METROLINX

Bowmanville Rail Service Extension

Initial Business Case Update
February 2020

Disclaimer

This Initial Business Case evaluates the case for implementing rail service to Bowmanville on the Lakeshore East corridor through various alignments and service patterns. The options presented are based on Metrolinx's initial view of achievable alignments and service patterns on a shared rail corridor, and the infrastructure requirements to enable the service extension. Variations in the preferred alignment's infrastructure scope and/or service pattern will be assessed through a Preliminary Design Business Case.

This business case uses the future GO Expansion electrified service on the Lakeshore East corridor to Oshawa as the baseline for analysis. As this project advances through the business case lifecycle, future analyses will consider the effects of re-baselining the existing service levels.

All figures within this Initial Business Case Update represent preliminary results. Forecasted costs, revenues and ridership figures are at a high level and will be subject to refinement as analysis of the Bowmanville Rail Extension proceeds to the Preliminary Design Business Case phase, and later analyses in the Business Cases lifecycle.

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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 Toronto and Hamilton Area (GTHA). 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 Initial Business Case (IBC) for this project was completed in 2015. The analysis assumed a four train peak-only service and achieved a Benefit Cost Ratio (BCR) of 0.56 which means that for every $1 spent the economy of Ontario would gain 56 cents of benefit. This document is an update to the Initial Business Case.

On June 20, 2016, the Province of Ontario announced that Metrolinx, the Province's regional transportation authority for the GTHA, would extend its Lakeshore East GO Rail services to Bowmanville. In the time since the Provincial announcement new factors and information have materialized necessitating an updated Initial Business Case to the previously announced project. These factors include updated information on local rail capacity, option costs, GO Expansion operations and the feasibility of the announced alignment.

Options for Analysis

This Business Case assesses four rail extension options in a study area spanning from the existing Oshawa GO Station in the west to Bowmanville in the east.

- **Base Case:** A 'Business as Usual' option with no rail extension east of Oshawa. Rather, operation of GO Bus services between Bowmanville and Oshawa will continue with increases in service when and where demand dictates.

- **Option 1:** Utilization of the 2016 announced Highway 401 crossing east of Thickson Road to Thornton's Corners GO Station. Rail service will make all stops between Bowmanville and Pickering GO station, and operate express between Pickering GO station and Union Station, including new station sites at Thornton's Corners, Ritson Road, Courtice and Bowmanville. The existing Oshawa GO station will be closed, with electrified GO service rerouted to the station at Thornton's Corners.
- **Option 2:** Extension through Oshawa GO Station connecting to Canadian Pacific (CP) Railway's General Motors (GM) spur line to cross Highway 401, and connect to CP's Belleville Subdivision. Rail service will make all stops between Bowmanville and Pickering GO station, and operate express between Pickering GO station and Union Station, including new station sites at Thornton's Corners East, Ritson Road, Courtice and Bowmanville. The existing Oshawa GO station remains open, and will continue to be the terminus of electrified GO service.
- **Option 3:** GO Rail services to Bowmanville via Canadian National (CN) Railway's Kingston Subdivision. Rail service will make all stops between Bowmanville and Pickering GO station, and operate express between Pickering GO station and Union Station, including new station sites at Ritson Road South, Courtice South and Bowmanville South. The existing Oshawa GO station remains open, and will continue to be the terminus of electrified GO service.
- **Option 4:** GO Rail services to Bowmanville via CN's Kingston Subdivision eventually connecting to CP's Belleville subdivision over Highway 401 in the vicinity of Colonel Sam Drive in Oshawa. Rail service will make all stops between Bowmanville and Pickering GO station, and operate express between Pickering GO station and Union Station, with new station sites at Ritson Road South, Courtice and Bowmanville. The existing Oshawa GO station remains open, and will continue to be the terminus of electrified GO service.

Options 1 through 4 will be analyzed under the lens of two varying service patterns that serve as bookend scenarios:

- **Peak-Only Service Pattern**: As tested in the 2015 IBC, four 12-car bi-level diesel trains per weekday 6:31AM – 9:30AM/3:01PM – 7:00PM peak period (two trains running in the peak hour) running to/from Bowmanville and Union Station operating express to/from Pickering GO Station.
- **All-Day Service Pattern**: Peak half-hourly 12-car diesel services to/from Bowmanville operating express between Union Station and Pickering GO Station, operating eight-car bi-levels hourly during the weekday off-peak (all operational hours outside of the AM and PM peak periods) and six-car bi-levels every two hours during weekends.

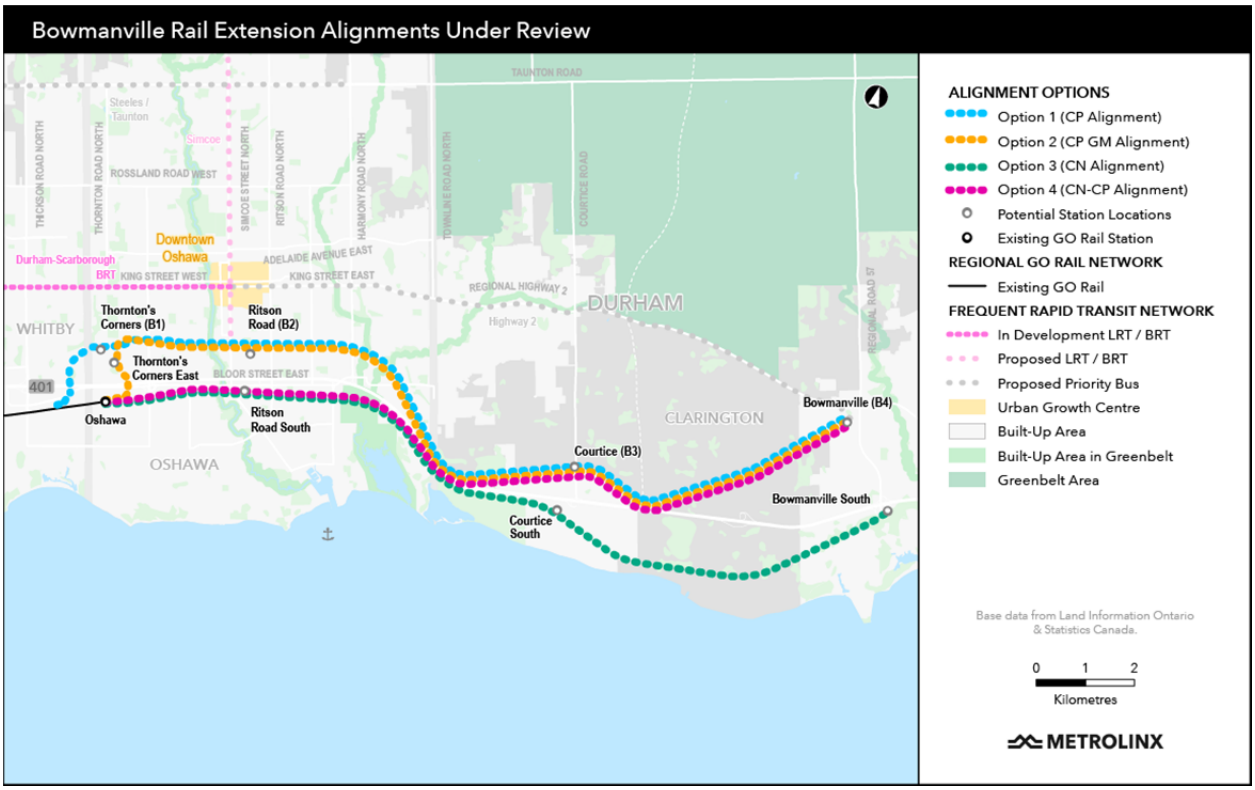

Figure E.1: Study Area Overview (Including Rail Alignments and Stations Under Review)

Method of Analysis

An Initial 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 Initial Business Case is the first 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 Initial Business Case Update 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 for the year 2031 were determined using outputs from the Province's regional demand model (Greater Golden Horseshoe Model) and the GO Expansion Full Business Case Model. Forecasts were generated for all options for peak-only and all-day service patterns. As would be expected, the all-day service pattern provides higher ridership and greater value for money than peak-only services as the infrastructure required to operate is common to both service patterns. However,

additional services drive operational costs that need to be balanced with ridership increases.

Options that utilize the CP corridor north of Highway 401 (Option 1, 2 and 4) demonstrate the slightly higher ridership generation potential. These alignments run closer to mature GO customer markets and larger population and job centres than alignments on the CN corridor running south of Highway 401. It should be noted that the 2031 annual Business as Usual (BAU) forecast for Oshawa itself is 4.6M, which means that many of the riders forecasted in Option 1 through 4 are existing GO Rail users redistributing to new stations further east of Oshawa GO Station.

Table E.1: 2031 Total Annual Boardings – All-Day Service

Station	BAU	Option 1	Option 2	Option 3	Option 4
Oshawa	4,624,000	-	2,807,000	3,761,000	3,712,000
Thornton's Corners (B1)	-	3,551,000	-	-	-
Thornton's Corners East	-	-	601,000	-	-
Ritson Road (B2)	-	823,000	797,000	-	-
Ritson Road South	-	-	-	450,000	441,000
Courtice (B3)	-	386,000	371,000	-	386,000
Courtice South	-	-	-	349,000	-
Bowmanville (B4)	-	1,550,000	1,537,000	-	1,652,000
Bowmanville South	-	-	-	1,497,000	-
TOTAL	**4,624,000**	**6,310,000**	**6,113,000**	**6,057,000**	**6,191,000**

Business Case Results

A final decision between all options must be made with total costs, benefits, operability, policy alignment and stakeholder considerations in mind. With an all-day service pattern, all options in this analysis have Benefit Cost Ratios (BCRs) in the range of 0.7 to 1.2 and annual ridership of 6 – 6.3M. These results indicate slight differences in performance between the options.

Option 1 aligns with strategic objectives including regional and local government policy. This option also produces the forecasted demand of

6.3M annual by 2031 and total project benefits of $809M. While closest in alignment to the 2016 announced project, this option has operational constraints where it ties into the Lakeshore East mainline and is the costliest to build due to infrastructure requirements and thus produces a Benefit Cost Ratio of 0.8 - 0.9.

Option 2 performs moderately from a ridership and benefit and cost perspective. This alignment delivers ridership similar to Option 1 but at a lower overall financial cost as existing infrastructure is utilized to cross Highway 401. However total project costs (real) are still high and result in a BCR between 0.7 – 0.9 with all-day service. This option allows for Oshawa GO Station to remain open, providing through movements from Bowmanville to Union, but has the longest travel time to Bowmanville due to four net new station stops and the crossing of Highway 401 which requires slow speed movements.

Option 3 is forecasted to produce slightly lower ridership of 6M annually and societal benefits of up to $681M over the project's 60-year lifecycle. These results are due to the alignment's location south of Highway 401, putting stations further away from the Region's population and job centres. This option achieves a BCR of 1.1 - 1.2, the highest of all options, in part to having the lowest total project costs.

Option 4 produces a Benefit Cost Ratio of 1.0 - 1.1. This means that for every dollar spent on this project, up to $1.10 dollars of benefit is returned to society. This option conforms to some strategic objectives, produces forecasted boardings comparable to Option 1, is feasible to construct and operate and is the least costly to build. However, Option 4 does not service central Oshawa, a key market for the extension.

Table E.2: Business Case Summary

	Option 1		Option 2		Option 3		Option 4	
	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day
Strategic Case								
2031 Annual Boardings (Millions)	5.0	63	4.7	6.1	5.0	6.1	5.0	6.2
Connectivity	15,000 people and 5,700 jobs within 800m of a station by 2031		14,300 people and 7,500 jobs within 800m of a station by 2031		8,300 people and 5,400 jobs within 800m of a station by 2031		11,300 people and 6,100 jobs within 800m of a station by 2031	
Sustainable Development	3 of 4 station sites in urban areas				1 of 3 station sites in urban areas		2 of 3 station sites in urban areas	
Economic Case (NPV 2018$ Millions)*								
Total Costs	$(771 - 907)	$(880 – 1,014)	$(626 - 738)	$(773 - 844)	$(496 - 569)	$(557 - 629)	$(542 - 622)	$(633 - 712)
Total Benefits	$316	$809	$267	$659	$278	$681	$296	$719
Benefit Cost Ratio (BCR)	0.4 – 0.4	0.8 - 0.9	0.4 - 0.4	0.7 - 0.9	0.5 - 0.6	1.1 – 1.2	0.5 - 0.6	1.0 - 1.1
Net Benefits	$(455 - 591)	$(71 - 205)	$(359 - 471)	$(114 - 225)	$(218 - 291)	$52 - 124	$(246 - 326)	$7 - 86
Financial Case (NPV 2018$ Millions)*								
Total Revenue Impacts	$78	$371	$78	$342	$73	$320	$76	$338
Total Capital Costs	$(575 - 586)		$(372 - 376)		$(316 - 376)		$(348 - 354)	
Total Operating and Maintenance Costs	$(121)	$(260)	$(132)	$(298)	$(114)	$(201)	$(125)	$(243)
Net Present Value (NPV)	**$(617 - 628)**	**$(464 – 475)**	**$(425 – 430)**	**$(345 - 350)**	**$(357 - 417)**	**$ (197 - 257)**	**$(397 - 403)**	**$(252 - 258)**
Operating Cost Recovery Ratio	65%	143%	60%	109%	64%	159%	61%	139%
Financial Case (Undiscounted YOE$)*								
Total Capital Costs	$(814 - 821)		$(527 - 529)		$(447 - 540)		$(492 - 498)	

	Option 1	Option 2	Option 3	Option 4
Deliverability and Operations Case				
Constructability	• Major, costly construction of rail-road grade separation over Hwy 401 (3 tracks, electrified) • Other rail-road grade separations and water crossings	• Uses existing rail infrastructure over Hwy 401 (additional improvements may be required) • Requires connection from mainline to spur	• No disruption to Hwy 401 during construction • Bowmanville Station site constrained by Hydro One transmission lines • Significant property acquisitions • Several bridge and at-grade crossing improvements	• Construction of a new bridge over Hwy 401 • Several bridge improvements • Several new and upgraded grade separations
Operations	• Closure of existing Oshawa GO station • Operational conflicts with Whitby Rail Maintenance Facility • Fewest number of parking spaces	• 3.5% grade to cross Hwy 401 • Requires changes to existing Oshawa GO station • Longest travel time	• Requires changes to existing Oshawa GO station • Shortest travel time	• Requires changes to existing Oshawa GO station
Environmental Approvals	• No additional environmental studies	• Additional studies for environmental approvals	• New Environmental Assessment Required	• Additional studies for environmental approvals
Stakeholder Dependencies	MTO and CP	CP, CN, Hydro One and VIA	CN and VIA	MTO, CP, CN and VIA
Timelines	70 months	70 months	72 months	60 months

*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) in 2015.

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. This would be done utilizing new double track sections along Canadian Pacific (CP) Railway's existing Belleville corridor north of Highway 401.

In 2018 it was determined by Metrolinx 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. Along with GO Expansion considerations, this IBC would serve to validate the work done in 2015 within the larger Regional Transportation Plan and incorporate new information on delivery costs, property impacts, CP's infrastructure requirements and municipal policy and plans. The update (this document) accounts for the new context and environment in which this project will operate so that an optimal investment decision is identified and selected.

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 IBC is the first of four business cases completed in an investment's lifecycle. It reviews variations of the preferred investment and selects a preferred option for further design and analysis.

This document is the Bowmanville Rail Service Extension Initial Business Case Update. The IBC update builds on the work done in the 2015 IBC. This analysis takes the recommended option from the IBC, applies new context and direction to it, and introduces three new options for analysis. This business case clarifies project scope, preliminary design, ridership demand, service patterns, benefits and costs at a high level.

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 investment option for this project which will be advanced for a Preliminary Design Business Case (PDBC) 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 investment options considered within this business case.

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 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 Oshawa GO Station and on the road network will continue to place constraints on future residents of the Region and 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 Bowmanville is identified as a 'Project in Delivery' in Metrolinx's 2041 Regional Transportation Plan	• Not constructing an announced rail extension threatens to cast the organization's reputation in a negative light unless the case for not proceeding is strong
	Transport Service Provision	• Currently Bowmanville is served by GO buses operating at half-hour 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	• 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	• 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	• 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	• Rail services offer more capacity at faster speeds to commuters than current transport infrastructure and technology provides	• 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.

