Design Criteria Report

Dundas BRT TPAP, PD and PDBC
Mississauga East

Metrolinx and the City of Mississauga

60645291

February 2022

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1. Introduction

The purpose of this Design Criteria Report (Report) is to outline the design criteria for the Dundas BRT Mississauga East Segment (Segment) between Etobicoke Creek and Confederation Pkwy. In addition, the report provides justification and rationale for use of this design criteria on the Project.

2. Standards, Codes and Guidelines

The standards, codes, design guidelines and design documents referred to in development of this Project are in part as shown in **Table 1** below:

Table 1. Standards, Codes and Guidelines

Title	Reference Number	Latest Issue
Accessibility for Ontarians with Disabilities Act	AODA, S.O. 2005, Chapter 11	2016
American National Standards Institute (ANSI)	Varies	Varies
American Public Transportation Association (APTA) Bus Rapid Transit Stations	APTA BTS-BRT-RP-002-10	December 2020 Rev. 1
American Public Transportation Association (APTA) Designing Bus Rapid Transit Running Ways	APTA BTS-BRT-RP-003-10	December 2020 Rev. 1
American Railway Engineering and Maintenance-of-Way Association (AREMA), Manual for Railway Engineering	N/A	2021
Canadian Highway Bridge Design Code (CHBDC)	CSA S6:19	November 2019
Canadian Standards Association (CSA)	Varies	Varies
City of Mississauga Cycling Master Plan	N/A	2018
City of Mississauga MiWay Infrastructure Growth Plan	N/A	September 14, 2020
City of Mississauga MiWay Standards and Drawings	Varies	Varies
City of Mississauga Dundas Connects Master Plan	N/A	May 24, 2018
City of Mississauga Streetscape Feasibility Study	N/A	May 2, 2019
City of Mississauga Standards and Drawings	Varies	Varies
City of Mississauga Transportation Master Plan	N/A	May 2019
GO Transit Design Requirements Manual (DRM)	GO-DRM-STD-2017-Rev4	September 2021
Illuminating Engineering Society (IES)	N/A	Varies
Manual of Uniform Traffic Control Devices for Canada (MUTCDC)	N/A	2021
Metrolinx General Guidelines for Design of Railway Bridges and Structures	RC-0506-04STR	November 15, 2018 Rev. 1.1
Metrolinx Universal Design Standard	DS-02	July 2019 V1.1
Metrolinx Sustainable Design Standard	DS-05	February 2021 V1.0
Ontario Building Code (OBC)	N/A	July 21, 2020
Ontario Electrical Safety Code (OESC)	CSA C22.1 ON-21	28th Edition (2021)
Ontario Provincial Standards and Specifications (OPSS)	Varies	Varies

Title	Reference Number	Latest Issue
Ontario Traffic Manual (OTM)	N/A	Varies
Transportation Association of Canada (TAC) Geometric Design Guidelines for Canadian Roads	N/A	June 2017
Transport Canada (TC) Standards	Varies	Varies
Transportation Cooperative Research Program (TCRP) Bus Rapid Transit – Volume 1: Case Studies in Bus Rapid Transit	Report 90 Vol. 1	2003
Transportation Cooperative Research Program (TCRP) Bus Rapid Transit – Volume 2: Implementation Guidelines	Report 90 Vol. 2	2003

Generally, the latest revision of any standard, code, design guideline or design document has been used.

3. Right-of-Way

The existing right-of-way (R.O.W.) through the Segment varies between ±22 m to ±42 m. Provided in **Table 2** below is a summary of the approximate existing R.O.W. widths through the various sections of the Segment.

Table 2. Existing Right-of-Way Widths

Section Limits	Existing R.O.W. Width
Etobicoke Creek to Arena Rd.	36 m – 42 m
Arena Rd. to Kirwin Ave./Camilla Rd.	(36 m)
Kirwin Ave./Camilla Rd. to Confederation Pkwy.	22 m – 33 m

Guiding the design of the BRT corridor is the City of Mississauga Official Plan amendment 106 to widen the Dundas St. R.O.W. to 42 m. Widening of the R.O.W. is required to allow for the addition of the dedicated median BRT guideway and the active transportation facilities. The widened R.O.W. varies in width between 32.4 m and 42.5 m.

