

Kitchener GO Rail Service Expansion

Preliminary Design Business Case
March 2021

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Executive Summary

Two-way all day service on the Kitchener corridor was identified by local communities as a priority to support growth and economic development along the Toronto-Waterloo Innovation Corridor. Service increases have been limited because a portion of the Kitchener corridor between Bramalea and Georgetown GO stations is a freight rail corridor owned by CN. In addition, Metrolinx primarily operates on a single track through most of the Guelph and Halton Subdivisions, which limits the ability to increase the frequency of two-way GO rail services.

In November 2019, Metrolinx published the Kitchener GO Rail Service Expansion Initial Business Case. Based on the results of the analysis, Metrolinx recommended pursuing service increases on the Kitchener corridor through greater co-production with CN on a shared use Halton Subdivision, rather than constructing a separate freight bypass corridor.

Through its new partnership with CN, Metrolinx continued working collaboratively to advance the preliminary design of corridor infrastructure, complete railway operational simulations, and conduct more detailed ridership analysis. This Preliminary Design Business Case reassesses the program based on the latest information to confirm that the benefits of the program continue to be delivered.

The analysis in this business case considers a business as usual scenario with existing infrastructure, an enhanced business as usual scenario with state of good repair improvements, and two investment options that deliver two-way all-day service to Kitchener corridor. All scenarios and options are compared against the Business as Usual without State of Good Repair Improvements scenario to determine the incremental impact of the investment.

Scenarios / Options		Infrastructure Scope	Travel Time	Service Pattern
Business As Usual Scenarios	Without State of Good Repair Improvements	No infrastructure changes	111 minutes	- Pre-negotiation service levels (September 2018 timetable) west of Bramalea GO station; with: 4 peak direction trains per peak period (approximately 1 train per hour) to / from Kitchener GO station 7 peak direction trains per peak period (approximately 2 trains per hour) to / from Mount Pleasant or Georgetown GO stations 1 train per hour two-way to Mount Pleasant GO station during the midday on weekdays 4 trains per hour two-way all-day to Bramalea GO station
	With State of Good Repair Improvements	Infrastructure rehabilitation on the Guelph Subdivision to lift slow orders	98 minutes	
Two-Way Service to Kitchener Options	With Existing Crossing at Silver Junction	Items above, plus passing track and new platforms on the Halton and Guelph Subdivisions to facilitate train meets	98 minutes	- Two-way all-day service extended to Kitchener with: 1 train per hour two-way all-day to Kitchener GO station 2 trains per hour two-way all-day to Mount Pleasant GO station 4 trains per hour two-way all-day to Bramalea GO station
	With Grade Separated Silver Junction	Items above, plus rail-rail grade separation and additional passing track at Silver Junction	90 minutes	Frequency doubles for Mount Pleasant and Kitchener peak period peak direction service

This business case evaluated the scenarios and options under the four cases identified in the Metrolinx Business Case Guidance, which includes consideration of the program's policy alignment, benefits, costs, constructability and operability. A full summary of the business case results is included below.

Case	Business as Usual with State of Good Repair Improvements Scenario	Two-Way Service to Kitchener Options	
		With Existing Crossing at Silver Junction	With Grade Separated Silver Junction
Strategic Case			
Strong Connections	• 7.0M annual boardings • 98 minute journey time from Kitchener to Toronto • Only provides counterpeak service to Bramalea GO station, and midday service to Mount Pleasant GO station • No additional residents or jobs served by two-way all-day rail service	• 10.9M annual boardings • 98 minute journey time from Kitchener to Toronto • Serves counterpeak and off-peak travel, as well as travel between Kitchener and Guelph • Additional 54K residents and 33K jobs served by two-way all-day rail service	• 11.0M annual boardings • 90 minute journey time from Kitchener to Toronto • Serves counterpeak and off-peak travel, as well as travel between Kitchener and Guelph • Additional 54K residents and 33K jobs served by two-way all-day rail service
Complete Travel Experiences	• Projected demand exceeds capacity west of Bramalea GO station • Potential delays due to the volume of freight rail traffic	• Sufficient capacity to meet projected demand • Potential for additional delays due to train meets for two-way passenger service; mitigated by additional passing track	• Sufficient capacity to meet projected demand • Additional mitigation of delays by separating passenger and freight traffic at Silver Junction
Sustainable Communities	• Urban Growth Centres on the corridor will not have two-way all-day service • Encourages passengers to use their home station by improving relative travel times • 1.6M reduction in annual vehicle-kilometres travelled	• Three Urban Growth Centres with two-way all-day service • Encourages passengers to use their home station by improving relative travel times and schedule flexibility • 16.2M reduction in annual vehicle-kilometres travelled	• Three Urban Growth Centres with two-way all-day service • Encourages passengers to use their home station by improving relative travel times and schedule flexibility • 16.2M reduction in annual vehicle-kilometres travelled
Economic Case (all dollar values in 2020\$, present value)			
Total Costs	\$237.3M to \$284.8M	\$1,347.2M to \$1,490.7M	\$1,531.1M to \$1,685.7M
Total Economic Impacts	\$413.7M	\$1,377.1M	\$1,485.0M
Net Benefits	\$128.9M to \$176.4M	\$(113.6M) to \$29.9M	\$(200.7)M to \$(46.1)M
Benefit-Cost Ratio (BCR)	1.45 to 1.74	0.92 to 1.02	0.88 to 0.97

Case	Business as Usual with State of Good Repair Improvements Scenario	Two-Way Service to Kitchener Options	
		With Existing Crossing at Silver Junction	With Grade Separated Silver Junction
Financial Case (all dollar values in 2020\$, present value)			
Total Revenue	\$23.1M	\$255.1M	\$296.7M
Total Capital Costs	\$249.3M	\$824.6M	\$1,012.8M
Total Operating and Maintenance Cost	\$0	\$591.1M	\$591.1M
Operating Cost Recovery Ratio	N/A	0.43	0.50
Deliverability and Operations Case			
Delivery	Improvements on the Guelph Subdivision are approved through prior EA assessments	Requires further design and EA approvals for Halton Subdivision scope	Requires further design and EA approvals for Halton Subdivision scope and the rail-rail grade separation
Operations	- Service limited to 2018 levels west of Bramalea GO station - Required passenger train meets can be scheduled on the Weston Subdivision	- Allows for two-way all-day service, with strict operation requirements - Requires precise train meets on Halton and Guelph Subs	- Allows for two-way all-day service, with less stringent operational requirements - Eliminates requirement for train meets at Silver Junction

The Business as Usual with State of Good Repair Improvements scenario demonstrates the benefits associated with completing rehabilitation works on the Guelph Subdivision to improve travel times; however, it does not deliver two-way all-day service to Kitchener. The scenario also assumes an adjustment to pre-negotiation service levels, similar to the Business as Usual scenario, to understand the benefits of the state of good repair improvements. This scenario results in a high benefit-cost ratio due to its low cost and the operation of primarily peak period, peak direction trips; however, the total benefits generated are the lower than options that provide two-way all-day service to Kitchener.

The Two-Way Service to Kitchener with Existing Crossing at Silver Junction option provides two-way all-day service along the entire Kitchener line and improves connections between communities on the corridor. The option generates benefits that are approximately equal to the costs of the program, while also remaining within the available funding commitment for improvements on the Kitchener corridor.

The Two-Way Service to Kitchener with Grade Separated Silver Junction option provides two-way all-day service to Kitchener with improved journey times, but achieves a slightly lower benefit cost-ratio. While it provides significant travel time savings for trips to / from the west end of the corridor, the total number of affected passengers is relatively low. The cost to implement this option also exceeds the available budget for the Kitchener Expansion program.

1

Introduction



Background

Two-way all day service on the Kitchener corridor was identified by local communities as a priority to support growth and economic development along the Toronto-Waterloo Innovation Corridor. Service increases have been limited because a portion of the Kitchener corridor between Bramalea and Georgetown GO stations is a freight rail corridor owned by CN.

In 2019, Metrolinx assessed options to increase service on the Kitchener corridor. Based on the results of the Initial Business Case (IBC) analysis, Metrolinx recommended pursuing service increases through greater co-production with CN on a shared use Halton Subdivision, rather than constructing a separate freight bypass corridor.

Through its new partnership with CN, Metrolinx continued working collaboratively to advance the preliminary design of corridor infrastructure, complete railway operational simulations, and conduct more detailed ridership analysis to further develop the program. Additionally, by working in partnership with CN, Metrolinx was able to implement early service increases on the Kitchener corridor, including the introduction of limited off-peak two-way service to Kitchener.

This Preliminary Design Business Case (PDBC) reassesses the program based on the updated information to confirm the benefits identified in the IBC continue to be delivered.

