

Executive Summary

Introduction

Extending the planned Hurontario LRT from the Brampton Gateway Terminal at Steeles Avenue to the Brampton GO station is a key transit priority and city-building project for the City of Brampton. The LRT extension will play an important role in the long-term rapid transit network in Brampton and is essential for supporting the sustainable growth and evolution of the Downtown Core and Central Area.

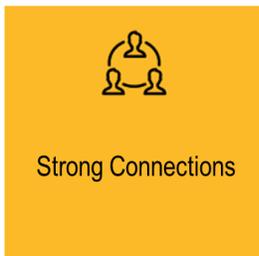
The Brampton LRT Extension study is intended to address the growth-related transportation needs specifically in Brampton by extending the Hurontario LRT along Brampton’s Main Street from the Brampton Gateway Terminal to the Brampton GO Station. In addition, the extension is envisioned as a transformational city-building project helping to achieve broader objectives of the 2041 RTP of building economically strong, well connected, and sustainable communities.

Vision and Goals

The LRT extension will contribute to a safer and more integrated transportation system to serve the City of Brampton, encouraging civic sustainability, emphasizing transit use and other modes of transportation over traditional automobiles, and supporting the revitalization of Downtown Brampton into an aesthetically beautiful, place-making destination. The vision for the LRT extension reflects the transportation vision and actions set out in the Brampton 2040 Vision (2018).

The study has three main goals as follows:

- Create Strong Connections
- Build Complete Travel Experiences
- Support Sustainable and Healthy Communities.



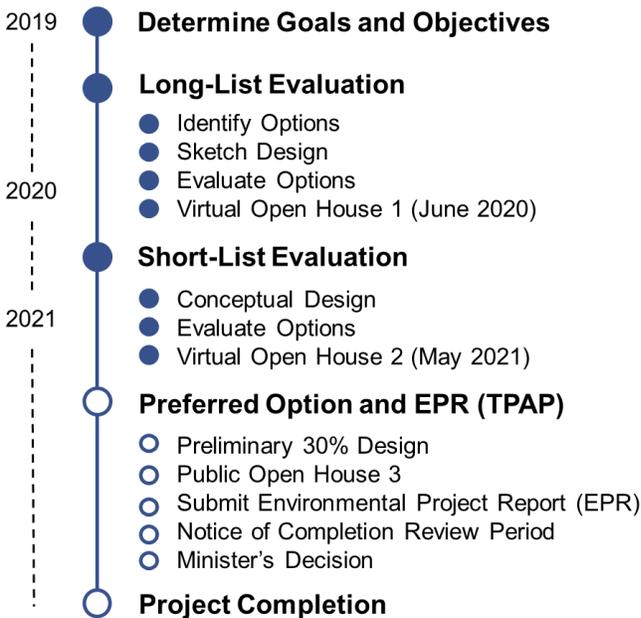
Project Background

In 2008, the publication of Metrolinx’ “Big Move” 2041 Regional Transportation Plan (RTP) identified a strategic need for a rapid transit system along the corridor between downtown Brampton and Port Credit (the Hurontario corridor) due to forecasted significant population and employment growth. In 2018, the [2041 RTP](#) was updated and reaffirmed the recommendation to extend the Hurontario LRT north from Steeles Avenue to Brampton GO.

Since the publication of the Big Move 2041 RTP and its latest update, the Hurontario-Main corridor has been a subject of studies that demonstrated the case for rapid transit, including [Hurontario Main Street Corridor Master Plan \(October 2010\)](#) and the [Hurontario-Main LRT Environmental Project Report \(June 2014\)](#). The [Hurontario LRT Benefits Case Analysis \(March 2016\)](#) presented a strong business case for this infrastructure, although with a reduced scope from Port Credit GO station in Mississauga through downtown Mississauga to Brampton’s Gateway Terminal. This project was approved by the provincial government, and the construction began in early 2020.

Study Process

The evaluation of options is a multi-level process that has occurred over the course of the study. The Preliminary Design Business Case (PDBC) constitutes the final step in the evaluation of options before the initiation of the Transportation Project Assessment Process (TPAP). The flow chart below illustrates the study process.



Through this process, the long list of LRT options was evaluated and narrowed down to a short list. The short list was evaluated and has been presented at Virtual Open House 2 from April 22 through May 2021. Once a preferred LRT option is selected, the TPAP can be initiated and the Environmental Project Report developed.

Business Case Approach Overview

Business Case analyses are required by Metrolinx for all capital projects slated to obtain financial contributions from higher levels of government. They are completed to define the rationale and requirements for delivering the investment and forecast its performance in relation to the determined goals. This Preliminary Design Business Case (PDBC) will identify the best performing alternative for the extension of the Hurontario LRT. The approach is based on Metrolinx' Business Case framework that comprises four cases and introductory/background chapters as follows:

- **Problem Statement:** defines the need for the project and the case for change. It spells out the project justification and provides directions for the evaluation of investment options considered within the business case by specifying its strategic objectives. The project background dates back to 2008 when the Metrolinx' "Big Move" 2041 Regional Transportation Plan (RTP) identified a strategic need for a rapid transit system along the Hurontario Street between downtown Brampton and Port Credit (the Hurontario Corridor) to address the forecasted significant population and employment growth in the region. The LRT project would also support the "city building" objectives and support sustainable growth and offer competitive transportation service.
- **Investment Options:** introduces the investment alternatives to be evaluated and compared through the four cases that constitute the Business Case. The chapter briefly discusses how the options were developed and outlines the assumptions used in the travel demand and performance modeling. The short list of options evaluated in this business case includes four surface options and two options with underground segments. The options differ principally with respect to the LRT use of the road space along its route (LRT operations on dedicated lanes versus LRT operations on lanes shared with other traffic, and LRT operations underground) and some differences in alignment and station locations.
- **Strategic Case:** addresses how the project (with its investment options) will achieve strategic transportation objectives. The strategic objectives were defined around the strategic goals of the 2041 RTP – (A) Strong Connections, (B) Complete Travel Experiences, and (C) Sustainable and Healthy Communities – and represent the desired outcomes associated with each goal. The objectives center around improving access to transit and its performance, promoting a more sustainable transportation system, and supporting city-building objectives. The Strategic Case presents the performance of the short-listed options against the identified strategic objectives where the performance is measured with a set metrics that include quantitative and qualitative measures, as indicated in the following graphic.

Strategic Case Criteria:



Strong Connections

- Improve access to transit
- Increase access to economic opportunities
- Support city-building objectives



Complete Travel Experiences

- Improve travel time and level of service
- Improve comfort and safety
- Building an integrated transportation network



Sustainable and Healthy Communities

- Move people with less energy and pollution
- Improve quality of life and public health
- Reduce impacts to the natural and cultural environment

- **Economic Case:** evaluates the life-time economic costs, benefits and impacts of the proposed investment project to establish its economic benefits to society, net benefits, and the benefit-cost ratio. Project benefits and impacts were monetized to the greatest extent possible and compared with costs in a structured benefit-cost analysis framework, capturing the following:

Economic Case Criteria:



User Benefits

- Travel Time Savings
- Reliability Benefits
- Journey Quality Benefits
- Travel Time Impacts to Vehicles
- Vehicle Operating Cost Savings



External Benefits

- Decongestion Benefits
- Reduction in Road Accidents
- Reduction in Vehicle Emissions
- Health Benefits



Costs

- Capital Construction Costs
- Major Maintenance, Rehabilitation and Renewal Costs
- Annual Operations and Maintenance Costs

- **Financial Case:** establishes the costs to deliver the project, provides an overview of life-cycle costs and revenues related to the project and its overall financial performance. Costs taken into account include capital construction costs, financial costs, capital renewal costs, and incremental annual LRT operating costs. These are compared against expected incremental fare revenues due to new transit users to determine the overall fiscal impact of the project and operating ratios.

