
Throughout the process, the project team engaged with stakeholders through a range of methods, including:

- **Surveys** of transportation professionals and people with lived experience;
- **Workshops** with transportation professionals and people with lived experience at each phase of the project;
- **On-site field reviews** with invited stakeholders to gain a shared understanding of experiences, opportunities, and challenges at three island platform bus stops in Metro Vancouver;
- **Case study interviews** with sixteen communities across Canada, the United States, and the Netherlands; and
- **Pilot projects** in five municipalities across British Columbia.

The input received was used to iteratively guide and shape the recommendations at all phases of the process. This involved a first step of listening and learning from the lived experiences, issues, and challenges of stakeholders; using this information to identify and summarize the key issues and challenges experienced with bus stops adjacent to protected cycling infrastructure; developing and discussing preliminary design solutions to address each of the issues and challenges identified; developing interim design guidance; conducting pilot projects; and finally confirming recommended design guidance upon completion of the pilot projects.

The process was completed over seven phases, including five rounds of stakeholder engagement, as shown in **Figure 1: Study Process.**

Figure 1: Study Process



Pacific Street, Vancouver, British Columbia

Obtaining informed input from people with lived experience

This Design Guide was developed with extensive input from people with lived experience who represented a broad range of perspectives and types of disabilities, including stakeholder workshops, on-site field reviews, and pilot projects. Key findings from this engagement are provided throughout this Design Guide.

Survey for People with Lived Experience

A survey for people with lived experience was available online from January 19 to February 14, 2023 and was distributed to a wide range of stakeholders. The survey was designed to learn about stakeholder's experiences (if any) with bus stops next to protected cycling infrastructure and was completed by 137 individuals with lived experience.

Stakeholder Workshops

Stakeholder workshops were conducted with people with lived experience at each phase of the project. Stakeholders represented a broad range of perspectives, including: the Alliance for Equality of Blind Canadians BC, the Canadian National Institute for the Blind, Gateway Navigation CCC Limited, the Rick Hansen Foundation, the Alzheimer Society of BC, Spinal Cord Injury BC, Inclusion BC, MOSAIC BC, the Council of Senior Citizens' Organizations of BC, HUB Cycling, Cycling Without Age, Inclusion BC, Kelowna Area Cycling Coalition, Disability Alliance BC, HUB's Youth Advisory Committee, Canadian Hard of Hearing Association, Wavefront Centre for Communication Accessibility, Orientation and Mobility Specialists, and TransLink's Access Transit Users Advisory Committee. These stakeholders were identified specifically for this project to represent a variety of interests. Four stakeholder workshops were held throughout the study.

On-site Field Reviews

In April 2023, on-site field reviews were held with project team members as well as people with lived experience to review three island platform bus stop designs in Metro Vancouver. The purpose of the on-site field reviews was to collect feedback and perspectives from people with disabilities on the existing designs of three island platform bus stops in Metro Vancouver, and to provide an opportunity for project team members and stakeholders with lived experience to gain a shared understanding of experiences, opportunities, and challenges at these island platform bus stops, to help inform recommendations in this Design Guide.

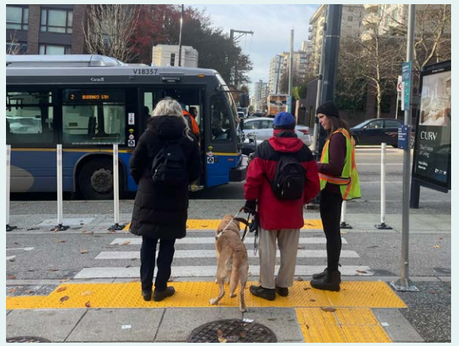
Thirteen participants and eight staff members attended the on-site field reviews. The participants represented various perspectives of lived experience, including people with sight loss, people who use mobility aids, people who are deaf and/or hard of hearing, and an orientation and mobility specialist. Participants also had various supports to assist them with the site visit, including guide dogs, white canes, manual wheelchairs, power chairs, and ASL interpreters.

Pilot Projects

This Design Guide included a pilot phase which involved installing a range of design treatments on a temporary or interim basis and obtaining structured input using a standardized evaluation template. Input was received from a range of stakeholders, including people with sight loss as well as people with other types of disabilities, pedestrians, cyclists, advocacy groups, and others.

Five municipalities participated in the pilot project, including the City of Kelowna, City of Nanaimo, City of North Vancouver, District of Saanich, and City of Vancouver. 11 separate bus stops were included in the pilot projects across the five municipalities, representing a range of contexts and configurations, including bus stops adjacent to uni-directional protected bicycle lanes, bi-directional protected bicycle lanes, and multi-use pathways, including constrained and unconstrained applications. A range of design treatments were included as part of the pilot projects and directly informed the recommendations in this Design Guide.

The pilots took place in November 2023. Over 80 people participated and provided feedback to the pilot projects. Within the pool of participants, 59 indicated they live with a disability, including 40 who live with partial or full sight loss and 19 who indicated other types of disabilities. Eight respondents participated by bicycle.



Pilot Project Evaluation Form

1.5 Limitations and Application of this Guide

This Design Guide provides guidance for communities across British Columbia based on extensive technical research and stakeholder engagement to help inform the design of bus stops adjacent to protected cycling infrastructure. This Design Guide is not prescriptive, and does not outline or establish mandatory standards or requirements of any kind. Rather, it provides suggested guidelines to assist local, regional, and provincial governments in applying best practices to the planning, design, operation, and maintenance of bus stops adjacent to protected cycling infrastructure. This Design Guide is meant to supplement – not replace – any existing local, provincial, or national guidelines, standards, and regulations.

The application of the treatment options provided in this Design Guide is to be considered in the context of each location and in consideration of impacts to other users. While this Design Guide provides design suggestions, it does not replace a community's planning and design process or the need to engage with people with disabilities throughout the planning and design process, nor does it provide design decisions. Transportation professionals implementing bus stops adjacent to protected cycling infrastructure in their communities will need to make their own design decisions by applying sound professional judgement that considers the unique context of each project, the context of the HRT ruling, and the needs of people with disabilities. Transportation professionals using this Design Guide are solely responsible for all design decisions including the implementation of any associated safety features, and it is important that such decisions be made in consultation with people with disabilities and all other interested stakeholder groups.

As British Columbia is a vast province with a wide range of community types, sizes, geographies, and climate conditions, a broad spectrum of possible design suggestions have been provided. Acknowledging that the planning and design of active transportation facilities can differ substantially between urban, suburban, and rural contexts, design suggestions have been provided for different contexts and environments.

Transportation professionals should strive to provide the best possible facility for the given context, even where the best practice design solution may not be feasible. This Design Guide offers best practice design solutions and encourages designing fully accessible facilities. However, it is recognized that active transportation facilities may not be appropriate or feasible on all roadways, and that context-specific constraints may make it challenging to create fully accessible facilities or facilities that are comfortable for everyone.

Section 2: Overview

Burrard Street, Vancouver, British Columbia

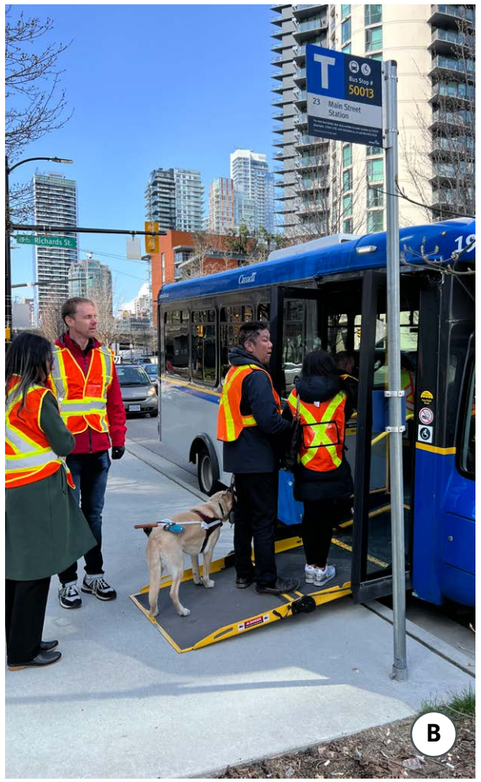
2.1 Key Elements of Bus Stops Adjacent to Protected Cycling Infrastructure

Bus stops adjacent to protected cycling infrastructure have been implemented in hundreds of communities around the world, with hundreds of examples in communities throughout British Columbia. In general, the overall design principles are often similar, as the design solution generally involves routing the protected cycling infrastructure behind the bus stop to maintain physical protection for people cycling while providing an island platform for boarding and alighting transit users as well as those waiting for a bus.

Key features that are relatively common are shown in **Figure 2** and generally include:

- **Island Platform** where transit users can wait to board and alight the bus, and which may include amenities such as a shelter, benches, bicycle parking, garbage receptacles, and other amenities.

- **Wheelchair Pad** to allow passengers using mobility devices to board and alight the bus via a mechanical ramp or lift that is deployed from one of the bus doors.



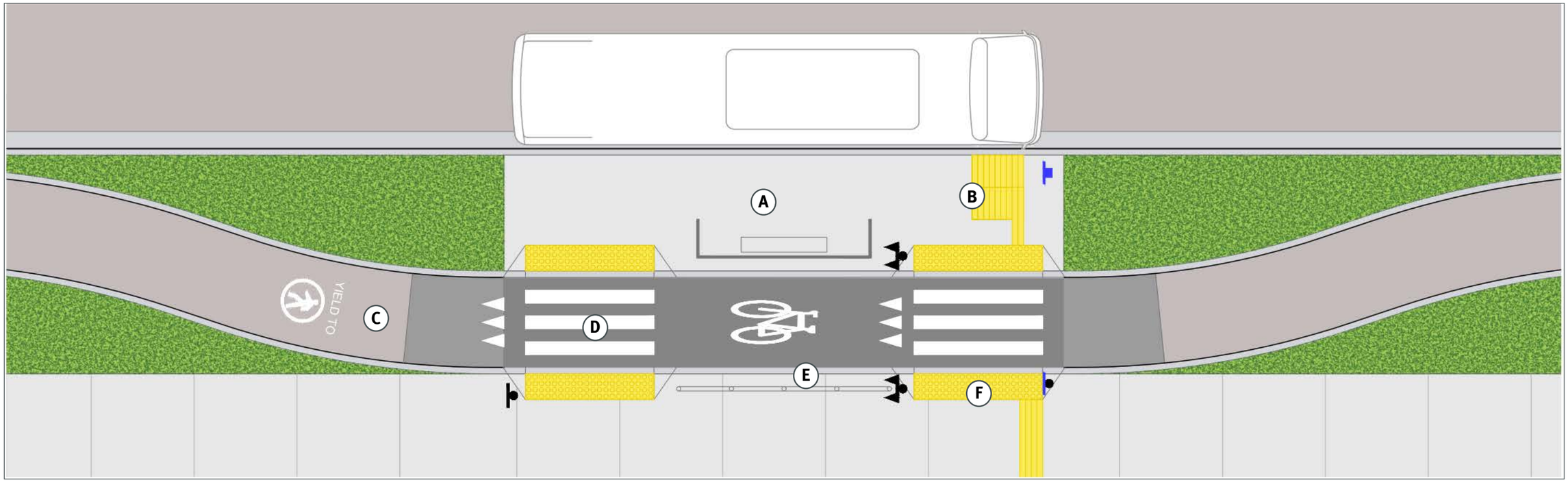
- **Bikeway** that is located between the island platform and the sidewalk, and which can often be raised or narrowed through the bus stop interaction zone.

- **Marked Pedestrian Crossings** to direct people to cross the bikeway at designated locations between the bus stop platform and the sidewalk.

- **Edge Treatments** between the bicycle lane and the sidewalk and the bus stop platform that are detectable by people with sight loss.

- **Tactile Attention Indicators** at marked pedestrian crossings to notify people with sight loss of a crossing point.

Figure 2: Key Features of a Bus Stop Adjacent to Protected Cycling Infrastructure



Despite these relatively common features, various configurations and design details can be considered depending on the type of cycling infrastructure along a project corridor. There is also significant variation in the design details of bus stops adjacent to protected cycling infrastructure in British Columbia and around the world. This lack of consistency can create significant challenges for people using these facilities, particularly people with disabilities including people with sight loss.

A key challenge in designing bus stops adjacent to protected cycling infrastructure is the balancing of trade-offs, especially along constrained corridors where consideration is required to find the optimal design treatment in environments with limited right-of-way widths. Based on the research completed for the development of this Design Guide, it was found that many communities around the world have implemented bus stops adjacent to protected cycling infrastructure in constrained applications with narrow bus stop platforms or no bus stop platforms.

Legend

- (A) Island Platform
- (B) Wheelchair Pad
- (C) Bikeway
- (D) Marked Pedestrian Crossings
- (E) Edge Treatments
- (F) Tactile Attention Indicators

2.2 Related Guidance

Several provincial, national, and international guidelines, standards, and studies were reviewed to inform this Design Guide, including:

- Canadian National Institute for the Blind (CNIB) – Cycling Infrastructure and People with Sight Loss – Design Challenges and Opportunities at Transit Stops Across Canada (2023)
- Canadian Standards Association (CSA) – Accessible Design for the Built Environment (2023)
- City of Montreal – Universally Accessible Bus Stops on the Edge of a Cycle Path (2022)
- Ontario Traffic Council (OTC) – Ontario Traffic Manual Book 18 Cycling Facilities (2021)
- Montgomery County – Planning and Designing Streets to be Safer and More Accessible for People with Vision Disabilities (2021)
- OC Transpo (Ottawa) – Bus Stops And 'Off-Road' Cycling Facilities: Interaction Zone Design Guidelines, Version 9.0 (2020)
- BC Ministry of Transportation and Infrastructure – BC Active Transportation Design Guide (2019)
- TransLink – Bus Infrastructure Design Guidelines (2018)
- AC Transit – Multimodal Corridor Guidelines (2018)
- Transportation Association of Canada (TAC) – Geometric Design Guide for Canadian Roads (2017)
- National Association of City Transportation Officials (NACTO) – Transit Street Design Guide (2016)
- Massachusetts Department of Transportation (MassDOT) – Separated Bike Lane Design Guide (2015)
- NACTO – Urban Bikeway Design Guide (2011)
- BC Transit – Infrastructure Design Guidelines (2010)

This Design Guide is consistent with – and builds on – the guidance in these documents and incorporates relevant and recent research, guidance, best practices, and lessons learned regarding the planning, selection, design, implementation, and maintenance of bus stops adjacent to protected cycling infrastructure.

The reference documents reviewed for this Design Guide reflect current standards and best practices at the time of publication in 2024. However, it is recognized that best practices and research into this topic is rapidly evolving. It is the responsibility of transportation professionals to ensure these guidelines are applied with an understanding of changing standards.

2.3 Goals

Six goals have been identified through collaboration with the Design Guide stakeholders that should be considered when planning and designing bus stops adjacent to protected cycling infrastructure:

Goal 1

Provide priority to pedestrians in the vicinity of bus stops adjacent to protected cycling infrastructure, as they are the more vulnerable road user.

Goal 2

Provide an environment that feels **safe and comfortable** for all people needing to access or interact with the bus stop, **whether they have a disability** and **whether they are walking, biking, or using transit.**

Goal 3

Strive to **maximize accessibility** to accommodate the broadest range of accessibility needs in as many aspects of designs and contexts as possible.

Goal 4

Promote **respectful behaviour** between people walking, biking, and using transit.

Goal 5

Encourage **consistency in the design and implementation** of bus stops adjacent to protected cycling infrastructure across British Columbia, while recognizing the need for context-sensitive designs depending on site-specific considerations.

Goal 6

Ensure **engagement feedback is meaningfully incorporated** in designs.

2.4 Key Issues and Challenges

Based on the findings of the literature review, review of guidelines and standards, case studies, and findings from stakeholder engagement, sixteen key issues with the design of bus stops adjacent to protected cycling infrastructure were identified and confirmed with stakeholders. These sixteen issues were grouped into five overarching themes. Design treatments for each of these sixteen issues are provided in **Section 4** and supportive guidelines are provided in **Section 5** to ensure that the guidance directly addresses the issues and challenges identified. **Section 6** summarizes how each of the design treatments addresses each of these key issues and challenges.

Theme 1: Wayfinding and Layout

The issues identified in Theme 1 relate to challenges navigating the key elements of the bus stop infrastructure. The lack of consistency in infrastructure across the network makes it challenging for users to locate the bus stop, to know where to cross the bikeway, and where key elements are located on the island platform.

- **Issue 1:** Difficulty finding the bus stop and information about bus routes served.
- **Issue 2:** Difficulty understanding and navigating a bus stop layout when arriving from the sidewalk or when getting off the bus.
- **Issue 3:** Difficulty knowing where to find pedestrian crossings of the protected cycling infrastructure.
- **Issue 4:** Lack of consistent, detectable, and visible edges between a raised bicycle lane and pedestrian space.

Theme 2: Safe and Respectful Behaviour

The issues identified in Theme 2 relate to users' concerns for their interactions with other modes, including cycling speeds, yielding behaviours, and unpredictable pedestrian movements. Challenges with user behaviours create feelings of unsafety and conflict among different modes.

- **Issue 5:** Feeling unsafe crossing the protected cycling infrastructure due to difficulty knowing if a person cycling is approaching or has stopped at the crossing particularly in a noisy environment.
- **Issue 6:** Uncertainty on how to indicate one's intention to cross or that one has yielded.
- **Issue 7:** Concerns about cycling speeds and disrespectful cycling behaviour.
- **Issue 8:** Unpredictable pedestrian behaviour, including pedestrians walking in or across the protected cycling infrastructure.

Theme 3: Design Elements

The issues identified in Theme 3 relate to difficulties with existing infrastructure at bus stops adjacent to cycling infrastructure. The challenges identified can result in barriers for people with disabilities, obstructed sightlines, and safety risks due to constrained spaces or barriers.

- **Issue 9:** Tight space with limited maneuverability on the passenger landing pad.
- **Issue 10:** Insufficient right-of-way to accommodate sidewalk, protected cycling infrastructure, landing area, and motor vehicle lane widths.
- **Issue 11:** Risk of people tripping or falling off the passenger landing area.
- **Issue 12:** Risk of unintentionally colliding with or not being able to get around barriers, bollards, curbs, or other obstructions.
- **Issue 13:** Obstructed sightlines due to shelters, ad panels, and/or other street furniture.

Theme 4: Operations and Maintenance

The issue identified in Theme 4 relates to the challenge in ensuring bus stops adjacent to protected cycling infrastructure are well-maintained to avoid barriers and safety risks for users, including in major weather events throughout the year.

- **Issue 14:** Bus stop and bicycle lane may not be cleared and usable at all times of the day, all year-round.

Theme 5: Education and Engagement

The issues identified in Theme 5 relate to the need for more targeted education and engagement related to bus stops adjacent to cycling infrastructure. By engaging with the accessibility community, the design of this infrastructure can be improved to remove and prevent barriers. Further, the lack of education and awareness of users' challenges at these bus stops can create unsafe behaviour that could be mitigated through education.

- **Issue 15:** Concerns that the accessibility community is not adequately engaged with during the planning and design process.
- **Issue 16:** Concerns that road users are unaware of rules of the road and behaviour expectations.

Section 3: Planning Guidelines

Marine Drive, North Vancouver, British Columbia

There are a number of planning matters to consider before designing and implementing bus stops adjacent to protected cycling infrastructure. This section provides planning guidelines that include several questions and considerations for transportation professionals to review before designing and implementing bus stops adjacent to protected cycling infrastructure. Engaging with people with disabilities and other impacted stakeholders is critical to help answer many of these questions and considerations based on their experience and perspectives. Based on the answers to these questions and considerations, there will be many cases where the preferred design solution involves bus stops next to protected cycling infrastructure; however, **if there are other alternatives available to avoid bus stops adjacent to protected cycling infrastructure, they should be explored to avoid or minimize conflicts between pedestrians, cyclists, and transit users, especially those with disabilities.**

The guidelines in **Section 4** apply to those cases in which bus stops adjacent to protected cycling infrastructure cannot be avoided based on the outcomes of the questions and considerations in this section. The application of the design guidelines in **Section 4** is important in those cases to ensure that, if bus stops adjacent to protected cycling infrastructure are installed, that the design of those bus stops accommodate the broadest range of accessibility needs in as many aspects of designs and contexts as possible.

This guidance applies to new infrastructure and may also be applied to retrofits of existing infrastructure.

3.1 Understanding the Context

The first series of questions and considerations transportation professionals should consider relate to understanding the context in which the bus stop is situated, including the type of users and modal priorities on the project corridor and the land use context.

What is the primary role and user priority for the corridor within the broader transportation network?

Multi-modal transportation corridors are streets that need to balance the needs of multiple road users, including pedestrians, cyclists, transit users, motor vehicles, and goods movement. They must consider broader network planning principles for each mode of transportation to ensure all modes have direct and seamless network connections.

As a first step, it is important to review and assess the role and modal priorities of the project corridor as part of the broader transportation network context. This includes identifying how the project corridor connects to the pedestrian, cycling and transit networks; considering the project impacts on other road users; understanding what current and future development plans are in the area; and considering any other opportunities or constraints that will inform the project design.

These considerations are often made at the planning level when local governments are developing strategic long-range transportation plans, active transportation plans, bicycle plans, transit plans, and/or other multi-modal transportation plans or strategies.

Key considerations include:

- **Street function:**
  - Is the project corridor located on an arterial street or similar classification corridor with the primary role being the local and regional movement of people?
  - If so, the design will need to consider the required motor vehicle and/or people-moving capacity, number of motor vehicle lanes required, and minimum lane widths required to accommodate this function as well as any impacts on traffic operations.
- **Goods movement:**
  - Is the project corridor located on a local or regional truck route?
  - If so, the design will need to consider minimum lane widths to accommodate large vehicles.
- **Transit:**
  - Is the project corridor located on a designated frequent transit corridor or is it otherwise a key transit corridor with frequent transit service? Would the project impact bus speed or reliability?
  - If so, the design will need to consider minimum lane widths to accommodate transit vehicles and to minimize impacts on transit operations, including bus speed, travel time, and reliability.
- **Cycling:**
  - Is the project corridor identified as an important cycling facility that is comfortable for most people in local or regional plans?
  - If so, the design will need to consider the type of cycling infrastructure that is desired and provide cycling infrastructure that is comfortable for most people.
- **Walking:**
  - Is the sidewalk wide enough to accommodate pedestrian demand and the needs of people with disabilities?
  - The design will need to consider the type of infrastructure that is desired based on the land use and roadway context.

In many cases, streets may not be able to achieve multiple objectives for all of these users. In these cases, transportation professionals should use their professional judgement to design for the context and provide the appropriate rationale to support their decision.

What is the land use context?

The planning and design of transit and active transportation facilities can differ substantially depending on whether they are located in an urban, suburban, or rural context. This context impacts land use, neighbourhood design, distance between destinations, road classification, and community expectations. In all contexts, safety is a key consideration that should be prioritized in all planning and design work. Key considerations for various land use contexts include:

- **Urban Context or Commercial Core:** Typically includes higher densities and mixtures of land uses, more services and destinations, greater transit frequency, and higher volumes of pedestrians, transit users, and people cycling. These contexts are typically complex, have constrained road widths with many competing priorities, and have volumes of people walking, cycling, rolling, or taking transit.
- **Suburban Context:** Typically involves lower density land uses and more residential land uses, outside of specific nodes of activity. These contexts often have street networks with arterial streets carrying significant volumes, and 'loop-and-lollipop' street networks that make it challenging to provide direct cycling routes. These contexts also will typically involve transit service.
- **Rural Context:** Typically involves low density land uses and may not have transit, or may only have relatively infrequent transit service. There are likely lower levels of people walking, cycling, rolling, or taking transit.

What is the user context?

Building on the previous questions, an important consideration relates to how many users of various types are using the project corridor. A busier corridor with a higher number of pedestrians, people cycling, and transit users results in more interactions at bus stops adjacent to cycling infrastructure. Key considerations for user context include:

- **What is the transit frequency and what are the transit volumes?** The frequency of transit service and passenger volumes indicate how many people are accessing each bus stop along the project corridor each day. Boarding and alighting data for a bus stop can provide insight on the number of people needing to cross a bikeway to access the island platform bus stop. Greater transit frequency also increases the likelihood of a person cycling needing to interact with a bus, resulting in more justification to provided separated cycling and transit facilities.
- **What are the cycling volumes?** A greater number of people cycling may make it more challenging for someone to cross the bikeway and increases the potential for conflict.
- **What are the pedestrian volumes?** A greater number of pedestrians using the sidewalk may also increase the interactions between cyclists and pedestrians potentially encroaching into the bikeway.
- **Are there any facilities or services in the immediate area that likely serve a higher proportion of people with disabilities?** The bus stop may provide access to key destinations, services, or amenities used by some people with disabilities, and/or may be located close to where some people with disabilities live. Engagement with transit agencies, local governments, and the accessibility community can help to understand if there are any facilities or services in the immediate area of the bus stop that likely serve a higher proportion of people with disabilities.

If there is a combination of high transit ridership, high cycling volumes, high pedestrian volumes, and/or facilities or services in the immediate area that likely serve a higher proportion of people with disabilities, enhanced design treatments may be appropriate as optional treatments to help improve interactions between pedestrians, people cycling, and transit users. Further details for when optional treatments may be considered are provided in **Section 4.2**.

3.2 Strategies for Eliminating Conflicts

Once transportation professionals have an understanding of the broader role and context of the project corridor, there are a number of strategies that can be considered to examine the potential for eliminating conflicts between pedestrians, people cycling, and transit users.

Can the bikeway and transit route be accommodated on different corridors?

The impacts on transit users where transit routes and bikeways are integrated should be considered when planning bikeways near transit. Whether taking transit or cycling, travel for both modes should be as direct as possible and should connect to the destinations that people cycling and people using transit would both like to access. In many cases, it may be preferred to provide bikeways and transit routes on the same corridor due to route directness, access to destinations, network connectivity, and/or other reasons. However, in some cases there may be opportunities and valid reasons to separate a bikeway from a transit route and provide the bikeway on an adjacent corridor. If the corridor is a destination in itself, with destinations that all road users want to access, then relocating either the transit route or the bikeway is not desirable, as users of both modes require access to those destinations.