	Driver	How does this Driver influence the problem/opportunity?	What is the impact of not addressing the problem/opportunity?
External	Congestion	• Increasing travel times on the regional road network are leading to decreasing reliability. 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	• Regional travel times will continue to increase without addressing the problem statement thus reducing accessibility, limiting economic development opportunities, increasing greenhouse gas emissions and negatively impacting overall quality of life
	Demographic Change	• An increasing population puts pressure on the transport network, contributing to increased congestion and pollution, particularly from automobile use	• 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	• Growth in jobs and changes in the nature of work, primarily brought about by automation and communication technologies, affect the demand for transit	• 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	• 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	• Municipal secondary plans and site plans for proposed station sites will be compromised without GO Rail stations; the core of several of these plans
	Land Use	• Transportation investment policies and programs must be intrinsically linked with land use policies and programs to plan for sustainable future communities	• 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 Oshawa GO Station with connections to Bowmanville via bus service 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 Business as Usual scenario thus putting constraints on the growing population of the region to access GO services.

Strategic Value

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. Its population is forecasted to grow from nearly seven million today to nine million by 2031, alongside a strong increase in the number of jobs. Durham Region's population is forecasted to reach 970,000 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.

[1] Statistics Canada

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. These goals will be achieved through the rail extension's ability to seamlessly connect transit modes, get commuters out of their cars and reduce carbon emissions, support regional secondary plans, allow for walkable communities and by placing commuters closer to regional employment, commercial and educational centres.

Strategic Objectives and Goals

As identified in the GO Expansion Full Business Case, there are three main areas in which rail service enhancements and/or extensions can benefit the region. Extending GO Rail services through Oshawa to Bowmanville will benefit the region in the following ways:

<u>High Quality of Life</u>
The Bowmanville Extension can improve quality of life by:

- Improving user experience and reducing the stress of daily travel by increasing transit travel speeds and reliability while expanding the range of destinations people can reach across Durham Region.
- 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.
- 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.

<u>Prosperous Economy</u>
The Bowmanville Extension can support prosperity and development by:

- Improving connectivity between homes, jobs and businesses via new services that decrease travel times and increase reliability.
- Creating connections between areas that are proposed for new residential and commercial development, such as station sites, as well as existing economic activity centres.

Sustainable Development

The Bowmanville Extension can lead to a more sustainable transit system by:

- 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.

Alignment with Goals

The proposed investment recommended through this IBC should directly support the realization of the three goals in the 2041 RTP.

Strong Connections

The proposed investment should create an improved transit connection in Durham Region. The key strategic objectives under this goal include:

- Increasing the number of people and jobs within walking distance (800m) of a station with access to GO Rail service.
- Increasing GO transit ridership in Durham Region.

Complete Travel Experiences

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

- Improving the transit network.
- Decreasing transit travel time.
- Increasing the reliability of transit.
- Providing improved GO station facilities.

Sustainable and Healthy Communities

The Bowmanville Rail Extension proposed investment should support sustainable land use and transportation patterns. The key strategic objectives under this goal include:

- Reducing auto vehicle trips.
- Encouraging active modes of transportation.
- Ensuring negative environmental impacts are minimized.

Alignment with Broader Policy

Through their plans and policies, project stakeholders at the Provincial, regional and municipal levels are aiming to improve the quality of life and safety, guide economic growth and development and achieve environmental sustainability for their respective regions.

A review of the following provincial, regional and municipal policies and plans examines how extending rail services to Bowmanville aligns with policies in the following documents:

- 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 summarizes key policies from these documents that align with the expanding rail services to Bowmanville.

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	• 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	• 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	• 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	• 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	• 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

Extending GO Rail services through Oshawa to Bowmanville aligns with these plans and policies as this improved rapid transportation will unlock development potential around station sites and their immediate neighbourhoods, encourage the use of environmentally sustainable modes of access and egress to GO stations and expand access to employment and educational opportunities across the region.

3

Investment Options

Introduction

This chapter describes four defined, well-scoped and defensible investment options for consideration and evaluation in the Strategic, Economic, Financial and Deliverability and Operations Cases.

For an IBC, options should focus on investments of differing scope, whether that difference lie in the technology, service or alignment under consideration, so long as the option can address the problem or opportunity under consideration.

Study Area

As displayed in Figure 2 below, the area of study in this IBC is the Oshawa to Bowmanville corridor. This 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. The corridor contains two major rail lines currently used for freight purposes. Running north of Highway 401 is CP's Belleville subdivision (shown in blue and orange). South of Highway 401 is CN's Kingston subdivision rail line (shown in green). GO services utilize this line until reaching Oshawa GO Station. The line continues east towards Kingston running between Highway 401 and the Lake Ontario shoreline.

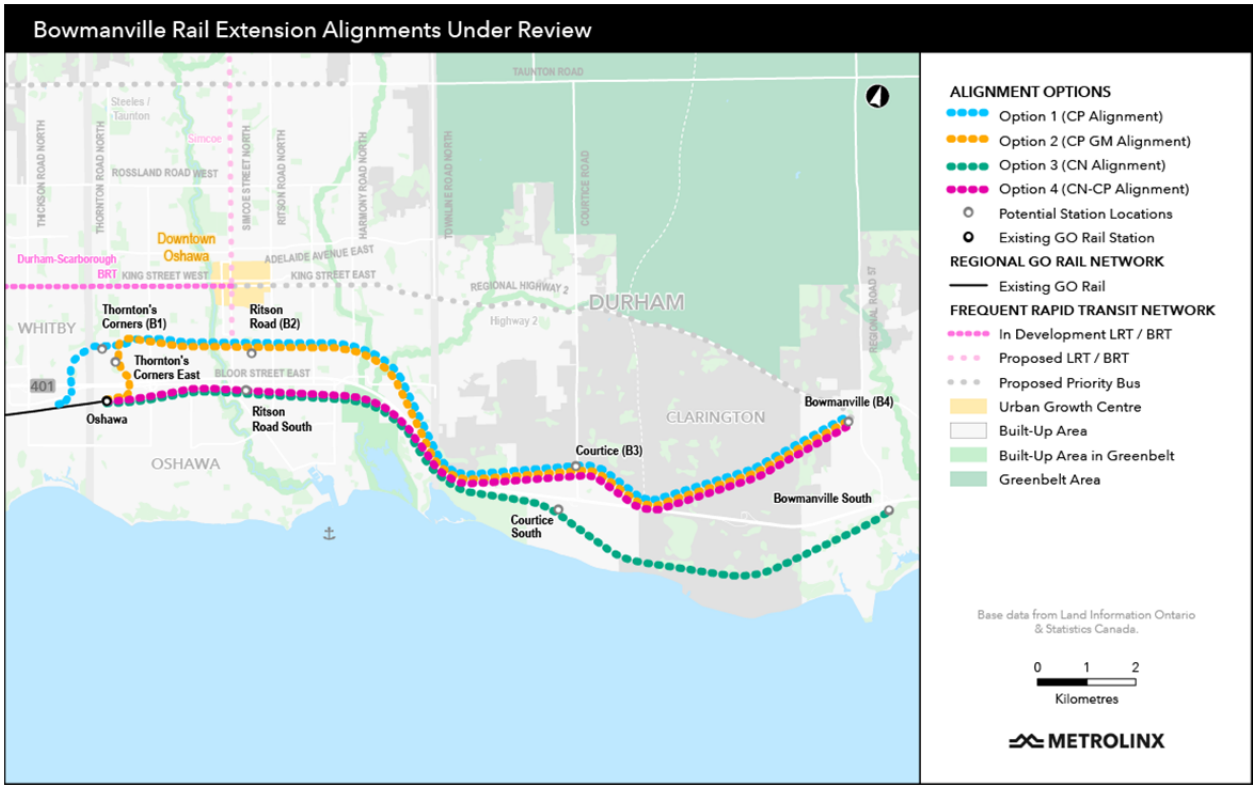


Figure 2: Study Area Overview Including Rail Alignments and Stations Under Review

Option Development

The 2015 IBC analyzed only one option which assumed four train movements per peak period travelling between Bowmanville and Union (running express after Pickering GO Station) along CP's Belleville subdivision. Bowmanville services would connect from CP's track to the Lakeshore East Line east of Thickson Road. The extension would have four new stations located at Thornton's Corners (B1), Ritson Road (B2), Courtice Road (B3) and in Bowmanville (B4) at Prince William Boulevard.

Since this option was announced by the Province in 2016, new information has come to light, infrastructure requirements and internally through GO Expansion capacity and service planning, which affects the announced alignment and necessitates the need for an update to the IBC.

Refinement of the GO Expansion service pattern has led to a proposed post-2028 plan that will see heavy train movements between Oshawa and Whitby. It is envisaged that during an average weekday peak hour, corridor track between Oshawa GO Station and the Lakeshore East mainline will see nine to 10 peak-direction train movements, counter-peak passenger services and other train equipment movements between Oshawa and Metrolinx's new Whitby Rail Maintenance Facility.

The Whitby Rail Maintenance Facility, opened in fall 2018, has east and west-facing 20-mph speed limited lead tracks that feed into the Lakeshore East main line. Slow moving trains to/from these lead tracks would conflict with passenger service moves to/from Bowmanville on the corridor where maximum speeds can achieve 90-mph. Further, rail capacity analysis has shown that it will be impossible to bring equipment out of the facility into service during peak hours without compromising main line capacity and performance of Bowmanville services.

This constant movement of trains will take place over the section of track where the proposed Bowmanville extension would connect from CP's Belleville subdivision near Thickson Road (see Figure 3), to the Lakeshore East Line. This connection would occur via what is known as a cross-plant rail junction (where two or more separate rail lines converge/diverge).

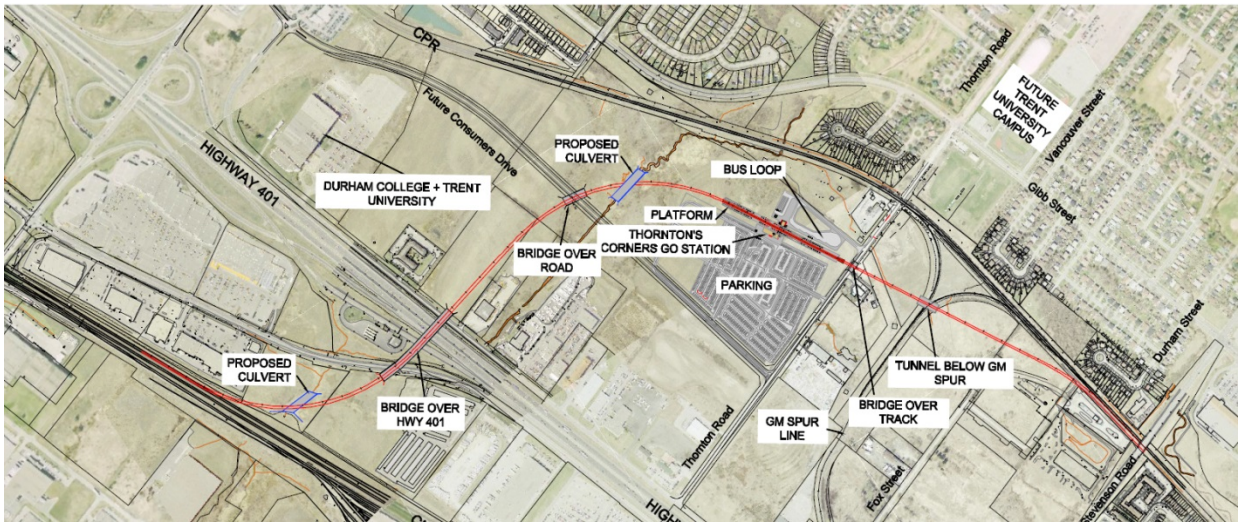


Figure 3: Overview of the 2016 announced GO - CP 401 rail connection (new connecting track in red)

This junction presents serious barriers to the successful operation of GO Expansion services. Train movements through the junction would operate below desired speeds severely compromising track capacity and performance in this section. With nearly 20 train movements anticipated per peak hour over the junction, incorporating an additional four plus trains per peak period on one of Canada's busiest stretches of rail corridor would create serious bottlenecks, capacity constraints and technical challenges as the junction would often be closed off from the extension due to train movements between Oshawa and Whitby GO Stations. With these constraints in mind Metrolinx staff determined that an alternative alignment to the 2016 announcement must be investigated that firstly, does not contain a cross-plant junction and secondly, is an extension of Oshawa GO Station services rather than being parallel to it. These issues, in addition to a significant increase in forecasted costs for the program, resulted in a re-examination of alignment options to be analyzed in this IBC.

Option Scoping

Options for analysis in this IBC 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 four options was reviewed, refined and approved by the Metrolinx Sponsor Office for analysis.

Base Case: A 'Business as Usual' scenario where GO Expansion's electrified bi-directional services provide four trains per hour making all stops between Union and Oshawa GO Station throughout the day, with additional service during peak periods by 2028. Continued operation of GO Bus services between Newcastle and Oshawa via Bowmanville with increases in service where demand dictates.

Option 1: Utilization of the 2016 announced Highway 401 crossing east of Thickson Road to Thornton's Corners (B1 Station) with three tracks, decreasing to one track plus sidings where necessary once on CP's corridor. All trips between Bowmanville and Union (running express between Pickering GO Station and Union) stop at Thornton's Corners (B1), Ritson Road (B2), Courtice (B3) and Bowmanville (B4) GO Stations

on the extension. The existing Oshawa GO station will be closed, with electrified GO service rerouted to the station at Thornton's Corners.

Option 2: Extension of one new track plus sidings where necessary through Oshawa GO Station connecting to CP's General Motors (GM) spur line to cross Highway 401, making an eventual connection to CP's Belleville Subdivision with one new track plus sidings where necessary. Trips between Bowmanville and Union (running express between Pickering GO Station and Union) stop at Oshawa, Thornton's Corners East, Ritson Road (B2), Courtice (B3) and Bowmanville (B4) GO Stations. Electrified GO Expansion services will terminate at Oshawa GO Station as Metrolinx does not electrify on corridors that they do not own and CP Rail will not allow electrification in their corridor.

Option 3: Operation of GO services to Bowmanville on CN's Kingston Subdivision via one new track, plus sidings where necessary. Trips between Bowmanville and Union (running express between Pickering GO Station and Union) operate via a direct connection to CN's corridor once east of Oshawa GO Station. Extension service would stop at new stations, Ritson Road South, Courtice South (located near Courtice Road south of Highway 401) and Bowmanville South (located near Bowmanville Avenue). Electrified GO Expansion services will terminate at Oshawa GO Station as Metrolinx does not electrify on corridors that they do not own and CP Rail will not allow electrification in their corridor.

Option 4: Operation of GO services to Bowmanville on CN's Kingston Subdivision via one new track, plus sidings where necessary eventually connecting to CP's Belleville subdivision over Highway 401 in the vicinity of Colonel Sam Drive in Oshawa. This alignment would continue on one track and sidings to Bowmanville. Trips between Bowmanville and Union (running express between Pickering GO Station and Union) stop at new station sites at Ritson Road South and the announced Courtice (B3) and Bowmanville (B4) Stations on CP's subdivision. Electrified GO Expansion services will terminate at Oshawa GO Station as Metrolinx does not electrify on corridors that they do not own and CP Rail will not allow electrification in their corridor.

Service Patterns

For this business case all four options (minus the base case) will be analyzed under the lens of two varying service patterns that serve as bookend scenarios:

- ***Peak Only Service Pattern***: Four 12-car bi-level diesel trains per weekday 6:31AM – 9:30AM/3:01PM – 7:00PM peak period (two trains running in the peak hour) running to/from Bowmanville and Union operating express to/from Pickering GO Station.
- ***All-day Service Pattern***: Peak half-hourly diesel services to/from Bowmanville operating express between Union and Pickering GO Station, operating eight-car bi-levels hourly during the weekday off-peak (all operational hours outside of the AM and PM peak periods) and six-car bi-levels every two hours during weekends.

New Stations (All Options)

This IBC 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 in a market-driven approach in partnership with third party stakeholders, as agreed upon between Metrolinx and the Region.

4

Strategic Case

Introduction

The Strategic Case summarizes the performance of the options against the identified strategic objectives to indicate if the investment addresses the Problem Statement and the goals of the 2041 RTP.

This chapter answers the following questions:

- What strategic benefits are envisaged?
- How do options contribute to strategic objectives and goals?
- What impact do the different options have on how people use the transit network and move around the region?
- What challenges exist that could jeopardize the achievement of strategic outcomes?

Strategic Evaluation: Alignment with Objectives

The following section synthesizes each option against the identified strategic outcomes and answers the question: does the investment address the problem statement and realize meaningful benefits? These strategic outcomes come from the GO Expansion Full Business Case and serve as a guide for overarching strategic objectives that this investment, an addition to GO Expansion, should align with.