4. Pinch Points and Constrained Areas

As part of this Project an assessment was conducted to establish any constrained areas within the Study Area, that could not be addressed through conventional design approaches, also known as Pinch Points. The assessment resulted in one Pinch Point being identified within the Study Area, which is through the Cooksville Area between Confederation Pkwy. and Jaguar Valley Dr.

A Pinch Point is a constrained area that may require different design approaches such as reduced number of lanes, or reductions in the proposed amenities in the boulevard space. Context sensitive refinements (as described elsewhere in this Report) have been made to optimize the corridor alignment and minimize impacts throughout the Segment. Refinements included optimization of the corridor alignment, application of minimum design standards (e.g., 3.35 m through lanes, 1.5 m sidewalks, 0.6 m pole zones, etc.) and a reduction in the proposed amenities in the boulevard space, including a consolidation of the cycle track, pole zone and sidewalk to a single multi-use path.

In addition to the Pinch Point through the Cooksville Area, there are several constrained areas that required similar refinements to mindfully balance the desired design objectives while mitigating impacts to property, utility infrastructure and build and environmental resources.

In the event that the constraints that necessitated the above-mentioned refinements change, the desired and/or standard design criteria shall be applied.

5. Road Geometry

The road geometry has been designed in consideration of and in accordance with the following:

- City of Mississauga Standards
- Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads
- Ministry of Transportation Ontario (MTO) Roadside Safety Manual

A description of each of the key road geometry elements is provided below.

5.1 Design Speed

Dundas St. is classified as an Urban Arterial roadway and has an existing posted speed limit of between 50-60 km/h. Based on the City of Mississauga's Geometric Design Standards for Roads, Dundas St. has been designed based on this classification with a design speed of 90 km/h and a proposed posted speed limit of 60 km/h.

5.2 Profiles and Alignments

The design of horizontal and vertical alignments for Dundas St., including minimum stopping sight distance, minimum 'K' factor, maximum grades, maximum super-elevation and minimum radii are based on a combination of the City of Mississauga Design Standards and the TAC Geometric Design Guide for Canadian Roads.

The horizontal alignment through the Segment has been mindfully located to ensure that the existing utilities and property impacts have been limited to the greatest degree possible.

For the majority of the Segment, the existing vertical profile has been maintained to limit the impact on existing utilities and adjacent properties.

Where possible an intersection deflection of 0% has been applied with a maximum of 5° in select locations, as per City of Mississauga Design Standards.

5.3 General Purpose Lane Widths

The design considers 3.50 m general-purpose lane (GPL) widths as per City of Mississauga Design Standards. This is typical for through lanes, left-turn and right-turn lanes. In constrained areas, the 3.50 m through lanes have been reduced to the minimum standard as per City of Mississauga Design Standards, which is 3.35 m, to either limit of eliminate impacts to property, and build and environmental resources.

6. Enhanced Boulevard

The enhanced boulevard consists of a dedicated cycle track, tree planting/furniture/pole zone, sidewalk and local bus stop reinstatement. A description of each of these elements is provided below.

6.1 Active Transportation

The active transportation facilities have been designed in consideration of and in accordance with the following:

- City of Mississauga's Transportation Master Plan 2019
- City of Mississauga's Cycling Master Plan 2018
- City of Mississauga Standards and Drawings
- City of Mississauga MiWay Standards and Drawings

The desired active transportation facilities consist of a standard 2.0 m wide dedicated and protected cycle track consistent with the City of Mississauga Design Standards. The cycle track is located adjacent to the curb lane throughout most of the Segment with the exception being between Confederation Pkwy. and Hurontario St. where it is located along the edge of the R.O.W. to avoid safety concerns with the cycle track being adjacent to door zones in the Cooksville area where provisions for street parking are being considered.

Adjacent to the cycle track is a varying width tree planting/furniture/pole zone, and adjacent to that is a standard 2.0 m wide sidewalk as per City of Mississauga Design Standards.

In constrained areas, the cycle track and sidewalk has been consolidated into a single multi-use path (MUP) to eliminate impacts to property and the build and environmental resources. Furthermore, the standard 2.0 m wide sidewalk has been reduced to the minimum standard as per City of Mississauga Design Standards, which is 1.80 m, to again eliminate impacts to adjacent properties.

6.2 Tree Planting Zone/Furniture Zone

The BRT corridor includes a tree planting zone within the boulevard, where possible, as proposed and agreed to by the City of Mississauga during development of the Dundas Connects Master Plan Study as presented in the Functional Streetscape Plan.

