SASKATOON BUS RAPID TRANSIT ACCESSIBILITY

This technical memorandum focuses on the design principles and guidelines that are being applied to create safe and functional BRT infrastructure for Saskatoon. These guidelines ensure that the system can be used by all, without the need for adaptation or specialized design to accommodate transit customers with disabilities.

Introduction

Accessibility to transportation facilities can be interpreted in many ways. Accessibility and the application of universal design principles is often associated with persons with disabilities; however, when design that considers the needs vulnerable street users is applied, benefits extend to all. For example, facility design that supports wheelchair use also supports someone pushing a stroller, and design elements that provide cues to the visually impaired also protect those who are simply not paying attention.

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Universal Design Principles

The following Universal Design principles, which were developed by The Center for Universal Design at North Carolina State University, are considered the standard design principles which will accommodate both persons with disabilities as well as the able bodied person. The principles are intentionally broad to guide a wide range of design disciplines.

- **Equitable Use** - Useful to people with diverse abilities
- **Flexibility In Use** - The design accommodates a wide range of individual preferences and abilities
- **Simple and Intuitive Use** - Easy to understand regardless of experience, knowledge, language skills, abilities or concentration level
- **Perceptible Information** - The design communicates information effectively to the user regardless of the user's sensory abilities
- **Tolerance For Error** - The design minimizes hazards and the adverse consequences of accidental or unintended actions
- **Low Physical Effort** - The design can be used efficiently and comfortably and with a minimum of fatigue
- **Size and Space For Approach and Use** - Appropriate size and space is provided for approach and use of facility regardless of user's body size, posture, or mobility

These principles are fundamental to designing BRT infrastructure. The actual BRT design is guided by the

Transportation Association of Canada's (TAC) Geometric Design Guide for Canadian Roads and the Manual of Uniform Traffic Control Devices for Canada; the City of Saskatoon's Design and Development Standards and the BRT Bus Station Basic Design Criteria. As well, the design process is guided by best practice for transit design as documented within the Accessibility for Ontarians with Disabilities, the Americans with Disabilities and the National Association of City Transportation officials (NACTO) Transit Street Design Guide manuals, and HDR's professional experience with transit design and operation.

Specific to accessibility and safety in Saskatoon, these design guidelines are supported by the City's Accessibility Rights, Accessibility Action Plan, Active Transportation Plan, and the Safe Growth and CPTED in Saskatoon initiatives.

For example, the Accessibility Action Plan and the Saskatoon Active Transportation Plan identified a number of actions relevant to BRT infrastructure:

- Install accessible pedestrian signals at all traffic signals.
- Provide accessible curb ramps with tactile features at intersections within the city.
- Install pedestrian countdown timers at warranted locations within the city.
- Ensure all transit stops within the city are accessible.
- Monitor crossing time at intersections to ensure adequate time is provided for all pedestrians.
- Enhancing the snow and ice program to also focus on addressing accessibility for persons with disabilities

From a design perspective the BRT has multiple system components: Vehicles, Roadways, Runningways, Transit Priority Measures, Pedestrian Sidewalks and Pathways, and Stations.

Vehicles

Saskatoon Transit is committed to operating 12 metre standard and 18 metre articulated fully accessible low floor buses.

Roadways, Runningways and Transit Priority Measures

The design of roadways, runningways, and transit priority measures will be guided by the TAC Geometric Design Guide for Canadian Roads, the Manual of Uniform Traffic Control Devices, the City of Saskatoon's Design and Development Standards and HDR's professional experience with runningway, transit signal priority measures and roadway geometric improvements for transit (queue jump lanes).

Station Approaches – Sidewalks and Pathways

All transit customers start and end their journey as pedestrians, and the station approaches will need to support surges of pedestrian traffic associated with higher volumes of boarding and alighting passengers. Hence, the sidewalks and pathways connecting to BRT stations are of critical importance.

Guidelines for Station Accessibility

There is a desire for all public sidewalks and movement spaces to include universal access design principles. The movement routes that provide access to BRT stations should be considered a high priority so that transit can be a viable transportation option for as many people as possible. In this regard, station approaches should receive priority attention for upgrading and retrofitting as necessary, and may warrant a higher level of universal access design consideration than other locations due to the importance of these routes. The following represents some of the key considerations for station approaches. Detailed assessments of individual sidewalks and pathways is required to identify location-specific treatments when reconfiguring existing facilities.