Does the investment realize a High Quality of Life?

Extending GO Rail service to Bowmanville will help residents achieve a higher quality of life whether they utilize the service or not. All four options will reduce transit travel times to and from the region while increasing transit reliability. Providing new GO Rail stations east of Oshawa GO will reduce transit access times and the stress of finding adequate vehicle parking. Additionally, all options will offer the opportunities for GO users to switch to a closer station, hence shifting their travel time from driving to Oshawa GO to riding a train at a closer station, which reduces the stress of driving and increases the predictability of their commute.

All options will attract net new customers to GO services, removing them from the local road network; thus for a time reducing congestion for other drivers. This will lead to a higher quality of life in the Oshawa to Bowmanville corridor compared to before the extension was in place.

Once built, these identified benefits will be realized for the medium to long term in the region as it is forecasted that ridership will grow into 2031 and beyond.

Does the investment realize a Prosperous Economy?

The Bowmanville extension will improve connections between Durham Region and the rest of the GTHA, and improve connectivity between employment clusters, urban growth centres and residential areas. Linking people and businesses via reliable and fast transport services will make it easier to connect, invest and innovate in the eastern GTHA for years to come.

Extension of peak services will improve access to jobs for residents in eastern Durham Region, especially for those without automobile access. Implementation of all-day service would make it easier for GTHA residents to commute to jobs and opportunities within the Oshawa to Bowmanville corridor.

Options 1 and 2 perform particularly well in this regard since the Ritson Road station site is located in close proximity to downtown Oshawa, which is identified by Metrolinx as an Anchor Hub (a major transit station located in proximity to an urban growth centre with a growing job market). Further, the proposed station sites at Thornton's Corners in Option 1 and at Thornton's Corners East in Option 2 are situated near residential areas and Durham College's Whitby campus, enabling students and staff alike a convenient means of travelling to and from the college.

Option 1, Option 2, and part of Option 4 also allow for stations located in areas of future intensification in Courtice and Bowmanville, but are constrained in terms of future station facility expansion options at Bowmanville. By building stations in these locations, nearby land is increased in value and unlocked for intensification; as desired and planned for by the local municipalities.

Does the investment realize Sustainable Development?

This extension will foster reduced auto dependency on travel not only to and from Toronto, but to GO stations themselves as the majority of

options for consideration will have stations built in residential areas or areas of planned high density land use. Reduced automobile use will decrease emissions from said vehicles and mean fewer accidents on local roads that often can lead to serious injury or death.

Some options better ensure these benefits than others. Option 3 would place stations in less populated and dense areas than Option 1, 2 and 4, thus leading to more vehicle travel to and from GO stations. Option 1, 2 and 4 allow for more sustainable development as the stations will unlock land use in their immediate surroundings where the local municipalities have plans to build residential and commercial properties. Higher density transit oriented development near the stations can optimize use of city infrastructure and reduce per capita land use. This will make sustainable means of access such as walking and cycling to these GO stations feasible and more attractive relative to driving.

Strategic Evaluation: Alignment with Goals

This section of the Strategic Case looks at the rationale for extending rail services to Bowmanville and how each of the proposed alignment and service options meets the goals of Metrolinx's 2041 RTP.

Strong Connections

Regional Connectivity

The expansion of GO Rail services and the construction of new rapid transit stations in Durham Region, particularly in densely populated areas, will improve connectivity between employment clusters, urban growth centres and residential areas. This will improve connections between people and the places they live, work and play such as downtown Bowmanville, Oshawa, Toronto and regional academic institutions. This extension will also open opportunities for residents in Oshawa to Bowmanville, particularly for those without automobile access, by improving access to the GO rail network. Under an all-day service pattern, it will also be easier for GTHA residents to commute to jobs and opportunities within the Oshawa to Bowmanville corridor.

Figure 4 and Table 3 provide a look at the population and employment figures located within walking distance (800m) of each proposed station. Figure 4 illustrates the projected number of individuals and jobs that

would be serviced by the proposed stations in 2031, while Table 3 combines the projected population and employment figures of the stations to indicate the totals in relation to the alignment options.

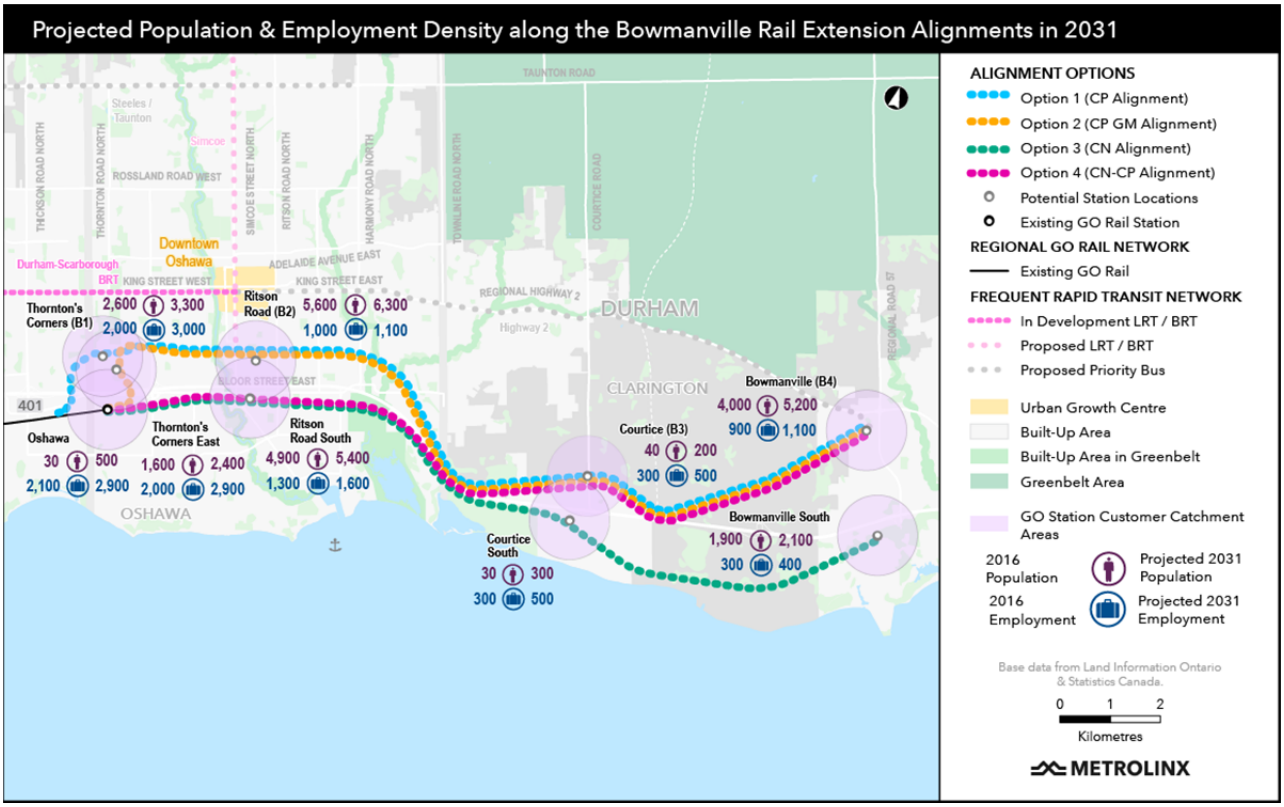


Figure 4: Deliverability along the Bowmanville Extension Alignments in 2016 and 2031

Figure 4 illustrates the surrounding population and employment within a 10 minute walking vicinity of each of the existing and proposed stations. Ritson Road, Ritson Road South and Bowmanville stations have the highest forecasted populations within 800m, while Oshawa, Thornton's Corners, Thornton's Corners East, and Ritson Road South stations have the highest forecasts for employment within 800m. These results are linked to the stations' proximity to dense and central locations in the Reigon.

Table 3: Total Population and Employment Along the Bowmanville Rail Extension Alignments in 2016 and 2031

Alignment Option	2016 Population	2031 Population	2016 Employment	2031 Employment
Option 1	12,200	15,000	4,000	5,700
Option 2	11,200	14,300	5,500	7,500
Option 3	6,900	8,300	4,000	5,400
Option 4	9,000	11,300	4,600	6,100

Table 3 data is informed by the population and employment data shown at each station in Figure 4. It indicates that for 2031 alignment Option 1 (15,000) is projected to serve the largest total population, followed by Option 2 (14,300) and Option 4 (11,300). Option 3 has a forecast of 8,300. These figures can be associated with the central locations of the stations in Option 1, 2 and 4, and the more remote locations in Option 3. In terms of employment, Option 2 is forecasted to serve the most jobs. The figures for projected employment in the Region in relation to each of the alignment options appear to be similar, with forecasts ranging from 5,400 to 7,500.

Option 1 and Option 2 perform well, especially in terms of the projected population since they provide stations closer to existing residential areas and downtown Oshawa. The area around the Thornton's Corners and Thornton's Corners East station sites has been identified as a priority development site by the City of Oshawa. They are also adjacent to Trent's future satellite campus and the existing Durham College Whitby campus, enabling students and staff alike a convenient means of travel. As shown in Figure 4, these sites are projected to serve between 2,400-3,300 individuals within 800m compared to 500 individuals at Oshawa GO Station. Both options will also have a station located at Ritson Road (B2) within close proximity to downtown Oshawa, which is identified by Metrolinx as an Anchor Hub.

Although Option 4 does not appear to perform as well as Option 1 and 2 when observing the nearby population figures, it would extend GO Rail services near the downtown core of Oshawa and Bowmanville, as it

incorporates two of the highest performing stations, Ritson Road South and Bowmanville stations.

Option 1, 2 and 4 also allow for stations located in areas of future intensification in Courtice and Bowmanville. By building stations in these locations, nearby lands will increase in value and be unlocked for intensification; as planned for by the local municipalities.

Option 3 does not perform as well as the other alignment options in optimizing municipal intensification, mobility hub and economic development goals. This alignment's performance is impacted by the fact that the proposed Courtice South and Bowmanville South stations are removed from residential areas. For example the Bowmanville South station site in Option 3 is forecasted to have 2,100 nearby individuals and 400 nearby jobs, compared to 5,200 individuals and 1,100 jobs near the Bowmanville station site n Options 1, 2 and 4. Overall though, Option 3 performs similarly to the other alignments on proximity to 2031 employment.

A report commissioned by Durham Region in the fall of 2019 examined the four alignments to provide a comparative examination of these routes from the standpoint of development potential, land value uplift and community benefits associated with transit oriented development. Findings indicate strong support for alignment north of Highway 401, Option 1 followed by Option 2, as it offers the most significant land value, market, and community benefits. The additional benefits gained from including the Thornton's Corners East station site in Option 2 have not been considered in the report commissioned by Durham Region, and would further improve the development opportunities for this alignment.

Ridership: Demand and Forecasts

As stations on the Bowmanville Extension are located near the existing Oshawa GO Station, it is a useful exercise to examine if existing ridership drawn to Oshawa GO Station comes from areas that would be more directly served by the extension stations.

Metrolinx's GO Rail Passenger Survey is a biannual survey that gathers information on existing riders' habits and travel patterns. Part of this survey identifies each respondent's home station and where they live.

Using this information, it is possible to qualitatively examine how existing passengers may benefit from the construction of new stations.

In this case, Oshawa GO Station serves as the nearest point for many residents to connect to the GO rail network. The existing volume of riders and their trip start locations for the home station of Oshawa GO Station can be found in Figure 5.

As can be seen in Figure 5, there are established ridership markets in areas near the proposed GO station sites. In particular, approximately 85% of current Oshawa GO Station users live north of Highway 401, and would be better served by stations at Thornton's Corners, Thornton's Corners East or Ritson Road.

Due to their distance from Oshawa GO Station, there are likely untapped riders in these areas as well that would start using GO once a more convenient option was available. Additionally, the existing riders would likely switch to the closer station and provide additional capacity at Oshawa GO for latent demand. This shift in trip patterns will lead to a reduction in auto operating costs, local road congestion and auto emissions as passengers would be able to travel shorter distances to reach a GO Rail station.

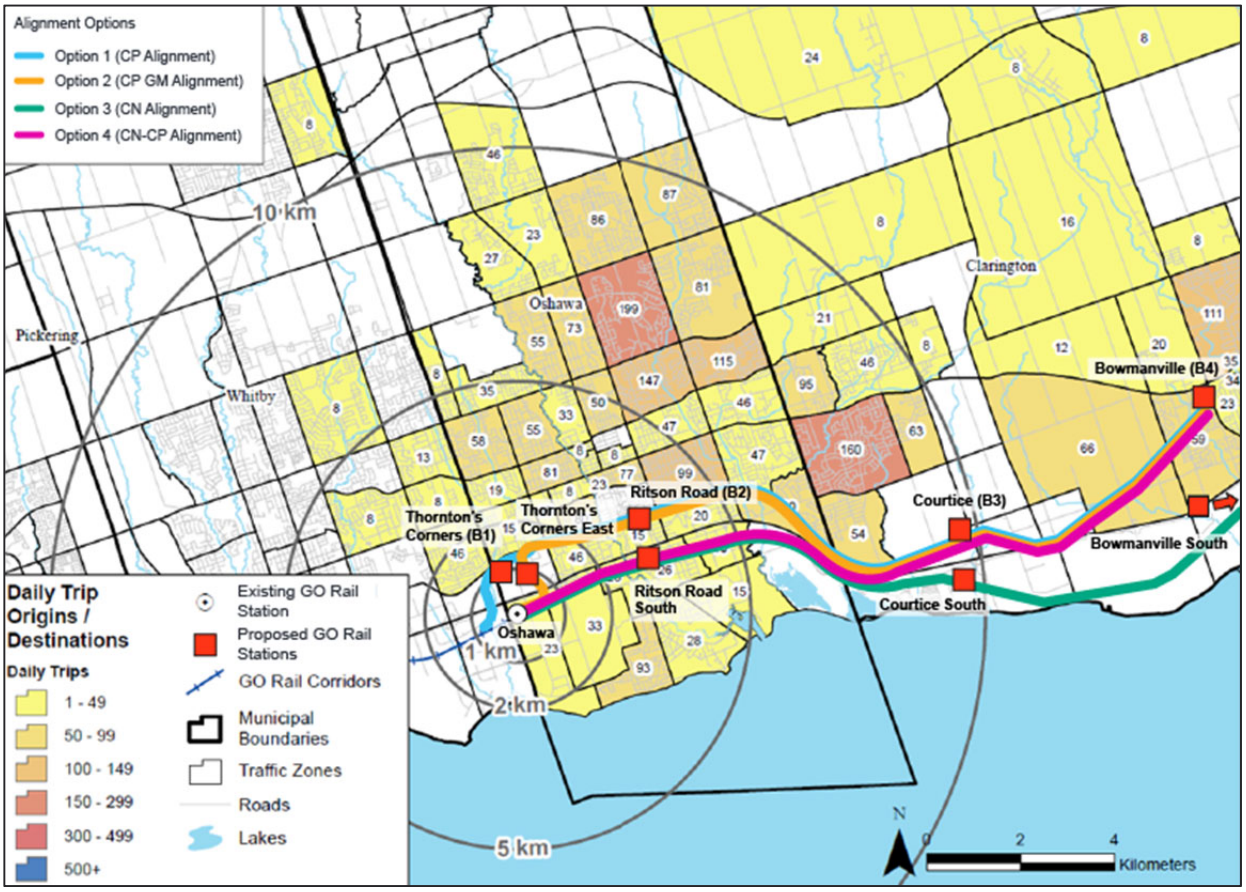


Figure 5: Existing Oshawa GO Station Ridership by Origin. Source: 2017 GO Rail Passenger Survey

Ridership forecasts were calculated for the entire 60-year lifecycle under analysis. Results are highlighted for 2031, as this year serves as a future baseline in GTHA transportation demand modelling. Total Bowmanville Extension GO Rail boardings are displayed for the three-hour AM peak period (6:31AM – 9:30AM) in Tables 4 and 6 and for the entire year in Tables 5 and 7 for both tested service patterns. For comparison purposes, each table displays ridership totals for Oshawa GO Station in the Business as Usual Base Case where no extension to Bowmanville is built.