For example, in communities with a dense, well-connected grid street network, it may be possible to provide a neighbourhood bikeway on a local street with low traffic volumes and speeds parallel to and near a major transit corridor. This could still provide a relatively direct route and access to destinations. However, there are a number of factors such as having disconnected street networks, lack of opportunities for parallel routes, lack of direct access to destinations, challenges crossing major streets, and/or higher traffic volumes and speeds that may make it uncomfortable for most people cycling to share the road with people driving. These factors may mean that separating a bikeway from a transit route is not desirable and may not achieve broader community goals.

The *BC Active Transportation Design Guide* identified five guiding principles for active transportation professionals: safe and stress-free, inclusive, context sensitive, cohesive and direct, and attractive and intuitive. Local governments should work closely with transit agencies to determine if it is suitable to consider providing bikeways and transit routes on different corridors after considering the needs of both modes and the guiding principles in the *BC Active Transportation Design Guide*.

Can the bikeway be provided exclusively on the left side of a one-way street?

Many communities have one-way street networks, particularly in downtown cores. Consolidating a bikeway to the left-side of a one-way street has the potential to eliminate the need to provide bus stops adjacent to protected cycling infrastructure. However, it is important to holistically consider the trade-offs of this configuration as it may result in other types of conflicts, such as driveways, intersections, or with on-street parking. Transportation professionals should refer to the *BC Active Transportation Design Guide* to guide their assessment of this treatment.

Can the bikeway be accommodated on a different corridor with less steep slopes?

If the bikeway is located on a project corridor with a steep slope, there is increased risk of cyclists travelling at high speeds which may present an increased risk of conflict between cyclists and pedestrians. If slopes on the approaching project corridor are greater than 5%, transportation professionals should consider if there are other corridors that could be considered instead.

Burrard Street, North Vancouver, British Columbia

3.3 Strategies for Minimizing Conflicts

In many cases, it may not be possible or desirable to eliminate interactions between people cycling and people accessing transit by re-routing infrastructure. The strategies below can help minimize those interactions and reduce barriers for people with disabilities when bus stops and cycling infrastructure do need to be installed adjacent to one another.

Can road space be reallocated?

Depending on the context, road space reallocation can help maximize the space available for a bus stop adjacent to protected cycling infrastructure. Where space is particularly constrained, transportation professionals should first examine whether there are possibilities to reallocate road space from motor vehicles to create additional space for the bus stop and/or bikeway, such as:

- Reducing the number of motor vehicle travel lanes; however, in the local context, road space reallocation should be considered alongside a full understanding of the role of the corridor for all modes and users;
- Reducing the width of motor vehicle lanes (taking into account design vehicle needs, such as buses, and relevant design guidance such as the TAC *Geometric Design Guide for Canadian Roads*);
- Removing on-street parking;
- If the bus stop is located within an on-street parking lane, adding in a bus bulge to allow the bus to stop in lane; and/or
- Removing bus bays or pull-outs and having buses stop in lane.

By examining possibilities to first reallocate road space from motor vehicles as the first priority, transportation professionals can seek to prioritize and maximize available space for people walking, cycling, rolling, and using transit.

Can a bus stop be provided at or adjacent to a signalized intersection?

Feedback from stakeholders indicated a clear preference for bus stops located adjacent to signalized intersections where the island platform can be integrated with a pedestrian refuge in a signalized crosswalk. This configuration would work best where the bikeway is in-line with traffic and has a dedicated bicycle signal. This provides people who wish to cross the street and the bikeway the ability to do so via the signalized crossing, which provides greater predictability about cyclist behaviour and greater certainty that cyclists have stopped. Transportation professionals should review whether the bus stop can be relocated to be at or adjacent to a signalized intersection.

It is recognized, however, that many bus stops cannot be located at or in close proximity to signalized intersections. **Any considerations for changes in bus stop location should be done in consultation with transit agencies and the accessibility community to ensure this does not create additional accessibility challenges and still achieves at least the same level of transit service and meets guidelines for desired bus stop spacing.**

Can a bus stop be removed, relocated, or consolidated while still achieving the same level of transit service?

As part of regular transit planning, transit agency staff regularly review bus stop locations, and consolidation can sometimes help improve bus speed and reliability. In some cases, there may be opportunities to relocate, consolidate, or remove bus stops to avoid interactions between people cycling and using transit, while considering transit agency guidelines for bus stop spacing. This can minimize the number of bus stops conflicts along a project corridor.

For example, if a bus route involves a turn off a street with a bikeway and onto a cross-street, there may be opportunities to locate the bus stop on the cross-street to avoid placing a stop adjacent to a bikeway. **Any considerations for changes in bus stop location should be done in consultation with transit agencies and the accessibility community to ensure that this does not create additional accessibility challenges and still achieves at least the same level of transit service and meets guidelines for desired bus stop spacing.**

Can uni-directional bikeways be provided instead of bi-directional?

In general, uni-directional (one-way) protected bicycle lanes that match the direction of the adjacent motor vehicle lanes are preferred for integrating bicycle facilities into the overall operation of a street. This configuration can simplify conflict management at intersections and can be more intuitive for all users.

Through stakeholder engagement, bi-directional (two-way) protected bicycle lanes were identified as a significant concern particularly for people with sight loss, as they have the additional complexity of negotiating a challenging interaction in both directions and it also increases the length of the crossing and their exposure. Bi-directional facilities can also pose concerns for other users as well.

Where feasible, uni-directional facilities are preferred as they help to address this concern by ensuring that people with sight loss can focus their attention on one direction of travel by people cycling. It is important to consider this decision holistically, as in some situations uni-directional facilities may not be practical or desirable. In such situations, while bi-directional facilities are less desirable, they may be considered if necessary, but only with configurations that include an island platform. Bi-directional facilities should not be used in constrained configurations, as described further in **Section 4.4.**

Transportation professionals should refer to the *BC Active Transportation Design Guide* for considerations for when to consider uni-directional or bi-directional protected bicycle lanes.

Can separation between people cycling and transit riders be achieved?

In cases where providing the bus stops adjacent to the cycling infrastructure may be the preferred condition, the design of the bus stops should be inclusive and accommodate the broadest range of accessibility needs.

The design guidelines in **Section 4** provide such guidance for bus stops adjacent to protected cycling infrastructure in various contexts. These guidelines are applicable for new infrastructure and may also be applied to retrofits of existing infrastructure.

Beach Avenue, Vancouver, British Columbia

Section 4:
Design Guidelines

Beach Avenue, Vancouver, British Columbia

The design guidelines in this section apply to those cases in which bus stops adjacent to protected cycling infrastructure are recommended after considering the planning guidelines in **Section 3**, with the goal of ensuring the design of such bus stops accommodates the broadest range of accessibility needs as possible.

4.1 Transit Stop Design Principles

Public transit provides an essential service that offers transportation options other than motor vehicles. Public transit also extends the range of travel for people walking, rolling, or cycling, making longer or time-constrained trips more feasible. Walking, rolling, and cycling also extend the reach of transit trips by providing 'first- and last-mile' opportunities to complete the trip by active transportation and by increasing the number of destinations easily accessible by public transit. Connecting active transportation networks to transit routes – with a focus on high frequency transit – extends the reach of both modes.

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

This section provides an overview of key principles related to transit stop design. Transportation professionals should refer to applicable design guidelines for further details and guidance related to the design of transit infrastructure. These guidelines include, but are not limited to:

- TransLink Bus Infrastructure Design Guidelines;
- BC Transit Infrastructure Design Guidelines;
- MoTI BC Active Transportation Design Guide; and
- MoTI BC Supplement to TAC Geometric Design Guide (**Section 960**).

4.1.1 Stop Location and Placement

Transit stops can be placed in one of three typical locations along a street in relation to intersections (see **Figure 3**):

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

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

Far-side transit stops are typically preferred both from an active transportation and traffic flow perspective. Far-side transit stops allow transit vehicles to move more efficiently along a corridor, prevent stopped buses from obstructing sightlines, and encourage pedestrians to cross at the rear of the bus. Occasionally, transit stops need to be located at the near-side or mid-block along a corridor to accommodate physical and transit route constraints. Near-side stops are generally used when far-side stops are impractical or unsafe, or if the stop serves multiple routes that change directions at the intersection. Mid-block stops are used in locations with long blocks.

Figure 3: Typical Bus Stop Locations

Source: BC Active Transportation Design Guide (MOTI, 2019)

4.1.2 Stop Layout

Bus stop layout is determined by the type of vehicles that will be using the stop and the facility type provided. Consideration is needed for the location of both the front and rear doors of any transit vehicles that will be using the stop to ensure clearance is maintained for boarding and alighting as well as the wheelchair lift or ramp. TransLink and BC Transit both provide information on their fleet of vehicles including dimensions to both the front and rear doors. The local transit agency should be consulted in the design process to confirm the design vehicles to be used. Four typical sizes of buses currently operate on roads in British Columbia, including conventional buses, articulated buses, double-decker buses, and community shuttles. The following layout considerations are needed to accommodate each of these vehicle types. It is noted that many bus stops serve multiple vehicle types; as such, the design should consider the minimum requirements that satisfy all vehicle types using a given stop.

- Conventional bus
  - 12.4 metre vehicle length
  - Minimum 9 metre bus stop length (landing pad)
  - Minimum 0.45 metre clearance for the route identification pole (from face of curb)
  - Preferred 3 metre long by 3 metre wide (2.5 metre minimum) clear area at the front door to accommodate the wheelchair ramp/lift

- Articulated bus
  - Minimum 15 metre bus stop length (landing pad)
  - Minimum 0.45 metre clearance for the route identification pole (from face of curb)
  - Preferred 3 metre long by 3 metre wide (2.5 metre minimum) clear area at the front door to accommodate the wheelchair ramp/lift
- Double-decker bus
  - Minimum 9 metre bus stop length (landing pad)
  - Minimum 0.45 metre clearance for the route identification pole (from face of curb)
  - Preferred 3 metre long by 3.2 metre wide (2.5 metre minimum) clear area at the front door to accommodate the wheelchair ramp/lift
- Community Shuttle
  - Minimum 8 metre bus stop length (landing pad hard surface)
  - A minimum 3 metre long by a preferred 3 metre wide clear area is required at the rear of the bus stop

4.2 Context-Sensitive Design

There are a number of questions and considerations for transportation professionals before designing and implementing bus stops adjacent to protected cycling infrastructure. These questions recognize that every situation is unique and context-sensitive designs are often required, while also striving for greater consistency across British Columbia to the extent possible.

Section 4.3 identifies a range of specific design treatments to address the key issues and challenges identified in **Section 2**. This Design Guide identifies treatments as **Core Treatments** or **Optional Treatments**, as summarized below:

- **Core Treatments** are those treatments that are critical to meet basic accessibility requirements and should be provided for any bus stop adjacent to protected cycling infrastructure to be designated as accessible by transit agencies.
- **Optional Treatments** are those treatments that would further enhance accessibility for the broadest range of users in a range of contexts. These treatments can go beyond Core Treatments to provide additional measures to improve access across a broader range of disabilities. These treatments are generally context-dependent and can be applied in areas of greater exposure to conflict.

Through stakeholder engagement, stakeholders identified the need for design consistency across the province. This is particularly important for people with sight loss so they know what to expect. This Design Guide aims to balance the need for consistency through Core Treatments, with the needs context-sensitive design, through additional Optional Treatments.

This categorization helps in ensuring basic levels of accessibility in all cases to help provide consistency in Core Treatments across the Province. It also provides transportation professionals with flexibility to consider context-sensitive designs where higher degrees of treatments are required due to greater exposure to conflict and/or where trade-offs are required due to lack of space or other constraints. In these cases, this context-sensitive approach prioritizes those treatments that maximize accessibility to accommodate the broadest range of accessibility needs in various designs and contexts.

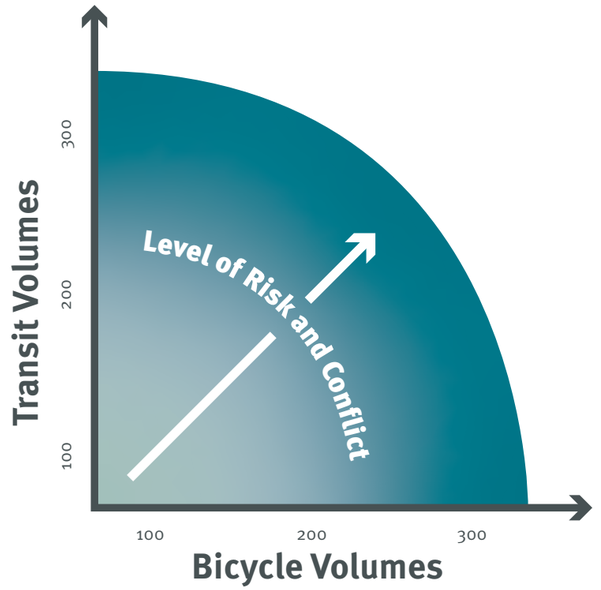
A key factor in context-sensitive design is understanding the conflict potential at the bus stop. Transportation professionals can seek to understand the conflict potential based on a number of factors. **Figure 4** provides a conceptual overview of how transportation professionals can seek to understand the level of exposure to conflict, based on two primary factors: daily transit volumes (as measured by boarding and alightings at the bus stop) and daily bicycle volumes. A bus stop with higher bicycle volumes and/or higher transit volumes presents a greater risk and potential for conflict with people needing to cross the bikeway to access the bus stop. In such cases, enhanced Optional Treatments may be required to address the higher level of exposure to conflict.

In addition to higher transit volumes and higher bicycle volumes, additional factors may also contribute to a greater exposure to conflict including:

- Higher volumes of pedestrians;
- Higher frequency of bus service;
- Bi-directional bikeway; and/or
- Steep downhill grade on cycling approach.

It should be noted that specific thresholds for what constitutes “high” volumes in **Figure 4** are illustrative and not prescriptive, as this will vary depending on the context of the community.

Figure 4: Identifying Level of Exposure to Conflict (Daily Volumes)



When present, any of these factors can increase the risk of conflicts between people accessing the bus stop and people cycling. In such cases, Optional Treatments may be desirable to address the higher levels of conflict. It should be noted that this Design Guide does not prescribe specific thresholds for what constitutes “high” volumes, as this will vary depending on the context of the community.

While this Design Guide provides a general guide for the provision of accessibility treatments, project specific considerations, including space constraints, opportunities, property ownership, etc. will ultimately determine how treatments are provided, on a case-by-case basis. As such, these design guidelines are not intended to place a rigid onus on agencies, local governments, or others to provide any specific amenity.

In an effort to provide design flexibility, consistent with the *BC Active Transportation Design Guide*, this Design Guide includes specific, targeted language to describe where, and the extent to which, design parameters may be varied to reflect site-specific challenges:

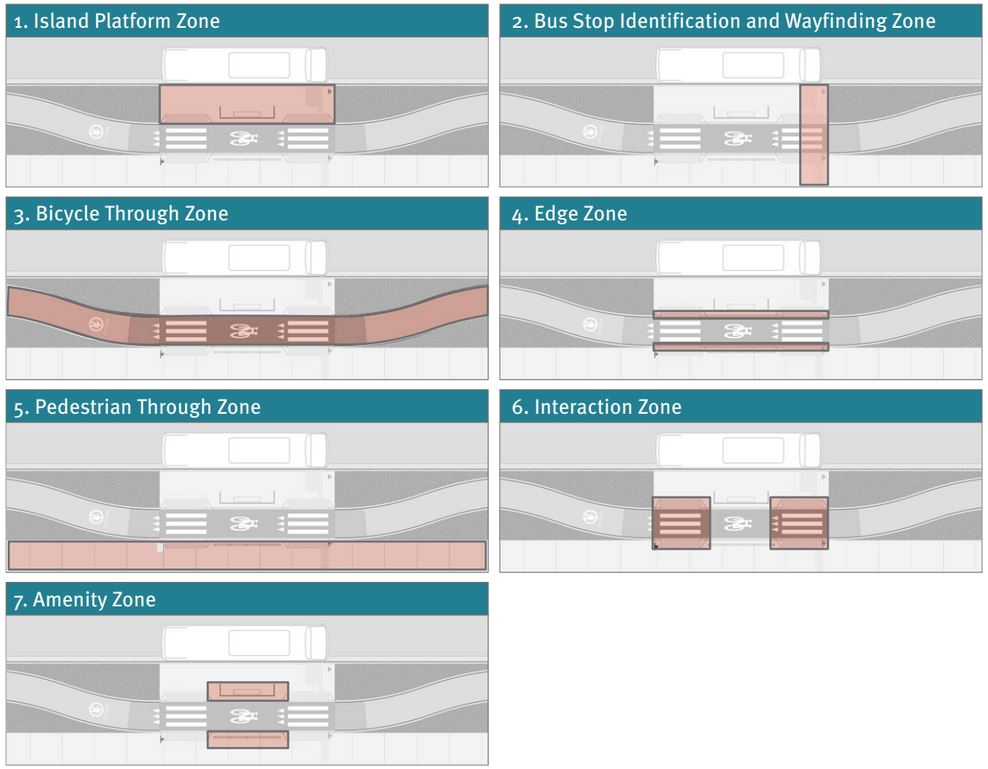
- **Desirable**: Desirable dimensions represent the recommended upper limit measurement for most applications to achieve the higher quality facility design and maximize user safety, accessibility, and comfort.
- **Constrained Limit:** Constrained limit dimensions represent the recommended lower limit for most applications to achieve acceptable facility design and maintain user safety, accessibility, and comfort. The constrained limit may not be desirable, but could possibly be required due to site-specific constraints.
- **Minimum**: Minimum dimensions are generally below the constrained limit and should only be considered in exceptional circumstances.

Pacific Street, Vancouver, British Columbia

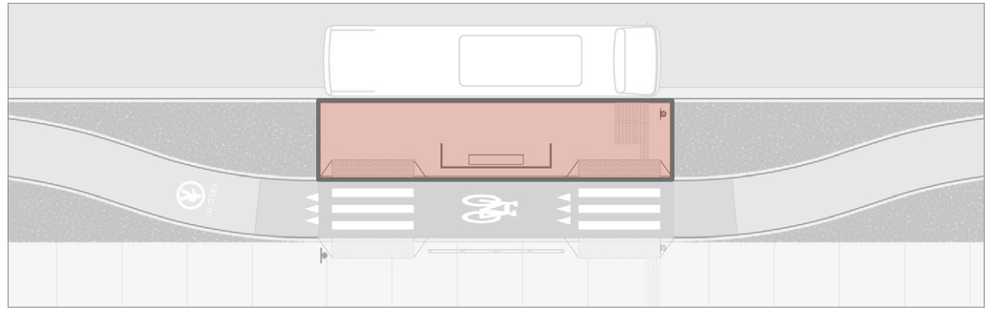
4.3 Design Elements and Treatments

For the purposes of this Design Guide, suggestions have been categorized into one of seven **Design Elements**, as shown in **Figure 5**. This section outlines a range of **Design Treatments** that transportation professionals can consider in the design of bus stops adjacent to cycling infrastructure within each of these seven Design Elements. Further details illustrating how these design treatments can be incorporated into specific configurations are provided in **Section 4.4**. Each of the Design Treatments outlined below has been identified as a direct response to address each of the key issues and challenges identified in **Section 2.4**. A summary of how each Design Treatment addresses each key issue and challenge is provided in **Section 6**.

Figure 5: Design Elements



4.3.1 Design Element 1: Island Platform Zone



The Island Platform Zone refers to the island where transit users board and alight the bus and where they wait for the bus. The island platform should be large enough in length (parallel to the curb) and width (perpendicular to the curb) to accommodate passengers waiting for the bus as well as those boarding and alighting the bus, including people using mobility devices. **It should be noted that the guidance for island platforms provided below does not apply to constrained bus stop applications,** as described further in **Section 4.4**.

Design Treatments for Design Element 1

Suggested design treatments for the Island Platform Zone are summarized below.

Design Treatment 1.1: The island platform should include key bus stop elements and meet or exceed the dimensions identified in TransLink and BC Transit guidance

CORE TREATMENT

TransLink's *Bus Infrastructure Design Guidelines* and BC Transit's *Infrastructure Design Guidelines* provide guidance regarding a number of key elements for the Island Platform Zone. Design parameters for some of these key elements are shown in **Figure 6** and summarized in **Figure 7**. Key elements of the bus stop include:

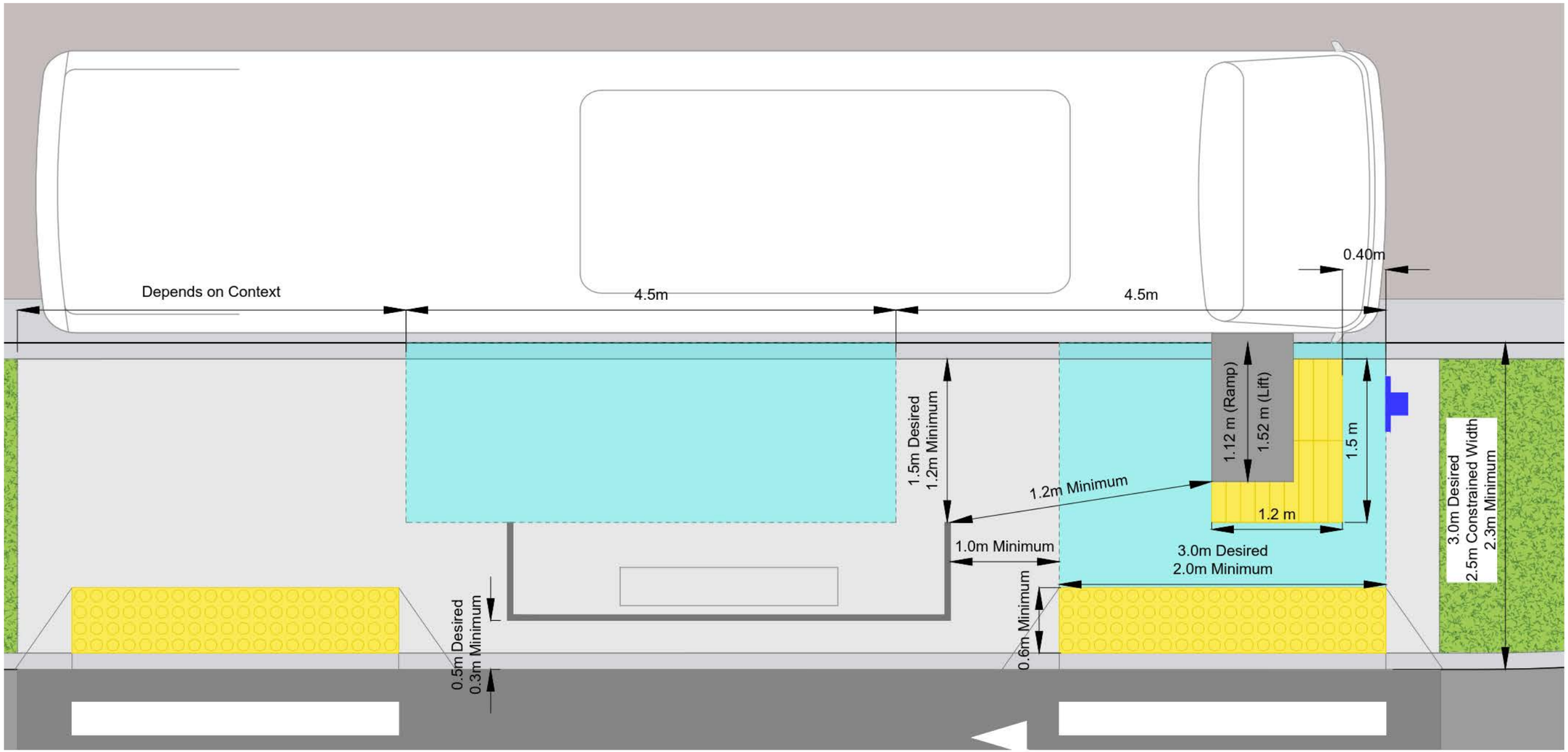
- **Bus stop ID pole** should be placed in line with where the front of the bus should stop and should be within 0.4 metres of the edge of Tactile Directional Indicator Mat, as shown in **Figure 7**;
- **Tactile Directional Indicator Mat** (shown in yellow with directional strips in **Figure 7**) should be located at the front door of the bus;
- **Wheelchair pad** (shown in dark grey in **Figure 7**) should be provided at the front door of the bus to accommodate a mechanical ramp or lift that drops from the front door of the bus (see **Design Treatment 1.3**); and
- **Passenger landing pad** (shown in blue in **Figure 7**) is a solid surface provided at a bus stop for passenger waiting and loading/unloading activity that should cover the front and rear bus door locations and should be free of obstructions.

Island platforms can vary considerably in length as this depends on the usage of the stop, including factors such as the frequency of buses, number of routes, timing stops, and the types of buses using the stop. Guidance for the length of the platform is not provided in this Design Guide. Transportation professionals should consult with local transit agencies and refer to TransLink's *Bus Infrastructure Design Guidelines* and/or *BC Transit's Infrastructure Design Guidelines* to determine the appropriate length of the Island Platform Zone.

Transportation professionals should refer to the aforementioned documents for more detailed design guidance to ensure they meet or exceed minimum required dimensions for each bus stop element.

Figure 6: Bus Stop ID Pole and Tactile Directional Indicator Mat, North Vancouver, British Columbia

Figure 7: Island Platform Key Elements and Dimensions



Note: specific dimensions may vary depending on specific bus stop configuration and type of transit vehicles accessing the bus stop.

Design Treatment 1.2: The island platform should be wide enough to accommodate people using mobility devices

CORE TREATMENT

Through discussions and field reviews with stakeholders, narrow island platforms were identified as being challenging for people with mobility devices to use due to limited space for maneuverability and barriers on the island platform. Stakeholders identified concerns of falling off the platform and into the roadway or bikeway.