Business Case Overview

Business case analyses are mandated by Metrolinx for all projects that exceed \$50M in capital costs. As projects develop in scope and construction, business cases are completed to define the rationale and requirements for delivering said investment. As shown in Figure 1, the PDBC is the second of four business cases completed in an investment's lifecycle. It reviews variations of the preferred option identified in the IBC and recommends an approach for procurement and construction.

Figure 1: Metrolinx Business Case Development Process



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The Case for Change



Introduction

The Kitchener GO Rail Service Expansion IBC, published in November 2019, established the case for implementing two-way all-day service between Toronto and Kitchener. The IBC recommended negotiating with CN for increased access to the Halton Subdivision to deliver enhanced passenger rail service. The PDBC phase further refines the infrastructure and service options to deliver the Kitchener Expansion Program.

This chapter updates the strategic outcomes and objectives of the program to guide the evaluation of investment options considered within this business case.

Problem Statement

The PDBC retains the problem statement identified in the 2019 IBC:

The current Kitchener GO corridor provides rail service for peak period peak direction trips to downtown Toronto, but has limited options for off-peak and counter-peak travel, as well as non-Toronto trips. Waterloo Region is growing as a tech hub, and there has been a growth in the number of “reverse commutes” towards the region. The Waterloo-Toronto corridor has also been designated as an innovation cluster and an important driver of Ontario’s economy. Employers in Waterloo Region have identified a need for improved transport connections to the labour and markets of the Greater Golden Horseshoe (GGH) to attract skilled workers and sustain economic growth in the region.

Key Drivers

Travel Behaviour

The IBC conducted a review of trip data from the Transportation Tomorrow Survey (TTS) to identify travel markets that are underserved by transit. Among the findings is a low transit mode share for counterpeak trips, off-peak trips and trips that do not involve Toronto as an origin or destination. In particular, travel between Kitchener-Waterloo and Guelph accounted for approximately 32,000 daily trips; however, transit was used for less than 1% of travel.

Transport Service Provision

Preliminary negotiations with CN allowed Metrolinx to enact an early service increase in 2019. New service included eleven new daily trips and eight extended trips on the Kitchener corridor. This includes new and extended peak trains, the introduction of hourly evening service to Mount Pleasant GO station and limited off-peak service to Kitchener GO station.

Between September and November, rail boardings at stations on the Halton Subdivision (Bramalea, Brampton, Mount Pleasant, and Georgetown GO stations) grew by 5% year-over-year, while boardings at Guelph Subdivision stations (Acton, Guelph Central and Kitchener GO stations) grew 55% year-over-year. Figure 2 shows the year-over-year growth in boardings. All growth is attributable to the new or extended trips added in 2019. Off-peak boardings accounted for 78% of growth, and made up 21% of total boardings in 2019 compared to 16% in 2018.

Figure 2: Average Weekday Daily Rail Boardings on the Kitchener Corridor (September – November)



Transport Infrastructure and Technology

In November 2018, a long-term lease on the Guelph Subdivision (west of Georgetown GO station) ended, which allowed Metrolinx to assume full control of the subdivision. Since then, Metrolinx has implemented a State of Good Repair program to rehabilitate infrastructure, remove slow orders and increase train speeds. Combined with the addition of a new express trip, average journey times between Kitchener GO station and Union Station was reduced from 122 minutes in September 2018 to 114 minutes in January 2020.

While some off-peak trips beyond Mount Pleasant were added in 2019, Metrolinx continues to primarily operate on a single track through most of the Guelph and Halton Subdivisions, which limits the ability to increase the frequency of two-way GO Train services.

Government Policy and Planning

Provincial and municipal plans and policies are supportive of enhanced rail service on the Kitchener corridor, and encourage the intensification of land use around stations. Table 1 summarizes the policies and plans related to the Kitchener corridor.

Table 1: Alignment with Broader Government Policy and Plans

Government Organization	Strategy, policy or plan	Link to Problem/Opportunity	Relationship Type(s)
Government of Ontario – Ministry of Municipal Affairs and Housing	Provincial Policy Statement	The Provincial Policy Statement under the Planning Act supports transit expansion that optimizes existing infrastructure, crosses jurisdictional boundaries, supports land use density, minimizes the length and number of vehicle trips, and supports the use of transit and active transportation.	Synergistic Approach
	Growth Plan for the Greater Golden Horseshoe, 2017	The 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. Specific areas identified for intensification to support transit include: - Major transit station areas on the Priority Transit Corridor between Union Station and Mount Pleasant GO station; - Four Urban Growth Centres: Downtown Kitchener, Uptown Waterloo, Downtown Guelph and Downtown Brampton.	Synergistic Approach
Government of Ontario – Ministry of Transportation	Draft Transportation Plan for Southwestern Ontario, 2020	The plan identified Kitchener’s unique position at the boundary of Southwestern Ontario and the Greater Golden Horseshoe, and supported the implementation of two-way all-day rail service between Kitchener and Toronto to serve as a connection for residents of Southwestern Ontario.	Synergistic Approach
Local and regional municipalities	Official Plans and Secondary Plans	The Official Plans of local and regional municipalities along the Kitchener corridor generally support the increased use of existing rail corridors to enhance passenger rail service. Municipalities have implemented policies for the GO station areas to encourage intensification and improve multi-modal access. Specifically: - City of Kitchener: <i>Planning Around Rapid Transit Stations (PARTS) Central Plan</i> specifies a minimum density of 225 people and jobs per hectare in the Urban Growth Centre around Kitchener GO station. - City of Guelph: <i>Downtown Guelph Secondary Plan</i> specifies a minimum density of 150 people and jobs per hectare in the Urban Growth Centre around Guelph Central GO station. - Town of Halton Hills: <i>Georgetown GO Station Secondary Plan</i> includes policies for transit supportive development around the GO station. - City of Brampton: The <i>Brampton 2040 Vision</i> plan identifies the area around Brampton GO station as a Major Growth Centre, while the areas around Bramalea and Mount Pleasant GO stations are identified as Town Centres.	Synergistic Approach

Stakeholder Input

Expansion of service on the Kitchener corridor is also supported by a wide range of non-government stakeholders, including major employers, boards of trade and the business community. These stakeholders, in collaboration with local municipalities, chambers of commerce, academic institutions, and Toronto Pearson Airport have formed *Connect the Corridor*, an advocacy group promoting further investment into Kitchener line service

In March 2020, *Connect the Corridor* published its Business Advisory Council on rail transit in the Innovation Corridor Employment Zone Final Report. The report identifies the economic benefits and public support for two-way all-day service on the Kitchener corridor, and the short and long term recommendations of *Connect the Corridor* regarding the transportation needs of the Innovation Corridor. The report also highlights the steps that the business community could enact to support the viability of improved rail service on the Kitchener corridor.

Economic Activity, Land Use, and Demographics

Municipalities along the Kitchener corridor are consistently ranked among the fastest growing municipalities in Canada, based on Statistics Canada's population estimates. Table 2 shows the growth in population along the Kitchener corridor.

Table 2: Population along the Kitchener Corridor

Municipality	2011 Census	2016 Census	2019 Estimate	Annual Growth Rate (2011-2016)	Annual Growth Rate (2016-2019)
Toronto	2,704,880	2,819,399	2,965,713	0.83%	1.70%
Brampton	542,442	617,571	696,975	2.63%	4.11%
Halton Hills	60,633	62,944	64,290	0.75%	0.71%
Guelph	125,768	136,447	143,169	1.64%	1.62%
Kitchener	226,651	241,628	263,790	1.29%	2.97%
Waterloo	101,961	108,775	119,869	1.30%	3.29%

(source: Statistics Canada. Table 17-10-0142-01 Population estimates, July 1, by census subdivision, 2016 boundaries)

The corridor has also experienced significant economic growth, and forms the core of the Toronto-Waterloo Innovation corridor. CBRE's latest report on the tech industry identified Toronto, Waterloo Region and Guelph as the first, fourth and thirteenth ranked tech markets in Canada, respectively¹. Five-year tech employment growth rates in these three municipalities were 54%, 40% and 95% respectively.

Summary of Key Drivers

Table 3 summarizes the key issues and considerations, both internal and external, for the current and future state of transportation in the Kitchener to Toronto corridor that shapes the opportunity and supports the case for investment in transit on the Kitchener corridor.

