

Bowmanville GO Rail Service Extension

Preliminary Design Business Case
April 2020

Disclaimer

All figures within this Preliminary Design Business Case Update represent preliminary results. Forecasted costs, revenues and ridership figures will be subject to refinement as analysis of the Bowmanville Rail Extension proceeds to the Full Business Case phase, and is further developed through detailed design and analysis.

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Executive Summary

Introduction

With the GO Expansion program, Metrolinx is moving forward on a significant investment that will transform transit access across the Greater Golden Horseshoe (GGH). Beyond GO Expansion, as described in the GO Expansion Full Business Case from November 2018, Metrolinx is advancing additional rail programs including the GO rail extension to Bowmanville. This investment will add new rail service and connectivity to the Lakeshore East GO rail line.

Extending GO rail services east beyond Oshawa into Bowmanville has been a long standing goal of the Region and local municipalities looking to grow and improve existing population and job centres through sustainable transportation modes. This proposed extension has been subject to several studies from various public and private authorities going back many years showing strong interest in the project.

An updated Initial Business Case (IBC) was completed in February 2020, and examined the potential to expand GO rail service to Bowmanville through multiple options proposing a peak-only and all-day service patterns. Option 2 from the IBC was chosen as the preferred option, which would provide all-day service to Bowmanville by a new connection from the GO Subdivision and Oshawa GO station through the Canadian Pacific (CP) Railway's General Motors (GM) spur line to cross Highway 401 and connect to CP's Belleville Subdivision. The preferred option achieved a Benefit Cost Ratio (BCR) of 0.7-0.9 meaning that for every \$1 spent, the economy of Ontario would gain 70-90 cents of benefit.

This document is the Bowmanville GO Rail Service Extension Preliminary Design Business Case, which through working in partnership with CP has allowed Metrolinx to build on the previously completed IBC by furthering the analyses of the preferred option in the IBC.

Options for Analysis

This Business Case assesses two service options using the preferred alignment identified in the IBC, which will all utilize the CP's GM spur line to cross Highway 401 and connect to CP's Belleville Subdivision. The options vary weekend service frequency and build on the option moved forward from the IBC.

The Belleville Subdivision is owned by CP, which is a federally regulated railway company, and all increases in service and infrastructure options must be agreed with our rail partner CP.

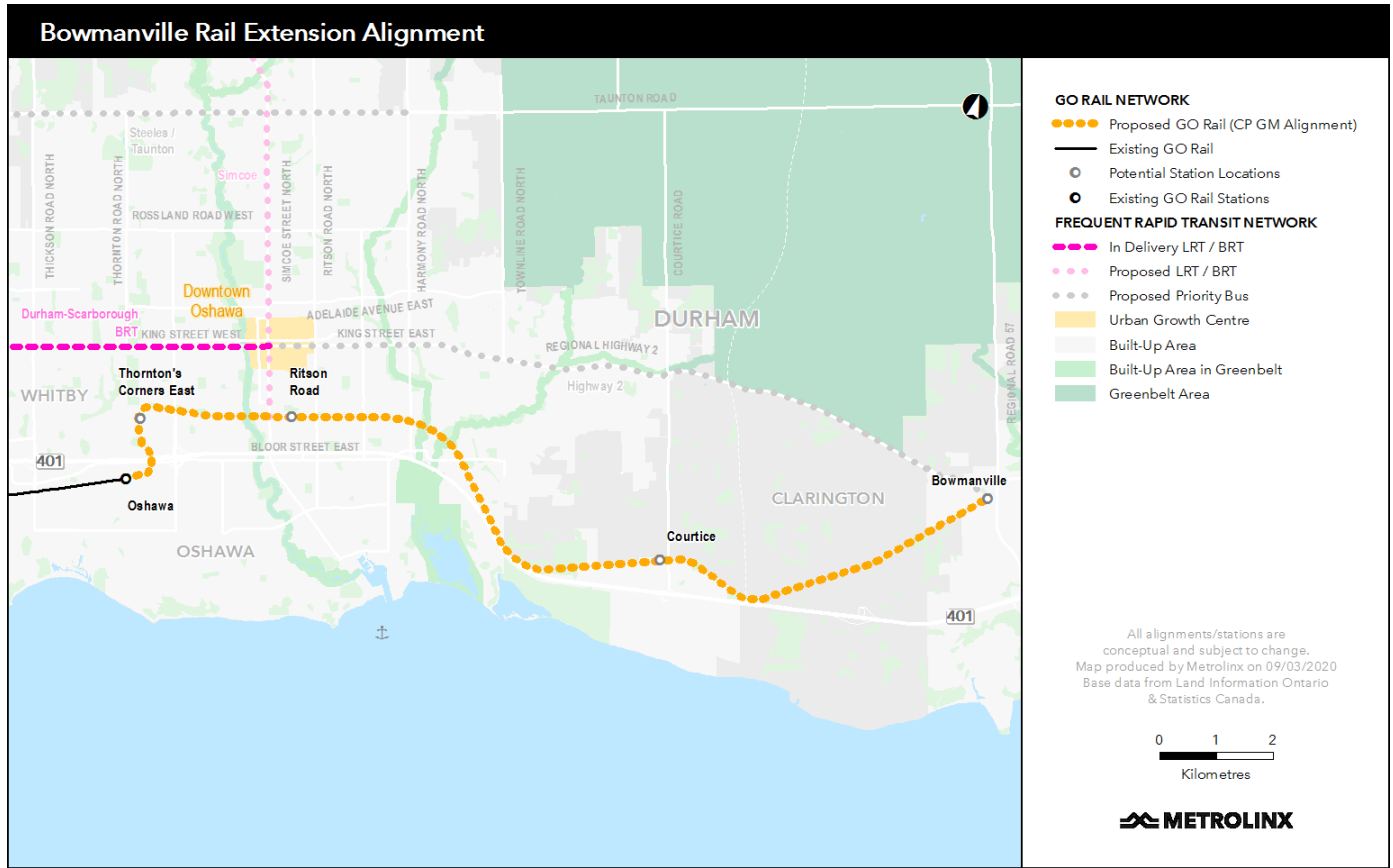


Figure E. 1: : Study Area Overview (Including Rail Alignments and Stations under Review

Business as Usual

The Business as Usual scenario with GO Expansion's electrified bi-directional services provide four trains per hour making all stops between Union Station and Oshawa GO station throughout the day, with additional service during peak periods. Continued operation of GO bus services between Newcastle and Oshawa via Bowmanville with increases in service where demand dictates.

Option 1: Weekend Service Every Two Hours

All services to/from Bowmanville will be operating diesel bi-levels. Peak half-hourly services to/from Bowmanville will be operating express between Union Station and Pickering GO station, making all stops between Pickering and Oshawa GO stations, as well as, Thornton's Corners East, Ritson Road, Courtice and Bowmanville stations. Weekday off-peak (all operational hours outside of the AM and PM peak periods) hourly services will be making all stops between Bowmanville and Union

Station. Weekend service will be every two hours making all stops between Bowmanville and Union Station.

Option 2: Weekend Service Every Hour

Identical service pattern to Option 1, except weekend service becomes hourly and makes all stops between Bowmanville and Union Station.

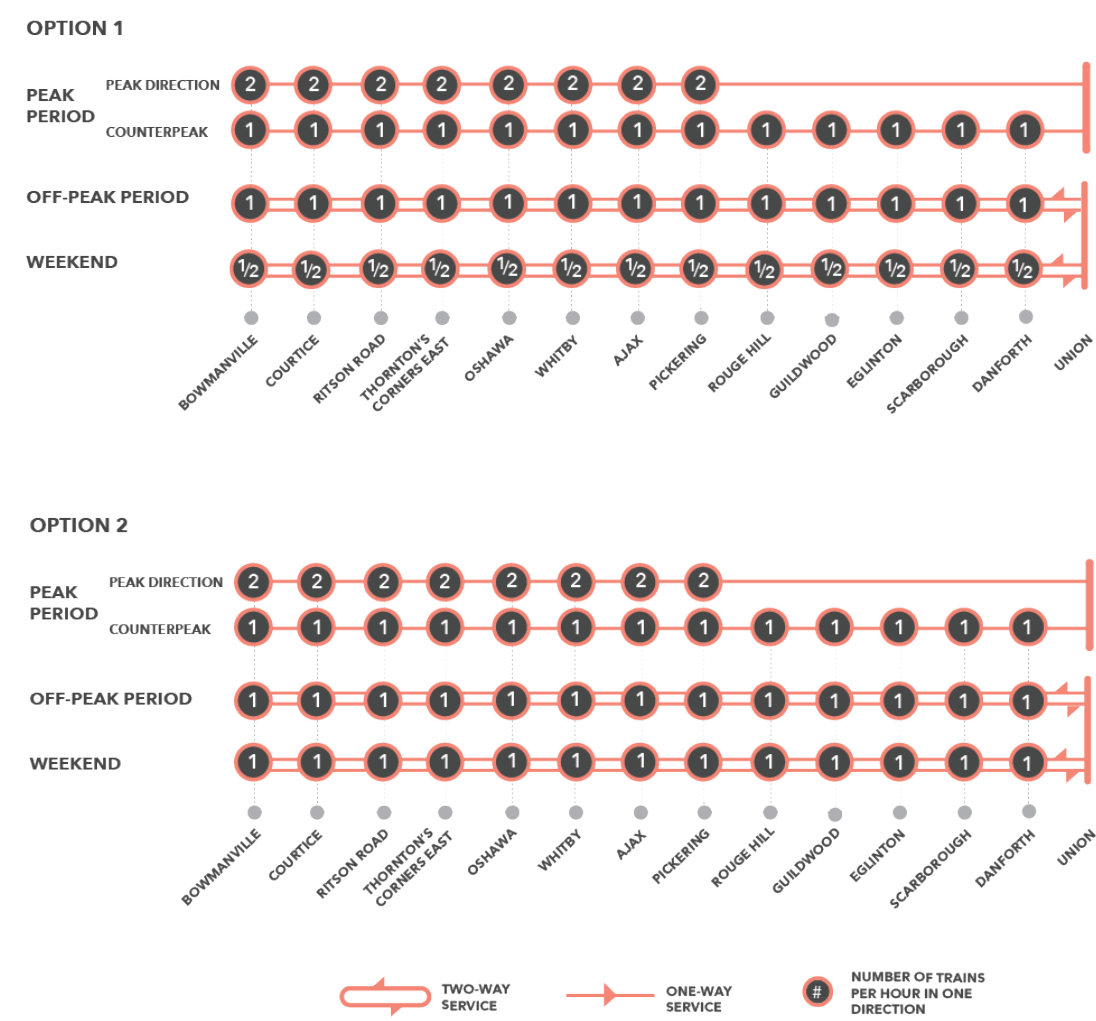


Figure E. 2: Service Diagrams for Option 1 and Option 2

Method of Analysis

A Preliminary Design Business Case Update has been developed for the Bowmanville Rail Extension. This approach follows Metrolinx's Benefits Management program and project evaluation best practice as per our Business Case Guidance. The Preliminary Design Business Case is the second of four Business Case documents developed over the course of an investment's lifecycle, guiding the process from options analysis to planning and design and then to delivery and operations. These Business Cases are intended to analyze the potential project, recommend a path forward and track results over the lifecycle of the investment.

The Preliminary Design Business Case will analyze the Bowmanville Rail Extension through four cases to best understand policy alignment, project benefits, costs and impacts of the investment and constructability. The four cases in this evaluation are:

- **Strategic Case** - Determines the value of addressing a problem or opportunity based on regional development goals, plans and policies.
- **Economic Case** - Assesses the economic costs and benefits of the proposal to individuals and society as a whole, and spans the entire period covered by the investment.
- **Financial Case** - Assesses capital and resource requirements, the overall financial impact of the proposal, its funding arrangements and financial value for money.
- **Deliverability and Operations Case** - Provides evidence on the feasibility and constructability of project options and considers delivery risks; establishes what is required to deliver and operate the project.

Ridership

Ridership forecasts were determined using outputs from the Province's regional demand model (Greater Golden Horseshoe Model). A newer version of the model was used in the PDBC compared to the IBC, which is expected to produce more accurate and relevant outputs in assessing the options within this business case. As a result of the adoption of this newer version, the ridership forecasts baseline year is updated from 2031 in the IBC to 2041 in the PDBC.

Table E. 1: 2041 Annual Boardings by Option

Station	Option 1	Option 2
	Weekend Service Every Two Hours	Weekend Service Every Hour
Oshawa	2,865,600	2,975,800
Thornton's Corners East	173,600	180,300
Ritson Road	352,000	365,500
Courtice	348,100	361,500
Bowmanville	1,131,700	1,175,200
TOTAL	4,871,000	5,058,300

Business Case Results

A final decision between all options must be made with total costs, benefits, operability, policy alignment and stakeholder considerations in mind. Options in this analysis have slight differences in performance with the Benefit Cost Ratios (BCRs) in the range of 0.72 to 0.80 and an annual rail boardings between 4.9M and 5.1M in 2041.

The two options differ only in frequency of service on weekends. Weekend service in Option 2 is increased to hourly service to Bowmanville, which leads to higher annual boardings, more revenue and operating costs. Frequent hourly weekend service drives increased rail boardings and revenue by 4 per cent while the operating and maintenance cost increased by 17 per cent.

