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On-Street Infrastructure Design Guide

BCTransit

7983

Territorial Acknowledgement:

We acknowledge with respect that BC Transit delivers our mission on the ancestral territories of Indigenous Peoples across British Columbia, and their historical relationships with the land continue to this day.

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CHAPTER 1 Introduction

1.1 PURPOSE

The *BC Transit Infrastructure Design Guide* (Guide) was created to promote best practice in transit infrastructure design.

The Guide identifies the design and operational requirements for the existing BC Transit bus fleet, while taking into consideration the interaction and needs of transit patrons and other road users.

They incorporate current BC Transit practices and best practices from: TransLink, the BC Ministry of Transportation and Transit (MoTT), the Transportation Association of Canada (TAC) and other North American transit service providers.

BC Transit is proactively developing and sharing this Guide to promote uniform practices across local governments within its jurisdiction, resulting in enhanced efficiency, safety and accessibility of transit services provided in BC outside of Greater Vancouver.

Local governments are encouraged to adopt this Guide to achieve consistency in transit infrastructure. Feedback is welcome as this is an iterative document to be revised as needed in the future.

The following subjects of interest, while relevant, are excluded from this document:

- Operational measures (bus routing, schedules, fares, bus fleet operation and maintenance)
- Community planning strategies
- Education and marketing strategies
- Project funding and investment

1.2 STRATEGIC ALIGNMENT

The mandate of BC Transit, as set out in the British Columbia Transit Act, is:

> *"to plan, acquire, construct or cause to be constructed public passenger transportation systems and rail systems that support regional growth strategies, official community plans, and the economic development of transit service areas," [and] "to provide for the maintenance and operation of those systems."*

BC Transit's Strategic Plan focuses on being part of the solution for the challenges impacting communities across the province. The plan has five objectives to guide our organization:

- **Always safe:** We will put safety first in everything that we do
- **Engaged people:** We will support our people to achieve success
- **Satisfied Customers:** We will grow ridership by making mobility accessible and enjoyable
- **Thriving Communities:** We will work with Local Government and First Nations partners to improve livability
- **Responsible stewardship:** We will use our resources wisely and develop the most sustainable solutions

1.3 INFRASTRUCTURE PRINCIPLES

There are four underlying principles of safe and efficient transit infrastructure:

Who

- People of all ages and abilities.

Why

- Transit infrastructure supports accessibility to all travelers. Transit, along with active transportation, is available as a sustainable travel option.

Where

- The location of transit infrastructure is safe, convenient and accessible.
- Best results are achieved when transit plays a key role in overall community planning and land use decisions.

How

- Transit infrastructure design is consistent with best practices and available guidelines.
- Safety and accessibility are prime considerations.

1.4 USING THIS GUIDE

This Guide provides advisory best practices, examples and general principles for consideration by road authorities. BC Transit makes no warranties, guarantees or representations, express or implied, that adherence to this Guide will result in a safe or legal design. This Guide does not establish a legal standard of care.

Users are solely responsible for ensuring that any design is safe and complies with all applicable federal, provincial or municipal laws, statutes, regulations, standards and codes including, without limiting the foregoing, the *Occupiers Liability Act*, RSBC 1996, c. 337, the Human Rights Code, RSBC 1996, c. 210 and decisions thereunder of the BC Human Rights Tribunal.

Typical design recommendations are provided, however, each project has a unique context which must be considered. Users are solely responsible for identifying all project specific design requirements. It is expected and recommended that the implementation of any infrastructure in accordance with this Guide will be reviewed and approved by an engineer or other qualified professional.

When the practices in this Guide cannot be achieved, users should document the rationale of any deviations and may consult with BC Transit.

BC Transit, its officers, agents, employees and assigns shall not be liable for any claim, injury, demand, loss, damage, cost, expense or liability of any kind (including legal fees), arising from any use of, reliance on, or inability to use the information in this Guide, including in relation to any personal injury, death, property damage or economic loss that may result from any errors, omissions or outdated information in the Guide or information that has been provided by BC Transit in relation to infrastructure design.

This Guide represents the best information available at time of writing. It will be updated as technical requirements, operational practices and customer expectations evolve.

CHAPTER 2 Bus Operation Specifications

2.1 DESIGN VEHICLES

BC Transit operates buses that vary in dimension and performance. To allow for interoperability between different buses on any given route, infrastructure must accommodate various bus models.

Table 2.1 provides the dimensions of BC Transit's two design vehicles. The dimensions are based on BC Transit's existing fleet including diesel and electric models. Mirrors extend 20-30 cm beyond the vehicle body.

All locations that are desired to accommodate fixed-route transit service should be designed to accommodate the Standard Bus. Locations that are planned to provide service by Double Deckers should also be designed to accommodate this design vehicle. Since BC Transit does not currently operate articulated buses, refer to the TransLink Bus Infrastructure Design Guidelines for information on this vehicle type. Though longer than a Standard Bus, articulated buses are more maneuverable due to the accordion in the middle.

Table 2.1 Design Vehicles

Parameter	Standard Bus	Double Decker
Width	2.6 m	2.6 m
Track	2.6 m	2.6 m
Length	12.7 m	13.6 m
Front Overhang	3.1 m	2.7 m
Wheelbase	7.2 m	6.6 m
Rear Overhang	2.4 m	4.3 m
Minimum Turning Radius (Wall to Wall)	13.4 m	12.5 m
Height	3.4 m	4.2 m
Lock to Lock Time	6.0 sec	6.0 sec

Note 1: 20 cm has been incorporated into the front overhang dimensions to account for the impact the on-bus bike rack has on maneuverability.

2.2 SWEPT PATH ANALYSIS

A swept path analysis should be conducted when designing turns that buses will need to complete. The analysis should use the design vehicles identified in Section 2.1 and a vehicle turning speed of 15 km/h should be used. Ten km/h can be used in constrained locations with infrequent transit service.

When conducting the analysis, a 45 cm lateral clearance is desired (30 cm minimum) between the vehicle body and adjacent obstructions (e.g. curbs, opposing travel lanes). This clearance is to account for variability in actual travel paths as well as bus mirrors which extend 20-30 cm beyond the vehicle body.

2.3 HORIZONTAL CLEARANCE

Table 2.2 summarizes the recommended horizontal clearance between the drivable area and rigid vertical obstructions that are more than 15 cm above road grade. The horizontal clearance zone begins at the curb face / gutterline if it is provided. If signs or poles are provided within the clearance area, they should be flexible and less than 1.2 m tall. While buses should not be required to contact flexible obstructions during regular service, this provision minimizes the impacts if obstructions are contacted by buses. Additional horizontal clearance requirements at bus stops are presented in Section 4.4.

Table 2.2 Recommended Horizontal Clearance

Scenario	Recommendation
Signs, poles, fire hydrants, street furniture (speed limit 50 km/h or less)	0.5 m
Signs, poles, fire hydrants, street furniture (speed limit 60 km/h or more)	0.6 m
Structures (buildings, bridge abutments)	1.0 m

Horizontal clearance is required since:

- Bus mirrors often extend beyond the travel lane.
- The crossfall of a road causes buses to tilt, with the potential for the top of the bus to extend beyond the roadway.
- The combination of long vehicle length and moderate wheelbase causes the front and rear bumpers to follow a different path than the wheels during even minor changes in steering.

2.4 VERTICAL CLEARANCE

All locations where double-decker buses operate or are planned to operate require a vertical clearance of at least 4.8 m. In all other cases, the clearance requirement is 3.8 m.

2.5 VEHICLE PERFORMANCE

Buses generally have lower acceleration and deceleration rates compared to passenger vehicles. For passenger comfort and safety, transit vehicle acceleration and deceleration rates should be considered in public road and transit facility design. The maximum deceleration rate for emergency situations should only be used in extreme conditions, e.g. to avoid a collision.

Table 2.3 Desirable Acceleration and Deceleration Rates for Buses

Item	Maximum Rate (m/s^2)	
	Standard Bus	Articulated Bus
Acceleration	0.9	0.7-0.9
Deceleration (normal service)	1.1	1.1
Deceleration (emergency condition)	2.7	2.7

Source: Canadian Transit Handbook (Canadian Urban Transit Association and Transportation Association of Canada)

2.6 BICYCLE RACKS

Although the width of a typical bicycle rack is less than the full width of the bus, the front corners of the bike rack may, in a sharp turn, encroach beyond the turning path of the front corners of the body of the bus. The road designer should ensure there is adequate clearance as well as access to the on-bus bicycle rack at bus stops.

2.7 VISIBILITY IMPAIRMENT ZONES

Visibility impairment zones must be considered when designing transit infrastructure because operators have limited visibility to the side and rear of the vehicle.

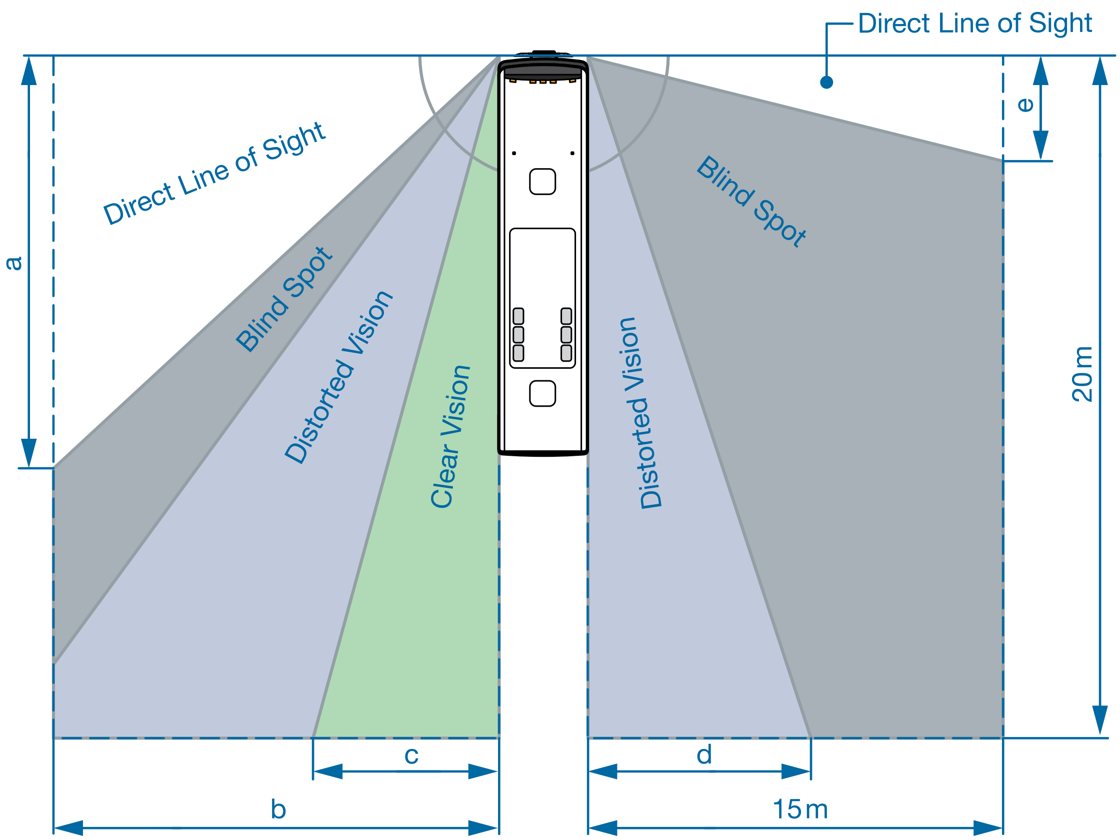


Figure 2.1 Visibility Impairment Zones

Source: TransLink Guidelines

Table 2.4 Visibility impairment zones

Vision	Means	Purpose	Var.	Bus Type	Angle (deg.)		Notes
					1	2	
Direct Line of Sight (Right Side)	Windows of the front door	Direct line of sight	e	Std NF	46	-	Door + first window (assumes no customers in front of red line in bus)
				STD Nv	49	-	Door + first window
				LD	38	-	Door + first window
				HD	52	2.7	(Angle 1) Door to red line on window (Angle 2) Door only
Distorted Vision (Right Side)	Single, slightly convex mirror on right	To check if customers have cleared door	d	Std NF	21	-	-
				Std Nv	26	-	-
				LD	64	-	-
				HD	22	-	-
Clear Vision (Right Side)	Flat mirror on right	To check real distance between approaching vehicles	d	LD	7	-	-
				HD	11	-	-
Direct Line of Sight (Left Side)	Shoulder checking left window of operator seat	Direct line of sight	a	Std NF	Full	-	Full sight of surrounding with mirrors
				Std Nv	Full	-	Full sight of surrounding with mirrors
				LD	64	-	-
				HD	55	-	-
Clear Vision (Left Side)	Flat mirror on left	To check real distance between approaching vehicles	c	Std NF	15	-	-
				Std Nv	9	-	-
				LD	13	-	-
				HD	13	-	-
Distorted Vision (Left Side)	Small convex mirror on the left	Check if there is a vehicle travelling next to a bus prior to a lane change	b	Std NF	34	-	-
				Std Nv	34	-	-
				LD	41	-	-
				HD	21	-	-

Source: TransLink Guidelines
Abbreviations: Standard Bus New Flyer (Std NF), Standard Bus Nova (Std Nv), Light Duty (LD), handyDART (HD).

- Due to the distortion in the convex mirror on the right side of the bus, the operator is unable to clearly judge the real distance between the bus and a vehicle approaching from behind;
- The blind area on the right side of the bus (see Figure 2.1) cannot be viewed either through the right-side mirror or by direct line of sight through the windows of the front door. Hence, bus movements that require merging to the right within a short distance, or making a left turn from the inside lane of the double left-turn lanes, may be hazardous; and
- The convex mirror on the left side of the bus creates a distorted image of the area that cannot be viewed either through the flat mirror or by direct line of sight through the windows in the bus operator's seat area. While this image has some use, it cannot be relied on to estimate either distance or speed of a vehicle approaching from behind.

2.8 VEHICLE WEIGHT

The weight of buses varies based on the model and the number of passengers on board. Table 2.5 provides the curb weight (vehicle only) and 90th percentile operating load for standard length buses (12.5 m / 40 ft.) and double deckers. The curb weight is the maximum curb weight amongst all bus models within the bus type. Buses are below the 90th percentile operating load 90% of the time and are above the 90th percentile operating load 10% of the time.

Table 2.5 Vehicle Weight

Bus Type	Gross Curb Weight [kg]				Approximate 90th Percentile Operating Load [kg]				
	Steer Axle	Drive Axle	Tag Axle	Gross	Steer Axle	Drive Axle	Tag Axle	Gross	Max Tire Point Load [kg/cm]
Standard Bus	4,900	9,100	N/A	14,000	5,600	10,200	N/A	15,800	92
Electric Standard Bus	5,700	10,900	N/A	16,600	6,400	12,000	N/A	18,400	105
Double Decker	4,800	7,600	5,200	17,600	6,000	8,700	5,900	20,600	98

CHAPTER 3 Street Design

3.1 BETTER STREETS, BETTER TRANSIT

On streets of every size and context, street design choices directly affect transit accessibility, travel time, reliability and capacity. Streets that comprehensively support transit create an upward spiral of higher ridership, better service, local economic growth and more compact, sustainable development. Basic transit accommodations are not enough to support future growth; high-quality transit requires dedicated space, efficient intersections and comfortable, well-designed and efficiently spaced bus stops. Transit-focused design also requires thoughtful active transportation facilities, ensuring that safe, accessible and inviting connections are available for passengers to access transit.

3.2 BUS SPEED AND RELIABILITY

Safe, accessible and effective transportation systems require efficient and reliable transit. Transit supportive street design directly impacts bus speed and reliability (BSR), attracting new transit riders and allowing BC Transit to operate more frequent service. Prioritizing transit also increases a street's person-moving capacity since transit is more space-efficient in moving people than passenger vehicles. All aspects of street design that impact general vehicle flow also impact bus speed and reliability.

Bus speed and reliability has a direct impact on the amount of service BC Transit can provide. If bus speed and reliability improve, bus frequency can also increase. If bus speed and reliability deteriorate, then bus frequency is reduced.

Speed: The rate at which a bus travels. Travel speed is a key metric that potential passengers consider when deciding between travel modes.

Reliability: The consistency of travel times. E.g., how consistent is bus travel time at 4pm on weekdays?

Delay: The increased travel time compared to free-flow conditions.

Table 3.1 provides an overview of potential design treatments to improve bus speed and reliability that could be worthwhile based on service level, with more information provided in the subsequent sections. Bus stop design and minor intersection design modifications can be useful in a variety of situations whereas significant intersection design modifications or bus lanes can be considered where service frequency is higher.

Table 3.1 Bus Speed and Reliability Design Opportunities

	< 4 buses/hour	4–15 buses/hour	15+ buses/hour or RapidBus
Bus Stops			
Stop Spacing	●	●	●
In Lane Stop	●	●	●
Intersections			
Passive TSP		●	●
Active TSP		●	●
Transit supportive intersection laning		●	●
Queue jump lane		●	●
Approach lane		●	●
Bus Lanes			●

TSP: Transit Signal Priority

3.2.1 Bus Stops

Stop Spacing

The number of stops on a bus route directly impacts the length of time to complete the route. Adding stops to bus routes makes them operate slower and reducing the number of bus stops makes them operate faster. The preferred spacing between stops depends on many factors and is further discussed in Section 4.2.1.

In-lane Bus Stops

In most cases, in-lane bus stops improve transit efficiency, safety and reliability by eliminating delays caused by merging back into traffic. Unlike bus bays, which require buses to wait for gaps in traffic before re-entering the roadway, in-lane stops allow for quicker boarding and departures as well as reducing the number of cars that pass buses at stops, reducing overall travel time. They can also create additional space for active transportation facilities, passenger amenities, moderate vehicle speeds and minimize conflicts between buses and other road users.

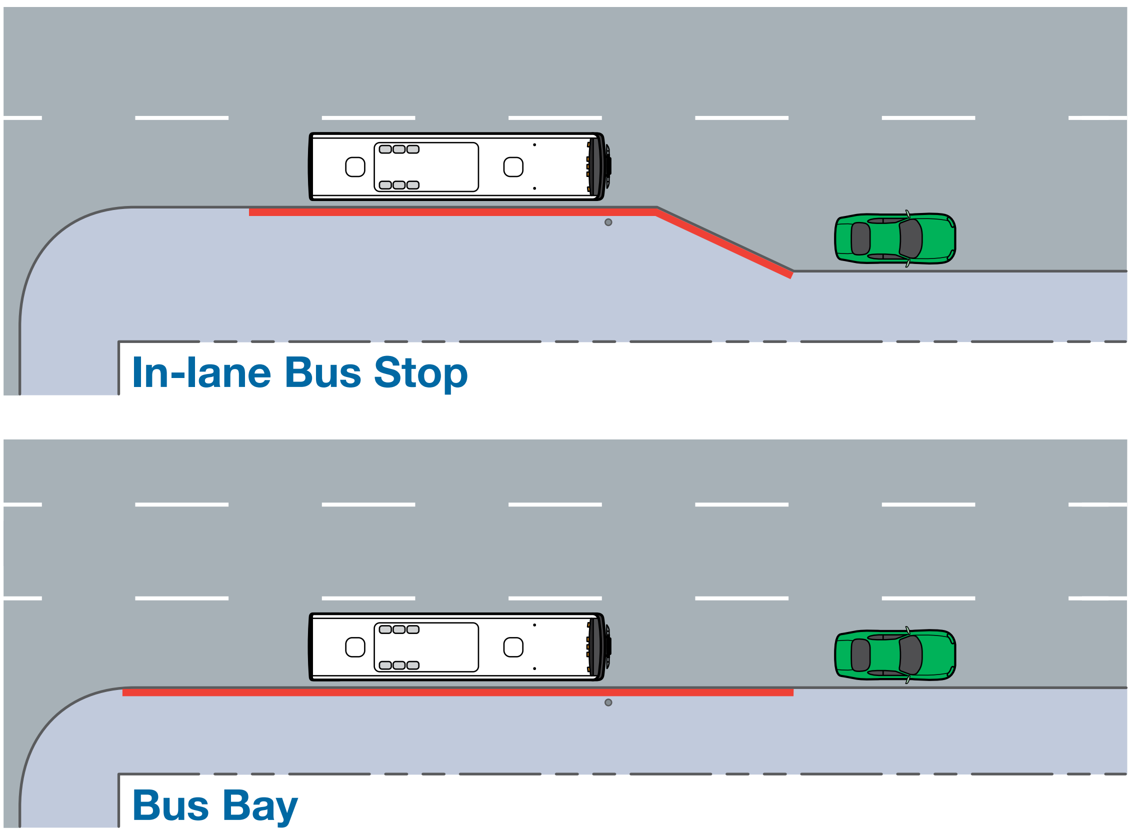


Figure 3.1 In-lane Bus Stops vs Bus Bays

In-lane bus stops are not desirable on high-speed roadways (speed limit of 60 km/h or greater) or in locations where a long dwell time is expected such as at key scheduled timing points or at the terminus of a route. Section 4.3 provides further information on the considerations for choosing the preferred bus stop configuration as well as design recommendations for in-lane bus stops and bus bays.

Having in-lane bus stops is increasingly beneficial for bus speed and reliability where there are higher transit frequencies and higher levels of congestion.

Table 3.2 In-lane Bus Stops

Transit Service	In-lane Stop	Notes
< 4 buses/hour	Suggested	Where there is low transit frequency, the primary benefit of an in-lane stop is a wider sidewalk which provides more space for waiting transit passengers and other sidewalk users.
4-15 buses/hour	Recommended	-
15+ buses/hour	Highly Recommended	-
RapidBus	Highly Recommended	In-lane stops are highly recommended for RapidBus service and are critical if bus lanes, approach lanes or queue jump lanes are not provided.

Note 1: See Section 4.3.1 for further information to identify the preferred bus stop configuration.

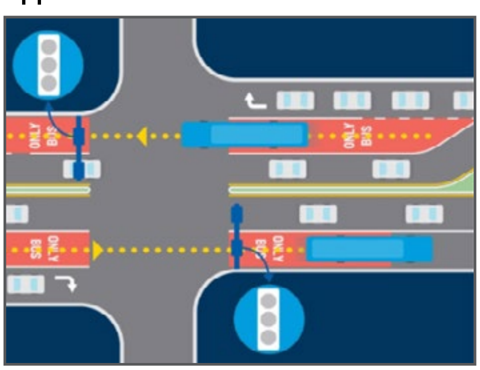
3.2.2 Intersections

The impact on bus speed and reliability should be considered when choosing a type of traffic control, traffic signal phasing/timing, laning and turn restrictions at intersections. Design interventions to maintain or improve bus speed and reliability should also be considered when vehicle capacity through an intersection is being planned to decrease, leading to worsened bus speed and reliability if no transit-supportive design interventions were implemented.

Appendix C provides a technical summary of transit priority measures. The following is a brief introduction to the most common design treatments:

- **Passive Transit Signal Priority** (TSP) is a traffic signal timing plan that favours transit movements through the intersection, without detecting buses in real-time. For example, green times for transit movements could be extended to minimize delay for the transit direction of travel.
- **Active TSP** uses real-time detection of buses to allow traffic signal controllers to make real-time adjustments to signal timing to reduce transit delays.
- If it is not possible to provide dedicated transit lanes at an intersection, it can be desirable to provide **Transit Supportive Intersection Laning** by selecting an intersection laning that minimizes transit delays.
- **Approach Lanes** and **Queue Jump Lanes** can be considered as a permanent solution or as an initial building block of a bus lane. An approach lane is a bus lane that only extends through one intersection and does not require any transit-specific traffic signal technology. A queue jump lane, is a bus-only or shared bus-right-turn-lane approaching an intersection. A transit signal head and technology to detect buses is required for buses to use a queue jump lane.