Island platforms should be wide enough for people to comfortably wait for the bus and navigate while boarding and alighting, particularly for those using mobility devices. Bus stop platforms should be designed based on the design parameters shown in **Table 1**. Where the minimum dimensions in **Table 1** cannot be achieved, transportation professionals may consider constrained configurations, as described in further detail in **Section 4.4**. It should be noted that furnishings may not be feasible while meeting the minimum widths shown in **Table 1**, in which cases transportation professionals may consider alternatives such as lean rails which may require less space.

Table 1: Bus Stop Platform Width (Measured Perpendicular to Curb)

	Conventional Buses	Community Shuttle Buses
Desired	3.0 metres	3.0 metres
Constrained Limit	2.5 metres	3.0 metres
Minimum	2.3 metres (no vertical obstruction at the back of pad)	3.0 metres

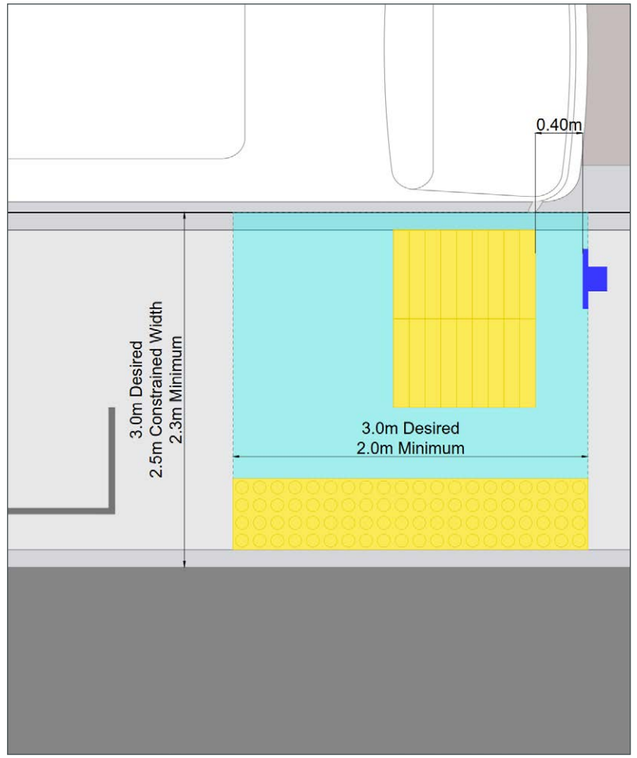
Design Treatment 1.3: Passenger landing pads should be clear of vertical obstructions

CORE TREATMENT

All TransLink and BC Transit buses are equipped with a mechanical ramp at the front door or a lift at the side-rear of the bus to allow people using mobility devices to board or alight the bus. Most vehicles in TransLink and BC Transit's fleets have wheelchair ramps that extend out 1.12 metres and wheelchair lifts that extend out up to 1.7 metres from the side of a bus when deployed. Bus stops should include sufficient space to ensure that a wheelchair lift or ramp can safely deploy and that people using mobility devices can maneuver around to access a deployed wheelchair lift or ramp, as shown in **Figure 8**. This area is referred to as a passenger landing pad, accessible landing pad, or wheelchair pad, and should be clear of obstacles and/or barriers to ensure it is fully maneuverable by people using mobility devices. The suggested dimensions for the accessible landing pad are shown in **Figure 9**.

Figure 8: Wheelchair Ramp Deployed onto Island Platform Bus Stop, Vancouver, British Columbia

Figure 9: Passenger Landing Pad (Wheelchair Pad) Dimensions



Design Treatment 1.4: Barrier curbs at bus stops should be used adjacent to the area where buses will stop to maximize usable space

CORE TREATMENT

Some stakeholders indicated concerns with island platform designs where the curb surrounding an island platform was a large roll curb, which significantly reduced the effective width of the island platform and resulted in concerns of falling off the island platform.

As a minimum, the curb adjacent to the roadway should be a barrier curb, as would typically be the case at conventional bus stops. Beveled or roll curbs are not considered part of the usable platform space. In addition, barrier curbs can be painted a designated colour indicating it is reserved for transit vehicles through the bus stop zone.

Design Treatment 1.5: The material used for the island platform should have a high degree of visual contrast from the bikeway

CORE TREATMENT

Bikeways are typically constructed with asphalt, whereas sidewalks are typically constructed using concrete. Concrete is lighter in colour than asphalt, which can help to provide some visual contrast between the cycling infrastructure and pedestrian realm. While this difference in hardscape materials is not reliably detectable with a white cane or underfoot, the contrasting colour between asphalt and concrete can help distinguish the island platform from the bikeway for some people who have partial vision, as shown in **Figure 10**, although it is recognized that this may not provide sufficient colour contrast for some people with low vision. The use of a yellow Tactile Warning Device in the edge zone can help to provide added colour contrast (see **Design Treatment 4.1** and Types of Tactile Delineators text box under **Design Element 2** for further guidance).

Figure 10: Colour Contrast Between Bikeway, Sidewalk, and Island Platform, New Westminster, British Columbia

79% of pilot project participants noted that contrasting colour and material between the bikeway and the bus stop was very helpful or somewhat helpful. However, some pilot participants with sight loss indicated that the colours of asphalt and concrete were not distinct enough to enable them to distinguish pedestrian and bicycle spaces in the bypass zone. In addition to the use of different materials such as asphalt and contrast, using strong contrast such as the use of high contrast edge treatments as described in **Design Treatment 4.1** can help to provide strong colour contrast.

Design Treatment 1.6: The island platform should have detectable 'bookends' at the start and end of the island

CORE TREATMENT

Many stakeholders indicated that they had difficulty identifying the longitudinal limits of the island platform. Several treatments can be used to help 'bookend' the bus stop platform, such as landscaping, bollards, fencing, and/or other street furniture, as shown in **Figure 11** and **Figure 12**. Transportation professionals should ensure that any 'bookend' treatments such as landscaping do not impact sightlines. It should be noted that depressed grooves in concrete are generally not a reliably, detectable feature. These limits of the platform should ideally coincide with the edges of marked pedestrian crossings.

Figure 11: Detectable 'Bookend' at End of Island Platform Using Vegetation, New Westminster, British Columbia

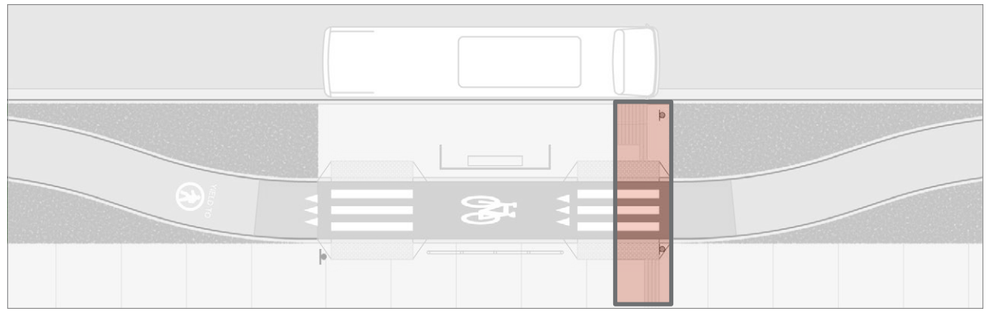
Figure 12: Detectable 'Bookend' at End of Island Platform Using Flexible Delineator Posts, Vancouver, British Columbia

In the highly constrained applications without an island platform, such as **Configuration 3 (Constrained With Shared Landing Pad)** in **Section 4.4**, Tactile Attention Indicators can be used to provide this bookend treatment and to provide a warning cue to people with sight loss exiting a bus in the event that they mistook the bikeway for a sidewalk and, secondarily, as a tactile measure to alert approaching cyclists, as shown in **Figure 13**.

The use of Tactile Attention Indicators as detectable bookends was piloted at two constrained bus stop locations. One participant with sight loss noted feeling they were not helpful, while mixed comments from two cyclists were received: one feeling that it helped raise awareness to cyclists of the presence of the bus stop, while the other felt it was confusing and could create a hazard. While some concerns were raised about installing Tactile Attention Indicators across the bikeway, their removal would leave a significant gap were someone with sight loss to exit the bus stop and immediately proceed down the bikeway in either direction. As such, this Design Guide includes this treatment as a last resort only in the most constrained applications.

Figure 13: Detectable 'Bookend' in a Constrained Application Without an Island Platform Using Tactile Attention Indicators, North Vancouver, British Columbia

4.3.2 Design Element 2: Bus Stop Identification and Wayfinding Zone



Stakeholders identified a number of challenges related to navigating the key elements of the bus stop, including difficulty finding the bus stop, difficulty finding information about bus routes served, and difficulty understanding and navigating a bus stop layout when arriving from the sidewalk or getting off the bus. The lack of consistency in infrastructure across the province makes it challenging for users to locate the bus stop, to know where to cross the bikeway, and where key elements are located on the bus stop platform.

Design Treatments for Design Element 2

Suggested design treatments for Bus Stop Identification and Wayfinding are summarized below.

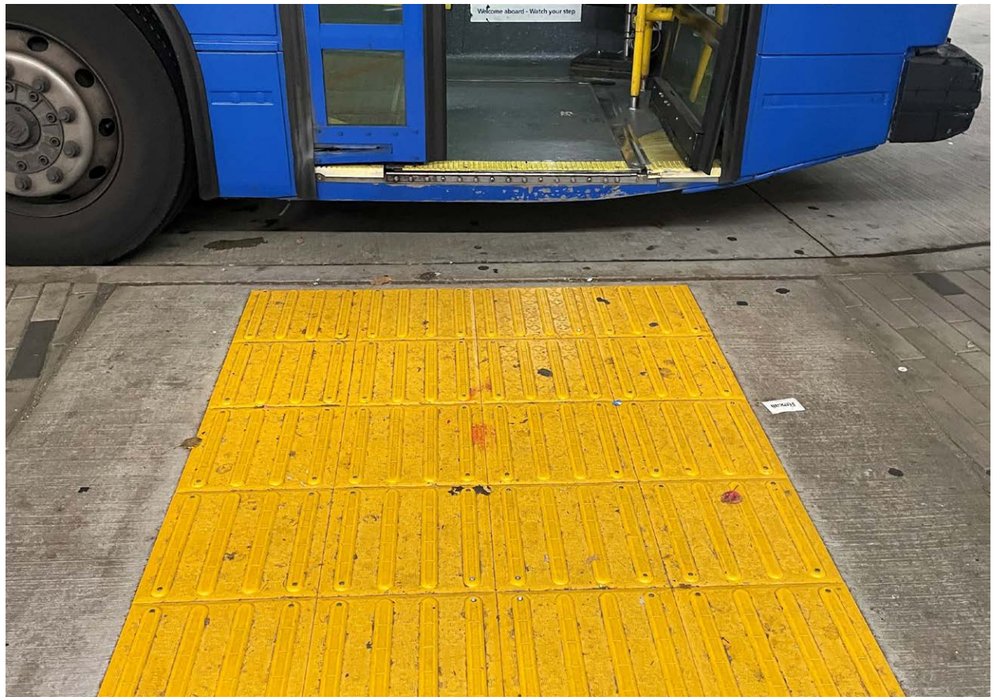
Design Treatment 2.1: The location of the front door of the bus stop should be clearly identifiable with a primary bus stop ID pole and use of a Tactile Directional Indicator Mat

CORE TREATMENT

TransLink and BC Transit both have guidance to identify the location where a bus should stop, including the placement of a bus stop ID pole. TransLink has guidance on the use of a Tactile Directional Indicator Mat adjacent to the primary bus stop ID pole, as shown in **Figure 14**. The primary bus stop ID pole is a critical design element that anchors many other aspects of the design of the bus stop and should be located within 0.4 metres of the edge of the Tactile Directional Indicator Mat so people with sight loss can detect the pole with additional information. The primary bus stop ID pole provides information to transit operators about where to stop the vehicle, and also provides messaging to transit users to inform them where they should wait for the bus and where to board the bus.

Transportation professionals should follow applicable design guidelines regarding the location and placement of the bus stop ID pole and use of Tactile Directional Indicator Mats.

Figure 14: Example of Tactile Directional Indicator Mat, North Vancouver, British Columbia

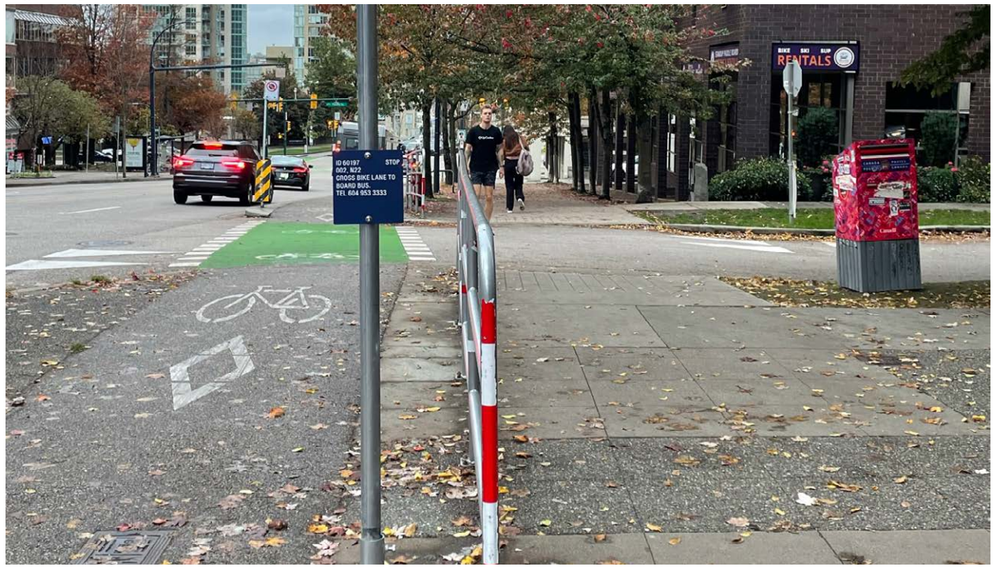


Design Treatment 2.2: A secondary bus stop ID pole should be installed on the sidewalk

CORE TREATMENT

One of the most significant issues identified by people with sight loss was the ability to identify the presence of a bus stop while on the sidewalk. Secondary bus stop ID poles should be installed on the sidewalk to provide information to people with sight loss about the presence of the bus stop along with route information before making the decision to cross the bikeway, as shown in **Figure 15**. Secondary bus stop ID poles do not require that the same amount of information be provided as the primary bus stop ID pole. Secondary bus stop ID poles should be limited to providing information to people with sight loss with the use of enhanced signage with braille and raised tactile letters (see **Design Treatment 2.3**) and optional tactile layout map signage (see **Design Treatment 2.4**). Care should be taken when installing secondary bus stop ID poles to ensure that they do not encroach into the Bicycle Through Zone or Pedestrian Through Zone and that they do not create safety hazards for pedestrians or cyclists.

Figure 15: Example of Secondary Bus Stop ID Pole, Vancouver, British Columbia



The pilot project found that installing secondary bus stop ID poles on the sidewalk was one of the most effective design treatments used. 86% of participants who tested this design treatment indicated it was very helpful or somewhat helpful for finding the bus stop.

Design Treatment 2.3: Enhanced signage with braille and raised tactile letters should be provided on bus stop ID poles indicating it is an island platform bus stop

CORE TREATMENT

TransLink has installed braille signage with information in both Unified English Braille and raised tactile letters at every bus stop throughout Metro Vancouver to identify which bus stop people are at and which bus routes are served by the stop. Where secondary bus stop ID poles are installed, they should also include this signage with bus stop and route information. Furthermore, where appropriate, these signs should be enhanced to indicate the need to cross a bikeway to access the island platform (in the case of a secondary bus stop ID pole) or the sidewalk (in the case of a primary bus stop ID pole). The signage can include a simple message such as **"cross bike lane to access sidewalk"** or **"cross bike lane to board bus,"** as shown in **Figure 16** and **Figure 17.** The braille and raised lettering should begin with new information provided on each new row, with braille and/or text left justified. The addition of a raised directional arrow on the sign, similar to an APS pushbutton, can also help orient and confirm which direction the person would walk to cross the bikeway. Braille signage has not been implemented outside of Metro Vancouver and would require installing new signs.

Figure 16: Example of Braille Signage with Raised Tactile Letters, Vancouver, British Columbia

Figure 17: Example of Braille Signage with Raised Tactile Letters, Vancouver, British Columbia

The pilot project found that installing signage with braille and raised tactile letters was generally effective. 70% of participants who tested this signage on a sidewalk and 72% of participants who tested this signage on a bus platform indicated it was very helpful or somewhat helpful for finding the bus stop. However, most participants in the pilot project were not trained to read braille. As such, it is important that these signs include braille and raised tactile letters, or just raised tactile letters.

Design Treatment 2.4: Enhanced signage with tactile map of bus stop layout can be provided on bus stop ID poles

OPTIONAL TREATMENT

Enhanced signage can be provided on bus stop ID poles to provide a tactile map describing the layout of the bus stop in a schematic format to help orient people with sight loss so they can more easily navigate to and from the bus stop platform, as shown in **Figure 18** and **Figure 19**. It is important that these signs be standardized so they are consistent and well understood.

Figure 18: Example of Tactile Layout Map Sign, Montgomery County, Maryland

Figure 19: Tactile Layout Map Sign Prototype

Tactile signage with enhanced maps of the bus stop layout was piloted in one municipality. The tactile signage with enhanced maps received generally positive feedback and was felt that it would be useful; however, further work with the accessibility community will be required to confirm design details of any tactile maps of the bus stop layout. In addition, it was emphasized that consistency and standardization in the design of the maps would be critical for people with sight loss.

Design Treatment 2.5: Tactile Directional Indicators can be installed across the sidewalk to identify the bus stop

OPTIONAL TREATMENT

Tactile Directional Indicators extending across the full width of the sidewalk can be used to help people with sight loss walking in the sidewalk to identify the presence of, and navigate to, a bus stop, as shown in **Figure 20** and **Figure 21**. This application can be used in conjunction with Tactile Directional Indicator Mats at the primary bus stop ID pole (see **Design Treatment 2.2**).

Tactile Directional Indicators should be oriented perpendicular to the sidewalk to intercept pedestrians on the sidewalk and provide directional guidance towards the bus stop. This application of Tactile Directional Indicators should be at least 0.6 metres wide. However, caution should be used when installing Tactile Directional Indicators as these surfaces may be uncomfortable and even painful for people using mobility devices to cross.

An alternative is to consider orienting the Tactile Directional Indicators parallel to the sidewalk. In such cases, the spacing of the Tactile Directional Indicator bars can affect how traversable the surface is to people using mobility aids. If these are installed parallel to the sidewalk, spacing should be considered to ensure a clear width be left free of these devices to ensure people with mobility devices can comfortably cross them. Further research is also recommended, such as working with suppliers to explore different spacing and width of the raised flat-top bars within the ranges allowed by the ISO and CSA Group specifications to explore if this can help with traversability.

The needs of all users should be considered and local stakeholders consulted when determining the orientation of Tactile Directional Indicators across the sidewalk.

Figure 20: Example of Tactile Directional Indicator Across Sidewalk with Perpendicular Orientation, Vancouver, British Columbia

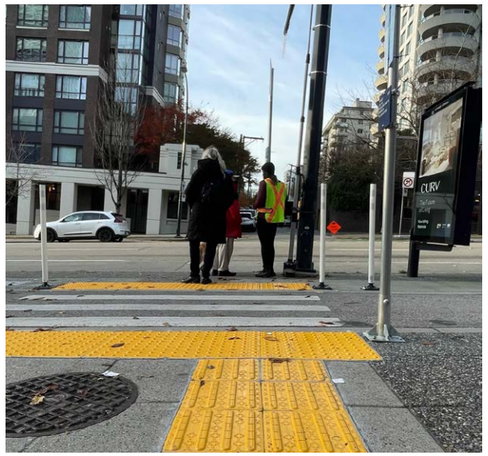
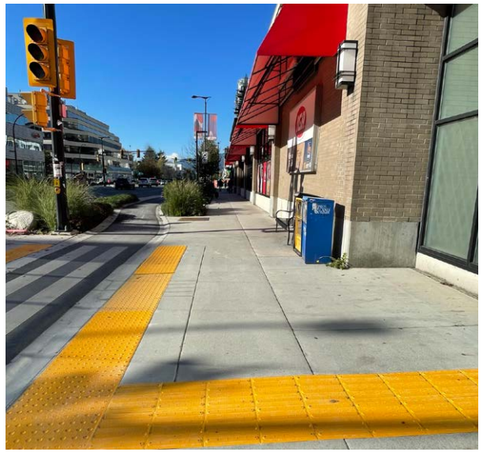


Figure 21: Example of Tactile Directional Indicator Across Sidewalk with Perpendicular Orientation, North Vancouver, British Columbia



In research conducted by Bentzen et al., the impact of Tactile Directional Indicators installed perpendicular and parallel to the direction of travel on the sidewalk was evaluated. The research concluded that parallel orientation to the direction of travel on the sidewalk was easier for pedestrians using mobility aids to traverse. However, pilot participants who had the opportunity to compare the two orientations did not report significant differences in traversability when continuing along the sidewalk (not accessing the bus stop). Some participants also expressed concern that the parallel orientation is not intuitive and may be challenging to implement in unconventional situations. As such, this Design Guide suggests that Tactile Directional Indicators are oriented perpendicular to the sidewalk which is also consistent with ISO and CSA Group guidance.

The pilot project found that installing Tactile Directional Indicators across the sidewalk was one of the most effective design treatments used. 91% of respondents who tested this feature indicated it was very helpful or somewhat helpful for finding the bus stop and for finding pedestrian crossings between the sidewalk and bus platform. Some participants who encountered these Tactile Directional Indicators found them to somewhat negatively impact their ability to access the stop and pass the stop on the sidewalk.

Almost all pilot participants with sight loss reported that they preferred to get on and off the bus through the front door of the bus. If a system of tactile delineators is used to guide people with sight loss to and from a bus stop, the system should be designed with the understanding that people with sight loss strongly prefer getting on or off the bus at the front door. In general, Tactile Directional Indicators should not be used to guide people to/from the bus's rear door.

The pilot projects found that when tactile devices are applied more extensively in isolation, such as around a bus stop, and without an established consistent practice, they can introduce significant design challenges, confuse pedestrians with sight loss, and have detrimental impacts on people with other types of disabilities. As such, within the context of this Design Guide, transportation professionals should adopt a minimalist approach to the use of tactile devices, wherein the use of tactile devices should primarily be only applied across the sidewalk to direct people with sight loss to the bus stop, and to mark the front bus boarding area at the bus stop ID pole. Additional tactile devices should only be used if other available cues are insufficient.

Design Treatment 2.6: Emerging technologies can be encouraged to assist with orientation, navigation, and wayfinding

OPTIONAL TREATMENT

There are a number of emerging technologies that can be considered to assist transit users with wayfinding and navigation. Many of the pilot participants with sight loss were observed to use apps for navigation, such as Google Maps, Aira, and NaviLens. Although apps require a working cell phone, which not all people have, for those that have a working cell phone, they can be beneficial and can supplement information provided at the stop.

Other technologies could include providing pictograms and/or audio messages on bus furniture provided on the sidewalk to direct transit users to the island platform.

Emerging technologies can supplement design treatments, but it is recognized that not everyone has access to smart phone or these technologies, and these solutions should not be a substitute for effective design treatments.

Types of Tactile Delineators

There are a range of different types of tactile delineators that can be used for a range of purposes and which are referenced throughout this Design Guide. Tactile walking surface indicator (TWSI) is the umbrella term for the different types of standardized tactile surfaces carefully designed to help people with sight loss independently and safely navigate the pedestrian realm. The different types of TWSIs must be reliably detectable with a white cane and/or underfoot, discernable from each other, and traversable by people using mobility devices. TWSIs are recommended by the CSA as the standardized detectable warning surface treatment. The CSA *Accessible Design for the Built Environment* provides detailed guidance on TWSI construction and placement. TWSIs should have a visual contrast of 75% from the pavement (yellow is typically used). They are most effective when placed adjacent to smooth pavement so that the difference is easily detected.

TransLink has conducted research on the use of TWSIs at bus stops in Metro Vancouver to share information on best practices for the use of TWSIs and achieve a more consistent approach to TWSIs in Metro Vancouver. The various applications of tactile delineators are summarized below:

Tactile Attention Indicator: Also referred to as a Detectable Warning Surface (DWS), a Tactile Attention Indicator (TAI) is a standardized tactile surface comprising a grid of truncated domes that alert people of an impending change in elevation, conflicts with other transportation modes, and/or other potential hazards. Tactile Attention Indicators are not to be used to provide alignment or guidance information.

Tactile Directional Indicator: A Tactile Directional Indicator (TDI) is surface of parallel raised elongated bars with flat tops, typically oriented parallel to the path of travel. These are typically installed for wayfinding/guidance along an unobstructed path. They are intended to be used underfoot and should not be used for edge delineation. Tactile directional indicators can also be used as a system for wayfinding with the use of Tactile Attention Indicators to indicate decision points.