Table 4: 2031 AM Peak Period Daily Boardings – Peak-Only Service Pattern

Station	BAU	Option 1	Option 2	Option 3	Option 4
Oshawa	4,590	-	2,800	3,750	3,700
Thornton's Corners (B1)	-	3,530	-	-	-
Thornton's Corners East	-	-	880	-	-
Ritson Road (B2)	-	1,070	1,030	-	-
Ritson Road South	-	-	-	580	570
Courtice (B3)	-	250	230	-	250
Courtice South	-	-	-	230	-
Bowmanville (B4)	-	2,000	1,980	-	2,130
Bowmanville South	-	-	-	1,930	-
TOTAL	**4,590**	**6,850**	**6,920**	**6,490**	**6,650**

Table 5: 2031 Total Annual Boardings – Peak Only Service Pattern

Station	BAU	Option 1	Option 2	Option 3	Option 4
Oshawa	4,494,000	-	2,733,000	3,662,000	3,618,000
Thornton's Corners (B1)	-	3,455,000	-	-	-
Thornton's Corners East	-	-	369,000	-	-
Ritson Road (B2)	-	505,000	490,000	-	-
Ritson Road South	-	-	-	276,000	270,000
Courtice (B3)	-	119,000	110,000	-	119,000
Courtice South	-	-	-	108,000	-
Bowmanville (B4)	-	954,000	948,000	-	1,018,000
Bowmanville South	-	-	-	922,000	-
TOTAL	**4,494,000**	**5,033,000**	**4,650,000**	**4,968,000**	**5,025,000**

Forecasts show large demand for expanded GO Rail services in Durham Region. Many of these future users likely want to use GO services today but cannot in the peak and off-peak due to restrictions around station access at Oshawa GO Station and proximity to the site.

Under a weekday peak-only service pattern all options show improved ridership when compared to the BAU scenario and are all within approximately 8 per cent of one another annually. Option 1 and 4 generate 5M annual boardings, just ahead of Option 3 with 4.9M annual boardings and Option 2 with 4.6M. Across all options, Oshawa/Thornton's Corners (B1) GO Stations attracts the highest ridership; an understandable result as these stations either already exist or are located in a mature GO Rail market. It should be noted that without the program, ridership is still forecast to be 4.4M in the BAU scenario.

Along Ritson Road, forecasts show that the Ritson Road station, located north of Highway 401 on CP's corridor, generates higher ridership than the Ritson Road South station on CN's corridor on the south. This is likely due to the station being in closer proximity to population centres, downtown Oshawa and having greater parking capacity than the Ritson Road South.

Bowmanville stations show strong demand for GO Rail service with a station on the CP corridor, as proposed in Option 1, 2 and 4, showing annual boardings of up to 1M; whereas a Bowmanville station south of Highway 401 in Option 3 generates annual boardings of 0.9M. Of all stations tested both stations in Courtice display the lowest daily and annual boardings under a peak-only service pattern.

Table 6: 2031 AM Peak Period Daily Boardings – All-Day Service Pattern

Station	BAU	Option 1	Option 2	Option 3	Option 4
Oshawa	4,580	-	2,780	3,730	3,680
Thornton's Corners (B1)	-	3,510	-	-	-
Thornton's Corners East	-	-	880	-	-
Ritson Road (B2)	-	1,070	1,030	-	-
Ritson Road South	-	-	-	580	570
Courtice (B3)	-	500	480	-	500
Courtice South	-	-	-	450	-
Bowmanville (B4)	-	2,000	1,980	-	2,130
Bowmanville South	-	-	-	1,930	-
TOTAL	**4,580**	**7,080**	**7,150**	**6,690**	**6,880**

Table 7: 2031 Total Annual Boardings - All-Day Service Pattern

Station	BAU	Option 1	Option 2	Option 3	Option 4
Oshawa	4,561,000	-	2,807,000	3,761,000	3,712,000
Thornton's Corners (B1)	-	3,551,000	-	-	-
Thornton's Corners East	-	-	601,000	-	-
Ritson Road (B2)	-	823,000	797,000	-	-
Ritson Road South	-	-	-	450,000	441,000
Courtice (B3)	-	386,000	371,000	-	386,000
Courtice South	-	-	-	349,000	-
Bowmanville (B4)	-	1,550,000	1,537,000	-	1,652,000
Bowmanville South	-	-	-	1,497,000	-
TOTAL	**4,561,000**	**6,310,000**	**6,113,000**	**6,057,000**	**6,191,000**

Under a weekly all-day service pattern, all options show improved ridership when compared to the BAU scenario and are within approximately 4 per cent of one another. Option 1 generates the highest 2031 annual boardings. Option 1 also generates the highest annual ridership under the peak-only service pattern. Peak period ridership is similar in the two proposed service pattern options, with marginal changes in totals between them. Comparing the all-day and peak-only service patterns, the all-day service pattern results in ridership increases in the off-peak and on weekends, which leads to annual boardings of 6.3M in Option 1 and 6.2M in Option 4; an increase of approximately 1.2M riders from peak-only service. Option 2 and 3 generate 6.1M annual boardings under all-day service. This is an increase of approximately 1.1M riders from peak-only service.

All-day station boardings follow the same pattern seen under peak-only service. Oshawa/Thornton's Corners (B1) GO stations are the busiest of the extension stations with 3.5-3.8M annual boardings. When compared to the other stations along the proposed extension alignments, stations in Bowmanville have the second highest annual boardings with totals of 1.5-1.7M. Ritson Road GO Station on CP's corridor doubles annual ridership forecasts compared to the southern station on CN's corridor,

an understandable result as internal research shows that 85 per cent of current Oshawa GO Station users live north of Highway 401. This puts GO's user base in closer proximity to proposed stations along CP's corridor rather than the CN corridor south of the highway. GO stations in Courtice show the lowest annual figures, with the Courtice South GO Station on the CN corridor totalling 349k boardings in Option 3.

When compared to the BAU scenario, operating all-day rail services to Bowmanville increases 2031 annual ridership by 1.5-1.7M depending on the alignment selected. Thus, the incremental ridership benefit of building the extension will be up to 1.7M by 2031.

Complete Travel Experiences

Transit Network Connectivity

The expansion of rail services deeper into Durham Region would further enhance the transit network, provide more connections with Durham Region Transit's (DRT) network and reduce transit access times.

As can be seen in Figure 6, station sites at Thornton's Corners, Thornton's Corners East, Ritson Road, Ritson Road South, and Bowmanville would be well integrated into the DRT network, as key arterial roads passing near these station sites are already well-served by buses. These stations are also located near existing transit hubs that could be connected to the station. Option 1 and 2 would provide connections to the proposed Durham-Scarborough BRT and the proposed Simcoe Street BRT, while Option 4 would only connect to a future extension of the Durham-Scarborough BRT to Bowmanville.

Furthermore, the Ritson Road Station has the potential to be connected with the proposed Durham-Scarborough Bus Rapid Transit (BRT) line that would provide service to downtown Oshawa. The current BRT alignment is assumed to extend east from Toronto's Scarborough Town Centre and terminate at Simcoe Street in downtown Oshawa. A potential extension of this route along King Street/Regional Highway 2 would also allow for a connection to the proposed Bowmanville station site in Options 1, 2 and 4, located just south of King Street / Regional Highway 2. Additionally, the Ritson Road station site is planned to be the southern terminus of the proposed Simcoe Street BRT. This proposed BRT line

would extend north from the Ritson Road station site to Highway 407, serving downtown Oshawa and Ontario Tech University.

The Ritson Road South station site is served by two bus routes while the Bowmanville South station site is only served by a peak bus route; both Courtice station site options are not currently served by any DRT routes. These stations are also located further from the network's service area, which increases the difficulty of connecting to transit services and reduces the appeal and likelihood of using transit as a station access mode to the proposed GO station sites. However, it should be noted that there is a possibility of DRT reconfiguring their current bus network to accommodate new station locations currently not served. Across all options, enhanced integration with local transit will improve the ridership at stations and reduce the reliance on car usage.

Note that different alignments will impact the operating costs for Durham Regional Transit (DRT) to access the proposed station sites, however, the operating cost of DRT have not been considered in the economic case.

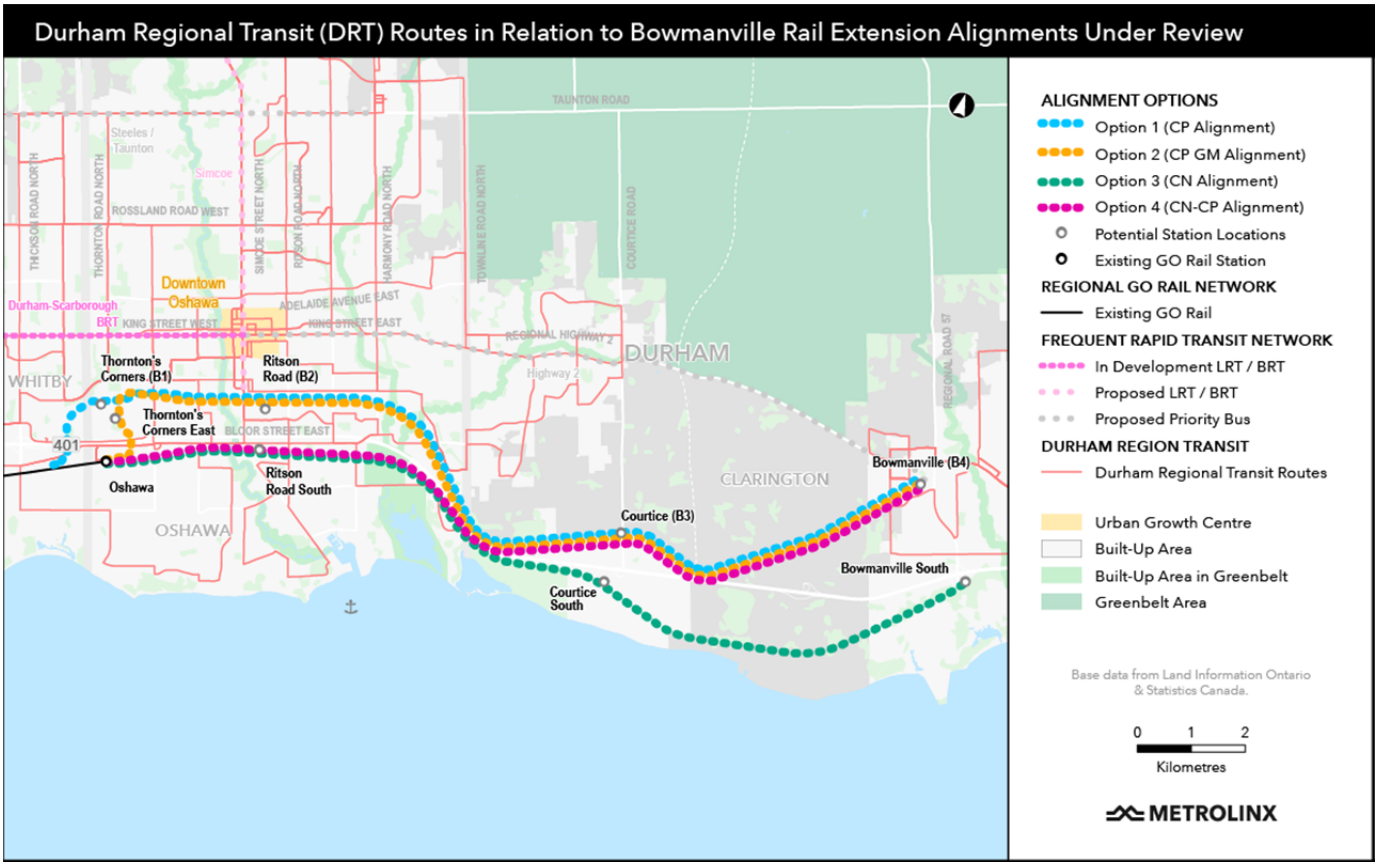


Figure 6: Existing and Proposed Stations in Relation to the DRT Network

The closure of the existing Oshawa GO Station in Option 1 impacts connectivity to the regional transportation network as seamless transfers between GO and VIA services would be terminated. However, digital ticket sales data shows that only 13 -15 people on an average weekday transfer between VIA and GO at Oshawa Station using this fare channel, suggesting that the impact could be limited to a small number of customers. In 2016 this represented 5,000 transfers and close to $50K, in fare revenue for Metrolinx. It remains to be seen if DRT would continue to serve Oshawa GO Station if only VIA were to continue operations while GO moves north to Thornton's Corners GO Station.

Transit Travel Time

All options would result in reduced transit travel times for Durham Region passengers with the extension of GO Rail service east of Oshawa GO Station. GO Bus services currently operate between Bowmanville and Oshawa GO Station via GO Bus Routes 90 and 91 on an hourly basis, with more frequent service during peak hours. With rail service extending to Bowmanville, GO Rail passengers would no longer be required to transfer to bus services to travel east of Oshawa GO station when using public transit.

Oshawa and Courtice area residents will see slight reductions in their travel times with this extension. This also applies to Bowmanville residents travelling during peak hours, as the GO Route 91 express bus currently services the Courtice and Bowmanville Park & Rides, offering individuals traveling between Bowmanville and Union Station a total travel time of approximately 80 minutes. Bowmanville residents travelling during off-peak hours, who currently use the GO Route 90 non-express bus route, will see reductions of approximately 30 minutes in a single trip from Union to the existing Bowmanville Station when using GO Rail. While modelling forecasted that the Courtice South and Bowmanville Station at Bowmanville Avenue would offer a similar reduction in travel time, it should be noted that the proposed station locations are south of Highway 401 and further from populated areas, which could result in added travel times in arriving at the station.

Option 2 is forecasted to have slightly longer travel times than other options due to the location and curvature of the proposed Highway 401 crossing as well as an additional station stop compared to all other options. Despite variation in the track alignment for each of the four options, the resulting travel times would all be similar in length, varying by up to seven minutes across the four options. Regardless of alignment, the extension of rail services into Durham Region would lower passenger travel times by eliminating transfers points, wait periods between rail and bus and by offering a frequent and faster mode of travel.

Transit Reliability

The four options' proposal of extending GO Rail service further into Durham Region would result in increased transit reliability and consistency. GO Rail service would provide transit service operations that would not be impacted by congestion on the local road network and Highway 401 that GO buses are subject to.

While both proposed service pattern options would provide more reliable transit services compared to the existing GO Bus services, the all-day service pattern would operate GO Rail on a half-hourly basis during peak hours and on an hourly basis during off-peak periods, offering customers a more reliable mode of transit throughout the day.

One cause for potential reliability concerns is the track alignment east of GO's Whitby Rail Maintenance Facility (WRMF) in Option 1. This busy section of the corridor would see service conflicts between new passenger trains operating between Whitby GO Station and Thornton's Corners GO Station, and train movements in and out of the WRMF. Passenger trains in this area would have to operate at lower speeds to allow for the operation of slower moving equipment entering and exiting the WRMF.

Parking Capacity

Parking at Pickering, Ajax, Whitby, and Oshawa GO stations is near capacity; with all stations reporting an average parking utilization rate of over 90% in 2019. With parking expected to be full in the near future, these constraints will likely inhibit future ridership in Durham Region. In addition to lost riders, riders who use these stations may have an unpleasant access/egress experience, reducing the attractiveness of GO Transit.

The rail service extension and addition of new stations as proposed by the four alignment options would alleviate parking constraints on these GO stations by providing new locations to access GO Rail with additional parking for the residents of the Region who will continue to rely on automobiles for station access. The extension also creates additional parking capacity to capture latent demand of untapped riders in the Region that would prefer to use GO if adequate parking is available. The additional benefits gained from these new riders have not been

considered in the economic case, and would further improve the performance of this project.

Table 8: Durham Region GO Station Parking Spaces (2031)

Station	BAU	Option 1	Option 2	Option 3	Option 4
Oshawa	2,400-2,800	-	2,400-2,800	2,400-2,800	2,400-2,800
Thornton's Corners (B1)	-	1,600 – 2,000	-	-	-
Thornton's Corners East	-	-	-	-	-
Ritson Road (B2)	68	600 - 800	600 - 800	-	-
Ritson Road South	-	-	-	445	445
Courtice (B3)	109	200 - 500	200 - 500	-	200 – 500
Courtice South	-	-	-	200 - 500	-
Bowmanville (B4)	85	780 - 850	780 - 850	-	780 - 850
Bowmanville South	-	-	-	795	-
TOTAL	**2,662-3062**	**3,180 – 4,150**	**3,980-4,950**	**3,840-4,540**	**3,825-4,595**

Table 8 indicates the numbers of parking spaces associated with the implementation of each of the four proposed options, as per the *Station Access Plan* and extension feasibility work. The Business As Usual Case maintains the parking at Oshawa GO Station, with potential to expand, and would continue to provide a minimal number of spaces at Ritson Road, Courtice, and Bowmanville Park & Ride locations. Option 1 would not only halt future parking expansion at the existing Oshawa GO Station, it would also result in the closure of the station to GO Rail services, leading to the removal of up to 2,800[2] parking spaces from the GO network at a location where parking is already at 99 per cent utilization. Despite the reduction of parking spaces with the proposed closure of the existing Oshawa GO Station, the alignment's planned stations would be located in more dense residential areas which would require fewer parking spaces. This is especially applicable to Thornton's Corners and Ritson Road station sites in Oshawa. As per the latest station facilities work, completed in 2017, this option would also see 1,600-

2 The figure 2,800 references the number of parking spaces at Oshawa GO Station if expansion of the facility is pursued as per the Station Access Plan.