Approach Lane



Queue Jump Lane

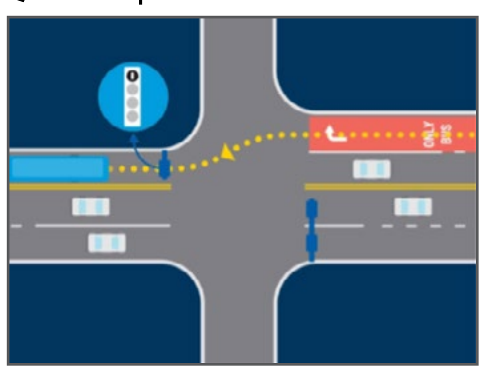


Figure 3.2 Approach and Queue Jump Lanes ***Source:*** *TransLink Transit Priority Toolkit*

3.2.3. Bus Lanes

Bus lanes are lanes that are reserved for buses either all day or select hours only. Depending on their context, they can be designed to also allow right-turning vehicles or vehicles accessing adjacent on-street parking. Bus lanes should be considered on streets that are planned to have 15+ buses/peak hour or RapidBus service. Bus lanes can also be considered on streets that have particularly high congestion or short blocks which make approach lanes or queue jump lanes impractical.

Fifteen standard buses can comfortably accommodate moving 800 people/hour which is similar to what a typical vehicle lane can accommodate through an urban signalized intersection (700-1000 vehicles/hour) but at a much lower user cost and environmental impact. Fifteen double-decker buses can move 1,500 passengers/hour.

Figure 3.3 illustrates a curbside bus lane operating westbound and an offset bus lane operating eastbound.

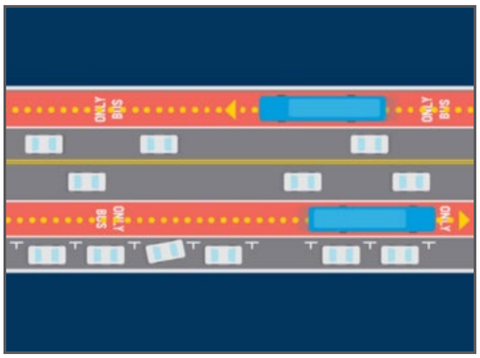


Figure 3.3 Bus Lane
Source: *TransLink Transit Priority Toolkit*

3.3 LANE WIDTH

Table 3.3 summarizes the minimum lane widths to support transit on straight street segments. TAC guidance regarding lane widening for buses on horizontal curves should be followed as the lane widths in Table 3.3 may not be sufficient on sharper horizontal curves. The minimum lane width is governed by the widest bus in the BC Transit fleet (Nova Bus) which has a total width of 3.2 m including mirrors.

Table 3.3 Lane Width

	Speed Limit	
	50 km/h or less	**60 km/h or more**
Adjacent to curb	Minimum: 3.5 m Desired: 3.7 m	Minimum: 3.6 m Desired: 3.7 m
Not adjacent to curb	Minimum: 3.3 m Desired: 3.5 m	Minimum: 3.5 m Desired: 3.6 m

Note 1: Lane widths include gutter width if provided

Figure 3.4 illustrates the minimum and maximum lane width for supporting transit service in various laning scenarios where the speed limit is 50 km/h or less.

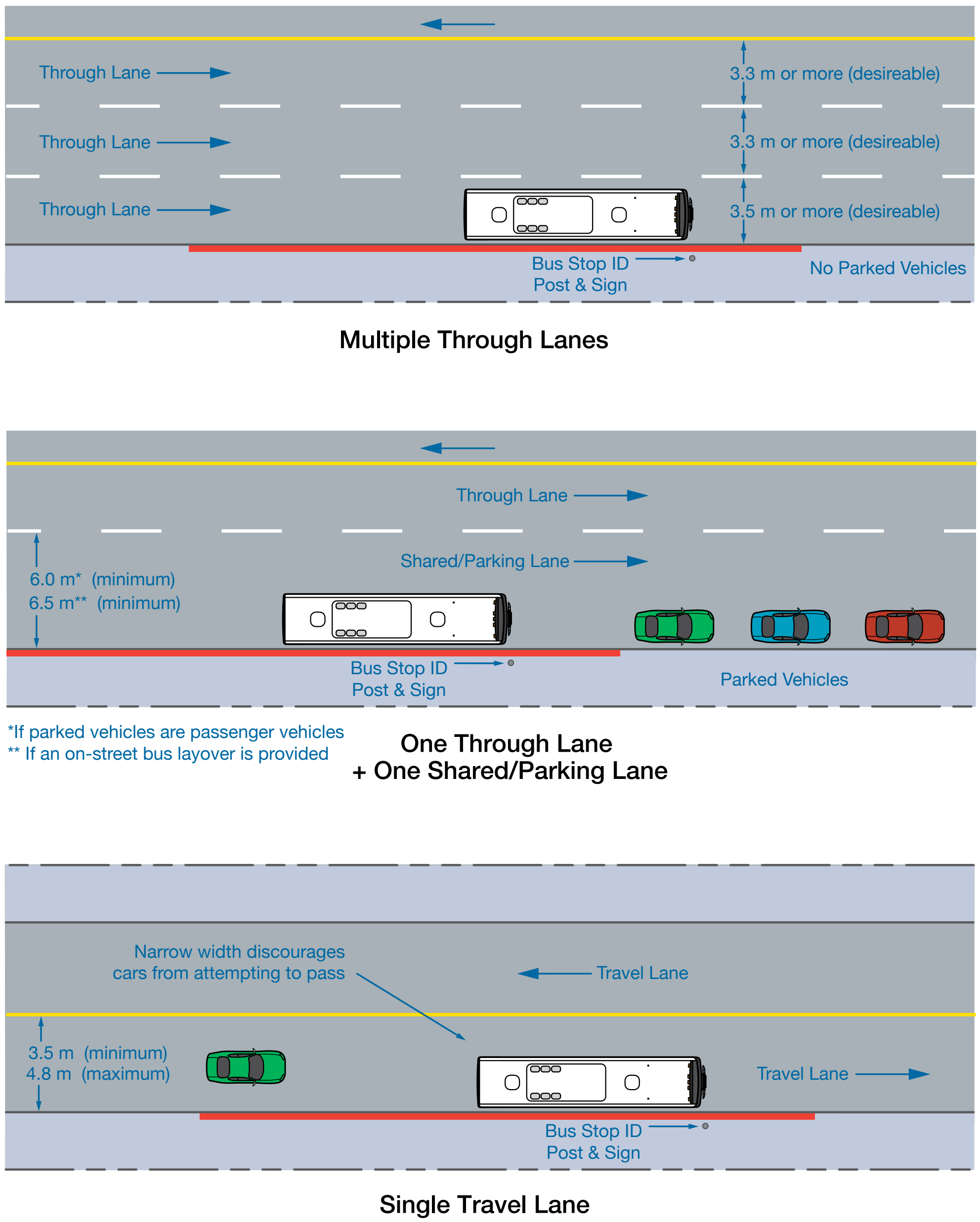


Figure 3.4 Lane Widths (Speed Limit of 50 km/h or Less)

Providing a lane below the recommended width increases the risk of bus collisions (which interrupts transit service and increases maintenance costs) and the workload of transit operators. Narrower lanes also require additional design considerations such as having a wider clear area along the curb and requiring longer entry and exit tapers at bus bays.

3.4 INTERSECTIONS

Figure 3.5 illustrates the paths of a bus making turn movements. A 0.45 m offset from parked vehicles and opposing vehicles should be maintained. Trade-offs from reducing this distance can be considered but safety should be the primary consideration. Where bus turning movements are relatively frequent, the design should exceed the minimum required dimensions.

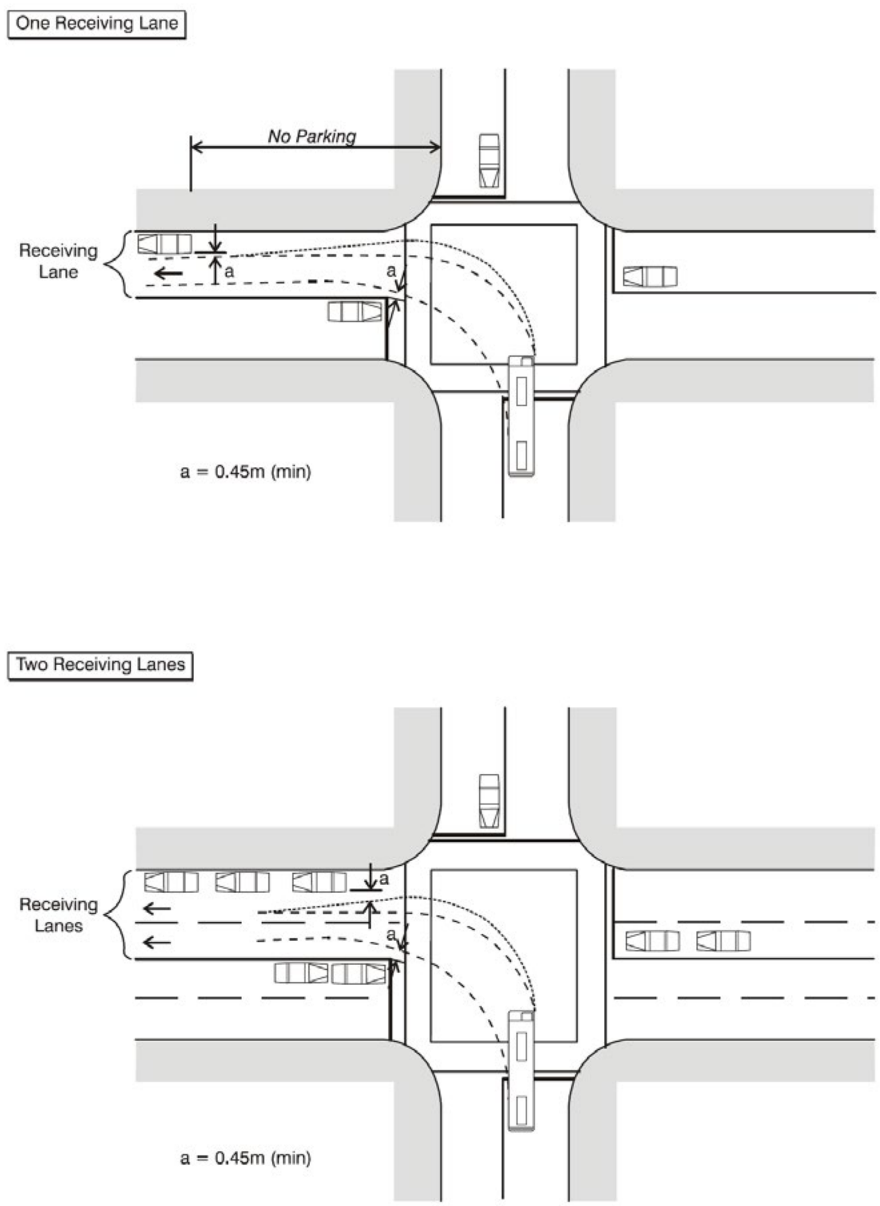


Figure 3.5 Bus Turning at Intersections
Source: *TransLink Transit Priority Toolkit*

3.5 ROUNDABOUTS

At roundabouts, the left-turn movement is usually the critical path for determining roadway width, however, all movements should be tested to confirm geometric requirements. The TAC Canadian Roundabout Design Guide should be consulted when they are utilized by transit vehicles.

- Mini-Roundabout: When the Inscribed Circle Diameter (ICD) is below 25 m, the central island may need to be flush with the roadway;
- Single-Lane Roundabout: ICD 25 to 60 m; raised central island may have traversable truck apron; and
- Multi-lane Roundabout: ICD 46 to 100 m; raised central island may have traversable truck apron.

Buses should not drive on the truck apron, as that could affect stability for standing passengers and increase wear on the vehicle.

In the roundabout planning stage, road designers can use a swept-path analysis software to test the BC Transit design vehicle. If the roundabout already exists, on-site testing will confirm performance.

When locating a bus stop near a roundabout, consider the following:

- **Vehicle speed:** Near-side stops are usually safer as vehicles slow down to enter the roundabout and accelerate exiting the roundabout.
- **Sight line obstruction:** A near-side stop should not obstruct pedestrian sightlines in or near a crosswalk.
- **Distance between near-side bus stop and crosswalk:** At the approach to a multi-lane roundabout, a near-side bus stop can be in the travel lane if it is set back at least 30 m from the crosswalk. Near-side stops should be far enough away from a splitter island in case a vehicle overtaking a stationary bus strikes the island, especially as the bus starts to pull away from the stop. At the approach to a single lane roundabout, a near-side bus stop can be in the travel lane at least 6 m from the crosswalk.
- **Distance between far-side bus stop and crosswalk:** Far-side stops should be located beyond the crosswalk, so they don't obstruct the view of crossing pedestrians. Bus bays can reduce the risk of vehicles queuing into the crosswalk or roundabout behind a stopped bus but may limit sight lines for bus drivers attempting to merge into traffic.

3.6 TRAFFIC CALMING MEASURES

Traffic calming measures should be minimized on bus routes. Traffic calming measures slow down transit service, making it a less desirable transportation mode and more expensive service to operate. Where traffic calming measures are implemented, transit design requirements must be considered to minimize the risk of vehicle damage and passenger safety. Table 3.4 summarizes the impact of traffic calming measures on transit.

Table 3.4 Impact of Traffic Calming Measures

Traffic calming measure	Impact on passenger safety	Impact on bus operational efficiency
Traffic circle	• No adverse impact, but avoid a series of traffic circles to minimize side-to-side movement	• The circulatory roadway width that provides traffic calming for passenger vehicles may result in buses having difficulty going through the traffic circle
Speed hump	• Shorter ramps result in greater passenger discomfort • A speed hump should not be installed immediately before or after a bus stop for passenger safety	• Buses need to reduce speeds significantly to travel over a speed hump • May cause damage to the suspension of the transit vehicle • A series of speed humps should be avoided along a bus route
Curb extensions	• No adverse impact	• The corner radii may impact the ability for a bus to complete a right turn
Raised intersections and crosswalks	• Should not be installed immediately before or after a bus stop for passenger safety	• A series of raised intersections/cross walks should be avoided along a bus route
Diverter	• No adverse impact	• Room must accommodate bus manoeuvre, and without obstruction by parked vehicles

Speed cushions are a potential alternative to speed humps and often preferred on transit routes and emergency response routes. Generally, less impactful to bus movement, speed cushions are 1.6 m wide so that they fit between wheels of larger vehicles such as buses and fire trucks. This allows a bus to pass with minimal effect, while still moderating speeding of motorists. Table 3.5 summarizes design guidance for vertical traffic calming measures on bus routes. Vertical traffic calming measures should be avoided while buses are turning.

Table 3.5 Design Guidance for Vertical Traffic Calming Measures

Device	Maximum Ramp Grade	Maximum Height
Speed Humps, Raised Intersections and Raised Crosswalks	1:20	80 mm
Speed Cushions	1:8	80 mm

3.7 MAXIMUM GRADE

Table 3.6 summarizes the maximum road grade for various scenarios. Designers should consider additional factors such as intersection density, number of lanes and heavy vehicle proportion when determining an appropriate grade.

Table 3.6 Maximum Road Gradients

Scenario	Maximum Grade
All scenarios except as noted below.	12%[1]
Buses comprise of at least 7% of the traffic stream.	10% (6% preferred)[2]
Gradients longer than 800 m.	8%[3]
Design speed of 100 km/h or greater.	5%[1]

Note 1: Based on TAC recommendations

Note 2: Based on MoTI recommendations

Note 3: Based on TransLink recommendations

3.8 GRADE CHANGE POINTS WITHOUT VERTICAL CURVES

On roadways with grade changes and no vertical curve, the transition at the grade change point should be no more than the transit design vehicle's permissible breakover, approach and departure angles.

Appropriate grade change points prevent the underside or the front/rear bumpers of the bus from contacting the pavement. Figure 3.6 illustrates the maximum changes in road grades at breakover, approach and departure points.

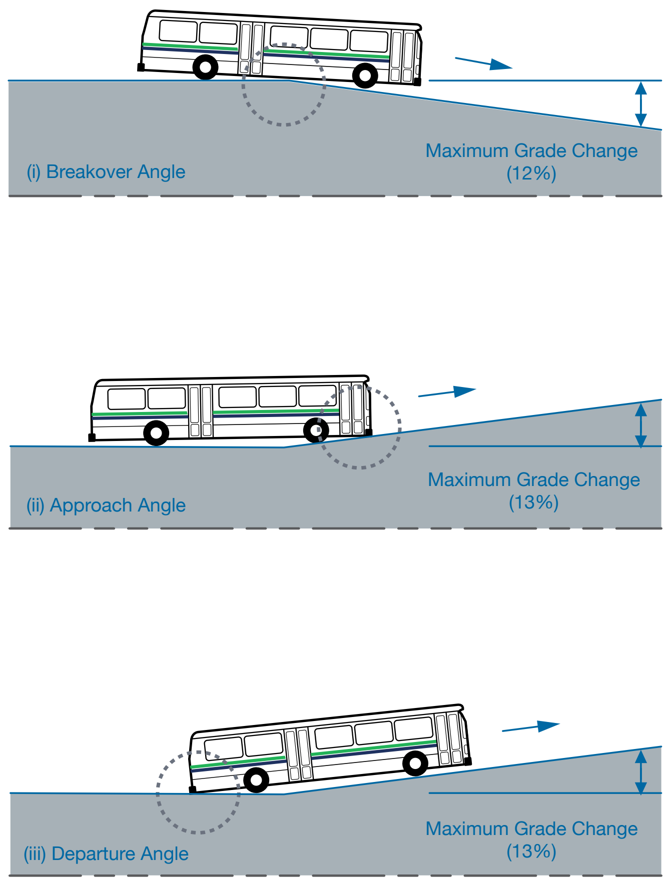


Figure 3.6 Grade Change Points for Standard Bus

3.9 SITE DISTANCES

When designing roads for transit operations, it's important to remember that sight distances for buses are different due to vehicle acceleration and deceleration capabilities, plus the need to protect passenger comfort and safety at all times.

Section 2.5 of the TAC Guide provides general sight distance requirements for vehicles and trucks.

Stopping Sight Distance

Stopping Sight Distance is the minimum sight distance criterion for transit vehicles (and other vehicles) at all times. The minimum Stopping Sight Distance for transit vehicles is the sum of perception and reaction distance, and braking distance:

- **Perception and Reaction Distance** is the distance travelled at operating speed from a driver's perception of an incident to their subsequent brake reaction time. It corresponds with the time elapsed from the instant a driver sees something and contacts the brake pedal. For design purposes, perception and reaction time is 2.5 seconds.
- **Braking Distance** is the distance travelled after hitting the brake to a complete stop. Bus deceleration rates in Section 2.5 are used to calculate minimum braking distance for transit vehicles. The maximum deceleration rate for Standard and Articulated Buses in Service Conditions is 1.1 m/s2; this rate is for normal operations where reasonable passenger comfort and safety is maintained. In Emergency Conditions, such as collision avoidance, the maximum deceleration rate for transit vehicles is 2.7 m/s2.

Table 3.7 Transit Vehicle Stopping Sight Distance

Initial Operating Speed (km/h)	Perception and Reaction Time (sec)	Service Conditions			Emergency Conditions		
		Perception and Reaction Distance (m)	Brake Distance (m)	Minimum Stopping Sight Distance (m)	Perception and Reaction Distance (m)	Brake Distance (m)	Minimum Stopping Sight Distance (m)
40	2.5	28	56	84	28	23	51
50	2.5	35	88	123	35	36	71
60	2.5	42	126	168	42	51	93
70	2.5	49	172	221	49	70	119
80	2.5	56	225	281	56	91	137
90	2.5	63	284	347	63	116	179

Higher deceleration rates (such as the emergency deceleration rate) should only be used if the operator is in an extreme situation. These rates should not be used for design purposes.

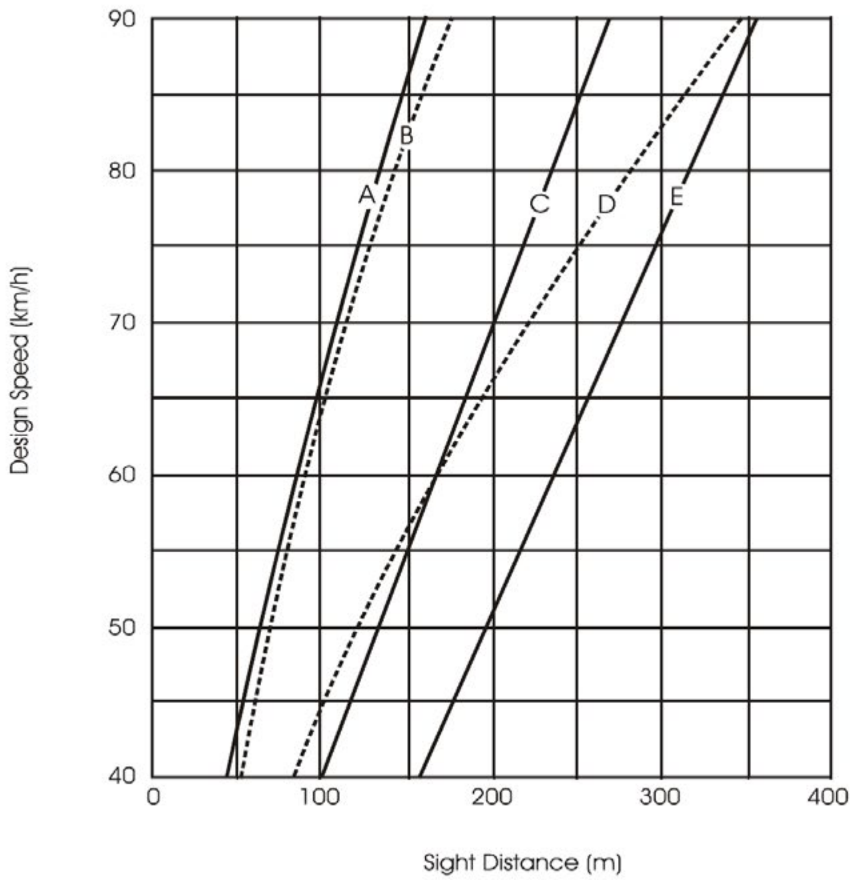
Decision Sight Distance

Sometimes, drivers must complete manoeuvres which require longer perception and reaction times, and actions more complex than a straightforward decision to stop. In these circumstances, use the Decision Sight Distance, a longer measure than the Stopping Sight Distance. According to Section 2.5.5 of the TAC Guide, Decision Sight Distance allows for a greater margin of error to react to unexpected circumstances and maintain safety in such complex situations. Table 2.5.6 (from the TAC Guide) provides the recommended Decision Sight Distance for a range of design speeds, depending on the type of manoeuvre.

Further research may be required to determine the Decision Sight Distance applicable to transit vehicles, particularly due to the fact that:

- The height of the bus operator's eye (1.80 m) is substantially higher than that of a passenger car driver (1.05 m); and
- Deceleration and acceleration rates of buses are significantly lower than those of a passenger car.

Whenever possible, Decision Sight Distance calculations should be used. If it is not possible to provide the Decision Sight Distance because of horizontal and/or vertical curvature, use traffic control devices to give advance warning of conditions ahead. See Figure 3.7 for Stopping and Decision Sight Distances requirements, as well specific Stopping Sight Distance calculations for transit vehicles in Service and Emergency Conditions.