Financial Case Criteria:



Costs

- Capital Construction Costs
- Financing Costs
- Major Maintenance and Renewal Costs
- Incremental Operations and Maintenance Costs



Revenues

- Additional LRT Revenues
- Additional GO Revenues

- **Deliverability and Operations Case:** provides a discussion on the feasibility and constructability of the project alternatives and considers risks. The discussion identifies known issues and constraints around each option that may facilitate or hinder project implementation and progress.

Deliverability and Operations Criteria:



Design / Operational Tradeoffs

- Emergency and Service Vehicles
- Property Impacts
- Driveway Impacts
- Utility Impacts
- Impacts to CN bridge
- Ability extend northward



Construction and Mitigation

- Constructability
- Construction Impacts
- Noise
- Traffic Management



Procurement and Delivery

- Risks and advantages of traditional and innovative procurement approaches



Operations and Maintenance

- Limitations and assumptions dictating the system operation and maintenance plans

The framework is based on common business case concepts and principles including objective, evidence-based and transparent approach, consideration of comprehensive life-time benefits, costs, and impacts compared to a Business as Usual (BAU) or a no-build scenario, and using industry accepted guidance and assumptions for key parameter values such as the of travel time savings or discount rates. In Metrolinx’ approach, business case analysis may be conducted multiple times as the project progresses through its development process, updated when new project-relevant data and information emerge.

As a PDBC, this business case conducts the analysis for a set of identified short-listed of options that incorporate certain design elements with potential impacts on their performance (conceptual design stage).

Problem Statement and Case for Change

Brampton’s population is forecasted to increase by nearly 200,000 between 2016 and 2031 (or by 31.4 percent), and employment is forecasted to increase by nearly 82,000 (or by 40.3 percent). In the study corridor, population is expected to increase by over 20,000 (or 34.6 percent) and employment is expected to increase by over 8,000 (or 46 percent) ¹.

The growth is expected to continue past 2031, although at a slower rate. Between 2031 and 2041, Brampton’s population is expected to increase by 9.6 percent while employment is expected to increase by 14 percent. For the study corridor, the forecasted rates of growth are 12 percent for population and 17 percent for employment. If growing transportation needs are not adequately addressed, the significant increase in population and employment will exacerbate congestion, lengthen travel time and impact the quality of life for City of Brampton residents and commuters.

¹ Future population and employment forecasts provided by the City of Brampton (September 2019)

High capacity rapid transit offers an opportunity to address these needs by providing an attractive travel option with competitive journey times, reliability, and connections to other modes. The Hurontario-Main corridor is currently serviced by four bus services which operate during weekday peaks, off-peak periods and weekends, and provide connections to Brampton GO and other parts of the city. Based on the forecasted ridership, it is estimated that at the minimum by 2031 transit frequencies in Mississauga and Brampton will have to increase by 15 percent, and frequencies of corridor routes will have to increase by 40 percent. Given increasing congestion, it is also estimated that average journey times would increase by 5 percent across all routes². Therefore, introduction of rapid transit in the corridor is needed to increase transit capacity, offer attractive travel times and performance compared to existing transit and to auto travel in this growth corridor.

Further supporting the case for change, since the publication of the Big Move 2041 Regional Transportation Plan, other studies have been undertaken and have demonstrated the need for rapid transit along Main Street in downtown Brampton.

The Hurontario Main Street Corridor Master Plan (October 2010) introduced a project vision to provide an easy, reliable, frequent, comfortable and convenient light rail transit service throughout the corridor, with effective connections to other links in the inter-regional transit network, which could alleviate anticipated congestion on the corridor. The Hurontario-Main LRT Environmental Project Report (June 2014) built on the first master plan's visions and guiding principles, identifying an approach for a comprehensive 'urban style' LRT which would have competitive journey times, increase journey time reliability, minimize adverse impacts, make a positive contribution to the "beautiful street" component of the vision, and have affordable capital and operating costs. The Hurontario LRT Benefits Case Analysis (March 2016) re-instated the vision from the Hurontario-Main LRT Environmental Project Report (June 2014) and compared the vision to Metrolinx "The Big Move" objectives presenting a strong business case for this infrastructure.

The Brampton LRT Extension study plans to connect the Hurontario LRT along Main Street from the Brampton Gateway Terminal to the Brampton GO Station. The project will address the need for an appropriate, reliable, frequent, comfortable and convenient rapid transit service required to meet the forecasted demand. In doing so, the extension will improve the vibrancy of the Main Street corridor and ensure effective connections to other links in the inter-regional transit network. The proposed vision presented in the Brampton LRT Extension Study is consistent with Metrolinx 2041 RPT vision and goals for transportation in the region.

The impacts of the COVID-19 pandemic on transit ridership and travel patterns have been duly noted and are recognized to be especially pronounced in the short term. However, the future population and employment to be served by the LRT extension is based on approved long-term growth forecasts. By 2041, the City continues to expect a need for this investment to meet the future needs of Brampton residents and businesses; therefore, the ongoing planning and design of the LRT is an important step to secure future funding.

² Hurontario LRT Benefits Case Analysis," March 2016; Prepared by Steer Davies Gleave for Metrolinx; para 3.18 and 3.19.

Findings from Public Engagement

The study has engaged the public at several occasions through the study. During the COVID-19 pandemic, following the advice of Ontario’s Chief Medical Officer of Health, engagement activities have been hosted in a virtual format.

Following the Summer 2020 virtual Open House, which presented a long list of LRT options, the study team received hundreds of comments from the public regarding the future of the LRT extension. Frequently noted key messages from virtual Open House 1 are as follows:



From Thursday, April 22, 2021 to Thursday May 13, 2021, virtual Open House 2 was held online, to solicit public feedback on the short list, the findings of the Preliminary Design Business Case and the emerging preferred investment options. A summary of the public input from virtual Open House 2 can be found under separate cover.

Investment Options

The study area extends 3.6 km from the Brampton Gateway Terminal at Steeles Avenue East to the Brampton GO Station in Downtown Brampton. To enable the development and evaluation of LRT options, the study area was segmented based on existing and future context such as land use, number of lanes, existing and future right-of-way, and environmental features. The study area was divided into the three major segments (A,B and C), each with its distinct cross-sectional characteristics and constraints:

- **Segment A**, further divided into two segments:
 - A1: Steeles Gateway: from Steeles Avenue to Charolais Boulevard; and
 - A2: Main Street Greenway: from Charolais Boulevard to Nanwood Drive.
- **Segment B**, Main Street South: from Nanwood Drive to Wellington Street.
- **Segment C**, Downtown: from Wellington Street to Brampton GO Station.