¹ CBRE, 2019 Scoring Canadian Tech Talent report

Table 3: Summary of Key Drivers

	Driver	How does this Driver influence the problem/opportunity?	What is the impact of not addressing the problem/opportunity?
Internal	Travel Behaviour	2016 TTS data shows lower transit mode share for counterpeak trips, off-peak trips and trips that do not include Toronto as an origin or destination; especially for trips between Kitchener-Waterloo and Guelph.	Trips will be made by auto-based modes, resulting in increased road congestion and emissions and reduced travel time reliability
	Transport Service Provision	2019 service improvements introduced new peak and off-peak services to Mount Pleasant and Kitchener GO stations. - New trips added in 2019 and off-peak services were the main drivers in ridership growth.	May inhibit future ridership growth and / or increase passenger crowding on the Kitchener corridor if additional services cannot be provided.
	Transport Infrastructure and Technology	- Metrolinx generally has access to a single track west of Bramalea GO station, limiting capacity and ability to run trains in opposite directions. - Improvements on the Guelph Subdivision have already removed some slow orders and resulted in journey time improvements on the Kitchener corridor.	- Off-peak and counter-peak services will continue to be provided by bus, which have less reliable travel times due to highway congestion and limited seated capacity. - Remaining slow orders will continue to restrict train speeds the corridor.
External	Government Policy and Planning	- Government of Ontario has announced plans to implement two-way all-day service to Kitchener. - MTO's Southwestern Ontario Transportation Plan also identifies two-way, all-day GO passenger rail service to Kitchener as a way to help connect southwestern Ontario travellers with other regions. - Provincial policy supports a shift towards more transit-supportive land use and a reduction in automobile travel. - Local and regional municipalities have identified two-way all-day service expansion as a priority and have incorporated it into official plans and transportation master plans.	- Not implementing an announced service expansion may negatively impact organizational reputation unless there is a strong case to not proceed. - Could hinder progress towards meeting Provincial policy goals. - Municipal plans for development and economic competitiveness will be compromised.
	Stakeholder Input	Broad support from non-government stakeholders, including <i>Connect the Corridor</i>	Will not adequately support the business community on the corridor
	Economic Activity, Land Use, and Demographics	- Projected increases in population and employment in all municipalities along the Kitchener corridor - The Kitchener-Toronto corridor has been identified as part of Ontario's innovation supercluster, and has experienced significant economic and employment growth.	- The Kitchener to Toronto corridor will be a less attractive place to live, work and do business - which will lower the overall quality of life and prosperity of the region. - The region may not achieve the expected growth in employment, or provide the quality of mobility that fosters productivity and economic development and enables employers to attract skilled workers.

Strategic Outcomes and Objectives

Similar to the 2019 IBC, the PDBC evaluates the benefits of further investment in the Kitchener corridor under the three broad goals of Metrolinx's 2041 Regional Transportation Plan.

Strong Connections

The proposed investment would increase the level of transit service on the Kitchener corridor and better connect people to jobs, services, and recreation. Options will be assessed based on their impact on the following strategic objectives:

- Increasing GO rail ridership on the Kitchener line;
- Increasing the number of people and jobs within walking distance (800m) of a GO rail station with two-way all-day rail service;
- Reducing transit travel time;
- Enabling counterpeak and off-peak travel; and
- Providing transit options for travel between Kitchener-Waterloo and Guelph.

Complete Travel Experiences

The proposed investment would provide a more comfortable and reliable travel experience for transit users. Options will be assessed based on their impact on the following strategic objectives:

- Providing sufficient transit capacity to serve peak period, peak direction demand; and
- Improving the reliability of transit service.

Sustainable Communities

The proposed investment supports sustainable land use and transportation patterns. Options will be assessed based on their impact on the following strategic objective:

- Supporting Provincial growth plans and policies;
- Improve station access, prioritizing those modes identified in the hierarchy of access within the 2016 GO Rail Station Access Plan;
- Encourage more sustainable station access by incentivizing Waterloo Region, Guelph and Halton Hills residents to use the Kitchener line instead of the Milton or Lakeshore West lines; and
- Reducing vehicle trips and vehicle kilometres travelled (VKTs).

3



Investment Options



Introduction

This chapter describes the investment options for consideration and evaluation in the Strategic, Economic, Financial, and Deliverability and Operations Cases. This PDBC further refines the service pattern and infrastructure scope evaluated in the IBC, with updates based on the latest work with CN on defining the infrastructure and service on the corridor, preliminary design of the infrastructure, and simulations of the railway operations.

Option Development

The 2019 IBC recommended advancing the Kitchener Expansion program by working with CN for increased use of the Halton Subdivision. Metrolinx explored variations of the infrastructure and service options to optimize the program, while delivering the Strategic Outcomes and Objectives identified in the IBC. Optimizations include changes to:

- the corridor infrastructure scope, such as the location of additional tracks or upgrades of existing tracks;
- service frequencies and station stopping patterns; and
- operating protocols on shared-use corridors.

Metrolinx carried out preliminary designs for the infrastructure scope to obtain greater cost certainty, and rail simulations of the service pattern to confirm its operability. Through program development to date, two options that deliver two-way service to Kitchener are identified for analysis. Each option proposes additional incremental upgrades to the Kitchener rail corridor to improve the speed, frequency and reliability of the service.

Service parameters shown in this document, including headways and journey times, represent an assumed average figure for the purpose of business case evaluation. Headways and journey times for specific trips will vary based on operational constraints and requirements, including station dwell times to accommodate passenger volumes, freight customer servicing needs, train meets for opposing train movements, and track and platform availability at Union Station. Metrolinx will continue to explore additional optimizations of the rail operations to further reduce travel times. Detailed timetabling of train schedules will be developed prior to the start of service.

Option Scoping

The analysis in this business case considers a business as usual (BAU) scenario with existing infrastructure, an enhanced BAU scenario with state of good repair improvements, and two investment options that deliver two-way all-day service to Kitchener corridor. All scenarios and options are compared against the BAU scenario without state of good repair improvements to determine the incremental impact of the investment.

Business as Usual

Similar to the IBC, the BAU scenario assumes the implementation of funded parallel programs. This includes improvements within the Union Station Rail Corridor and on the Metrolinx-owned Weston Subdivision through the GO Expansion program, which will allow for more frequent service between Union Station and Bramalea GO station.

The BAU scenario also assumes the delivery of stations with approved business cases in partnership with third party stakeholders. Specifically on the Kitchener corridor, this includes the proposed stations in Breslau, which has an approved PDBC, and at Woodbine-Highway 27, which has an approved PDBC and a private sector partner in place to deliver the station. The BAU scenario also includes the Region of Waterloo's proposal to relocate Kitchener GO station to the King-Victoria Transit Hub.

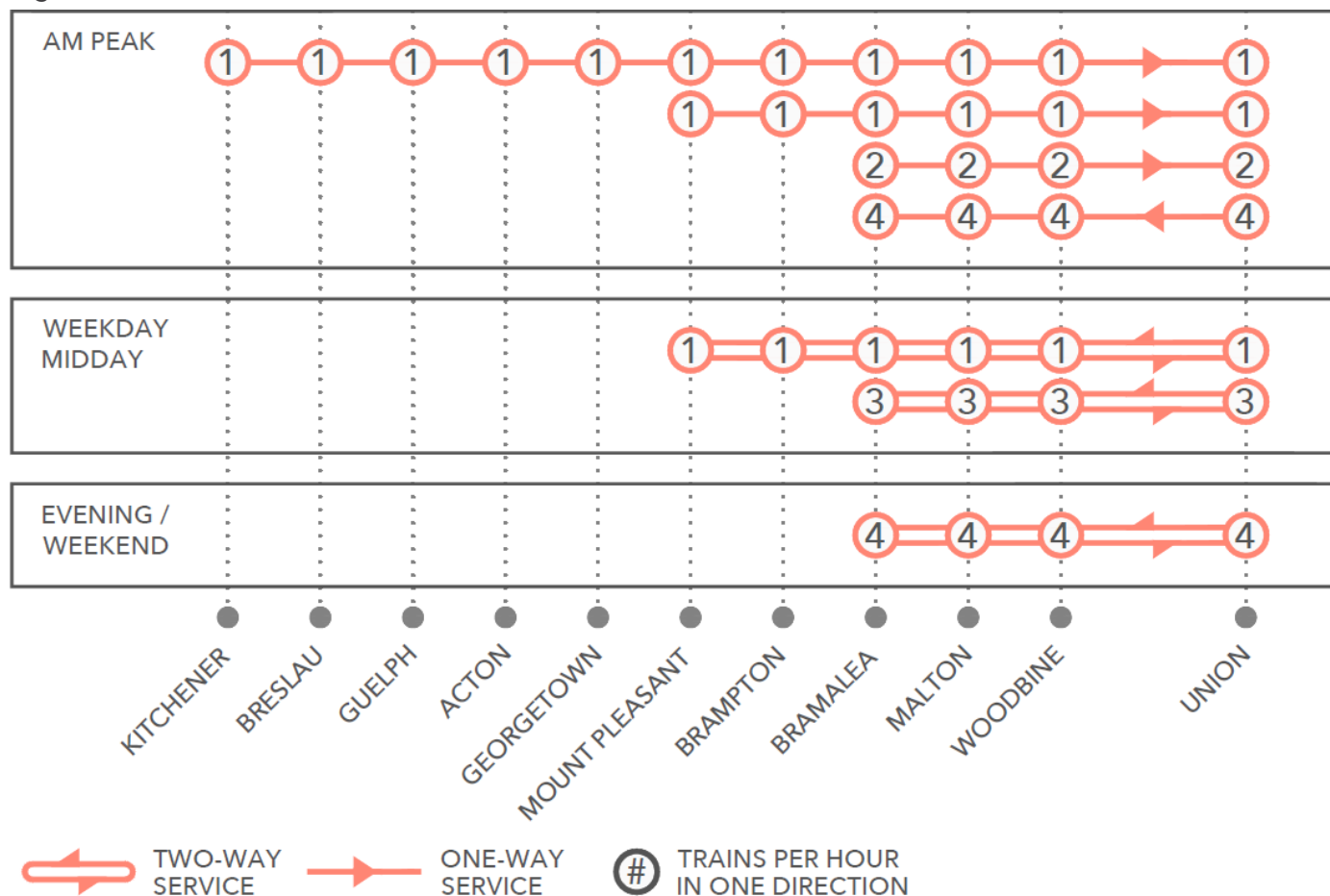
Since the development of the IBC, Metrolinx has continued to refine the interface between the outer and inner service on the Kitchener corridor. The GO Expansion program initially proposed an outer diesel service on the Kitchener corridor which operates express between Bramalea GO station and Union Station. As part of the optimization of the program, the outer service is now proposed to make additional stops at Malton GO station and a future station at Woodbine to improve connectivity between the west end of the Kitchener corridor and future airport rail service to Pearson International Airport as part of the GO Expansion program.