A minimum stopping sight distance (TAC)	D minimum stopping sight distance (Service Conditions, buses)
B minimum stopping sight distance (Emergency Conditions, buses)	E desirable decision sight distance (TAC)
C minimum decision sight distance (TAC)	

Source: Adapted from TAC Geometric Design Guide for Canadian Roads

Figure 3.7 Stopping and Decision Sight Distances

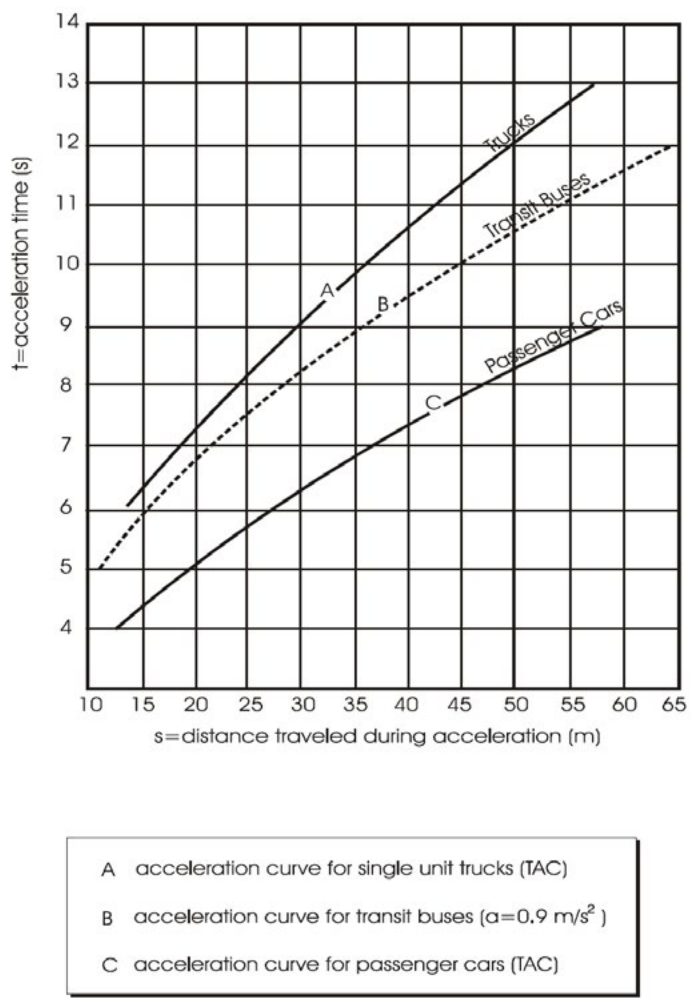
Crossing Sight Distance

The required crossing time depends upon the perception and reaction time of the bus operator, the bus acceleration time, the width of the major roadway, the length of the bus, and the speed of the approaching vehicle on the major roadway.

See Figure 3.8 for the distance travelled by a transit vehicle during acceleration. The minimum Crossing Sight Distance from an intersection along a major roadway can be calculated, as shown in Figure 3.9, based on:

1. The design speed of the major roadway (V),
2. The perception and reaction time of the crossing driver on the major roadway (j), and
3. The length of acceleration time for the bus to cross the major roadway (t).

Sight triangles are used to determine building setbacks at intersections, or if existing obstructions such as parking zones, advertising signs, trees, etc., need to be removed or relocated. The required sight triangle for a crossing manoeuvre at an intersection depends on the minimum Crossing Sight Distance for the bus on the stop approach and the approaching vehicle on the major roadway.



Source: Adapted from TAC Geometric Design Guide for Canadian Roads

Figure 3.8 Acceleration Time for Stopped Buses

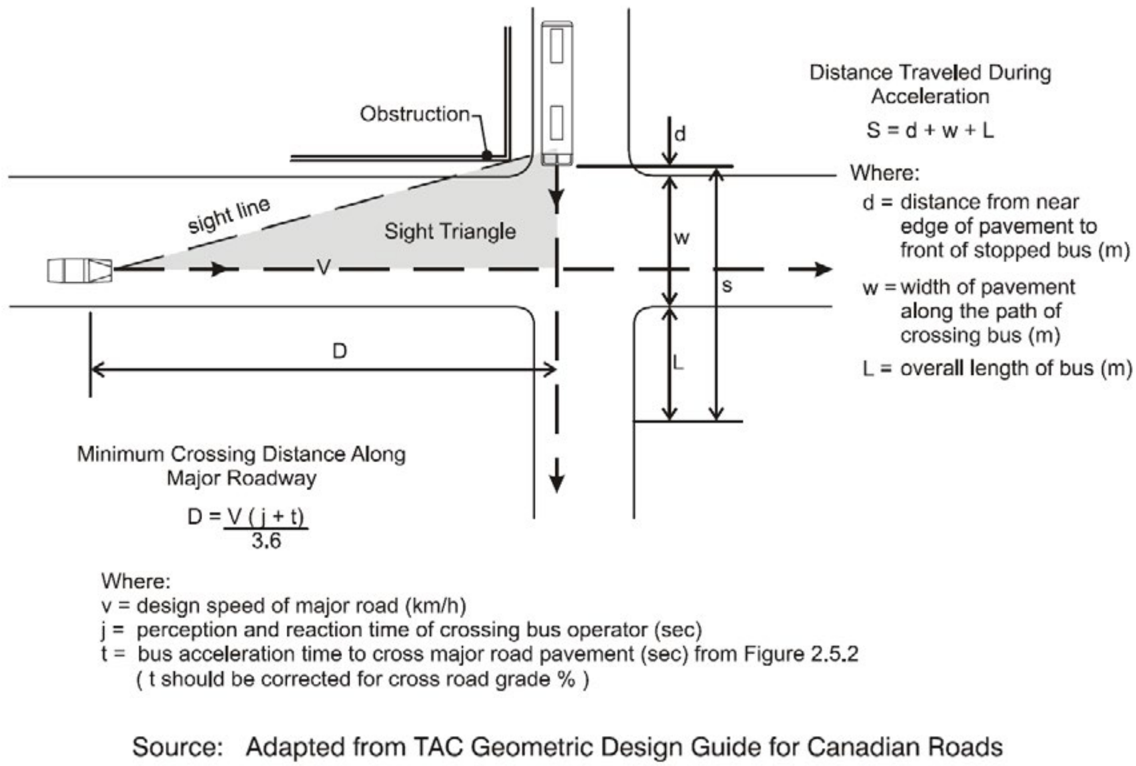


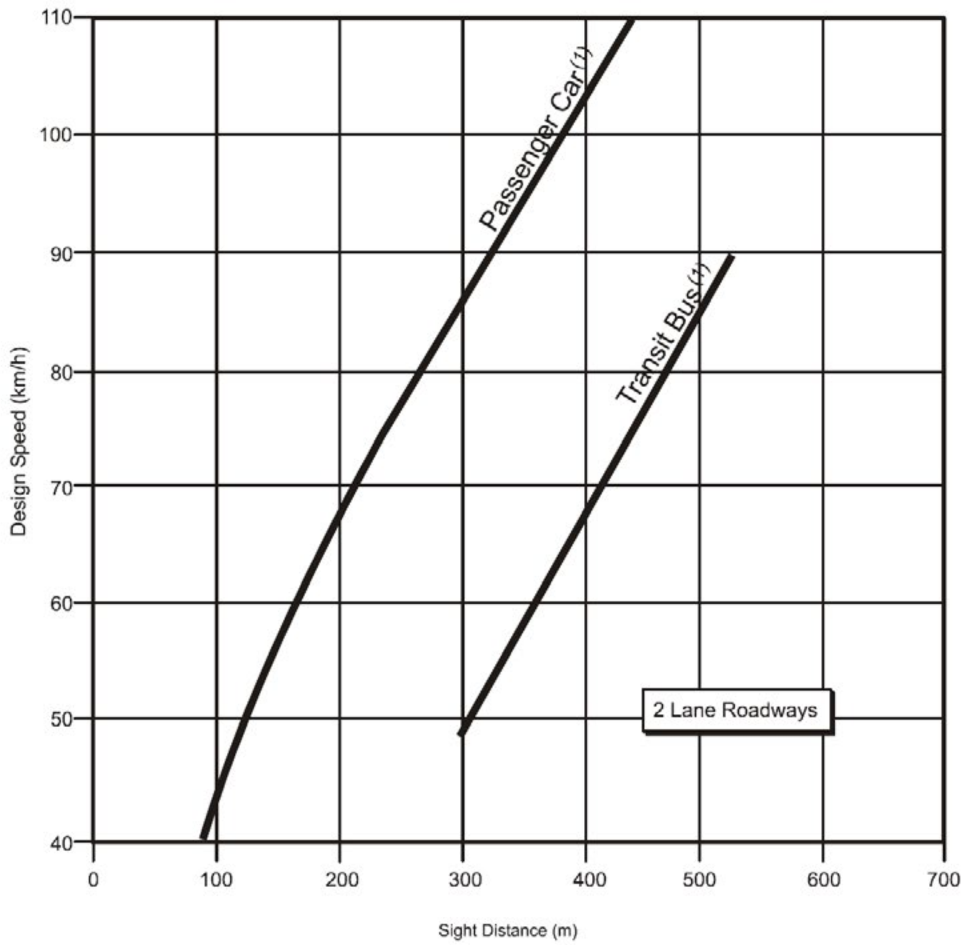
Figure 3.9 Minimum Crossing Distance along Major Roadway

Turning Sight Distance

A vehicle approaching from the right of a left-turning bus, at the instant the turning manoeuvre begins, should be sufficiently far away so that the turning bus can accelerate to a speed that does not significantly interfere with the approaching vehicle.

To determine the required Turning Sight Distance, TAC assumes the approaching vehicle will slow to 85% of the design speed at the intersection, and there will be a gap of at least 2 seconds between the turning bus and the approaching vehicle. Due to their acceleration characteristics, transit vehicles need more time to complete turns.

Figure 3.10 shows the Turning Sight Distance requirements for transit vehicles from a stop control on a minor road. An average acceleration rate of 0.9 m/s2 for transit vehicles (instead of 1.9 m/s2 used for passenger cars) is assumed for both left- and right-turning movements.



Note:
(1) Sight distance to a vehicle approaching from the right for a passenger car (or bus) turning left, or for a passenger car (or bus) turning right to a vehicle approaching from the left.

Source: Adapted from TAC Geometric Design Guide for Canadian Roads

Figure 3.10 Turning Sight Distance for Stopped Buses

Merging Sight Distance

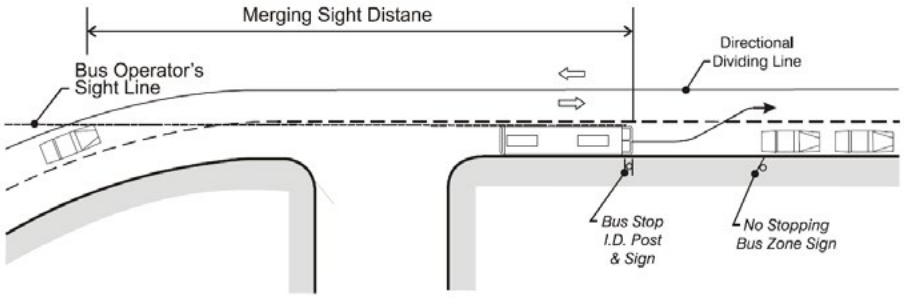
Merging Sight Distance is the distance between a merging bus to a vehicle approaching from behind. It's assumed the driver in the vehicle behind will not know exactly when the bus will start merging.

The minimum Merging Sight Distance for a transit vehicle is the sum of:

- The minimum Stopping Sight Distance of the approaching vehicle in the travel lane,
- The distance travelled by the same approaching vehicle at the design speed during the bus driver's 2.5 seconds of perception and reaction time, and
- The length of the bus.

The minimum Merging Sight Distance for transit vehicles can determine the location of bus stops and other transit facilities, especially on roadways with horizontal curvature and other obstructions such as buildings and trees.

Figure 3.11 illustrates the minimum Merging Sight Distance for transit vehicles leaving a bus stop for a range of vehicle speeds on a through-traffic roadway.



Merging Sight Distance, M.S.D. = S.S.D. + V+L

S.S.D. = Stopping Sight Distance
V = Distance traveled during the (2.5 sec) perception and reaction time of bus operator
L = Length of bus

Source: Adapted from TAC Geometric Design Guide for Canadian Roads

Design Speed (km/h)	S.S.D. (m)	V (m)	L* (m)	M.S.D. (m)
40	45	30	12	87
50	65	35	12	112
60	85	40	12	137
70	110	50	12	172
80	140	55	12	207
90	170	60	12	242

Note: *Assume Standard Bus

Figure 3.11 Merging Sight Distance for Stopped Buses

Pedestrian Sight Lines

Transit Operators have blind spots and visibility impairment zones on both sides of the bus, where they can't see other road users. Pedestrians boarding or alighting from transit vehicles, as well as other people walking near bus stops/facilities, may be unaware of a driver's restricted vision.

Operators need adequate pedestrian sight lines wherever there is any potential conflict between buses and pedestrians, for example where a bus turns right at an intersection or where a merge to the right must be made within a short distance.

Table 3.8 Pedestrian Sight Distance Formula

Pedestrian Sight Distance		
$PSD = 0.278vj + \frac{0.0386v^2}{d}$		
Var.	**Meaning**	**Typically Assumed Value**
v	Speed within Bus Loop (km/h)	20 km/h
j	Perception and Reaction Time of Bus Driver (s)	2.5 s
d	Deceleration Rate (m/s^2)	1.1 m/s^2 (desirable)

Source: TransLink Bus Infrastructure Design Guidelines

Based on assumed values, the typical pedestrian sight distance is 28 m. However, the input values may be different at certain bus stops, and designers are encouraged to validate with BC Transit. It's also important to note that the sight distance is an empirical value under ideal weather conditions. It is reduced or obstructed during adverse weather conditions.

CHAPTER 4 Bus Stops

4.1 INTRODUCTION

This chapter outlines how to plan and design bus stops. A qualified professional should review the appropriateness of a proposed bus stop location while taking into account the local context. Planning bus stops is an iterative process considering:

- Safety and accessibility;
- Stop intervals;
- Placement;
- Configurations; and
- Amenities.

4.2 BUS STOP PLACEMENT

4.2.1 Stop Spacing

Bus stop spacing depends on the type of transit service, land use and the availability of safe stopping locations. The following table summarizes typical bus stop spacing based on type of transit service; however, they may vary between transit systems.

Table 4.1 Recommended Horizontal Clearance

Type of Service	Stop Spacing
Rapid Transit Network (RTN)	800 m to 2,000 m
Frequent Transit Network (FTN)	300 m to 500 m
Local Transit Network (LTN)	250 to 300 m
Targeted Transit	Varies

4.2.2 Bus Stop Location Options

Bus stops are commonly placed in a location which balances safe, accessible and convenient access by transit users as well as other road safety and operational constraints.

BC Transit prefers stops to be located after an intersection (far-side), however, before an intersection (near-side) and mid-block can also be appropriate depending on the circumstances.

Far-Side Stops

Advantages

Putting a bus stop on the far side of an intersection is generally preferred over the near-side or mid-block configuration because:

- Pedestrians and vehicles travelling in the same direction have a clearer view of intersection traffic controls (for example, a STOP sign or traffic signals);
- Buses pulling in or out of a near-side bus stop can cause queues and delays at a traffic signal or STOP sign;
- Stopped buses are not blocking right-turn vehicles on the near-side, increasing right-turn throughput;
- There is reduced risk of bus passengers stepping in front of the bus to cross the street; and
- Pedestrians cross the intersection behind rather in front of the bus.

Disadvantages

- Slightly increased walking distance to the intersection crosswalk for bus passengers;
- Bus operators have restricted view of passengers approaching from the intersection;
- For a far-side stop sited beyond a channelization island or in an acceleration lane, potential weaving conflicts between buses approaching the stop area and right-turn traffic from the intersecting street; and
- Traffic behind a stopped bus could potentially extend into the intersection, causing delays and potential safety concerns for other road users. This is particularly critical for far-side stops with long dwell time.

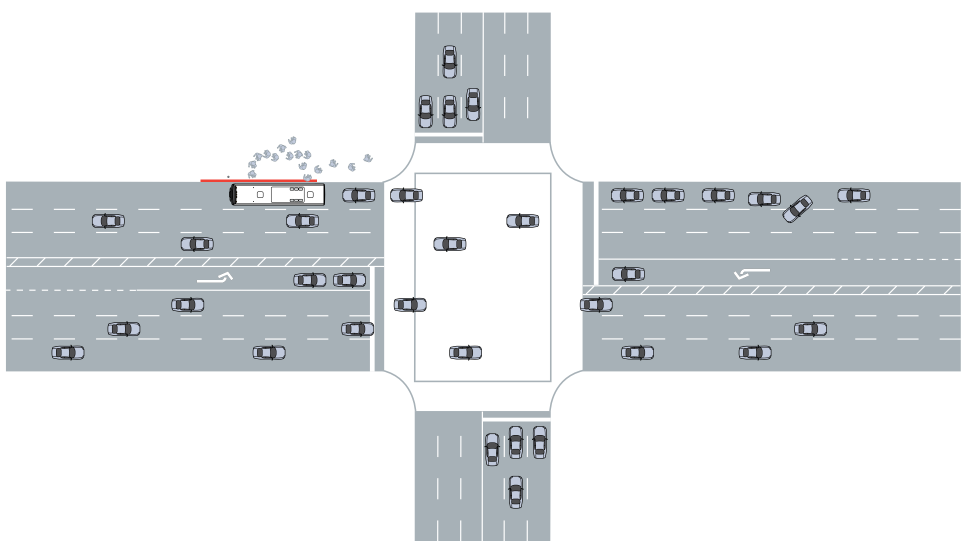


Figure 4.1 Potential Disadvantage of a Far-Side In-lane Bus Stop

Near-Side Stops

Advantages

- When used in combination with a far-side stop, a near-side stop can facilitate passenger transfers between two bus routes (see Figure 4.12); and
- When a quadrant has a significantly higher transit ridership or a distinct demographic that requires increased accessibility, (e.g. schools, hospitals, parks, etc.).

Disadvantages

- If significant, vehicle queues on the curb-lane can delay buses getting to the stop;
- Stopped buses can limit traffic control sightlines for drivers travelling in the same direction; and
- If right-turn vehicle volumes are significant, a stopped bus could block right-turn traffic movements, causing weaving conflicts.

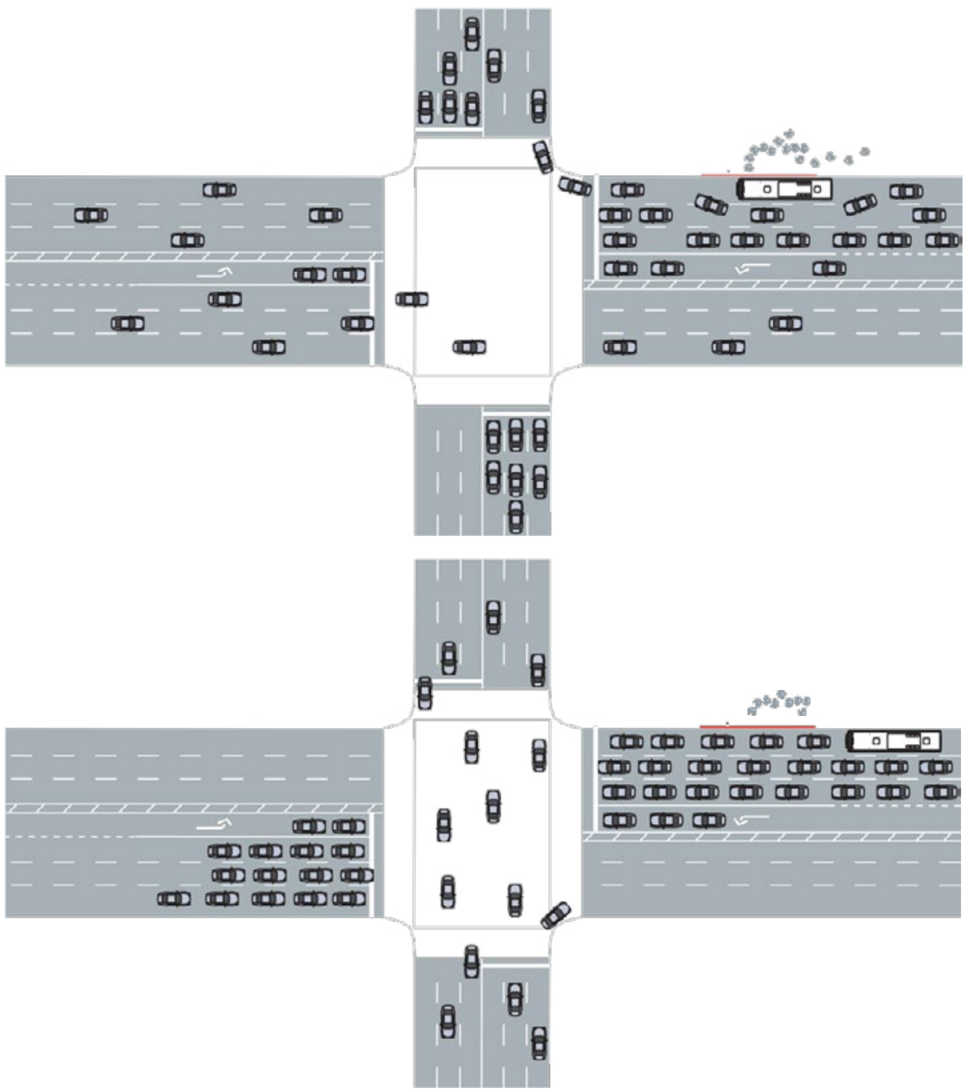


Figure 4.2 Potential Disadvantages of a Near-side Bus Stop

Mid-Block Stops

Advantages

If local trip generators justify its use, mid-block configuration advantages include:

- More available space on the sidewalk to accommodate waiting passengers; and
- The stop location can correspond to particular ridership generator(s) between adjacent intersections.

Disadvantages

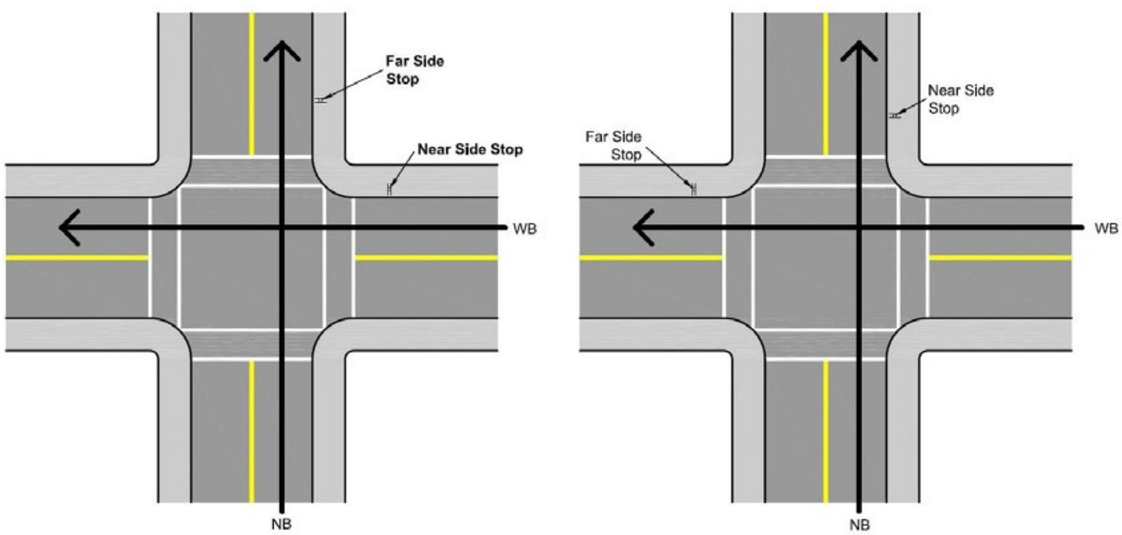
- Crossing the street at an unmarked location near the bus stop; and
- Increased walking distance for passengers making transfers if the connecting bus route is at a different location.

Transit Signal Priority Considerations

Transit Signal Priority (TSP) improves transit travel times and customer experience by altering traffic signal timings to accommodate approaching transit vehicles. TSP is most effective at far-side bus stops and can be inefficient at near-side stops.

Route Transfer Considerations

Bus stops should coordinate with passenger transfer movements (see Figure 4.12, especially when a large transfer volume is anticipated between two transit services. For example, a near-side bus stop can enhance passenger transfers on two intersecting streets.



The diagram (left) illustrates a preferred scenario where convenience is provided for a passenger transferring from a westbound route to a northbound route without having to cross the intersection at the crosswalk. The diagram (right) illustrates a less ideal situation where the same passenger would have to cross the intersection to make the transfer.

Figure 4.3 Bus Stop Placement for Route Transfer Coordination

4.2.3 Distances from Intersections and Crosswalks

The bus zone should be placed in a location where it can be safely accessed by buses and does not negatively impact the safety of other road users. The following figures describe the minimum clearance distances from intersections and crosswalks, however, site-specific conditions (such as horizontal and vertical road curvature, lane width, landscaping, vehicle speeds and vehicle volume) could warrant longer clearance distances.