Implementing weekend service every hour will result in \$26M economic benefits and \$11M additional revenue at a cost of \$97M to the society. The service generates a BCR of 0.38 meaning for every \$1 spent on increasing weekend service to hourly service, the economy of Ontario would gain 38 cents of benefit. This additional service generates an incremental Cost-Recovery (R/C) Ratio of 0.12, meaning that for every dollar spent operating an increased hourly weekend service, Metrolinx will recover \$0.12.

Table E. 2: Business Case Summary

	Option 1	Option 2
	Weekend Service Every Two Hours	Weekend Service Every Hour
Strategic Case		
Strong Connections	<ul style="list-style-type: none"> Annual boardings 4.9 million (2041) 19,000 people and 10,400 jobs within 800 metre of a station along the extension by 2041 	<ul style="list-style-type: none"> Annual boardings 5.1 million (2041) 19,000 people and 10,400 jobs within 800 metre of a station along the extension by 2041
Complete Travel Experience	<ul style="list-style-type: none"> New stations improve connections to the DRT network Average in-vehicle travel time from Bowmanville to Union Station reduced by 15 minutes; from Peterborough to Union Station reduced by 30 minutes New stations provide improved GO facility capacity with 3,980-4,950 total parking spaces 	
Sustainable Development	<ul style="list-style-type: none"> Encourage Active Modes of Transportation with three of four proposed station locations located in residential areas 	
Economic Case (2020\$ Present Value)*		
Total Costs	\$1,340M to \$1,450M	\$1,437M to \$1,547M
Total Economic Impacts	\$1,073M	\$1,111
Net Benefits	\$(377M) to \$(267M)	\$(437M) to \$(326M)
Benefit Cost Ratio (BCR)	0.74 to 0.80	0.72 to 0.77
Financial Case (2020\$ Present Value)*		
Total Revenue	\$295M	\$306M
Total Capital Costs	\$1,335M	\$1,335M
Total Operating and Maintenance Costs	\$582M	\$679M
Operating Cost Recovery Ratio	0.51	0.45
Deliverability and Operations Case		
Constructability	<ul style="list-style-type: none"> Uses existing (single track) CP rail spur over Hwy 401 (additional improvements may be required) Requires connection from mainline to GM Spur line 	
Operations	The operation of consist length between six and 12-car, as well as, two diesel locomotives are under consideration	
Environmental Approvals	Additional studies required for environmental approvals	
Stakeholder Dependencies	Obtain consent and approval of CP, CN, Hydro One and VIA	

	Option 1	Option 2
	Weekend Service Every Two Hours	Weekend Service Every Hour
Procurement	Design-Bid-Build procurement for delivery of infrastructure	
Timeline	Assumed 70 months delivery timeline or longer	

*All totals rounded

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Introduction



Background

Metrolinx currently operates two-way, all-day GO rail services on the Lakeshore East line between Union Station and Oshawa GO station with increased frequency during peak periods. Extending GO rail service beyond Oshawa to Bowmanville is a long standing goal of the local community and subject to several studies by Metrolinx, and previously GO Transit, including a 2009 Feasibility Study, a 2011 Environmental Assessment (EA) and most recently an Initial Business Case (IBC) Update in February 2020.

On June 20, 2016, The Province of Ontario announced that Metrolinx, the Province's regional transportation authority for the Greater Toronto and Hamilton Area (GTHA), would extend its rail services through Oshawa terminating in Bowmanville. After initial discussion with Canadian Pacific (CP) Railway, it was determined that the extension would be done by utilizing new double track sections along CP's existing Belleville Subdivision north of Highway 401.

In 2018, Metrolinx determined that an updated IBC for this investment was necessary for several reasons. The rationale included further development and refinement of the GO Expansion program (formerly referred to as Regional Express Rail or RER), culminating in the publication of the GO Expansion Full Business case in November 2018. This program will result in changes to GO rail capacity and operations on the Lakeshore East line which in turn impacts the Bowmanville Extension.

An updated IBC was completed in February 2020, and examined the potential to expand GO rail service to the Bowmanville through multiple options proposing a peak-only and all-day service patterns. Option 2 from the IBC was advanced, which would provide all-day service to Bowmanville using CP's General Motors (GM) spur line to cross Highway 401 and connect to CP's Belleville Subdivision.

Business Case Overview

Business cases are required by Metrolinx's Capital Projects Approval Policy for all capital infrastructure investments. As projects develop in scope and construction, business cases are completed to define the rationale and requirements for delivering the project. The Preliminary Design Business Case (PDBC) is the second of four business cases completed in an investment's lifecycle. It reviews variations of the preferred option from the Initial Business Case and selects a preferred option for further design and analysis.

This document is the Bowmanville Rail Service Extension Preliminary Design Business Case, which builds on the previously completed IBC

Update by furthering analysing the preferred option in the IBC. This analysis takes the preferred option from the IBC, applies new context and direction to it, and introduces two new service pattern options for analysis. This business case clarifies and defines project scope, preliminary design, ridership demand, service patterns, benefits and costs.

This business case will examine the options through four distinct lenses: Strategic (how the investment supports organizational and regional public policy and objectives), Economic (the investment's benefits to individuals and society), Financial (costs of the investment to Metrolinx) and Deliverability and Operations (construction viability and timelines, operating plans and risks). This four-chapter analysis concludes with a recommendation for a preferred service option for this project which will be advanced for a Full Business Case (FBC) analysis.

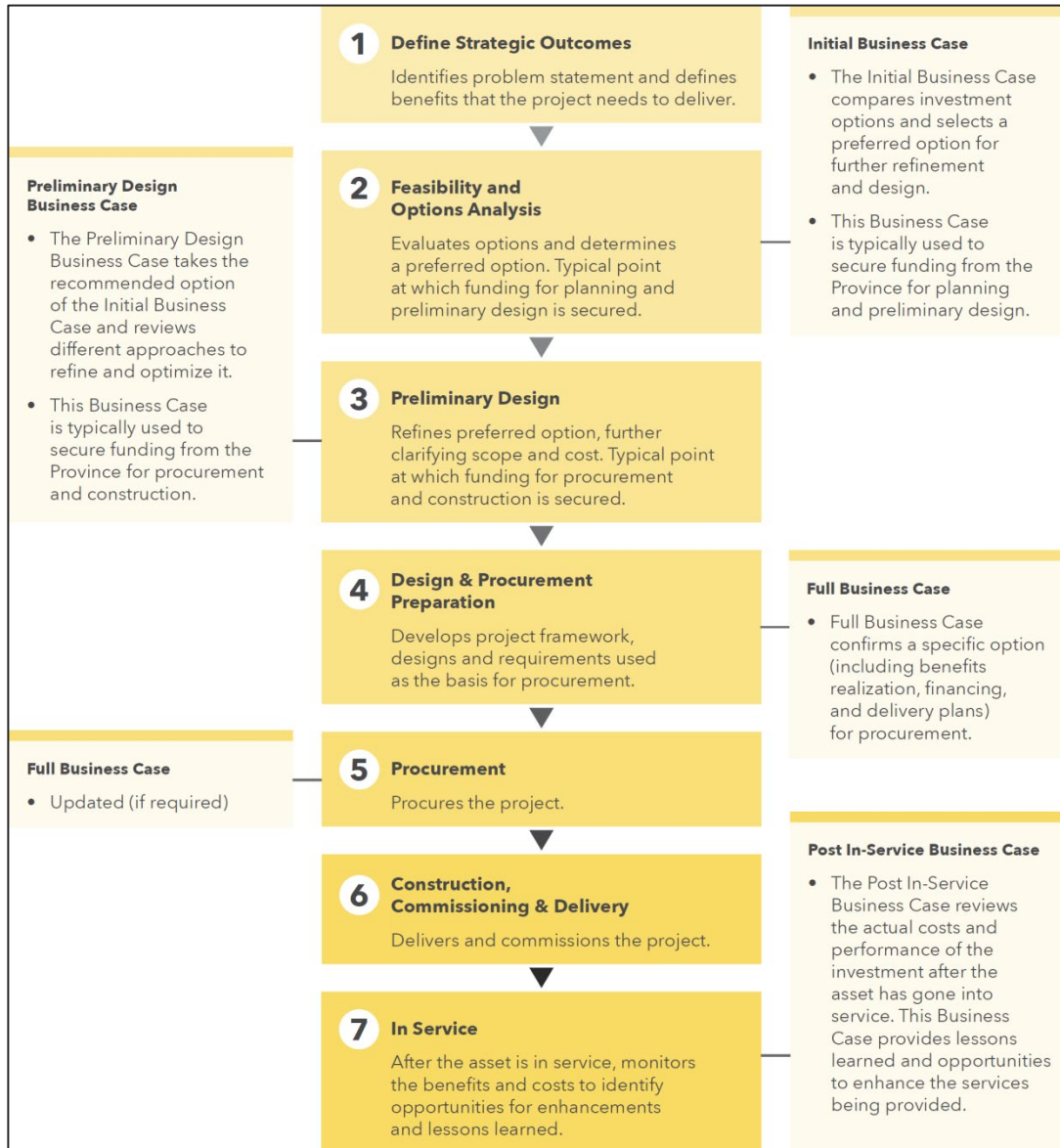


Figure 1: Metrolinx Business Case Development Process

2



Problem Statement



Introduction

This chapter defines the case for change, which is used to guide the evaluation of service options considered within this business case. Problems, opportunities and solutions identified in the previously completed IBC continue to be relevant to this PDBC.

Case for Change

Problem Statement

“How can transit service be developed in the Oshawa to Bowmanville corridor to best meet the short, medium and long term transportation needs of the local communities? ”

GO ridership to and from Durham Region is projected to increase as the population and the employment opportunities in the Region continue to grow. GO rail service along the Lakeshore East line currently terminates at Oshawa GO station and bus services are operated east of the station to Bowmanville. High passenger demand at the Oshawa GO station has caused the station parking lot to reach its capacity, with many GO passengers driving to the station from the Municipality of Clarington to access passenger rail services directly. If not addressed, congestion at the Oshawa GO station and on the road network will continue to place constraints on future residents of the Region, commuters in accessing GO services and in traveling to, from, and throughout Durham Region. The provision of improved and expanded GO service in the Region will address congestion and expand mobility options and access to them, while accommodating future ridership associated with increases in population and employment opportunities.

Key Drivers

The following table outlines the key issues and considerations, both internal and external, for the current and future state of transportation in the Oshawa to Bowmanville corridor that both shape the opportunity, and support the case, for this investment.

Table 1: Key Driver Analysis

Driver		How does this Driver influence the problem/opportunity?	What is the impact of not addressing the problem/opportunity?
Internal	Organization Policy	• The extension of rail service to	• Not constructing an announced rail

Driver	How does this Driver influence the problem/opportunity?	What is the impact of not addressing the problem/opportunity?
Transport Service Provision	Bowmanville is identified as a 'Project in Delivery' in Metrolinx's 2041 Regional Transportation Plan	<p>extension threatens to cast the organization's reputation in a negative light unless the case for not proceeding is strong</p> <ul style="list-style-type: none"> Discourage cross municipal boundaries transit connections and general transit use, which does not align with the Metrolinx's 2041 Regional Transportation Plan
	<ul style="list-style-type: none"> Currently Bowmanville is served by GO buses operating at hourly intervals, or better, connecting with rail services at Oshawa GO station which is at full capacity for parking on an average weekday. This investment has the potential to alleviate congestion and supply at Oshawa GO while simultaneously offering mass rapid transit to Bowmanville 	<ul style="list-style-type: none"> Oshawa GO station parking supply will continue to be at capacity forcing potential GO users to either find alternative access modes to the station, switch home stations or not use GO altogether unless new station access means are provided to enable ridership growth Failing to address service provision (ensuring that enough services go where people want to go, when they want to go there) means that regional growth will be constrained or remain reliant on automobiles
Travel Behaviour	<ul style="list-style-type: none"> According to the 2016 Transportation Tomorrow Survey, tens of thousands of residents commute between Oshawa, Bowmanville and Toronto. Within Durham Region this growing commuting base overwhelmingly travels by auto. Developing intra-regional rail services in this area will alleviate pressure on the local road network and support the development of more local connections 	<ul style="list-style-type: none"> Durham Region residents will continue to commute by auto for inter and intra-regional trips if no alternative travel options are provided to them, thus increasing local road congestion, emissions and urban sprawl People spend more time travelling and have fewer mobility choices, lowering their quality of life
Transport Infrastructure and Technology	<ul style="list-style-type: none"> Rail services offer more capacity at faster speeds to commuters than current transport infrastructure and technology provides 	<ul style="list-style-type: none"> Maintaining the current operation of GO bus services in the Region of Durham will allow ridership to continue to grow, however the extension of GO rail services has the potential to further increase GO ridership in the Region, due to higher speeds and capacity.
External Congestion	<ul style="list-style-type: none"> Increasing travel times on the regional road network are leading to decreasing reliability. 	<ul style="list-style-type: none"> Regional travel times will continue to increase without addressing the problem statement thus reducing