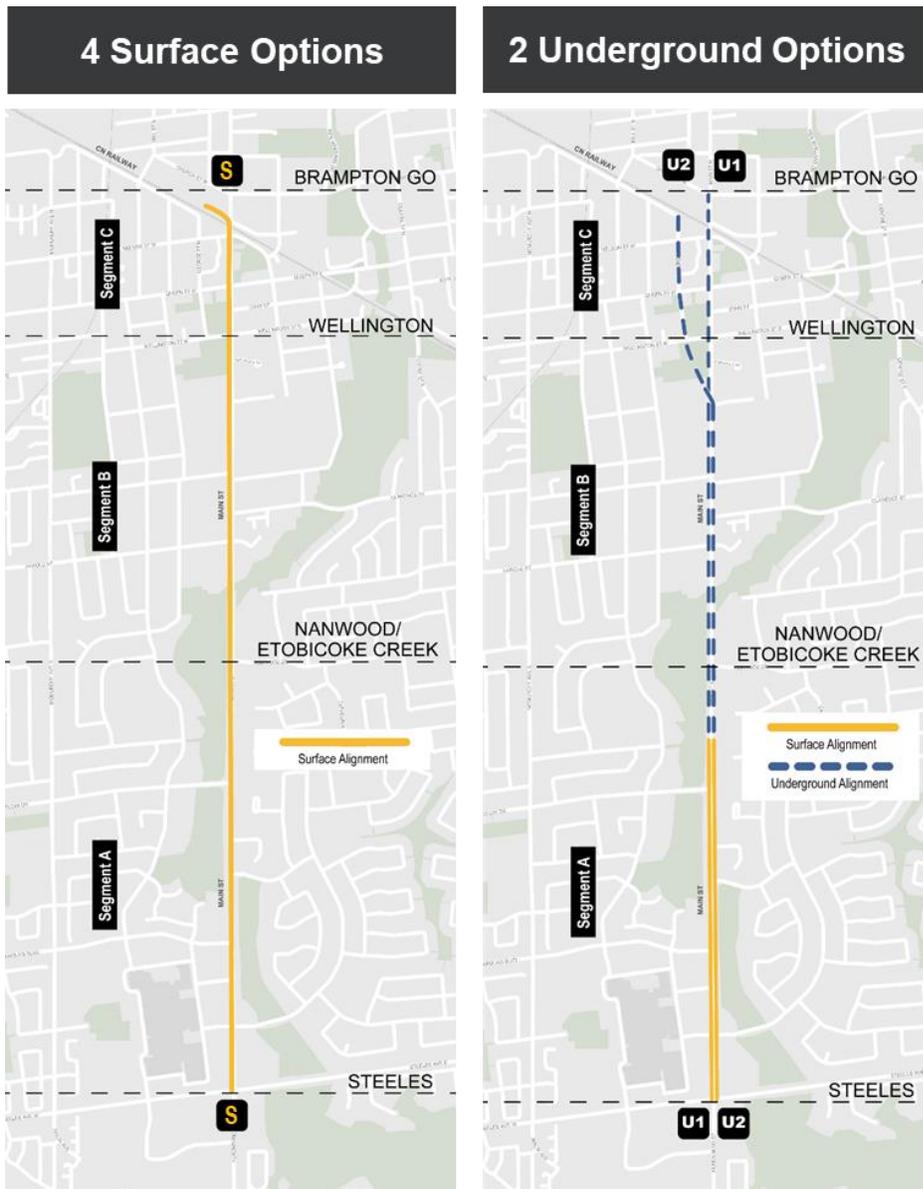


A long list of twelve (12) options was developed and included:

- Six (6) Surface Options (surface LRT along Main Street);
- Four (4) Loop Options (surface LRT along Main Street with a one-way counterclockwise loop along Nelson Street, George Street, and Wellington Street); and
- Two (2) Underground Options (surface LRT along Main Street from Steeles Avenue to just south of Nanwood Drive and then underground from Nanwood Drive to the Brampton GO Station).

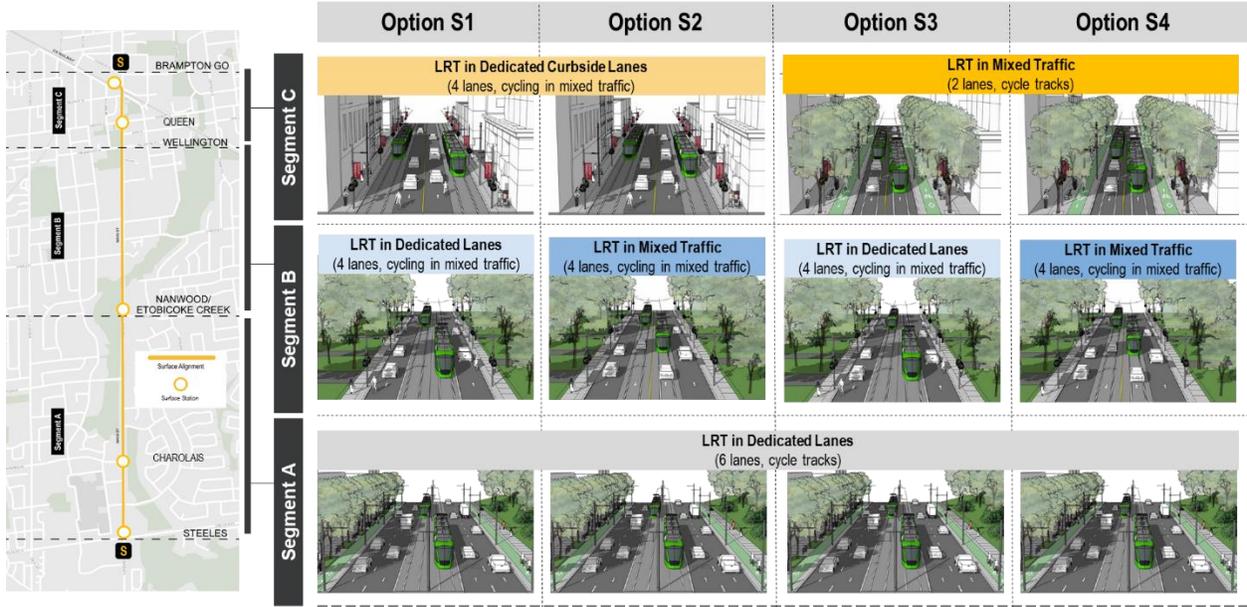
The long list of options was evaluated, presented to the public at virtual Open House 1 from June 22 to July 31, 2020 and narrowed down to a short list for further assessment. Loop options were not advanced due to technical feasibility pertaining to physical constraints and operational challenges in Downtown Brampton with respect to the proposed Hurontario LRT vehicle.

Based on the evaluation of the long list, a short list of six (6) options were carried forward. The short list is composed of four (4) surface options and two (2) underground options which were modelled to investigate impacts on transit and vehicular levels of service. Options generally differ with respect to the use of the road space (dedicated lanes versus lanes shared with other traffic), in alignment and station locations. Surface options are denoted by an “S” whereas underground options are denoted by a “U”.



Surface Options

Short List: Surface Options

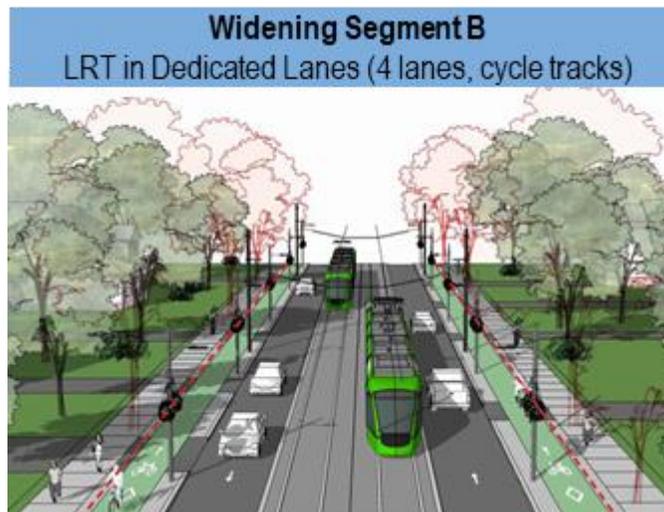


All boulevard configurations shown are subject to change.