Minimum clearance distances are provided for intersections (stop-controlled and signalized) as well as unsignalized pedestrian crossings. If a bus stop is near an intersection that has an unsignalized pedestrian crossing, then the longer of the two minimum requirements should be used. Design advice for locating bus stops near roundabouts is provided in Section 3.5.

Intersection Clearances

Table 4.2 Minimum Clearances from Intersections

Situation	In-lane Stop	Bus Bay
Far-side (after a bus travelling straight through the intersection)	6 m	18 m (1)
Far-side (after a bus turning left or right at the intersection)	14 m	18 m
Near-side	6 m	14 m

Note 1: Can be reduced to 6 m if the intersection design allows buses to merge lanes through the intersection

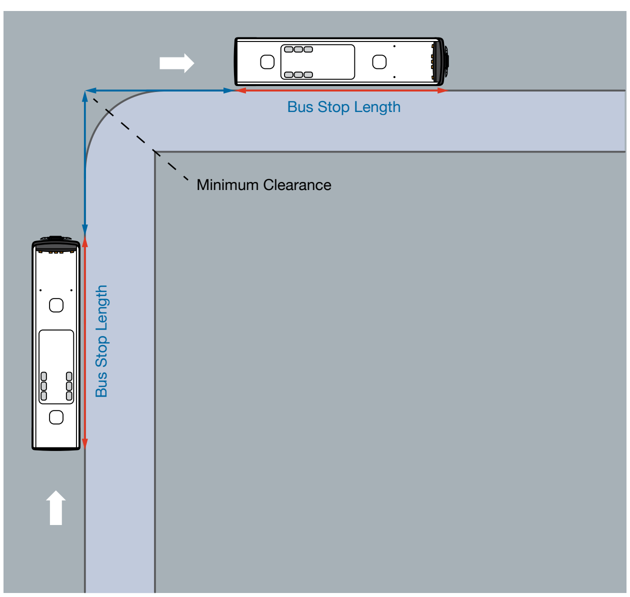


Figure 4.4 Intersection Clearances

Crosswalk Clearances

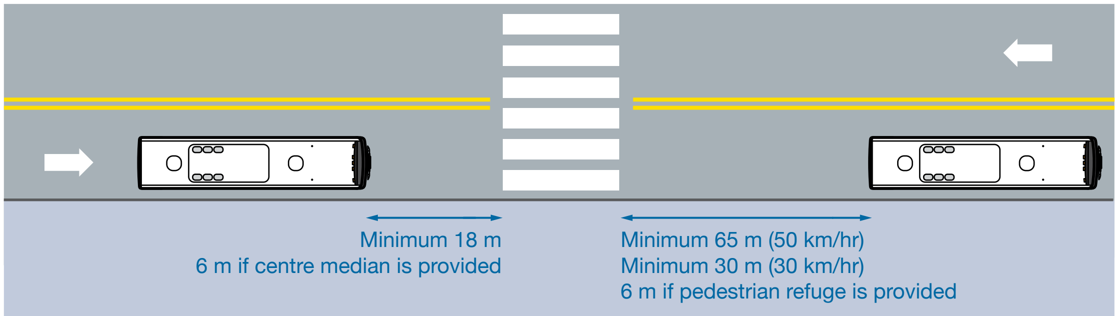


Figure 4.4: Distance to Unsignalized Crosswalk – One Lane per Direction – In-lane Stop

Buses stopping in the only travel lane before an unsignalized crossing should stop at least 18 m before the crosswalk. A double yellow centre line is recommended to legally restrict vehicles from passing stopped buses which could be a safety risk at the crossing. The clearance can be reduced to 6 m if a centre median is provided to physically prevent vehicles from passing stopped buses.

Bus stops placed after an unsignalized crossing, should be at least 65 m from the crossing at a 50 km/h design speed and at least 30 m from the crossing at a 30 km/h design speed so that stopped buses do not obscure the sightline between crossing pedestrians and vehicles travelling in the opposite direction from the stopped bus. The clearance can be reduced to 6 m if a centre median with pedestrian refuge is provided.

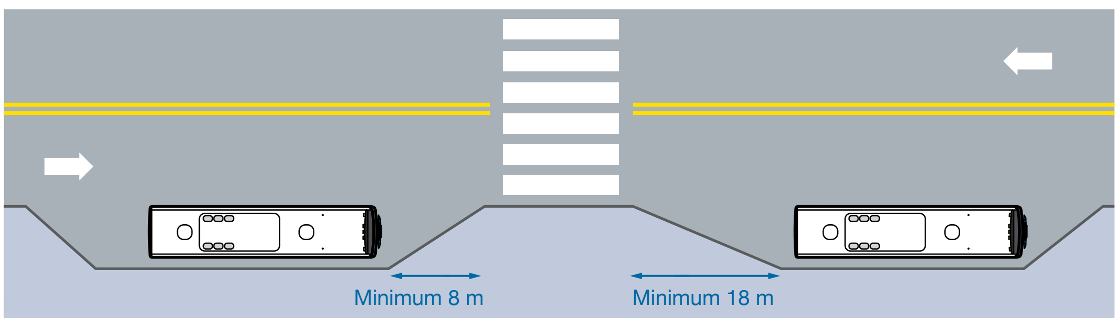


Figure 4.5: Distance to Unsignalized Crosswalk – One Lane per Direction – Bus Bay

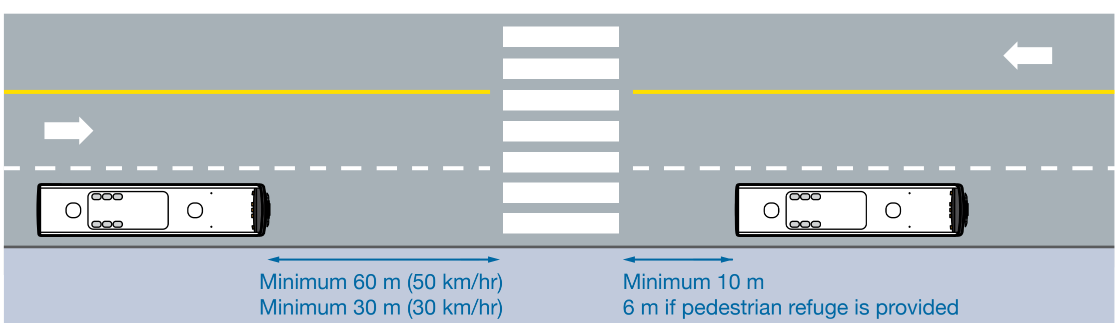


Figure 4.6: Distance to Unsignalized Crosswalk – Two Lanes per Direction

When there are two or more lanes per direction, a bus stop before an unsignalized crossing needs to be positioned so that stopped buses do not obscure the sightline between crossing pedestrians and vehicles travelling in the second travel lane.

4.2.4 Distances from Driveways

Bus stops should be kept away from driveways whenever possible to minimize conflicts between buses and vehicles. If it can't be avoided, see Figure 4.7 for the minimum requirements, and also consider:

- Turning movement volumes of the driveway;
- Type, spacing and distance between access driveways near the stop;
- Peak usage of the bus stop compared to peak usage of the access driveway;
- Type of buses that use the bus stop;
- Available space to accommodate passengers and amenities;
- Expected service level and customer boarding/alighting volumes at the bus stop;
- Sight line requirements between passengers, bus operators and drivers accessing the driveways; and
- Possibility that traffic queued at the driveway will affect the efficient operation of the bus stop.

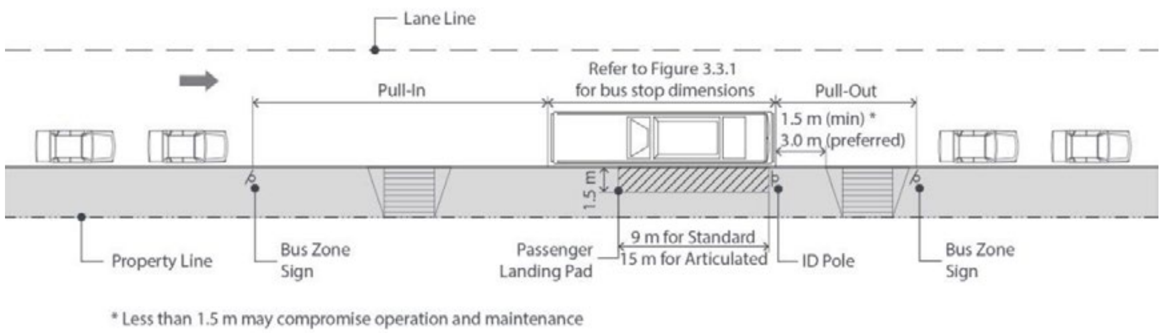


Figure 4.7 Requirements for Bus Stop between Access Driveways
Source: TransLink Bus Infrastructure Design Guidelines

4.3 BUS STOP CONFIGURATIONS

4.3.1 Overview

There are three general bus stop configurations:

- **In-lane stops** where buses stop in the curbside travel lane;
- **Bus bays** where buses can stop outside of the typical road width either for an extended stop or to not interrupt high-speed vehicle flow.

In-lane stops are the default bus stop configuration. Removing the need for buses to pull into and out of a general-purpose traffic lane has multiple benefits including:

- More space for passenger amenities and pedestrians.
- More efficient and reliable transit travel speeds.
- More comfortable transit experience.
- Less pavement wear from buses turning out of bus bays.
- Less transit vehicle wear.

Bus bays should only be provided in the following scenarios:

- Streets with high vehicle speeds (60 km/h or higher).
- Stops where buses are expected to dwell for an extended period, such as timing points and layover locations.
- Incorporated into a bus queue jump lane.
- Allows express buses stopped in their travel lane to pass stopped non-express buses stopped in a bus bay.

4.3.2 Bus Stop Length

The bus stop design guidance throughout this guide is based on each bus stop only needing to accommodate one bus at a time, however, there are circumstances when multiple buses need to be accommodated, and a longer bus stop is needed.

The following table provides general guidance for when bus stops need to accommodate one, two or three buses boarding passengers simultaneously. This guidance is based on buses only boarding/alighting passengers and does not consider additional space requirements if buses need to stop for a longer duration due to an operational requirement (e.g. layover, transit operator switch-off, timing point).

Table 4.3 Bus Stop Length

Buses/hour	Bus Stop Capacity	Bus Stop Length
1-12	1 bus	15 m
12-25	2 buses	30 m
25-60	3 buses	45 m

Bus stops with high boardings or frequent usage of the bus's accessibility ramp may need to consider additional bus stop capacity than the guidance provided in the table due to longer dwell time. In addition, a bus stop serving a high number of low frequency routes will likely have more times with multiple buses at the bus stop than a bus stop with fewer routes at a higher frequency, even if the combined number of buses/hour is the same.

Bus stops that serve over 25 buses/hour and multiple routes that go to different destinations should consider splitting the bus stop so that routes with different destinations stop at different locations.

4.3.3 Bus Stop Zone Signs and Markings

The bus stop zone consists of the bus stop length (see Section 4.3.2) plus the distance before and after a stopped bus that is used for buses accessing and egressing the stop. The bus stop zone is illustrated as a red line in the bus stop configurations shown in the remainder of Section 4.3.

The road authority is required to keep the bus stop zone clear from stopped vehicles. This can be accomplished through painting the curb red and/or signs. The preferred arrangement for signs is to install a bus zone sign (see Figure 4.8) at both ends of the bus zone with arrows pointing towards the bus stop.

Figure 4.8 Bus Zone Sign

Source: Ministry of Transportation and Transit

4.3.4 In-Lane Bus Stop (No On-Street Parking)

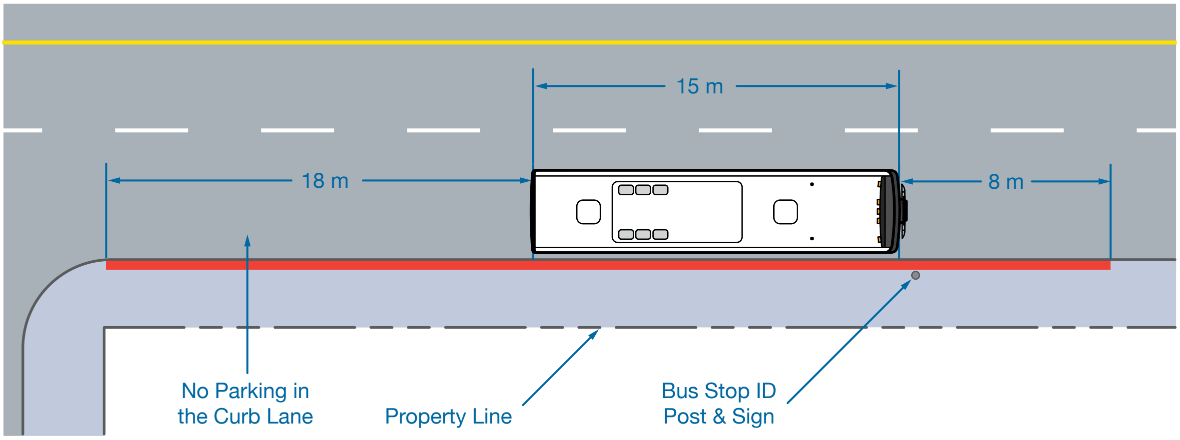


Figure 4.9 In-lane Bus Stop

4.3.5 In-Lane Bus Stop (On-Street Parking)

Refer to Figure 4.10 for the layout of a bus bulge which creates an in-lane stop on a street with on-street parking. The depth (D) of the bus bulge is typically equal to the depth of the parking lane.

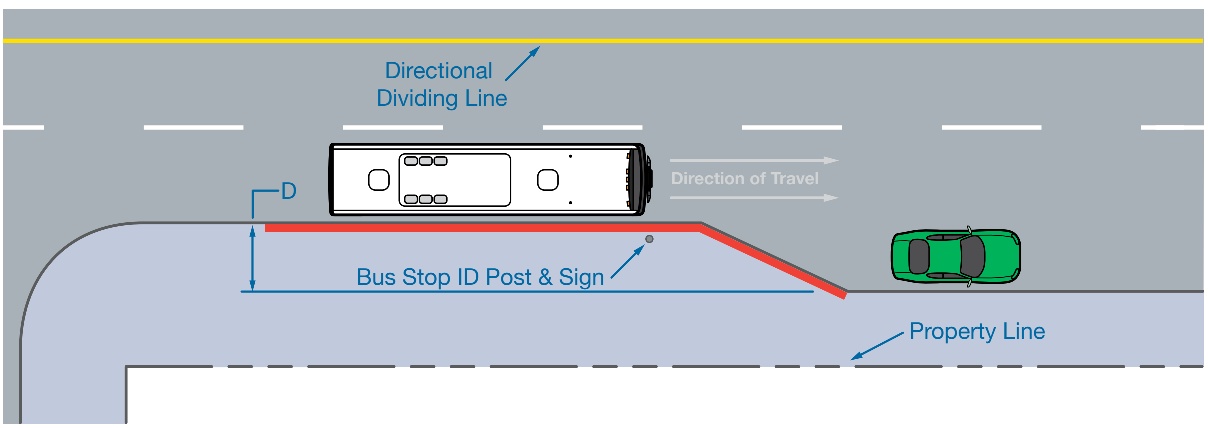
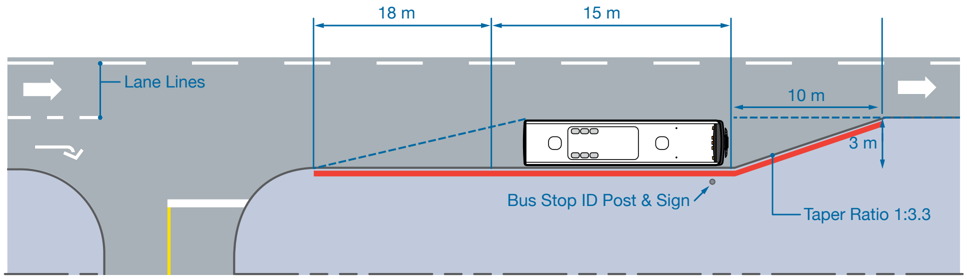


Figure 4.10 Bus Bulge

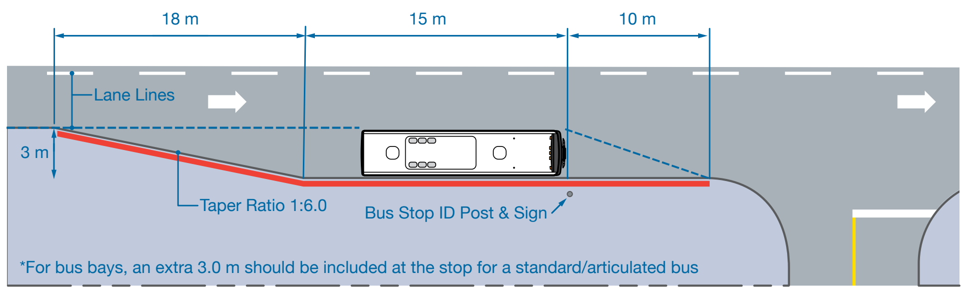
4.3.6 Bus Bay (No On-Street Parking)

Bus bays are short pull-over zones adjacent to main travel lanes, where buses can stop to pick up passengers without interfering with regular traffic flow. Refer to Figure 4.11 for design details. Bus bays should provide a curve in the transition area as opposed to point to ease maintenance.

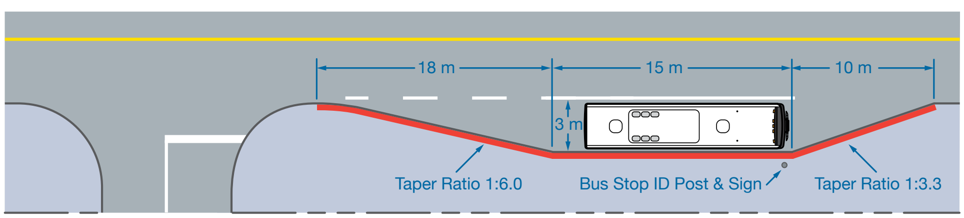
On a typical urban arterial road, operators slow down to about 30 km/h when entering and exiting a bus bay. On exit, bus operators usually accelerate after they have merged back into the adjacent travel lane, not within the taper of the bus bay.



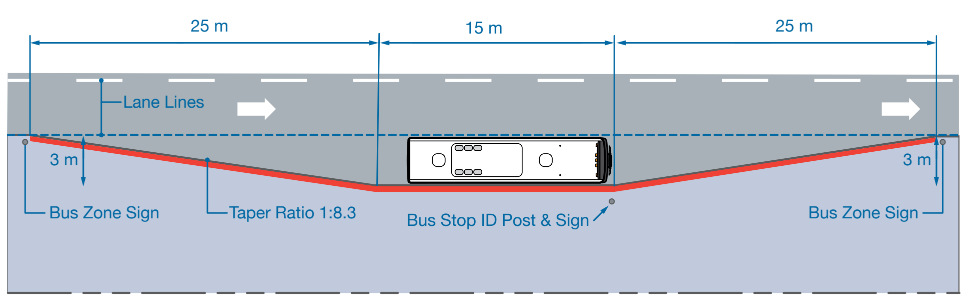
Near Side—Speed Limit < 50 km/h



Far Side—Speed Limit < 50 km/h



Mid-Block—Speed limit < 50 km/h



Mid-Block—Speed Limit > 60 km/h

Figure 4.11 Bus Bay (No On-street Parking) Configurations

4.3.7 Bus Bay Design (On-street Parking)

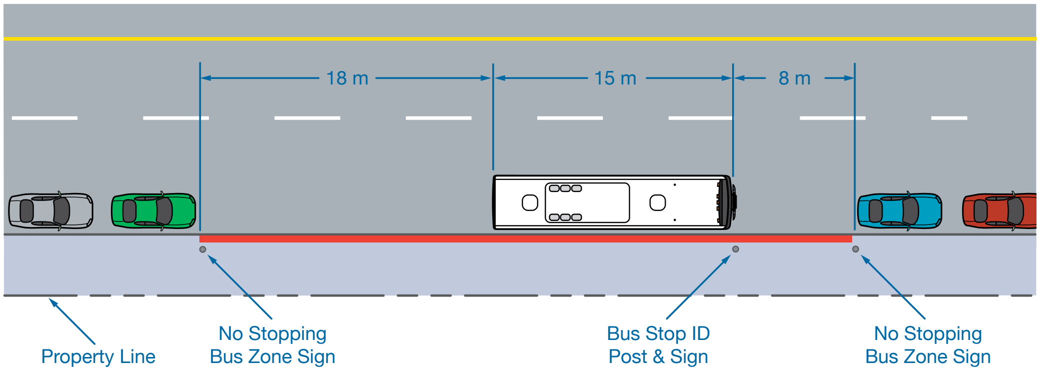
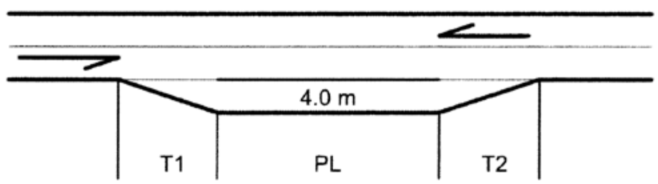


Figure 4.12 Mid-Block Bus Stop Configuration

4.3.8 Bus Bay Design (Highway)

In a highway environment, BC Transit adopts MoTT's pull-out guidelines for bus bay design.



Note: Minimum Pullout width is 4.0 m. This is a shoulder widening. Parking should be prohibited in the pullout area. The minimum width is to avoid pavement degradation by off-tracking or wide vehicles. Pavement design should be as per travel lanes.

Figure 4.13 Rural/Highway Pullout Design

Source: BC MoTT TAC Supplement

Table 4.4 Rural/Highway Pullout Lengths

Reference Speed km/h	T1 m and (ratio)	Minimum PL (m)	Desirable PL (m)	Maximum PL (m)	T2 m and (Ratio)
50	30 (7.5:1)	30	70	200	30 (7.5:1)
60	40 (10:1)	45	120	300	40 (10:1)
70	50 (12.5:1)	65	190	500	50 (12.5:1)
80	60 (15:1)	85	270	600	60 (15:1)

Note: Use the ratio if Pullout width is other than 4.0 m. Minimum width is 4.0 m. This is a shoulder widening. The minimum width is to avoid pavement degradation by off-tracking or wide vehicles. Pavement design should be as per travel lanes.
Source: MoTT TAC Supplement

4.3.9 Tiered Bus Stops

Tiered stops combine an in-lane bus stop and a bus bay to better serve express and local buses. The bus bay should be placed upstream of the in-lane stop so local buses, when pulled into the bus bay, do not impact through traffic and express buses. Tiered stops emphasize service priority and provide opportunity for timed transfers. The bus bay can also be used as a timing point or layover location for the local bus route.

- Stop amenities can be placed on the bulge to preserve sidewalk capacity and throughput; and
- Concrete bus pads are S-shaped, conform to the curb, and continuous throughout the stop.

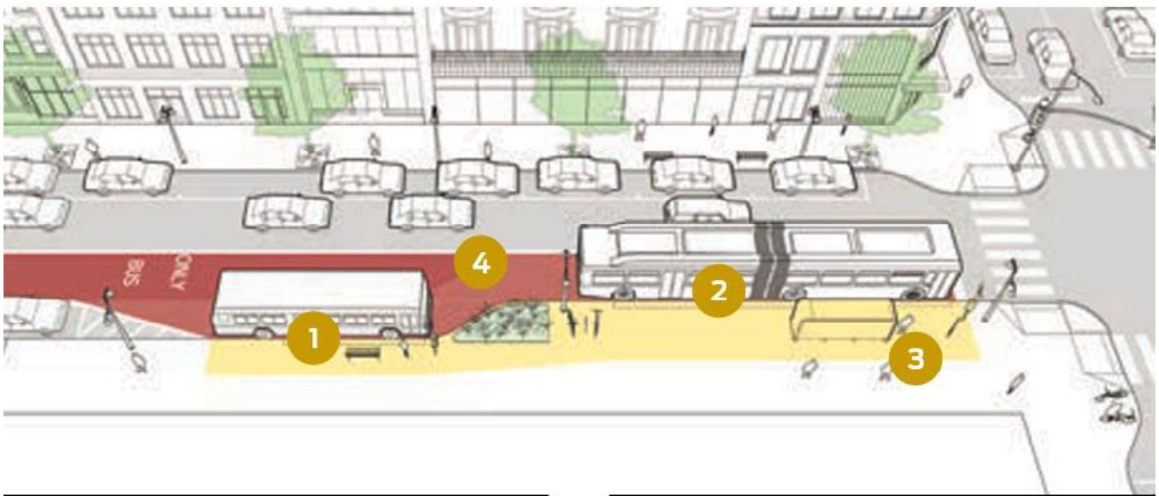


Figure 4.14 Tiered Bus Stop
Source: NACTO Transit Street Design Guide

4.3.10 Concrete Bus Pads

Buses are heavy and can cause deformation in asphalt pavement – especially in locations where they start, stop or turn. In particular, bus stops are susceptible to pavement damage. Although concrete bus pads are more expensive than normal asphalt paving, they will reduce long-term maintenance costs and help to retain roadway surface shape, drainage and skid resistance. Installing a concrete bus pad may result in lower lifecycle costs at bus stops that have some or all the following characteristics:

- Bus bay (as opposed to an in-lane stop);
- Used by double deckers;
- High transit frequency;
- Buses layover at the end of a route for an extended duration.