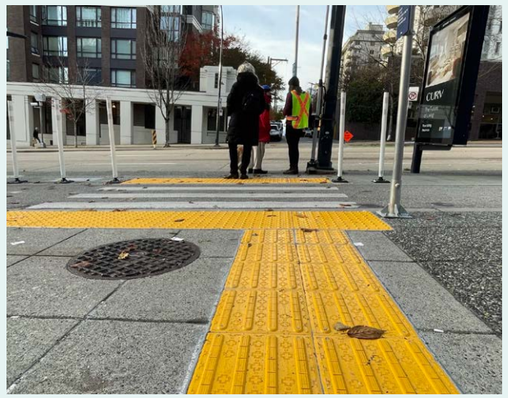


Figure 22: Examples of Various Types of Tactile Delineators

Legend

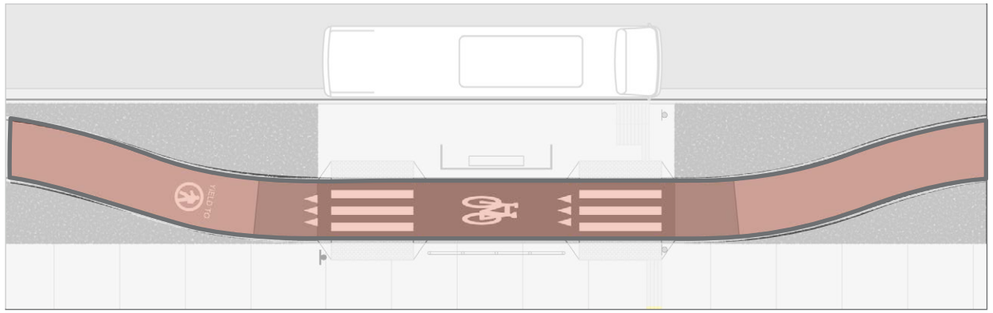
- Detectable Beveled Curb
- Tactile Directional Indicator
- Tactile Warning Delineator
- Tactile Directional Indicator Mat
- Tactile Attention Indicator

Tactile Directional Indicator Mat: TransLink and BC Transit provide guidance for the use of a Tactile Directional Indicator Mat to be used at the front door of where a bus will stop. The parallel raised based bar should be oriented perpendicular to the path of travel.

Tactile Warning Delineator: A Tactile Warning Delineator (TWD) is a trapezoidal shaped delineator that can be used as a detectable edge between a sidewalk and bicycle lane at the same height. There is currently limited research on the use of TWDs and they are an emerging treatment that transportation professionals may consider.

Source: Beezy Bentzen

4.3.3 Design Element 3: Bicycle Through Zone



The Bicycle Through Zone refers to the areas reserved for the use of people cycling, including protected bicycle lanes and multi-use pathways. Transportation professionals should refer to the *BC Active Transportation Design Guide* and TAC *Geometric Design Guide for Canadian Roads* for detailed guidance for the Bicycle Through Zone.

Design Treatments for Design Element 3

Suggested design treatments for the Bicycle Through Zone adjacent to bus stops are summarized below.

Design Treatment 3.1: The Bicycle Through Zone should meet or exceed minimum widths identified in the *BC Active Transportation Design Guide* and/or TAC *Geometric Design Guide for Canadian Roads*

CORE TREATMENT

Transportation professionals should ensure the Bicycle Through Zone meets or exceeds minimum widths for bikeways as identified in the *BC Active Transportation Design Guide* and/or TAC *Geometric Design Guide for Canadian Roads*, as summarized in **Table 2**. In particular, bikeways should be wide enough to accommodate the anticipated user volumes and the operational characteristics of bicycles using these facilities. However, unlike bikeways in other contexts, the widths selected should encourage people cycling to slow down and not to pass one another while travelling through the bus stop zone, as passing increases the potential for conflict between people cycling and those crossing the bikeway. Bikeways should also be wide enough to accommodate a range of types of bicycles, including cargo bikes and bicycles with trailers. It is noted that **Design Treatment 3.3** includes suggestions for narrowing bikeways, and suggests that bikeways should be reduced on the approach to the bus stop and adjacent to the bus stop to encourage better yielding behaviour; however, bikeways should never be narrowed below the minimum width.

Table 2: Bicycle Through Zone Design Parameters

	Uni-directional Protected Bicycle Lane	Bi-directional Protected Bicycle Lane	Multi-use pathway
Desired	2.5 metres	4.0 metres	4.0 metres
Constrained Limit	1.8 metres	3.0 metres	3.0 metres
Minimum	1.5 metres	2.4 metres	2.7 metres

Design Treatment 3.2: The Bicycle Through Zone should be clear and free of obstructions

CORE TREATMENT

The Bicycle Through Zone should have a clear useable width and should be free of obstructions. In particular, obstructions such as rigid bollards should be avoided as they can present safety hazards. Flexible delineator posts may be considered within the Bicycle Through Zone on bi-directional bikeways.

Design Treatment 3.3: Information and/or treatments should be provided to slow cyclists and to emphasize the need to yield to pedestrians as is legally required

CORE TREATMENT

Significant concerns were raised by stakeholders about the speeds (and perceived speeds) of people cycling and the lack of stopping or yielding to pedestrians as is legally required when a pedestrian has entered a crosswalk. A range of geometric design treatments can be considered, as described below, to address this concern. Additional considerations for signage and pavement markings that can also be used for this purpose are provided in the discussion for **Design Element 6.**

While this overall Design Treatment is a Core Treatment, it may not always be necessary or desirable to use all the design treatments noted below. As such, each of the individual treatments noted below are considered optional, so long as transportation professionals install at least some of these treatments to achieve the intent of this Design Treatment as a Core Treatment. Transportation professionals should determine which of these treatments (or combination of treatments) are best suited to the specific project based on the local context through the planning and design process.

Some pilot project participants indicated that they found the clutter of certain pilot designs overwhelming or confusing. Transportation professionals should emphasize the importance of simplicity and clarity in design to avoid design clutter and creating confusion.

Narrow the bikeway where feasible to encourage people cycling to slow down in advance of the crossing and to discourage people cycling from passing each other, as shown in **Figure 23**. However, the Bicycle Through Zone should never be narrowed below the minimum widths identified in **Table 2**.

Figure 23: Narrowed Bikeway Adjacent to Island Platform, Montreal, Quebec

Raise the bikeway to sidewalk level or intermediate level at approaches to the bus stop to encourage people cycling to slow down in advance of the crossing, without posing undue safety hazards to people cycling or limiting the ability of larger bicycles such as cargo bikes to be accommodated, as shown in **Figure 24**.

Figure 24: Bikeway Raised to Sidewalk Level Adjacent to Island Platform, Nanaimo, British Columbia

Introduce horizontal deflection in the bikeway on the approach to the bus stop with a horizontal curve with appropriate radii to encourage people cycling to slow down in advance of the crossing while ensuring they are designed with appropriate radii to safely and comfortably accommodate people cycling, as shown in **Figure 25**. Additional caution should be used on bi-directional facilities when considering the appropriate radius. If the horizontal deflection is too abrupt, users travelling in the opposing direction may travel in the opposing side of the bikeway to minimize speed reduction, but which may pose risk for additional conflict. Transportation professionals should refer to the *BC Active Transportation Design Guide* and/or TAC *Geometric Design Guide for Canadian Roads* for guidance on tapers.

Figure 25: Horizontal Deflection of Bikeway Adjacent to Island Platform, New Westminster, British Columbia

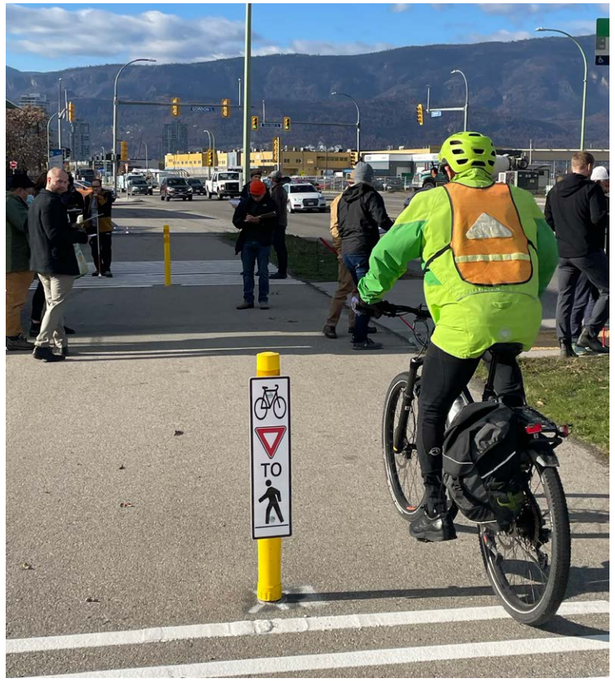
Install transverse thermoplastic pavement markings, also commonly referred to as "cycling rumble strips", which provides tactile feedback that encourages people cycling to slow down, as shown in **Figure 26**. However, the use of these markings may decrease accessibility for people cycling with small tires or those using micromobility devices with small tires such as rollerblades, skateboards, and e-scooters.

Figure 26: Example of Transverse Thermoplastic Pavement Markings, Vancouver, British Columbia

Provide a solid yellow directional dividing line on bi-directional facilities to discourage passing.

Provide low-risk channelization in bi-directional bicycle lanes to provide a visual cue to slow cyclists using paint or median treatments along with the potential of flexible delineator posts on bi-directional facilities, but avoiding the use of rigid bollards which can present safety issues for people cycling, as shown in **Figure 27**. Flexible delineator posts can be enhanced with low-mounted "Bicycles Yield to Pedestrians" signs to reinforce the requirement to yield to people crossing the bikeway (see **Design Treatment 6.6**)

Figure 27: Example of Low-risk Channelization with Flexible Delineator Post, Kelowna, British Columbia



A range of design treatments to slow cyclists and to emphasize the legal requirement to yield to pedestrians were tested in the pilot projects. Cycling speeds and yielding behaviour were common concerns among pilot participants. A key challenge for people with sight loss is determining when it is safe to cross due to the difficulty of hearing cyclists above ambient background noise.

One municipality tested transverse thermoplastic pavement markings. In the locations where these were tested, participants felt they neither made the cyclist more audible nor helped to slow cycling speeds. Transverse thermoplastic pavement markings can be used as an optional cue to cyclists that they are entering a different environment and that they should pay attention, while noting that these were not found to be effective at making cyclists audible or improving cyclist yielding behaviour.

Design Treatment 3.4: The material used for the bikeway should have a high degree of visual contrast from the sidewalk and island platform

CORE TREATMENT

Cycling infrastructure is typically constructed with asphalt, and sidewalks are typically constructed using concrete. Asphalt is darker than concrete, which can help to provide a visual contrast between the cycling infrastructure and pedestrian realm. While this does not provide a detectable edge, the contrasting colour between darker asphalt and lighter coloured concrete can help distinguish the cycling infrastructure from the pedestrian realm, although it is recognized that this may not provide sufficient colour contrast for some people with low vision. The use of yellow Tactile Warning Delineators as edge treatments can help to provide added colour contrast (see **Design Treatment 4.1** and Types of Tactile Delineators text box under **Design Element 2** for further guidance).

Only 18% of pilot project participants noted that contrasting colour and material between the bikeway and the sidewalk was very helpful or somewhat helpful. Some pilot participants with sight loss indicated that the colours of asphalt and concrete were not distinct enough to enable them to distinguish pedestrian and bicycle spaces in the bypass zone. In addition to the use of different materials such as asphalt and contrast, having strong contrast such as the use of high contrast edge treatments as described in **Design Treatment 4.1** can help to provide strong colour contrast.

4.3.4 Design Element 4: Edge Zones

Edge zones refer to the area between the Bicycle Through Zone and the Island Platform Zone, and between the Bicycle Through Zone and the Pedestrian Through Zone. One of the key issues identified by stakeholders was the lack of consistent detectable and visible edges between the Bicycle Through Zone and these adjacent spaces for pedestrians.

Design Treatments for Design Element 4

Design Treatment 4.1: Edge treatments that are cane-detectable should be provided next to the Bicycle Through Zone

CORE TREATMENT

Edge treatments should be provided between the Bicycle Through Zone and adjacent spaces for pedestrians that are detectable by people with sight loss in order to distinguish between the bikeway and the pedestrian realm. This helps people with sight loss identify where the bikeway is located before entering that space. There are a range of edge treatment options that can be considered, as described below.

Lateral buffer with landscaping between cycling infrastructure and pedestrian realm: Where sufficient space is available, a lateral buffer with landscaping or other treatments provides a clear and easily detectable edge between the bikeway and the pedestrian realm and makes it easier for people who are shorelining (a technique used to find a landmark or destination with a white cane), as shown in **Figure 28**. **This is the most preferred edge treatment where sufficient space is available.**

Figure 28: Lateral Buffer with Landscaping, North Vancouver, British Columbia

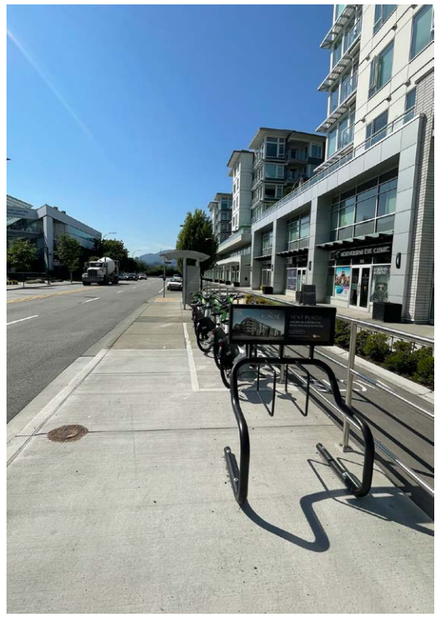
Intermediate-height bikeway with curb: In constrained environments, where there is no room for lateral separation with landscaping or other treatments, the preferred treatment is to install the cycling infrastructure at an intermediate-height between the roadway grade and sidewalk grade, as shown in **Figure 29**. This can be done using a beveled curb or a short barrier curb. This vertical delineation between the sidewalk and cycling infrastructure provides a detectable edge between the two adjacent facilities. Intermediate-height applications can also benefit from having other treatments to define edge treatments, such as closely spaced street furniture including fences, railings, utility poles, lamp standards, bicycle racks, or other treatments, as shown in **Figure 30**.

Figure 29: Intermediate-height Cycling Infrastructure with Beveled Curb, Vancouver, British Columbia

Sidewalk-height cycling infrastructure with street furniture: In constrained environments, where there is no room for lateral separation with landscaping or other delineation treatments, closely spaced street furniture such as fences, railings, utility poles, lamp standards, bicycle racks, or other treatments can be provided to provide a physical edge between the different elements, as shown in **Figure 30**, These delineation treatments should be continuous, except for gaps at pedestrian crossing locations, and should be detectable with a long white cane.

Sidewalk-height cycling infrastructure with Tactile Warning Delineators or other detectable edges: In constrained environments, where the cycling infrastructure is at sidewalk-height and, in the absence of any of the detectable edges described above, Tactile Warning Delineators (TWDs) or other tactile detectable edges can be provided to help provide wayfinding for pedestrians through these flush areas. There is currently limited research on the use of TWDs, although they are an emerging treatment that transportation professionals may consider. TWDs should have high contrast such as the use of yellow.

Figure 30: Intermediate-height Cycling Infrastructure with Street Furniture, Including Bicycle Parking, Fence, Shelter, and Micromobility Hub, North Vancouver, British Columbia

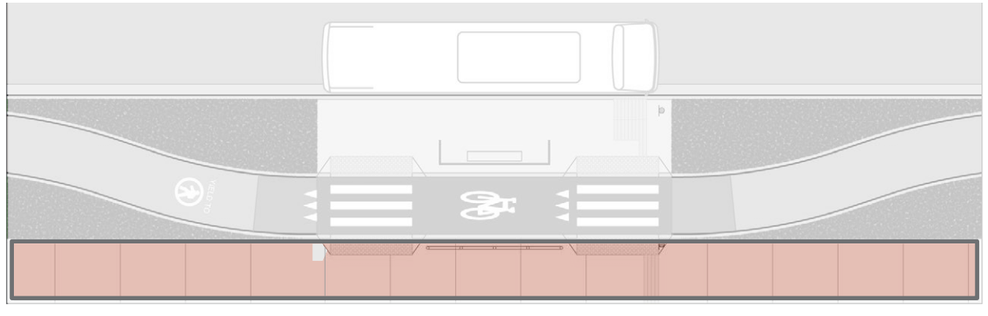


It should be noted that many existing bus stops use edge treatments such as different hardscape materials, textures, grooves, or colours as shown in **Figure 31**. Such treatments are generally unproven or too subtle to be reliably detectable with a white cane or underfoot, which was confirmed during site visits conducted as part of this project, and are not recommended.

Some pilot project participants were confused when discontinuous treatments were provided to provide edge treatments, which may create the potential that people with sight loss may cross at an unintended location where they are less visible and safe. As such, delineation features such as fences, railings, bicycle racks, or other treatments should be continuous, except for gaps at pedestrian crossing locations, and should be detectable with a long white cane.

Figure 31: Examples of Edge Treatments that are Not Reliably Detectable, Burnaby, British Columbia (left) and Vancouver, British Columbia (right)

4.3.5 Design Element 5: Pedestrian Through Zone



The Pedestrian Through Zone generally refers to the sidewalk (excluding configurations with multi-use pathways). The Pedestrian Through Zone is the area intended for pedestrian movement, where people travel, interact with each other, and access destinations along a street. Providing a Pedestrian Through Zone that is functional and comfortable for most people should be prioritized over other zones when designing the pedestrian environment. Transportation professionals should refer to the *BC Active Transportation Design Guide* and TAC *Geometric Design Guide for Canadian Roads* for detailed guidance for the Pedestrian Through Zone.

Design Treatments for Design Element 5

Suggested design treatments for the Pedestrian Through Zone are summarized below.

Design Treatment 5.1: The Pedestrian Through Zone should meet or exceed minimum widths identified in the *BC Active Transportation Design Guide* and/or TAC *Geometric Design Guide for Canadian Roads*

CORE TREATMENT

Transportation professionals should ensure that pedestrian infrastructure meets or exceeds minimum widths in the BC Active Transportation Design Guide and/or the TAC Geometric Design Guide for Canadian Roads.

The Pedestrian Through Zone should have a minimum width of at least 1.8 metres, which allows two people using mobility devices to pass one another. A minimum width of 1.8 metres is also recommended for snow clearing operations, as this helps prevent plow damage to road amenities and utilities. Providing between 1.8 and 2.1 metres allows sufficient clearance for a pedestrian to pass someone with a service animal. In areas of high pedestrian activity, the Pedestrian Through Zone should be wider than 1.8 metres. The absolute minimum width for the Pedestrian Through Zone is 1.5 metres, and should only be used under constrained conditions for distances under 100 metres.

Design Treatment 5.2: The Pedestrian Through Zone should be free of obstructions

CORE TREATMENT

The Pedestrian Through Zone should be kept clear of obstructions at all times, with the minimum width described above maintained for the length of the project corridor and through all pedestrian crossings. Utilities, street lights, signs, street furniture, advertising boards, vegetation, or other obstructions should not encroach into the minimum widths required for the Pedestrian Through Zone.

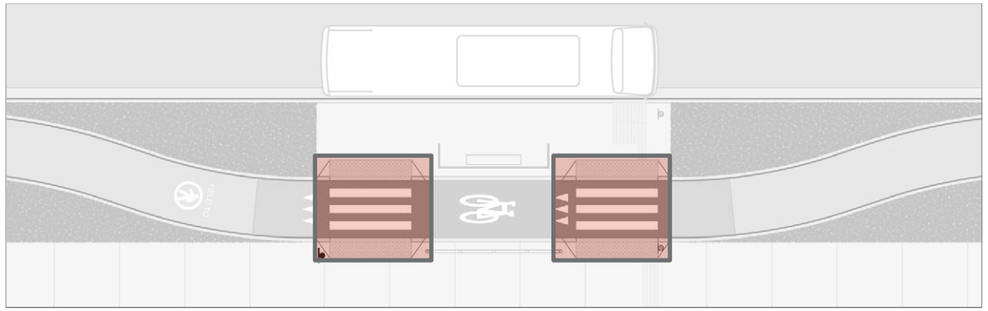
Design Treatment 5.3: The material used for the Pedestrian Through Zone should have a high degree of visual contrast from the bikeway

CORE TREATMENT

Cycling infrastructure is typically constructed with asphalt, and sidewalks are typically constructed using concrete. Concrete is lighter than asphalt, which helps provide a visual contrast between the cycling infrastructure and pedestrian realm. While this does not provide a detectable edge, the contrasting colour between darker asphalt and lighter coloured concrete can help distinguish the Pedestrian Through Zone from the cycling infrastructure.

Mission, British Columbia

4.3.6 Design Element 6: Interaction Zones



Interaction Zones refer to the locations where pedestrians and cyclists occupy or pass through the same space. These zones are generally focused on the designated pedestrian crossings across the bikeway. This Design Guide recommends that design treatments be provided to encourage pedestrians to cross the Bicycle Through Zone at designated locations to improve predictability for all users.

Design Treatments for Design Element 6

Suggested design treatments for the Interaction Zones are summarized below.

Design Treatment 6.1: A marked pedestrian crossing should be provided at the front door of the bus in line with the bus stop ID pole or at the front of the island platform

CORE TREATMENT

Providing marked pedestrian crossings helps to clearly communicate to pedestrians where they are intended to cross and discourages crossing at non-designated locations. Marked pedestrian crossings also help raise awareness to cyclists to expect pedestrians at those locations and provide the right-of-way to pedestrians when they enter the crossing. At the most basic level, a marked pedestrian crossing should consist of conventional "zebra" pavement markings which feature wide, white lines aligned parallel to the bikeway. These pavement markings can be enhanced with other treatments (see **Design Treatment 6.6**).

At minimum, a marked pedestrian zebra crossing should be provided to align with the bus stop ID pole or at the front of the island platform to help people with sight loss know where to board the bus. It is noted that in some cases it may be not be possible to align the crosswalk with the front of the island platform depending on the overall bus stop configuration. In such cases, other elements such as enhanced signage with tactile maps of bus stop layouts (see **Design Treatment 2.4**) and/or the use of Tactile Directional Indicators for wayfinding (see **Design Treatment 2.6**) can be provided to direct people to marked pedestrian crossing locations.

A marked pedestrian crossing can be provided in conjunction with **Design Treatment 6.4** to channelize pedestrians to the marked pedestrian crossing. Without such treatments, if only a marked pedestrian crossing is provided, this may result in pedestrians crossing at non-designated crossing locations.

Marked pedestrian crossings should include at least one of the following signage applications:

Figure 32: Pedestrian Crosswalk Sign (RA-4)

Figure 33: Bicycles Yield to Pedestrians Sign (RB-39)

- **Pedestrian Crosswalk signage:** The "zebra" crosswalk markings can be supplemented by side-mounted *Pedestrian Crosswalk* (RA-4, MUTCD-C) signs (see **Figure 32**). The *Pedestrian Crosswalk* sign is used to indicate the location of a pedestrian crosswalk and, if used, should be installed on both sides of the bikeway, and be mounted back-to-back when used on bi-directional bikeways. Note that the signage should be mounted at an appropriate height for visibility of people cycling. Crosswalk signage is an optional treatment due to concerns raised by stakeholders about sign clutter and the potential for too many signs to result in confusion. A smaller scale sign may also be considered to reduce sign clutter.
- **Bicycles Yield to Pedestrians signage:** The standard *Bicycles Yield to Pedestrians* (RB-39, MUTCD-C) sign can be provided to alert people cycling to the potential for pedestrians to be crossing the bikeway and remind people of their legal obligation to yield to pedestrians who are in the crossing (see **Figure 33**). The sign should be mounted and placed in a visible location for people cycling directly adjacent to the bikeway and at a low height, ideally at eye level of people cycling if installed in a location not intended for pedestrian use to improve conspicuity for people cycling.

Design Treatment 6.2: A marked pedestrian crossing should be provided at the rear door or at the back of the island platform

CORE TREATMENT

In addition to a marked pedestrian crossing at the front door, an additional marked pedestrian crossing should be provided near the rear of the bus. While people with disabilities typically board and alight the bus using the front door, providing a marked pedestrian crossing to align near the rear door of the bus or back of the island platform provides additional clarity on where to expect pedestrians and yielding expectations for the many transit riders who will alight from the rear of the bus. Encouraging the use of a designated pedestrian zone at or near the end of a platform may also help avoid unpredictable pedestrian behaviours, such as walking along the bicycle lane to access the platform.

Providing a rear crossing is a core treatment; however, it is recognized that site constraints can sometimes make it challenging or impractical to install two crossings. In addition, transportation professionals should determine if two or three crossings should be provided depending on the length of the platform, the type of transit vehicles serving the bus stop, and the number of bus routes serving the bus stop.

Marked pedestrian crossings at the rear door of the bus or at the back of the island platform should also include the signage identified in **Design Treatment 6.1.**

Design Treatment 6.3: Tactile Attention Indicators should be used at all marked pedestrian crossings across protected bicycle lanes

CORE TREATMENT

Tactile Attention Indicators provide information to people with sight loss about where the marked pedestrian crossings are located. This gives people with sight loss the opportunity to adjust their behaviour for the crossing and avoid mistaking a bikeway for a sidewalk. Tactile Attention Indicators should be used at both ends of all marked pedestrian crossing locations. Tactile Attention Indicators should be used at all crossings and be the same width as the pedestrian crossing. Note that this does not apply to multi-use pathway configurations.

The pilot project found that installing Tactile Attention Indicators marking the location of crosswalks between the sidewalk and the island platform was one of the most effective design treatments used. 91% of evaluation form respondents who tested this feature indicated it was very helpful or somewhat helpful for finding the bus stop from the sidewalk. 88% indicated it was very helpful or somewhat helpful for finding designated pedestrian crossings between the sidewalk and the bus platform.

Design Treatment 6.4: Treatments should be used to channelize pedestrians to marked pedestrian crossings

CORE TREATMENT

Pedestrians may not always cross at the marked crossings, which increases confusion and creates a less predictable environment. A range of treatments can be provided to channelize people to designated crossing locations to improve predictability and visibility. The range of treatments to be considered, include:

- Landscaping;
- Fences or railings;
- Shelters;
- Benches;
- Bicycle racks;
- Micromobility zones; and,
- Other street furniture

In addition to helping to create predictable pedestrian crossing points, many of these amenities also help to improve the customer experience by providing an area for customers to comfortably wait for the bus.

As noted above for **Design Treatment 4.1,** these delineation treatments to channelize pedestrians should be continuous, except for gaps at pedestrian crossing locations, and should be detectable with a long white cane.

In some of the pilot projects, some people with sight loss confused bollards, intended to provide a detectable edge to the platform, with the bus stop ID pole. If delineation features are discontinuous and/or similar to bus stop ID poles, there is the potential that pedestrians with sight loss may cross at an unintended location where they are less visible and safe. Pedestrian realm delineation features should be continuous, except for gaps at pedestrian crossing locations, and should be detectable with a long white cane.