West of Bramalea GO station, the BAU scenario assumes GO Transit's pre-negotiation service levels (September 2018 timetable). Service improvements implemented in 2019 required the ability to further utilize this part of the CN-owned corridor, which were granted early as part of preliminary negotiations with CN. Further investment on the Halton Subdivision will be required to expand service on the corridor beyond these pre-negotiation levels. The BAU service pattern will consist of:

- four peak direction trains per peak period (approximately one train per hour) to / from Kitchener GO station;
- a total of seven peak direction trains per peak period (approximately two trains per hour) to / from Mount Pleasant or Georgetown GO stations;
- one train per hour two-way between Mount Pleasant GO station and Union Station during the midday on weekdays; and
- a total of four trains per hour two-way all-day between Bramalea GO station and Union Station..

Figure 3 shows the proposed outer service pattern on the Kitchener corridor under the BAU scenario.

Figure 3: BAU Service Pattern



With the stopping pattern shown in Figure 3, the BAU scenario will achieve a journey time of 111 minutes between Kitchener GO station and Union Station.

Business as Usual with State of Good Repair Improvements (BAU+SOGRI)

This business case evaluated an enhanced BAU scenario where continued infrastructure rehabilitation is completed on the Guelph Subdivision to enable improve train speed and journey time. This BAU+SOGRI scenario was evaluated to understand the benefits of the state of good repair improvements. The speed improvements will reduce the journey time on the Kitchener corridor to 98 minutes between Kitchener GO station and Union Station.

This scenario does not include new track infrastructure on the Guelph or Halton Subdivisions, and will not enable an expansion of service frequency west of Bramalea GO station above pre-negotiation levels. Therefore, the service pattern for this option is assumed to remain consistent with the BAU scenario.

Option 1: Two-Way Service to Kitchener with Existing Crossing at Silver Junction

This option considers further investment in track infrastructure, which will unlock two-way service on the Kitchener corridor. The service pattern assumes that trains will primarily operate on a single track through a majority of the Guelph Subdivision. Sections of passing track will be implemented, as required by train schedules, to allow for two-way operations.

The CN Halton Subdivision is a main artery for freight traffic and is important for both CN operations and the overall Ontario economy. Project development work conducted by Metrolinx determined that additional track capacity will be required to deliver the proposed service increases. The corridor would consist of three and four track segments, with two tracks primarily used for freight traffic and the remaining track(s) more utilized for passenger movements; although the dynamic nature of trains sharing a corridor mean that all tracks are available to all traffic when required. Train meets will typically be scheduled at locations with two passenger tracks; however, co-production (operating both passenger and freight trains on the same set of tracks) will also be used to enable train meets in constrained portions of the network.

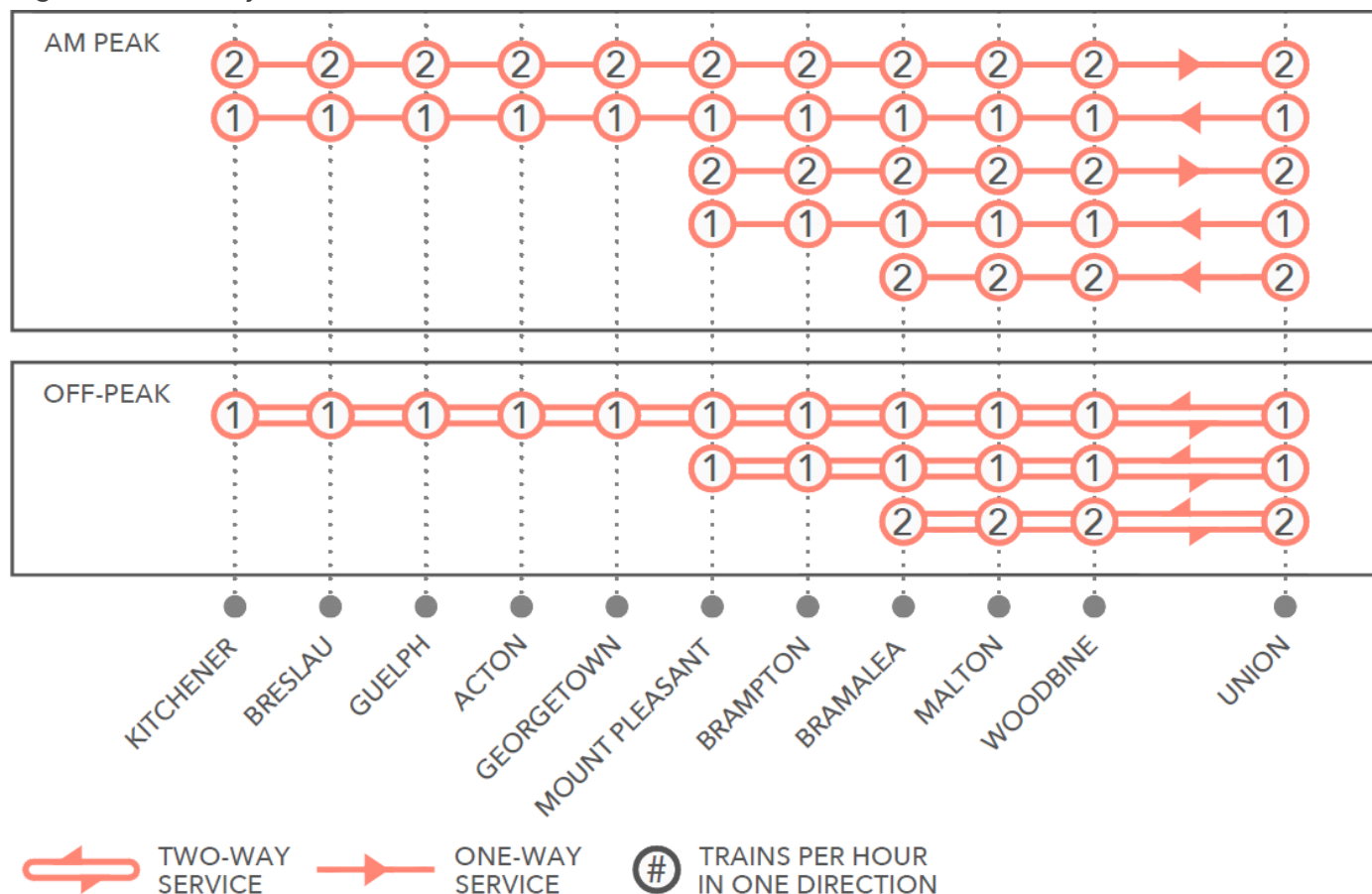
Capital investments would be directed towards alleviating the key constraints and bottlenecks on both the Halton and Guelph Subdivisions to maximize service frequency and reliability. These include the provision of additional track capacity and passing locations, as well as construction of additional station platforms to enable co-production and support bi-directional operations.

The service pattern assumes:

- one train per hour (60-minute frequency) two-way all-day between Kitchener GO station and Union Station, operating express between Woodbine GO station and Union Station;
- a total of two trains per hour (30-minute frequency) two-way all-day between Mount Pleasant GO station and Union Station, operating express between Woodbine GO station and Union Station; and
- a total of four trains per hour (15-minute frequency) two-way all-day between Bramalea GO station and Union Station, operating express between Woodbine GO station and Union Station.