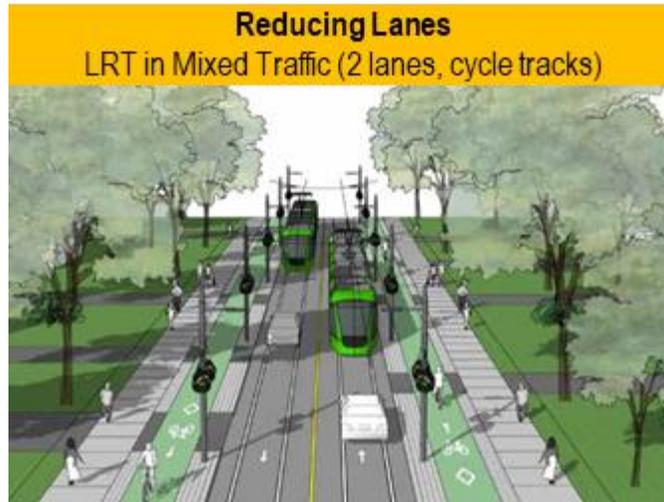
- Option S1** This option consists of an above-ground dedicated LRT lanes in all segments of Main Street with the terminal station at the Brampton GO Station. This option reduces the travel lanes for automobiles to 2 lanes in Segments B and C. This alternative does not permit left turns along Segment B. No on-street parking is planned for Main Street. This option does not provide a continuous dedicated cycling route: cyclists can use dedicated cycle tracks in Segment A but must ride in mixed traffic conditions or on parallel routes in Segment B and C.
- Option S2** This option consists of an above-ground dedicated LRT lanes in Main Street segments A and C and an LRT in mixed traffic within Segment B. The terminal station at the Brampton GO Station. This option is consistent with the 2014 TPAP recommendations. No on-street parking is planned for Main Street. This option does not provide a continuous dedicated cycling route: cyclists can use dedicated cycle tracks in Segment A but must ride in mixed traffic conditions or on parallel routes in Segment B and C.
- Option S3** This option alignment consists of a dedicated LRT lane in Segments A and B, and a shared LRT lane in Segment C. The terminal station is at the Brampton GO Station. This segment reflects the vision of Downtown Reimagined, which includes two lanes of shared mixed traffic and wide boulevards on either side in Segment C. No on-street parking is planned for Main Street. This option does not provide a continuous dedicated cycling route: cyclists can use dedicated cycle tracks in Segment A and C but must ride in mixed traffic conditions or on parallel routes in Segment B.

- Option S4** This option alignment consists of a dedicated LRT lane in Segment A and a shared LRT lane in Segment B and C. The terminal station is at the Brampton GO Station. This segment reflects the vision of Downtown Reimagined, which includes two lanes of shared mixed traffic and wide boulevards on either side in Segment C. No on-street parking is planned for Main Street. This option does not provide a continuous dedicated cycling route: cyclists can use dedicated cycle tracks in Segment A and C but must ride in mixed traffic conditions or on parallel routes in Segment B.

Surface options presented challenges in accommodating dedicated cycling facilities between Nanwood Drive and Wellington Street due to the limited 20 m right-of-way available in that section of the study corridor. This led to a subset of options being developed that would enable cycling and provide full cycling network connectivity between uptown and downtown Brampton. Variations in the Segment B cross-section were identified while retaining Segment A and C elements consistent with options S3 and S4. These additional options ultimately possessed critical flaws, major impacts and operational and safety concerns. Therefore, they were not evaluated in the PDBC. The investigation of cycling opportunities in Segment B is summarized and reasons for not including them in the PDBC are explained as follows:



- Right-of-way (ROW) widening in Segment B to accommodate dedicated cycle tracks:** ROW widening posed significant impacts to the natural and cultural heritage environment as well as residential properties and their driveways. Widening would require an additional 6180 m² of property acquisition (as compared to no widening) which would result in increased project costs to the City. Furthermore, strong public and property owner interest has been expressed for the retention of the heritage character and mature tree canopy on Main Street south. An arborist survey was conducted on November 24, 2020 to quantify impacts of widening the ROW to 30m on existing trees. Trees expected to be removed, injured and retained were identified, including mature trees of significance (>100 cm Diameter at Breast Height). 148 trees would be removed (0 significant) while 111 would be injured (5 significant). A meandering multi-use trail was considered but was found to not minimize impacts to trees between the edge of the street and the future ROW line.



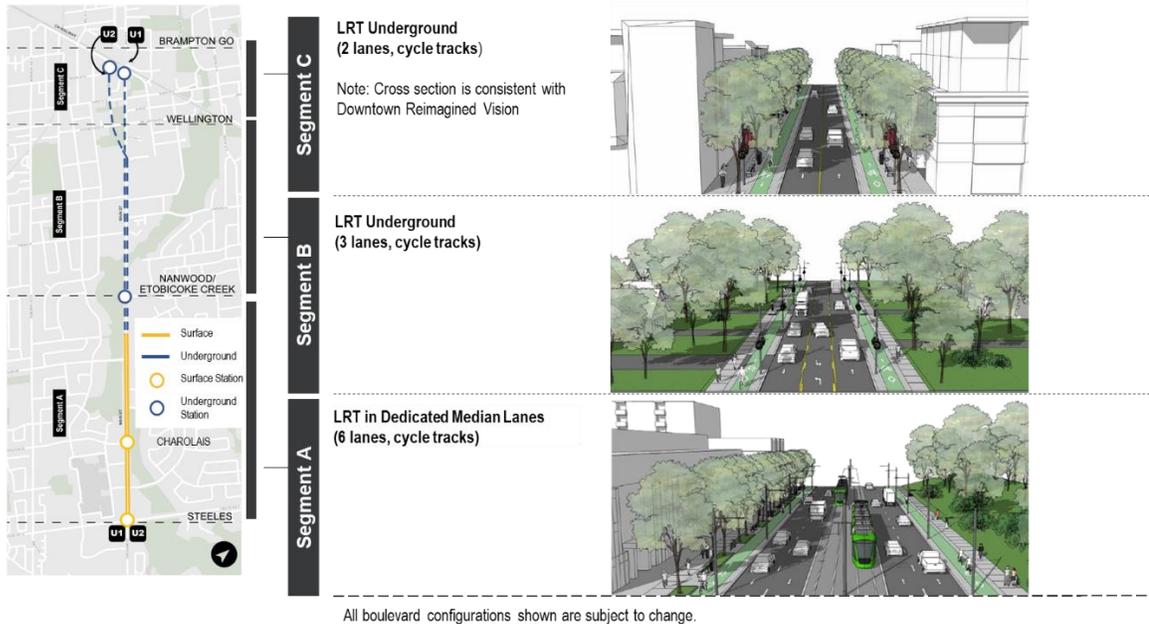
- **Reduction of lanes in Segment B to 2 / 3 shared LRT and general traffic lanes:** With a 2 or 3 lane section in Segment B, a significant increase in auto and transit travel time was observed, eroding the value of money proposition for such an option. Moreover, it would be unsafe to have vehicles turn left out of driveways across the opposing LRT lanes. The number of driveways (approximately 73) and length (~1 km) of this segment further increases risk of severe collisions (broadside and rear end). It would be extremely difficult to enforce turn restrictions as these are private, unsignalized driveways, making this option unfavorable from a traffic safety perspective. The mixed traffic/transit conditions would also be very poor for emergency/service vehicle operations (garbage removal, snow clearing) and would have additional negative impacts on transit/traffic unless shifted to off peak hours.

In light of the interrupted cycling network that characterizes surface options in Segment B, alternative or parallel cycling routes are under consideration to provide cycling connections to downtown Brampton. Potential cycling connections include routes along low traffic streets such as Elizabeth Street or along the existing Etobicoke Creek trail. Improvements to alternative or parallel cycling routes will be confirmed in the next stages of the study. In the absence of dedicated infrastructure, cycling in mixed traffic is to be protected in surface options through the use of sharrows and the provision of dedicated cycling facilities along alternate parallel routes.

This analysis is consistent with the Hurontario-Main LRT TPAP (2014) recommendations which do not include dedicated cycle facilities between Nanwood Drive and Wellington Street.

Underground Options

Short List: Underground Options 1 (Main St) & 2 (George St)



- Option U1** This option consists of a dedicated surface LRT in Segment A and underground portion running along Main Street in Segments B and C. Surface stations are provided at Steeles and Charolais while underground stations are provided at Nanwood and Brampton GO. For underground options, there is no station at Wellington/Queen. On the surface, the 3 traffic lanes will be provided along Segment B and the Downtown Reimagined vision of two lanes of shared mixed traffic with wide boulevards on either side will be provided in Segment C. No on-street parking is planned for Main Street. The terminus station is to be under Main Street. This option provides a continuous dedicated cycling route: cyclists can use dedicated cycle tracks in Segment A, B and C
- Option U2** This option consists of a dedicated surface LRT in Segment A and an underground portion running along Main Street in Segment B before diverting onto George Street in Segment C. Surface stations are provided at Steeles and Charolais while underground stations are provided at Nanwood and Brampton GO. For underground options, there is no station at Wellington/Queen. On the surface, the 3 traffic lanes will be provided along Segment B and the Downtown Reimagined vision of two lanes of shared mixed traffic with wide boulevards on either side will be provided in Segment C. No on-street parking is planned for Main Street. The terminus station is located under George Street. This option provides a continuous dedicated cycling route: cyclists can use dedicated cycle tracks in Segment A, B and C

Station Locations

Station locations identified in the long list evaluation stage were reviewed and confirmed. The short list evaluation stage incorporated additional technical findings as well as public feedback received during virtual Open House 1 (held from June 22 to July 31, 2020) to inform the recommended station locations for surface and underground routes.