2,000 new spaces built at Thornton's Corner station site, thus recouping a majority of the removed parking from Oshawa GO Station.

Option 2 proposes four net new stations without the closure of the Oshawa GO Station. It would provide a total of 3,980 - 4,950 spaces, including the existing Oshawa GO Station spaces. It offers the highest number of parking spaces among all options. Note that the new Thornton's Corners East Station would not offer park and ride spaces; rather focusing on providing bus loop, cycling and Pick Up Drop Off (PPUDO) infrastructure.

Option 3 and 4 propose three net new stations, providing a similar number of additional parking spaces to the GO network, and would preserve the spaces at the existing Oshawa GO Station. Option 3 would provide 1440 - 1,740 new parking spaces, leading to a total of 3,840 - 4,540 spaces, including the existing Oshawa GO Station spaces. This amount of additional parking would not be ideal though as Option 3 proposes net new stations located in less populated areas that would require customers to depend on automobiles as a primary mode of station access. Option 2 and 4 would offer a comparable number of parking spaces while also proposing a total of three or four new stations that will partly develop existing Park & Ride Lots that are located in central locations.

Sustainable Communities

Energy Use

The GTHA's transport network is a major source of greenhouse gas (GHG) emissions and is one of the region's major contributors to climate change. Extending rail services to Bowmanville is forecasted to shift demand from the auto network to the rail network and remove thousands of daily auto trips off of regional roads, resulting in greenhouse gas emission and accident reductions.

This is true for all four options, however, Option 1, 2 and 4 would propose more central station locations which would further discourage automobile usage when it comes to accessing GO stations. Option 3 would continue to encourage car-dependency as the primary mode of station access and egress since the proposed station locations are removed from dense residential areas.

This reduction in automobile use benefits not only those users switching to GO, but also users of the local road network who still drive. Remaining commutes by automobiles will be subject to reduced congestion levels post-investment.

Health

The Bowmanville Extension will foster reduced auto dependency for travel not only to and from Toronto, but also to the proposed GO stations themselves as the majority of the options in consideration propose station locations in residential areas or areas of planned high density land use. This would increase the propensity of GO passengers to use sustainable modes of transportation when accessing stations.

The proposed station locations of Option 1, 2 and 4 along the extension are located in dense residential areas that will encourage the use of active transportation as a mode of access and egress to the stations. Option 3 would place stations in less populated areas, maintaining the current state of auto-dependence for Durham Region passengers accessing the stations.

Table 9 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 Plan only incorporates the stations associated with Option 1 as this was the only option in consideration at the time of the Plan's development. It can be seen that Option 1's stations, some of which are also a part of Option 2 and 4, have reasonably high targets for active modes of transportation. The walking targets are especially high for the Thornton's Corners, Ritson Road and Bowmanville station sites as they are located in dense residential areas. This information is also displayed on map in Figure 7 to indicate the alignments that each of the stations is associated with.

Options 1 and 2 remain the options proposing the highest number of stations located in dense residential areas, encouraging cycling, walking and other methods of active transportation to access GO stations.

Table 9: 2016 GO Rail Station Access Plan Active Transportation Targets (2031)

Station	Walking Target	Cycling Target
Oshawa GO Station	2-4%	1-2%
Thornton's Corners (B1)	12-14%	2-4%
Ritson Road (B2)	14-16%	2-4%
Courtice (B3)	6-8%	1-2%
Bowmanville (B4)	12-14%	2-3%

*Proposed Thornton's Corners East station as well as stations on the CN corridor, Ritson Road South, Courtice South and Bowmanville South, were not within the scope of the 2016 Station Access Plan.

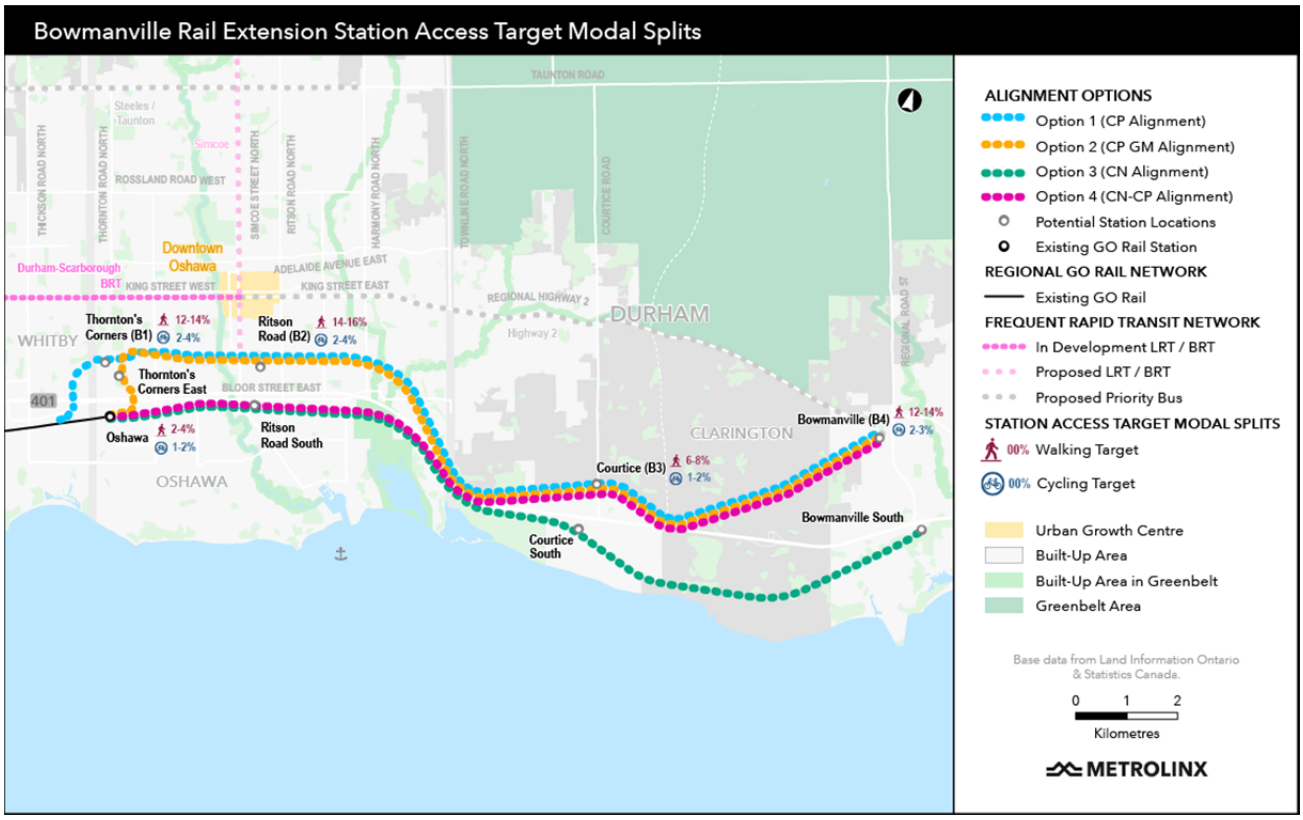


Figure 7: Station Access Plan Active Transportation Targets (2031)

Another societal health impact brought on by this extension is noise pollution. The CP corridor, on which Option 1, 2 and 4 would operate, passes through eighteen residential neighbourhoods in Oshawa and Bowmanville which are located within 30m of the corridor track centerline. The potential operation of half-hourly bi-directional diesel rolling-stock along this corridor would create new rail traffic noise in area previously accustomed to only freight movements by CP. The CN alignment borders fewer residential properties and therefore would impact fewer residents sonically.

Natural Habitat Impact

Environmental impacts are also accounted for when reviewing constructing the extension. A common element of all options is their crossing of various creeks and water features. Option 1 would cross Corbett Creek immediately south of Highway 401 and run parallel to the west side of the creek, north of Highway 401, as it makes its way to the CP corridor. This alignment and Option 2 will also require new bridge spans over creeks on the CP corridor once north of Highway 401.

Option 3 and 4 pass by the Second Marsh lands near the shores of Lake Ontario. The building of a second mainline through this area and other enabling works will require caution and a well-developed environmental plan to avoid impacts to this government-protected natural heritage area.

Further, land acquisition and expropriation will take place in every option analysed. This brings with it impacts to land owners not looking to sell at this time. Land requirements and environmental considerations by option are further detailed in the Deliverability and Operations Case.

Strategic Case Summary

Table 10: Strategic Case Summary

2041 RTP Goal	Strategic Outcome	Option 1	Option 2	Option 3	Option 4
Strong Connections	Population and jobs served by Bowmanville Rail Extension	15,000 people and 5,700 jobs within 800m of a station along the Bowmanville Extension with direct access to rail services by 2031	14,300 people and 7,500 jobs within 800m of a station along the Bowmanville Extension with direct access to rail services by 2031	8,300 people and 5,400 jobs within 800m of a station along the Bowmanville Extension with direct access to rail services by 2031	11,300 people and 6,100 jobs within 800m of a station along the Bowmanville Extension with direct access to rail services by 2031
	Increase GO ridership in the Durham Region	Annual Ridership All Day Service: 6,310,000 Peak Only: 5,033,000	Annual Ridership All Day Service: 6,113,000 Peak Only: 4,650,000	Annual Ridership All Day Service: 6,057,000 Peak Only: 4,968,000	Annual Ridership All Day Service: 6,191,000 Peak Only: 5,025,000
Complete Travel Experiences	Improve the Transit Network	Improved connections to the DRT network with four new stations. Closure of the existing Oshawa GO Station would impact connectivity to VIA	Improved connections to the DRT network with three new stations.	Would not improve the transit network as the three new stations are not connected to the current DRT system	Improved connections to the DRT network with three new stations.

2041 RTP Goal	Strategic Outcome	Option 1	Option 2	Option 3	Option 4
	Improve Transit Travel Time	Average travel time from Union Station to Bowmanville reduced around 30 minutes	Average travel time from Union Station to Bowmanville reduced around 30 minutes	Average travel time from Union Station to Bowmanville reduced around 30 minutes	Average travel time from Union Station to Bowmanville reduced around 30 minutes
	Improve Transit Reliability	Transit service will have a separate ROW from road vehicles, but will share the corridor with freight traffic The all-day service pattern would provide more reliable service throughout the day through the operation of all-day rail service			
	Provide improved GO Facility Capacity	3,180-4,150 total parking spaces. Termination of GO services at Oshawa GO Station would result in the loss of 2,400 existing spots	3,980-4,950 total parking spaces	3,840-4,540 total parking spaces	3,825-4,595 total parking spaces
Sustainable Communities	Reduce Auto Vehicles Trips	3 of 4 proposed stations are centrally located, would promote non-auto access to GO stations and would provide direct GO Rail access for Durham communities	3 of 4 proposed stations are centrally located, would promote non-auto access to GO stations and would provide direct GO Rail access for Durham communities	3 new stations providing direct access to rail services may discourage some auto usage, however, station locations are less accessible by all access modes	2 of 3 proposed stations are centrally located, would promote non-auto access to GO stations and would provide direct GO Rail access for Durham communities

2041 RTP Goal	Strategic Outcome	Option 1	Option 2	Option 3	Option 4
	Encourage Active Modes of Transportation	3 of 4 proposed station locations would be in residential areas, encouraging active modes of station access	3 of 4 proposed station locations would be in residential areas, encouraging active modes of station access	1 of 3 proposed station locations would be in residential areas, encouraging active modes of station access	2 of 3 proposed station locations would be in residential areas, encouraging active modes of station access
	Natural Habitat Impact	Additional EA work required	Additional EA work required	New EA would be required	Additional EA work required

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 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?

Assumptions and Parameters

The Economic Case makes use of assumptions and parameters throughout the social cost benefit analysis, as noted in Table 11. The assumptions and parameters used within this Business Case come from Metrolinx's Business Case Guidance, as of April 2018. All analysis is presented in real terms in 2018$ and assumes an economic discount rate of 3.5 per cent.[3]

Table 11: Economic Case Inputs and Assumptions

Input	Detail
Analysis Approach	• All benefits/costs expressed in real terms in 2018$ • Appraisal begins in 2018. It assumes five years of construction (2020-2024), 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 Inflation	0%
Value of Time (VoT) (2018$)	$17.71/hour
VoT Growth Rate	0%
Auto Occupancy	1.077
Auto Operating Cost Savings (2018$)	$0.09/km
Decongestion Benefit (2018$)	0.01 hours/km (peak); 0.0013 hours/km (off-peak)
Safety Improvements (Accident Mitigation) (2018$)	$0.10/km

[3] *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
GHG Value	$0.011/km

Costs

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

- **Capital 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.

The capital and operating and maintenance costs for the entire project 60-year 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. Two capital cost estimates were tested in this analysis. This results in capital costs, total costs, benefit cost ratios and net present values being presented as a range. Capital costs do not vary by the service pattern utilized.

Capital costs include a contingency allowance of up to 40 per cent based on the conceptual level of engineering utilized for this assignment, an additional indirect cost of 15 per cent, agency cost of 18 per cent and flagging costs.

Table 12: Economic Costs Summary (NPV 2018$ Millions)*

Cost Category	Option 1		Option 2		Option 3		Option 4	
	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day
Total Costs	$(771 - 907)	$(880 – 1,014)	$(626 - 738)	$(773 - 844)	$(496 - 569)	$(557 - 629)	$(542 - 622)	$(633 - 712)
Capital Costs	$(627 - 763)		$(436 - 548)		$(360 - 433)		$(395 - 475)	
Operating and Maintenance Costs	$(121)	$(260)	$(167)	$(342)	$(114)	$(201)	$(125)	$(243)
Fleet Capex, Disposals, Refurb and Lifecycle	$(27)	$0	$(27)	$0	$(26)	$0	$(26)	$0
Terminal Value	$4	$1	$4	$1	$4	$1	$4	$0

*All totals rounded

Benefits: User (Internal) 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.

User impacts considered in this business case were determined using outputs from the Province's regional demand model. Modelling outputs enable benefit and ridership calculation for the 60-year project lifecycle under analysis. User benefits are considered through the lens of changes in costs, or 'willingness to pay' for a trip. 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 cost[4] 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 13: User Impacts Summary (NPV 2018$ Millions)*

Impact Type	Option 1		Option 2		Option 3		Option 4	
	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day
Existing and New Transit User Time Savings	$62	$171	$57	$128	$40	$112	$52	$129
Auto User Time Savings	$109	$161	$82	$130	$102	$149	$104	$151
Average (Total) Auto Operating Cost Reduction	$47	$74	$35	$54	$44	$70	$44	$70
Fare Revenue Adjustment**	$78	$370	$78	$324	$73	$320	$76	$338
TOTAL	**$296**	**$776**	**$252**	**$636**	**$259**	**$651**	**$277**	**$688**

*All totals rounded

**See Metrolinx Guidance 2 page 107 *"Step two"*

[4] *Generalized cost is the sum of the monetary (e.g. public transit fare) and non-monetary (i.e. time spent travelling – time is monetized using a Value of Time factor) costs of a journey.*

Option 1 generates the largest internal benefits under both service patterns. Options 2 through 4 all demonstrate internal benefits at or near $650M over the project lifecycle with an all-day service. Apart from fare revenues, the primary driver of internal benefits is auto user time savings. Existing and new transit user time savings, when services are run all day, also are a key benefit contributor. This shows that there is large demand to use GO Services in Durham Region that currently do not in the peak and off-peak likely due to restrictions around station access and proximity.

Benefits: External (Societal) 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). These benefits are calculated in two ways:
    - 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 14: External Impacts Summary (NPV 2018$ Millions)*

Impact Type	Option 1		Option 2		Option 3		Option 4	
	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day
Safety Benefits	$15	$24	$11	$17	$14	$22	$14	$23
Environmental Benefits	$5	$9	$4	$6	$5	$8	$5	$8
TOTAL	**$20**	**$33**	**$15**	**$23**	**$19**	**$30**	**$19**	**$31**

*All totals rounded

Shown above, safety benefits from reduced automobile collisions are the primary driver of external benefits. Both safety and environmental benefits are tied to ridership totals. Thus Option 1, with the highest overall ridership, produces the largest external benefits to society.