Driver	How does this Driver influence the problem/opportunity?	What is the impact of not addressing the problem/opportunity?
	These facts pressure Durham Region residents to travel for longer amounts of time than previously required. A long term solution is needed to mitigate these negative trends	accessibility, limiting economic development opportunities, increasing greenhouse gas emissions and negatively impacting overall quality of life
Demographic Change	<ul style="list-style-type: none"> An increasing population puts pressure on the transport network, contributing to increased congestion and pollution, particularly from automobile use 	<ul style="list-style-type: none"> Not addressing the problem will make the Oshawa to Bowmanville corridor a less attractive place to live, work and do business - which could limit the overall quality of life and prosperity of the region
Economic Activity	<ul style="list-style-type: none"> Growth in jobs and changes in the nature of work, primarily brought about by automation and communication technologies, affect the demand for transit 	<ul style="list-style-type: none"> If the transit network is not improved, the region may not be able to accommodate the expected growth in jobs, or provide the quality of mobility that fosters productivity and economic development
Government Policy and Planning	<ul style="list-style-type: none"> Local municipalities have identified this rail extension as a priority and have incorporated it into regional and transportation plans to enable future growth and accessibility 	<ul style="list-style-type: none"> Municipal secondary plans and site plans for proposed station will be compromised without GO rail stations; the core of several of these plans
Land Use	<ul style="list-style-type: none"> Transportation investment policies and programs must be intrinsically linked with land use policies and programs to plan for sustainable future communities Delivery of new stations through the Transit Oriented Communities Strategy will encourage intensification 	<ul style="list-style-type: none"> If land use is not planned in conjunction with upgrades and changes to the transit network, there risks being imbalances in transit demand and available capacity, thereby affecting peoples' mobility options and opportunities Previous transport developments contributed to urban sprawl - potential solutions in the Oshawa to Bowmanville corridor should be planned carefully to limit further contributions to sprawl

Business as Usual

If this investment is not pursued, GO rail services will continue to terminate at the Oshawa GO station with connections to Bowmanville via bus services operating hourly. The Lakeshore East line currently offers two-way, all-day service between Union Station and Oshawa GO station with trains departing every 15-20 minutes in the peak period, every 15-

30 minutes throughout the rest of the day and half-hourly to hourly during evenings and weekends. In 2028, Oshawa will become the eastern terminus of GO Expansion. This generational project will invest new infrastructure to accommodate faster trains in both directions, offering rail service operating to Union Station at a frequency of just under seven minutes in the peak period and every 15 minutes in the off-peak.

Oshawa GO station parking is currently at full utilization; this is assumed to continue under the Business as Usual scenario, thus putting constraints on the growing population of the region to access GO services.

Electrified GO Expansion services will terminate at Oshawa GO station as Metrolinx does not pursue electrification on corridors that they do not own and CP will not allow electrification in their corridor.

Strategic Objectives and Goals

The Metrolinx 2041 Regional Transportation Plan (2041 RTP) was adopted by the Metrolinx Board of Directors on March 8, 2018. The 2041 RTP presents a vision for the future of the GTHA:

"The GTHA will have a sustainable transportation system that is aligned with land use, and supports healthy and complete communities. The system will provide **safe, convenient and reliable connections**, and support a **high quality of life, a prosperous and competitive economy**, and a **protected environment**."

The GTHA is undergoing rapid growth and development. The Growth Plan forecast its population to grow from nearly seven million today to ten million by 2041, alongside a strong increase in the number of jobs. Durham Region's population is forecast to reach 1.2 million by that same year from 646,000 in 2016.¹ While growth presents opportunities for the region, it can also create challenges. Without investment, the GTHA's regional transportation system will be unable to support a high quality of life, increased prosperity, and environmental sustainability.

Constructing a GO rail extension from Oshawa to Bowmanville will support the RTP's goals of creating strong connections, complete travel experiences and sustainable and healthy communities in the following ways:

¹ Statistics Canada

Strong Connections

The proposed investment would create an improved transit connection in Durham Region by:

- Increasing the number of people and jobs within walking distance (800 metre) of a station with access to GO rail service;
- Increasing GO transit ridership in Durham Region;
- Creating connections between areas that are proposed for new residential and commercial development, such as station sites, as well as, existing economic activity centres; and
- Expanding the range of destinations people can reach across Durham Region using transit.

Complete Travel Experiences

The proposed investment would provide faster and more reliable travel times for transit users through the extension of rail service further into Durham Region by:

- Improving connectivity between homes, jobs and businesses via new services that decrease travel times and increase reliability; and
- Improving user experience and reducing the stress of daily travel by increasing transit travel speeds.

Sustainable and Healthy Communities

The proposed investment would support sustainable land use and transportation patterns by:

- Encouraging the use of active modes of transportation, such as walking or cycling to access transit facilities by providing station locations in dense residential areas;
- Reducing transport emissions by attracting travellers off regional roads to the rail network by providing services and stations in areas previously not serviced by GO; and
- Reducing transport related collisions, deaths and injuries by attracting travellers from the auto network to the rail network by providing new stations and improved services.

The Provincial, Regional and Municipal policies are supported in the following documents, as summarized in [Table 2](#):

- Provincial Policy Statement Under the Planning Act (2014)
- Growth Plan for the Greater Golden Horseshoe (2017)
- Metrolinx 2041 Regional Transportation Plan (2018)
- Durham Region Transportation Master Plan (2017)
- Clarington Transportation Master Plan (2016)

Table 2: Summarizing Alignment with Broader Policies and Plans

Stakeholder	Document	Specific Policy and Key Considerations
Government of Ontario - Ministry of Municipal Affairs and Housing	Provincial Policy Statement Under the Planning Act	<ul style="list-style-type: none"> Section 1.6.7 on Transportation Systems states the need to expand transit that optimizes existing infrastructure, crosses jurisdictional boundaries, supports land use density, minimizes the length and number of vehicle trips and supports current and future use of transit and active transportation
	Growth Plan for the Greater Golden Horseshoe	<ul style="list-style-type: none"> Articulates support for an integrated, multi-modal, regional transit network as key to economic growth, reduced air pollution and improved public health
Government of Ontario - Ministry of Transportation	Metrolinx 2041 Regional Transportation Plan	<ul style="list-style-type: none"> The RTP's vision calls for the GTHA's transportation system to provide a high quality of life, a prosperous economy and a protected environment - all strategic outcomes of this investment - with the goals of strong connections, complete travel experiences and sustainable and healthy communities to pursue the vision
Regional and Local Municipalities	Durham Region Transportation Master Plan	<ul style="list-style-type: none"> Durham's long-term goals include creating healthy and complete, sustainable communities with a variety of mobility choices Supporting the planning, design and operation of an integrated transit service within the Region and adjacent areas is a listed priority Action item 19 of the plan identifies working with Metrolinx to implement the extension; the plan identifies the Bowmanville Extension as "a top priority for the Region"
	Clarington Transportation Master Plan	<ul style="list-style-type: none"> Focus on sustainable transportation planning with a primary principle to "Integrate transportation and land use planning" Aim to reduce the existing high level of reliance on the private automobile by promoting an increased role for pedestrian, cycling, and transit modes and transportation demand management (TDM) measures Lists the GO extension as a top transit service initiative

3



Investment Options



Introduction

This chapter describes two defined, well-scoped and defensible service options for consideration and evaluation in the Strategic, Economic, Financial and Deliverability and Operations cases.

In the PDBC, options development should focus on variations of the preferred option from the IBC. These variations should be similar in technology, alignment under consideration, order of magnitude costs, benefits and timeline to implement.

In this PDBC, the difference between the variations will lie in the service concept while continuing to provide all-day service to Bowmanville via CP's GM spur line to cross Highway 401 and connect to CP's Belleville Subdivision.

Study Area

As displayed in [Figure 1](#) below, the study area is the preferred alignment identified in the IBC. The primary travel corridor for private motorists and GO bus services in this area is Highway 401. Durham Region Transit (DRT) provides local transit services off of Highway 401 on the local road network.

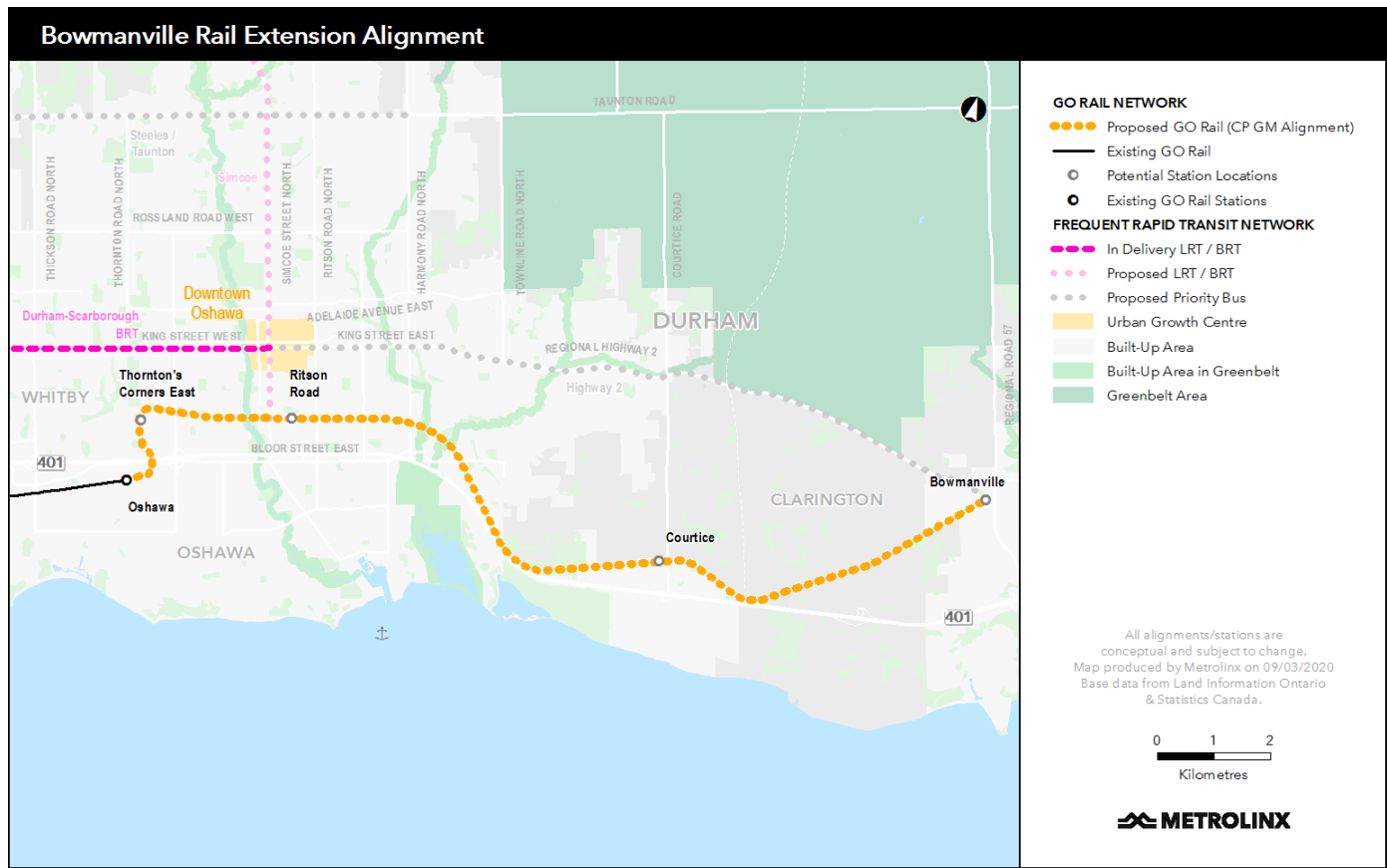


Figure 1: Study Area Overview Including Rail Alignments and Stations Under Consideration

Option Development

The option advanced from the IBC recommended the extension of all-day service to Bowmanville via CP's GM spur line to cross Highway 401 and connect to CP's Belleville Subdivision. This PDBC continues to analyze this alignment and proposes two all-day service concepts with the intent of optimizing the level and extent of GO rail service along the Corridor. Options were developed to test the performance of more frequent weekend service.

Different weekend service levels are being examined to optimize the benefits and costs.

Option Scoping

Options for analysis in this PDBC were determined by the Metrolinx project team. The working group took into account the GO Expansion program, the aforementioned operational constraints, geographic

limitations, policy and timeline considerations and local transit demand. A final list of two options was reviewed and refined for analysis.

Business as Usual

The Business as Usual scenario with GO Expansion's electrified bi-directional services provides four trains per hour making all stops between Union Station and Oshawa GO station throughout the day, with additional service during peak periods. GO rail services will continue to terminate at the Oshawa GO station. Continued operation of GO bus services between Newcastle and Oshawa via Bowmanville with increases in service where demand dictates.