Ramps

People with mobility impairments, especially wheelchair users, rely on the availability of curb ramps to transition from the sidewalk to street level crosswalks. Without curb ramps, station approaches are not usable for many people. The major design elements of a curb ramp are the approach, the landing, the ramp, the flares, the detectable warning surface, and the gutter (see Figure 1). In order to be accessible to people with mobility impairments, the slope, width, and length of each of these design elements should meet the following

guidelines. The City of Winnipeg provides greater detail than Saskatoon with regard to sidewalk ramps to support accessibility. Winnipeg's Priority 1 layout provides good guidance for Saskatoon (City of Winnipeg Public Works Standard Detail SD-229AA).

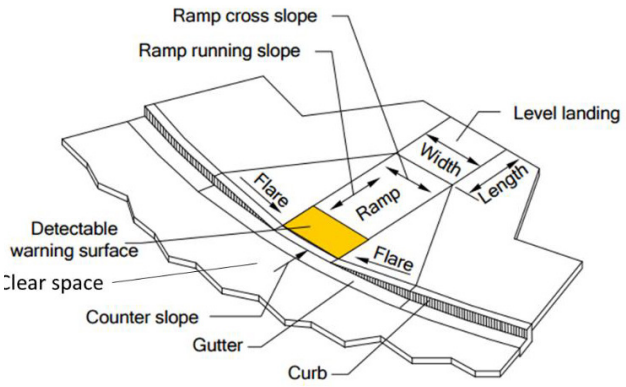

Figure 1. Sidewalk Ramp Elements

There are three types of curb ramps:

- Perpendicular
- Parallel
- Diagonal

At corners, perpendicular curb ramps are preferred and are best suited to a smaller curb radius. For larger radius corners, a diagonal curb ramp may be necessary, but it is preferable to reduce the radius of the curb if possible and use perpendicular curb ramps. Ramp types are illustrated in Figure 2.

A combination ramp (Figure 3), as shown in the photo, may be a consideration, particularly if the curb is higher than most. Combination curb ramps take the best features of parallel and perpendicular ramps and combine them. A parallel ramp is installed to lower the elevation of the landing. Then shorter perpendicular curb ramps are installed to bridge the remaining elevation gap between the landing and the street.

Figure 3. Combination Ramp

Detectable Warning Strips

Saskatoon's Specifications and Standards do not include detectable warning strips. Research has shown that a 0.6 m strip maximizes detectability and minimizes inconvenience to other pedestrians, who may have difficulty walking over large areas of truncated domes. Ideally, the strip of detectable warnings should extend across the full width of the curb ramp or flush surface. In some situations, the detectable warning may not be able to extend completely to the edge of the ramp because the

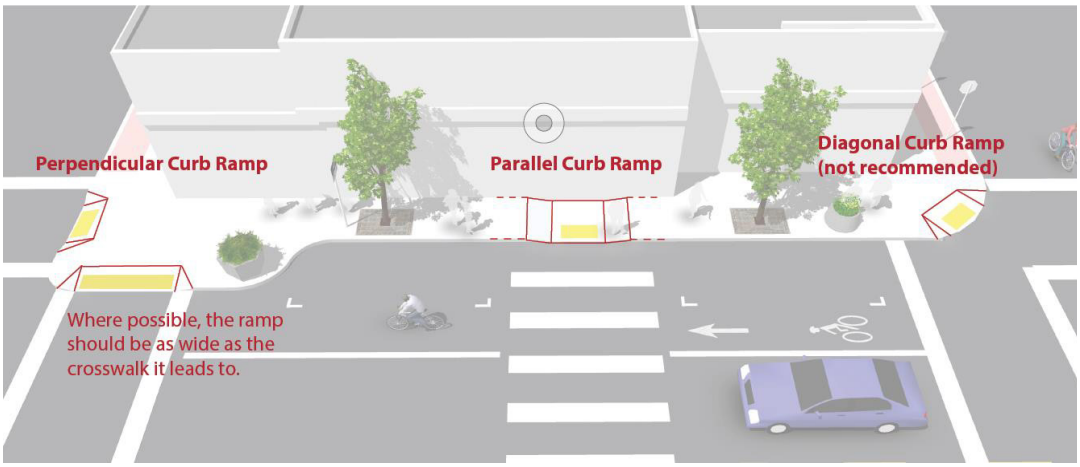

Figure 2. Types of Ramps

detectable warning tiles are manufactured in predetermined widths. It should be placed approximately 150 mm to 200 mm from the curb. The orientation should be parallel to the pedestrian's path of travel and approximately equivalent to a single walking pace. An example of a detectable warning strip is shown in Figure 4.