Design Treatment 6.5: Accessible grades should be provided to access crossings

CORE TREATMENT

All marked pedestrian crossings, curb ramps, sidewalks, and bus platforms should have accessible grades and should meet accessibility requirements in the CSA *Accessible Design for the Built Environment Standards*.

Design Treatment 6.6: Enhanced crossing treatments can be provided based on level of conflict

OPTIONAL TREATMENT

Enhanced treatments at pedestrian crossings may be desirable in some cases if it is determined that there is potential for a higher level of conflict. People cycling have the same rights and duties as people driving, according to the British Columbia Motor Vehicle Act; as such, people cycling must legally yield to pedestrians who are crossing in a crosswalk. Enhanced treatments that can be considered beyond "zebra" pavement markings are described below:

- **Wider crossings:** At higher volume transit stops and/or where transit user activity is concentrated at a single point, a wider pedestrian crossing can increase the capacity for pedestrians. Tactile Attention Indicators should be used at all crossings and be the same width as the pedestrian crossing.
- **Pavement markings:**
  - **Advance Yield to Pedestrians pavement markings:** These pavement markings, also sometimes referred to as "shark's teeth" pavement markings, feature a line of solid white isosceles triangles, pointing towards people cycling, that can be used in advance of a marked pedestrian crossing to increase awareness of the need for people cycling to yield to pedestrians.
  - **Bicycles Yield to Pedestrians pavement markings:** Adding the word "Yield" in the bikeway with a pavement marking can provide additional cues to further remind people cycling of their legal obligation to yield to pedestrians who are in the crossing, as shown in **Figure 34**.

Figure 34: Example of Bicycles Yield to Pedestrians pavement markings, North Vancouver, British Columbia

- **Signage:**
  - **Enhanced low-mounted and/or dynamic "Bicycles Yield to Pedestrians" signage:** Additional signage can be provided to further increase awareness of people cycling of their obligation to yield to pedestrians in the crossing, including the use of signage installed low to the ground directly adjacent to the bikeway (or in the bikeway in the case of bi-directional bikeways if space permits) for increased conspicuity for people cycling, as well as the potential for enhanced dynamic signage that could be activated with dynamic lighting by pedestrians to indicate when they intend to cross (see **Figure 25**). Enhanced and/or dynamic signage can be considered as an Optional Treatment in areas of high potential conflict.
  - **"Cyclists Stop if Bus Present" signage:** In constrained applications without an island platform, transportation professionals may consider additional signage indicating that cyclists should stop if a bus is present, as shown in **Figure 36**.

Figure 35: Low-mounted "Bicycles Yield to Pedestrian" Sign on Flexible Post, Kelowna, British Columbia

Figure 36: Example of Custom "Cyclists Stop if Bus Present" Sign, Nanaimo, British Columbia

- **Additional traffic control devices:**
  - **Actuated flashing beacons, such as Rectangular Rapid Flashing Beacons (RRFBs):** Actuated flashing beacons are pedestrian-activated treatment systems which consist of two rapidly and alternately flashing rectangular amber beacons mounted above side-mounted pedestrian crosswalk signs, as shown in **Figure 37** and **Figure 38**. The beacons are activated by a pedestrian pushbutton, that should be conveniently and intuitively located directly adjacent to the crosswalk, as shown in **Figure 39**. They should include a locator tone and audible messaging such as **"yellow lights are flashing – cross bike lane to access sidewalk"** or **"yellow lights are flashing – cross bike lane to access bus stop"**. These devices provide a visual cue to people cycling that pedestrians are intending to cross at the marked crossing. However, these devices do not necessarily provide certainty that a person cycling has stopped. In addition, they may also create confusion for motorists with the introduction of flashing lights within the roadway environment and motorists' field of view.

    The beacons may also not be a warranted level of pedestrian crossing control based on the TAC *Pedestrian Crossing Control Guide*, although it is noted that the guide does not specifically refer to their application in this context. Before implementing such treatments, transportation professionals should consider whether they are warranted based on the local context and should also ensure space is available within the island platform to avoid distraction or confusion with the flashing lights within drivers' field of view. Transportation professionals should determine the preferred placement of the pushbutton and the flashing beacons based on the local context, while ensuring they are placed as conveniently and intuitively as possible for people with sight loss while ensuring they are as visible as possible for approaching cyclists. Actuated flashing beacons can be considered as an Optional Treatment in areas of high potential conflict.

  - **Accessible Pedestrian Signal (APS):** These devices can be used where the island platform is integrated with a signalized intersection. The purpose of an APS is to assist people with sight loss in crossings at locations which are controlled by traffic signals. APS' provide audible and vibrotactile indications that act as the "walk" signal for people with sight loss and any other users who may benefit from additional sensory prompts (such as seniors or children). APS' may be used at locations with pre-timed, vehicle-actuated, or pedestrian-activated traffic control. APS pushbuttons should be conveniently and intuitively located directly adjacent to the crosswalk, and should have a locator tone.

Figure 37: Actuated Flashing Beacon at Island Platform Crosswalk, Mission, British Columbia

Figure 38: Actuated Flashing Beacon at Island Platform Crosswalk, Saanich, British Columbia

Figure 39: Example of Pushbutton at Actuated Flashing Beacon, Mission, British Columbia

Actuated flashing beacons were tested in one municipality as part of the pilot project. Where actuated flashing beacons were tested, their helpfulness was questioned by stakeholders because they failed to resolve the core issue of determining when it is safe to cross. This feedback was also provided by stakeholders throughout the development of this Design Guide. In addition, the actuated flashing beacon that was tested as part of the pilot project did not have a locator tone, which made it difficult for people with sight loss to find.

Design Treatment 6.7: Conduct further research to explore the potential application of treatments to help provide additional cues if a person cycling is approaching

OPTIONAL TREATMENT

Stakeholders with sight loss have clearly expressed concerns about their difficulties in detecting when and where people cycling are approaching a crossing, particularly in noisy environments, because people inherently generate minimal sound when cycling. There is currently limited research or examples available for effective and practical treatments that can be used to provide such audible cues. It is a challenging problem to solve as audible treatments may pose potential concerns for adjacent residents and/or business owners, may not be helpful in corridor with high cycling volumes, and may be difficult to hear over ambient noise. While there is limited research or examples currently available, it is suggested that further research be conducted to continue to identify and assess the effectiveness of potential treatments to help identify if a person cycling is approaching.

Further research should be conducted for audible treatments and other technologies to identify if a cyclist is approaching and to encourage them to stop for crossing pedestrians

As noted above, stakeholders have expressed concerns about knowing if people cycling are approaching, particularly in busy environments. Beyond "cycling rumble strips," there is currently limited research or examples available for effective treatments that can be used to provide additional noise detection. There are also no known technologies that have been used in this application and these treatments may present concerns to adjacent residents of the additional noise, particularly on busy cycling corridors.

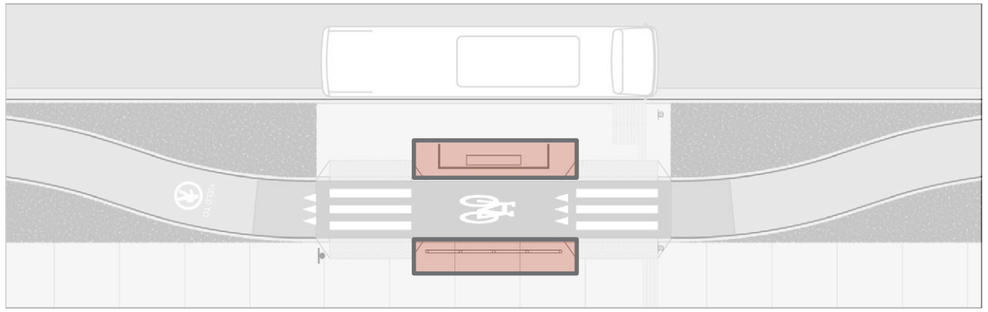
However, while this is a treatment worth exploring further, auditory feedback still does not give the pedestrian confidence that people cycling have stopped and whether it is safe to cross. Some stakeholders have suggested treatments such as bicycle signals and/or other visual or audible technologies that might help address these issues. However, treatments such as these are not known to have been used in this context anywhere in North America to date, and are not recognized in the MUTCD-C, and may not be legal or enforceable under British Columbia's *Motor Vehicle Act*.

It is recommended that researchers or practitioners conduct further research and test various technologies and treatments to provide reliable audible information to identify if a person cycling is approaching and to encourage a person cycling to stop.

Audible treatments and technologies

Montgomery County, Maryland, recommends exploring methods to make bicycles more audible to people with sight loss who want to cross the bikeway. Such methods include applying an audible surface to the bicycle lane on approaches to pedestrian crossings or using passive detection linked to a speaker at the crossing that produces a sound when people cycling are approaching.

4.3.7 Design Element 7: Amenity Zones



Amenities at bus stops help to improve the transit user experience. Amenities can include benches and shelters to make it more comfortable for passengers when waiting for a bus, along with other features such as garbage receptacles, bicycle racks, micromobility stations, and other features.

Design Treatments for Design Element 7

Suggested design treatments for Amenities are summarized below.

Design Treatment 7.1: Shelters and benches should be provided and prioritized on the Island Platform Zone wherever feasible to provide a comfortable waiting area in a consistent location relative to the bus stop ID pole

CORE TREATMENT

Shelters and benches are important amenities to improve the customer experience and provide a comfortable space to wait for the bus. This is especially important for transit users with limited mobility or seniors that cannot stand for long periods and require more frequent breaks to rest. Shelters are also an important element to assist people with sight loss to identify the presence of a bus stop and finding the correct point to wait for a bus, as the shelter helps to identify the bus stop using echolocation as it blocks the sound from traffic.

Wherever possible, shelters and benches should be provided and located on the bus stop platform such that they are in a consistent location relative to the bus stop ID pole compared to other bus stops in the system. Typically, they are placed in advance of the bus stop ID pole, but can also be placed after the bus stop ID pole to avoid obstacles or in the interest of improved sightlines. When installed in a consistent location, shelters can also potentially serve as a key landmark for people with sight loss as they are often large enough to reflect ambient noise in a way that humans can detect, particularly when paying close attention.

When locating shelters and benches on the island platform, it is important to ensure that the passenger landing pad area remains unobstructed. In constrained applications, it may not be feasible to provide a bus shelter on the island platform. In such cases, other design treatment should be used to provide a detectable edge between the island platform and the bikeway and to channelize pedestrians to designated crossing locations.

Design Treatment 7.2: Amenity design and placement should ensure adequate sightlines at crossings

CORE TREATMENT

While transit shelters have many benefits, they can present sightline concerns by limiting visibility of users on the corridor. However, the side panels on shelters were also identified by stakeholders as being important for echo-location of the shelter itself. Ideally shelters placed in advance of bikeway crossings should be transparent, as shown in **Figure 40**, to provide adequate sightlines while also ensuring people with sight loss can use the shelter to identify the bus stop. Alternatively, canopy shelters with no side panels can be provided as shown in **Figure 41**. Altneratively, if shelters do have side panels, the entire shelter can be relocated after the crossing, if feasible. It is also desirable that the backwall of the shelter is clear; however, recognizing that many shelters are designed without clear backwalls, it is acceptable if these are not clear when provided after the crossing. It is noted, however, that many shelters are provided by advertising companies which may pose challenges in installing shelters without advertising panels.

Figure 40: Example of a Bus Shelter with Clear Side and Back Panels, Vancouver, British Columbia

Figure 41: Example of Bus Shelter with No Side Panel and Clear Back Panels, North Vancouver, British Columbia

Several pilot participants mentioned the value of bus shelters in locating and identifying bus stops. People with sight loss can sense changes in the acoustic reverberation of their surrounding environment when they are passing close to a shelter and potentially understand that it signifies a bus stop. Furthermore, people with low vision can often see the shelter. Shelters are also critical bus stop signifiers for people with intellectual and developmental disabilities. As such, bus shelters should be prioritized and provided wherever possible, and should be placed as close as possible to the boarding location.

Design Treatment 7.3: Amenities should be placed in consistent locations relative to the bus stop ID pole and aligned to avoid cluttering the island platform and introducing obstacles

CORE TREATMENT

While amenities add desirable features for transit users, care should be taken to ensure they do not require unnecessary zigzagging to navigate and that they do not introduce barriers for some users to access crossings or a deployed bus ramp.

Design Treatment 7.4: Amenity placement should include a horizontal shy distance from the Bicycle Through Zone

CORE TREATMENT

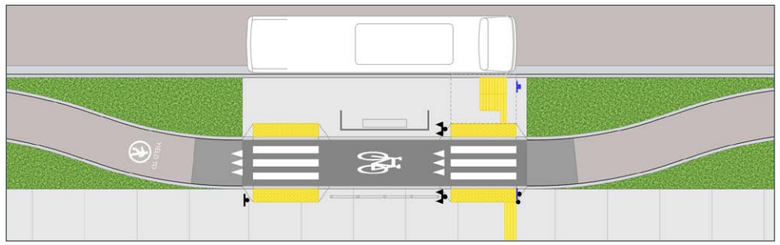
Amenities should not introduce hazards for people cycling past a bus stop, with amenities offset a safe and comfortable shy distance from the Bicycle Through Zone. Recognizing the constrained context of bus stops adjacent to protected cycling infrastructure, the recommended constrained limit is at least 0.3 metres from the edge of the Bicycle Through Zone, with no shy distance reserved for only extenuating circumstances.

4.4 Configurations

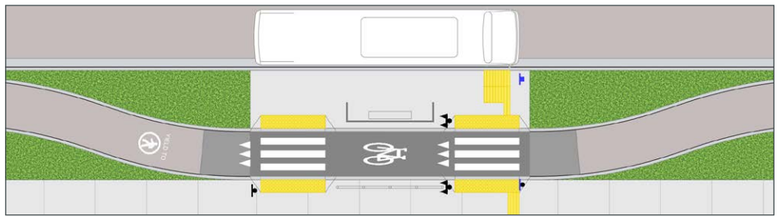
The Design Elements and Design Treatments described in **Section 4.3** are components of all bus stops adjacent to cycling infrastructure; however, the overall geometry of these bus stops can be grouped into four broad types of bus stop configurations, as described below and shown in **Figure 41**.

Figure 41: Types of Bus Stop Configurations

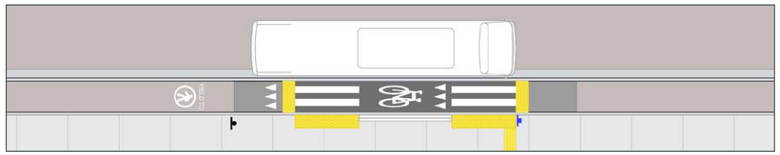
Type 1: Conventional Island Platform Bus Stop



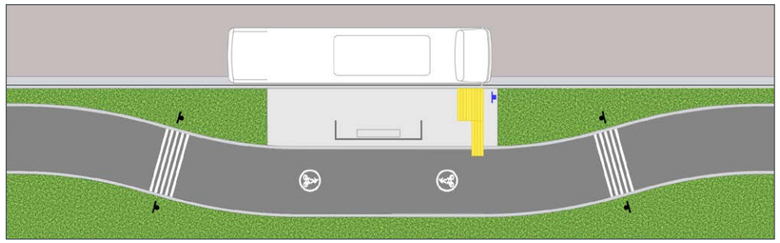
Type 2: Constrained Bus Stop with Dedicated Landing Pad



Type 3: Constrained Bus Stop with Shared Landing Pad



Type 4: Multi-use Pathway



Type 1: Conventional Island Platform Bus Stop

This configuration includes an island platform that meets or exceeds the minimum widths identified for the island platform as identified in the guidance for **Design Element 1.** This configuration accommodates passengers waiting for the bus as well as those boarding and alighting the bus on an island platform. **This is the most preferred configuration**, particularly if it can be integrated with a signalized intersection.

Type 2: Constrained Bus Stop with Dedicated Landing Pad

This configuration applies when the minimum width for the island platform as identified in the guidance for **Design Element 1** cannot be achieved, but where a narrower platform can still be provided. This narrower platform is not wide enough to accommodate passengers waiting for the bus or those boarding and alighting the bus, and only includes a narrow "landing pad" that is only wide enough to accommodate a wheelchair ramp or lift deployed from the side of a bus. Transit users are directed to wait for the bus on the sidewalk instead of on the landing pad. The bikeway in this configuration must be fully elevated to full sidewalk height to allow people using mobility aids to maneuver to access the wheelchair ramp or lift from the bikeway at the same elevation. This configuration provides space for alighting transit users to step out of the bus and orient themselves before crossing a bikeway. **This configuration should only be considered when a conventional island platform cannot be accommodated**.

Type 3: Constrained Bus Stop with Shared Landing Pad

This configuration is further constrained and does not provide sufficient space to even provide a narrow landing pad. The bikeway is located immediately adjacent to the bus stop and includes a bikeway that must be elevated to full sidewalk height. Transit users must board and alight directly across the bikeway. **This configuration should only be considered when constrained bus stops with dedicated landing pads cannot be provided.**

Type 4: Multi-Use Pathway

This configuration refers to applications when the bus stop is adjacent to a multi-use pathway, including unconstrained and constrained scenarios.

These general configurations also include sub-categories, as described below. This Design Guide also highlights additional configurations for bus bulges. Further details for each configuration are provided in the section below, illustrating some of the key Core Treatments and Optional Treatments for each configuration. Note that not all design treatments apply to all configurations. The configurations shown below are conceptual and are intended to outline the key design treatments that transportation professionals can consider as general guidance in similar real-life applications.

Figure 43 on the following page outlines a decision-support framework to identify when to consider various configurations, in order of priority. Based on this decision-support framework, **island platform bus stops should only be considered, once all other options eliminating and/or mitigating conflicts have been considered.**

If an island platform bus stop is required, the first preference is to provide a Conventional Island Platform Bus Stop, with preference for bus stops that be integrated with signalized intersections and adjacent to uni-directional bikeways.

Constrained bus stops should only be considered once all other options for road space reallocation have been exhausted, taking into account the modal priorities of the corridor.

When considering how to manage and prioritize trade-offs, the pedestrian realm should be considered the highest priority, followed by the cycling infrastructure, and the general roadway prioritized last. To achieve this prioritization, the following approach should be applied, in order of priority:

1. Consider opportunities for land acquisition, particularly if the configuration is implemented as part of a redevelopment opportunity.
2. Repurpose or reduce width of motor vehicle lanes, including general purpose lanes, turn lanes, and on-street parking lanes – but not below minimum widths. However, in the local context, reducing motor vehicle lanes should be considered alongside a full understanding of the role of the corridor for all modes and users.
3. Remove bus stop pullouts and accommodate buses stopping in the general purpose lane.
4. Reduce width of cycling infrastructure – but not below minimum widths.
5. Reduce width of sidewalk or bus stop platform – but not below minimum widths.

Constrained applications can only be considered if there is still insufficient space for a conventional island platform after evaluation of these trade-offs.

Further, constrained applications with a shared landing should only be considered where there is infrequent interactions between transit users and people cycling.

Pandora Avenue, Victoria, British Columbia

Figure 43: Decision-Support Framework for Bus Stop Configurations

Preference 1: Eliminate Conflicts

For new bus stops or bikeways, only consider options below after **Strategies for Eliminating Conflicts** in **Section 3.2** have been considered, including:

- Can the bikeway be provided on a different corridor than the transit route?
- If on a one-way street, can the bikeway be provided on the left side of the street?
- Can the bikeway be accommodated on a different corridor with less steep slopes?

If conflicts can be eliminated, a bus stop adjacent to cycling infrastructure is not required.

Preference 2: Conventional Island Platform Bus Stop

If conflicts cannot be eliminated, a conventional island platform can be considered, as shown in the configurations on the right. The first preference is to provide conventional island platforms with crosswalk integration and uni-directional protected bicycle lanes.

Preference 3 : Constrained Bus Stop with Dedicated Landing Pad

If a conventional island platform cannot be achieved, and/or in locations with low conflict potential as noted in **Section 4.2**, a constrained platform can be considered. This can be considered after exploring opportunities to:

- Acquire additional right-of-way;
- Repurpose or reduce width of motor vehicle lanes;*
- Remove bus stop pullouts and accommodate buses stopping in lane;
- Reduce width of cycling infrastructure; and/or
- Reduce width of sidewalk or bus stop platform.

If a constrained configuration is the only possibility after considering these questions, a constrained platform with dedicated landing pad configuration may be considered.

Constrained configurations should only be considered for uni-directional bikeways.

Preference 4: Constrained Bus Stop with Shared Landing Pad

If a constrained platform with dedicated landing pad cannot be achieved, a constrained platform with shared landing pad can be considered. This can be considered if interactions between people using transit and people cycling is expected to be infrequent, based on:

- Bus frequency;
- Ridership;
- Cycling volumes; and/or
- Prevalence of people with disabilities.

These options should only be considered where the conflict potential is low.

Constrained configurations should only be considered for uni-directional facilities.

*** Reducing motor vehicle lanes should be considered alongside a full understanding of the role of the corridor for all modes and users, in the local context.**

Order of preference

Configurations		Figure
1A	**Conventional island platform with crosswalk integration (uni-directional protected bicycle lane)**	**Figure 44**
1B	Conventional island platform with crosswalk integration (bi-directional protected bicycle lane)	Figure 45
1C	Conventional island platform without crosswalk integration (uni-directional protected bicycle lane)	Figure 46
1D	Conventional island platform without crosswalk integration (bi-directional protected bicycle lane)	Figure 47

Configurations		Figure
2	Constrained platform with dedicated landing pad	Figure 48

Configurations		Figure
3	Constrained with shared landing pad	Figure 49

Additional Configurations		Figure
4A	Multi-use pathway	Figure 50
4B	Constrained multi-use pathway	Figure 51
4C	Highly constrained multi-use pathway	Figure 52
5	Bus bulge	Figure 53

Configuration 1A – Conventional Island Platform With Crosswalk Integration (Uni-Directional Protected Bicycle Lane)

Configuration 1A provides an island platform that meets or exceeds the minimum widths identified for the island platform as identified in the guidance for **Design Element 1**. As shown in **Figure 44**, the bikeway is raised to sidewalk level or intermediate level when adjacent to the island platform. Detectable edge treatments and pedestrian channelization are provided between the bikeway and the island platform and sidewalk with a range of potential treatments, including bus shelter placement, landscaping, fencing, other amenities, and/or tactile indicators. Tactile Directional Indicators are also provided across the sidewalk to help people with sight loss identify the presence of the bus stop and should be oriented perpendicular to the sidewalk.

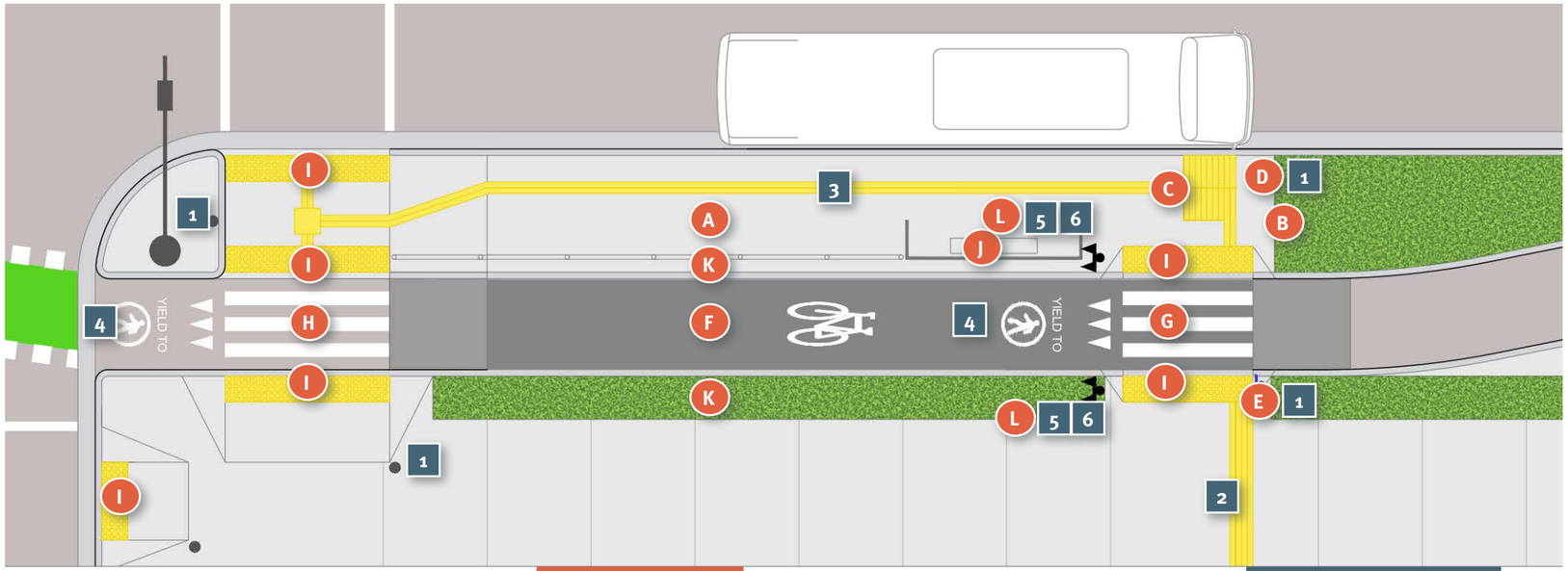
This configuration is located adjacent to a signalized intersection. The pedestrian crossing at the front door of the bus is aligned with the bus stop ID pole, leading to the front door of the bus. The island platform is also integrated with a signalized intersection with a pedestrian refuge area beside the traffic signal to allow pedestrians to cross the bikeway using the existing signalized intersection.

This configuration can be applied to far-side bus stops (as shown) or near-side bus stops.

This configuration is for a uni-directional protected bicycle lane.

This is the most preferred configuration wherever possible. However, it is noted that many bus stops are not located at or near a signalized intersection and, as such, it has limited applicability to cases where it can be located directly adjacent to a signalized intersection. This configuration can also be applied to unsignalized intersections.