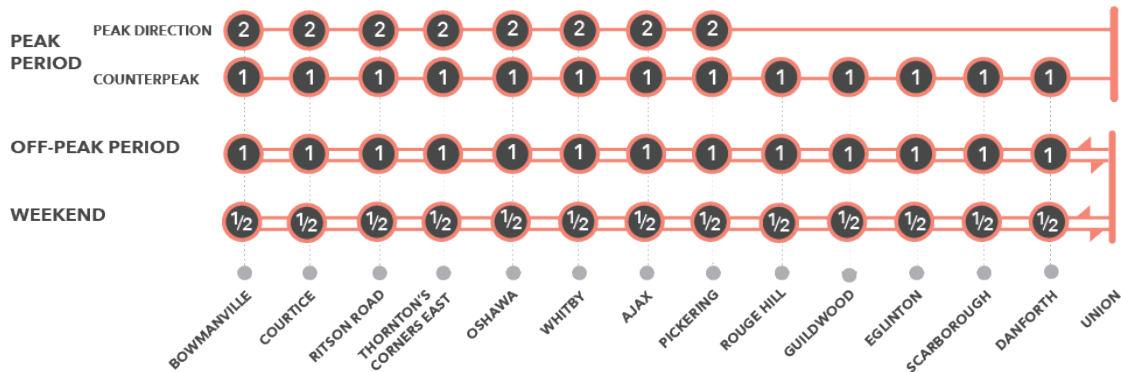
Option 1: Weekend Service Every Two Hours

All services to/from Bowmanville will be operating diesel bi-levels. Peak half-hourly services to/from Bowmanville will be operating express between Union Station and Pickering GO station, making all stops between Pickering and Oshawa GO stations, as well as, Thornton's Corners East, Ritson Road, Courtice and Bowmanville stations. Weekday off-peak (all operational hours outside of the AM and PM peak periods) hourly services will be making all stops between Bowmanville and Union Station. Weekend service will be every two hours making all stops between Bowmanville and Union Station.

Option 2: Weekend Service Every Hour

Identical service pattern to Option 1, except weekend service becomes hourly and makes all stops between Bowmanville and Union Station.

OPTION 1



OPTION 2

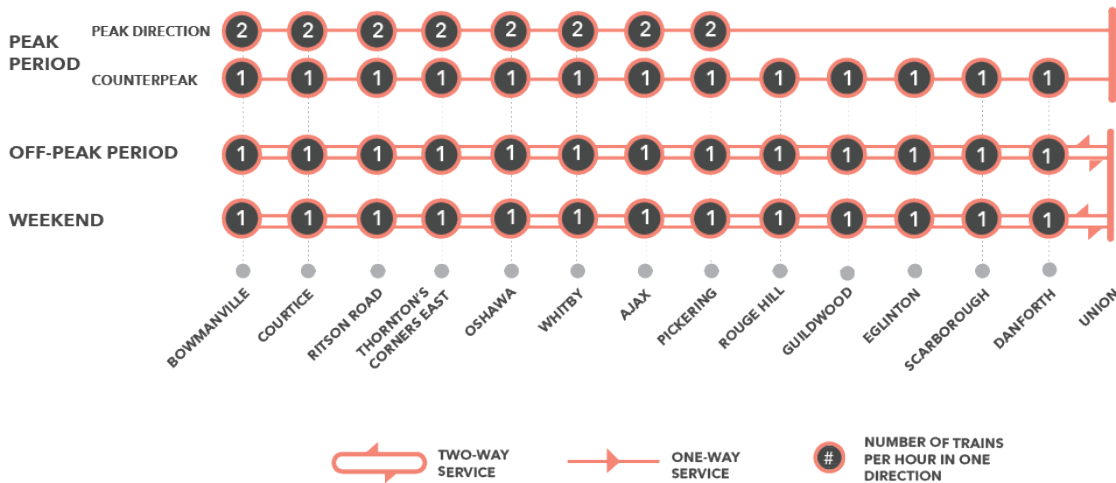


Figure 2: Service Diagrams for Option 1 and Option 2

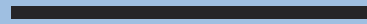
Infrastructure Requirements

Extension of two new tracks through Oshawa GO station connecting to CP’s GM spur line to cross Highway 401. After crossing Highway 401, a new rail line would diverge off CP’s line and run parallel to the GM Spur line on the east side and make an eventual parallel connection to CP’s Belleville Subdivision with one new track plus sidings and passing tracks where necessary. Electrified GO Expansion services will terminate at Oshawa GO station as Metrolinx does not pursue electrification on corridors that they do not own and CP will not allow electrification in their corridor.

New Stations

This PDBC analysis includes the delivery of new stations in order to determine the full benefits of the Bowmanville Extension program. The proposed stations are to be delivered through a market driven strategy in partnership with third party stakeholders. Region of Durham will be a key stakeholder in the delivery of the new stations. As the stations will be funded by third party stakeholders, station costs are only included in the Economic Case but not the Financial Case as it affects the overall cost to society.

4



Strategic Case



Introduction

As demonstrated in the IBC, the extension to Bowmanville realizes meaningful benefits, aligns with the GO Expansion objectives and addresses the goals of the 2041 RTP:

- Helps residents achieve a higher quality of life by reducing transit travel times, creating better connections with DRT network and increasing transit reliability and parking availability.
- Strengthens economic development by connecting employment clusters, urban growth centres and residential areas within the Oshawa to Bowmanville corridor.
- Encourages sustainable development by fostering reduced auto dependency and optimizing use of city infrastructure and reduce per capita land use through intensification.

The Strategic Case summarizes the impacts to the strategic performance for each of the options and challenges that could jeopardize the achievement of strategic outcomes.

Strategic Evaluation: Alignment with Goals & Objectives

Strong Connections

Regional Connectivity

Hourly weekend service to Bowmanville in Options 2 will improve connections between people and the places they live and play such as downtown Bowmanville, Oshawa, and Toronto all week long. A consistent frequent service throughout the week will increase land values, encourage intensification and reduce auto dependency.

Figure 3 below illustrates the surrounding population and employment within 800 metre of each of the existing and proposed stations. The population and employment data for the Oshawa and Thornton's Corners East stations catchment areas are mutually exclusive. Oshawa and Thornton's Corners East stations have the highest forecasts for employment in 2041 while Ritson Road and Bowmanville stations have the highest population forecast in the same year. These population and employment opportunities results are linked to these stations' proximity to dense and central locations in the Region.

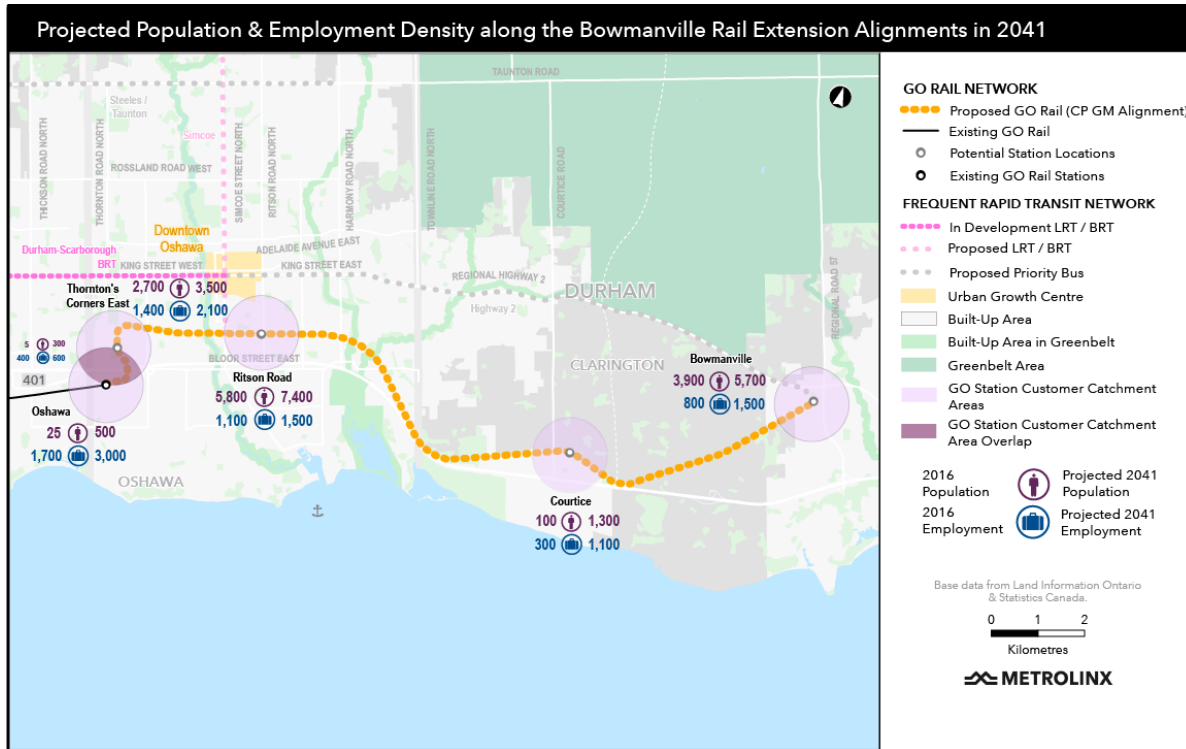


Figure 3: Projected Population and Employment along the Bowmanville Extension Alignment in 2016 and 2041

As shown in the overlapping area in Figure 3, about 330 people and 600 jobs are within both the Thornton's Corners East and Oshawa GO station catchment area. These people and jobs will benefit from having an alternative station access at Thornton's Corners East station.

The area around the Thornton's Corners East station is identified as a priority development site by the Region of Durham. It is also adjacent to the existing Durham College Whitby Campus and Trent University's future satellite campus, thus enabling students and staff alike a convenient means of travel. Ridership forecasts, population and employment opportunities related to these establishments are captured in the transportation demand model used in this business case.

Both options will realize the benefits of decreased auto-dependence and better active transportation as residences and students have better station access.

Ridership Demand & Forecast

As Metrolinx's GO Rail Passenger Survey cited in the IBC, there are established ridership markets in areas near the proposed GO stations, see Figure 4.

As shown in Figure 4, a significant number of existing riders using Oshawa GO station in 2016 are closer to the proposed new stations: Thornton's Corners East, Ritson Road, Courtice or the Bowmanville stations. Thus, these riders will have better station access as a result of the extension.

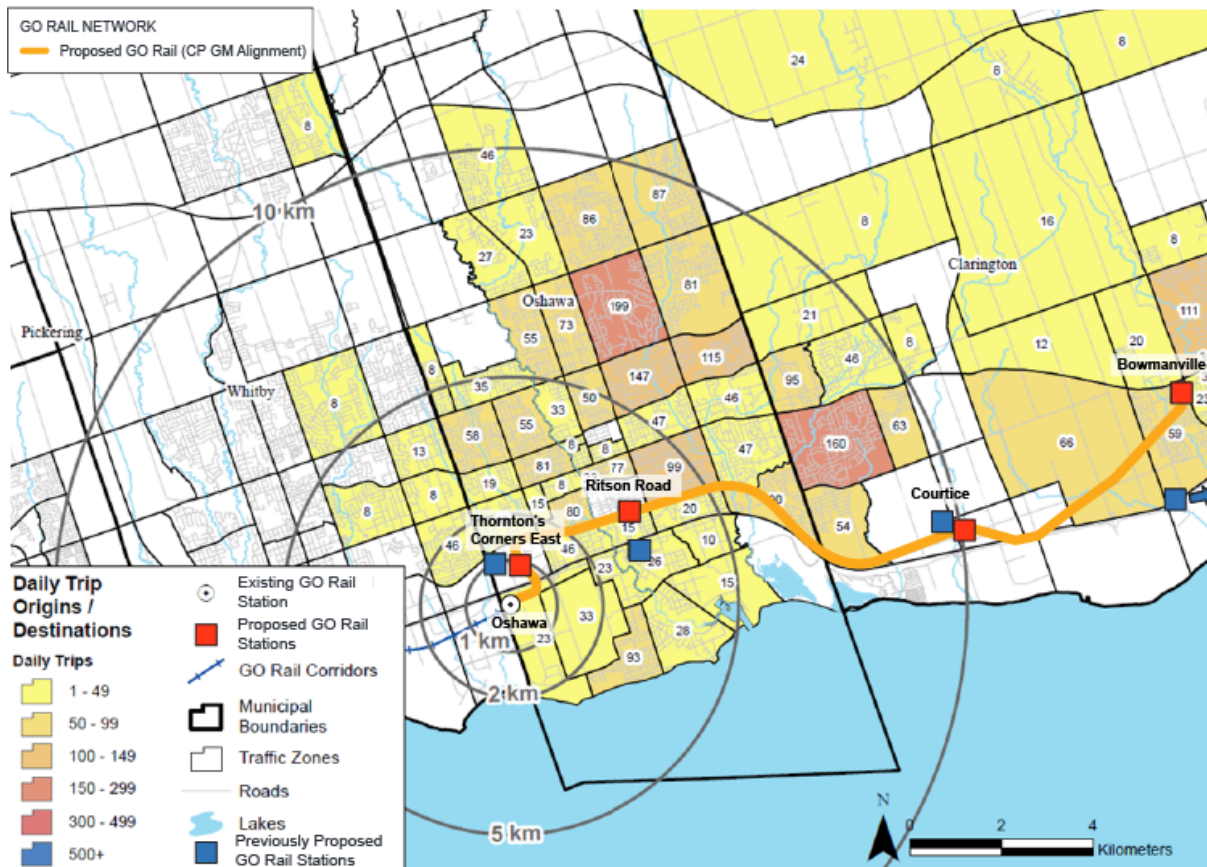


Figure 4: Existing Oshawa GO Station Ridership by Origin. Source: 2017 GO Rail Passenger Survey

Ridership forecasts were calculated using the Greater Golden Horseshoe Model (GGHMv4), a regional four stage travel demand model, for the entire 60-year lifecycle under analysis. Results are highlighted for 2041, as this year serves as a future baseline in GTHA transportation demand modelling. Bowmanville Extension GO rail annual boardings are displayed for in Table 3.