During the peak period, the frequency of peak direction service to Mount Pleasant and Kitchener GO stations will double, providing four trains per hour (15-minute frequency) to Mount Pleasant GO station and two trains per hour (30-minute frequency) to Kitchener GO station. Figure 4 shows the proposed service pattern.

Figure 4: Two-Way Service Pattern



This option also includes the speed improvements on the Guelph Subdivision. The assumed travel time between Kitchener GO station and Union Station is 98 minutes.

Option 2: Two-Way Service to Kitchener with Grade Separated Silver Junction

A key operational constraint on the Kitchener corridor is Silver Junction, where the Halton and Guelph Subdivisions intersect. At this location, GO trains must cross from the south side of the corridor to the north side of the corridor as the track heads north at Georgetown GO station towards Acton GO station and onwards towards Kitchener GO station. To reduce impacts on freight operations to acceptable levels and increase the resilience and on-time performance of GO rail service, Metrolinx proposes to have opposing GO trains meet at Georgetown GO station and crossover simultaneously through an at-grade cross-plant move. The timetable for the Two-Way Service to Kitchener with Existing Crossing at Silver Junction option includes recovery time to facilitate the train meet while maintaining service reliability.

An alternative solution that may be required is the building of a rail-rail grade separation at Silver Junction that allows GO trains to crossover without impacting operations. This would require additional

capital investment to deliver the infrastructure, but eliminates the requirement for the train meet and the associated recovery time in the schedule, thereby reducing journey times to 90 minutes.

The service pattern is assumed to remain consistent with the Two-Way Service to Kitchener with Existing Crossing at Silver Junction option.

4

Strategic Case



Introduction

The Strategic Case summarizes the performance of the options against the identified strategic outcomes and objectives to indicate if the investment addresses the Problem Statement of the 2019 IBC and the goals of the 2041 RTP.

Strategic Evaluation

Strong Connections

Increasing GO Rail Ridership

The improvements to Kitchener corridor service are expected to generate additional rail ridership. Table 4 shows the annual boardings for Kitchener line stations under each scenario and option considered in this PDBC.

Table 4: Annual Boardings by Option

	BAU Scenario	BAU+SOGGR Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
Kitchener	43,700	61,700	210,600	239,100
Breslau	334,500	370,000	559,100	592,200
Guelph Central	285,000	309,700	632,400	666,200
Acton	140,900	160,100	384,400	416,200
Georgetown	358,700	356,800	378,600	378,600
Mount Pleasant	1,842,500	1,868,800	3,273,800	3,273,800
Brampton	1,394,600	1,346,100	2,495,500	2,495,500
Bramalea	1,135,400	1,141,500	1,455,200	1,455,200
Malton	452,000	441,300	445,400	445,400
Woodbine	1,048,000	1,009,800	1,046,200	1,046,200
Total	7,035,100	7,065,600	10,881,300	11,008,500

Note: Figures may not sum to totals due to rounding

Implementing the BAU+SOGGR scenario only generates approximately 30,000 additional boardings per year relative to the BAU scenario, whereas the Two-Way Service to Kitchener with Existing Crossing at Silver Junction option is forecasted to generate approximately 3.8 million additional boardings per year. The main driver of the ridership growth is the new off-peak services introduced through this

option. There is a slight decline in ridership at the eastern stations, since passengers originating from the west are able to access two-way all-day service without driving to Bramalea GO station.

The delivery of the Two-Way Service to Kitchener with Grade Separated Silver Junction option would provide additional travel time savings for trips west of Georgetown GO station, resulting in additional ridership uplift at stations on the Guelph Subdivision.

Increasing the Number of People and Jobs with Access to Two-Way GO Rail Service

Due to operational constraints on the Halton Subdivision, the BAU and BAU+SOGR scenarios will only provide two-way all-day rail service up to Bramalea GO station; while both Two-Way Service to Kitchener options will extend the service to Kitchener GO station.

On the Halton and Guelph Subdivisions, the extension will provide walkable access to two-way all-day rail service (defined as an 800m radius from the rail station) to an additional 54,000 people and 33,000 jobs. In particular, the extension will serve Urban Growth Centres in Downtown Brampton (15,600 people and 7,500 jobs), Downtown Guelph (7,500 people and 9,700 jobs) and Downtown Kitchener (8,700 people and 11,700 jobs). These stations are projected to have the highest densities of population and employment, and have an urban built form that is more supportive of transit ridership.

Reducing Transit Travel Times

Through the implementation of the GO Expansion program in the BAU scenarios, all trains to Bramalea, Mount Pleasant or Kitchener GO stations will operate express between Union Station and a future GO station at Woodbine-Highway 27, reducing the average journey time relative to current service levels.

Each scenario and option assessed in the PDBC delivers incremental infrastructure improvements that lift operational restrictions on the service and decrease journey times. Table 5 provides a comparison of rail travel times to Union Station from the three Urban Growth Centres on the corridor. For comparison, travel times by driving and GO rail service in 2020 is also included.

Table 5: Comparison of Peak Period Peak Direction Travel Times to Union

Scenario / Option	Kitchener	Guelph Central	Brampton
Estimated driving time (2020)	100 - 150 min	100 - 150 min	50 - 90 min
Current Service (Jan 2020)	114 min	91 min	43 min
BAU Scenario	111 min	84 min	36 min
BAU+SOGR Scenario	98 min	79 min	36 min
Two-Way Service to Kitchener with Existing Crossing at Silver Junction	98 min	79 min	36 min
Two-Way Service to Kitchener with Grade Separated Silver Junction	90 min	71 min	36 min

Enabling Counterpeak and Off-Peak Travel

Under the BAU and BAU+SOGGR scenario, the GO Expansion program is expected to implement two-way all-day rail service between Union Station and Bramalea GO station, as well as midday off-peak rail service to Mount Pleasant GO station. Counterpeak and off-peak travel further west will continue to be served by connecting bus services at Mount Pleasant (to Georgetown, Acton and Guelph Central) and Bramalea (to Kitchener) GO stations. There are also Regional GO Bus connections to Guelph from Square One, York Mills and Highway 407 GO bus terminals; and to Kitchener from Square One GO bus terminal.

With the implementation of either of the Two-Way Service to Kitchener options, off-peak and counterpeak travel beyond Bramalea GO station will be served by a single-seat rail trip, resulting in less transfers and improved journey times. The additional infrastructure under the Two-Way Service to Kitchener with Grade Separated Silver Junction option generates further travel time improvements.

Figure 5, Figure 6, and Figure 7 compare the counterpeak travel times to Kitchener, Guelph Central and Brampton GO stations, respectively; while Figure 8, Figure 9, and Figure 10 compare the off-peak travel times. Current transit travel times and estimated driving times are also included for reference.