Figure 44: Conventional Island Platform With Crosswalk Integration (Uni-Directional Protected Bicycle Lane)



Legend

- Shelter and Bench
- Bus stop ID pole
- Actuated flashing beacon
- Sign
- Pushbutton
- Landscaping
- Tactile Attention Indicator
- Tactile Directional Indicator
- Tactile Directional Indicator Mat
- Fence or other continuous amenities

Core Treatments

- **A** Island platform with desired width of 3.0 metres (minimum 2.3 metres)
- **B** Detectable 'bookend' at end of island platform
- **C** Tactile Directional Indicator Mat and Passenger Landing Pad clear of obstructions at front door of bus
- **D** Primary bus stop ID pole with enhanced braille and raised tactile letter signage at front of island platform
- **E** Secondary bus stop ID pole with enhanced braille and raised tactile letter signage on sidewalk
- **F** Bicycle lane raised to sidewalk level or intermediate level and/or narrowed through bus stop zone
- **G** Marked pedestrian crossing at front of island platform
- **H** Marked pedestrian crossing at rear of island platform integrated with signalized intersection with Accessible Pedestrian Signal
- **I** Tactile Attention Indicators at all marked pedestrian crossings
- **J** Bus shelter with no side panels or clear panels
- **K** Fence, landscaping, and/or other continuous amenities to provide detectable edge treatments and to channelize pedestrians to marked crossings
- **L** "Pedestrian Crosswalk" and/or "Bicycles Yield to Pedestrians" signage

Optional Treatments

- **1** Enhanced sign with tactile map of bus stop layout
- **2** Tactile Directional Indicators across sidewalk
- **3** Tactile Directional Indicators to direct pedestrians to signalized intersection
- **4** "Bicycles Yield to Pedestrians" and/or "Advance Yield to Pedestrians" pavement markings
- **5** Enhanced and/or dynamic "Bicycles Yield to Pedestrians" signage
- **6** Actuated flashing beacons

4.4.2 Configuration 1B – Conventional Island Platform With Crosswalk Integration (Bi-Directional Protected Bicycle Lane)

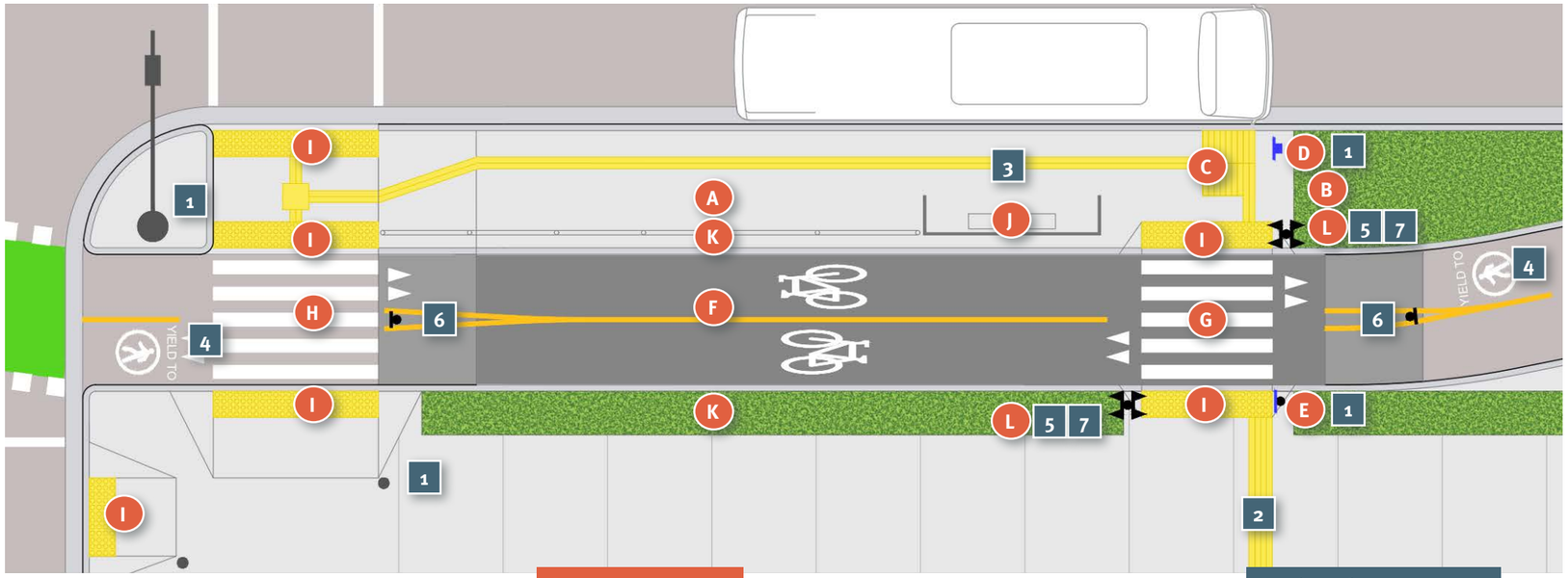
Configuration 1B provides an island platform that meets or exceeds the minimum widths identified for the island platform as identified in the guidance for Design Element 1. As shown in **Figure 45**, the bikeway is raised to sidewalk level or intermediate level when adjacent to the island platform. Detectable edge treatments and pedestrian channelization are provided between the bikeway and the island platform and sidewalk with a range of potential treatments, including bus shelter placement, landscaping, fencing, other amenities, and/or tactile indicators. Tactile Directional Indicators are also provided across the sidewalk to help people with sight loss identify the presence of the bus stop and should be oriented perpendicular to the sidewalk.

This configuration is located adjacent to a signalized intersection. The pedestrian crossing at the front door of the bus is aligned with the bus stop ID pole, leading to the front door of the bus. The island platform is also integrated with a signalized intersection with a pedestrian refuge area beside the traffic signal to allow pedestrians to cross the bikeway using the existing signalized intersection.

This configuration can be applied to far-side bus stops (as shown) or near-side bus stops.

This configuration is for a bi-directional protected bicycle lane.

Figure 45: Conventional Island Platform With Crosswalk Integration (Bi-Directional Protected Bicycle Lane)



Legend

- Shelter and Bench
- Bus stop ID pole
- Actuated flashing beacon
- Sign
- Pushbutton
- Landscaping
- Tactile Attention Indicator
- Tactile Directional Indicator
- Tactile Directional Indicator Mat
- Fence or other continuous amenities

Core Treatments

- **A** Island platform with desired width of 3.0 metres (minimum 2.3 metres)
- **B** Detectable 'bookend' at end of island platform
- **C** Tactile Directional Indicator Mat and Passenger Landing Pad clear of obstructions at front door of bus
- **D** Primary bus stop ID pole with enhanced braille and raised tactile letter signage at front of island platform
- **E** Secondary bus stop ID pole with enhanced braille and raised tactile letter signage on sidewalk
- **F** Bicycle lane raised to sidewalk level or intermediate level and/or narrowed through bus stop zone
- **G** Marked pedestrian crossing at front of island platform
- **H** Marked pedestrian crossing at rear of island platform integrated with signalized intersection with Accessible Pedestrian Signal
- **I** Tactile Attention Indicators at all marked pedestrian crossings
- **J** Bus shelter with no side panels or clear panels
- **K** Fence, landscaping, and/or other continuous amenities to provide detectable edge treatments and to channelize pedestrians to marked crossings
- **L** "Pedestrian Crosswalk" and/or "Bicycles Yield to Pedestrians" signage

Optional Treatments

- **1** Enhanced sign with tactile map of bus stop layout
- **2** Tactile Directional Indicators across sidewalk
- **3** Tactile Directional Indicators to direct pedestrians to signalized intersection
- **4** "Bicycles Yield to Pedestrians" and/or "Advance Yield to Pedestrians" pavement markings
- **5** Enhanced and/or dynamic "Bicycles Yield to Pedestrians" signage
- **6** Flexible delineator posts with "Bicycles Yield to Pedestrians" signage
- **7** Actuated flashing beacons

4.4.3 Configuration 1C – Conventional Island Platform Without Crosswalk Integration (Uni-Directional Protected Bicycle Lane)

Configuration 1C provides an island platform that meets or exceeds the minimum widths identified for the island platform as identified in the guidance for **Design Element 1**. As shown in **Figure 46**, the bikeway is raised to sidewalk level or intermediate-level when adjacent to the island platform. Detectable edge treatments and pedestrian channelization are provided between the bikeway and the island platform and sidewalk with a range of potential treatments, including bus shelter placement, landscaping, fencing, other amenities, and/or tactile indicators. Tactile Directional Indicators are also provided across the sidewalk to help people with sight loss identify the presence of the bus stop and should be oriented perpendicular to the sidewalk.

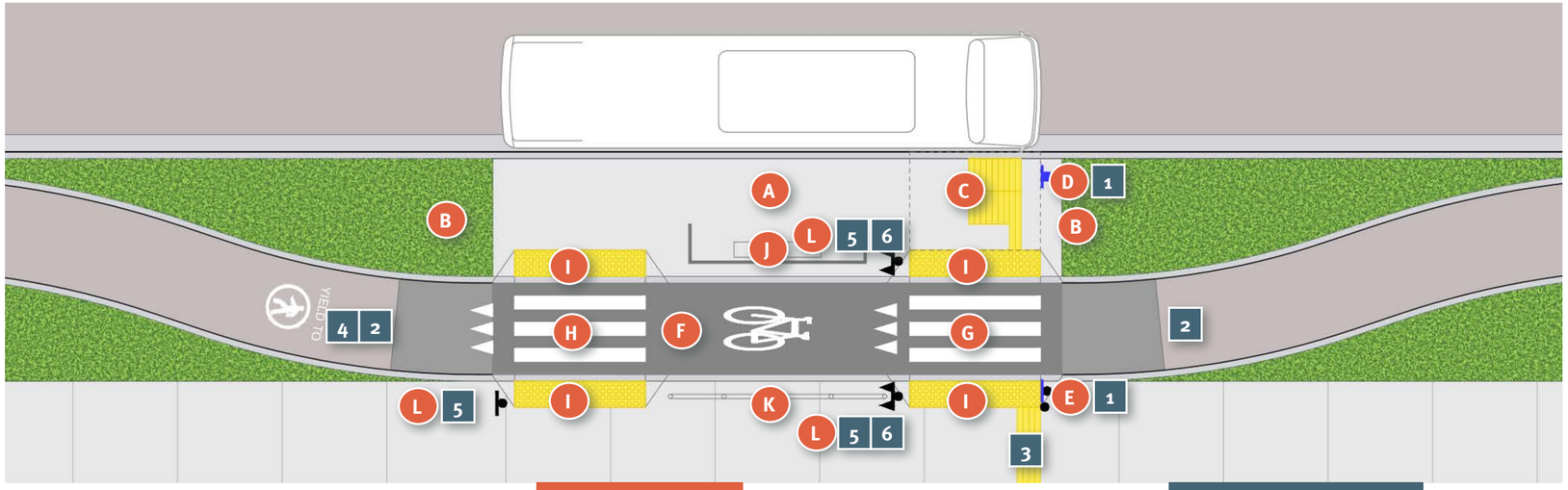
This configuration can be located:

- At an unsignalized intersection (near-side or far-side);
- Upstream or downstream from an unsignalized intersection; or
- At a mid-block location.

The pedestrian crossing at the front door of the bus is aligned with the bus stop ID pole, leading to the front door of the bus with an additional crosswalk at the rear door of the bus.

This configuration is for a uni-directional protected bicycle lane.

Figure 46: Conventional Island Platform Without Crosswalk Integration (Uni-Directional Protected Bicycle Lane)



Legend

- Shelter and Bench
- Bus stop ID pole
- Actuated flashing beacon
- Sign
- Pushbutton
- Landscaping
- Tactile Attention Indicator
- Tactile Directional Indicator
- Tactile Directional Indicator Mat
- Fence or other continuous amenities

Core Treatments

- **A** Island platform with desired width of 3.0 metres (minimum 2.3 metres)
- **B** Detectable 'bookends' at start and end of island platform
- **C** Tactile Directional Indicator Mat and Passenger Landing Pad clear of obstructions at front door of bus
- **D** Primary bus stop ID pole with enhanced braille and raised tactile letter signage at front of island platform
- **E** Secondary bus stop ID pole with enhanced braille and raised tactile letter signage on sidewalk
- **F** Bicycle lane raised to sidewalk level or intermediate level and/or narrowed through bus stop zone
- **G** Marked pedestrian crossing at front of island platform
- **H** Marked pedestrian crossing at rear of island platform
- **I** Tactile Attention Indicators at all marked pedestrian crossings
- **J** Bus shelter with no side panels or clear panels
- **K** Fence, landscaping, and/or other continuous amenities to provide detectable edge treatments and to channelize pedestrians to marked crossings
- **L** "Pedestrian Crosswalk" and/or "Bicycles Yield to Pedestrians" signage

Optional Treatments

- **1** Enhanced sign with tactile map of bus stop layout
- **2** Horizontal deflection of bicycle lane at start and end of bus stop zone
- **3** Tactile Directional Indicators across sidewalk
- **4** "Bicycles Yield to Pedestrians" and/or "Advance Yield to Pedestrians" pavement markings
- **5** Enhanced and/or dynamic "Bicycles Yield to Pedestrians" signage
- **6** Actuated flashing beacons

4.4.4 Configuration 1D – Conventional Island Platform Without Crosswalk Integration (Bi-Directional Protected Bicycle Lane)

Configuration 1D provides an island platform that meets or exceeds the minimum widths identified for the island platform as identified in the guidance for **Design Element 1**. As shown in **Figure 47**, the bikeway is raised to sidewalk level or intermediate-level when adjacent to the island platform. Detectable edge treatments and pedestrian channelization are provided between the bikeway and the island platform and sidewalk with a range of potential treatments, including bus shelter placement, landscaping, fencing, other amenities, and/or tactile indicators. Tactile Directional Indicators are also provided across the sidewalk to help people with sight loss identify the presence of the bus stop and should be oriented perpendicular to the sidewalk.

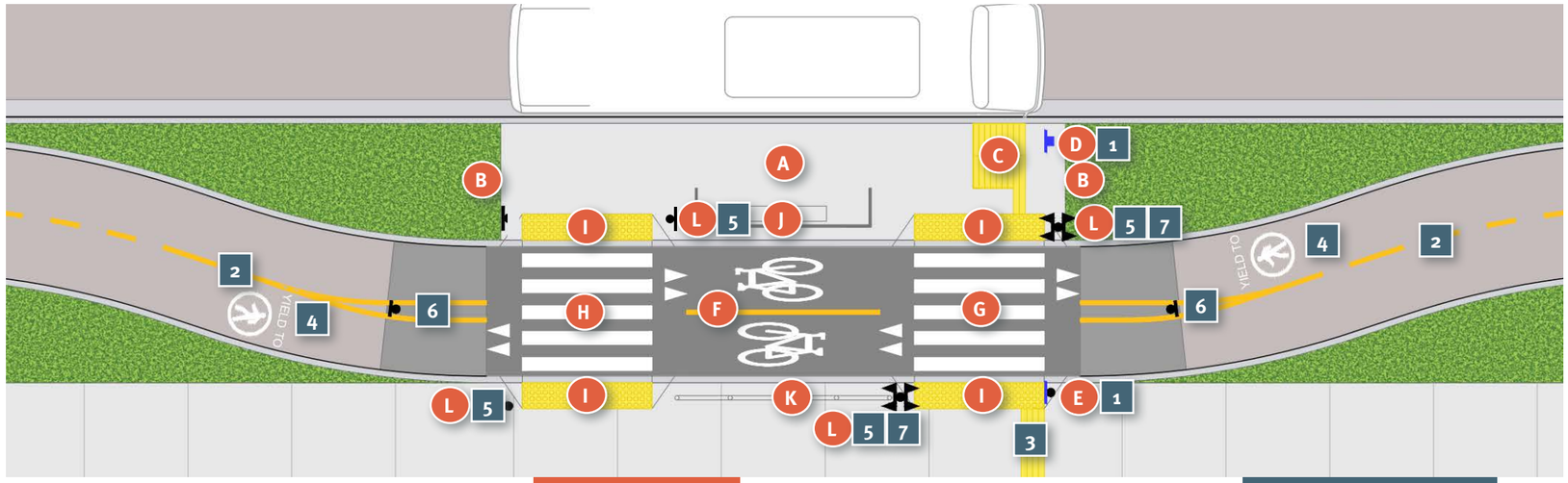
This configuration can be located:

- At an unsignalized intersection (near-side or far-side);
- Upstream or downstream from an unsignalized intersection; or
- At a mid-block location.

The pedestrian crossing at the front door of the bus is aligned with the bus stop ID pole, leading to the front door of the bus with an additional crosswalk at the rear door of the bus.

This configuration is for a bi-directional protected bicycle lane.

Figure 47: Conventional Island Platform Without Crosswalk Integration (Bi-Directional Protected Bicycle Lane)



Legend

- Shelter and Bench
- Bus stop ID pole
- Sign
- Pushbutton
- Landscaping
- Tactile Attention Indicator
- Tactile Directional Indicator
- Tactile Directional Indicator Mat
- Fence or other continuous amenities

Core Treatments

- **A** Island platform with desired width of 3.0 metres (minimum 2.3 metres)
- **B** Detectable 'bookends' at start and end of island platform
- **C** Tactile Directional Indicator Mat and Passenger Landing Pad clear of obstructions at front door of bus
- **D** Primary bus stop ID pole with enhanced braille and raised tactile letter signage at front of island platform
- **E** Secondary bus stop ID pole with enhanced braille and raised tactile letter signage on sidewalk
- **F** Bicycle lane raised to sidewalk level or intermediate level and/or narrowed through bus stop zone
- **G** Marked pedestrian crossing at front of island platform
- **H** Marked pedestrian crossing at rear of island platform
- **I** Tactile Attention Indicators at all marked pedestrian crossings
- **J** Bus shelter with no side panels or clear panels
- **K** Fence, landscaping, and/or other continuous amenities to provide detectable edge treatments and to channelize pedestrians to marked crossings
- **L** "Pedestrian Crosswalk" and/or "Bicycles Yield to Pedestrians" signage

Optional Treatments

- **1** Enhanced sign with tactile map of bus stop layout
- **2** Horizontal deflection of bicycle lane at start and end of bus stop zone
- **3** Tactile Directional Indicators across sidewalk
- **4** "Bicycles Yield to Pedestrians" and/or "Advance Yield to Pedestrians" pavement markings
- **5** Enhanced and/or dynamic "Bicycles Yield to Pedestrians" signage
- **6** Flexible delineator posts with "Bicycles Yield to Pedestrians" signage
- **7** Actuated flashing beacons

4.4.5 Configuration 2 – Constrained Platform With Dedicated Landing Pad

Configuration 2 applies when the minimum width for the island platform as identified in the guidance for **Design Element 1** cannot be achieved, but where a narrower platform can still be provided. This narrower platform is not wide enough to accommodate passengers waiting for the bus or those boarding and alighting the bus, and only includes a narrow "landing zone" of at least 1.8 metres that is only wide enough to accommodate a wheelchair ramp or lift deployed from the side of a bus.

As shown in **Figure 48**, transit users are directed to wait for the bus on the sidewalk instead of on the landing zone with the placement of the shelter and primary bus stop ID pole on the sidewalk. The landing pad is wide enough for the wheelchair ramp or lift to deploy, but the bikeway in this configuration must be fully elevated to full sidewalk level to ensure a level surface for people with mobility aids to navigate the wheelchair ramp or lift.

Detectable edge treatments are provided between the bikeway and the island platform and sidewalk with a limited range of potential treatments, including fencing or barriers, and/or tactile indicators. This configuration provides space for alighting transit users to step out of the bus and orient themselves before crossing a bikeway.

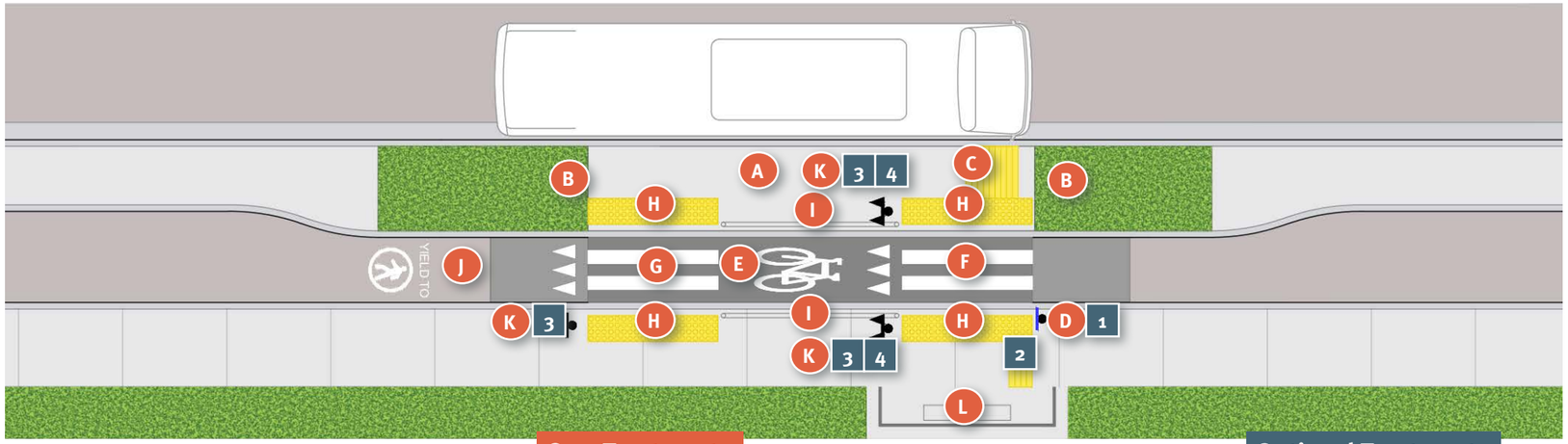
This configuration can be located:

- At a signalized intersection (near-side or far-side);
- At an unsignalized intersection (near-side or far-side);
- Upstream or downstream from an unsignalized intersection; or
- At a mid-block location.

This configuration should only be considered when there is insufficient space for a conventional island platform after considering all other opportunities for road space reallocation.

This configuration should only be used for a uni-directional protected bicycle lane.

Figure 48: Constrained Platform with Dedicated Landing Pad



Legend

- Shelter and Bench
- Bus stop ID pole
- Sign
- Landscaping
- Tactile Attention Indicator
- Tactile Directional Indicator
- Tactile Directional Indicator Mat
- Fence or other continuous amenities

Core Treatments

- **A** Landing zone at least 1.8 metres wide to accommodate wheelchair ramp or lift
- **B** Detectable 'bookends' at start and end of island platform
- **C** Tactile Directional Indicator Mat at front door of bus
- **D** Primary bus stop ID pole with enhanced braille and raised tactile letter signage on sidewalk
- **E** Bicycle lane raised to sidewalk level and narrowed through bus stop zone
- **F** Marked pedestrian crossing at front of island platform
- **G** Marked pedestrian crossing at rear of island platform
- **H** Tactile Attention Indicators at all marked pedestrian crossings
- **I** Fence, continuous amenities, and/or tactile indicators to provide detectable edge treatments and to channelize pedestrians to marked crossings
- **J** "Bicycles Yield to Pedestrians" and/or "Advance Yield to Pedestrians" pavement markings
- **K** "Pedestrian Crosswalk" and/or "Bicycles Yield to Pedestrians" signage
- **L** Shelter placed back of sidewalk or in another location where feasible

Optional Treatments

- **1** Enhanced sign with tactile map of bus stop layout
- **2** Tactile Directional Indicators across sidewalk
- **3** Enhanced and/or dynamic "Bicycles Yield to Pedestrians" signage
- **4** Actuated flashing beacons

4.4.6 Configuration 3 – Constrained With Shared Landing Pad

Configuration 3 is even further constrained and does not provide sufficient space to even provide a narrow landing zone. As shown in **Figure 49**, the bikeway is located immediately adjacent to the bus stop. Transit users must board and alight directly across the bikeway. The bikeway in this configuration must be fully elevated to full sidewalk height to allow for the wheelchair ramp or lift to deploy across the bikeway.

Transit users are directed to wait for the bus on the sidewalk instead of on the landing zone with the placement of the shelter and primary bus stop ID pole on the sidewalk. Detectable edge treatments are provided between the bikeway and the sidewalk with a limited range of potential treatments, including tactile indicators. This configuration does not provide space for alighting transit users to step out of the bus and orient themselves before crossing a bikeway.

This configuration should also include enhanced signage to remind people cycling that they must yield to pedestrians, as well as a sign indicating that a wheelchair ramp or lift may drop across the bikeway and they should proceed with caution.

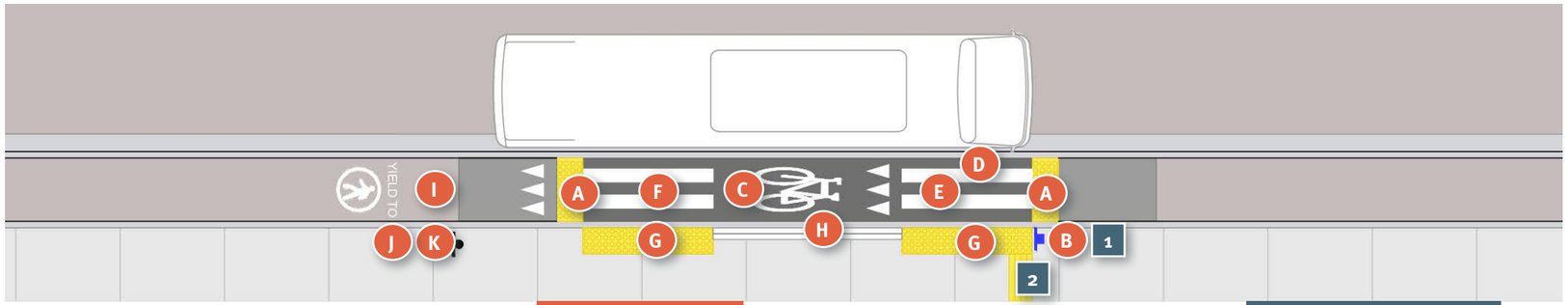
This configuration can be located:

- At a signalized intersection (near-side or far-side);
- At an unsignalized intersection (near-side or far-side);
- Upstream or downstream from an unsignalized intersection; or
- At a mid-block location.