Table 3: 2041 Annual Boardings by Option

Station	Option 1	Option 2
	Weekend Service Every Two Hours	Weekend Service Every Hour
Oshawa	2,865,600	2,975,800
Thornton's Corners East	173,600	180,300
Ritson Road	352,000	365,500
Courtice	348,100	361,500
Bowmanville	1,131,700	1,175,200
TOTAL	4,871,000	5,058,300

Forecasts show large demands for expanded GO rail services in Durham Region. Many of these future users likely want to use GO services today but are unable to as a result of restrictions around station access at the Oshawa GO station and proximity to the station.

Option 2 has more frequent hourly weekend service and results in 4 per cent more riders.

Complete Travel Experiences

Transit Network Connectivity

The current track alignment and the new stations proposed connectivity to the DRT network are shown in [Figure 5](#) below. Passengers who wish to connect with the proposed Durham-Scarborough Bus Rapid Transit (BRT) line will transfer at the proposed Ritson Road station and will not be impacted in all options.

Currently, the area near the Thornton's Corners East station is under-developed and there are limited DRT buses serving the surrounding area. The closest transit hub to this proposed station is the Oshawa Centre Terminal, which is about 1.5km away, and it is well-served by DRT buses.

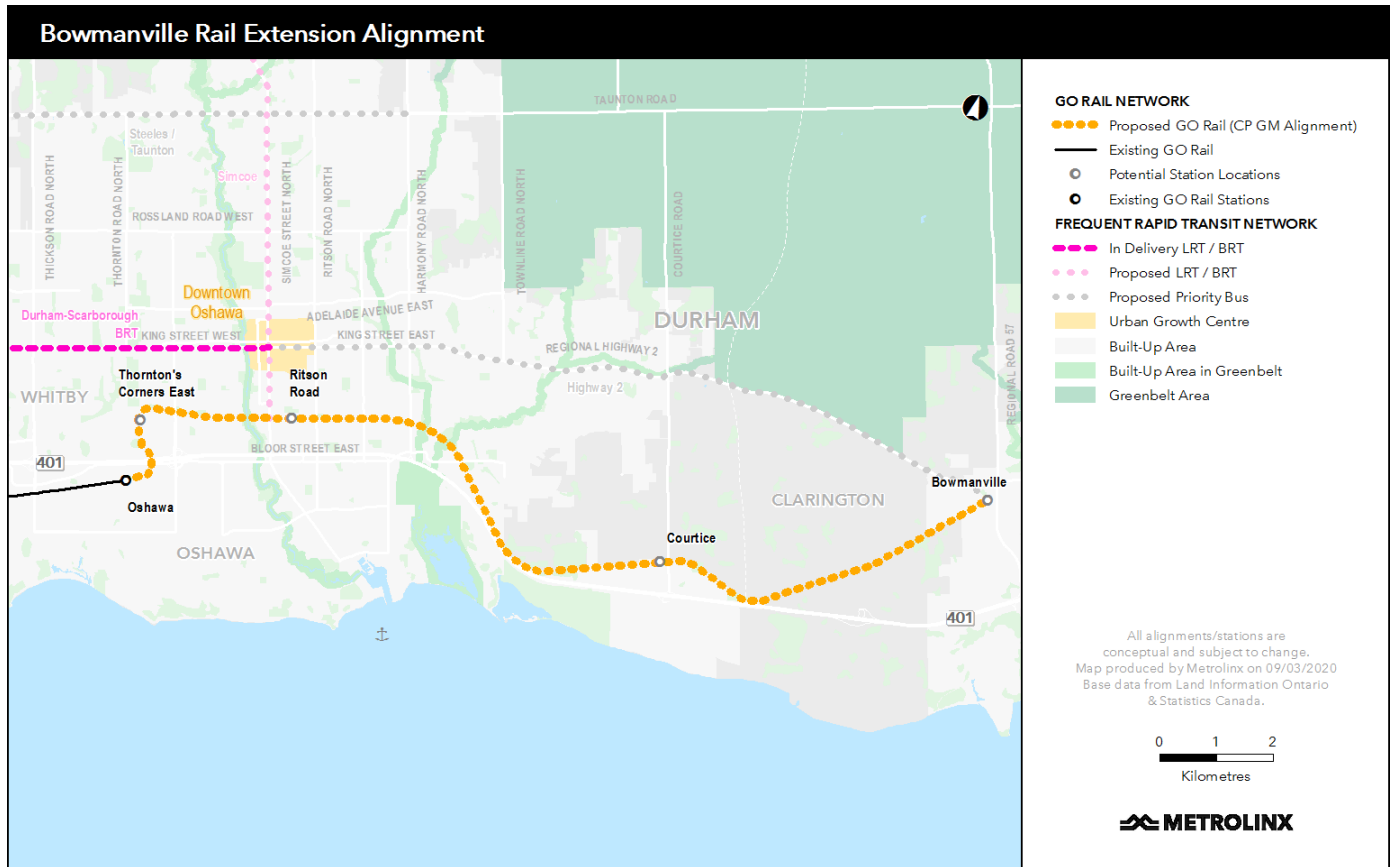


Figure 5: Existing and Proposed Stations in Relation to the DRT Network

Travel Time

In-vehicle travel time, which is the time a rider spent in the vehicle, is not affected by service frequency, hence, both options have the same travel time even though they have different weekend service levels.

Table 4: In-vehicle Travel Time in the Peak Period Peak Direction to Union Station

	Estimated Driving Time (2041)	BAU (Bus-Rail Service)	Options 1 and 2 (Rail Extension)	Driving vs. Rail Extension Travel Time Savings	BAU vs. Rail Extension Travel Time Savings
Bowmanville GO Station	96 min	80 min*	66 min	30 min, 31%	14 min, 18%
Peterborough	145 min	155 min**	126 min	19 min, 13%	29 min, 19%

*Bowmanville GO Station location for BAU is assumed to be the bus stop at Clarington Blvd. and Durham Hwy. 2 (Park and Ride) location.

** Peterborough area for BAU is assumed to the Trent University.

Table 4 shows that the rail extension improves in-vehicle travel time by approximately 15 minutes compared to the BAU. The overall journey time savings are anticipated to be more substantial than the in-vehicle travel time because passengers no longer have to wait for a bus connection at the Oshawa GO station. When comparing to driving from Bowmanville GO station to Union Station, users taking the GO rail service will experience an approximately 30-minute travel time savings.

Peterborough area residents will see approximately 30-minute reductions in their in-vehicle travel times with the rail extension compared to the BAU. Passengers currently using the GO Route 88 bus and connecting at Oshawa GO station for rail services to Union Station will transfer at the proposed Bowmanville station instead. Similar to the Bowmanville scenario, the overall journey time savings are anticipated to be more substantial than the in-vehicle travel time because passengers no longer have to wait for a bus connection at Oshawa GO station. Users will see approximately a 19-minute reductions in their travel time with the rail extensions compared to driving from Peterborough to Union Station.

Though Option 2 provides more frequent weekend service, the in-vehicle travel time does not change. In addition, due to the low service frequency, riders are expected to time their arrival at the station in both scenarios instead of arriving at a random time. As a result, wait time is expected to be very similar between Options 1 and 2.

Transit Reliability

Thornton's Corners East station is located on a single track segment between Oshawa GO and Ritson Road stations. Trains stopping at this station combined with the peak period service levels create tight timing between opposing train movements on the single track segment, thus impacting service resiliency if unplanned delays occur. Potential mitigation measures to protect service reliability include negotiating with CP for track access at Thornton's Corners East station in the event of unplanned delay.

Parking Capacity

The Thornton's Corners East station focuses on promoting active modes of transportation and the use of public transit through bus loop, cycling and Passenger Pick Up Drop Off (PPUDO) infrastructure. Furthermore,

there are no planned park and ride spaces at the proposed station. Parking capacity assumptions may change as station delivery is pursued through a market drive strategy.

Currently, parking at Oshawa GO stations is near capacity and is expected to be full in the near future. Ritson Road station will be a more attractive alternative for these passengers in Options 1 and 2. Parking constraint at the stations affects ridership forecasts and is reflected when projecting rail boardings for each option under consideration.

Parking constraint is not an issue on weekends, thus Option 2 will not be affected when the weekend service frequency increases from every two hours to hourly.

Table 5: Durham Region GO Station Parking Spaces (2031)

Station	Oshawa	Thornton's Corners East	Ritson Road	Courtice	Bowmanville	Total
BAU	2,400-2,800	-	68	109	85	2,662-3062
All Options	2,400-2,800	-	600 - 800	200 - 500	780 - 850	3,980-4,950

Sustainable Communities

Health

Table 6 below indicates the target modal split percentages for GO station access in 2031 as per the *Station Access Plan* for the Bowmanville Extension stations. It should be noted that the Access Plan is based on a different location for the Thornton's Corners East station as that was the location under consideration at the time of the Plan's development. It is assumed that the new location proposed in this PDBC has the same target for active modes of transportation.

Table 6: 2016 GO Rail Station Access Plan Active Transportation Targets (2031)

Station	Walking Target	Cycling Target
Oshawa GO	2-4%	1-2%
Thornton's Corners*	12-14%	2-4%
Ritson Road	14-16%	2-4%
Courtice	6-8%	1-2%
Bowmanville	12-14%	2-3%

*Proposed Thornton's Corners East station was not within the scope of the 2016 Station Access Plan. The Thornton's Corners Station in this table and the following figure is another location under consideration at the time of the Plan's development.

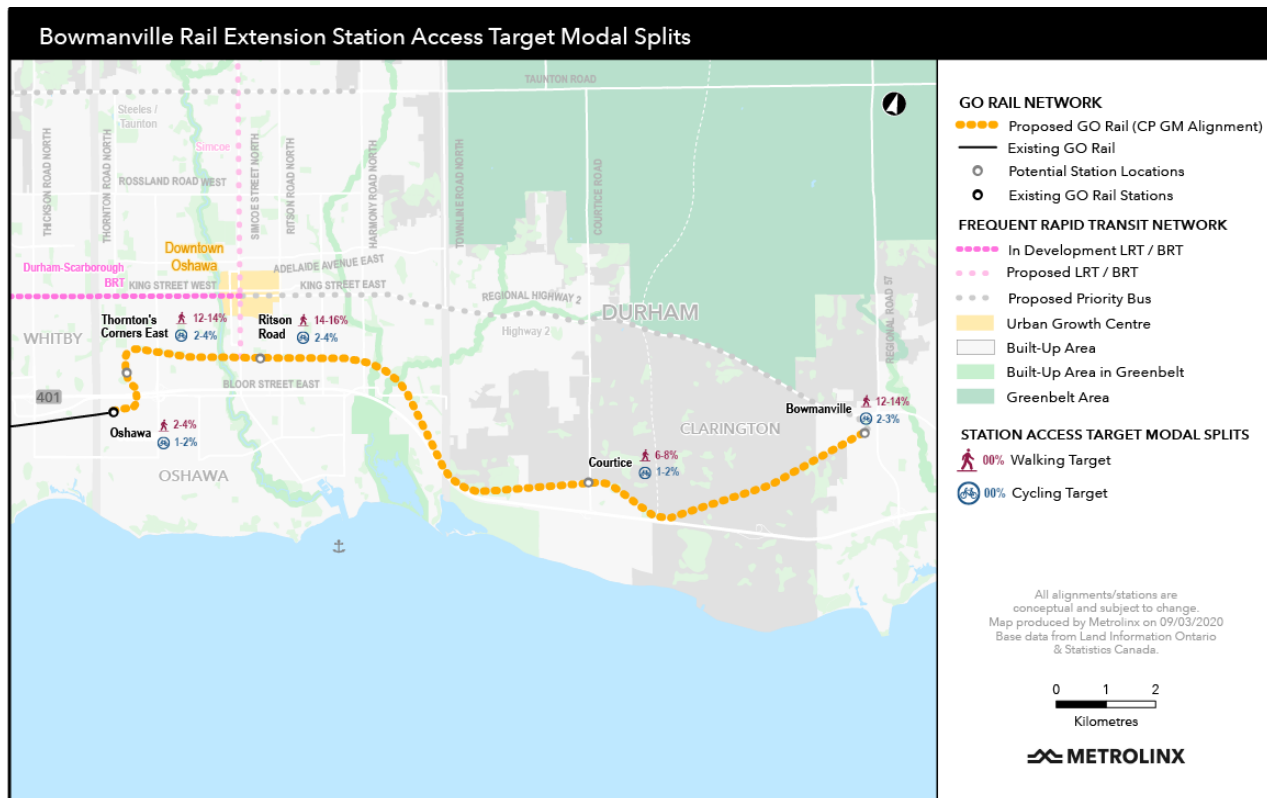


Figure 6: Station Access Plan Active Transportation Targets (2031)

Another societal health impact brought on by more frequent services in hourly weekend service is noise pollution. The rail extension would operate and passes through eighteen residential neighbourhoods in Oshawa and Bowmanville which are located within 30m of the corridor track centerline. The potential operation of hourly weekend bi-directional diesel service in Option 2 would create additional rail traffic noise compared to the weekend service every two hours in Option 1.