Figure 5: Counterpeak Travel Time -Union Station to Kitchener GO station

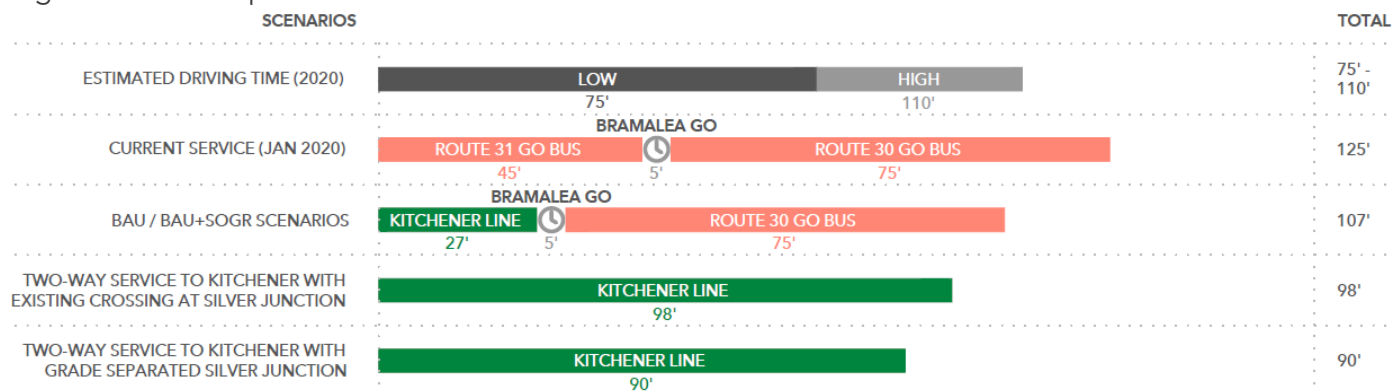


Figure 6: Counterpeak Travel Time -Union Station to Guelph Central GO station

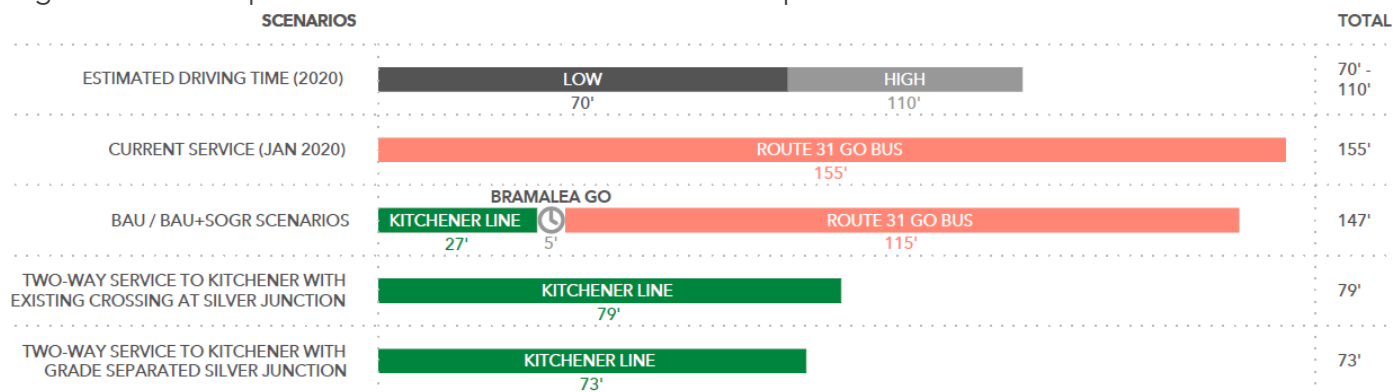


Figure 7: Counterpeak Travel Time -Union Station to Brampton GO station

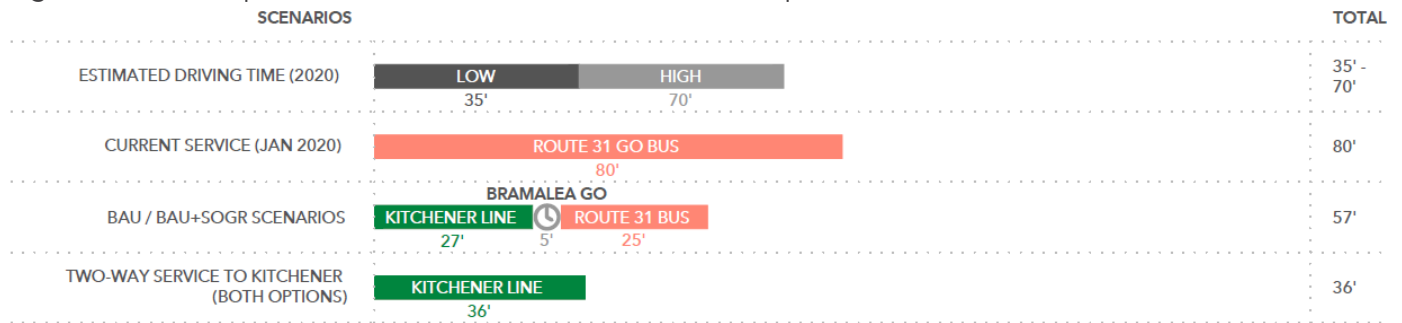


Figure 8: Off-Peak Travel Time - Between Union Station and Kitchener GO station

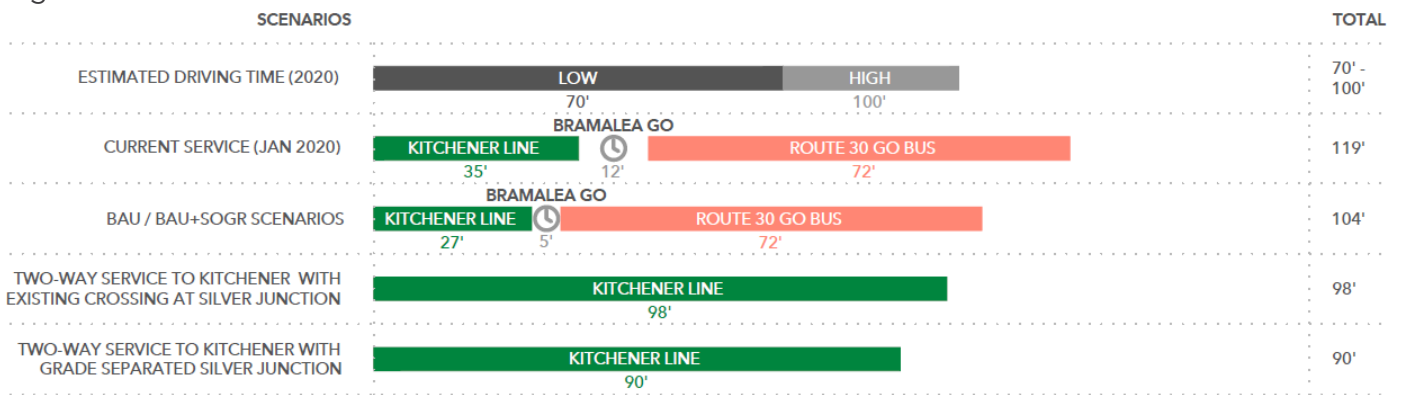


Figure 9: Off-Peak Travel Time - Between Union Station and Guelph Central GO station

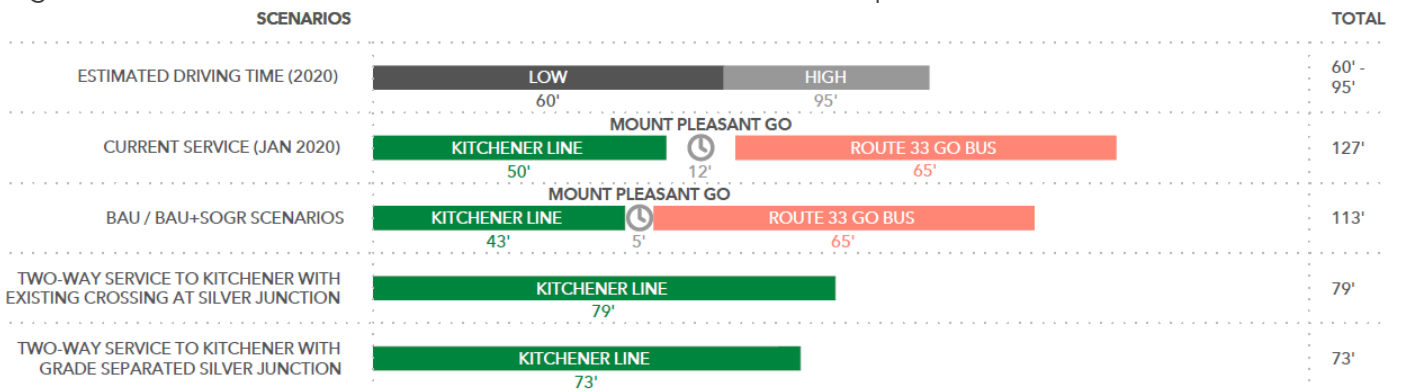


Figure 10: Off-Peak Travel Time – Between Union Station and Brampton GO station

SCENARIOS		TOTAL
ESTIMATED DRIVING TIME (2020)	LOW HIGH 30' 60'	30' - 60'
CURRENT SERVICE (JAN 2020)	KITCHENER LINE 42'	42'
ALL BAU SCENARIOS / INVESTMENT OPTIONS	KITCHENER LINE 36'	36'

Providing Transit Options for Travel between Kitchener-Waterloo and Guelph

Travel between Guelph and Kitchener-Waterloo currently requires a transfer between GO bus routes at the Aberfoyle Park and Ride. This requires a large detour to the south, resulting in significantly longer travel times. The bus routes are not coordinated, and wait times for transfers can be up to 55 minutes on some midday trips. .

Under the BAU and BAU+SOGT scenarios, these bus services will continue to be the primary transit connection between these cities. Even assuming improved schedule coordination between the bus routes (5 minute transfer time), the route along Highway 401 still results in a significantly longer travel time relative to driving.

New and extended trips added as part of the August 2019 schedule change began to provide a rail transit option for Kitchener-Waterloo to Guelph commutes. The 07:57 departure from Kitchener GO station arrives at Guelph Central GO station at 08:17; while the 17:22 departure from Guelph Central GO station arrives at Kitchener GO station at 17:47. With the assumed service adjustment to pre-negotiation levels under the BAU and BAU+SOGT scenarios, these trips would no longer be available.