Concrete bus pads should be a minimum of 3 m wide, stretch across the entire lane or bay where a bus stops, and be long enough to extend beyond the entire wheelbase of a bus. Concrete bus pads should consist of reinforced concrete with an appropriate road base for the local conditions.

4.4 TYPICAL LAYOUTS

4.4.1 Urban Bus Stop Layout

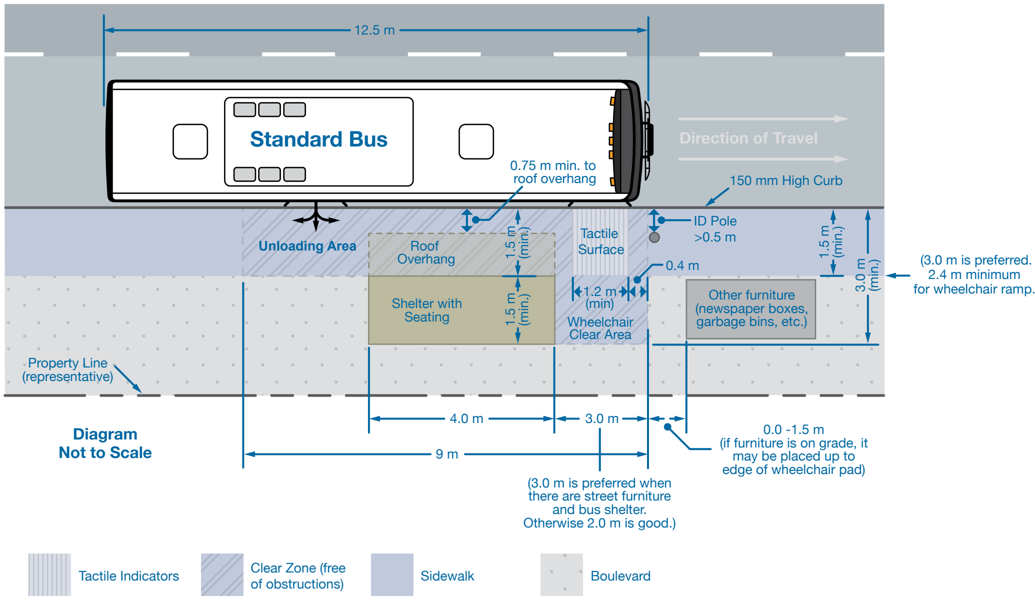


Figure 4.15 Urban Bus Stop Layout

The bus stop ID pole needs to be at least 0.5 m from the face of the curb. If the sidewalk is less than 2 m wide, the ID pole can be placed at the back of the sidewalk as long as it is in a visible location to passengers and transit operators.

Bus stops are preferred to be in flat locations. Sidewalks with grades greater than 8% are not considered accessible. A sidewalk crossfall of 2% is recommended.

Refer to Appendix B for tactile surface details.

4.4.2 Rural Locations

Rural roads do not always have sidewalks. In these locations, a landing pad can be constructed to create an accessible bus stop. The pad should have a minimum depth of 3.0 m if a shelter is provided. The pad should have a curb ramp (maximum 8% slope) at each end to direct passengers away from the road.

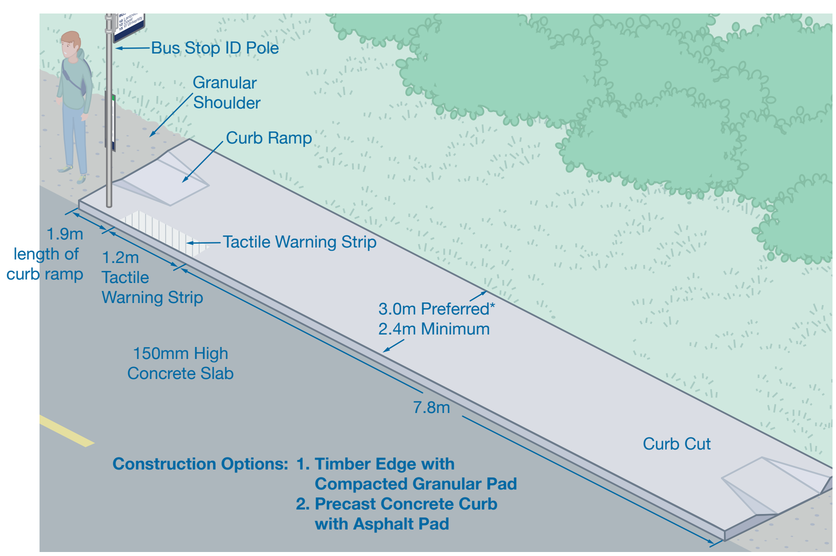


Figure 4.16 Rural Bus Stop Layout

4.5 CYCLING INFRASTRUCTURE INTEGRATION

4.5.1 Design Considerations

This section provides design considerations for when buses stop in a bike lane, adjacent to a bike lane or adjacent to a multi-use path. Buses are allowed to stop in one-way painted bike lanes if the location is signed and marked appropriately. Buses cannot stop in two-way bike lanes or in multi-use paths.

For one-way streets, the BC Active Transportation Design Guide recommends bicycle lanes be located on the left side of the roadway to eliminate conflicts between cyclists and transit vehicles. When conflicts cannot be eliminated, transit stops should be carefully designed.

As stated in Section 3.4, vertical obstructions should be avoided within 50 cm of travel lanes that buses utilize. Therefore, any rigid posts or signs on barriers separating cycling infrastructure from travel lanes should be placed at least 50 cm from the travel lane. Posts or signs within the 50 cm clearance zone should be flexible and less than 1.2 m tall so that they do not damage buses if they are contacted.

4.5.2 Island Platform Bus Stops

The Design Guide for Bus Stops Adjacent to Cycling Infrastructure should be used when designing bus stops adjacent to a protected bike lane or multi-use path. The guide provides a detailed summary of the challenges and best practices for designing island platform bus stops.

Within the guide, constrained bus stop layouts are shown for bus stops that cannot accommodate a conventional island platform. The constrained bus stop layouts provide design recommendations if only a narrow landing pad can be provided or if no landing pad can be provided. Providing a bus stop with a narrow landing pad or no landing pad reduces the accessibility of the bus stop.

To deploy the bus's accessibility ramp, the landing pad should be at least 2.4 m deep. Bus stops with a landing pad narrower than 1.5 m may not be able to accommodate transit service.

4.5.3 Stopping In One-Way Bike Lanes

The painted white lane adjacent to the bicycle lane should be dashed where buses are expected to cross.

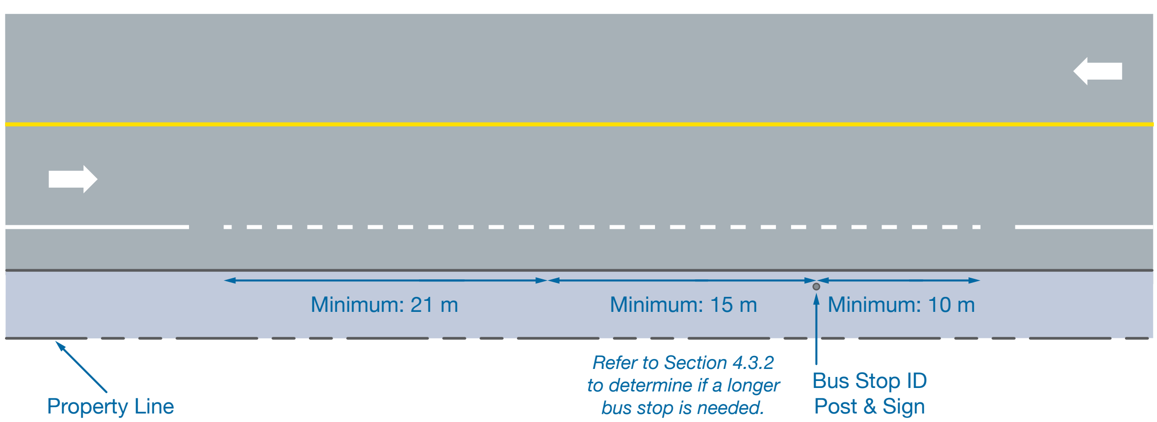


Figure 4.17 Stopping in Bike Lanes

Green pavement markings can be installed within the 10 m and 21 m taper areas but should not be installed within the 15(+) m bus stop area to minimize skidding.

As stated in Section 3.3, it is preferred that the effective lane width is between 3.5 m and 4.8 m (so that vehicles cannot pass a stopped bus), or 6.0 m or greater so that cars can safely pass stopped buses. Having the width of the travel lane plus the bike lane between 4.8 m and 6.0 m should be avoided where possible.

4.5.4 Crossing Bike Lanes

For stops where buses need to cross the bicycle lane to enter and exit:

- A minimum 3 m wide bus bay lane next to a bicycle lane is preferred so that the stopped bus doesn't impact the bicycle lane;
- Compared to a bus bay without an adjacent bicycle lane, a longer bus pull-in and pull-out distance should be provided (distance is based on the width of the bicycle lane and either a 1:6 (entering) and 1:3.3 (exiting) taper ratio; and
- In any situation where a bus could encroach into the bicycle lane, the bus stop location should be examined to ensure that the cyclist can pass the stopped bus safely, or make other decisions in a safe and timely manner, e.g. stop behind the bus or make a lane change into the adjacent travel lane.

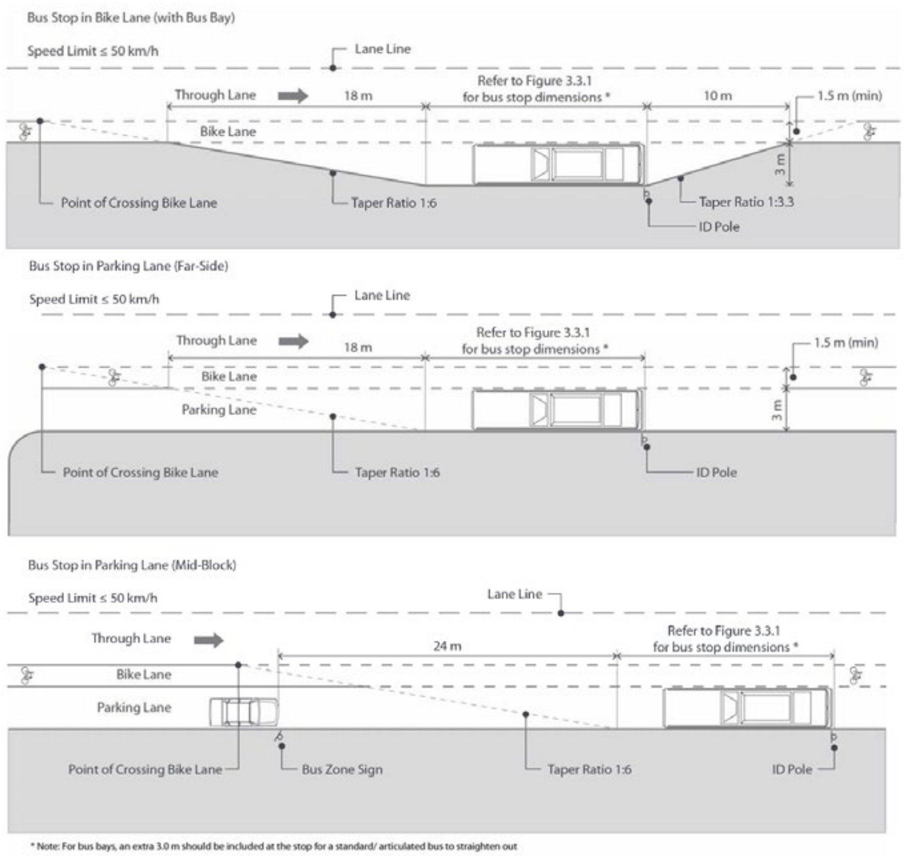


Figure 4.18 Bus Bay next to Bicycle Lane

Source: TransLink Bus Infrastructure Design Guidelines

4.6 PASSENGER AREA

Passenger amenities should include an adequate waiting and queuing area, as well as the potential amenities listed in Table 4.5. The size of a passenger zone depends largely on the expected maximum number of waiting passengers at the bus stop, estimated by the on- and off-loading, the volume of transfer passengers and the scheduled bus frequencies at the stop.

Table 4.5 Bus Stop Amenities

Amenities	Criteria for Provision			
	Local Transit Stop	Frequent Transit Stop	Rapid Transit Stop	Transit Exchange
Bus stop pole and sign	Mandatory	Mandatory	Mandatory	Mandatory
System Icon	Recommended	Recommended	Mandatory	Mandatory
Route/Schedule information holder	Recommended	Recommended	Mandatory	Mandatory
Lighting	Recommended	Recommended	Mandatory	Mandatory
Passenger landing pad	Recommended	Recommended	Mandatory	Mandatory
Wheelchair pad	Recommended	Recommended	Mandatory	Mandatory
Accessible Access	Recommended	Recommended	Mandatory	Mandatory
Garbage Receptacles	Recommended	Recommended	Mandatory	Mandatory
Seating	Recommended	Recommended	Mandatory	Mandatory
Shelter	Recommended	Recommended	Mandatory	Mandatory
Passenger Information Display System (warranted if service headway is long and on-time performance is poor)		If Warranted	If Warranted	If Warranted
Wayfinding Information and local map (warranted if there are high-density of local attractions nearby)		Recommended	Recommended	Recommended
Bicycle Parking		If Warranted	Recommended	Recommended
Park & Ride		If Warranted	If Warranted	If Warranted
Passenger Queue Management (warranted if boarding volumes are high and/or all-door boarding is permitted)			If Warranted	If Warranted

4.6.1 Safety And Accessibility

The ability for transit users and operators to safely access stops in addition to the safety of all other road users is a primary objective. Patrons of all ages and abilities should be able to access bus stops.

The general provisions of an accessible bus stop are as follows:

- Non-slip finishes;
- Street furniture and signage are kept out of the way of pedestrian circulation by providing 0.6 m of clear space between elements and providing a clear width of 1.5 m at the point of embarkation.
- Ensure that each designated area for mobility device users has a minimum length of 2.4 m, measured perpendicular to the edge of the curb or vehicular route, and a minimum width of 1.5 m, measured parallel to the vehicular route.

- Obstructions within or adjacent to the walkway are removed, or clearly marked if removal is not feasible;
  - Obstructions more than 0.1 m from walls, columns or free-stranding supports should be at or below 685 mm from the floor, making them white cane detectable or have the underside at a height of at least 2.05 m from the floor.
- Visual and tactile cues are made through colour and texture contrast;
- Contrasting colour should be at a minimum of 70% contrast;
- Signage should be free of glare, use a sans serif font and be of high contrast.

Nearby crosswalks with ramps are recommended for all stops to facilitate access by people with wheeled devices, including wheelchairs, strollers, etc.

4.6.2 Bus Shelters

Bus shelters are partially enclosed waiting areas that protect waiting passengers from the weather and contain important information such as route maps and schedules. Clearly identified BC Transit shelters are preferable.

Bus shelters are warranted when more than one of the following conditions is met:

Table 4.6 Bus Shelter Warrant

Condition	Bus shelter
Bus service	Frequent services are provided and/or there are a number of transfers at a stop, hence more passenger activities.
Adjacent land use	Shelter can be made compatible with the adjacent land use (for example, a bus stop in a busy commercial area or modal interface with rail, boat or air transit) and space is available for construction such that the shelter can be sited on level ground and without obstructions by trees, utility poles, etc.
Passenger demographics	There are relatively high percentages of seniors and/or people with physical disabilities using the bus stop.
Passenger request	The request is supported by the conditions above.

Shelters should be located:

- Parallel to curb. Usually the shelter faces the curb, but can be rear-facing to accommodate winter conditions;
- Where the transit operator can easily see waiting passengers;
- Clear of the passenger landing area or pedestrian path; and
- Clear of steps between the sidewalk/bus pad and the shelter.

Some municipalities and transit systems have agreements in place with companies to acquire shelters at no cost in return for the right to display advertising. Regardless, the same location criteria and design considerations apply.

Figure 4.19 BC Transit Branded Shelter

While shelters are available in various configurations, the BC Transit recommends:

- Four-sided shelters must have a minimum 1 m wide opening;
- Not typically installing glass panels due to high maintenance costs, but if used, they should be marked with a contrasting horizontal stripe minimum 75 mm wide, located approximately 140 to 160 cm above ground level. Glass panels are recommended where other materials would otherwise create a sight line issue;
- Sides are transparent;
- Seating is oriented to view oncoming transit and pedestrians; and
- Lit shelters are preferred to improve shelter safety and visibility.

No component of the bus shelter should be closer than 75 cm to the curb to avoid a potential collision with the right mirror of the bus.

BC Transit also offers the Transit Shelter Program which provides an overview of standardized bus stop shelter designs across the province for all operating conditions, including harsh winter weather.

4.6.3 Seating

Even without a bus shelter, seating is a beneficial amenity. Seating should be located away from access driveways, using nearby trees for shade and wind/rain protection. Seating should also not obstruct the accessible path of travel. Materials should be resistant to weather, water retention and vandalism.

Seating should have a seat height of between 430 mm and 486 mm and, where possible, offer armrests and backrests. An adjacent firm and level area of at least 830 mm x 1350 mm should be provided for mobility device users.

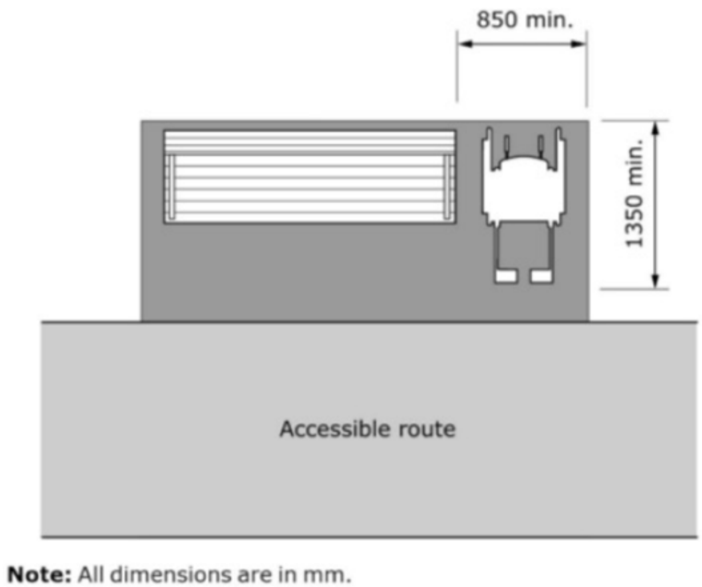


Figure 4.20 Bench Area

Source: CSA B651-18 (Figure 55)

4.6.4 Passenger Information Display Systems and Wayfinding

Providing clear and simple transit information improves customer satisfaction. The Passenger Information Display System (PIS or PIDS) can be deployed at rapid bus corridors to give real-time transit arrival information. Wayfinding maps are often offered in high-density areas, transfer stops or areas with local attractions. PIS/PIDS and wayfinding should:

- Present information in a manner that is clear, simple and universal, particularly helpful when transfer stops are some distance apart;
- Carefully consider level of detail to avoid confusion and information-overload;
- Present key information, particularly frequency, running time (throughout the week), and accessible destinations so transit users can make well-informed decisions;
- Use universal design principles, including audible and tactile resources;
- Make signs visible and recognizable from all corners of an intersections; and
- Maintain BC Transit's brand.

4.6.5 Passenger Queue Management

Passenger queue management is used at bus stops where an exceptionally high number of boarding passengers can block the sidewalk. Queue management is particularly useful at locations where all-door boarding is permitted. A well-managed queuing system reduces crowding at doors and can lower the overall stop dwell time.

- Alighting passengers must be able to exit the bus first. This should be communicated to boarding passengers through signage;
- Stops serving multiple routes should provide a separate boarding and queuing area for each route;
- The marked queue lines should have sufficient clearance for a pedestrian through-zone; and
- Use lean bars where there are long queues.

4.6.6 Physical Protective Measures

Physical protective measures, such as barrier curbs, bollards, fences, guardrails, concrete roadside or low barriers can enhance passenger safety and protect infrastructure at multi-position bus stops and transit exchanges.

While not mandatory, protective measures should be considered at locations where there have been incidents in the past, or where the following potentially hazardous situations may exist:

- Bus stop is at a downward slope, with a passenger waiting area/infrastructure in front of the transit vehicle. Transit vehicle may roll forward;
- Bus stop is at an upward slope with a passenger waiting area/infrastructure behind the transit vehicle. Transit vehicle may roll backward;
- Bus stop with a high-density passenger waiting area in front or behind the stopped transit vehicle;
- Bus stops along high-speed routes where transit vehicles operate with high deceleration or acceleration rates; and/or
- A structure is located near the curb face, e.g. within 2 m.

Bollards or barriers can be concrete, steel, wood or a combination of these materials. If barrier curbs are continuous and high, they can interfere with bus entry and exit, as well as passenger boarding and alighting. If the decision is to use bollards at a bus stop, it's preferable to use fixed bollards. However, if vehicle access is required, use removable or retractable bollards.

Bollard design considerations include:

- Use at least two bollards and ensure the space in between is less than the width of transit vehicles using the stop;
- Fixed bollards designed against a defined level of threat and installed permanently in a foundation capable of resisting the threat;
- Removable bollards installed in a sleeve or mount buried underground. Usually flush with the ground surface so the bollard can be removed to allow access. They are generally designed to resist low impact loads in comparison with fixed bollards, and may be installed temporarily at locations where there is a possibility of access change; and
- Retractable bollards that may be automatically or manually operated to retract underground. Retractable bollards may use lift assistance mechanisms to deploy.
- Position protective measures behind the curb within the potential trajectory of transit or vehicle movements.

While physical protective measures can improve safety, they also reduce the usable passenger waiting area and may be problematic for those with limited eyesight. Furthermore, if a bus carrying passengers collides with the protective measure, injuries could occur. Before installing bollards of other protective barriers, conduct a careful analysis and risk assessment.

4.6.7 Lighting

Lighting at bus stops and other transit facilities improves passenger visibility, promotes personal security and deters unwanted activities. Lighting levels at transit facilities should be no less than adjacent street lighting. Supplemental lighting may be required at isolated bus stops, transit exchanges or Park & Rides.

TransLink's Universally Accessible Bus Stop Design Guidelines recommend a lighting level of 20 to 50 lux at all ground level bus stops. For transit exchanges and bus stops, TransLink Guidelines recommends a lighting level of 50 lux.

4.6.8 Maintenance

Bus stop maintenance is typically conducted by the road authority. Table 3.3 summarizes the recommended bus stop elements to be regularly inspected. Snow clearing should be prioritized on streets that have transit service including the sidewalks at and near bus stops.