Strategic Evaluation: Challenges & Opportunities

This section of the Strategic Case looks at the challenges that could jeopardize the achievement of strategic outcomes.

Regional Connectivity

The proposed stations in the Bowmanville Extension program are to be delivered in a market driven strategy in partnership with Durham Region as a key stakeholder, as well as other third party stakeholders. Realization of ridership benefits and revenue will be impacted if the proposed stations do not materialize.

The ridership demand forecast assumes that DRT has reconfigured their current bus network to accommodate new station locations which are currently not served by local transit. If integration with local transit is not delivered, there will be negative impacts to the ridership at the proposed stations sites and lesser impacts on reducing the reliance on car usage.

Although assumptions were made to modify the DRT network to accommodate the Bowmanville Extension, the benefits and operating costs for DRT to access the proposed stations were not examined in this PDBC. It is anticipated that they may be examined in the next stage of the business case process.

Land Use Policy

Ridership demand and forecast assumes standard land use changes, such as future intensification and development potential based on secondary plans or market driven land use in the area. If the projected land use scenario is not achieved, there will be a negative impact to the ridership at the proposed stations sites.

Strategic Case Summary

Results indicate that Option 2 with hourly weekend service generates the highest boardings. Both options align with the Region and municipalities' planning and policy, serve a bigger population and provide better access to employment opportunities than the Business as Usual scenario. However, both options are exposed to train delays as bidirectional trains stop at the Thornton's Corners East station, which is located along single track segment. Potential measures protecting service reliability in the event of unplanned delay should be examined.

Both options have significant in-vehicle travel time savings compared to the Business as Usual scenario, yet, there is only slight differences in travel time savings between the two options examined.

Table 7: Strategic Case Summary

2041 RTP Goal	Strategic Outcome	Option 1	Option 2
		Weekend Service Every Two Hours	Weekend Service Every Hour
Strong Connections	Population and jobs served by Bowmanville Rail Extension	19,000 people and 10,400 jobs within 800 metre of a station along the extension by 2041	
	Increase GO ridership in the Durham Region	2041 Annual Boardings 4.9 million	2041 Annual Boardings 5.1 million
Complete Travel Experiences	Improve the Transit Network	New stations improved connections to the DRT network	
	Improve Transit Travel Time	Significant in-vehicle travel time savings compared to the BAU, but no differences among the Options themselves.	
	Improve Transit Reliability	Risk of train delays as bidirectional trains are stopping along single track segment; mitigation measures available	
	Provide improved GO Facility Capacity	3,980-4,950 total parking spaces	
Sustainable Communities	Encourage Active Modes of Transportation	3 of 4 proposed station locations would be in residential areas, encouraging active modes of station access	
	Noise Impacts	Moderate	Additional rail traffic noise due to weekend service every hour

5

Economic Case



Introduction

The Economic Case is one of two chapters focused on the rationale for pursuing an investment (the other being the Strategic Case). While the Strategic Case evaluates options based on a project specific policy/plan oriented evaluation framework, the Economic Case determines if the expected benefits of this investment exceed the costs required to deliver it, and articulates the overall benefit to society and economic viability of each investment option.

This analysis considers the magnitude of costs and benefits over a 60-year lifecycle (the evaluation period) and determines the following metrics:

- **Benefit Cost Ratio (BCR)** – the present value of benefits divided by the present value of costs, which is used to indicate benefits realized per dollar spent.
- **Net Present Value (NPV)** – the present value of benefits minus present value of costs, which is used to indicate total net benefits to the region.

The Economic Case uses real values and a social discount rate, as opposed to nominal values and a financial discount rate used in the Financial Case. Real values do not include the impact of general inflation, but do consider real growth. A social discount rate reflects society's time value preference for consumption – a benefit or cost incurred tomorrow may be less 'valuable' than the same benefit or cost incurred today.

All results included the Economic and Financial Case chapters are incremental to the BAU scenario – meaning they are the new benefits that can be realized and the new costs required to provide the Bowmanville rail extension.

This chapter answers the following questions:

- What are the benefits and costs associated with the investment options in real terms?
- What is the overall impact to society, as indicated by the Benefit Cost Ratio (BCR) and Net Present Value (NPV) of the investment options?
- How sensitive is economic performance to key assumptions used in option scoping and evaluation?

Methodology

The impacts of the proposed investment were estimated using a regional four stage travel demand model, the Greater Golden Horseshoe Model

(GGHMv4). Specifically, the GGHMv4 was used to forecast ridership, in-vehicle travel time benefits, reduction in vehicle kilometres travelled and improved link reliability. Benefits associated with crowding relief on transit were estimated outside the model by comparing existing volume and capacity on the corridor to future volume and capacity of the proposed investment. Additionally, operating costs for the options were calculated in the GO Expansion Full Business Case model using information on the proposed service concept, stopping pattern and other service characteristics like fleet type and route kilometres.

Additional bus operating and fleet costs associated with an increase in local bus feeder service required to connect Durham region residents with the Bowmanville extension were also estimated and included in the analysis of all investment options under consideration.

Assumptions and Parameters

A number of assumptions and parameters are made throughout the social cost benefit analysis, as noted in Table 8. The assumptions and parameters used within this Business Case are consistent with the second volume of Metrolinx's Business Case Guidance, as of April 2019. All analysis is presented in real terms in 2020\$ and assumes an economic discount rate of 3.5 per cent.²

Table 8: Economic Case Inputs and Assumptions

Input	Detail
Analysis Approach	All benefits/costs expressed in real terms in 2020\$ Appraisal begins in 2020. It assumes five years of construction (Sep 2021-Sep 2025), with a hypothetical opening year of 2025, and 60 years of operation (2025-2084)
Evaluation Period	60 years
Ridership and Benefits Growth Cap	30 years from base year of evaluation
Economic Discount Rate	3.5%
Inflation Rate	2.0%
Real Growth Rate	0%
Value of Time (VoT) (2020\$)	\$18.42/hour

² Real values, used in the Economic Case, reflect the increase in the value of goods and services in terms of purchasing power from the base year. Nominal values, used in the financial case, reflect the expected cost of a good or service in the year of expenditure. These values include both the general inflation rate as well as the increase for the good/service in real terms

Input	Detail
VoT Growth Rate	0%
Auto Occupancy	1.077
Auto Operating Cost Savings (2020\$)	\$0.09/km (marginal)
Decongestion Benefit	0.01 hours/km (peak), 0.0013 hours/km (off peak)
Safety Improvements (Accident Mitigation) (2020\$)	\$0.10/km
GHG Value (2025 forecast, \$2019)	\$54.50/ton

Costs

The costs or “required investment” to deliver the Bowmanville Rail Extension are divided into two categories:

Infrastructure Costs – fixed one-time costs incurred during the implementation of the investment. Capital costs include the station costs and labour and materials required for construction, however, property costs are excluded from the economic analysis.

Operating and Maintenance Costs – ongoing costs required to operate the service, provide day to day maintenance and complete major rehabilitations throughout the lifecycle of the project.

Rehabilitation Costs – major rehabilitations to restore infrastructure to ensure operational conditions throughout the project’s lifecycle.

The infrastructure, operating and maintenance, and major rehabilitation costs for the entire lifecycle of the Bowmanville Extension are listed below. These costs are incremental to the Business as Usual (BAU) scenario and have been discounted based on the approach defined earlier in this chapter.

Infrastructure costs include an estimate of 15 per cent for indirect costs, agency costs of 25 per cent and flagging costs. All Capital cost ranges reported including infrastructure and rehabilitation cost ranges are adjusted for optimism bias at 18 per cent based on the conceptual level of design used and represent an 80% confidence interval.

Table 9: Economic Costs Summary (2020\$ Present Value) *

Cost Category	Option 1	Option 2
	Weekend Service Every Two Hours	Weekend Service Every Hour
Infrastructure, Fleet, Rehabilitation and Replacement Costs	\$766M to \$878M	\$766M to \$878M
Operating and Maintenance Costs	\$585M	\$682M
Terminal Value	\$(11)-\$(13)	\$(11)-\$(13)
Total Costs	\$1,340M to \$1,450M	\$1,474M to \$1,547M

*All totals rounded

Optimism Bias

Optimism bias is the demonstrated systematic tendency for appraisers and cost estimators to be overly optimistic and expect better than likely project outcomes. In the context of transit infrastructure investments, optimism bias can lead to underestimation of costs and construction duration.

In the PDBC, the expected cost of infrastructure is further adjusted to account for optimism bias. The adjustment for optimism bias is expected to decrease with the increase in the level of project design. For this PDBC, some infrastructure elements are at a higher or lower level of design than others; however, since the analysis is at the PDBC stage, a uniform 18% uplift was applied across the program. Rehabilitation costs and terminal values are interdependent with infrastructure costs and so they also include an optimism bias uplift.

Optimism bias adjustment is not applied to ongoing operating and maintenance costs.

User Impacts

User Impacts are a key area of analysis for transport investments. They represent how the investment will improve the welfare of transport network users or travellers. This includes both travellers who will and will not make use of the Bowmanville Extension as both groups benefit from travellers switching to GO rail from other modes.

The Bowmanville Extension will change the cost of travel to three main groups:

- **Existing GO Bus/Rail Passengers** - The Bowmanville Extension will reduce the generalized cost³ of travel below the current cost of travel for GO users coming to/from Bowmanville. This investment will thus provide a direct benefit to existing users.
- **New GO Rail Passengers** - The Bowmanville Extension will reduce the generalized cost of travel on GO in Durham Region. This will attract new users to GO that previously travelled via other modes. New users will receive a benefit equal to the difference in what they were willing to pay and the new generalized cost of travel on GO.
- **Auto Users** - The Bowmanville Extension will attract some auto users off of local roads. This leads to decongestion of said roads which in turn reduces the travel time and operating cost for travellers who remain on the auto network.

All user impacts included in this analysis are 'net impacts' across the investment; a sum of benefits and disbenefits.

Table 10: User Impacts Summary (2020\$ Present Value)*

Category	Impact Measure	Option 1	Option 2
		Weekend Service Every Two Hours	Weekend Service Every Hour
Transit	Travel Time Benefits	\$494M	\$513M
	Crowding and Reliability Benefits	\$101M	\$101M
	Congestion Reduction	\$108M	\$112M
Automobile	Operating Cost Reduction	\$54M	\$56M
Total User Impacts		\$757M	\$782M

*All totals rounded

Travel time savings capture the largest portion of benefits in each of the options under consideration for the Bowmanville extension. Option 2

³ Generalized cost is the sum of the monetary cost (e.g. public transit fare) and non-monetary cost, i.e. time spent travelling (crowded or not, sitting or standing) - time is monetized using a Value of Time factor.

generates larger benefits to society in comparison with Option 1, resulting mainly from the increased benefits to more riders on weekends. In all other respects, both Options generate similar benefits. This shows that there is unsatisfied demand to use GO rail services in Durham Region on weekends. In the BAU scenario, there is only one access point to the GO Rail network, i.e. Oshawa station. This makes GO Rail relatively far (compared to the options) and less accessible for the residents of Durham region creating the new demand.

External Impacts

Every auto trip taken can contribute negative impacts to society – whether it is emissions that pollute the air or injuries that occur from collisions. These impacts are called external impacts, or the ‘social cost of transport’. Transportation investments are an opportunity to reduce these social costs by improving the economic efficiency of the transportation system – meaning less impact for the same amount of travel (measured in impact per passenger kilometre).

For instance, motorists switching to GO rail decrease the number of trips on the GTHA’s road network. This will lead to fewer car collisions and emissions, thus making the GTHA’s transportation network safer and society healthier.

One type of external impact is estimated for this investment:

- **Mode change** – if travellers move from a less efficient mode to GO rail then there is an impact equivalent to the externalities per trip on GO rail, minus the externalities on their previously used mode. These benefits are based on the change in automobile vehicle kilometres travelled (VKT) and are calculated using two factors:
 - Number of automobile trips that switch to GO rail
 - Trip length for trips that used auto and now use GO rail (i.e., the reduction in VKT)

Table 11: External Impacts Summary (2020\$ Present Value)*

Category	Impact Measure	Option 1	Option 2
		Weekend Service Every Two Hours	Weekend Service Every Hour
Safety	Accident Reduction	\$19M	\$19M
Environmental	Greenhouse	\$8M	\$8M

	Gas Emission Reductions	
Total External Impacts	\$27M	\$27M

*All totals rounded

Safety benefits from reduced automobile collisions are the primary driver of external benefits. Both safety and environmental benefits are tied to reduction in VKT. Both Options produce similar external benefits to society.

Economic Case Summary

The economic evaluation indicates that the Bowmanville Extension program would generate travel time savings for existing and new GO riders, and reduce automobile usage along the corridor.

Results indicate that Option 1 with a weekend service every two hours is the least costly to construct and operate and delivers the highest benefit per dollar spent on the project, a Benefit Cost Ratio of 0.74 to 0.80.