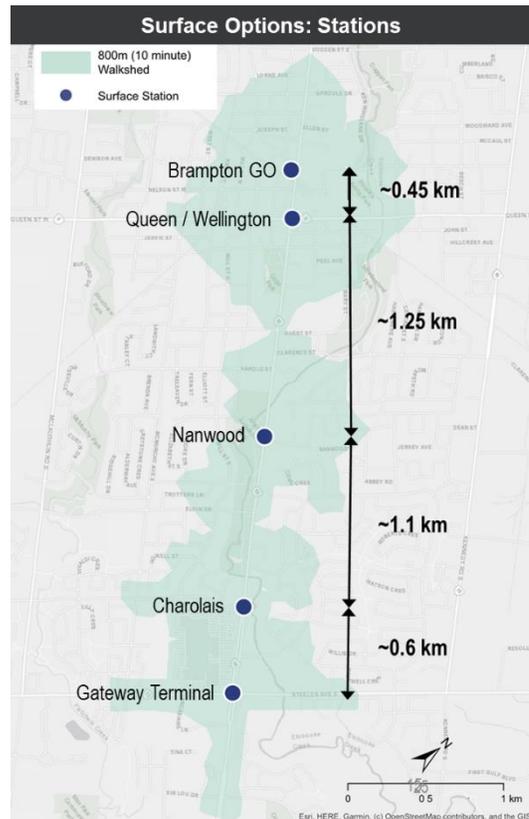
It should be noted that, although the Brampton Gateway Terminal Station is shown as part of the LRT Extension Study, it will be implemented as part of the Hurontario LRT project (Port Credit GO Station to Brampton Gateway Terminal). The exact location of the station (i.e. south of Steeles Avenue or north of Steeles Avenue) is subject to discussions with Metrolinx; however, for the purposes of this PDBC, it has been assumed to be located on the north side of Steeles Avenue.

Surface Stations / Stops

The proposed station locations for the surface options are shown below and are as follows:

- Brampton GO
 - Island Platform
- Downtown
 - Queen Street, Northbound Platform
 - Wellington Street, Southbound Platform
- Nanwood
 - Far-Side, Split Platform
- Charolais
 - Far-Side, Split Platform
- Gateway Terminal
 - North side of Steeles, Island Platform

There was no change to the station locations relative to the base assumptions from the long list phase. Furthermore, the station locations are consistent with the 2014 Hurontario-Main TPAP recommendations.



Underground Stations / Stops

The proposed station locations for the underground options are shown below and are as follows:

- Brampton GO (underground)
- Nanwood (underground)
- Charolais (surface)
 - Far-Side, Split Platform
- Gateway Terminal (surface)
 - North side of Steeles, Island Platform

The underground station at Wellington Street was screened out during the short list phase. The implications on Metrolinx Preliminary Design Business Case strategic criteria such as ridership, future population, employment, low-income demographics served were reviewed.

Results indicated that the strategic benefits of maintaining the underground station were not deemed to outweigh implementation costs and impacts to Wellington Park, especially given the station's proximity to Brampton GO (within its 800m walkshed). Moreover, public support at virtual Open House 1 for an express service with fewer stops as well as general concerns related to project funding and availability further validated the removal of Wellington Station.



Summary of the Business Case Evaluation

The Preliminary Design Business Case (PDBC) for the Brampton LRT Extension study evaluated four surface and two underground LRT options to identify an emerging preferred option for each.

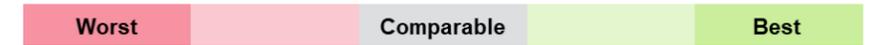
The following sections document the comparison of LRT options and present the overall conclusions drawn from the PDBC for each of the strategic, economic, financial and deliverability and operations case. One emerging preferred surface and one emerging preferred underground option has been identified.

Surface Options

D: LRT in Dedicated Lanes
S: LRT in Shared Lanes

Strategic Case

Comparison of how each option performs relative to the rest.



Evaluation Criteria ³		S1 (DDD)	S2 (DSD)	S3 (DDS)	S4 (DSS)	
Strong Connections	LRT Daily Ridership	30,900	27,700	29,500	26,300	
	Ridership increase on HuLRT (Peak Period)	6,200	5,200	5,800	4,800	
	2041 Population within 800 m of Stations	All options serve the same future population (28,500)				
	2041 Employment & low-income residents served	All options serve the same number of jobs and low-income residents (17,000 and 2,400)				
Strategic Case	Complete Travel Experiences	Support areas with land uses compatible with rapid transit	Compatible (transit in dedicated lanes, cycling in mixed traffic in Segment C)	Least Compatible (transit in shared lanes, cycling in mixed traffic in Segment C)	Most Compatible (transit in mostly dedicated lanes, dedicated cycling in Segment C)	Less Compatible (transit in shared lanes, dedicated cycling in Segment C)
		Transit Travel Time (PM Peak hour)	8 min	11 min	9 min	12 min
		Average Auto Travel Time in LRT Corridor per trip	6 min	6 min	7 min	6 min
		Total Transit Travel Time Savings	35,000 person-min	17,000 person-min	28,000 person-min	11,000 person-min
	Pedestrian and Bicycle Level of Service	Worse active transportation conditions		Better active transportation conditions		
	Transit and Vehicle Level of Service	Generally comparable between surface options.				
	Potential for Conflicts between LRT, Autos and AT	Low Conflict (LRT & auto) High Conflict (AT & auto)	High Conflict (LRT & auto) High Conflict (AT & auto)	Low Conflict (LRT & auto) Low Conflict (AT & auto)	High Conflict (LRT & auto) Low Conflict (AT & auto)	
	Transfer times from LRT to nearby transit services (Bus and GO) and Downtown Brampton	All options have similar transfer times: 2 minutes to Brampton Transit Bus Terminal, 4 minutes to Brampton GO (EB) and 4 minutes to Queen / Main Street.				
	Sustainable Communities	Daily VKT Reduced in Study Corridor, PM Peak	1,500	400	1,300	300
		Additional Transit Trips, PM Peak (Diverted from Auto)	950	500	700	500
Ability to Incorporate Downtown Reimagined Compatibility with Parks and Public Spaces Ability to provide a continuous cycling network		Less desirable public realm Gap in the cycling network connectivity in Segments B and C		More desirable public realm Gap in cycling network connectivity in Segment B		
Impacts to Natural Environment, Cultural Heritage & Drainage		Similar impacts between surface options All options require similar ROW, Traction Power Substations at-grade and similar stormwater management considerations.				
Strategic Case Recommendation		S3 best fulfils the objectives and supports the strategic case.				

³ This table presents the key differentiating elements between options. For a complete account of evaluation criteria and performance metrics, please see the full PDBC report.

Economic Case

D: LRT in Dedicated Lanes
S: LRT in Shared Lanes

Comparison of how each option performs relative to the rest.

		Worst	Comparable	Best	
Evaluation Criteria		S1 (DDD)	S2 (DSD)	S3 (DDS)	S4 (DSS)
Economic Case	Total Economic Benefits (\$ Million, 2019)	\$529	\$338	\$446	\$276
	Total Economic Costs (\$ Million, 2019)	\$375	\$381	\$379	\$385
	Net Present Value (\$ Million, 2019)	\$155	-\$43	\$67	-\$109
	Benefit-Cost Ratio (BCR)	1.41	0.89	1.18	0.72
Economic Case Recommendation		S1 and S3 best support the economic case.			