Economic Case Summary

Results indicate that Option 3 with all-day service generates the largest Net Benefits of up to $124M and highest Benefit Cost Ratio of 1.2, with Option 4 also performing well. While Option 1 is the costliest to construct, it also generates the largest total benefits. Once compared to costs however, these benefits do not net to a positive total; -$71 - 205M under the all-day service pattern. Option 2 also generates benefits below project costs for both service patterns.

Options with all-day service show larger benefit totals, higher Net Present Values and Benefit Cost Ratios across all four tested options when compared to the peak-only service pattern.

Table 15: Economic Case Summary (NPV 2018$ Millions)*

Impact Type	Option 1		Option 2		Option 3		Option 4	
	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day
Total Costs	**$(771 - 907)**	**$(880 – 1,014)**	**$(626 - 738)**	**$(773 - 844)**	**$(496 - 569)**	**$(557 - 629)**	**$(542 - 622)**	**$(633 - 712)**
Capital Costs	$(627 - 763)		$(436 - 548)		$(360 - 433)		$(395 - 475)	
Operating and Maintenance Costs	$(121)	$(260)	$(167)	$(342)	$(114)	$(201)	$(125)	$(243)
Fleet Capex, Disposals, Refurb and Lifecycle	$(27)	$0	$(27)	$0	$(26)	$0	$(26)	$0
Terminal Value	$4	$1	$4	$1	$4	$1	$4	$0
Total Benefits (Impacts)	**$316**	**$809**	**$267**	**$659**	**$278**	**$681**	**$296**	**$719**
User Impacts	$296	$776	$252	$651	$259	$651	$277	$688
External Impacts	$20	$33	$15	$23	$19	$30	$19	$31
BCR	**0.4 – 0.4**	**0.8 - 0.9**	**0.4 - 0.4**	**0.7 - 0.9**	**0.5 - 0.6**	**1.1 – 1.2**	**0.5 - 0.6**	**1.0 - 1.1**
NPV (2018$)	**$(455 - 591)**	**$(71 - 205)**	**$(359 - 471)**	**$(114 - 225)**	**$(218 - 291)**	**$52 - 124**	**$(246 - 326)**	**$7 - 86**

*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?

Dollar figures for the 60-year evaluation period from the hypothetical service start date (2025) through to the end of 2084 are in nominal dollars (i.e., the dollar figure expected to be paid or received expressed in the year of the payment). Nominal dollars 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 costs are compared against incremental revenues to derive the net present value in 2018$ for the financial case as well as the operating cost recovery ratio. 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 the proposed options forms the largest component of overall project costs. Estimates of probable capital costs were completed in 2018$ and include two estimates. This results in capital costs and net present values being presented as a range.

Costs include property acquisition and a contingency allowance of up to 40 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 18 per cent and flagging costs are incorporated to account for the completion of designs, procurement activities and support activities during construction.

Capital costs are identical within each option regardless of service pattern, as the same infrastructure is required to operate one daily train or dozens. These values do not include costs for stations or the acquisition of rolling stock. It was assumed for this analysis that stations will be delivered by third party investment through a market-driven strategy, as agreed upon between Metrolinx and the Region. Existing spare GO diesel trains would be utilized for services to and from Bowmanville, removing the need to acquire new rolling stock.

For reporting purposes, estimates of probable capital costs are also provided in undiscounted year of expenditure dollars (YOE$) in Table 16.

Table 16: Capital Costs in Financial Terms (Millions)*

Line Item	Option 1	Option 2	Option 3	Option 4
Total Capital Cost (NPV 2018$)	$(575 - 586)	$(372 - 376)	$(316 - 376)	$(348 - 354)
Total Capital Costs (Undiscounted YOE$)	$(814 - 821)	$(527 - 529)	$(447 - 540)	$(492 - 498)

*All totals rounded. Includes Property, Indirect Cost 15%, Professional Service and Agency Costs 18%, Non-recoverable HST 1.76%, Contingency between 25% - 40% and Flagging

With the construction of a net new three-track Highway 401 crossing, Option1 is estimated to have the highest capital costs of $575 - 586M.

Option 2 has reduced costs when compared to Option 1 as it would not necessitate a new build three-track crossing of Highway 401. Rather, this option would utilize existing rail infrastructure to cross Highway 401.

Option 3 has the lowest capital costs of $316 - 376M. Largely because the option would have fewer bridges and structures to modify and fewer

at-grade crossings compared to the other three options as this alignment never switches rail corridors nor crosses Highway 401.

Option 4 with capital costs of $348 - 354M is the second least costly option. While a grade separation over Highway 401 is required for the alignment, this option generally has lower track work and property costs than Options 1 and 2.

Operating and Maintenance Costs

The operation and maintenance of additional GO Rail service, particularly for options under an all-day service pattern, add to total project costs. Operating and maintenance costs cover all aspects of keeping the investment running including staffing, fuel, vehicle and track upkeep and other state of good repair costs.

Table 17: Operating and Maintenance Costs in Financial Terms (NPV 2018$ Millions)*

Line Item	Option 1		Option 2		Option 3		Option 4	
	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day
Operations and Maintenance (Includes Bus Cost Reduction)	$(121)	$(260)	$(132)	$(298)	$(114)	$(201)	$(125)	$(243)
GO Bus Cost Reduction	$7	$91	$7	$91	$7	$91	$7	$91

*All totals rounded

Operating and maintenance costs are similar, by service pattern and track owner across the board for all options. However, one freight corridor owner has a higher rate than another for track user fees. This drives up operating costs for some options more so than others. Other variations in costs are primarily attributed to the extensions track length.

With the expansion of rail services to Bowmanville, GO Bus routes 90 and 91 will see reductions in service and their operating pattern under all four options. Under the peak-only service pattern, GO buses will no longer have to travel between Bowmanville and Oshawa in the peak

periods. Buses would only operate between Newcastle and Bowmanville during these hours, as rail services will replace these operations. This leads to a $7M reduction in operating and maintenance costs over the project lifecycle for each option. When the all-day service pattern is applied cost reductions are much higher, as rail operations will service Bowmanville all-day on weekdays and weekends. Thus, Routes 90 and 91 will primarily be reduced to operating between Newcastle and Bowmanville resulting in fewer trips, vehicle kilometers travelled and reduced costs of $91M over the project lifecycle for each option.

While not captured here, DRT would face new cost increases varying by option to align their local bus services with the GO extension. DRT has communicated that they estimate servicing new stations located south of Highway 401 on the Kingston Subdivision would be costlier to their annual bus operations than alignments located north of the highway.

Revenue Impacts

All options are forecasted to increase demand for GO Transit services leading to a corresponding increase in fare revenues for GO. Across all options the difference in revenue generated is minimal. With the largest forecasted ridership, Option 1 is anticipated to generate the highest fare revenues of all options with $78M under peak-only service and $371M with all-day service, with Option 2 performing nearly as well. Conversely Option 3 sees the smallest ridership and thus lowest incremental fare revenue for all-day service. These figures include the impact of GO Bus users switching to rail services.

Table 18: Fare Revenues in Financial Terms (NPV Millions 2018$)*

Line Item	Option 1		Option 2		Option 3		Option 4	
	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day
Fare revenue	$78	$371	$78	$342	$73	$320	$76	$339

*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). In the time since the 2016 announcement this funding commitment has not changed in value.

The Ministry of Transportation has asked Metrolinx to assess the status of all current transit projects and determine the feasibility of applying a market-driven approach that leverages third party investment in transit to help reduce the cost to provincial taxpayers. Metrolinx has initiated this review and will report back on the potential for applying a market-driven approach to stations on the Bowmanville Rail Service Extension.

Financial Case Summary

Of all options, with all-day service, Option 1 has the largest construction costs and a Net Present Value of up to -$475M. This is attributed to the requirement for a three-track grade crossing of Highway 401 and operating on CP track. Conversely this option also generates the largest fare revenues.

Option 2 has the highest operating and maintenance costs of all options and a less favourable NPV and R/C Ratio when compared to Option 3 and 4. Capital costs for options 2 through 4 are all within the current dedicated funding total.

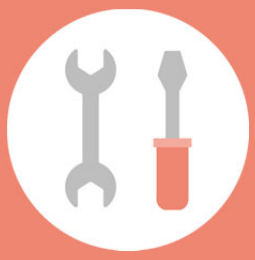
Table 19: Financial Case Summary (Millions)*

Financial Case Metric	Option 1		Option 2		Option 3		Option 4	
	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day	Peak-Only	All-Day
NPV 2018$								
Total Revenue Impacts	$78	$371	$78	$342	$73	$320	$76	$338
Total Capital Costs	$(575 - 586)		$(372 - 376)		$(316 - 376)		$(348 - 354)	
Total Operating and Maintenance Costs	$(121)	$(260)	$(132)	$(298)	$(114)	$(201)	$(125)	$(243)
Net Present Value (NPV)	**$(617 - 628)**	**$(464 – 475)**	**$(425 – 430)**	**$(345 - 350)**	**$(357 - 417)**	**$ (197 - 257)**	**$(397 - 403)**	**$(252 - 258)**
Operating Cost Recovery Ratio (R/C Ratio)	**65%**	**143%**	**60%**	**109%**	**64%**	**159%**	**61%**	**139%**
Undiscounted YOE$								
Total Capital Costs	$(814 - 821)		$(527 - 529)		$(447 - 540)		$(492 - 498)	

*All totals rounded

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.

Option Feasibility

A feasibility study of the four options was conducted to determine preliminary design, feasibility of delivery and operation, construction timelines and capital costs. The study assumed that all four alignments would utilize a single track, plus sidings where necessary to enable two-way operations of trains. Findings from this work inform the majority of this chapter and include a review of the following:

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

Option 1

This alignment requires a new three track rail corridor (2.1km) to cross north over Highway 401 then connecting to the CP Belleville Subdivision. The connection from the GO Subdivision to B1 Station would consist of three electrified tracks to enable RER services to terminate at the station replacing existing Oshawa GO Station as the terminus station. It would also necessitate three rail-over-road grade separations, at a cost of approximately $110M. Additional grade separations are requested by CP in this area, a road-under-rail grade separation on Thornton Road South and one rail-rail separation where Metrolinx's new track would pass under CP's wye track to the GM plant south of Highway 401 connecting into the Belleville Subdivision. Lastly, resolution of train

movement issues between the WRMF and extension spur track are required to facilitate this option.

The Thornton's Corners station site will accommodate four tracks with only two extending east of the station reducing to a single track just west of the GM Spur. The station, as shown in Figure 8 will contain two island platforms to accommodate three service tracks and an additional pocket track to the north. All other station features would remain unchanged from announced preliminary designs for this station and the remaining three new stations east to Bowmanville.

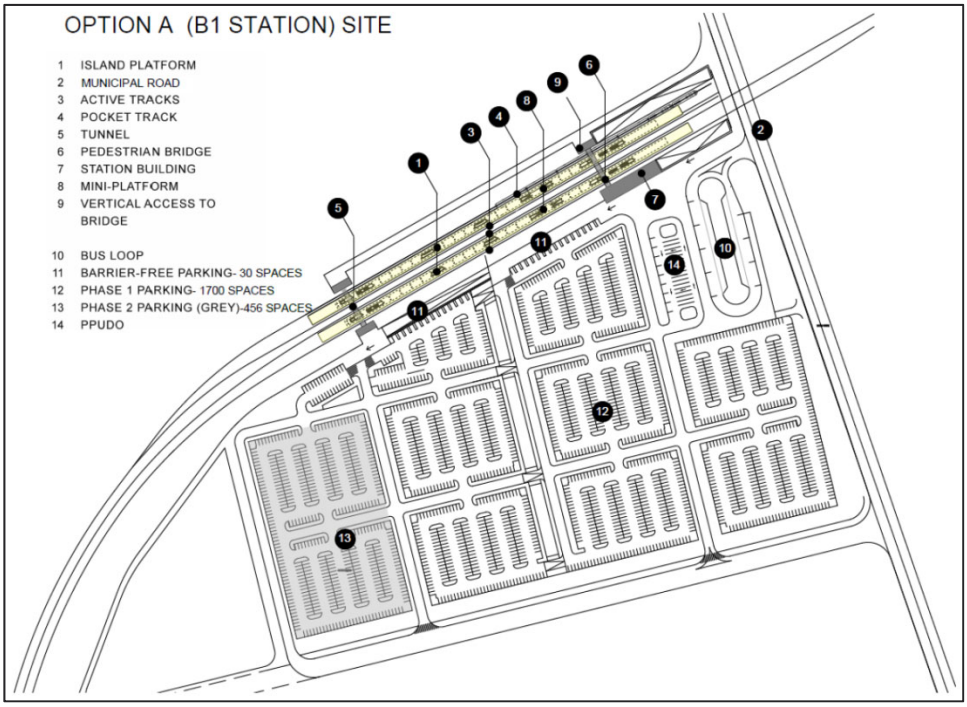


Figure 8: B1 (Thornton's Corners) Station Site Plan

Property requirements remain consistent with Stantec's preliminary design and roll plan, with major fee simple being required for the Thornton's Corners station and the layover station (if required) and minor fee simple for expansion on the south side of the corridor. The three

track structure for the GO-CP connection can be accommodated in the property previously purchased for the connection.

Environmental Assessment (EA) screening found that no provincially significant wetlands, or Areas of Natural or Scientific Interest are located within the immediate corridor or station areas (120m buffer along the conceptual track centreline and facility boundaries). All proposed station sites however would remove varying amounts of agricultural land and greenspace, including wooded areas and some parkland near the Ritson Road station site at Cowan Park.

Multiple water crossings exist along this route. The alignment would require three new structures to be constructed for the Corbett Creek GO-CP connection as well as obtaining regulatory approval from the Central Lake Ontario Conservation Authority (CLOCA) for a new bridge crossing over Oshawa Creek. This location has been the subject of major concern by CLOCA due to the existing bridge acting as a bottleneck to Oshawa Creek, which is a major flood risk for the local community. Metrolinx has been approached by the City, Region and CLOCA to assist where possible in having the existing CP structure replaced. The remaining water features are currently crossed by either raised structures or by culvert (both of which may require expansion for new track). Additionally, the construction of stations at Thornton's Corners, Ritson Road, Courtice and in Bowmanville will result in the removal of agricultural land and greenspace, including wooded areas and some parkland.

Option 1 generally aligns with the previously assessed project in the 2011 Environmental Project Report (EPR) and is consistent with the study areas assessed through the addendum process underway. Advancing this alternative through the environmental assessment process would not result in the need for substantial additional investigations or consultation, and it can be pursued on a timely schedule by re-initiating the currently planned studies.

Essential to implementing this alignment is stakeholder agreement. Agreement is required from the Ministry of Transportation of Ontario (MTO) to construct a rail bridge over Highway 401, and with CP regarding use of their Belleville Subdivision Right of Way for GO infrastructure and service. A high-level assessment of the infrastructure upgrades required on the CP corridor to enable a future state where GO service and CP freight operations can exist in tandem on the subdivision

has been used. To enable dual operations Metrolinx could build a double-track passenger corridor that would not restrict CP's freight operations or future capacity expansion capabilities on the subdivision and its track to General Motors.

If agreement with CP is reached, and resolution of movement conflicts in and out of the WRMF is reached, property acquisitions, permits and approvals and procurement could begin. These tasks and construction are estimated to last 70 months in total.

Option 2

Option 1 and 2 primarily differ in the route used to connect from the GO Subdivision to CP's Belleville Subdivision. In Option 2, existing GO subdivision tracks (two) are to extend through and east of the existing Oshawa GO Station. The south GO track will tie into the north track east of the station and tie into CP's existing single-track GM Spur bridge south of Highway 401. GO Trains will share the GM Spur track across Highway 401. After the bridge two potential routes exist. GO trains could either utilise CP's existing connecting track or potentially diverge onto a new alignment north towards the CP's Belleville Subdivision connecting with it west of Stevenson Road. The alignment chosen also impacts the proposed Thornton's Corners East station in the immediate area. The new GO alignment will then follow the proposed CP corridor single track alignment as in Option 1.

Analysis of the approach to the GM Spur bridge determined that a grade of 3.5 per cent would be required to allow for eastbound GO Trains to successfully incline from the GO Subdivision at Oshawa GO Station to tie into the GM Spur. The current maximum grade on the GO Rail network is 2.0 per cent. An incline of 3.5 per cent would need to be reduced to enable the operation of either a 10 or 12-car consists. If a shallower grade is not achievable then eight or six-car consists should be explored for operation on this alignment. Further study on grading, other enabling works to the GM Spur bridge or the operation of shorter consists should be pursued if this option is selected for further development. In addition, using the GM Spur bridge to cross Highway 401 will require slow speed movements. The slower speed crossing of Highway 401 is a combination of approaching the GM Spur bridge and also stopping at the Thornton's Corner East station site.