With the introduction of two-way all-day rail service, peak and off-peak trips in both directions would be served by rail transit and operate significantly faster than GO Bus service. The removal of slow orders on the Guelph Subdivision would also reduce travel times by approximately 4 minutes, relative to current service levels. Figure 11 shows the travel times between Guelph Central GO and Kitchener GO stations.

Figure 11: Travel Time –Guelph Central GO station to Kitchener GO station

SCENARIOS		TOTAL
ESTIMATED DRIVING TIME (2020)	LOW HIGH 28' 55'	28' - 55'
CURRENT SERVICE (JAN 2020) / BAU / BAU+SOGT SCENARIOS	ROUTE 29 GO BUS ROUTE 25 GO BUS 33' 5' 52'	90'
TWO-WAY SERVICE TO KITCHENER (BOTH OPTIONS)	KIT LINE 19'	19'

Complete Travel Experiences

Providing Sufficient Transit Capacity to Serve Peak Demand

The capacity of the offered service was evaluated by comparing the projected peak period, peak direction ridership (boardings and alightings) in 2041 against the maximum seated capacity that can be provided, based on the proposed service patterns.

Between September 2019 and November 2019, Kitchener line rail ridership figures indicated a train utilization of 68% over the final two hours of the a.m. peak (arrival at Union Station between 07:30 and 09:30).

The BAU and BAU+SOGGR scenarios assume pre-negotiation service levels as per the September 2018 timetable, since further investments are assumed to be required to enable increased services.

Compared to present day service, this represents a net decrease of one trip per day from Kitchener. While potential crowding is mitigated by the proposed express stopping pattern which bypasses the inner stations; demand in the BAU scenarios is expected to exceed available seat capacity for trips serving Brampton GO station. Capacity challenges will be exacerbated by the additional ridership attracted by improved travel times in the BAU+SOGGR scenario.

Both Two-Way Service to Kitchener options extend peak period trips to accommodate growing demand from Brampton, Halton Hills, Guelph and Waterloo Region. Compared to present day peak service, there will be a net increase of one trip per peak period from Kitchener GO station, and four trips per peak period from Mount Pleasant GO stations. While ridership will also increase as a result of the improved service, the additional trips provides sufficient seat capacity to accommodate the demand over the peak period.

Table 6 shows the cumulative ridership, available capacity and train utilization for the service during a two-hour a.m. peak period under the BAU scenario and the Two-Way Service with Existing Crossing at Silver Junction option.

Table 6: 2-Hour AM Peak Period Demand (2041) and Capacity

Station	BAU Scenario			Two-Way Service to Kitchener with Existing Crossing at Silver Junction		
	Cumulative Ridership	Max Seated Capacity	Train Utilization	Cumulative Ridership	Max Seated Capacity	Train Utilization
Kitchener	120	3 trains; 5,550 seats	2%	250	4 trains; 7,400 seats	3%
Breslau	1,040		19%	1,270		17%
Guelph Central	650		12%	890		12%
Acton	1,000		18%	1,320		18%
Georgetown	1,760	5 trains; 9,250 seats	32%	1,980	8 trains; 14,800 seats	27%
Mount Pleasant	6,600		71%	7,670		52%
Brampton	9,650		104%	11,340		77%
Bramalea	10,640	8 trains; 14,800 seats	72%	11,840		80%
Malton	10,950		74%	12,060		81%
Woodbine	12,160		82%	13,110		89%

Improving the Reliability of Transit Service

The BAU and BAU+SOGT scenarios will continue to provide peak period, peak direction service on the Kitchener corridor, as well as a low frequency midday two-way service to Mount Pleasant GO station. This limits Metrolinx's corridor requirements to a single track between Bramalea GO station and Kitchener GO station. This infrastructure and operating configuration exposes the service to potential delays as a result of:

- VIA Rail services on single-track segments of the Guelph Subdivision;
- local freight services on single-track segments of the Guelph Subdivision
- mainline and local freight services on double-track segments of the Halton Subdivision; and
- freight movements at Silver Junction.

Under the Two-Way Service to Kitchener with Existing Crossing at Silver Junction option, additional track is proposed to be constructed on the Guelph and Halton Subdivisions to provide passing opportunities west of Bramalea GO station. This reduces the potential for delays as a result of each train meet; however, the introduction of counter-peak and more frequent off-peak passenger train movements increases the total number of train meets. In particular, the requirement to have passenger trains meet and simultaneously cross-over at Silver Junction presents a significant reliability challenge. Preliminary timetabling retains recovery time in the schedule to accommodate the train meets while maintaining the service's on-time performance.

The Two-Way Service to Kitchener with Grade Separated Silver Junction option proposes a rail-rail grade separation that will allow passenger trains to crossover from the south side of the corridor to the north side without interfering with freight rail movements. This eliminates the requirement for a precise train meet at Silver Junction and the potential for delays from conflicting freight movements, thereby improving the service reliability on the corridor.

Sustainable Communities

Supporting Provincial Growth Plans

The BAU and BAU+SOGGR scenarios will terminate two-way all-day service at Bramalea GO station. The Urban Growth Centres in Downtown Brampton, Downtown Guelph, Downtown Kitchener, and Uptown Waterloo will not have access to two-way all-day rail service. This inhibits growth of these hubs, and presents challenges in meeting Provincial and municipal growth targets.

The implementation of either of the Two-Way Service to Kitchener options will extend two-way all-day rail service to Kitchener, directly serving Downtown Brampton, Downtown Guelph, and Downtown Kitchener. Uptown Waterloo will also be connected via the ION LRT to Kitchener GO station.

Encouraging More Sustainable Station Access

The GO Rail Passenger Survey found that some passengers living near the Kitchener corridor are choosing to travel to access the GO rail network via more distant stations on the Lakeshore West and Milton corridors. The results for passengers from Waterloo Region, Wellington County, City of Guelph, and Town of Halton Hills found:

- an estimated 290 daily passengers access the GO rail network at a Kitchener line station east of Georgetown GO station (primarily Mount Pleasant, Brampton and Bramalea GO stations);
- an estimated 380 daily passengers access the GO rail network at a Milton line station (primarily Milton, Lisgar and Meadowvale GO stations); and
- an estimated 260 daily passengers access the GO rail network at a Lakeshore West line station (primarily Aldershot and Oakville GO stations).

Passengers may be choosing to travel further due to more competitive journey times, greater schedule flexibility and availability of parking capacity at these stations. In particular, even with the implementation of regular express service in the BAU scenario, travel between Waterloo Region and Toronto is still faster via Aldershot GO station. The Lakeshore West line also provides more frequent peak service, as well as off-peak service, that could better meet passengers' travel needs.

The implementation of service improvements on the Kitchener corridor will improve the competitiveness of the corridor, and incentivizes passengers to use their home station. The speed improvements on the Guelph Subdivision will attract passengers looking for reduced journey time. Table 7 shows a comparison of journey times to Union Station from Kitchener-Waterloo and Cambridge.

Table 7: Average Journey Time to Union (Kitchener Expansion Options)

Origin	Travel Time Components	Kitchener-Waterloo			Cambridge		
		Kitchener GO	Milton GO	Aldershot GO	GO Station in Breslau	Milton GO	Aldershot GO
BAU Scenario	Station Access*	10	53	58	24	50	45
	Rail	111	65	57	101	65	57
	Total	121	118	115	125	115	102
BAU+SOG Scenario / Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Station Access*	10	53	58	24	50	45
	Rail	98	65	57	91	65	57
	Total	108	118	115	115	115	102
Two-Way Service to Kitchener with Grade Separated Silver Junction	Station Access*	10	53	58	24	50	45
	Rail	90	65	57	84	65	57
	Total	100	118	115	108	115	102

* station access time based on the average driving time from the origin community to the GO station, assuming a minimum of 10 minutes

Extension of two-way all-day service to Kitchener GO station will also improve the attractiveness of Kitchener corridor stations for passengers valuing schedule flexibility.

Reducing Vehicle Use

The implementation of enhanced service on the Kitchener corridor is expected to attract new riders to use GO rail service, as well as incentivize existing passengers to consider boarding at their home station. Riders able to use their home station may be able to access stations via other modes such as walking, local transit, cycling and pick-up / drop-off. Combined, these will reduce the use of vehicles, relative to the BAU scenario, which provides benefits including reduced congestion, improved safety, lower travel-related energy use and lower greenhouse gas emissions.

The BAU+SOG scenario is forecasted to result 1.6 million less annual vehicle kilometres travelled in 2041, relative to the BAU scenario; while the both Two-Way Service to Kitchener options are forecasted to result in a 16.2 million kilometre reduction in vehicle use.

Strategic Case Summary

Table 8 provides a summary of the performance of each scenario and option against the strategic outcomes and objectives.