Financial Case

D: LRT in Dedicated Lanes
S: LRT in Shared Lanes

Comparison of how each option performs relative to the rest.

		Worst	Comparable	Best	
Evaluation Criteria		S1 (DDD)	S2 (DSD)	S3 (DDS)	S4 (DSS)
Financial Case	Capital Construction Costs (\$ Million, 2019)	\$348	\$354	\$353	\$357
	Rehabilitation and Major Maintenance (\$ Million, 2019)	\$38	\$39	\$39	\$39
	Operations and Maintenance Costs (\$ Million, 2019)	\$25	\$25	\$25	\$25
	Total Incremental Revenues (\$ Million, 2019)	\$97	\$76	\$89	\$67
	Net Financial Impact (\$ Million, 2019)	-\$315	-\$342	-\$327	-\$354
Financial Case Recommendation		S1 and S3 best support the financial case.			

Deliverability and Operations Case

D: LRT in Dedicated Lanes
S: LRT in Shared Lanes

Comparison of how each option performs relative to the rest.



		Evaluation Criteria	S1 (DDD)	S2 (DSD)	S3 (DDS)	S4 (DSS)
Deliverability and Operations	Procurement & Delivery	Procurement Strategies	Two potential procurement strategies are recommended for consideration: <ul style="list-style-type: none"> Option 1: Proponent issues Design – Bid – Build (DBB) contract for construction of the extension. Proponent to reach agreement for HuLRT Project Co to operate and maintain the extension. Proponent could also use Design – Bid – Finance model in which a single contract is awarded for the design, construction, and full or partial financing of a facility Option 2: Proponent to reach agreement for HuLRT Project Co to Design – Build – Finance – Operate – Maintain (DBFOM) the extension. Potential to remove finance from DBFOM contract if it can be financed publicly. 			
	Design and Operational Trade-Offs and Issues	Emergency and Service Vehicle Operations	Impact to operations in Segment B (single traffic lane in each direction).	Limited impact to operations.	Impact to operations in: Segment B (single traffic lane in each direction) and Segment C (single mixed traffic/transit lane in each direction)	Impact to operations in Segment C (single mixed traffic/transit lane in each direction).
		Property Impacts	All options pose similar magnitude impacts to properties (~4,900 – 5,100 m ² property required)			
		Driveway Impacts	Conversion of full moves access driveways to right-in-right-out (RIRO) for Segments A, B & C (77 driveways)	Conversion of full moves access driveways to right-in-right-out (RIRO) for Segments A and C (19 driveways)	Conversion of full moves access driveways to right-in-right-out (RIRO) for Segments A and B (73 driveways)	Conversion of full moves access driveways to right-in-right-out (RIRO) for Segment A (15 driveways)
		Utility Impacts	24 major utility conflicts have been identified			
		Impacts to CN bridge	Overhead Catenary System (OCS) mitigation required to provide vertical clearance under Main Street bridge. S1 may require widening to improve active transportation (i.e. add dedicated cycling infrastructure); whereas S3 and S4 do not.	Overhead Catenary System (OCS) mitigation required to provide vertical clearance under Main Street bridge. S2 may require widening to improve active transportation (i.e. add dedicated cycling infrastructure); whereas S3 and S4 do not.	Overhead Catenary System (OCS) mitigation required to provide vertical clearance under Main Street bridge.	Overhead Catenary System (OCS) mitigation required to provide vertical clearance under Main Street bridge.
		Ability to Extend Line in the Future	All options enable future extensions to the north.			
		Constructability	Surface construction is to be undertaken similarly to typical road widening construction for the length of the study area.			
	Schedule	Surface options are estimated to take up to 6 years from design to opening day.				
	O & M	Operations and Maintenance	<ul style="list-style-type: none"> The LRT extension is to be designed as a fully compatible extension of the planned and under construction HuLRT, building on system assets such as Maintenance and Storage facilities and technology specifications. The extension is to be facilitated such that the preliminary system operations plan documented in the 2014 Hurontario-Main LRT Environmental Project Report (EPR) applies to this project and that operator of the extension and overall line will achieve consistent operations and maintenance plans. 			
Deliverability and Operations Recommendation		S2 and S4 best meet the deliverability and operations objectives as they minimize impacts to roadway and service operations and driveways.				

Preliminary Design Business Case Findings

The performance of each option has been synthesized for each business case criterion in the table below.

Evaluation Criteria		S1 (DDD)	S2 (DSD)	S3 (DDS)	S4 (DSS)
Surface Options	Strategic Case				
	Economic Case				
	Financial Case				
	Deliverability and Operations Case				
	PDBC Recommendation	 Do Not Carry Forward	 Do Not Carry Forward	 Carry Forward	 Do Not Carry Forward

With the considerations above, Option S3 is preferred as it best fulfils the objectives of the strategic case, generates the second highest economic case outputs and achieves financial case results that are better than most other surface options. Driveway access impacts are the greatest for S3, however, this trade-off is acceptable to minimize transit travel times along the corridor.

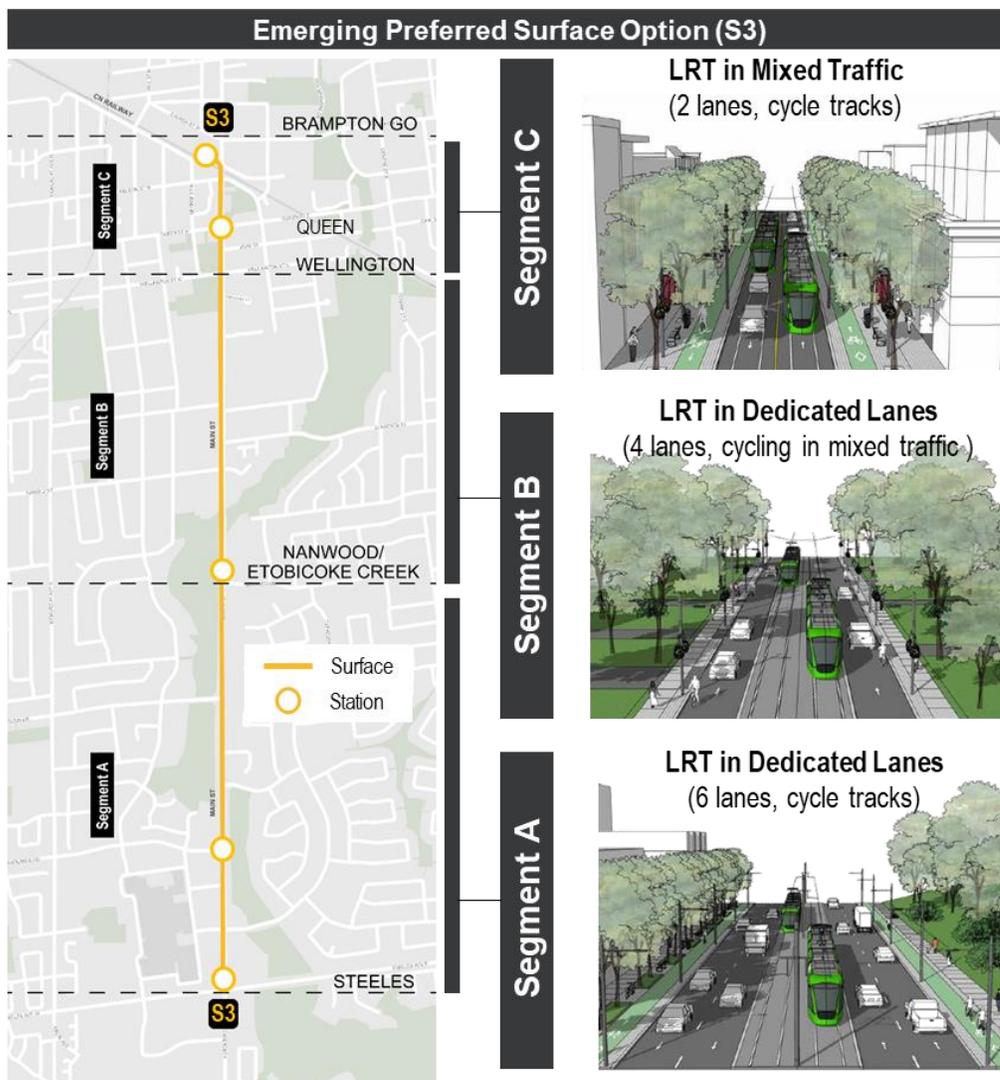
Option S3 provides the opportunity to revitalize Downtown Brampton into an aesthetically beautiful, place-making destination with wider sidewalks, streetscaping, and cycle tracks (consistent with Downtown Brampton Reimagined Vision) while minimizing overall transit travel time. Driveway accesses will be modified as a result of the dedicated LRT right-of-way, but this will ensure safe and efficient travel for all users of the street.