Table 4.7 Maintenance Checklist

Element	Preferred Condition	Frequency of on-site check required (Typical)
Access routes used by passengers	No physical obstacles, clear of materials that create slippery surfaces	Once a year, or as requested by passengers
Crosswalks	Conspicuous sign and pavement markings	Part of regular roadway maintenance
Lighting	In operation, adequate lighting level	Part of regular roadway maintenance
Landscaping	Low-level shrubbery or canopied trees	6 months
Bus stop sign	Good visibility, not obscured by streetlights and trees	6 months
Bus stop pavement marking (red)	Good visibility	Part of regular roadway maintenance
Bus shelter and bench	Free of vandalism and weathering effects	6 months
Garbage receptacles	Free of vandalism, free of pooling of liquids	Monthly, or as requested
Bus schedules and route maps	Free of vandalism	6 months
Curbside	Free of potholes, no drainage issue	6 months
Bus pad	Free of cracks in concrete or asphalt	6 months

CHAPTER 5 Transit Hubs

5.1 INTRODUCTION

Transit Hubs allow for a greater degree of passenger transfer movement (both bus-to-bus and intermodal) than at a typical curbside stop. Transit hubs can consists of the following components:

- Transit Exchange;
- Park & Rides; and
- Passenger Pick-Up and Drop-Off Facility (also known as a Kiss-and-Ride)

5.2 TRANSIT EXCHANGES

A transit exchange has multiple transit stops, allowing passengers to transfer from one bus to another. Transit exchanges are commonly the terminal stops for many bus routes and can be on- and off-street.

Figure 5.1 Example of an On-street Transit Exchange

Figure 5.2 Example of an Off-street Transit Exchange

5.2.1 Location Considerations

A bus transit exchange is often at the end of a route to maximize transfer opportunities and minimize any detours a bus must take to access it.

Major trip generators like shopping centres and institutional facilities are also good locations for a transit exchange, acting not only as an exchange but also as a hub of concentrated activities.

Another candidate location for a bus transit exchange is where multiple bus routes pass by in the vicinity, creating high demand for transfer movements between routes.

5.2.2 Design Considerations

The size of a transit exchange depends on land availability, local operating conditions, the number of bus routes served by the site, as well as:

- Bus access (to and from adjacent roadways);
- Bus circulation within the transit exchange;
- The type and number of buses;
- Bus layover space;
- Pedestrian access routes to and from the transit exchange;
- Passenger amenities;
- Bicycle parking;
- Accessibility within the transit exchange, and the surrounding area;
- Measures to reduce bus-auto-pedestrian conflict;
- Bus operator restrooms;
- Integration with nearby parking or drop-off zones; and
- Signage within the layout to direct users to appropriate bay.

Passenger platforms vary in size and configuration depending on the number and types of buses, as well as expected passenger volumes and profile. The two most common transit exchange configurations are the parallel loading platform and the sawtooth loading platform.

A combination of these configurations is often used in actual design. All designs should consider the typical design considerations for on-street bus stops.

Parallel Loading Platform

A parallel loading platform typically consists of multiple bus stops aligned one after another along a curb, with spacing in-between to accommodate bus pull-in and pull-out movements. To accommodate the same number of buses, a parallel loading platform usually requires a longer platform length than the sawtooth platform. Figures 5.3 – 5.5 provides various layouts with the Independent Arrival/Departure layout providing the most flexibility but also using the most space.

The right-of-way between the platform and the edge of the bus transit exchange should be 6.5 m to allow buses to pass a stopped bus.

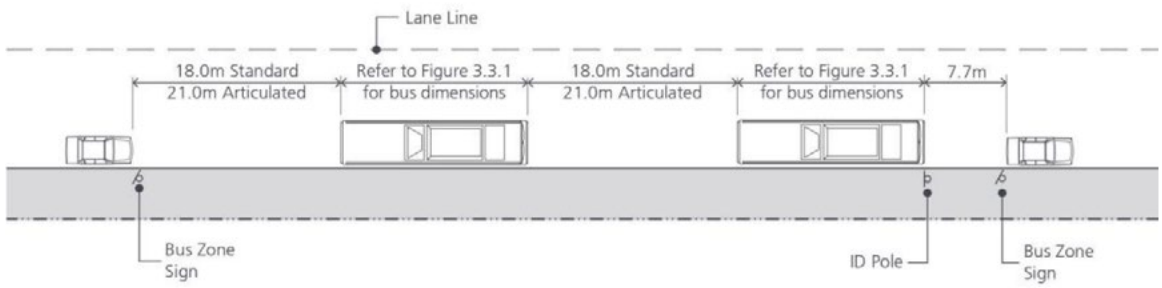


Figure 5.3 Independent-arrival, Independent-departure Bus Stop Layout.

Source: TransLink Bus Infrastructure Design Guidelines

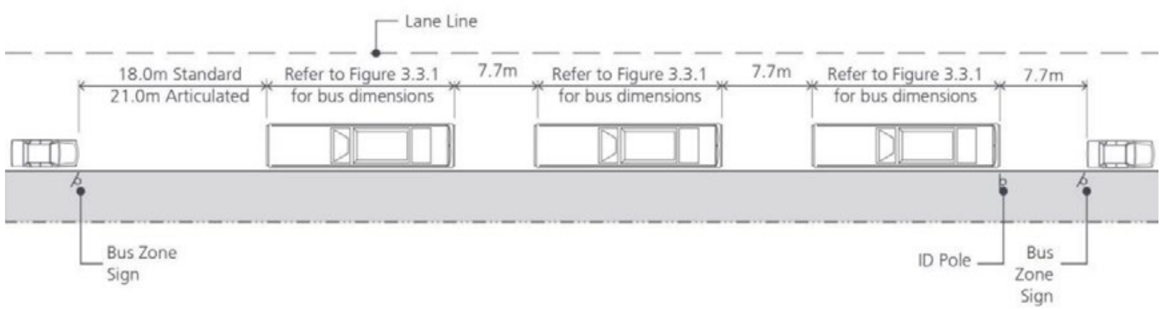


Figure 5.4 Independent-arrival, First-out Bus Stop Layout

Source: TransLink Bus Infrastructure Design Guidelines

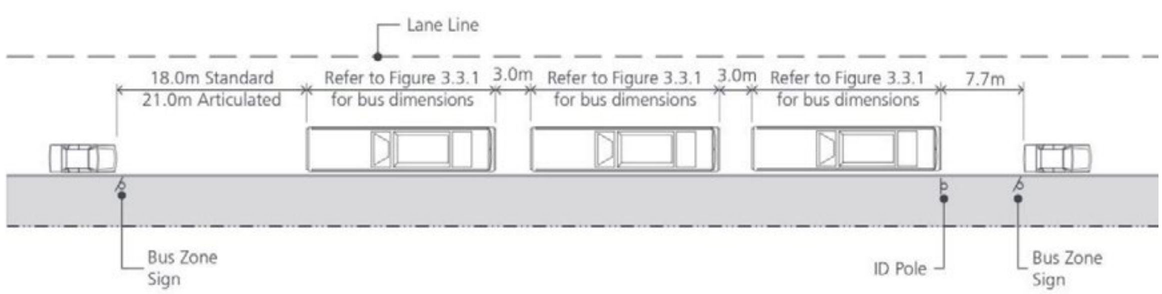


Figure 5.5 First-in, First-out Bus Stop Layout

Source: TransLink Bus Infrastructure Design Guidelines

Sawtooth Loading Platform

Sawtooth loading platforms are characterized by the jagged edges of the pedestrian platform area, which allow buses to pull in at an angle. They require a shorter platform length than a parallel loading platform.

Figure 5.6 Sawtooth Loading Platform

The platform teeth should protrude 1.3 m from the rest of the platform, and taper over a 14 m pull-in/stopping zone and a 6 m pull-out zone. It is preferred that all jagged edges are rounded with a radius of 8 m (minimum 6 m) for easier maintenance (see Figure 5.7).

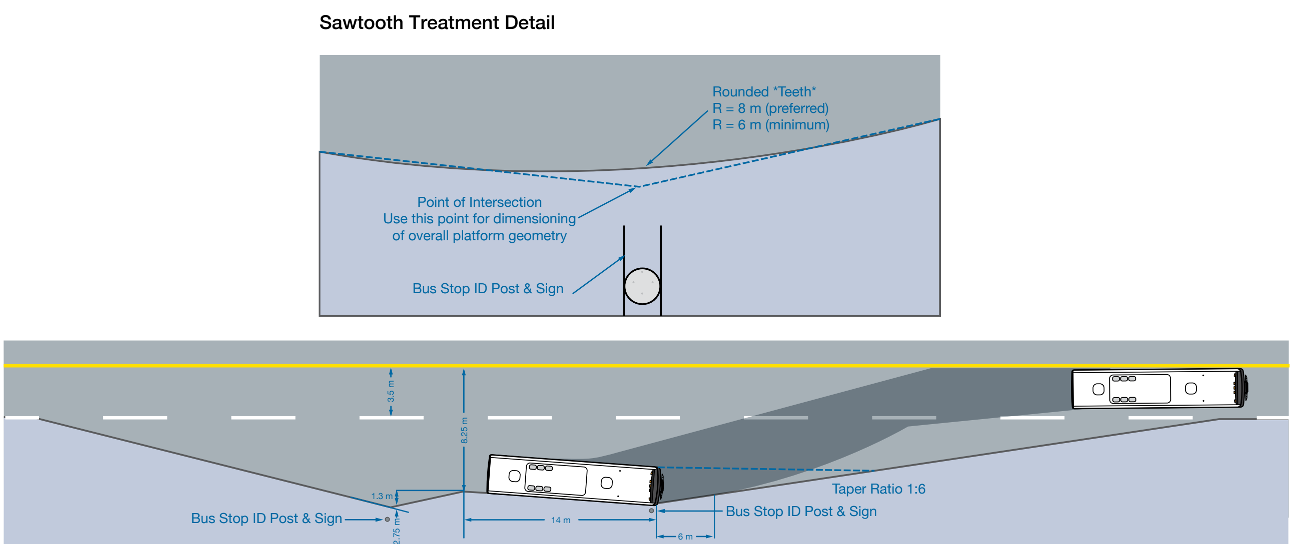


Figure 5.7 Sawtooth Loading Platform Reference Points

Sawtooth platforms can be used at curbside stops, and as part of an island platform at a bus transit exchange. Depending on the set-up, there are several key layout dimensions to consider.

i. Curbside sawtooth stop

The length of the platform requires a 2.75 m minimum platform clear width (excluding the teeth). Additionally, the roadway space for bus parking should be at least 4.75 m from the tip of the teeth (e.g. 6.05 m including teeth width) to the nearest travel lane. This allows buses to safely pull in and out of their stops without interfering with traffic. At either end of the bus layover space, there should be a taper to and from the adjacent travel lane. A 1:6 taper ratio is recommended.

Based on all these criteria, a rough approximation of the area required for this type of bus stop is as follows:

- Land width: 8.8m measured from the left edge of nearest travel lane
- Land length: 77 m (including tapers) for a single bus stop, plus an additional 20 m for each additional bus stop

Note that calculating an area using these values includes two triangular wedges of land at either end (where the tapers are located) that is not actually required for use. Depending on the nature of existing site conditions, it may be possible to reduce the total land area required by excluding these sites.

Figure 5.8 illustrates an example of a 4-bay curbside sawtooth stop.

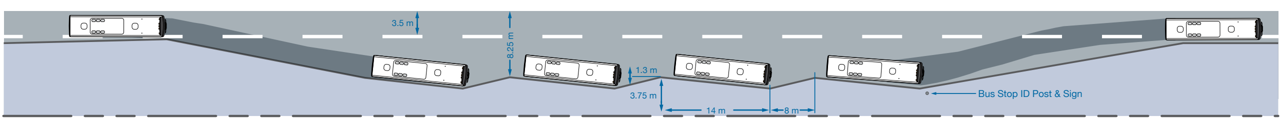


Figure 5.8 Multi-Bay Curbside Sawtooth Stop

ii. Island platform at transit exchange

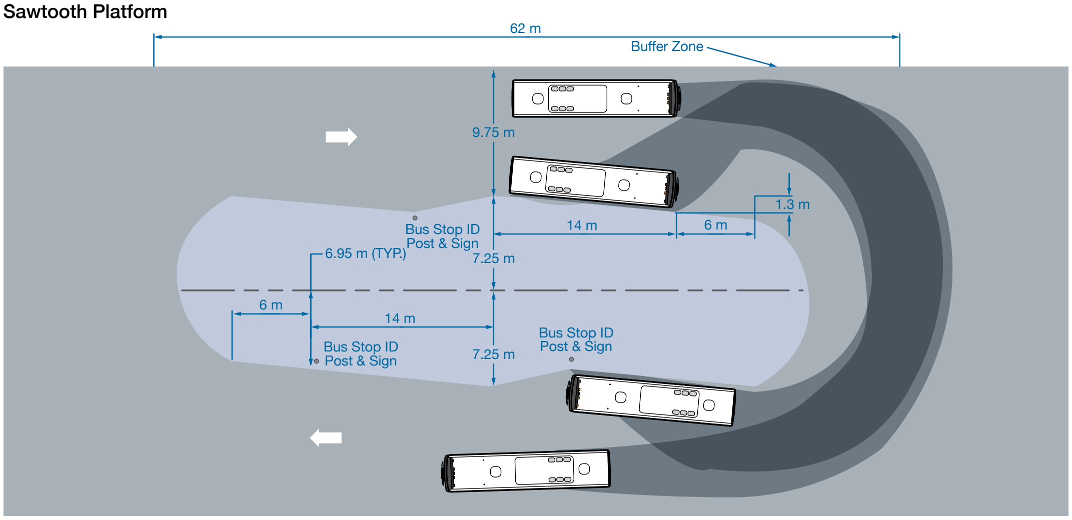
An island platform may feature sawtooth bus stops on both sides. This set-up is typically used at a major transit exchange, which is assumed to be off-road with prohibited access by general traffic. There are two major design considerations for an island platform: the accommodation of pedestrians (ensuring the platform is large enough to handle expected pedestrian volumes), and making sure buses have sufficient space to move around the exchange.

Island platforms should be at least 5.5 m wide (excluding the teeth) to allow for pedestrian circulation. Wider platforms are recommended if high passenger volumes are anticipated or there are amenities such as benches and landscaping. In terms of road space, a minimum of 9.75 m (from the tip of the teeth) is required for effective bus circulation and adequate layover space.

At the end of an island platform, buses must make a 180-degree turn. To accommodate this sweep path, the transit exchange must be wide enough, with a minimum distance from the stops closest to the end of the turn area. There is some degree of trade-off between these two parameters. A narrower platform needs more space past the end of the platform for a bus to make a turn, while a wider platform needs less.

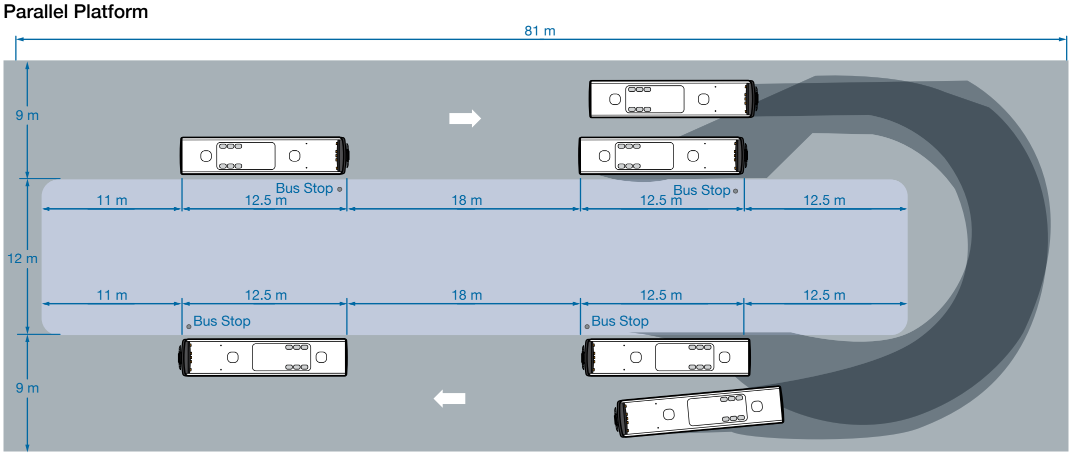
Figure 5.9 illustrates two sample bus loop designs: a 4-bay wide sawtooth platform and a 4-bay parallel platform. It's assumed that all buses enter and exit the loop in a clockwise manner.

Sawtooth Platform



62m
x 34m
2,108m²

Parallel Platform



81m
x 30m
2,430m²

Figure 5.9 Platform Size Requirements (For Illustrative Purpose Only)

Other Considerations in Transit Exchange Design

- Provide buffer room at the edge of the bus loop because drivers do not execute turns in exactly the manner shown in the sweep path analysis. The exact amount depends on site conditions at the end of a transit exchange, and the severity of consequences if the bus exceeds them. For example, if the transit exchange has a large gravel shoulder beside it with no major obstructions, it's not an issue if a bus drives on it occasionally. But if there is a major vertical surface at the edge of the site, such as a fence or wall, there should be a buffer – up to 2 m depending on conditions – to allow for bus mirrors and bike racks. It's not safe or efficient if a driver has to back up and try again after an improperly executed turn;
- Where there is very limited space, paint lines on the pavement to reflect the outer front wheel sweep path. This will help bus drivers complete the turn;
- With exceptionally complicated manoeuvres, field test the layout at a bus depot; and
- Include layover space if a bus transit exchange is a timing point or a terminus loop, and multiple routes are scheduled to arrive at the same bay. This might require additional land around the outer edges of the loop.

5.2.3 Bus-Pedestrian Conflicts within a Transit Exchange

Properly designed transit exchanges minimize conflicts and collision risks between buses and pedestrians. Painted crosswalks, handrails and/or wayfinding signage are used to guide pedestrians to areas of high visibility.

Pedestrians in a crosswalk should never have their backs to oncoming buses. As a result, locate crosswalks to maximize available sight distance between drivers and pedestrians: either behind a bus stop, before

a point where a bus starts to turn, or at a point after the bus has turned. Curb extensions can enhance pedestrian visibility at a crosswalk in front of a bus stop.

If there are potential shortcut routes with limited visibility, use handrails to funnel pedestrians to a specific path and/or crosswalk.

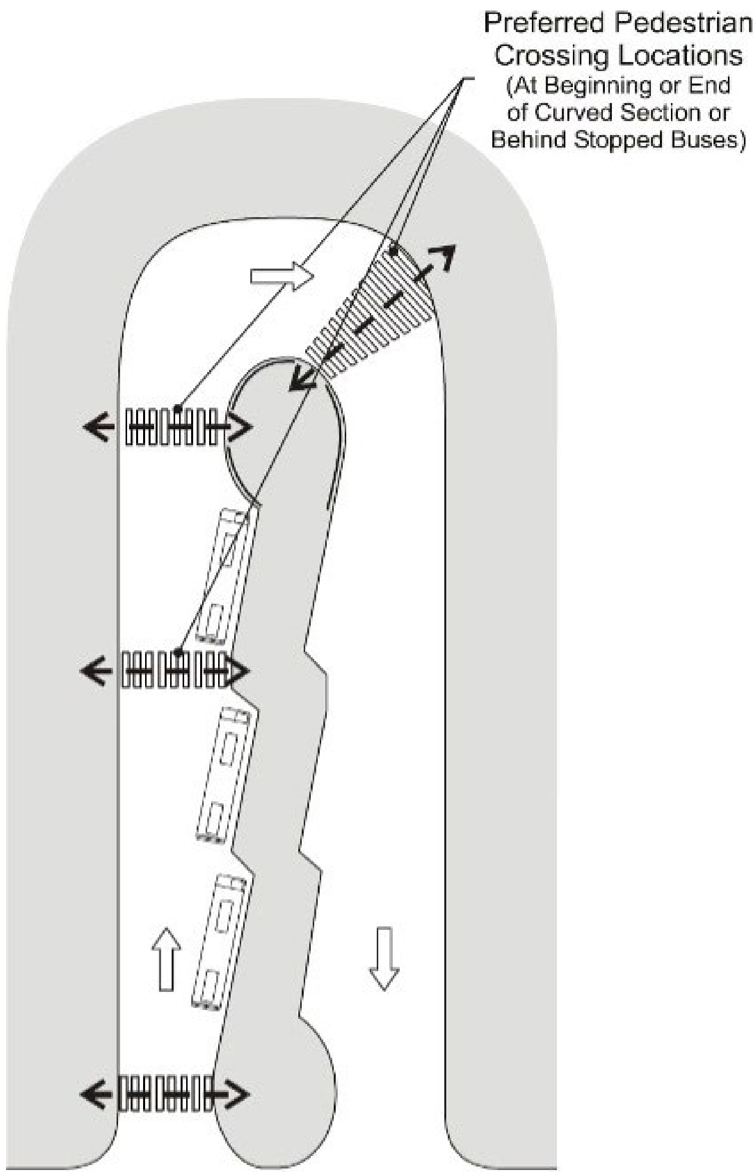


Figure 5.10 Pedestrian Crossing Within a Transit Exchange

Source: TransLink Bus Infrastructure Design Guidelines

5.2.4 Passenger Access, Boarding and Alighting Activities

Pedestrian access both within a bus transit exchange and to the surrounding area are important considerations in the design process. Walkways to surrounding areas should be as direct as possible and wide enough to accommodate pedestrian flows.

The Highway Capacity Manual (Transportation Research Board) describes the relationship between effective walkway width and passenger flow rates using Level of Service (LOS) (see Figure 5.9). Effective walkway width is what's available to pedestrians after discounting lateral restrictions such as a grass boulevard, trees and other fixed objects.

Eighty pedestrians per minute per metre is maximum capacity for a walkway (LOS E). For design purposes, LOS C is recommended. Using figure 5.11, the required walkway width can be determined based on the expected pedestrian flow rate, if it is known.

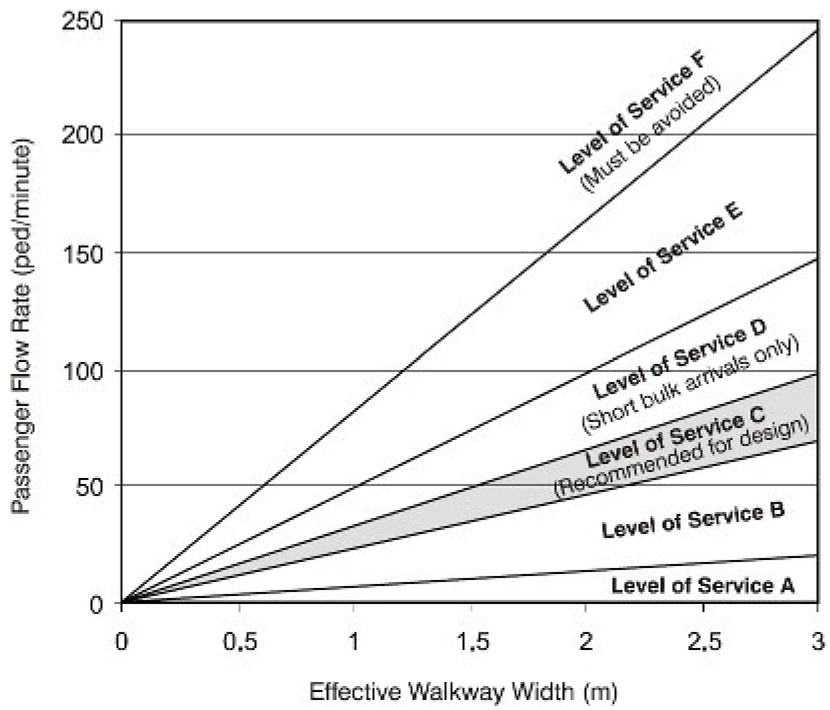


Figure 5.11 Relationships Between Pedestrian Flow Rate and Effective Walkway Width

Source: Highway Capacity Manual, Transportation Research Board

Effective walkway width (see Figure 5.12) may be lower than the total width, depending on what is

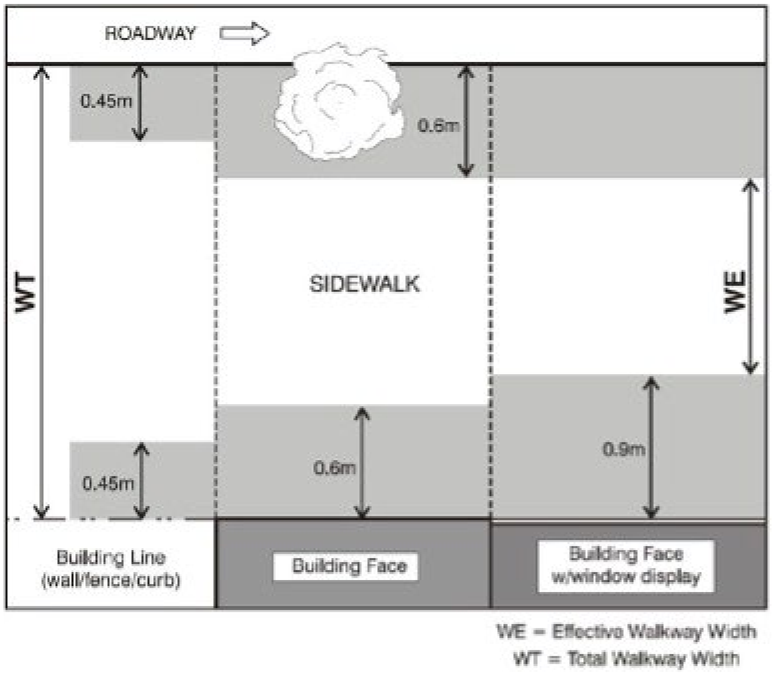


Figure 5.12 Effective and Total Walkway Widths

Source: Highway Capacity Manual, Transportation Research Board

To accommodate a pedestrian and a person using a mobility device, the suggested minimum effective walkway width (WE) is 2 m. To accommodate three pedestrians abreast, between 2.25 m to 3 m WE is recommended.