The minimum tree planting zone width used is 2.0 m as per City of Mississauga Design Standards, while the furnishing and bike parking facilities shall be as per City of Mississauga Design Standards.

Above and below ground utility infrastructure has been considered to ensure that this infrastructure accommodates the street tree corridor.

6.3 Pole Zone

The pole (utility) zone throughout the Segment is located between the proposed cycle track and sidewalk. The standard width of 2.0 m has been applied, where possible, as per the City of Mississauga Design Standards. In constrained areas, the standard pole zone width has been reduced to as much as the minimum of 0.6 m.

Where property impacts result from application of the minimum pole zone width of 0.6 m and the desired 2.0 m tree planting/furniture/pole zone does not result in a building displacement or impact to the function of a property, the desired 2.0 m tree planning/furniture/pole zones have been applied.

6.4 Local Stop Reinstatement

In addition to the introduction of the BRT infrastructure and enhanced active transportation facilities, the existing MiWay local curbside bus stops are being reinstated as per MiWay's recommendations provided on February 17th,

2021. In order to limit the impacts to adjacent properties in the vicinity of the reinstated local bus stops, MiWay's Raised Cycle Track at Nearside and Farside Bus Stops (Constrained) Standard 2240.083 has been applied throughout.

With application of the above-mentioned standard, the reinstated local stop will be placed in-between the proposed cycle track and sidewalk. To address concerns with the interaction between transit riders and cyclists, a 15 m mixing zone and signage has been introduced.

7. BRT Corridor

The BRT corridor, including platforms, has been designed in consideration of and in accordance with the following:

- Accessibility for Ontarians with Disabilities Act (AODA)
- APTA Bus Rapid Transit Stations
- APTA Designing Bus Rapid Transit Running Ways
- City of Mississauga Design Standards and Drawings
- Metrolinx Universal Design Standard
- TCRP Bus Rapid Transit – Volume 1: Case Studies in Bus Rapid Transit
- TCRP Bus Rapid Transit – Volume 2: Implementation Guidelines

7.1 Median Guideway

The median BRT guideway consists of a BRT lane in each direction, raised medians and painted buffers. A description of each of these elements is provided below.

7.1.1 BRT Lanes

The median BRT guideway consists of one dedicated BRT lane in each direction with a lane width of 3.50 m as per City of Mississauga Design Standards. The BRT lanes may be contrasted from the general-purpose lanes through the application of red plastic treatment, as used by the City of Mississauga for its bus only lanes.

Transitions from the BRT guideway into a GPL have been provided with a minimum length of 80 m, while transitions from a GPL into the BRT guideway have been provided with a minimum length of 65 m.

7.1.2 Raised Medians and Buffers

Physical barriers between the median BRT lanes or the median BRT lanes and general-purpose lanes have been provided by means of raised medians. The raised medians are intended to prevent general-purpose traffic from making left turn movements across the median BRT guideway.

A minimum raised median width of 1.0 m, face of curb to face of curb, has been applied which will not only prohibit left-turn movements but also provide snow storage.

Painted buffers between the BRT lanes and general-purposes lanes have been provided with a standard 0.5 m width provided in unconstrained locations, while a minimum width of 0.3 m has been provided in constrained locations.

Due to the median BRT guideway being enclosed by the raised medians throughout the majority of the Segment, the City of Mississauga shall consider developing a BRT specific maintenance strategy including snow removal within the BRT guideway and at the BRT platforms.

7.2 BRT Platforms

Through consultation with MiWay and Metrolinx's consultant preparing the Metrolinx BRT Standards we have developed the following design criteria for the BRT platforms.

The proposed platforms are to be located in the median on the far-side of the intersections. The length of the platforms is designed to accommodate two articulated buses with a length of 40 m. A 5 m long ramp, with an AODA compliant maximum 5% running slope, from the adjacent cross walk has also been provided. Finally, a 25 m long mountable median has been provided from the end of the passenger platform for service vehicles and emergency medical services crossing.

The desired platform width used in the design is 4.2 m to accommodate a pass-through shelter which provides the maximum passenger protection. Where constraints exist, a 3.6 m open shelter platform may be applied to either limit or eliminate property impacts.

The assumed height of the proposed platform is 150mm above adjacent BRT lane surface which will permit level boarding with the use of a BRT specific transit vehicle. If in the future, based on the Service Plan, it is determined that conventional transit vehicles are to operate within the BRT guideway and service the BRT stops, the BRT platform height will need to be adjusted to 355mm above adjacent BRT lane surface.