Figure 4. Detectable Warning Strip

Sidewalk Width

Unlike vehicles, there is no "design vehicle" for pedestrians – with or without disabilities. A single wheelchair user requires a minimum clear space of 0.9 m, and for two wheelchairs, a minimum of 1.8 m is required to pass one another. People with crutches typically require 1.1 m of usable travel width, and people with service animals or sighted guides require a minimum of 1.2 m of travel space.

The City of Saskatoon Specifications and Standards provide for sidewalk widths of 2.5m on arterial and higher street classifications, but only 1.5m on Collectors. Along BRT routes, there is higher pedestrian traffic and greater potential pedestrians needing to pass each other, particularly after disembarking, in addition to the need to accommodate those with disabilities. The minimum through zone on sidewalks should be 1.8m on BRT routes, regardless of the street classification. The through zone should be for pedestrian movement and free of permanent and temporary objects, as illustrated in Figure 5.

Other zones will vary in width depending on the type and location of the street, but they should not infringe on the pedestrian through zone.

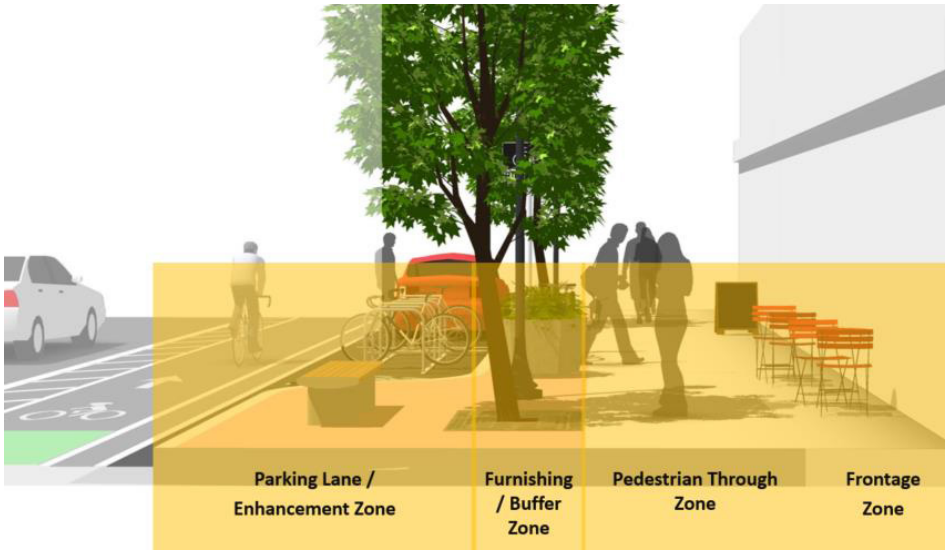

Figure 5. Public Space "Zones"

BRT Station Design Criteria

The BRT Bus Station Basic Design Criteria incorporates elements that are consistent with universal accessible design principles. Table 1 summarizes the accessible design elements of the station design criteria and provides additional detail where appropriate. Figure 6 illustrates some of the accessibility features associated with stations.

Table 1. BRT Station Accessibility Elements

Station Element	Accessibility Design Guidelines	Rationale / Application
Roadway Curb	Near Level Boarding • Curb Height 260mm • Curbs should not be higher than the road to bus clearance to avoid potential interference with bus ramps	• Brings platform pad height to near the floor level of a low-floor bus for easier access for those with reduced mobility
	Tactile Strip • Truncated dome detectable warning surface • 0.6m wide • Parallel to curb for entire length of the platform	• Provides guidance for customers with visual impairments
Station Pad	Clear Path • Minimum 1.8m between curb and shelter • No street furniture or other obstacles in clear path	• Allows for easy movement along the length of the station
	Clear Loading Area • Minimum 1.5m by 2.5m clear area at bus front door	• Accommodates movement of wheelchairs, other mobility devices
	Pad Flooring • Meets safety requirements (slip resistance) • Concrete surface (no pavers) • Free of grates, catch basins, manhole covers or other similar objects	• Changes in the surface level (even small) are a barrier to wheelchairs and other mobility devices and may present a tripping hazard to others
	Connection to adjacent sidewalk or path • Full accessible connection	• Allow for movement by all between the station and other pedestrian facilities
Station Shelter and Furniture	Shelter Size • Minimum 6.0m x 1.75m • Two entrance openings required • Minimum clear waiting space free of benches or other amenities of 760mm x 1220mm	• Provides room for wheelchair movement inside the shelter • Two openings removes the need for 180° turning by wheelchairs or mobility devices • Clear waiting area provides enough waiting space fully within the shelter with room for others to pass
	Shelter Opening • Minimum 0.95m wide	• Allow for wheelchair in/out of shelter
	Seating • Minimum one seat with armrests with a seat height of between 400mm and 450mm • Additional seating or leaning bars within the shelter and on the pad as appropriate for the station location	• Provides resting space for those with mobility impairments
Customer Systems	Customer Information • Where possible, provide multiple formats for customer information (maps, schedules, etc.), eg., electronic, audible, tactile, visual, etc.	• Allows visually or hearing impaired to receive service information • Increasingly, smart phones and other personal devices with location services may be able to provide this function