Use a directional line or physical barrier if pedestrian flows are heavy and even in both directions. For routes with heavy boarding and alighting activities, offer separate unloading and loading areas to minimize pedestrian conflicts and reduce dwell times.

5.2.5 Loading Area Estimation

According to the Transit Capacity and Quality of Service Manual - 2nd Edition (TCQSM), the capacity of a linear loading area in buses per hour is*:

$$B_l = \frac{3{,}600 * (g/c)}{t_c} + t_d * \left(\frac{g}{c}\right) + Z * c_v * t_d$$

Where:

Bl	=	Loading area bus capacity (bus/hour)
3,600	=	Number of seconds in 1 hour
g/c	=	Green time ratio (the ratio of effective green time to total traffic signal cycle length, equals 1.0 for unsignalized streets and bus facilities
tc	=	Clearance time (seconds)

td = Mean dwell time (seconds)

Z = Standard normal variable corresponding to a desired failure rate (assume to equal (1 – failure rate), where failure rate is 0.25)

cv = Coefficient of variation of dwell times (assume 0.6)

**Refers to linear stops (as in parallel loading) as opposed to a sawtooth or other loading configuration.*

The resulting capacity (Bl) is then compared to the desired provision of buses per hour (typically derived from the arrival headway). Site characteristics and desired access and circulation patterns determine the length and arrangement of the various loading areas. Additional loading areas might be necessary if the route terminates at the transit exchange and/or vehicles are stored overnight.

In a transit exchange, linear stops are usually separated by the required pull-in zone (see Figure 5.3). However, when multiple stops are arranged in a linear manner without the pull-in zone, efficiency may be reduced due to the following:

- Rear-loading areas are used less because an arriving bus typically stops at the front-loading area;
- Dwell times are higher in rear-loading areas compared to front-loading because passengers waiting near the front need time to walk to the rear; and
- Depending on the gaps between buses, sometimes a bus can't leave until the bus in front departs. To account for this reduced efficiency, the TCQSM - 2nd Edition applies an equivalent efficiency factor:

$$\mathbf{Bs = N_{el} * B_l}$$

Where:

B_s = Bus stop bus capacity (bus/hour)

B_l = Loading area bus capacity (bus/hour), as calculated from the previous formula

N_{el} = Estimated capacities as shown in Exhibit 4-14 (Table 5.1) of the TCQSM - 2nd Edition (reproduced below)

Table 5.1 Estimated Capacities of Transit Exchanges

	Number of on-line loading areas									
Dwell Time (s)	1		2		3		4		5	
	g/C 0.5	g/C 1.00	g/C 0.5	g/C 1.00	g/C 0.5	g/C 1.00	g/C 0.5	g/C 1.00	g/C 0.5	g/C 1.00
30	48	69	84	120	118	169	128	182	133	189
60	27	38	48	66	68	93	74	101	76	104
90	19	26	34	46	48	64	52	69	54	72
120	15	20	26	35	37	49	40	53	51	55

Note: Assumes 10-second clearance time, 25% failure rate, 60% coefficient of variation of dwell times, and random bus arrivals. To obtain the vehicle capacity of non-linear on-line bus stops, multiply the one-loading area values shown by the number of loading areas provided.

5.3 MICROMOBILITY PARKING

All high-activity bus stops and transit exchanges, especially those with a Park & Ride, should consider parking for bicycles and other micromobility devices. Safe, organized, well-lit and conveniently located short- and long-term parking deters damage and theft, and may enable more people to access transit service.

The BC Active Transportation Design Guide provides detailed bicycle parking best practices.

5.4 PARK & RIDES

Park & Rides are usually located in suburban and rural areas, adjacent to transit connections to regional centres. Physical size is based on anticipated demand. Park & Rides have ample parking and may contain other amenities such as short- and long-term bicycle storage.

5.4.1 Park & Ride Design

To support transit ridership, a successful Park & Ride must be designed for use by cars, pedestrians and cyclists. Specific considerations are given to adjacent road network traffic operations, the interaction between various modes of travel and:

- Number of access driveways, driveway geometry and traffic control;
- Parking supply;
- Parking stall type, dimensions and configuration;
- Site circulation;
- Site security; and
- Interaction between modes

5.4.2 Access driveways

Surrounding street traffic conditions determine the most appropriate location for Park & Rides access driveway(s). Avoid putting access driveways along exclusive turn lanes to reduce conflict between vehicles slowing to turn into the facility and exiting vehicles crossing traffic lanes to merge into the traffic stream. They also shouldn't be in the middle of a vertical crest curve as sight distance is limited for exiting vehicles, resulting in an increased risk of angle or crossing-type collisions.

The number of access driveways is based on peak arrival/departure volumes and adjacent road network geometry and traffic conditions.

If traffic volume is relatively high on an adjacent street, multiple access driveways can minimize delays for exiting vehicles. At the same time, driveway locations must be considered in the context of the surrounding road network, to ensure convenience and maintain traffic operations.

Typically, an access driveway is 8.5 m wide for a 2-lane access and 11.0 m wide for a 3-lane access. Simulation software can be used to assess the appropriate traffic control needed at the driveway intersection. Geometric design should also consider anticipated traffic volumes, movements at individual driveways, the number of lanes, traffic control with the intersecting public road, and available storage length for the anticipated queue in the exiting direction.

5.4.3 Parking supply

Designers must think long-term and consider land use, population growth, demographic, social and economic trends, auto and transit travel networks, and future increase in transit ridership. In the early planning stages, a survey of similar facilities can help identify trip patterns and parking utilization.

At least 5% of the stalls should be accessible parking.

5.4.4 Parking Stall Dimensions and Configuration

Municipalities typically set requirements for parking stall dimensions. The best practice for accessible perpendicular parking is to have a minimum stall width of 2.6 m with an adjacent, shared, access aisle of 2 m wide (see Figure 5.13). The access aisle should connect to a curb ramp and sidewalk or designated walkway allowing for safe and direct passage from the parking stall to the transit facilities.

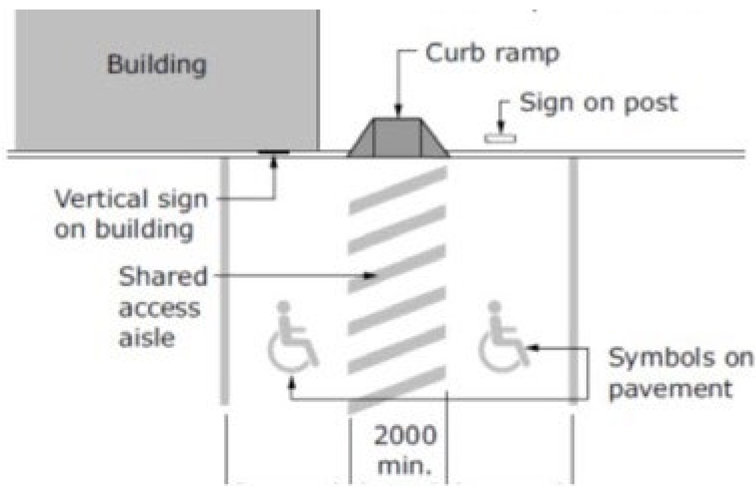


Figure 5.13 Accessible Perpendicular Parking

Source: CSA B651-18 (Figure 67)

Accessible parallel parking stalls should have a width of 2.6 m and length of 5.5 m with an adjacent, shared, access aisle with a minimum width of 2 m. The access aisle should connect to a curb ramp and sidewalk or designated walkway allowing for safe and direct passage from the parking stall to the transit facilities.

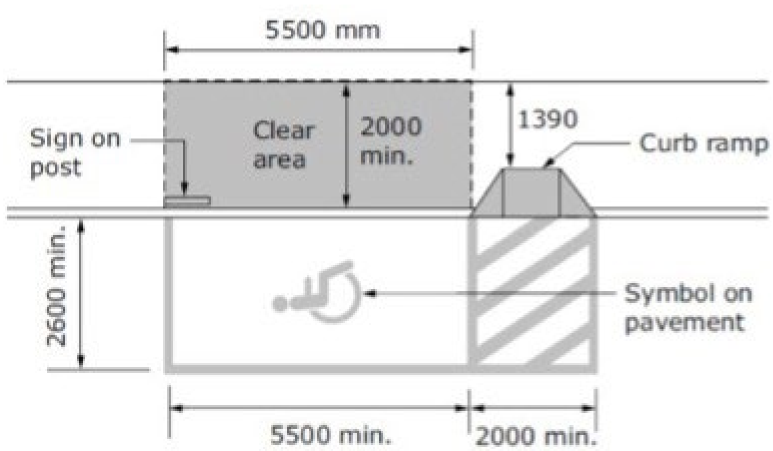


Figure 5.14 Accessible Parallel Parking

Source: CSA B651-18 (Figure 68)

Where possible, an accessible drop-off stall is recommended. The stall should have an access aisle adjacent and parallel to the accessible route and of at least 1.5 m and 7 m long and feature either a curb with a curb ramp or a tactile attention indicator (see Figure 5.13).

Unless the entire drop off area is curbed or level (requiring tactile indicators), the access aisle is located on the pavement to allow for a ramp to be lowered from a side-loading van and to ensure that someone exiting a vehicle has sufficient level maneuverability without impeding access to the sidewalk for other pedestrians.

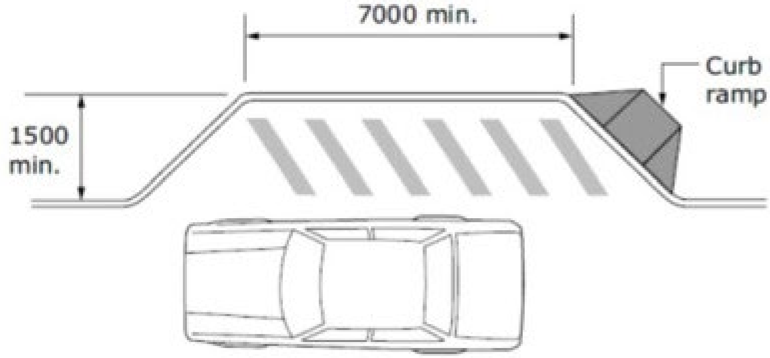


Figure 5.15 Accessible Pick-up / Drop-off

Source: CSA B651-18 (Figure 65

5.4.5 Site Circulation

Parking should be easy to find in a Park & Ride. A single, continuous path from the street to a parking space is ideal. Clear signage at major access points as well as within the lot (pavement arrows and STOP signs for example) will assist in site circulation.

5.4.6 Site Security

A safe and secure environment is important for all facility users. Measures to minimize unauthorized activities include:

- Natural surveillance;
- An enforcement policy;
- Signage to indicate the enforcement policy;
- Lighting;
- Remote surveillance; and
- Fencing and pathway bollards to control pedestrian and vehicle access.

5.4.7 Interaction between Travel Modes

Key considerations to improve the interaction of travel modes include:

- Safe pedestrian connections between the parking lot and the transit stops. For example:
  - Use wayfinding to direct pedestrians to follow desired paths rather than cut through parked vehicles;
  - Keep the walking distance reasonable (300 metres or less, equivalent to travel time of 5 minutes or less) to reduce shortcuts;
  - Use marked crosswalks and appropriate signage to minimize pedestrian/vehicle conflicts;
  - If possible, use raised pedestrian pathways to further enhance visibility;

- Separate access for transit vehicles and cars to minimize conflicts; and
- Separate access and secured/protected storage for cyclists.

5.5 PASSENGER-PICK-UP AND DROP-OFF FACILITIES

Passenger pick-up and drop-off (PPUDO) facilities, also known as kiss-and-rides, are short-term parking areas where passengers are picked up or dropped off. They can consist of a designated series of parking stalls or a pull-up zone alongside a designated pedestrian area. Parking times are usually restricted to around 5 minutes. Between one and five PPUDO stalls are typically sufficient.

PPUDOs are typically included in Park & Rides or adjacent to transit exchanges. Specific considerations are as follows:

- PPUDOs should be easily accessible from the adjacent road network, and not create conflicts with adjacent road traffic. For example:
  - Because there is high turnover during specific periods (typically in the morning for drop-off and in the late afternoon for pick-up), PPUDO design must account for the surge to avoid queues encroaching onto the adjacent road;
  - Conversely, access points should be located away from any vehicle queues entering and exiting the facility;
- PPUDOs should be located close to the transit exchange entrance (at the least the drop-off spaces); and
- Pick-up spaces can be separate and slightly farther away; however, passengers shouldn't have to cross more than one street. Otherwise, they will use unofficial pick-up locations that are more convenient and closer to the transit exchange.

GLOSSARY

Accessible Pedestrian Signal	Pedestrian signals that communicate information about the state of the signal (Walk, Flashing Don't Walk, Don't Walk) in non-visual formats.
Articulated Bus	Segmented bus that has rear portion flexibility but is permanently connected to a forward portion and has no interior barrier to hinder passenger movement between the two portions.
AutoTURN	Transoft Solutions Inc. software that analyzes and visualizes vehicle-turning swept paths.
Bollard	A short post on the street or sidewalk that acts as a boundary marking or protective barrier.
Bus Bay	A bus stop where a bus pulls off the roadway to a designated area (which typically consists of tapers and a loading area), picks up and drops off passengers, then re-enters roadway.
Bus Bulge	A bus stop used a passenger zone, where a widened piece of sidewalk extends into the parking lane of a roadway.
Bus Fleet	BC Transit vehicles, such as: conventional bus, double-decker bus, handyDART, light duty bus, low floor bus, community bus or alternative technology bus.
Bus Pad	An overlay of concrete at a transit facility, used to minimize pavement wear.
Bus Shelter	A building or other structure that provides protection from the weather, sometimes with seating and other passenger convenience amenities.
Bus Stop	An area where passengers wait for, board, alight and transfer between transit vehicles, usually identified with a bus stop sign (RB-58) and red painting along the road curb, where a road curb is available.
Bus Stop Sign	A bus stop sign is a pole-mounted rectangular plate with the stop's identification number, the words BUS STOP, and other information such as other bus routes, or a wheelchair accessible decal, if applicable.
Bus Sweep Path	The horizontal distance taken up by a transit vehicle when it turns. The width increases when a bus begins to turn and decreases as the bus completes the turn.
Conflict Zone	Area where different modes of travel intersect.
Crime Prevention through Environmental Design (CPTED)	A proactive crime prevention strategy that uses proper design and the built environment to reduce crime and improve safety.
Curb letdown	Also known as a curb ramp or curb cut. A short ramp cutting through a curb or built up to it to provide continuous and accessible access between the road and a sidewalk or raised concrete/asphalt pad.
Detector	A device used to indicate the presence or passage of vehicles.
Dwell Time	The scheduled time a vehicle or train should discharge and take on passengers at a stop, including opening and closing doors.

Far-Side Bus Stop	Located after an intersection, in the same direction as bus travel.
Flag Stop	When a pedestrian flags or signals a bus to stop.
Hybrid Bus	A hybrid electric bus combining conventional and electric propulsion systems.
Layover	Layover may either be recovery time for the schedule to ensure on-time departure for the next trip, or break time between trips for bus drivers. Regardless of the situation, layover space is required for transit vehicle parking.
Mid-Block Bus Stop	Located midway between two adjacent intersections.
Near-Side Bus Stop	Located before an intersection, in the same direction as bus travel.
In-Lane Bus Stop	Located on the curb travel lane to load and unload passengers.
Parallel Loading	A type of transit platform configuration parallel to a roadway.
Park & Ride	An area where passengers park their personal cars or bikes and then use the transit system.
Passenger Information Display System	An automated system that provides transit status and arrival information.
Passenger Landing Pad	A stable, level, raised and slip-resistant surface for passenger boarding and alighting.
Passenger Pick-Up and Drop-Off Facilities	Designated spaces for taxis or private cars to pick up or drop off passengers using public transit. Usually with limited parking duration.
Passenger Zone	Where passengers wait for, get on and off buses. May be bounded by the road curb, adjacent property lines or boulevards. Consists of a variety of amenities, such as the passenger landing pad, wheelchair pad and bus shelter, etc.
Pull-In and Pull-Out Zones	Areas where transit vehicles either decelerate to stop at, or accelerate to leave, a bus stop.
Queue Jump Lane	A geometric Transit Priority Measure (TPM) used at a signalized intersection. An auxiliary or right-turn lane where through movement is allowed for transit vehicles, but not general traffic. Transit vehicles can use this lane to bypass through-traffic queues.
Real-Time Information	Accurate arrival information electronically displayed at a bus stop, either on a pole or under the roof of a shelter.
Right-of-Way	The legal right of a pedestrian, cyclist or transit vehicle to proceed first, ahead of others.
Sawtooth Loading	A platform configuration characterized by jagged edges for buses to pull in at an angle.

Sight Distance	Sight distance is the length of roadway ahead visible to the driver.
Sight Line	A line of sight from the eye to a perceived object. In transportation, a sight line typically refers to the ability of a road user to detect an object or another road user.
Timing Point	A location, usually a bus stop, where a transit vehicle arrives at a set time.
Traffic Calming	According to the Transportation Association of Canada, traffic calming is used to alter motorist behaviour on a street or on a street network. Can involve changing traffic routes or flows within a neighbourhood.
Transit Exchange	A focal point for passenger transfers between transit modes (for example, between bus and rail) and/or transit routes.
Transit Infrastructure	ll fixed components in an environment where transit operates, including areas where passengers wait to get on and off transit vehicles, as well as roadways used by transit vehicles.
Transit Priority Measures (TPMs)	Measures that give transit vehicles priority over other road users, such as exclusive bus lanes.
Transit Signal Priority (TSP)	The alteration of normal signal phasing or sequence to provide preferential treatment for transit vehicles.
Universal Access	The ability of all people (including people with disabilities and other mobility challenges) to have equal opportunity to access transit service.
Visibility Impairment Zones	Bus drivers have blind spots on both sides of the vehicle.
Wheelchair Landing Pad	Located in the passenger waiting area near the front door of the bus. Allows persons in wheelchair to use the wheelchair ramp safely and without any obstructions.

APPENDIX A Design Checklist for Bus Stop Facilities

Refer to this checklist at the onset of the design process and/or towards the end to ensure all aspects have been considered.

☐	Design Aspect	Relevant Section(s)
☐	Far-side, near-side or mid-block configuration • Advantages and disadvantages	4.2.2
☐	Bus stop visibility • Signing	Appendix D
☐	Passenger amenities • Passenger landing pad • Wheelchair pad • Bus shelter • Miscellaneous amenities	4.6
☐	Universal access • Minimum requirements	4.6
☐	Pedestrian safety • Interaction with pedestrian crosswalks	4.2.3
☐	Bus stop layouts/dimensions • Curbside stop • Bus bay • Bus bulge • Multi-position stop	4.3
☐	Maintenance • Preferred conditions • Frequency of on-site checking	4.6.8

APPENDIX B Tactile Walking Surface Indicators

Tactile Walking Surface Indicators (TWSIs), are used by people with low vision or who are blind to locate bus stops and other changes in the environment. They are required to be detectable underfoot when walking or by a white cane. They also must be contrasted with the surrounding surface.

In alignment with the Canadian Standards Association, TWSIs at the front of bus stops shall consist of flat-topped, parallel, elongated bars having:

- A height of 4 mm to 5mm;
- A top width between 17 mm and 30 mm and a base width of 10 +/- 1mm greater than the top width;
- A centre-to-centre distance between adjacent bars of 57 mm to 85 mm;
- A top length of not more than 270 mm and the base length 10 +/- mm greater than the top length;
- A spacing of 20 mm to 30 mm between the ends of the parallel bar;
- A height of base plate of not more than 3 mm;
- Slip resistant material.

Table C.1 Bar Width and Spacing Combinations

Top Width of Elongated Bars (mm)	Base Width (mm +/- 1 mm)	Centre-to-centre Distance between Elongated Bars (mm)
17	27	57-78
20	30	60-80
25	35	65-83
30	40	70-85

Source: CSA B651-18 (Table 3)

At the front of bus stops, TWSIs should be:

- Placed perpendicular to the curb;
- Aligned with the front door of a bus;
- Have a minimum length of 1.2 m along the sidewalk and be the entire width of the sidewalk;
- A contrasting colour to surrounding surfaces – yellow is preferred;
- Only be provided at bus stops that provide a hard-surfaced passenger zone and wheelchair pad.

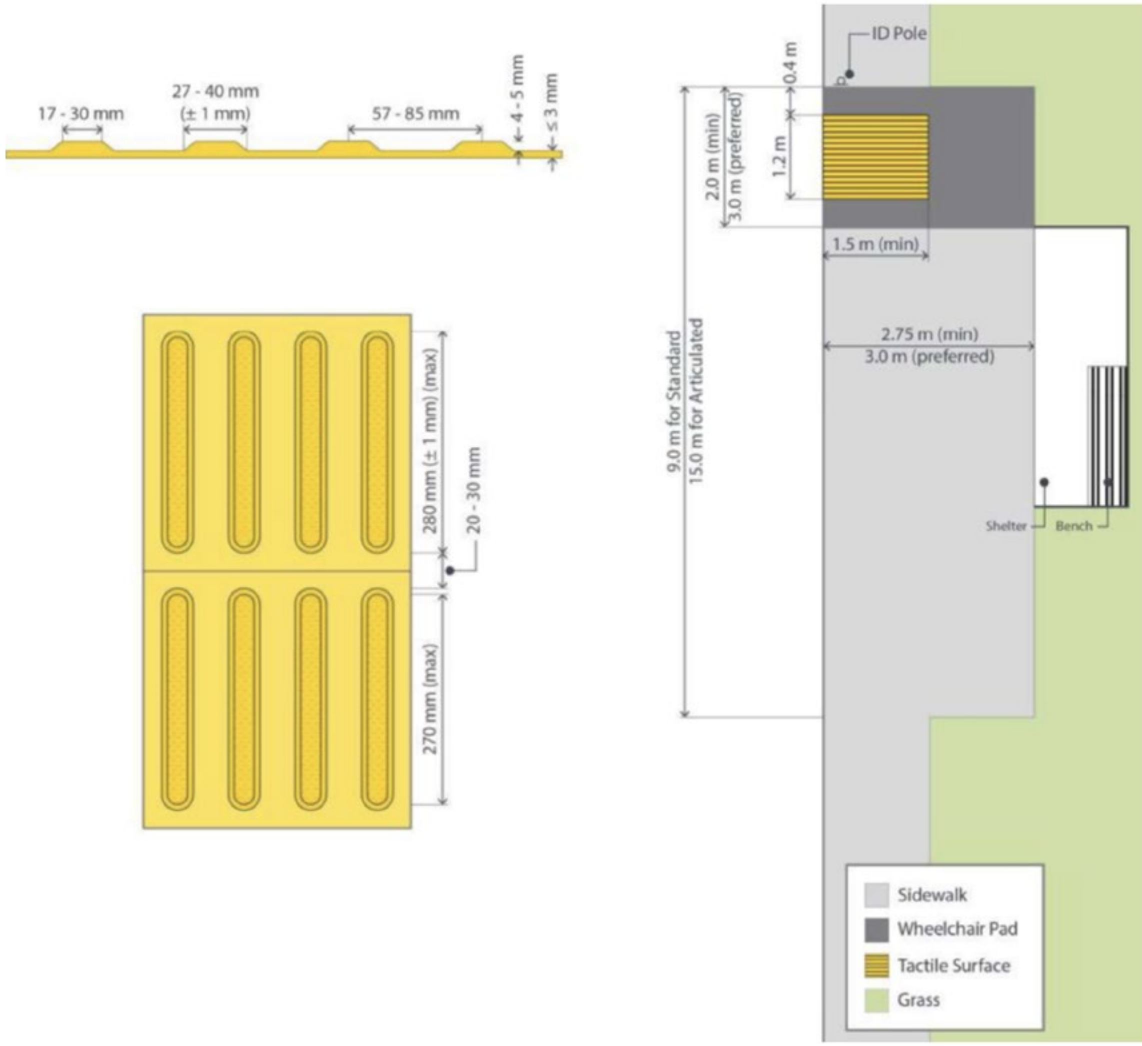


Figure B.1 Typical Layout of TWSIs at Bus Stops

Source: TransLink Bus Infrastructure Design Guide (Figure E2)

APPENDIX C Transit Priority Measures

C.1 Introduction

Transit Priority Measures (TPMs) aim to improve transit safety, travel time and reliability, leading to additional benefits such as mode shifts, reduced vehicle emissions, reduction in fleet size and increased customer satisfaction.