Therefore, Option S3 is the emerging preferred surface option.

Emerging Preferred Surface Option S3

The emerging preferred surface Option S3 is described as follows:

- The LRT will run in dedicated lanes between Steeles Avenue and Wellington Street and in shared lanes from Wellington Street to the Brampton GO Station. There will be 5 surface stops along the route at Brampton Gateway, Charolais, Nanwood, Queen / Wellington and Brampton GO.
- Option S3 allows for an enhanced streetscape in Segments A and C, including: cycle tracks, widened sidewalks, and a planting and furnishing zone. Cyclists must ride in mixed traffic in Segment B or use parallel routes.
- Driveways in Segment B will be modified to right-in, right out access.
- Overhead catenary systems and traction power substations (TPSS) will be located above ground in the study area.



All boulevard configurations shown are subject to change.

Underground Options

Strategic Case

U: Underground

Comparison of how each option performs relative to the rest.



		Evaluation Criteria	U1 (via Main St)	U2 (via George St)
Strategic Case	Strong Connections	LRT Daily Ridership	30,500	
		Ridership increase on Hurontario LRT (Peak Period)	6,100	
		2041 Population within 800 m of Stations	All options serve the same future population (28,000)	
		2041 Employment and Number of low-income residents served	All options serve the same number of jobs and low-income residents (15,000 and 2,200)	
		Support areas with land uses compatible with rapid transit	Compatible (higher order transit, AT improvements)	Compatible (higher order transit, AT improvements)
	Complete Travel Experiences	Transit Travel Time (PM Peak hour)	7 min	8 min
		Average Auto Travel Time in LRT Corridor, Minutes per Trip	6 min	6 min
		Total Transit Travel Time Savings compared to BAU	35,000 person-min	
		Pedestrian and Bicycle Level of Service	Improved active transportation conditions throughout study area	
		Transit and Vehicle Level of Service	Comparable transit and vehicle conditions	
		Potential for Conflicts between modes (LRT, Autos and AT)	Low Conflict between LRT, auto & AT	
		Transfer times from LRT to nearby transit services	Similar transfer times to nearby transit services: 3 minutes to Brampton Transit Bus Terminal, 4-5 minutes to Brampton GO Station	
		Transfer times from LRT to Downtown Brampton	4 min	6 min
	Sustainable Communities	Daily VKT Reduced in Study Corridor, Peak Period	1,200	
		Additional Transit Trips, PM Peak (Diverted from Auto)	700	
		Ability to Incorporate Downtown Reimagined	Ability to incorporate Downtown Reimagined in Segment C	
		Compatibility with Parks and Public Spaces	Similar relationship to parks and public spaces	
		Ability to provide a continuous cycling network	Ability to provide continuous and uninterrupted cycling facilities along the study corridor (reallocating road space for Segment B)	
		Impacts to the Natural Environment, Cultural Heritage & Drainage	Similar impacts on natural and cultural heritage resources and drainage	
Strategic Case Recommendation		U1 best fulfils the objectives and supports the strategic case.		

Economic Case

U: Underground

Comparison of how each option performs relative to the rest.

		Worst	Comparable	Best
		U1 (via Main St)	U2 (via George St)	
Economic Case	Evaluation Criteria	U1 (via Main St)	U2 (via George St)	
	Total Economic Benefits (\$ Million, 2019)	\$466	\$472	
	Total Economic Costs (\$ Million, 2019)	\$1,432	\$1,465	
	Net Present Value (\$ Million, 2019)	-\$965	-\$992	
	Benefit-Cost Ratio (BCR)	0.33	0.32	
Economic Case Recommendation		U1 best supports the economic case as it has a marginally better value for money.		

Financial Case

U: Underground

Comparison of how each option performs relative to the rest.

		Worst	Comparable	Best
		U1 (via Main St)	U2 (via George St)	
Financial Case	Evaluation Criteria	U1 (via Main St)	U2 (via George St)	
	Capital Construction Costs ⁴ (\$ Million, 2019)	\$1,425	\$1,425	
	Rehabilitation and Major Maintenance (\$ Million, 2019)	\$140	\$143	
	Operations and Maintenance Costs (\$ Million, 2019)	\$25	\$25	
	Total Incremental Revenues (\$ Million, 2019)	\$86	\$87	
	Net Financial Impact (\$ Million, 2019)	-\$1,504	-\$1,506	
Financial Case Recommendation		U1 and U2 have a comparable financial case performance.		

⁴ Construction costs for underground options do not include streetscape or road configuration improvements at the surface as these were assumed to be undertaken as a separate City of Brampton initiative. Property acquisition are not included.

Deliverability and Operations Case

U: Underground

Comparison of how each option performs relative to the rest.



Evaluation Criteria		U1 (via Main St)	U2 (via George St)
Deliverability and Operations	Procurement Strategies	Two potential procurement strategies are recommended for consideration, similar to surface options: <ul style="list-style-type: none"> Option 1: Proponent issues Design – Bid – Build (DBB) contract for construction of the extension. Proponent to reach agreement for HuLRT Project Co to operate and maintain the extension. Proponent could also use Design – Bid – Finance model in which a single contract is awarded for the design, construction, and full or partial financing of a facility Option 2: Proponent to reach agreement for HuLRT Project Co to Design – Build – Finance – Operate – Maintain (DBFOM) the extension. Potential to remove finance from DBFOM contract if it can be financed publicly. 	
	Emergency and Service Vehicle Operations	Limited impact to emergency and service vehicles.	
	Property Impacts	~2,700 m ² property required.	~5,300 m ² property required.
	Driveway Impacts	All full moves access driveways in Segment A converted to right-in-right-out unless at signalized intersection (9 driveways along the surface portion)	
	Utility Impacts	<ul style="list-style-type: none"> Segment B will have no impact on existing utilities. Segment C will have limited impact on existing utilities. 	<ul style="list-style-type: none"> Segment B will have limited impact on existing utilities. Proposed location of surface connection for Brampton GO station may have minor impacts on existing utilities.
	Ability to Extend Line in the Future	<ul style="list-style-type: none"> Able to extend north in the future along Main Street. 	<ul style="list-style-type: none"> More difficult to extend north in the future from George Street. Potential conflict with building foundations.
	Constructability	<ul style="list-style-type: none"> For underground sections, a combination of Sequential Excavation Method (mining) and Open Cut construction is anticipated. TBM was ruled out during optioneering due to its high costs for such short length of the study area. For surface sections (Segment A), construction is to be undertaken similarly to typical road widening construction for the length of the study area. 	
	Schedule	Underground options are estimated to take between 7 and 8 years from design to opening day.	
	Operations and Maintenance	<ul style="list-style-type: none"> The LRT extension is to be designed as a fully compatible extension of the planned and under construction HuLRT, building on system assets such as Maintenance and Storage facilities and technology specifications. The extension is to be facilitated such that the preliminary system operations plan documented in the 2014 Hurontario-Main LRT Environmental Project Report (EPR) applies to this project and that operator of the extension and overall line will achieve consistent operations and maintenance plans. 	
Deliverability and Operations Recommendation		U1 better meets the design and operational objectives as it minimizes property and utility impacts and facilitates future extensions.	