Table 12: Economic Case Summary (2020\$ Present Value)*

Impact Type	Option 1	Option 2
	Weekend Service Every Two Hours	Weekend Service Every Hour
Total Costs	\$1,340M to \$1,450M	\$1,437M to \$1,547M
Infrastructure, Fleet, Rehabilitation and Replacement Costs	\$766M to \$878M	\$766M to \$878M
Terminal Value	\$(11M) to \$(13M)	\$(11M) to \$(13M)
Bus Fleet Costs	\$12M	\$12M
Operating and Maintenance Costs	\$585M	\$682M
Total Economic Impacts	\$1,073M	\$1,111M
User Impacts	\$756M	\$781M
External Impacts	\$27M	\$28M
Incremental Fare Revenue Adjustment	\$290M	\$301M
Benefit-Cost Ratio	0.74 to 0.80	0.72 to 0.77
Net Benefits (NPV)	\$-377M to \$-267M	\$-437M to \$-326M

*All totals rounded

6



Financial Case



Introduction

The Financial Case assesses the overall financial impact of proposed investment options. While the Strategic Case and Economic Case outline how an investment achieves organizational goals and social value, the Financial Case is one of two cases (the other being the Deliverability and Operations Case) that focuses on the requirements to successfully deliver an investment. This includes a review of total revenue (fares) gained and expenditures (capital, operating and maintenance) required over the lifecycle of the investment incremental to the base case scenario.

This chapter answers the following questions:

- How much does the investment cost? What are the capital costs, operating costs, revenues, net financial effect and financial cost recovery ratios?
- How are costs allocated?
- What is the source of funding for the investment? Are there identified risks in the funding sources?

Year-over-year financial flows over the 60-year evaluation period from the hypothetical service start date (2025) through to the end of 2084 are estimated in nominal dollars (i.e., the dollar figure expected to be paid or received expressed in the year of the payment). Nominal financial flows are calculated assuming an annual inflation rate of 2 per cent. The annual costs and revenues are discounted back to a single value using a nominal discount rate of 5.5 per cent. Once discounted, total capital costs and incremental operating costs are compared against incremental revenues to derive the net present value in 2020\$ for the financial case as well as the operating cost recovery and return on investment ratios. For these reasons capital costs, operational and maintenance costs and fare revenues reported in the Financial Case differ from those in the Economic Case.

Capital Costs

The capital cost of building and delivering the proposed investment options forms the largest component of overall project costs. Infrastructure costs include property acquisition and a contingency allowance of up to 25 per cent based on the conceptual level of engineering utilized for this assignment. Further, an additional indirect cost of 15 per cent, agency cost of 25 per cent and flagging costs are incorporated to account for the completion of designs, procurement activities and support activities during construction.

Capital costs include an estimate for additional GO fleet required to operate the Bowmanville extension, as well as an estimate for the minimum additional local surface fleet necessary to operate a bus feeder service into the future GO stations along the extension.

Capital costs are the same between options because the same infrastructure is required to operate the proposed services. It was assumed for this analysis that stations will be delivered by third party investment through a market driven strategy.

The sums of capital costs reported in Table 13 below differ from those reported in the Economic Case. The below figures are in nominal terms discounted to 2020\$ values using a 5.5 per cent discount rate (the Economic Case uses real value with a 3.5 per cent discount rate).

Table 13: Capital Costs in Financial Terms (2020\$ Present Value)

Line Item	Option 1	Option 2
	Weekend Service Every Two Hours	Weekend Service Every Hour
Infrastructure, Fleet, Rehabilitation and Replacement Costs	\$865M	\$865M
GO Rail Fleet	\$469M	\$469M
DRT Fleet	\$12M	\$12M
Terminal Value	\$(11M)	\$(11M)
Total Capital Costs	\$1,335M	\$1,335M

All totals rounded. Includes Property, Indirect Cost 15%, Professional Service and Agency Costs 25%, Non-recoverable HST 1.76%, Contingency of 25% and Flagging

Operating and Maintenance Costs

The operation and maintenance of additional GO rail service will incur additional costs for staffing, fuel, vehicle and track maintenance and other state of good repair costs. Some operating cost savings can be expected with the reconfiguration of parallel GO bus service along the extension. Additional operating costs have been estimated to Durham Region Transit from an estimated increase in required bus feeder services into the new GO stations along the extension.

Table 14: Operating and Maintenance Costs in Financial Terms (2020\$ Present Value)*

Line Item	Option 1	Option 2
	Weekend Service Every Two Hours	Weekend Service Every Hour
GO Operating and Maintenance Costs	\$470M	\$566 M
GO Bus Operating Cost Savings	\$(12M)	\$(12M)
DRT Operating Costs	\$125M	\$125M
Total Operating and Maintenance*	\$583M	\$679M

*All totals rounded

Operating and maintenance costs rise with frequency of service on weekends. Option 1 is less costly to operate with service on the weekends every two hours. Option 2 is the costlier with higher frequency on weekends.

With the expansion of rail services to Bowmanville, GO bus route 88 will see a reconfiguration of routing and a change in service and operating pattern under all options. The bus service will no longer run to Oshawa, instead the route will be between Trent University, Peterborough and the new Bowmanville GO Rail station resulting in a \$12M reduction in operating and maintenance costs over the project lifecycle for each option. On the other hand, Durham Region Transit (DRT) is expected to introduce new feeder services to the proposed GO stations which would incur a cost for the minimum required fleet to operate the service. This additional service is estimated to cost DRT between \$108 to \$125 million in operations and maintenance. Although the impacts to DRT are demonstrated in the Financial Case, they are not included in the calculation of the summary financial metrics.

Revenue Impacts

Both options are expected to increase demand for GO Transit services leading to a corresponding increase in fare revenues for GO. With higher rail boardings, Option 2 is anticipated to generate the greatest fare revenues with Option 1 performing nearly as well. This suggests that going from a service every two hours to every hour doesn't have a great impact on fare revenue.

Table 15: Fare Revenues in Financial Terms (2020\$ Present Value)*

Line Item	Option 1	Option 2
	Weekend Service Every Two Hours	Weekend Service Every Hour
Incremental Fare Revenue	\$295M	\$306M

*All totals rounded

Funding Sources

Funding to plan, design and construct the Bowmanville Rail Extension comes from the Province of Ontario. On June 20, 2016, the provincial government announced its intention to build this project with a capital funding commitment of \$550M in 2014\$ values (a 2018-dollar value of \$654M). Metrolinx will also be seeking third party contribution for the project.

Financial Case Summary

Both options require the same capital investment under the Financial Case. The difference in operating costs and projected revenues between the options drives the variation in the summary financial metrics.

Option 1 carries the lower cost burden with weekend service every two hours. The net revenue is negative across both options over the 60-year time horizon, with Option 2 generating the lower negative net revenue. This suggests that the increase in fare revenue from the additional ridership along the corridor does not outweigh the required cost to build and operate the service along the extension. The project is not deemed profitable on a strictly financial basis. The operating cost ratio across both options is less than 1, with Option 1 better than Option 2 due to lesser service on weekends. This suggests that the increased fare revenue would not be enough to operate the project.

Table 16: Financial Case Summary (2020\$ Present Value)

Financial Case Metric (Incremental to BAU)	Option 1	Option 2
	Weekend Service Every Two Hours	Weekend Service Every Hour
Total Revenue	\$295M	\$306M

Total Capital Costs **	\$1,335M	\$1,335M
Total Operating and Maintenance Cost	\$582M	\$679M
Net Operating Cash Flow	\$(288M)	\$(373M)
Net Revenue (NPV)	\$(1,622M)	\$(1,708M)
Operating Cost Recovery Ratio	0.51	0.45
Return on Investment (ROI)	0.15	0.15

All totals rounded

***Including estimated GO Rail and additional DRT fleet required*

7



Deliverability and Operations Case



Introduction

The Deliverability and Operations Case is an analysis of investment delivery, operations and maintenance, service plans and any other issues that may prevent the realization of an option. This includes delivering the project from original concept through planning, design, environmental assessment, stakeholder engagement, procurement, construction and operations. The Deliverability and Operations Case is one of two cases (the other being the Financial Case) focused on requirements for delivering the investment.

It should be highlighted that although there are option variations in the PDBC, the deliverability and operations concerning each option are identical, except where specified. The inclusion of the Thornton's Corners East station does not impact the plan, nor the variations in weekend service frequency as the projected infrastructure requirements are designed to accommodate the most intensive service level, which is during the peak period on weekdays.

This chapter answers the questions on the following:

- Project Delivery
- Operations and Maintenance plan
- Procurement plan

Project Delivery

This PDBC assumes the alignment will primarily utilize a single track, sidings and sections of double track to accommodate train meets. Project delivery components will be identical across all options except for stations delivery. Findings from the IBC will inform the majority of this chapter and include any changes on the following:

- Project Sponsor and Governance Arrangement
- Major project components and constructability
- Environmental assessment requirements
- Construction impacts
- Main project risks and stakeholder dependencies
- Milestone dates

Project Sponsor and Governance Arrangement

Metrolinx is the overall project sponsor, while CP will be a key technical stakeholder. As the corridor is owned by CP, all decisions on infrastructure and services require working with CP to agree to and deliver the optimal solution. CP will work with Metrolinx to enable

commuter rail operations on the GM Spur, as well as, the CP-owned Belleville Subdivision.

Major Project Components and Constructability

The infrastructure scope for the preferred alignment has been refined since the release of the IBC and is subject to agreement with CP as the corridor owner. This PDBC assumes two GO Subdivision tracks will extend through the existing Oshawa GO station. The GO tracks will tie into a new north track east of the station and further tie into CP's existing single-track GM Spur south of Highway 401. GO trains will share the GM Spur track across Highway 401. After the bridge GO trains diverge onto a new alignment east of the existing GM Spur track towards the CP's Belleville Subdivision connecting with it west of Stevenson Road. The alignment will then follow the proposed CP corridor single track alignment. In addition, the half-hourly service in the peak period will require passing tracks between the proposed Ritson and Courtice GO stations.

Analysis of the approach to the GM Spur determined a compensated grade of three per cent would be required to allow for eastbound GO Trains to successfully incline from the GO Subdivision at Oshawa GO station to climb and connect into the GM Spur. To accommodate the approach and potentially achieve a higher speed crossing over Highway 401, the operation of trains between six and 12-car lengths, as well as, two diesel locomotives are under consideration.

This PDBC will continue to assume changes at Oshawa GO station as stated in the IBC, including extension of the existing VIA Rail pedestrian bridge. It should be noted that impacts to the bus loop configuration and recently built VIA station platform access are results of planned work unrelated to the Bowmanville extension and are not required to enable the rail extension.

As the Detailed Design begins, level crossings involved will need to be taken into considerations. The level crossings will be evaluated with the corridor owner CP to determine if they meet the current Transport Canada Standards.

Environmental Assessment Requirements

This PDBC assumes no additional changes to the environmental impacts and the environmental assessment process beside those already identified in the IBC, which would require the scoping and completion of additional environmental studies along the GM Spur.

Construction Impacts

The Bowmanville Extension will lead to significant modifications or changes in operations at Oshawa GO station. As described in the IBC, the Oshawa GO station is to remain functional to both GO/VIA service; VIA would continue to provide customer access on their island platform on tracks No. 2 and 3. Other station features such as the new station building will remain unchanged while parking capacity may be impacted due to the relocation of the bus loop.

Main Project Risks and Stakeholder Dependencies

Project Risks

The Metrolinx project team has developed a Quantitative Cost Risk Analysis. The analysis tracks the probability and impact of potential project risks. It also outlines strategies to mitigate these risks, where possible.

Stakeholder Dependencies

Reliable and timely rail services to Bowmanville are dependent on a consistent access to cross the GM Spur. While the GM Spur is currently not in use, CP will need to maintain operations flexibility to support the future development of the site. As a result, collaboration between Metrolinx and CP is required to enable reliable and consistent operations on the Spur.

The Bowmanville Extension will need to secure portions of industrial property south of Highway 401, as well as, land north of Highway 401 in the area between Thornton Road South, the Belleville Subdivision and Fox Street, as stated in the IBC.

The Extension proposes to operate on CP's Belleville Subdivision and briefly utilize lands owned by CN north of the Kingston Subdivision east of the Oshawa GO station in order to reach the GM Spur. Agreements may also be required with VIA Rail for modifications to the existing Oshawa GO station and potentially Hydro One due to possible impacts on above ground hydro services in the vicinity of the Highway 401 crossing.

As such, the program has key stakeholders which Metrolinx had previously consulted related to land acquisition and obtaining consent and approval. The main stakeholders include CP, CN, VIA and Hydro One, Region of Durham, City of Oshawa, Town of Whitby and Town of Clarington.

Another project risk is station delivery through third party stakeholders with Durham Region as the key stakeholder. Station delivery timing and coordination will be critical to realize the benefits of the extension.

Milestone Dates

Upon Provincial approval, Metrolinx will move forward with property acquisitions, permits and approvals, detailed design and procurement. These tasks and construction are estimated to last 70 months or longer in total, taking into account of Early Works program completion, procurement and ongoing discussion with CP.

Operations and Maintenance Plan

Roles and Responsibilities

Metrolinx and CP will generally be responsible for the delivery, maintenance and operation of infrastructure on the extension. A detailed assignment of roles and responsibilities, as well as, apportionment of related costs, will be established as part of future discussions between Metrolinx and CP. In addition, some of Metrolinx's responsibilities may transition to the successful proponent of the GO Expansion program once it has been awarded.

Changes in Service Provision

GO Rail Services

Across all options, services to Bowmanville would operate diesel bi-level trains. The off-peak, counter peak and weekend service would operate all stops between Union Station and the proposed Bowmanville station, whereas the peak period peak direction service would operate express between Union Station and Pickering GO station and making all stops between Pickering and the proposed Bowmanville station.