There are three TPM categories: regulatory measures, transit signal priority (TSP) and physical measures. Often, a combination is used; for example, a queue jump lane requires a queue jump signal phase to improve transit flow.

C.2 Regulatory Measures

Regulatory measures are road management rules that prioritize transit movement or impose restrictions on private vehicles. Common regulatory measures include:

- Movement restrictions on private vehicles at all times or during certain time periods;
- Parking restrictions at all times or during certain time periods; and
- Exemption of transit movements from existing movement restrictions.

C.3 Transit Signal Priority

TSP is an extensive subject, but there are two general types, passive and active:

- **Passive TSP** is a signal timing plan that favours transit movements through the intersection, without detecting buses in real-time. For example, green times for transit movements could be extended to minimize delay for the transit direction of travel.
- **Active TSP** works through real-time detection of buses with traffic signal controllers making real-time decisions based on transit arrival information. Depending on the pre-programmed TSP logic, the traffic signal controller may grant an extension, reduction or reject the TSP request. Active TSP has two sub-categories:

1. Conditional – Priority is granted only when certain conditions are met, typically if a bus is a certain number of minutes behind schedule or carrying more than a specific number of passengers. Conditional TSPs are less disruptive to general traffic, but more expensive because they require an additional exchange of information between the transit vehicle and the traffic signal controller.
2. Unconditional –The traffic signal controller only knows that a bus is approaching. Unconditional TSPs can lead to unnecessary provisions on buses well ahead of schedule, causing bunching and traffic disruption, but is less expensive due to less communication requirements.

Active TSPs need sophisticated detection and communication systems. Various detection and communication technologies exist, and a preferred system should be selected that is compatible with existing traffic signal technology and bus equipment as well as meeting location-specific needs. Inductive in-road loops, radar, video and GPS systems could be considered, however, BC Transit buses currently do not have on-board equipment to communicate directly with traffic signal controllers. Designers should consult with BC Transit and the jurisdiction that operates the traffic signal.

An active TSP request must be communicated to the traffic controller at a reasonable upstream distance. This distance is a function of travel speed and the green extension time that can be granted. If a maximum green extension is granted, the bus must be able to clear the intersection given the distance and the operating speed. This is why TSPs are not compatible with near-side stops.

For the inductive loop detection method, the upstream detector is called the check-in detector (see Figure C.1). Designers should consult with BC Transit and the relevant jurisdiction to determine optimal check-in detector locations

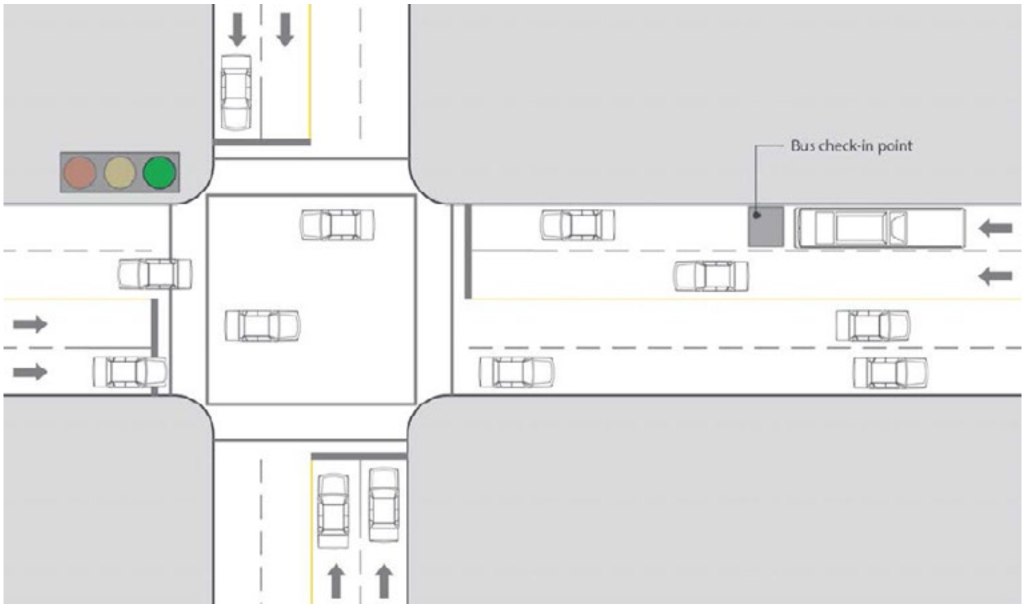


Figure C.1 Active Transit Signal Priority Check-In Point

Source: TransLink Bus Infrastructure Design Guidelines

TSP is separate from traffic signal pre-emption which can be an infinite amount of all-red time for all other traffic, until the vehicle requesting the pre-emption clears the intersection. Pre-emption implies that the transit vehicle always arrives in a green window, which is not the case for TSP. It is less commonly used for buses, as opposed to rail and light-rail crossings. Because of these differences in meaning and execution, documents should clearly identify TSP or preemption to avoid misinterpretation of the technical standards.

C.4 Physical Measures

Physical measures designate a portion of the roadway to transit operation, either by new infrastructure or reallocation of existing roadway usage. Common physical measures include:

- Dedicated transit lane (curbside, median, contraflow, etc.) and transitways;
- Approach lanes, which create a short bus lane segment through an intersection; and
- Queue jump lanes, where a bus lane is provided before the intersection and a transit signal phase allows buses to easily enter traffic flow ahead of general traffic.

C.5 Bus Lane Design

NACTO's Transit Street Design Guide is a good source of information regarding the design considerations for various categories of bus lanes including standard, offset, curbside, centre, time-exclusive, shared bus-bike and contra-flow lanes.

Key Bus Lane Considerations

BC Transit recommends that bus lanes are dedicated solely to transit unless a vehicle needs to enter the lane to make a right turn.

- Bus lanes can significantly improve on-time performance on streets where transit is delayed by congestion and curbside activities;
- Carefully manage left- and right-turns across transit facilities. Use appropriate signage and markings if turning movements cross or use the transit lane. In some cases, particularly for left turns, turning movements must be prohibited, or operated by fully protected signal phases;

- Continuous markings, signage and enforcement may be required to maintain the integrity of the transit lanes;
- The use of red paint to identify bus lanes should be limited to locations where general traffic is not allowed and where there is a significant concern that general traffic would enter the bus lane;
- For corridors with pronounced commercial and retail activities, on-street parking, loading, parklets, and other curbside uses can be placed on the right side of the bus lane – often called offset, floating, or parking-adjacent bus lanes;
- For corridors with minimal curbside activities, curbside bus lanes are an option, with right-turn movements managed accordingly; and
- For corridors with pronounced goods movement traffic and/or pedestrian traffic, a time-exclusive bus lane can be considered. In this case, buses only have the right-of-way during certain periods. Typically, lanes are designated to buses during peak periods, to goods movements during off-peaks and/or night times, and potentially to other active modes during off-peaks and/or weekends.

Bus Lane Pavement Markings

Figure C.2 illustrates typical bus lane pavement marking details. The recommendations are for an all-day bus lane in the right-hand lane and they would need to be adjusted for other configurations.

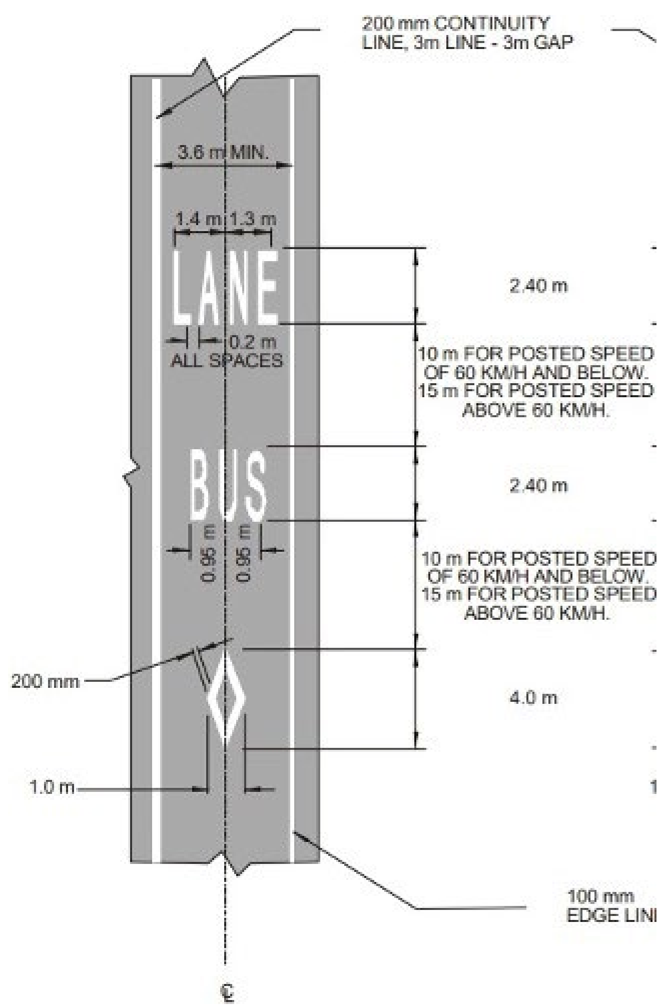


Figure C.2: Transit Lane Pavement Marking

Source: MoTT Manual of Standard Traffic Signs & Pavement Markings

- **Reserved Diamond:** 1.0 m wide by 4.0 m long, with a line width 200 mm. The distance between the Reserved Diamond and BUS is 10 m for speeds of 60 KM/H and below, 15 m for speeds above 60 KM/H.
- **Bus Lane:** The BUS dimensions are 2.40 m long by 1.9 m wide. The distance between BUS and LANE follows the same rules between Reserved Diamond and BUS. The LANE dimensions are 2.40 m long by 2.7 m wide, with 0.2 m spacing between each letter.
- **Thick White Dashed Line:** This line is used on the left side of transit lanes throughout standard traffic flow. 6 m segments of 200 mm wide white with 3 m gaps.
- **Thin White Line:** This line is used on the left-hand side of transit lanes at intersections (dashed) and on the right side of the transit lane if there is no curb (solid). Dashed lines are comprised of a 0.5 m line and 0.5 m gap. See example in Figure C.3.
- **Angled Taper Line After Right Turn:** Where there is a right turn into a bus lane, there must be an angled white dashed line as further action to avoid regular vehicles turning into the transit lane. A 2:1 taper ratio is required, with a 1.5 m gap. See example in Figure C.4.

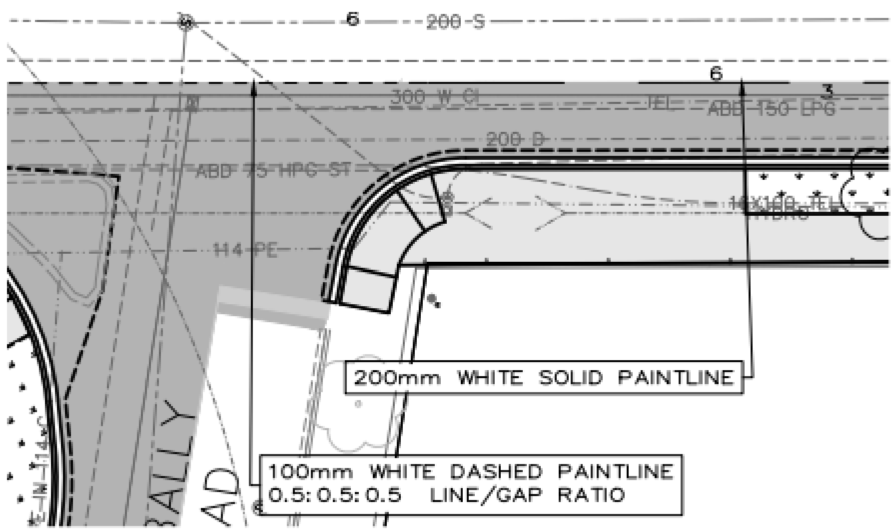


Figure C.3: Dashed Line Usage for Bus Lanes (Douglas Corridor Phase 2B)

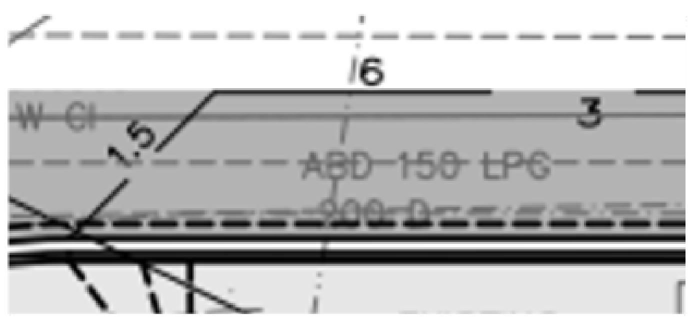


Figure C.4: Right-hand Turn Taper (Douglas Corridor Phase 2B)

Bus Lane Signs

R-200-1D: There are different types of R-200 signs, all of which are variations of overhead transit/HOV lane designation signage. Project specific discrepancies between the different R-200 signs may occur, depending on the purpose of the transit lane. However, the standard signage is R-200-1D. All R-200 signage is overhead, with the following spacing between signs:

$$\text{SPACING (m)} = \text{SPEED}\left(\frac{\text{Km}}{\text{H}}\right) * 4$$

W-321: HOV Lane in Right Lane after Turn symbol. The purpose of this sign is to inform drivers who are turning right onto a street with a transit lane to go past the lane and to turn into the all-purpose traffic lane. The sign needs to be located on the right-hand side of the intersecting street. Best practice is to place the sign on a pole with the sign at a minimum distance of 2.0 m above the ground.

APPENDIX D Signing

D.1 Bus Stop ID Pole

The bus stop ID pole should be 3 m (10 ft) tall and installed near the front right corner of the stopped bus.

- If the sidewalk is 2 m wide or greater, the ID pole should be placed 0.5 m from the curb.
- If the sidewalk is less than 2 m wide, the ID pole should be placed towards the back of the sidewalk, ensuring that it is still visible to transit passengers and operators.
- If no sidewalk is provided, it should be placed in a location that is visible to transit passengers and operators but does not risk being contacted by buses or other vehicles

Figure D.1 illustrates the preferred ID pole placement and sign orientation.

- Where the ID pole is placed close to the curb, the bus stop flag sign must be mounted with the free edge of the sign pointing away from the roadway (as shown in Figure D.1).
- If the ID pole is installed at the back of the sidewalk, the direction should be reversed, with the free edge of the sign pointing towards the roadway.
- Strip signs are centered on the ID pole and are installed on both sides, ensuring it is visible from passengers approaching from both directions.

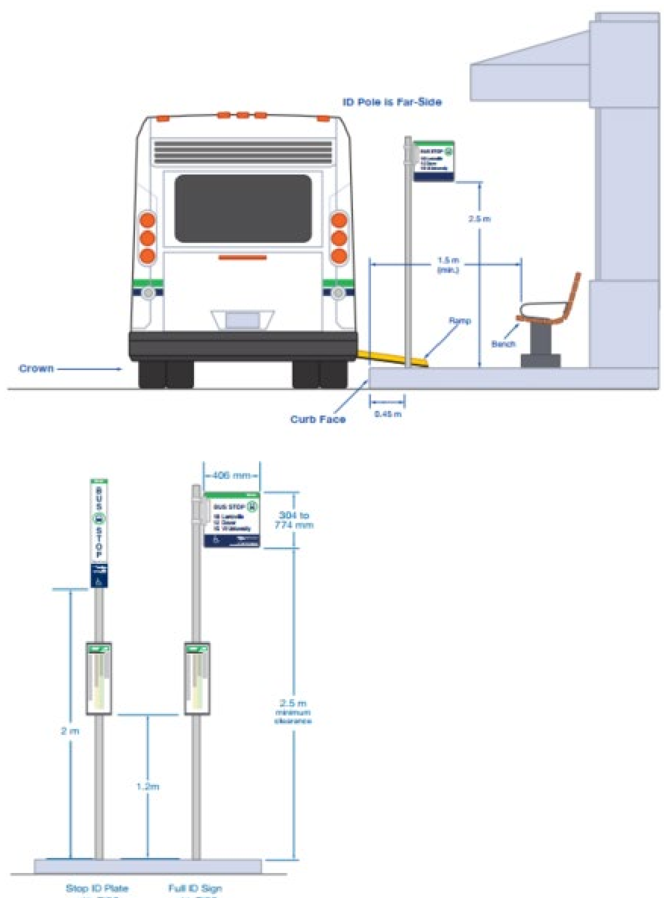


Figure D.1 Bus Stop ID Pole

D.2 Bus Stop Signs

Bus stop signs should comply with section 810.4 of the American Disability Act (ADA) Standards for Accessible Design regarding text font, size, spacing and sign height.

- Signs should have a non-glare finish and have a minimum contrast of 70% between the characters and the background;
- Characters should be uppercase, lowercase or a combination of both (with a combination being the most accessible);
- Characters should be written in a sans serif font, not be italic, oblique, script or have unusual forms;
- Characters should have a width-to-height ratio of between 3:5 and 1:1;
- Character height should be relative to the expected viewing distance.

General Sign Standards

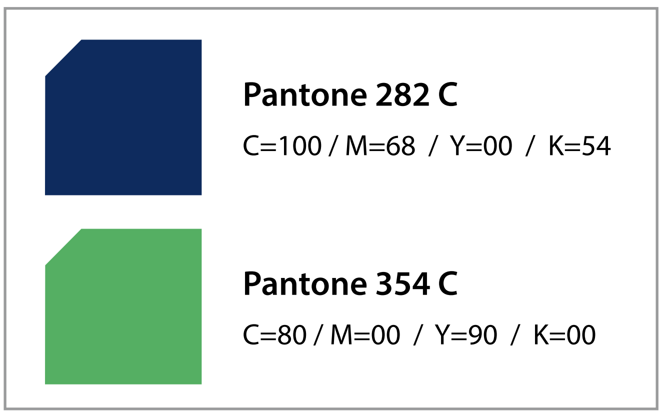


Figure D.2 General Sign Standards

Strip Sign

Size: 4.5″ wide by 30″ tall

Reflective Grade: Diamond

Required Information

- Stop ID Number
- Words "Bus Stop"
- Universal Symbol
- BC Transit Logo
- BC Transit Website
- Transit System Phone No.
- Funding Partners
  - Provincial
  - Municipal System(s)
- Wheelchair accessible decal (only on stops that meet accessible criteria)

Figure D.3 Strip Sign

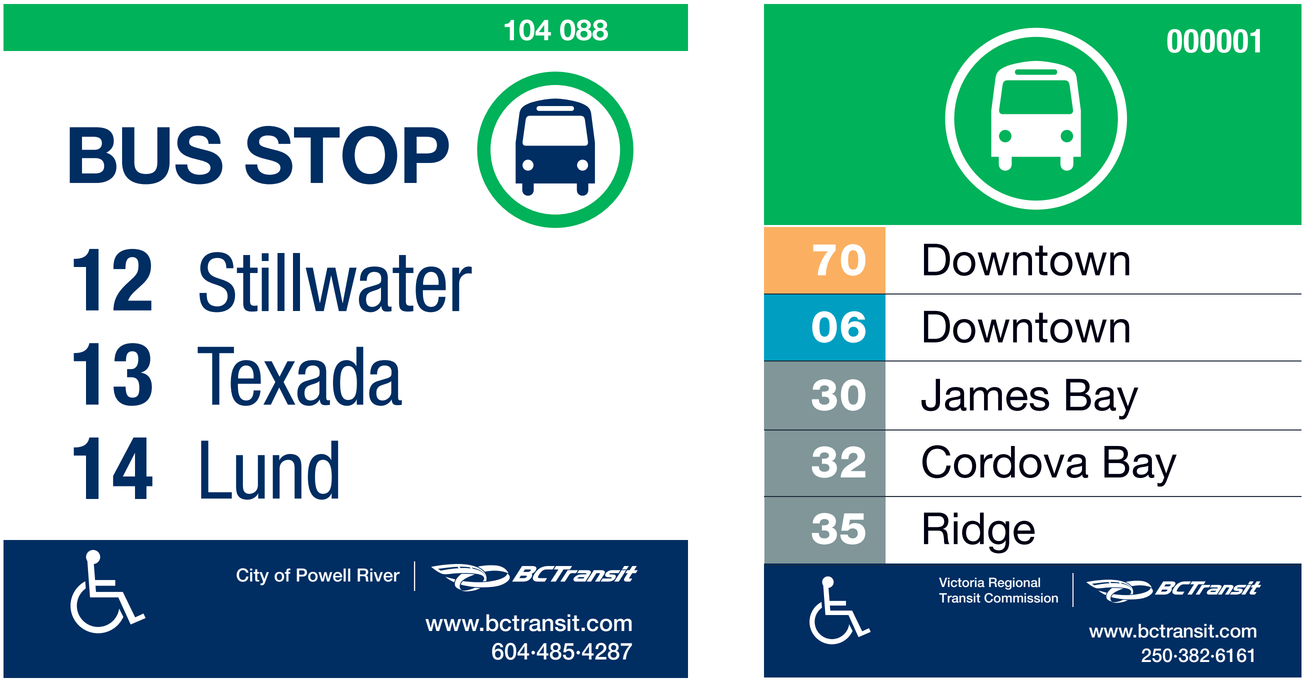


Figure D.4 Flag Sign

Flag Signs

Size: 16" w (height varies depending on # of routes listed)

Reflective Grade: Diamond

Required Information:

- Stop ID Number
- Universal Symbol
- BC Transit Logo
- BC Transit Website
- Transit System Phone No.
- Funding Partners (Municipal System)
- Wheelchair Accessible decal (only on stops that meet accessible criteria)

Route numbers and names (and frequency on System Signage (see right)

D.3 Other Signs

Figure D.5 Park and Ride Sign

Park and Ride Sign

Size: 8' wide x 4' high

Reflective Grade: Hi-Intensity (HI)

Required Information

On white area:

- BC Transit Logo
- Tag Line (Linking Communities, Businesses & Lifestyles)

On blue area:

- Universal Symbol
- "Park & Ride"
- Location (address)
- Funding Partners
  - Provincial
  - Municipal System(s)

Figure D.6 Building Sign

Building Sign

Size: 6′ wide x 4′ high

Reflective Grade: Hi-Intensity (HI)

Required Information

On white area:

- BC Transit Logo
- Tag Line (Connecting People and Communities)

On blue area:

- Location (address)
- Funding Partners
  - Provincial
  - Municipal System(s)

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