This option leads to significant changes at Oshawa GO Station. Impacts to existing station infrastructure include replacement of the existing VIA Rail pedestrian bridge, a new tunnel access to the GO island platform, and impacts to the bus loop configuration and recently built VIA station platform access. This configuration will result in an eastward shift to the GO platform to provide closer access to station facilities. To connect the Lakeshore East Line to the GM Spur the northern CN/VIA track No. 1 would have to become a through track with no platform access at Oshawa GO. 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 and parking areas will remain unchanged as per the below site plan in Figure 9.

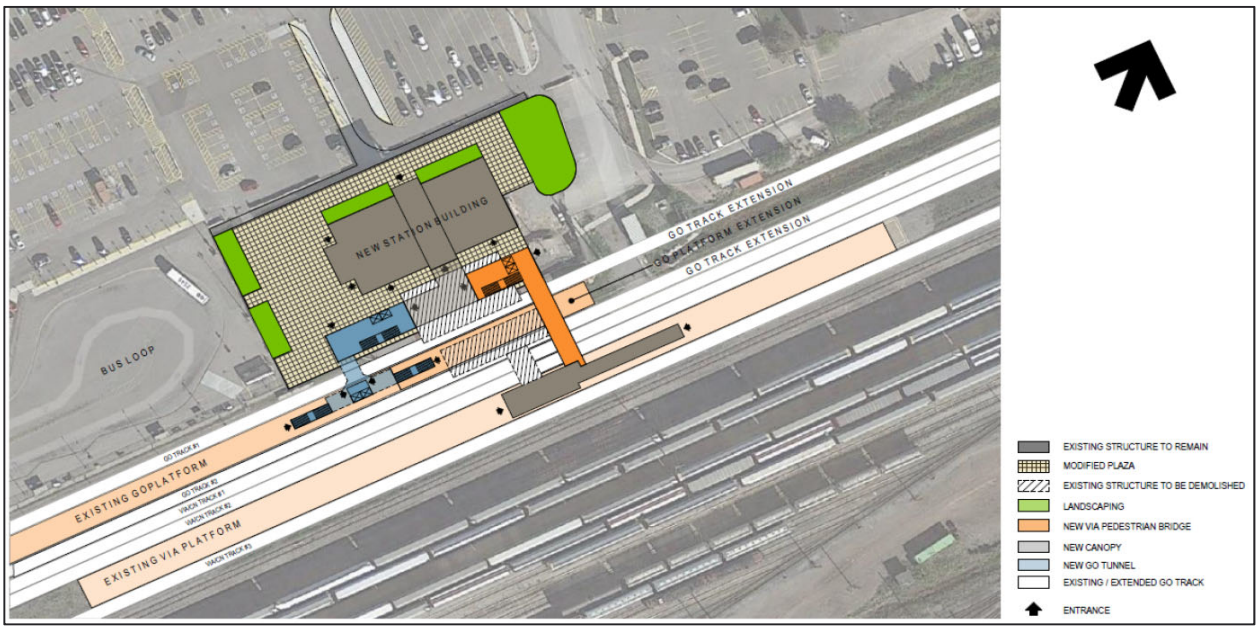


Figure 9: Proposed Oshawa GO Station Site Plan and Modifications

To enable an approach to the GM Spur bridge industrial property south of Highway 401 along the north side of the curve will need to be acquired in an area that consists of industrial use and site parking. Land will also need to be secured north of Highway 401 in the area between Thornton Road South, the Belleville Subdivision and Fox Street.

EA screening found one Provincially Significant Wetland (Corbett Creek Wetland Complex) totaling 0.13-ha located within the study area approximately 60m from the track centerline which is associated with the GM Spur CN to CP crossing. As well, one new watercourse crossing may be required for the GM Spur CN to CP connection. As with Option 1, the construction of stations at the Thornton's Corners East, Ritson Road, Courtice and Bowmanville station sites will result in the removal of agricultural land and greenspace, including wooded areas and some parkland.

Advancing this alternative through the environmental assessment process would require the scoping and completion of additional environmental studies along the GM Spur. Further, it would result in a relatively substantial alteration to the project that was previously presented to the public, thus necessitating a communications strategy to explain the project's rationale.

As with Option 1, this alignment requires the consent and approval of track owners and other impacted parties. In this option CP as well as CN, VIA and Hydro One would have to be consulted and approvals will be required. This is due to GO's need to operate on CP's Belleville Subdivision and briefly utilize CN's Kingston Subdivision east of Oshawa GO Station in order to reach the GM Spur. Agreements will also be required with VIA Rail for modifications to the existing Oshawa GO Station and Hydro One due to impacts on above ground hydro services in the vicinity of the Highway 401 crossing. Further, clearance from the new top of rail to the underside of Hydro One's power lines will need to be confirmed to ensure adequate distance is provided.

While the GM spur bridge is currently not in use, CP would prefer to maintain operations flexibility. As a result, CP will work with Metrolinx to enable non-freight operations on the bridge if this alignment is to be pursued.

Once agreements are reached with all parties and an approval to proceed is secured, property acquisitions, permits and approvals and procurement could begin. These tasks and construction are estimated to last 70 months in total.

Option 3

As with Option 2 this alignment calls for an extension of the GO Subdivision extending east of Oshawa GO Station north of the existing VIA platform. GO Track No. 1 (north) will tie into GO Track No. 2 (south) just east of the Oshawa GO Station. The north CN/VIA track No. 1 will become a through track with no platform access. A single GO track will extend eastward from Oshawa GO Station along the CN Kingston Subdivision, north of the existing Mainline to the Bowmanville South station in the vicinity of the Highway 401 / Waverley Road interchange.

The vertical and horizontal alignments of the new GO track will follow that of the existing CN tracks with a maximum design speed for 100-mph where feasible.

Thirteen bridges and/or culverts along the alignment will require improvements to their current state to allow for the new GO track. In addition four at-grade road-rail crossing will have to be upgraded at Wilson Road, Darlington Park, on a private road and a farm crossing to accommodate for the new track.

Oshawa GO Station would see similar changes as in Option 2. The main difference from Option 2 would be that the existing north track is extended eastwards, north of the existing VIA Rail platform and connected through a # 20 turnout to the extension of the VIA station track. It then continues as a new mainline, at 28 foot track spacing from the existing CN North mainline. There is an existing railway roadbed from Oshawa Creek to east of Wilson Road that can be utilized for this new track.

A new station would be built in the vicinity of Simcoe Street South and Bloor Street East, approximately three kilometres east of Oshawa GO Station. As shown in Figure 10 the station concept is designed to provide areas for a station building, bus loop, Passenger Pick Up Drop Off (PPUDO) area and 445 parking stalls. The station site will have two access points: one from an access road that can be built on the existing road right-of-way west of the site, and the second access just off of Bloor Street East.

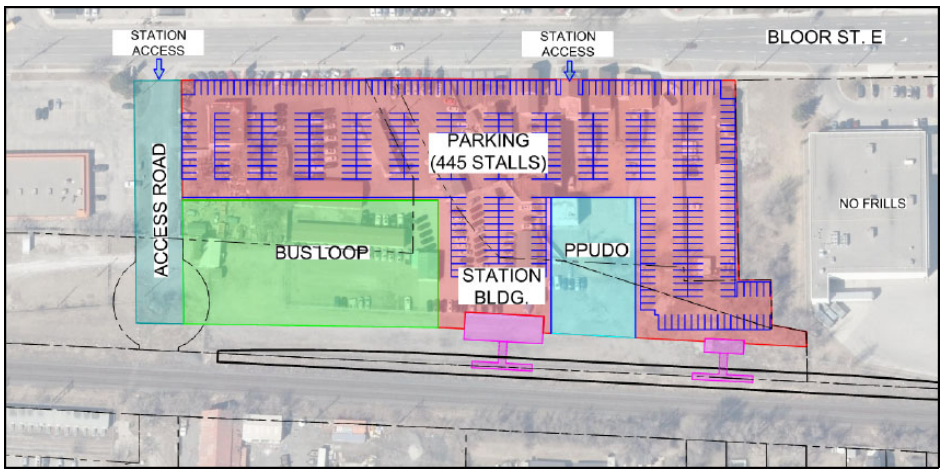


Figure 10: Proposed Ritson Road South GO Station Site Plan

It was assumed that the new station will be located on Davey's Auto Sales property, but additional property areas will likely be required from adjacent neighboring properties. At this location one additional station track will be constructed, using #20 turnouts. The opening day single track will be served by an island platform with two pedestrian tunnels that will provide access from the station building and parking lot.

A station site in Courtice was identified on this alignment along Darlington Park Road, situated east of Down Road and west of the intersection with Courtice Road. Farmland properties currently occupy this area. To operate this alignment a passing track in Courtice would be needed for two-way services to operate unimpeded.

In Bowmanville, a 17-acre station site was identified in the 2009 Feasibility Study just west of the Bowmanville Avenue/Highway 401 interchange on the north side of the CN corridor and west of the former Fifth Wheel Truck stop site. This site was initially selected for costing and feasibility in this IBC. Through the course of analysis it was determined that the station site would not be tenable for operations due to Hydro One's 500kV transmission lines running overhead. While a station could be built and operated at the site, no parking or light fixtures would be allowed underneath the wires. Only roads connecting the station building to the main parking area would be permitted under the wires. This makes for an impractical and unpleasant access/egress experience

for customers thus reducing the attractiveness and utilization of the station.

With this information an alternative station site was identified. A station site immediately to the east of Bowmanville Avenue and south of Highway 401, from the same 2009 Feasibility Study, was selected. Costs were modified and applied to the alternative site which forms the station site in this IBC analysis.

This is the only studied option that does not cross over Highway 401, thus eliminating any potential for traffic delays due to bridge construction.

To accommodate for this option properties must be purchased at the following locations:

- Between Simcoe Street South and Ritson Road South: To accommodate the new GO track and the new Ritson Road South GO Station.
- Between Ritson Road South and Wilson Road South: To accommodate the new GO track.
- Between Wilson Road South and Farewell Street: Certain areas on the north side of the CN corridor have been identified as sensitive areas where property acquisition may be required. In this area the new GO track centre line is approximately 5.5m from the existing CN-ROW. In order to avoid encroaching into these residential properties, the drainage design is proposed to be a combination of subdrain and storm sewer.
- Between Down Road and Courtice Road: To accommodate the new Courtice South GO Station
- East of Bowmanville Avenue and Energy Drive: To accommodate the new GO track and new Bowmanville GO Station.
- Between Oshawa and Courtice there is a hydro line running north of the CN corridor. The new GO track grading limit reaches the hydro pole line in certain locations. Relocation of the power line away from new Right Of Way (ROW) for approximately three kilometres, and acquisition of property to the limit of grading will be necessary.

EA screening found no major items of concern when compared to the other alignments, but Oshawa Second Marsh, identified as a provincially significant wetland (PSW) is located within 30m of the track.

Five residential neighbourhoods, primarily located in the central sections of the corridor, reside within 30m of the centreline. This is a sharp decrease compared to the 18 residential areas that the CP alignment passes through. This means less noise pollution for residents; however, it conversely means that the alignment is located further away from population centres.

Option 3 deviates substantially from the 2011 EPR, as it contemplates a route entirely along the CN corridor which was not identified as the preferred option in the EPR. A new EA is required for this project with a timeline of 24 months. This would include public consultation with the various municipalities, an exercise that has been completed for the original alignment. The public consultation would carry reputational risk for deviating on the announced alignment that had been previously accepted through these communities.

CN and VIA have not yet been consulted regarding this proposed alignment, reaching an agreement with them will be required in order to construct.

If approval to proceed with CN is reached, property acquisitions, permits and approvals and procurement would begin. These tasks and construction are estimated to last 72 months in total.

Option 4

This alignment would utilize both CN and CP's corridors to provide rail services to Bowmanville. As with Option 2 and 3, GO service would travel through Oshawa GO Station onto CN's corridor stopping at the proposed Ritson Road South station site via a new single GO track. East of Harmony Road, GO service would cross Highway 401 on a new bridge that would tie it into CP's Belleville Subdivision (see Figure 11). A single new GO track would service the publically announced stations at the Courtice and Bowmanville station sites on CP's Belleville Subdivision.

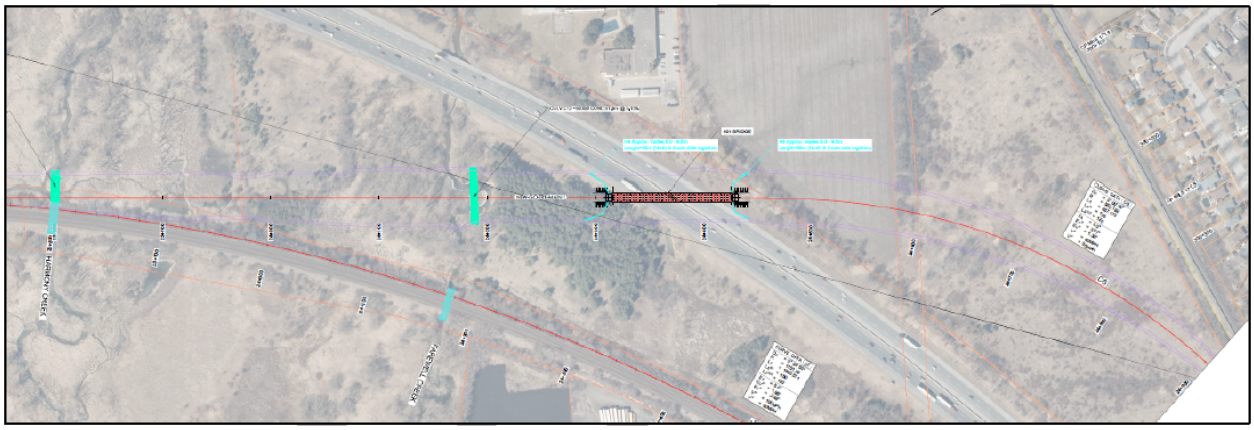


Figure 11: Proposed CN/CP Connecting Track across Highway 401

Twelve bridges and/or culverts along the alignment will be built or require improvements to their current state to allow for the GO track. In addition, existing grade separation modifications will be required at seven locations and two track carrying structures on CN's corridor while two new roadway and railway grade separations will be required on CP's track.

The proposed structure over Highway 401 will consist of two-span simply supported steel through-truss, with ballasted steel plate deck, cast-in-place concrete substructure on spread footings, and approach slabs at the bridge ends. The total length of the bridge is approximately 100m (50m each span), and total width is 6.5 m. The bridge will be designed to meet American Railway Engineering and Maintenance-of-way Association (AREMA) and Metrolinx Guidelines for Design of Railway Bridges and Structures.

The existing Oshawa GO Station would see similar impacts as in Option 2 and 3, including replacement of the existing VIA Rail pedestrian bridge, a new customer access to the GO island platform, and potential impacts to the bus loop configuration and recently built GO/VIA station building. This new configuration will result in an eastward shift to the GO platform to provide closer access to station facilities while keeping the station functional to both GO and VIA services.

The Ritson Road South station site would have an identical layout as with Option 3 while station sites in Courtice and Bowmanville would mirror those proposed in Option 1 and 2.

Option 3 and 4 would see a new GO station at Ritson Road South, rather than north of Highway 401 at 500 Howard Street (Knob Hill Farms). The proposed Ritson Road station site north of Highway 401 would utilize the heritage designated Knob Hill Farms building as a part of the new station building. Metrolinx owns this heritage structure and thus is mandated by law to ensure that the building is kept in a state of good repair. If no station is built at this site, the property would be surplus to Metrolinx; the agency is still responsible to maintain and upkeep the site or to dispose of it.

To accommodate for this option properties must be purchased at the following locations:

- Between Simcoe Street South and Ritson Road South: To accommodate the new GO track and the new Ritson Road Station.
- Between Ritson Road South and Wilson Road South: To accommodate the new GO track.
- Between Wilson Road South and Farewell Street: Certain areas on the north side of the CN corridor have been identified as sensitive areas where property acquisition may be required. In this area the new GO track centre line is approximately 5.5m from the existing CN-ROW. In order to avoid encroaching into these residential properties, the drainage design is proposed to be a combination of subdrain and storm sewer.
- Between Farewell Street and Prestonvale Road: To accommodate the new Highway 401 grade separation structure.
- Between Oshawa and Courtice there is a hydro line running north of the CN corridor. Relocation of the power line will be needed to accommodate the new GO track and some of the work for the new Highway 401 grade separation structure.