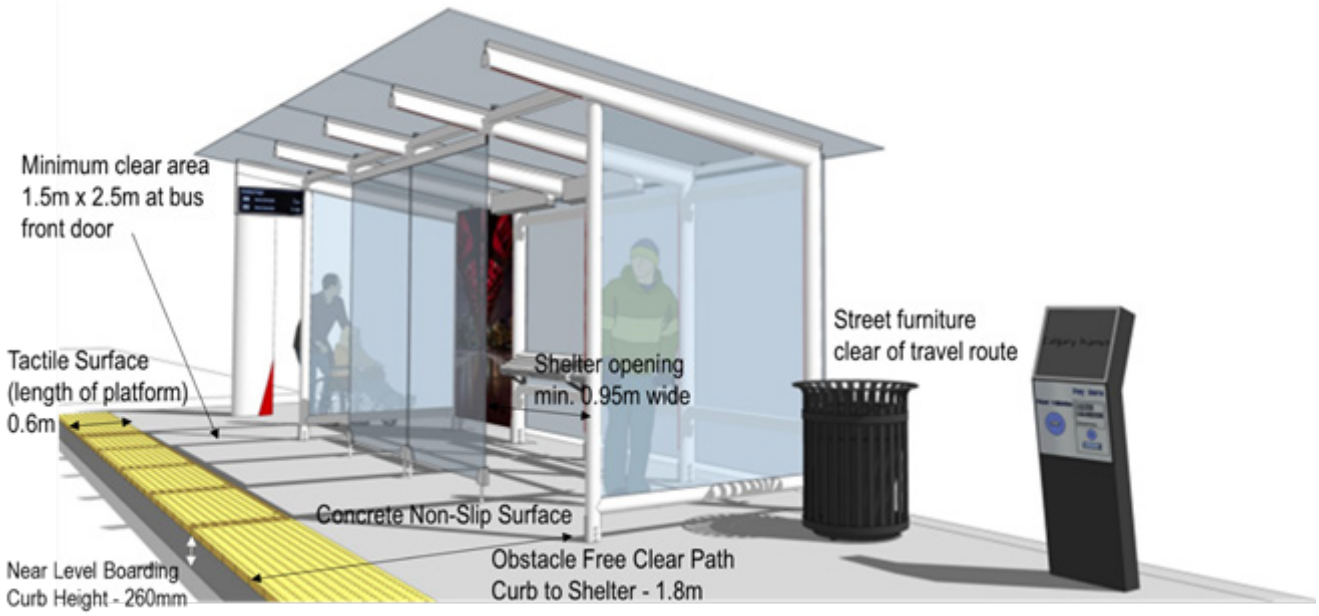

Figure 6. Examples of Station Pad Accessiblity Features

Conclusion

A high standard of accessibility design is inherent in the Saskatoon BRT infrastructure design. Mobility and accessibility design practice is evolving and there may be some specific details, such as detectable warning strips at pedestrian crossings that could enhance the current practice. In addition, design standards for pedestrian facilities that provide access to BRT stations should reflect the standards for high use facilities. Some BRT routes are on collector streets, which have a minimum sidewalk width requirement of 1.5m. As a minimum, there should be a 1.8m wide pedestrian through zone, and free of permanent or temporary obstructions.

As well, older pedestrian facilities that provide access to BRT stations should be a high priority for upgrading to support the higher pedestrian volumes generated by BRT. Upgraded facilities should apply universal accessible design principles to accommodate a wider range of users, including persons with disabilities.

Finally, a key principle in universal design is to create an environment for all, without the need for adaptation. If this principle is applied to all design the requirements for persons with disabilities and the accessibility needs of others will be met.