To accommodate a compensated grade of three per cent approaching the GM Spur, the operation of consist length between six and 12-car, as well as, two diesel locomotives are under consideration.

GO Bus Services

GO Bus Route 88 currently provides connectivity to Peterborough and Trent University from the Oshawa GO station. The PDBC assumes Route 88 will be re-routed to connect Peterborough and Trent University from

the proposed Bowmanville station to shorten the distance travelling on road.

Local Bus Services

Currently, DRT bus service connects passengers at the Oshawa GO station, Newcastle Carpool Lot and Bowmanville Park & Ride. The PDBC assumes the local transit network will be optimized. For example, DRT Route 910 will be rerouted to connect to the Thornton's Corners East station in Options 1 and 3. DRT Routes 401, 407, 410, 411 and 414 will be rerouted to connect to the Ritson Road station across all options. DRT Routes 402 and 412 will be extended to the proposed Courtice station across all options and DRT Route 501 and 502 will be reconfigured to connect to the proposed Bowmanville station across all options.

DRT has not been consulted on the assumptions made in the PDBC. Further collaboration with DRT is anticipated as more in-depth operational information becomes available to ensure integration with the local bus network.

Depot/Stabling Arrangements

The proposed Bowmanville station will have the potential ability to store two trains overnight with wayside power and diesel fueling, thus reducing dead-head movements for the morning service.

All trains for the extension, besides those stored overnight at Bowmanville station will be maintained at the nearby Whitby Rail Maintenance Facility. If warranted, the Bowmanville Extension could trigger Phase Two construction for the Whitby Rail Maintenance facility.

Procurement Plan

Recommended Procurement Method

As the owner of the Belleville Subdivision, CP reserves the right to self-perform all design and construction work within this subdivision, such as the track, grading and signal related work. The guiding principles of the strategy is under development in collaboration with CP. For work outside of the corridor, Metrolinx is pursuing the procurement option Design-Bid-Build for existing stations and overnight layover works, where design is procured and completed before proceeding with construction.

This arrangement may change as the project evolves.

Industry Capacity and Experience to Deliver Project

The scope of the Bowmanville extension includes new infrastructure and the reinstatement, repair, replacement or upgrade of existing infrastructure, such as platform, track, signal and structures. The scale and scope of the proposed works are within reach of existing general contractors within the market.

Deliverability and Operations Case Summary

This PDBC builds on the preferred option from the IBC and there are no significant changes in the project delivery or operations and maintenance plan. Since the release of the IBC, collaboration with CP has continued to develop the program and more details regarding the Bowmanville Extension are made available in this chapter.

The table below summarizes the key findings of the Deliverability and Operations case.

Table 17: Deliverability and Operations Case Summary

Deliverability and Operations Consideration	PDBC – All Options
Project Delivery and Constructability	<ul style="list-style-type: none">• Typical constructability challenges associated with a rail corridor program• Uses existing (single track) CP rail spur over Hwy 401 (additional improvements may be required)• Requires connection from mainline to GM Spur line
Environmental Assessment Requirements	Additional studies required for environmental approvals
Construction Impacts	Require changes to existing Oshawa GO station
Third Party Agreements	Obtain consent and approval of CP, CN, Hydro One and VIA
Implementation Schedule	Assume 70 months delivery timeline or longer
Operating and Maintenance Plan	Construct new layover at the proposed Bowmanville station
Service Changes	Implement two-way all-day rail service to Bowmanville Reconfigure GO bus services and optimize local bus routes
Procurement Plan	Design-Bid-Build procurement for delivery of infrastructure

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Business Case Summary



Introduction

This chapter summarizes the findings of the four-case evaluation, provides a recommendation on the option to be advanced for a full business case, highlights additional work or investigations that are required to confirm the findings of this business case and next steps.

Investment Review

Extending GO rail service beyond Oshawa to Bowmanville has been a long standing goal of the local community and Durham Region. This project has been subject to multiple studies by Metrolinx and other authorities culminating in this Preliminary Design Business Case. Options in this analysis have slight differences in performance with the BCR in the range of 0.72 to 0.80 and an annual boardings between 4.9M and 5.1M in 2041.

The two options differ only in frequency of service on weekends. Weekend service in Option 2 is increased to hourly service to Bowmanville, which leads to higher annual boardings, more revenue and operating costs. Frequent hourly weekend service drives increased rail boardings and revenue by 4 per cent while the operating and maintenance cost increased by 17 per cent.

Implementing weekend service every hour will result in \$26M economic benefits and \$11M additional revenue at a cost of \$97M to the society. The service generates a BCR of 0.38 meaning for every \$1 spent on increasing weekend service to hourly service, the economy of Ontario would gain 38 cents of benefit. This additional service generates an incremental Cost-Recovery (R/C) Ratio of 0.11, meaning that for every dollar spent operating an increased hourly weekend service, Metrolinx will recover \$0.11.

APPENDIX A - Ridership Demand & Forecast

Total Bowmanville Extension GO rail boardings are displayed for the three-hour AM peak period (6:00AM - 9:00AM) in the following table.

2041 Weekday AM Peak Period Boardings and Alightings by Option

Station	Option 1		Option 2	
	Weekend Service Every Two Hours		Weekend Service Every Hour	
	Boardings	Alightings	Boardings	Alightings
Oshawa	7,110	2,090	7,110	2,090
Thornton's Corners East	140	420	140	420
Ritson Road	480	650	480	650
Courtice	890	230	890	230
Bowmanville	3,330	300	3,330	300
TOTAL	11,950	3,690	11,950	3,690

Both options share the same AM peak service level, thus they have identical AM peak period boardings and alightings.

APPENDIX B – Sensitivity Analyses

Several tests were conducted on key input assumptions and parameters to determine the range of benefits possible and their impact on BCRs. This was done for each investment option. The sensitivity tests are focused on uncertainties that have a substantial impact on the business case.

The values of key economic parameters were varied to determine how the options would perform under different circumstances to reflect these uncertainties. Tests were conducted on the following items related to the uncertainty in economic parameters assumed in the business case evaluation:

- Value of Time Growth Rate of 0.7 per cent (0 per cent rate used in reported results)
- Economic Discount Rate of 2.5 per cent (3.5 per cent rate used in reported results)
- Ridership Growth Rate of 1 per cent (2% used in reported results)

Parameter	Metrolinx Assumption	Tested Value	Option 1	Option 2
Benefit Cost Ratios using Standard Metrolinx Assumptions			0.74 to 0.8	0.72 to 0.77
Value of Time Growth Rate: A parameter used to escalate the Value of Time across the investment lifecycle. Value of Time is a factor used to monetize changes in generalized time to determine the overall welfare benefit to transport network users.	0.0%	0.7%	0.85 to 0.91	0.85 to 0.91
Economic Discount Rate: Over time, the value of a cost or benefit will decrease – as a result, an economic discount rate is applied. The economic discount rate reflects	3.5%	2.5%	0.93 to 1	0.9 to 0.97

Parameter	Metrolinx Assumption	Tested Value	Option 1	Option 2
society's time preference for money.				
Ridership Growth Rate: A parameter used to escalate ridership throughout the investment lifecycle.	2%	1%	0.74 to 0.8	0.72 to 0.77

These tests noted the following conclusions:

- The ridership growth rate tests had minimal impacts on the BCR and benefits; and
- The value of time growth rate and economic discount rate have a significant impact on BCR and benefits.

Sensitivity of Project Scale:

Stop at Thornton's Corner East

Thornton's Corners East (TCE) was identified as a station of interest in the IBC, but analysis of the station in that document was limited. The PDBC sought to examine TCE in more detail for the following reasons:

- TCE is strongly supported by Durham Region, and aligns with their long term planning goals for the area.
- TCE represents a significant site with major development potential.
- However, it generates significantly less rail boardings than the other three extension stations due to its proximity to Oshawa station.
- Inclusion of TCE adds additional travel time for the majority of Bowmanville extension users.

Due diligence was conducted to examine the economic, financial and strategic performance of this specific station, due to the unique circumstances.

The analysis shows that TCE station creates \$26M economic benefits. Though the station is very close to Oshawa, benefits remain positive as the time penalty is mitigated by the slow average speed over the GM spur. The economic costs to society are estimated at \$87M to society, yielding a BCR of 0.35-0.36.

From a financial standpoint, the TCE station stop will produce a Cost-Recovery (R/C) Ratio of 0.06, as serving TCE increases operating and maintenance cost by 10-12 percent, which is significantly more than the added revenue.

Overall, TCE does generate additional boardings as well as 2-3% additional revenue. Significant alightings occur due to job proximity, which explain the loss of ridership if the station were removed. Its location north of Highway 401 enables better future active connections to Oshawa and better supports Durham Region's development strategy.

The detailed economic and financial analysis is provided below.

Economic Case Summary

	Option 1	Option 1-A	Option 2	Option 2-A
Impact Type	Thornton's Corners East Station not in place; Weekend Service Every Two Hours	Thornton's Corners East Station not in place; Weekend Service Every Two Hours	Thornton's Corners East Station not in place; Weekend Service Every Hour	Thornton's Corners East Station not in place; Weekend Service Every Hour
Total Costs	\$1,340M to \$1,450M	\$1,251M to \$1,361M	\$1,437M to \$1,547M	\$1,347M to \$1,458M
Infrastructure, rehab and replacement costs	\$766 M to \$959 M	\$745 M to \$764 M	\$766M to \$959M	\$745 M to \$764 M
Terminal Value	\$(11M) to \$(13M)	\$(11M) to \$(13M)	\$(11M) to \$(13M)	\$(11M) to \$(13M)
Operating and Maintenance Costs	\$585M	\$516M	\$682M	\$613M
Total Economic Impacts	\$1,073M	\$1,042M	\$1,110M	\$1,079M
User Impacts	\$756M	\$741M	\$781M	\$767M
External Impacts	\$27M	\$16M	\$28M	\$16M
Incremental Fare Revenue Adjustment	\$289M	\$285M	\$301M	\$296M
Benefit-Cost Ratio	0.74 to 0.80	0.77 to 0.83	0.72 to 0.77	0.74 to 0.80
Net Benefits (NPV)	\$-376M to \$-267M	\$-318M to \$-208M	\$-436M to \$-326M	\$-378M to \$-268M

Financial Case Summary:

	Option 1	Option 1-A	Option 2	Option 2-A
Financial Case Metric (Incremental to BAU)	All Stops; Weekend Every 2 Hours	Thornton's Corners East Station not in place; Weekend Every 2 Hours	All Stops; Hourly Weekend	Thornton's Corners East Station not in place; Hourly Weekend
Total Revenue	\$295M	\$290M	\$306M	\$301M
Total Capital Costs **	\$1,335M	\$1,335M	\$1,335M	\$1,335M
Total Operating and Maintenance Cost	\$582M	\$511M	\$679M	\$608M
Net Operating Cash Flow	\$(288M)	\$(221M)	\$(373M)	\$(306M)
Net Revenue (NPV)	\$(1,622M)	\$(1,556M)	\$(1,708M)	\$(1,641M)
Operating Cost Recovery Ratio	0.51	0.57	0.45	0.50
Return on Investment (ROI)	0.15	0.16	0.15	0.16

Glossary

Term	Definition
Benefit Cost Ratio (BCR)	Present value of benefits divided by present value of costs, which is used to indicate benefits realized per dollar spent.
Business Case (BC)	A generic term for a collection of evidence which, when assembled in a logical and coherent way, explains the contribution of a proposed investment to organizational objectives. It supports decision-making process to sift options, select a preferred option and optimize the preferred option.
Business as Usual Scenario (BaU)	The baseline against which options are compared where the intervention has not occurred and existing business practices, committed plans and general trends continue into the future.
GO Expansion Program	Capital program to implement electrified two-way, all-day service across the GO rail network.
Greater Toronto and Hamilton Area (GTHA)	The combined area of the Cities of Hamilton, and Toronto; and the Regions of Durham, Halton, Peel, and York.
Initial Business Case (IBC)	This first Business Case in the Business Case process that compares investment options and selects a preferred option for further refinement and design. This Business Case is typically used to secure funding from the Province for planning and preliminary design.
Net Present Value (NPV)	Present value of benefits minus present value of costs, which is used to indicate total net benefits to the region.
Preliminary Design Business Case (PDBC)	The Preliminary Design Business Case takes the recommended option of the Initial Business Case and reviews different approaches to refine and optimize it. This Business Case is typically used to secure funding from the Province for procurement and construction.
Terminal Value	The terminal value is the estimated value of the Bowmanville extension at the end of the forecast period in today's dollars.

Term	Definition
Vehicle-Kilometres Travelled (VKT)	A measure of roadway use, commonly used in estimating congestion, that reflects the distance that an individual drive, or, more typically, the cumulative distance driven by all vehicles in an urban region during a specified period of time. Vehicle kilometres travelled can reflect the link between land use and transportation. Land uses that are further away from each other result in longer trip lengths, more traffic on roadways and more vehicle kilometres travelled, for example
Wider Economic Impacts	Benefits from investing in transportation that lead to a more productive region. Typically these benefits include agglomeration (enabling increased innovation, collaboration, and productivity) and labour supply benefits (increased job access for employee and a larger labour pool for employers).