This configuration should only be considered when a constrained bus stop with dedicated landing pad cannot be provided and in cases where conflict potential is low with interactions between transit users and people cycling expected to be infrequent.

This configuration should only be used for a uni-directional protected bicycle lane.

Figure 49: Constrained With Shared Landing Pad



Legend

- Bus stop ID pole
- Sign
- Tactile Attention Indicator
- Tactile Directional Indicator
- Tactile Warning Delineator or other treatments to provide detectable edge

Core Treatments

- **A** **Tactile Attention Indicators at start and end of island platform along the bikeway to provide detectable 'bookends' at start and end of island platform**
- **B** **Primary bus stop ID pole with enhanced braille and raised tactile letter signage on sidewalk**
- **C** **Bicycle lane raised to sidewalk level and narrowed through bus stop zone**
- **D** **Passenger Landing Pad at sidewalk level and across bicycle lane at front door of bus**
- **E** **Marked pedestrian crossing at front of island platform**
- **F** **Marked pedestrian crossing at rear of island platform**
- **G** **Tactile Attention Indicators at all marked pedestrian crossings**
- **H** **Tactile indicators to provide detectable edge treatments and to channelize pedestrians to marked crossings**
- **I** **"Bicycles Yield to Pedestrians" and/or "Advance Yield to Pedestrians" pavement markings**
- **J** **"Pedestrian Crosswalk" and/or "Bicycles Yield to Pedestrians" signage**
- **K** **"Bicycle stop if bus present" signage**

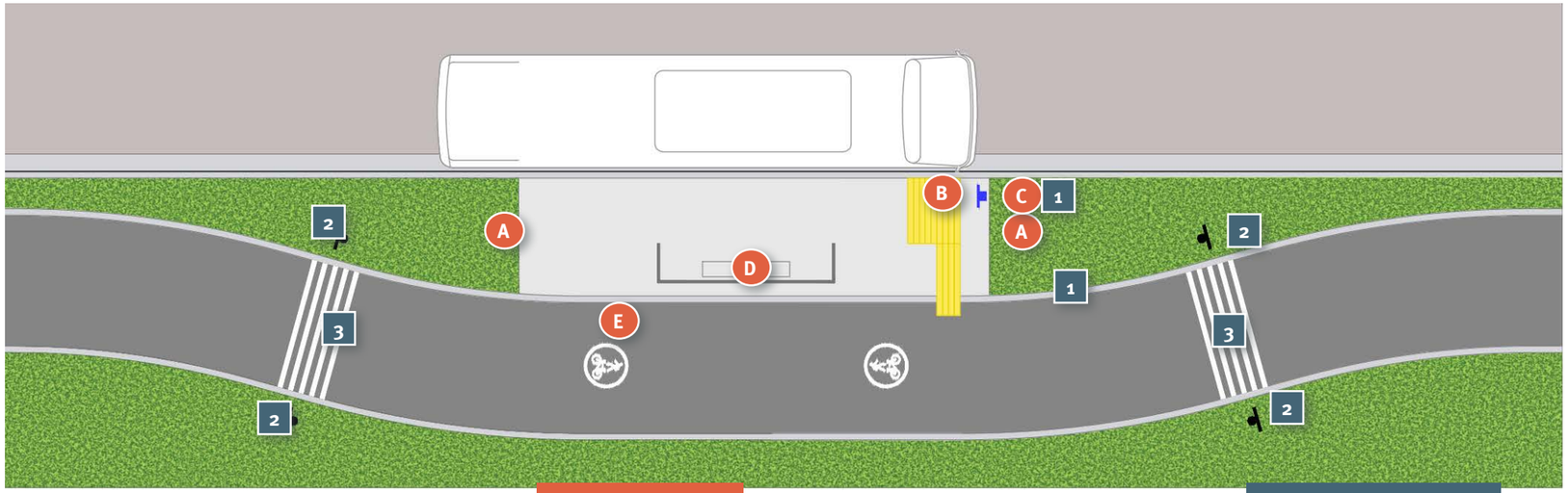
Optional Treatments

- **1** **Enhanced sign with tactile map of bus stop layout**
- **2** **Tactile Directional Indicators across sidewalk**

4.4.7 Configuration 4A – Multi-Use Pathway

This configuration illustrates a standard width transit island between a multi-use pathway and the roadway, as shown in **Figure 50**. The multi-use pathway bends around the island platform. The wheelchair maneuvering zone is fully within the island, and there is a shelter on the island. A shelter should be used to provide a detectable edge between the landing pad and the multi-use pathway. There is a bus stop ID pole and Tactile Directional Indicator Mat at the front entrance of the bus. Raised transverse pavement markings and/or flexible delineator posts with "Bicycles Yield to Pedestrians" signage could be used to remind cyclists that they are entering a unique context and should yield to pedestrians.

Figure 50: Other Application: Multi-Use Pathway



Legend

- Shelter and Bench
- Bus stop ID pole
- Sign
- Landscaping
- Tactile Directional Indicator
- Tactile Directional Indicator Mat
- Tactile Warning Delineator or other treatments to provide detectable edge

Core Treatments

- **A** Detectable 'bookends' at start and end of island platform
- **B** Tactile Directional Indicator Mat and Passenger Landing Pad clear of obstructions at front door of bus
- **C** Primary bus stop ID pole with enhanced braille and raised tactile letter signage at front of island platform
- **D** Bus shelter with no side panels or clear panels
- **E** Multi-use pathway pavement markings

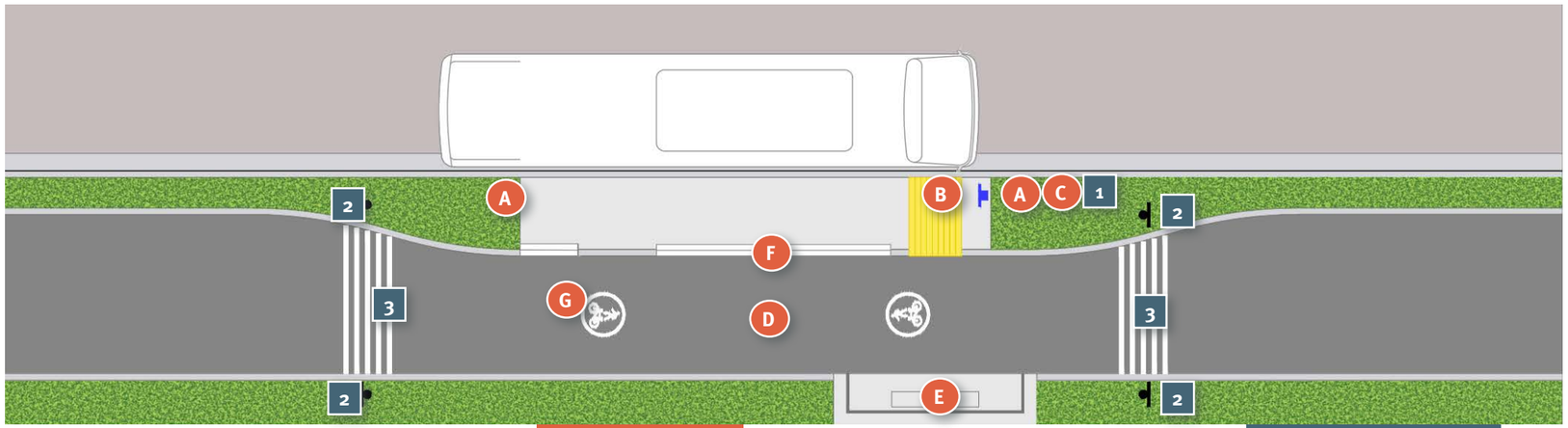
Optional Treatments

- **1** Enhanced sign with tactile map of bus stop layout
- **2** Enhanced or dynamic "Bicycles Yield to Pedestrians" signage
- **3** Raised transverse pavement markings

4.4.8 Configuration 4B –Constrained Multi-Use Pathway

This configuration illustrates a constrained application with a narrowed multi-use pathway to provide a dedicated landing pad, as shown in **Figure 51**. The multi-use pathway narrows to provide a landing pad. Tactile Warning Delineators or other treatments should be used to provide a detectable edge between the landing pad and the multi-use pathway. The wheelchair maneuvering zone is fully within the landing pad, and the shelter is provided behind the multi-use pathway. There is a bus stop ID pole and Tactile Directional Indicator Mat at the front entrance of the bus. Raised transverse pavement markings and/or flexible delineator posts with "Bicycles Yield to Pedestrians" signage could be used to remind cyclists that they are entering a unique context and should yield to pedestrians.

Figure 51: Other Application: Constrained Multi-Use Pathway



Legend

- Shelter and Bench
- Bus stop ID pole
- Sign
- Landscaping
- Tactile Directional Indicator Mat
- Fence or other continuous amenities
- Tactile Warning Delineator or other treatments to provide detectable edge

Core Treatments

- **A** Detectable 'bookends' at start and end of island platform
- **B** Tactile Directional Indicator Mat and Passenger Landing Pad clear of obstructions at front door of bus
- **C** Primary bus stop ID pole with enhanced braille and raised tactile letter signage at front of island platform
- **D** Narrow multi-use pathway to provide landing zone that is least 1.8 metres wide to accommodate wheelchair ramp or lift
- **E** Shelter placed back of sidewalk or in another location where feasible
- **F** Tactile Warning Delineator or other treatments to provide detectable edge with gap at crossing locations
- **G** Multi-use pathway pavement markings

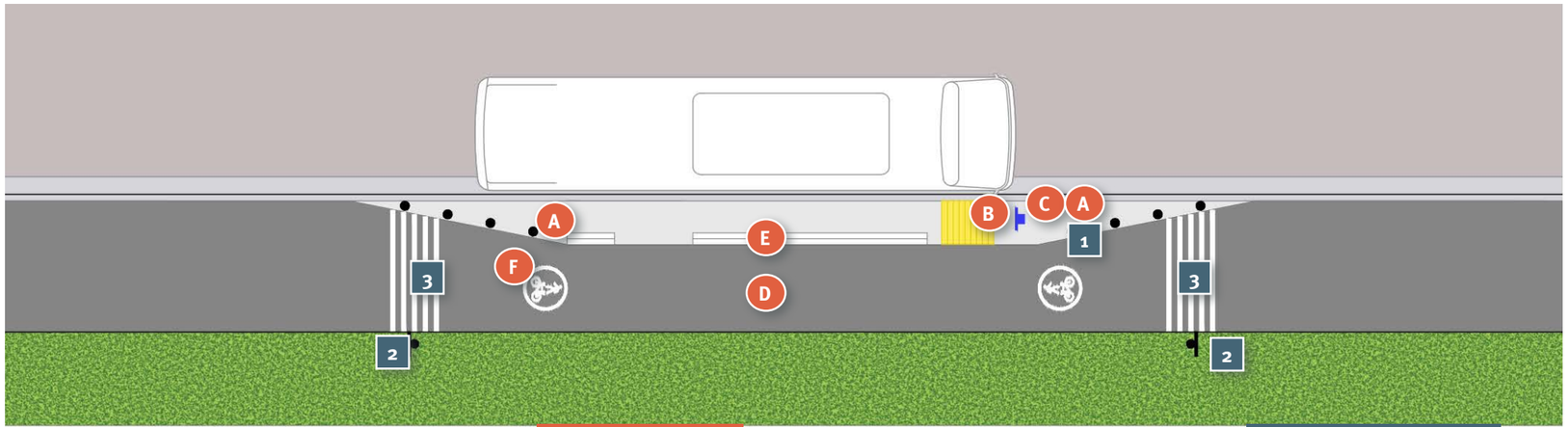
Optional Treatments

- **1** Enhanced sign with tactile map of bus stop layout
- **2** Enhanced or dynamic "Bicycles Yield to Pedestrians" signage
- **3** Raised transverse pavement markings

4.4.9 Configuration 4C – Highly Constrained Multi-Use Pathway

This configuration illustrates a constrained application with a highly constrained context where only 3.0 metres is available for a combined bus stop and multi-use pathway, as shown in **Figure 52**. The multi-use pathway narrows to provide landing pad, with the landing pad prioritized to ensure at least 1.0 metres is provided in order to provide a waiting area. Tactile Warning Delineators or other treatments can be used to provide a detectable edge between the landing pad and the multi-use pathway. The wheelchair maneuvering zone is partially within the landing pad, and no shelter is provided. There is a bus stop ID pole and Tactile Directional Indicator Mat at the front entrance of the bus. Raised transverse pavement markings and/or flexible delineator posts with "Bicycles Yield to Pedestrians" signage could be used to remind cyclists that they are entering a unique context and should yield to pedestrians.

Figure 52: Highly Constrained Multi-Use Pathway



Legend

- Shelter and Bench
- Bus stop ID pole
- Sign
- Landscaping
- Tactile Directional Indicator Mat
- Fence or other continuous amenities
- Tactile Warning Delineator or other treatments to provide detectable edge

Core Treatments

- **A** Detectable 'bookends' at start and end of island platform
- **B** Tactile Directional Indicator Mat and Passenger Landing Pad clear of obstructions at front door of bus
- **C** Primary bus stop ID pole with enhanced braille and raised tactile letter signage at front of island platform
- **D** Narrow multi-use pathway to provide landing zone that is least 1.0 metres wide to provide waiting area
- **E** Tactile Warning Delineator or other treatments to provide detectable edge with gap at crossing locations
- **F** Multi-use pathway pavement markings

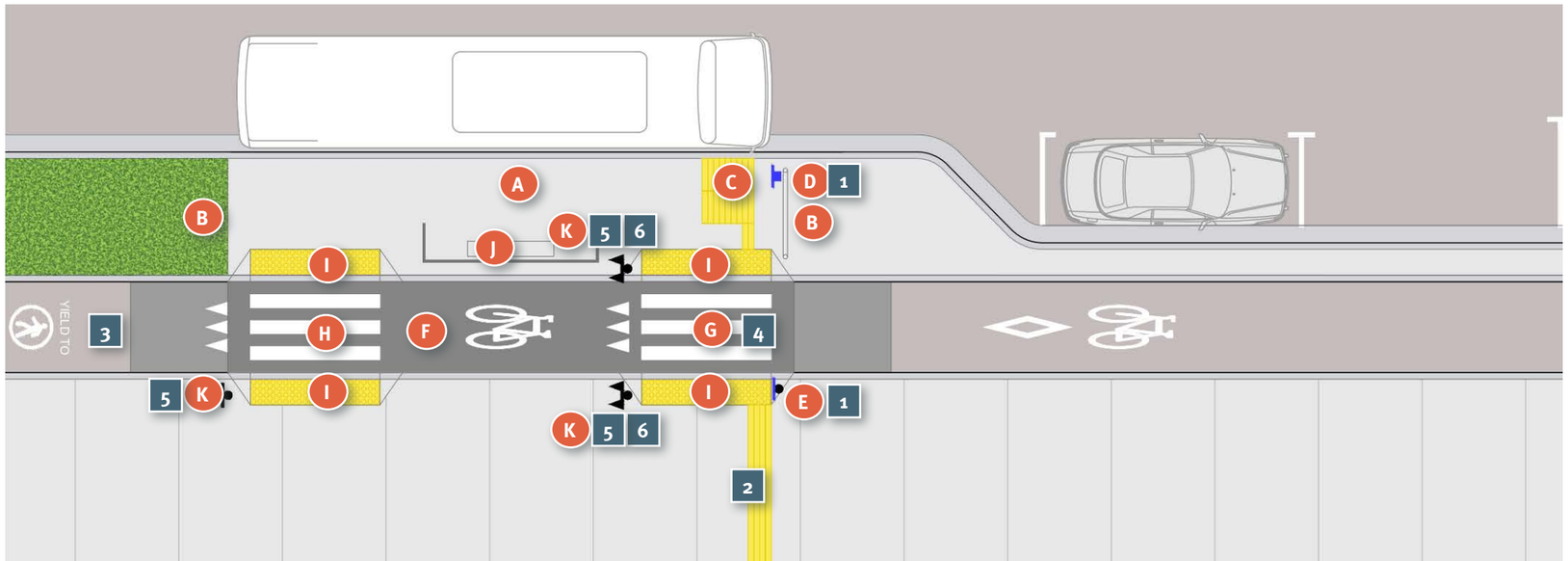
Optional Treatments

- **1** Enhanced sign with tactile map of bus stop layout
- **2** Enhanced and/or dynamic "Bicycles Yield to Pedestrians" signage
- **3** Raised transverse pavement markings

4.4.10 Configuration 5 – Other Application: Bus Bulge

This configuration illustrates a standard width transit island with a bus bulge to maintain bus speed and reliability by allowing buses to stop in lane when on-street parking is provided, as shown in **Figure 53**. The configuration shown is similar to Configuration 1C – Conventional Island Platform Without Crosswalk Integration.

Figure 53: Other Application: Bus Bulge



Legend

- Shelter and Bench
- Bus stop ID pole
- Sign
- Landscaping
- Tactile Attention Indicator
- Tactile Directional Indicator
- Tactile Directional Indicator Mat
- Fence or other continuous amenities

Core Treatments

- **A** Island platform with desired width of 3.0 metres (minimum 2.3 metres)
- **B** Detectable 'bookends' at start and end of island platform
  Tactile Directional Indicator Mat and Passenger Landing Pad clear of obstructions at front door of bus
- **D** Primary bus stop ID pole with enhanced braille and raised tactile letter signage at front of island platform
- **E** Secondary bus stop ID pole with enhanced braille and raised tactile letter signage on sidewalk
- **F** Bicycle lane raised to sidewalk level or intermediate level and/or narrowed through bus stop zone
- **G** Marked pedestrian crossing at front of island platform
  Marked pedestrian crossing at rear of island platform
- **I** Tactile Attention Indicators at all marked pedestrian crossings
- **J** Bus shelter with no side panels or clear panels, fence, landscaping, and/or other amenities to provide detectable edge treatments and to channelize pedestrians to marked crossings
- **K** "Pedestrian Crosswalk" and/or "Bicycle Yield to Pedestrians" signage

Optional Treatments

- **1** Enhanced sign with tactile map of bus stop layout
- **2** Tactile Directional Indicators across sidewalk
- **3** "Bicycles Yield to Pedestrians" and/or "Advance Yield to Pedestrians" pavement markings
- **4** "Pedestrian Crosswalk" and/or "Bicycles Yield to Pedestrians" signage
- **5** Enhanced and/or dynamic "Bicycles Yield to Pedestrians" signage
- **6** Actuated flashing beacons

Section 5: Supportive Guidelines

Sixth Street, New Westminster

This section provides additional guidance above and beyond design treatments to improve bus stops adjacent to protected cycling infrastructure, including operations, maintenance, education, engagement, legislation and regulations, and monitoring.

5.1 Operations

Beyond the design of bus stops adjacent to protected cycling infrastructure, there are several operational practices that can be made by transit agencies to improve advance trip planning and to improve the customer experience during the trip.

Operational guidelines include:

Operations 1: Automatic audible announcements should be provided for alighting passengers at island platform bus stops

All TransLink and most BC Transit vehicles are equipped with annunciators that provide voice, data, and real-time location capability for every bus and support vehicle in their fleets. The automatic announcements can be modified to notify alighting passengers that they will need to cross a bikeway upon exiting the vehicle. These announcements could be developed following the development of the digital inventory as noted below.

The pilot project found that providing audible announcements on buses indicating that the bus stop is adjacent to cycling infrastructure was one of the most effective design treatments used. 93% of evaluation form respondents who tested this feature indicated it was very helpful or somewhat helpful for navigating from the bus stop boarding/alighting location to the sidewalk.

Operations 2: Digital inventory of all island platform bus stops can be developed and this information can be provided online and to call centre representatives

TransLink and BC Transit both maintain an inventory of all bus stops in their respective systems, including designating whether a bus stop is considered accessible or not. There is currently no system available to track bus stops adjacent to protected cycling infrastructure. TransLink and BC Transit could work with their local government partners to develop an inventory of all bus stops adjacent to protected cycling infrastructure across the province. This information could be integrated into the existing bus stop databases with Bus Stop ID numbers so that it could be accessed by call centre representatives and could be made available online to assist with advance trip planning. This database would need to be regularly updated and maintained.

Operations 3: Information and maps of bus stop layouts can be provided online

Stakeholders indicated that advance trip planning is often an important consideration so people can plan their route and familiarize themselves with the bus stop layout in advance of the trip. To assist with this, maps could be provided online of bus stops with a schematic layout and configuration of the stop. This could be developed in conjunction with the digital inventory as noted above, and along with development of 3D tactile maps at the stop to ensure a consistent format.

Operations 4: Consider the use of GPS-based wayfinding technology to add special instructions for navigating island platform bus stops.

There are a range of GPS-based technologies that can be used to provide additional information for people navigating island platform bus stops. While the specific technologies are still evolving, agencies and local governments can consider the use of these technologies.

5.2 Maintenance

Ensuring ongoing rehabilitation and maintenance of new and existing infrastructure is important to ensuring universal access and safety of road users. Built environment infrastructure that is not maintained creates barriers to all people, including people with disabilities. Maintenance needs to be considered at all stages of the planning and the design process. Maintenance is necessary to keep active transportation facilities functional and usable throughout all seasons, which ensures that facilities are universally accessible throughout the year.

As communities establish priority levels for clearing during weather events, bus stops adjacent to protected cycling infrastructure should be considered a top priority. Further, operations and maintenance staff should be aware to not clear sidewalks or cycling infrastructure in a way that will create barriers for people with disabilities, including covering pavement markings or signage or pushing snow into the Pedestrian Through Zone. It should be noted that maintenance of the bus stop is typically the responsibility of local governments.

Maintenance guidelines include:

Maintenance 1: Local governments and transit agencies should ensure that all elements of the bus stop are well-maintained and useable at all times of day, throughout the year

Local governments and transit agencies should follow the guidelines in Chapter I.3 of the *BC Active Transportation Design Guide* along with local maintenance practices to ensure all elements of the bus stop are well-maintained and useable at all times of day, throughout the year, including but not limited to:

- Installing **highly durable materials for TWSIs** such as steel or cast iron, which can add additional strength where snow removal is required; It is noted that many of the TWSIs recommended in this Design Guide may provide challenges for winter maintenance and may require additional care to ensure they are clear, detectable, and not slippery at all times of the year;

- Implement **seasonal maintenance** (such as clearing debris, snow, ice, etc.);
- Prioritize **the clearing of cycling infrastructure** adjacent to bus stops during storm events, including pedestrian crossings and platforms;
- Ensure bus stop geometry, curbing, and furniture layout **supports adequate access for snow clearing and/or sweeping equipment**; and
- Ensure **materials for markings and tactile applications are slip resistant.**

Maintenance 2: Adequate lighting should be provided to ensure visibility at all times of the day and throughout the year

Bus stops should be safe and accessible at all times of the day and throughout the year. In most parts of the province, lighting can be challenging particularly in dark, winter months. Transportation professionals should ensure adequate pedestrian-scale lighting is provided. In addition, some stakeholders noted that in the case of advertising panels, light from the shelters can help provide contrast to those with low vision at night and in the rain.

Maintenance 3: A feedback tool can be developed and applied to report maintenance needs

Local governments often have feedback tools for residents to report maintenance issues, such as through the website, a mobile app, or phoning 311. Local governments could consider adding a feedback tool and/or providing opportunities to residents to report maintenance needs if a system is not yet in place. In addition, this could include increased coordination between transit agencies and local governments to directly share requests and feedback instead of requiring the public to report maintenance needs through separate channels.

5.3 Education

Protected cycling infrastructure is still an emerging design type for many communities in British Columbia. Further, bus stops adjacent to protected cycling infrastructure have additional elements that some road users may be unfamiliar with using. A lack of education and familiarity of new infrastructure can be a barrier to use. The purpose may not be clearly communicated to other road users and could create concerns for people who are unfamiliar about using bus stops adjacent to protected cycling infrastructure.

For people cycling, design elements such as yield signage, pedestrian crossings, or enhanced flashing beacons could be confusing and unfamiliar when they are first implemented or encountered. For transit users, design elements such as designated pedestrian crossings, cycling interactions and island platforms could be confusing and feel unsafe.

Education is critical to supplement design treatments with information and materials to educate all road users about their legal requirements, including the legal requirement for cyclists to yield the right-of-way to pedestrians in a crosswalk, and to promote safe and respectful behaviour by all road users.

Participants from the pilot projects noted that post-construction education will be critical to informing people with disabilities about accessibility features incorporated into bus stop designs adjacent to cycling infrastructure. People with sight loss and dog guides will need to become familiar with the features of these new designs. For example, if TWSIs are increasingly used around bus stops or tactile maps are installed, people must be aware of this fact to interpret it correctly. If navigational information is provided through long-press on an APS, people will need to know how to access it. Such training may be provided by Orientation and Mobility Specialists, CNIB, or other entities.

Education 1: Education materials should be developed to be provided online and/or on-site to provide information about the bus stop, including what it is, how to use it, and how to promote respectful behaviour

It is recommended that an education component is included as part of the launch plan for any new or retrofitted bus stops adjacent to protected cycling infrastructure to help introduce a community to the new facilities and the rules of the road. A communication and education strategy should be incorporated into a project's capital budget to support community awareness and understanding during project development and after the project is completed. Education should also be ongoing to reach new or visiting users and to be a reminder to frequent users.

TransLink and/or provincial agencies could develop or promote educational materials to ensure consistent information and messaging is provided throughout Metro Vancouver and elsewhere in the province, and tailored by each jurisdiction to reflect the local context and application.

These materials could also be created by the jurisdiction responsible for implementation or as part of a partnership between community, cycling groups, or other organizations or agencies with an interest in safe, active and accessible transportation.