Preliminary Design Business Case Findings

The performance of each option has been synthesized for each business case criterion in the table below.

	Evaluation Criteria	U1 (via Main St)	U2 (via George St)
Underground Options	Strategic Case		
	Economic Case		
	Financial Case		
	Deliverability and Operations Case		
	PDBC Recommendation	 Carry Forward	 Do Not Carry Forward

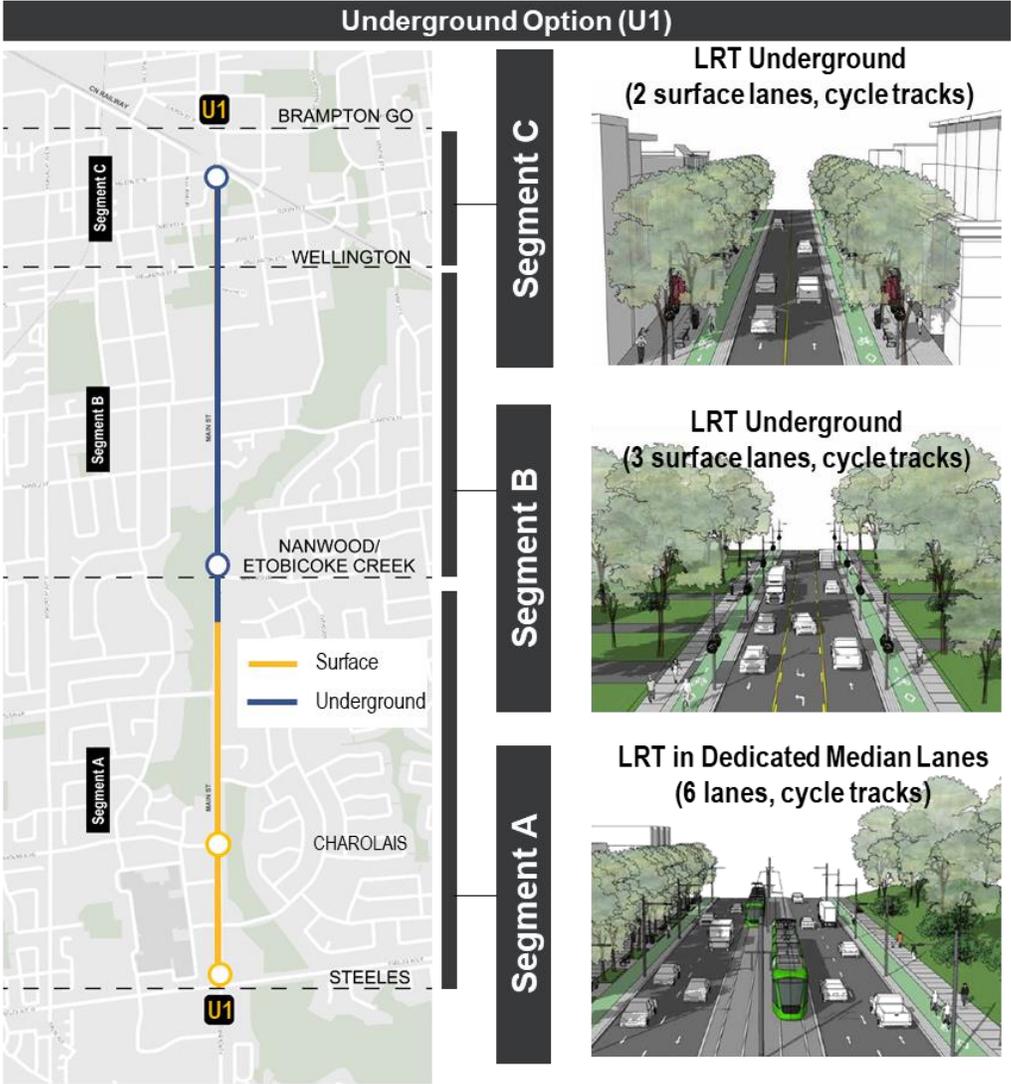
Overall, Option U1 (via Main Street) and U2 (via George Street) perform similarly from a strategic perspective with U1 have certain marginal benefits related to transfer and LRT travel time. However, Option U1 is more preferred than U2 as it is less costly, located closer to the heart of Downtown Brampton, requires less property takings and is more easily extended north in the future.

Therefore, Option U1 is the emerging preferred surface option.

Emerging Preferred Underground Option U1

The emerging preferred underground option U1 is described as follows:

- The LRT will run in dedicated lanes north of Steeles Avenue to Elgin Drive then run underground from just south of Nanwood Drive to the Brampton GO Station along Main Street. There would be 4 stops / stations along the line, with 2 at the surface (Brampton Gateway and Charolais) and 2 underground (Nanwood and Brampton GO).
- Option U1 allows for an enhanced streetscape in Segments A, B, and C, including: cycle tracks, widened sidewalks, and a planting and furnishing zone. Option U1 allows for a continuous cycling network along Main Street.
- No access modifications are required in Segment B. Traction Power Substations (TPSS) will be located underground within underground station.
- The portal and the two underground stations are located in the floodplain. Potential impacts to be mitigated.



All boulevard configurations shown are subject to change.

Comparison of Emerging Preferred Options

The emerging preferred surface and underground options S3 and U1 were compared and their key differences summarized as follows.

	Evaluation Criteria	Option S3 (DDS)	Option U1 (via Main Street)
Strategic Case	Strong Connections	<ul style="list-style-type: none"> 9 minute transit travel time Does not improve multi-modal level of service as much as option U1. 	<ul style="list-style-type: none"> 7 minute transit travel time Improves multi-modal level of service more than option S3.
	Complete Travel Experiences	<ul style="list-style-type: none"> Does not provide the same opportunity for improving pedestrian and cycling at the surface. Lack of dedicated cycling facilities in Segment B creates a discontinuous cycling network More opportunity for conflicts between modes 	<ul style="list-style-type: none"> Improves pedestrian and cycling facilities/level of service at the surface. Continuous cycling network. Less opportunity for conflicts between modes
	Sustainable and Healthy Communities	<ul style="list-style-type: none"> Inability to close streets for civic events in Downtown. Greater temporary and permanent impacts to natural and cultural environment (especially in Segment B). 	<ul style="list-style-type: none"> Provides opportunity to close streets for civic events in Downtown. Fewer impacts to natural and cultural environment (especially in Segment B).
Economic Case	Net Present Value	\$66.9 million	-\$965 million
	Benefit-Cost-Ratio	1.18	0.33
Financial Case	Capital Costs	\$353 million	\$1.43 billion ⁵
	Net Financial Impact	-\$324 million	-\$1.5 billion
Deliverability and Operations Case	Impacts to Road Operations	<ul style="list-style-type: none"> More impact to emergency and service vehicle operations 	<ul style="list-style-type: none"> Fewer impact to emergency and service vehicle operations
	Impacts to Property	<ul style="list-style-type: none"> More property impacts (up to 5,100 m² property required) 	<ul style="list-style-type: none"> Fewer property impacts (~2,700m² property required)
	Impacts to Driveways	<ul style="list-style-type: none"> More driveway and access impacts/restrictions (73 driveways) 	<ul style="list-style-type: none"> Fewer driveway and access impacts/restrictions (9 driveways)
	Impacts to Utilities	<ul style="list-style-type: none"> More utility impacts (24 major utility conflicts) 	<ul style="list-style-type: none"> Limited utility impacts
	Schedule	<ul style="list-style-type: none"> Up to 6 years from design to opening day. 	<ul style="list-style-type: none"> 7 to 8 years from design to opening day.

Next steps will include refining the design and engineering to maximize benefits and mitigate outstanding risks for the emerging preferred options, selecting a preferred option and carrying it through the Transit Project Assessment Process (TPAP).

⁵ Construction costs for underground options do not include streetscape or road configuration improvements at the surface. These were assumed to be undertaken as a separate City of Brampton initiative. Property acquisition are not included.