8. Design Criteria Summary

The design criteria developed for this Project, is shown in **Table 3** below:

Table 3. Design Criteria Summary

DESIGN PARAMETERS	MISSISSAUGA DESIGN STANDARDS	TAC DESIGN STANDARDS	PROPOSED DESIGN STANDARDS
DESIGN SPEED	90 km/h	90 km/h	90 km/h
POSTED SPEED	50-60 km/h	60 km/h	50-60 km/h
MINIMUM STOPPING SIGHT DISTANCE	N/A	170 m	170 m
EQUIVALENT MINIMUM 'K' FACTOR	83 Crest 41 Sag	39 Crest 38 Sag	83 Crest 41 Sag
GRADES MAXIMUM	6.0 %	6.0 % (Urban Arterial Divided)	6.0 %
MAXIMUM SUPER-ELEVATION	4.0 % 6.0 %	4.0 % 6.0 %	4.0 %
MINIMUM RADIUS	580 m	530 m (4% SE)	580 m
INTERSECTON DEFLECTION		3-5°	3-5°
DESIRED CROSS SECTION	N/A	N/A	4 GPL Lanes @ 3.50 m 2 Median BRT Lanes @ 3.50 m 0.50 m Platform/GPL Buffer 4.20 m BRT Station Platform 2.00 m Medians[1]
THROUGH LANE WIDTH	3.50 m (Standard) 3.35 m (Minimum)	3.30 m (Lower Limit) 3.70 m (Upper Limit)	3.50 m (Standard) 3.35 m (Minimum)
CURB LANE WIDTH	3.50 m (Minimum)	3.30 m (Lower Limit)	3.50 m (Minimum)
RIGHT TURN LANE WIDTH	3.50 m (Minimum)	3.70 m (Upper Limit)	3.50 m (Minimum)
LEFT TURN LANE WIDTH	3.50 m (Standard) 3.35 m (Minimum)	3.30 m (Lower Limit) 3.70 m (Upper Limit)	3.50 m (Standard) 3.35 m (Minimum)
BRT LANE WIDTH	3.50 m	N/A	3.50 m
MEDIAN WIDTH	2.00 m (Standard) 1.00 m (Minimum)	2.00 m	2.00 m (Standard)[1] 1.00 m (Minimum)[1]
BRT STATION LENGTH	N/A	N/A	40 m Platform 5 m Ramp 25 m Service Platform
BRT STATION WIDTH	N/A	N/A	4.20 m (Desired) 3.60 m (Minimum)
BRT/GPL BUFFER	0.50 m (Standard) 0.30 m (Minimum)	N/A	0.50 m (Standard) 0.30 m (Minimum)
LOCAL STOP BUS SHELTER PAD	4.0 m (Length) 2.1 m (Width)	N/A	4.0 m (Length) 2.1 m (Width)
LOCAL STOP PEDESTRIAN LANDING PAD	15.0 m (Length) 2.0 m (Width)	N/A	15.0 m (Length) 2.0 m (Width)
SIDEWALK FACILITY WIDTH	2.00 m (Standard) 1.50 m (Minimum)	1.50 m (Minimum) 2.30 m (Maximum)	2.00 m (Standard) 1.50 m (Minimum)
CYCLING FACILITY WIDTH	2.00 m (Standard) 1.50 m (Minimum)	1.50 m (Minimum) 3.00 m (Maximum)	2.00 m
MULTI-USE PATH WIDTH	3.50 m (Standard) 3.00 m (Desired) 2.70 m (Minimum)	2.70 m (Minimum) 6.00 m (Maximum)	3.00 m (Minimum)[2]
POLE ZONE (BETWEEN CYCLE TRACK AND SIDEWALK)	2.00 m (Standard) 0.60 m (Minimum)	N/A	2.00 m (Standard) 0.60 m (Minimum)
PLANTING ZONE WIDTH	2.00 m (Minimum)		2.00 m (Minimum)

ROW WIDTH (ROAD & BOULEVARD)	42.00 m	N/A	Up to 42.00 m[3]
TRAFFIC SIGNALS	City of Mississauga Std.	N/A	City of Mississauga Std.

[1] Localized median widening at intersections.

[2] Provision of multi-use path varies on proposed structures.

[3] ROW width varies.

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