Examples of ways in which communities can provide and share information include:

- **Online materials,** such as providing information on a dedicated project webpage with supporting resources, videos, and social media;
- **Signage can be posted with QR codes** at specific locations to better provide information that is more relevant and local;
- **Published materials such as informational posters can be provided onsite,** available in community or provided to local businesses (such as bike shops) to share and promote;
- **Social media campaigns & digital marketing ads** could be created for cycling organizations, local jurisdictions and other stakeholders to share; and
- **Signage can be provided locally in person** to show examples of how to use the facilities.

Example of educational resources are provided below.

Education example – tutorial video

In anticipation of opening its first two-way protected bicycle lane, the City of Nanaimo developed a “Floating Bus Stop Tutorial”. This 3-minute video reviews the rules of the road for each type of mode in order to increase community understanding of this new type of infrastructure.

Education example – city on-site posters

Examples of posters placed on-site to provide education and awareness about different types of infrastructure and how to use it. On the left is an example of how to use a zebra crossing in the City of North Vancouver, and on the right is an example of how to use a “bus pad”, which refers to an island platform bus stop, in the City of New Westminster.

Education example – dedicated project webpage

Montgomery County Department of Transportation in Maryland has a dedicated project webpage that provides interactive infographics and videos to understand the new features and traffic patterns associated with new pedestrian and bikeway infrastructure.

Education 2: Education campaigns can be developed to share information more broadly about bus stops, what they are, how to use them, and how to promote respectful behaviour

It is recommended that senior levels of government such as TransLink and/or provincial agencies develop and/or promote materials for education campaigns to ensure consistent information and messaging is provided throughout Metro Vancouver and elsewhere in the province.

Local jurisdictions can also develop broad, ongoing education campaigns to encourage, promote and educate users on roles and behaviours when using bus stops and active transportation facilities.

Feedback from pilot project participants noted that it is very effective when cyclists ring a bell to indicate they are passing. One example of an education campaign could be focused on signage and other educational materials encouraging cyclists to ring their bells.

Widespread education can help to reach a broader audience and create familiarity across the community. These campaigns could be developed in partnership with other agencies and cycling organizations to demonstrate support and increase awareness to their members.

Examples of ways in which communities can partner to provide and share information include:

- Partner with local organizations to provide cycling and walking training and tours with lessons on how to use the facilities;
- Partner with transit agencies to incorporate education materials on bus stops, bicycle racks and ads on or in buses and SkyTrains;
- Use existing events such as Go by Bike Week to incorporate educational messaging, materials, webinars, or presentations; and,
- Work with agencies to develop materials that accommodate different types of disabilities.

Education 3: Mobile apps can be encouraged to assist with orientation, navigation, and wayfinding

There are a number of emerging technologies and mobile applications that can be considered to assist transit users with wayfinding and navigation, such as the use of Aira, a mobile app that provides professional, on-demand navigation that includes geofencing whereby users can tap their phones to connect with a staff member to assist with orientation, navigation, and wayfinding. Staff members are connected with users with smartphones or smart glasses, and staff can provide users with detailed descriptions of their surroundings. This includes pinpointing the location of the bus stop and bikeway. Moreover, staff can offer real-time assistance by assessing whether the bikeway is safe to cross and guiding users to a suitable waiting location for the next bus. Additionally, this connection to an Aira agent can be helpful when it comes to boarding the bus and locating an available seat.

5.4 Engagement

Engaging with residents and stakeholders on the planning and design of transportation facilities is a critical component to the success of any project. Ensuring people with disabilities are meaningfully included in the engagement process helps to ensure the prevention and removal of barriers. It is essential that the engagement undertaken is intentional and effective at gathering input and providing information.

Suggestions for ways in which communities can create meaningful engagement includes:

Engagement 1: Work with local Accessibility Advisory Committees and obtain their input regarding bus stops adjacent to cycling infrastructure within the context of the design guidelines

Through the Province's *Accessible BC Act*, every local government is required to establish an Accessibility Advisory Committee (AAC). The intention of establishing an AAC is to raise awareness about accessibility and inclusion, establish internal accessibility standards and to embed accessibility within the organization. This provides an opportunity for municipalities to work with their specific AAC's when planning and designing bus stops adjacent to protected cycling infrastructure. Further, the *Accessible BC Act* also requires the establishment of a feedback mechanism to report any barriers or challenges in the community.

Engagement 2: Develop a stakeholder list and engage with a broad range of stakeholders, including people who cycle and people with a range of disabilities, during the planning and design process

In addition to engaging with Accessibility Advisory Committees, it is recommended that communities engage with a diversity of interested users including people cycling and people with disabilities. Perspectives and feedback shared by stakeholders can help to build trust between the community and its members and help to ensure new barriers are not created through the design. Stakeholders may wish to be consulted through a variety of means including surveys, working sessions, presentations, and discussions.

Engagement 3: Partnerships should be established with organizations in your community that represent people with disabilities

Building relationships with partners that represent people with disabilities can help the community to connect with subject matter experts and connect with their members. Where communities may be lacking internal expertise, or capacity on their Accessibility Advisory Committees, partnerships provide an opportunity to make connections and learn from the perspectives of people with lived experience. Establishing partnerships also provides the opportunity to share project engagement opportunities with their members and to collaborate on education campaigns.

Engagement 4: Site visits can be conducted with people with disabilities at existing bus stops adjacent to cycling infrastructure to explore retrofit opportunities

Site visits to existing bus stops adjacent to cycling infrastructure is another tool to build internal awareness and understanding as well as to establish trust with members of the public. When conducting a site visit, it is important to ensure there is a diversity of representation of disabilities in order to work together to understand what barriers or solutions work for most people. Other considerations when planning a site visit include:

- Ensure an adequate number of staff are in attendance with a high ratio of staff to members of the public;
- Ensure transportation needs to and from the site(s) are met; and,
- Share materials and information and objective of the site visit in advance so attendees know what to expect

Engagement 5: Partner with Orientation and Mobility Specialists and others to provide training and help people with sight loss become familiar with island platform bus stops

Orientation and mobility (O&M) specialists teach people with sight loss to travel safely, confidently, and independently in their environment. They work with infants, children and adults usually on a one-to-one basis in a home, school, hospital or in the community. O&M specialists can provide assistance to people with sight loss to become familiar with island platform bus stops.

5.5 Monitoring

As new design interventions are incorporated to improve bus stops adjacent to protected cycling infrastructure, monitoring and evaluation of the infrastructure will be critical for communities to understand the effectiveness of treatments and to provide insights for improvement. Monitoring usage, patterns, compliance, and trends allows for evaluation to take place.

Direction for monitoring and evaluation of active transportation facilities is included in Chapter I.2 of the *BC Active Transportation Design Guide*. In particular, local governments should track any known incidents or near-misses at bus stop adjacent to protected cycling infrastructure. However, it should be noted that actual incidents may be unknown and/or underreported, as an incident between a pedestrian and a person cycling may not result in an ICBC claim or police-reported incident.

There are other ways that communities have been monitoring active transportation safety concern. For example, BikeMaps (BikeMaps.org) can be used to collect data on cycling trouble spots from people using the network. The data is crowd-sourced and self-reported. The platform collects data on cycling safety, hazards, and locations where bicycle theft occurred.

When evaluating user behaviours at bus stops adjacent to cycling infrastructure, clear parameters should be established as observations could be perceived differently across data collectors. In 2018, Transport for London (United Kingdom) commissioned a study to review the accessibility performance of their bus stops adjacent to cycling infrastructure and the impacts for people with disabilities. The level of any given interaction between pedestrians and people cycling was measured by observing interaction behaviour and then coding to the defined level as per the descriptions below:

- **Level 1: Precaution** – A pedestrian, or person cycling slowing down in response to another user requiring the same space.
- **Level 2: Controlled Action** – Pedestrian, or person cycling, deviating from route.
- **Level 3: Near Miss** – Pedestrian, or person cycling, rapidly slowing down, stopping or changing direction to avoid collision.
- **Level 4: Very Near Miss** – Pedestrian, or person cycling, using emergency braking or violent swerve.
- **Level 5: Collision** – Contact between a person cycling and a pedestrian.

Communities could work with local academic institutions or organizations to conduct this level of evaluation and analysis.

To understand users experience using the infrastructure, qualitative data could also be collected through site visits or public surveys. Communities could seek feedback through in-person interviews and informal discussions at the site or through an online survey that seeks to understand people's experience using the infrastructure.

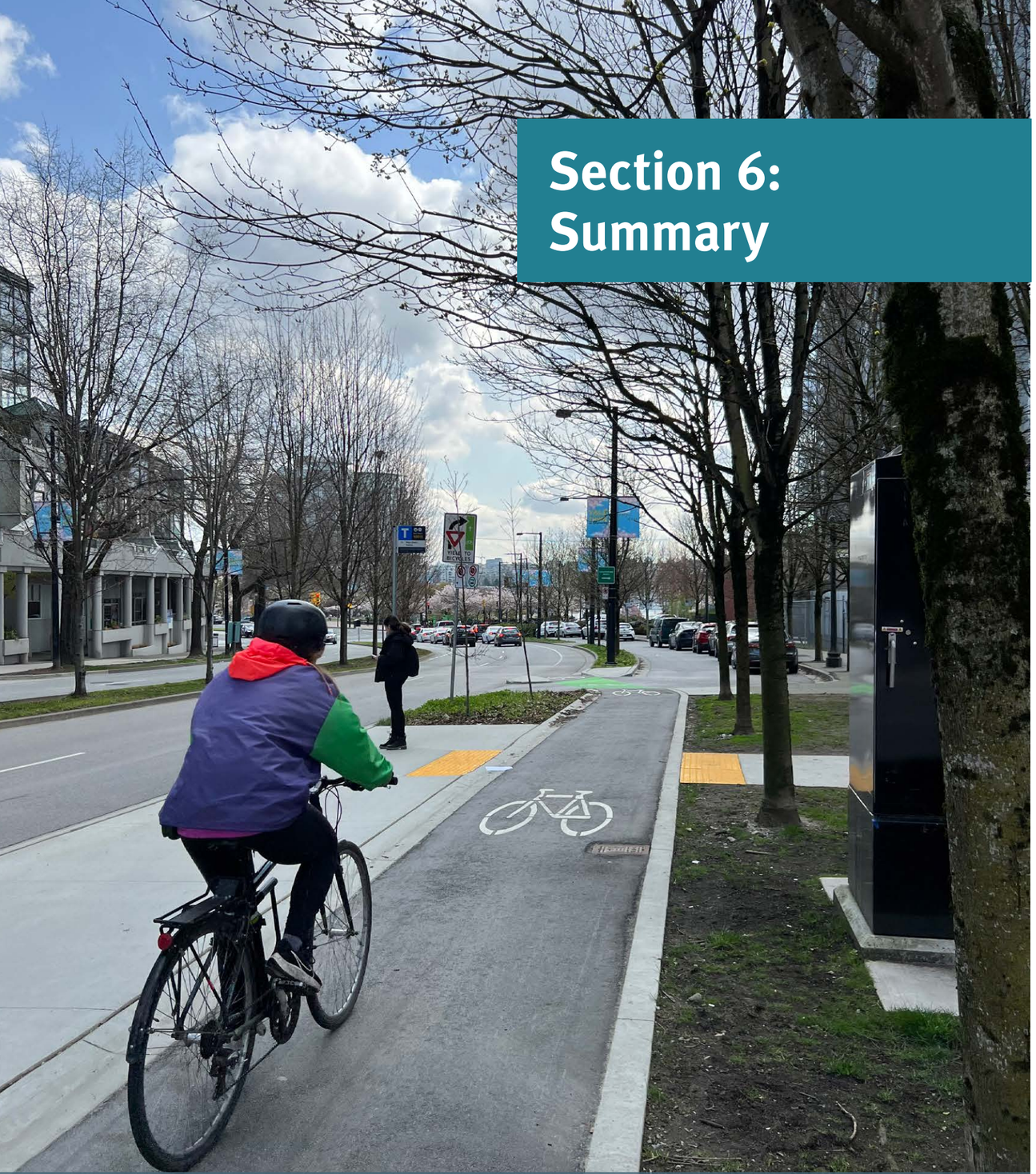
5.6 Further Research

As noted previously, stakeholders have expressed concerns about knowing if people cycling are approaching and having certainty that cyclists have stopped. However, there are few, if any, existing known products or treatments available that can reliably address these issues, and the efficacy of any such treatments have not been well studied and are not known.

This Design Guide recognizes how significant these issues are for people with sight loss and includes recommendations underscoring that transportation professionals and people with lived experience continue to work together to better understand the tools and technologies with potential to address these issues along with potential changes to legislation and regulations to support the use of such tools and technologies in the future.

Gorge Road, Saanich, British Columbia

Section 6: Summary



Pacific Street, Vancouver, British Columbia

TransLink, in partnership with MoTI, has created this Design Guide to provide updated guidance for communities in Metro Vancouver and elsewhere in British Columbia on how to design bus stops when located adjacent to protected cycling infrastructure. This Design Guide provides a comprehensive set of planning and engineering guidelines offering approaches for the planning, design, operations, and maintenance of bus stops adjacent to protected cycling infrastructure in a range of contexts and applications throughout British Columbia. The guidance applies to new infrastructure and may also be applied to retrofits of existing bus stops adjacent to protected cycling infrastructure. Recognizing the range of contexts across British Columbia, ranging from large urban centres which may have high levels of walking, cycling, and transit use, to small and rural communities which may have lower levels of walking, cycling, and transit, this Design Guide provides flexible and context-sensitive guidance for communities of all sizes and types across British Columbia.

Based on the findings of the technical review and findings from stakeholder engagement, sixteen key issues and challenges with the design of bus stops adjacent to cycling infrastructure were identified. These sixteen key issues and challenges were grouped into five overarching themes. The guidelines in this Design Guide were specifically developed to respond to and address each of these sixteen issues. In total, 45 treatments related to design, operation, and maintenance along with education and engagement were identified to address these sixteen key issues and challenges. The Design Treatments were identified and confirmed with stakeholders throughout the development of this Design Guide, including the surveys, stakeholder workshops, on-site field reviews, and pilot projects. The following pages provide a summary of each of the treatments suggested in this Design Guide, along with a summary of whether each treatment is Core or Optional and an overview of which key issues and challenges are addressed with each treatment.

Together, these 45 treatments can help to remove barriers and improve accessibility when bus stops are located adjacent to protected cycling infrastructure by providing guidance to address issues learned through the study. Transportation professionals should work together with people with disabilities within the context of this Design Guide throughout the planning and design process to address many of the identified issues and reduce many of the barriers for people with disabilities to access bus stops when located adjacent to protected cycling infrastructure.

While this Design Guide aims to remove barriers and improve accessibility, it is recognized that this is just a first step and there remain some issues that are not fully addressed in this Design Guide and that require further research. Notably, it is recognized that people with sight loss continue to have concerns about their ability to detect people cycling and to have confidence that a person cycling has stopped for them. These are complex challenges that extend well beyond just bus stops, and relate to any interaction between people cycling and people with sight loss throughout the transportation network.

This Design Guide recognizes how significant these issues are for people with sight loss. Transportation professionals and people with lived experience should continue to work together to better understand the tools and technologies available with potential to address these issues along with potential changes to legislation and regulations to support the use of such tools and technologies in the future.

Summary of Design Treatments and Issues Identified

		Wayfinding and Layout				Safe and Respectful Behaviour				Design Elements					Operations & Maintenance	Education and Engagement	
	Core / Optional	**Issue 1:** Difficulty finding the bus stop and information about bus routes served	**Issue 2:** Difficulty understanding and navigating a bus stop layout when arriving from the sidewalk or when getting off the bus	**Issue 3:** Difficulty knowing where to find pedestrian crossings of the protected cycling infrastructure	**Issue 4:** Lack of consistent detectable and visible edges between a raised bicycle lane and pedestrian space	**Issue 5:** Feeling unsafe crossing the protected cycling infrastructure due to difficulty knowing if a person cycling is approaching or has stopped at the crossing, particularly in a noisy environment	**Issue 6:** Uncertainty on how to indicates one intention to cross or that one has yielded	**Issue 7:** Concerns about cycling speeds and disrespectful cycling behaviour	**Issue 8:** Unpredictable pedestrian behaviour, including pedestrians walking in or across the protected cycling infrastructure	**Issue 9:** Tight space with limited maneuverability on the passenger landing pad	**Issue 10:** Insufficient right-of-way to accommodate sidewalk, protected cycling infrastructure, landing area, and motor vehicle lane widths	**Issue 11:** Risk of people tripping or falling off the passenger landing area	**Issue 12:** Risk of unintentionally colliding with or not being able to get around barriers, bollards, curbs, or other obstructions	**Issue 13:** Obstructed sightlines due to shelters, ad panels, and/or other street furniture	**Issue 14:** Bus stop and bicycle lane may not be cleared and usable at all times of the day, all year-round	**Issue 15:** Concerns that the accessibility community has not been adequately engaged with during the design process	**Issue 16:** Concerns that road users are unaware of rules of the road and behaviour expectations
Island Platform Zone																	
DT 1.1: The island platform should include key bus stop elements and meet or exceed the dimensions identified in TransLink and BC Transit guidance	C									✓	✓		✓				
DT 1.2: The island platform should be wide enough to accommodate people using mobility devices	C									✓			✓	✓			
DT 1.3: Passenger landing pads should be clear of vertical obstructions	C									✓			✓				
DT 1.4: Barrier curbs should be used adjacent to the area where buses will stop to maximize useable space	C											✓					
DT 1.5: The material used for the island platform should have a high degree of visual contrast from the bikeway	C				✓												
DT 1.6: The island platform should have detectable ‘bookends’ at the start and end of the island	C											✓					
Bus Stop Identification and Wayfinding																	
DT 2.1: The location of the front door of the bus stop should be clearly identifiable with a primary bus stop ID pole and use of a tactile directional indicator mat	C	✓	✓														
DT 2.2: A secondary bus stop ID pole should be installed on the sidewalk	C																
DT 2.3: Enhanced signage with braille and raised tactile letters should be provided on bus stop ID poles indicating it is an island platform bus stop	C	✓	✓														

		Wayfinding and Layout				Safe and Respectful Behaviour				Design Elements					Operations & Maintenance	Education and Engagement	
	Core / Optional	**Issue 1:** Difficulty finding the bus stop and information about bus routes served	**Issue 2:** Difficulty understanding and navigating a bus stop layout when arriving from the sidewalk or when getting off the bus	**Issue 3:** Difficulty knowing where to find pedestrian crossings of the protected cycling infrastructure	**Issue 4:** Lack of consistent detectable and visible edges between a raised bicycle lane and pedestrian space	**Issue 5:** Feeling unsafe crossing the protected cycling infrastructure due to difficulty knowing if a person cycling is approaching or has stopped at the crossing, particularly in a noisy environment	**Issue 6:** Uncertainty on how to indicates one intention to cross or that one has yielded	**Issue 7:** Concerns about cycling speeds and disrespectful cycling behaviour	**Issue 8:** Unpredictable pedestrian behaviour, including pedestrians walking in or across the protected cycling infrastructure	**Issue 9:** Tight space with limited maneuverability on the passenger landing pad	**Issue 10:** Insufficient right-of-way to accommodate sidewalk, protected cycling infrastructure, landing area, and motor vehicle lane widths	**Issue 11:** Risk of people tripping or falling off the passenger landing area	**Issue 12:** Risk of unintentionally colliding with or not being able to get around barriers, bollards, curbs, or other obstructions	**Issue 13:** Obstructed sightlines due to shelters, ad panels, and/or other street furniture	**Issue 14:** Bus stop and bicycle lane may not be cleared and usable at all times of the day, all year-round	**Issue 15:** Concerns that the accessibility community has not been adequately engaged with during the design process	**Issue 16:** Concerns that road users are unaware of rules of the road and behaviour expectations
DT 2.4: Enhanced signage with tactile map of bus stop layout can be provided on bus stop ID poles	O	✓	✓	✓													
DT 2.5: Tactile directional indicators can be installed in the sidewalk to identify the bus stop	O	✓	✓	✓													
DT 2.6: Emerging technologies can be encouraged to assist with orientation, navigation, and wayfinding	O	✓	✓	✓	✓	✓		✓									
Bicycle Through Zone																	
DT 3.1: The Bicycle Through Zone should meet or exceed minimum widths identified in the BC Active Transportation Design Guide and/or TAC Geometric Design Guide for Canadian Roads	C							✓					✓				
DT 3.2: The Bicycle Through Zone should be clear and free of obstructions	C												✓				
DT 3.3: Information and/or treatments should be provided to slow cyclists and to emphasize the need to yield to pedestrians as is legally required	C					✓		✓									
DT 3.4: The material used for the bikeway should have a high degree of visual contrast from the sidewalk and island platform	C				✓												
Edge Zones																	
DT 4.1: Edge treatments that are cane detectable should be provided next to the Bicycle Through Zone	C				✓												

		Wayfinding and Layout				Safe and Respectful Behaviour				Design Elements					Operations & Maintenance	Education and Engagement	
	Core / Optional	**Issue 1:** Difficulty finding the bus stop and information about bus routes served	**Issue 2:** Difficulty understanding and navigating a bus stop layout when arriving from the sidewalk or when getting off the bus	**Issue 3:** Difficulty knowing where to find pedestrian crossings of the protected cycling infrastructure	**Issue 4:** Lack of consistent detectable and visible edges between a raised bicycle lane and pedestrian space	**Issue 5:** Feeling unsafe crossing the protected cycling infrastructure due to difficulty knowing if a person cycling is approaching or has stopped at the crossing, particularly in a noisy environment	**Issue 6:** Uncertainty on how to indicates one intention to cross or that one has yielded	**Issue 7:** Concerns about cycling speeds and disrespectful cycling behaviour	**Issue 8:** Unpredictable pedestrian behaviour, including pedestrians walking in or across the protected cycling infrastructure	**Issue 9:** Tight space with limited maneuverability on the passenger landing pad	**Issue 10:** Insufficient right-of-way to accommodate sidewalk, protected cycling infrastructure, landing area, and motor vehicle lane widths	**Issue 11:** Risk of people tripping or falling off the passenger landing area	**Issue 12:** Risk of unintentionally colliding with or not being able to get around barriers, bollards, curbs, or other obstructions	**Issue 13:** Obstructed sightlines due to shelters, ad panels, and/or other street furniture	**Issue 14:** Bus stop and bicycle lane may not be cleared and usable at all times of the day, all year-round	**Issue 15:** Concerns that the accessibility community has not been adequately engaged with during the design process	**Issue 16:** Concerns that road users are unaware of rules of the road and behaviour expectations
Pedestrian Through Zone																	
DT 5.1: The Pedestrian Through Zone should meet or exceed minimum widths identified in the BC Active Transportation Design Guide and/or TAC Geometric Design Guide for Canadian Roads	C								✓								
DT 5.2: The Pedestrian Through Zone should be free of obstructions	C												✓				
DT 5.3: The material used for the Pedestrian Through Zone should have a high degree of visual contrast from the bikeway	C				✓												
Interaction Zones																	
DT 6.1: A marked pedestrian crossing should be provided at the front door of the bus in line with the bus stop ID pole or at the front of the island platform	C			✓					✓								
DT 6.2: A marked pedestrian crossing should be provided at the rear door or at the back of the island platform	C			✓					✓								
DT 6.3: Tactile attention indicators should be used at all marked pedestrian crossings across protected bicycle lanes	C			✓													
DT 6.4: Treatments should be used to channelize pedestrians to marked pedestrian crossings	C								✓								
DT 6.5: Accessible grades should be provided to access crossings	C			✓													
DT 6.6: Enhanced crossing treatments can be provided based on level of conflict	O						✓	✓									

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DT 6.7: Conduct further research to explore the potential application of treatments to help provide additional cues if a person cycling is approaching	C					✓	✓	✓	✓								
Amenities																	
DT 7.1: Shelters and benches should be provided and prioritized on the Island Platform Zone wherever feasible to provide a comfortable waiting area in a consistent location relative to the bus stop ID pole	C	✓			✓				✓				✓				
DT 7.2: Amenity design and placement should ensure adequate sightlines at crossings	C													✓			
DT 7.3: Amenities should be placed in consistent locations relative to the bus stop ID pole and aligned to avoid cluttering the island platform and introducing obstacles	C									✓	✓		✓				
DT 7.4: Amenity placement should include a horizontal shy distance from the Bicycle Through Zone	C												✓				

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Operations																	
O1: Automatic audible announcements should be provided for alighting passengers at island platform bus stops			✓														
O2: Digital inventory of all island platform bus stops can be developed and this information can be provided online and to call centre representatives		✓															
O3: Information and maps of bus stop layouts can be provided online		✓	✓														
O4: Consider the use of GPS-based wayfinding technology to add special instructions for navigating island platform bus stops		✓	✓														
Maintenance																	
M1: Local governments and transit agencies should ensure that all elements of the bus stop are well-maintained and useable at all times of day, throughout the year															✓		
M2: Adequate lighting should be provided to ensure visibility at all times of the day and throughout the year															✓		
M3: A feedback tool can be developed and applied to report maintenance needs															✓		

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Education																	
ED1: Education materials should be developed to be provided online and/or on-site to provide information about the bus stop, including what it is, how to use it, and how to promote respectful behaviour			✓				✓	✓	✓								✓
ED2: Education campaigns can be developed to share information more broadly about bus stops, what they area, how to use them, and how to promote respectful behaviour						✓	✓	✓	✓								✓
Engagement																	
EN1: Work with local Accessibility Advisory Committees and obtain their input regarding bus stops adjacent to cycling infrastructure within the context of the design guidelines																✓	
EN2: Develop a stakeholder list and engage with a broad range of stakeholders, including cyclists and people with a range of disabilities, during the planning and design process																✓	
EN3: Partnerships should be established with organizations in your community that represent people with disabilities																✓	
EN4: Site visits can be conducted with people with disabilities at existing bus stops adjacent to cycling infrastructure to explore retrofit opportunities																✓	
EN5: Partner with Orientation and Mobility Specialists and others to provide training and help people with sight loss become familiar with island platform bus stops																✓	✓

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