EA screening found no major items of concern when compared to the other alignments, but the Oshawa Second Marsh Provincially Significant Wetland (PSW) is located within 30m of the track. Further, the

construction of stations in Courtice and Bowmanville will remove varying amounts of agricultural land and greenspace, including wooded areas.

Eight residential neighbourhoods, primarily located in the central sections of the corridor, reside within 30m of the centreline. This is an intermediate amount compared to five residential neighbourhoods in Option 3 and the eighteen residential areas that the CP alignment passes through in Option 1 and 2. This means somewhat less noise pollution for residents; however it conversely means that the alignment is located further away from most existing population centres.

Option 4 deviates substantially from the 2011 EPR, as it contemplates half of the route along the CN corridor which was not identified as preferred in the EPR. Advancing this alternative through the environmental assessment process would require the scoping and completion of additional environmental studies along the CN corridor and would result in a new project compared to what was previously presented to the public. A new environmental program for the CN corridor portion would need to be developed and implemented, substantially affecting project budget and schedule. A new consultation program would be recommended to 'reset' project communications focused on the new route and station locations. This alternative would effectively require the scoping and implementation of a new EA process.

Whereas other options need approval and agreement with one or two operating partners, this option requires approval from multiple partners; CN, CP, VIA Rail and the MTO. Extra care will have to be taken to ensure that GO operations do not conflict with CN, CP and VIA operations on this proposed route and that construction of the bridge has minimal impacts to Highway 401 traffic.

If approval to procced with CN, CP and VIA is reached, a schedule with a preliminary design phase and a new regulatory and stakeholder engagement process for the alignment will commence. These tasks and construction are estimated to last 60 months in total.

Operations and Maintenance Plan

All options will lead to significant modifications or changes in operations at Oshawa GO Station. For Option 1 GO service to Oshawa GO Station would cease to exist, leaving the station for VIA-only rail access. Option 2

through 4 would have GO Trains running through the current station site onto the CN corridor. All stations would add additional resources to the current Metrolinx network that would have to be staffed, landscaped, contracted for snow removal and general maintenance and upkeep.

Across all options the all-day service pattern would operate 12-car diesel bi-level trains in the peaks switching to eight-car train in the off-peak period and six-car on weekends. This switch in consist size accounts for reduced off-peak and weekend demand and leads to operating cost savings. Successfully integrating a service pattern with differing consist sizes will have to be carefully implemented in GO's overall daily rail operations.

Depot/Stabling Arrangements

No new layover sites were assumed for this analysis as all trains for the extension 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. In addition, either Bowmanville station location could have the potential ability to store two or three trains overnight on siding tracks. Thus would reduce dead-head movements to being each morning service.

Deliverability and Operations Case Summary

Of the four proposed alignments three are technically feasible for GO Rail operations. Option 2 is not likely to be operationally feasible for normal 8-12 car bi-level diesel trains due to the restricting grade of 3.5 per cent between Oshawa GO Station and the GM Spur crossing of Highway 401. Finding ways to reduce this grade or consideration of running shorter trains is required if this alignment is to be pursued.

Option 1 is the costliest to build due to the addition of the third track between the GO Corridor and Station B1, track user fees and due to the additional bridges and structures required along the GO/CP Connection, including a crossing of Highway 401. This alignment would be operational after 70 months of design and construction.

Option 3, wholly along the CN corridor, is a lower cost option and likely to be the easiest to build. However, it has the longest duration and project delay due to the need to restart the engineering and stakeholder

engagement process from scratch, forecasted to open after 72 months of design and construction. It also is located furthest away from the Bowmanville community.

Option 4 provides a second viable option with the benefit of providing direct access to the Bowmanville community and is less costly than Option1, though it requires a new crossing of Highway 401. This Option also has an overall delay in forecasted completion, being operational 60 months after design and construction. While all proposed options face risks regarding to stakeholder agreement, Option 4 has a large number of major stakeholders that would project require sign-off: CN, CP, VIA Rail and MTO. The greatest risk for this option is negotiating agreements with all stakeholders in a timely fashion to execute work.

8

Business Case Summary

Introduction

This chapter summarizes the findings of the four-case evaluation, provides a recommendation on the option(s) to be advanced for preliminary design, 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 updated Initial Business Case. This analysis shows that a valuable way to develop transit service in the Oshawa to Bowmanville corridor in the short, medium and long term is through an all-day rail service operating year-round.

Of the four studied alignments, Option 1 most closely matches the previously announced alignment. It enables the largest forecasted ridership, economic benefits for society, fare revenues and best aligns with local development plans and the strategic goals of a High Quality of Life, Prosperous Economy and Sustainable Development. However, this alignment has operational constraints and the financial cost to construct exceeds current project budget.

Option 3 and 4 are both feasible to build and operate on while providing ridership levels and fare revenues close to other options. Option 4 aligns better with public policy, local development plans and the identified strategic goals of the project. It produces a BCR of 1.0 - 1.1 while Option 3 generates a BCR of 1.1 - 1.2. However, these options utilize a rail corridor located further from population and demand centres, leading to less sustainable station access reliance and do not service to the central Oshawa core, a key market for the city and extension.

Option 2 has the second highest ridership and capital costs are within existing budget commitments. This alignment services all major population centres along the extension, keeps Oshawa GO Station open and utilizes existing rail infrastructure at Highway 401 to bring down project costs.

Next Steps

Once an alignment for development is agreed to by Metrolinx, the Province and affected stakeholders, a Preliminary Design Business Case following Metrolinx's stage-gate process will begin, assessing the preferred option at a more detailed level of analysis further refining project scope, operability and costs.

APPENDIX - 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 under the all-day service pattern scenario. Tests were conducted on the following items:

- Development potential for transit oriented development at Courtice GO Station (B3)
- Durham Region Land Use Forecast
- Economic Discount Rate of 2.5 per cent (3.5 per cent rate utilized in reported results)
- Purchase of new rolling stock to operate extension services (no rolling stock purchase assumed in reported results)
- Track user fees
- Value of Time growth rate of 0.75 per cent (0 per cent growth rate utilized in reported results)
- Six-car Train Operations (12-car assumed in reported results)

Unless otherwise stated, all BCRs reported in this Appendix are above and beyond the main results of the IBC.

Transit Oriented Development at Courtice GO Station

Courtice GO Station (B3) on the CP corridor at Courtice Road is located in a largely rural, agricultural area in the Municipality of Clarington. In support of higher-order development near the station, Clarington has initiated development of a Secondary Plan based on guidance presented in their 2018 Official Plan. The Courtice Employment Lands Secondary Plan will guide how the area surrounding the station will become a major employment and innovation hub. In this Secondary Plan, the lands immediately surrounding Courtice GO Station are to become the area of highest density for both residential and commercial uses. Since this Secondary Plan is currently underway and not finalised, detailed land use designations for the area surrounding the station were not known and could not be input into demand and benefits modelling.

Without the detailed land use from the Secondary Plan, a sensitivity analysis was completed to determine if reasonable development on Metrolinx-owned lands at 1350 Courtice Road would significantly affect ridership at the station. Density and land use in this study was based on

information presented in the Clarington Official Plan, notably Table 4-2, Table 4-3, and Section 10.8.

Potential ridership was forecast for this site based on the October 12, 2017 station concept developed by Perkins and Will and Official Plan land use and density targets in the aforementioned sections. A conservative examination was undertaken where only development on Metrolinx-owned lands was considered. In the Official Plan, the surrounding lands are also slated to be redeveloped; however, without control over these lands, Metrolinx would be unable to control timing of and type of development. The Metrolinx-owned parcel at 1350 Courtice Road is also designated under a different land use designation that allows higher density mixed use development which can drive more ridership than employment or commercial designations. A summary of the sensitivity analysis can be found in Table 20.

Table 20: Courtice Station Ridership Sensitivity Analysis

Category	Description	Amount	Notes
Property Requirements	Total parcel area	12.1ha	From October 12, 2017 Perkins and Will B3 Concept Plan
	Area required for ultimate station	3.5ha	From October 12, 2017 Perkins and Will B3 Concept Plan
	Gross remaining land for development	8.6ha	
Developable Land	Ratio of Gross to Net developable area	0.75	Conservative conversion between net/gross land
	Net developable area	6.45ha	
Density and Population	Minimum net density	200 units/net ha	From Table 4-3 in Clarington Official Plan
	Minimum units	1290 units	
	Residents per unit	1.8 persons/unit	
	Total residents	2320 persons	
Ridership	Percent of residents who use GO daily	10%	Conservative estimate based on other GO stations with adjacent development and transit use percentages for the region

Category	Description	Amount	Notes
	Estimated daily ridership	230 riders	

As shown above, development of only the Metrolinx-owned parcel to density targets in the Clarington Official Plan can lead to an additional 230 daily riders at the station. It should be noted that while the Clarington Official Plan considers mixed-use on the site, this analysis only considers the residential portion. The addition of these riders to the station raises the BCR for the Bowmanville Extension to 0.9 in Option 1 and 2 and 1.1 in Option 4. Option 3 was not tested as the proposed station site is at a more preliminary stage and land requirements need to be further refined; this should be examined in the next business case stage. These results with transit oriented development are accounted for in the main IBC figures and form the reported BCRs in the main document. Results are summarized in Table 21 below.

Table 21: Courtice Transit Oriented Development Sensitivity Test Benefit Cost Ratios – All-day Service Patterns

Test Option	Option 1	Option 2	Option 3	Option 4
All-day Service Pattern – Without Courtice transit oriented development	0.7 - 0.8	0.6 - 0.7	N/A	0.9 - 1.1
IBC Results: All-day Service Pattern – With Courtice transit oriented development	0.8 - 0.9	0.7 – 0.9	N/A	1.0 – 1.1

As can be seen, the addition of a moderate amount of development on the Metrolinx-owned parcel alone would raise the BCR for the three options with a Courtice B3 Station.

Alternative Land Use Forecast

To forecast future year demand and calculate project benefit totals, Metrolinx applies a 2031 population and employment land use forecast. This forecast assumes growth based on market trends, and is a primary input to the Province's Regional Travel Demand Model.

The Municipality of Clarington provided Metrolinx with alternative 2031 land use projections to be applied as sensitivity tests. These forecasts were inputted through the same modelling process as was done for the primary IBC findings to determine if a variance (if any) in project demand and benefits is generated from alternative land use projections.

Two alternative land use scenarios were modelled:

- **Growth Plan Compliant** – Assuming Clarington's population and employment projections and reducing the 2031 projections for Toronto to ensure that total population and employment for the GTHA remain in compliance with Schedule 3 of the Growth Plan for the Greater Golden Horseshoe
- **Growth Plan Plus** - Assuming Clarington's population and employment projections, without reducing Toronto projections to compensate (Higher total population and employment for the GTHA than in the Growth Plan for the Greater Golden Horseshoe)

The Growth Plan Compliant scenario leads to a slight reduction in Option benefits and ridership for all four alignments; however the impact is not large enough to alter the majority of Option BCRs. At first glance it seems counterintuitive that by raising population and employment forecasts in Durham Region, benefits and ridership would decrease. The reason for the decline in performance is due to travel patterns. With more jobs located in Durham Region, and fewer in Toronto in this scenario, fewer commuters are required to travel by GO to downtown for work. In place, more Durham residents work and live in the same region, thus leading to travel by modes other than GO which are more practical for their trip length. In turn, increased employment in Durham may have an impact on counter peak travel. Counter peak demand on GO is expected to be much lower than peak direction travel as most of these counter peak direction trips would likely be made by car. Thus counter peak travel does not offset the losses in peak direction travel.

The Growth Plan Plus scenario marginally increases benefits and ridership for most alignment scenarios. In this scenario Clarington's higher land use forecasts are included in addition to Toronto`s high market trend growth. This results in higher population and employment totals in both Durham Region and Toronto and therefore higher ridership on GO between Durham Region and Toronto. This land use assumption however is not compliant with Growth Plan 2031 Region-

wide population and employment control totals, and thus represents an unlikely future development scenario.

Table 22: Durham Region Land Use Forecast Sensitivity Test Benefit Cost Ratios – All-day Service Patterns

Land Use Forecast	Option 1	Option 2	Option 3	Option 4
Metrolinx Forecast (Main IBC results)	0.8 - 0.9	0.7 – 0.9	1.1 – 1.2	1.0 – 1.1
Growth Plan Compliant	0.8 – 0.9	0.7 – 0.9	1.0 – 1.1	1.0 –1.1
Growth Plan Plus	0.8 – 0.9	0.9 – 1.0	1.0 – 1.1	1.0 – 1.1

Economic Discount Rate

Sensitivity tests were conducted on reported BCRs with an Economic Discount Rate of 2.5%, to compare results to those in the IBC which use an Economic Discount Rate of 3.5%.

Table 23: Economic Discount Rate Sensitivity Test Benefit Cost Ratios – All-day Service Patterns

Economic Discount Rate	Option 1	Option 2	Option 3	Option 4
2.5% Economic Discount Rate	0.9 – 1.1	0.9 – 1.0	1.2 – 1.4	1.2 – 1.3
3.5% Economic Discount Rate (Main IBC results)	0.8 - 0.9	0.7 - 0.9	1.1 – 1.2	1.0 - 1.1

Rolling Stock Purchase

The IBC assumes that no new rolling stock is required for purchase in order to operate Bowmanville Extension services. As GO Rail network corridors are electrified through the GO Expansion program, diesel locomotives may become available in the mid to late 2020s. However, in the case that excess rolling stock is not available for operations to/from Bowmanville, a test was run to see BCR impacts when five new 12-car diesel bi-level trains are purchased for all-day service patterns.

Table 24: Rolling Stock Sensitivity Test Benefit Cost Ratios – All-day Service Patterns

Rolling Stock Purchased	Option 1	Option 2	Option 3	Option 4
Five Trains	0.8 – 0.9	0.7 – 0.9	1.1 – 1.2	1.0 – 1.1

Track User Fees

Metrolinx incurs track user fees from CN and CP for each kilometre operated on their rail corridors. These fees do not pay for maintenance and operating costs to our freight partners, but rather are fees incurred for the opportunity to use either company's corridor. As this cost is not a resource payment, but rather a transfer payment, it can be argued that this cost should only be accounted for in the financial case and not the Economic Case.

Removing these costs from the Economic Case will impact option Benefit Cost Ratios. Two sensitivities were considered for this test. The first assumes a marginal fee that accounts for the opportunity cost of freight railways allowing Metrolinx to operate on their tracks. The marginal fee assumes that the resource cost to the freight operators is equal to one another; utilizing the lower rate of the two operators. The second test assumes no user fee, on the premise that no additional resource costs are utilized when accessing a freight operator's track.

Table 25: Track User Fees Sensitivity Test Benefit Cost Ratios – All-day Service Patterns

Track User Fee	Option 1	Option 2	Option 3	Option 4
Marginal Fee	0.9 – 1.0	0.8 – 1.0	1.1 – 1.2	1.1 – 1.3
No Fee	0.9 - 1.0	0.9 - 10	1.1 - 1.3	1.2 - 1.3

With a reduced marginal user fee applied, BCRs increase for Option 1, 2 and 4. This is expected as costs for these options fall when the lower fee is implemented. When no user fee is charged, BCRs rise across all options with Option 3 and 4 performing best.

Value of Time Growth Rate

A sensitivity test was conducted on reported BCRs with the Value of Time annual growth rate set to 0.75 per cent, whereas it is recommended that it be set to 0 per cent as done in the IBC reported results.

Table 26: VoT Growth Rate Sensitivity Test Benefit Cost Ratios – All-day Service Patterns

VoT Growth Rate	Option 1	Option 2	Option 3	Option 4
0.75% VoT Growth Rate	0.8 – 0.9	0.7 – 0.9	1.1 – 1.2	1.0 – 1.1

Six-car Train Operations

A sensitivity test was conducted on consist length to determine if a reduction from diesel 12-car operations to other operations would increase or decrease overall option performance. The rolling stock test replaced all diesel 12-car trains with diesel six-car trains. This adjustment increased the high-end range of BCRs for Option 3 and 4 while lowering the range of BCRs for Option 2.

Table 27: Six-car Operations Sensitivity Test Benefit Cost Ratios – All-day Service Patterns

Consist Length	Option 1	Option 2	Option 3	Option 4
Six-car Operations	0.8 – 0.9	0.7 – 0.8	1.1 – 1.3	1.0 – 1.2

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.

Term	Definition
Vehicle-Kilometres Travelled (VKT)	A measure of roadway use, commonly used in estimating congestion, that reflects the distance that an individual drives, 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).