Table 8: Strategic Case Summary

Strategic Objective	BAU Scenario	BAU+SOGGR Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
Strategic Outcome: Strong Connections				
GO Rail Ridership	7.0M annual boardings	7.0M annual boardings	10.9M annual boardings	11.0M annual boardings
People and Jobs with Access to Two-Way GO Rail Service	1K residents and 6K jobs within 800m of a station on the Halton or Guelph Subdivisions with two-way all-day GO rail service	1K residents and 6K jobs within 800m of a station on the Halton or Guelph Subdivisions with two-way all-day GO rail service	54K residents and 39K jobs within 800m of a station on the Halton or Guelph Subdivisions with two-way all-day GO rail service	54K residents and 39K jobs within 800m of a station on the Halton or Guelph Subdivisions with two-way all-day GO rail service
Transit Travel Times	111 minute travel time between Kitchener GO station and Union Station.	98 minute travel time between Kitchener GO station and Union Station.	98 minute travel time between Kitchener GO station and Union Station.	90 minute travel time between Kitchener GO station and Union Station.
Counterpeak and Off-Peak Travel	- Bus transfer required for evening, weekend and counterpeak travel to Kitchener, Guelph or Brampton - Bus transfer required for midday travel to Kitchener or Guelph	- Bus transfer required for evening, weekend and counterpeak travel to Kitchener, Guelph or Brampton - Bus transfer required for midday travel to Kitchener or Guelph	Direct, single seat transit trip between Union Station and Kitchener, Guelph or Brampton for all directions and travel times	Direct, single seat transit trip between Union Station and Kitchener, Guelph or Brampton for all directions and travel times
Travel Between Kitchener-Waterloo and Guelph	Over 90 minute transit travel time between Kitchener and Guelph	Over 90 minute transit travel time between Kitchener and Guelph	19 minute transit travel time between Kitchener and Guelph	19 minute transit travel time between Kitchener and Guelph

Strategic Objective	BAU Scenario	BAU+SOGGR Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
Strategic Outcome: Complete Travel Experiences				
Providing Sufficient Transit Capacity to Serve Peak Demand	Demand exceeds maximum seated capacity for trips west of Bramalea GO station	Demand exceeds maximum seated capacity for trips west of Bramalea GO station	Sufficient seated capacity to meet projected ridership demand	Sufficient seated capacity to meet projected ridership demand
Improving the Reliability of Transit Service	- Potential delays as a result of conflicting movements, including freight - Train meets between passenger trains are scheduled on the Weston Subdivision.	- Potential delays as a result of conflicting movements, including freight - Train meets between passenger trains are scheduled on the Weston Subdivision.	Additional passing track reduces the risk of delays for each train meet; however, counter-peak and more frequent off-peak service increases the total number of train meets	Rail-rail grade separation eliminates the most restrictive train meet on the corridor.
Strategic Outcome: Sustainable Communities				
Supporting Provincial Growth Plans	Urban Growth Centres on the corridor will not have two-way all-day service	Urban Growth Centres on the corridor do not receive two-way all-day service	Three Urban Growth Centres are directly served by two-way all-day rail service, while a fourth is connected via an LRT.	Three Urban Growth Centres are directly served by two-way all-day rail service, while a fourth is connected via an LRT.
Encouraging More Sustainable Station Access	The Lakeshore West and Milton line provide faster travel times and better schedule flexibility for Waterloo Region residents	Encourages passengers to use their home station by improving relative travel times	Encourages passengers to use their home station by improving relative travel times and schedule flexibility	Encourages passengers to use their home station by improving relative travel times and schedule flexibility
Reducing Vehicle Use	Base vehicle use estimated in 2041.	1.6 million VKT reduced per year relative to the BAU scenario	16.2 million VKT reduced per year relative to the BAU scenario	16.2 million VKT reduced per year relative to the BAU scenario

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 scenarios and 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 of pursuing each investment option.

The Economic Case compares costs and benefits to determine the overall economic viability of an investment. This analysis considers the magnitude of costs and benefits for a 60-year lifecycle (the evaluation period) as well as:

- Benefit Cost Ratio – the net benefits divided by the net costs, which is used to indicate benefits that are realized per dollar spent
- Net Benefits – the net benefits minus net costs, which is used to indicate total net benefits to the region

Methodology

The impacts of the proposed investment were estimated using a regional four stage travel demand model, the Greater Golden Horseshoe Model (GGHMv4). Specifically, the GGHMv4 was used to forecast ridership, in-vehicle travel time benefits, benefits associated with reductions in transfers and improved link reliability. Benefits associated with a reduction in wait time and crowding relief on transit were estimated outside the model. Wait time benefits were estimated by comparing current service frequency with the investment's proposed frequency, while benefits attributed to crowding relief on transit were estimated by comparing existing volume and capacity to future volume and capacity of the proposed investment. Additionally, operating costs for the options were calculated in the GO Expansion Full Business Case model using information on the proposed service pattern, stopping pattern and other service characteristics like fleet type and route kilometres.

The BAU and BAU+SOGT scenarios are assumed to have the same service pattern. Therefore, benefits and costs associated with service pattern changes are not captured for the BAU+SOGT scenario (i.e., incremental rail operating costs, operating cost savings on the bus network, crowding and wait time benefits for transit users).

Both Two-Way Service to Kitchener options are assumed to have the same service pattern and are therefore estimated to have the same benefit associated with the proposed service. In the Two-Way Service to Kitchener with Grade Separated Silver Junction option, riders boarding or alighting west of Georgetown GO receive additional travel time benefits, saving 8 minutes of in-vehicle time. The ridership of this option was not modelled through the GGHMv4. Ridership was assumed to be consistent with the Two-Way Service to Kitchener with Existing Crossing at Silver Junction option east of Georgetown GO station, while an uplift was applied to ridership at stations west of Georgetown GO station based on the travel time savings associated with the rail-rail grade separation at Silver Junction.

A number of assumptions and parameters are made throughout the social cost benefit analysis, as noted in Table 9. The assumptions and parameters used within this Business Case are consistent with the second Volume of Metrolinx's Business Case Guidance, as of April 2019.

Table 9: Economic Case Assumptions

Input	Impact Type
Analysis Approach	All benefits/costs are expressed in real terms in 2020\$. Appraisal begins in 2020. It includes six years of construction (2020/21-2025/26), with a hypothetical opening year of 2025 and 60 years of operation (2025-2084)
Evaluation Period	60 years
Ridership and Benefits Cap	30 years from base year of evaluation
Economic discount rate	3.5%
Real Growth Rate	0%
Value of Time (VoT) (2020\$)	\$18.42/hour
VoT Growth Rate	0%
Auto occupancy	1.077
Auto operating cost savings (2020\$)	Total operating cost: \$0.67/km Marginal operating cost: \$0.09/km
Decongestion benefit (2020\$)	0.01 hours/km (peak) 0.0013 hours/km (off-peak)
Safety improvements (accident mitigation) (2020\$)	\$0.10/km
GHG value (2020\$)	\$0.011/km

All analysis completed in this section uses real values and a social discount rate, as opposed to nominal values and a financial discount rate. Real values do not include the impact of general inflation, but must 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.

The model analyzed all options for the proposed investment relative to the BAU scenario. The results from each option were then compared to determine the incremental benefits that can be realized and incremental costs required to provide enhanced rail service on the Kitchener corridor.

Costs

The costs or 'required investment' to deliver the Kitchener Expansion program are divided into two categories:

- **Infrastructure Costs** - fixed one-time costs incurred during the implementation of the investment, as well as major rehabilitations to restore infrastructure to ensure operational conditions throughout the project's lifecycle. The capital costs include the labour and materials required for construction; as well as contingency. Property acquisition 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 operating and maintenance costs also account for cost savings as a result of discontinuing parallel GO bus services.

The capital, operating, maintenance, and rehabilitation costs for the entire lifecycle of the Kitchener Expansion program are listed below. These costs are incremental to the BAU scenario and have been discounted based on the approach defined earlier in this chapter. Ranges in the capital and rehabilitation costs, as well as the terminal value, represent an 80% confidence interval and include an uplift of 18% for optimism bias.

Table 10: Economic Costs Summary (2020\$, present value)

Economic Costs (\$M, Present Value)	BAU+SOG Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
Infrastructure, Rehabilitation and Replacement Costs	\$240.8M to \$289.0M	\$806.6M to \$952.2M	\$993.1M to \$1,150.1M
Bus Fleet Savings	\$0	\$(25.8)M	\$(25.8)M
Operating and Maintenance Costs	\$0	\$578.2M	\$578.2M
Terminal Value	\$(4.2)M to \$(3.5)M	\$(13.9)M to \$(11.8)M	\$(16.8)M to \$(14.5)M
Total Costs	\$237.3M to \$284.8M	\$1,347.2M to \$1,490.7M	\$1,531.1M to \$1,685.7M

Optimism Bias

The capital and rehabilitation costs include consideration of optimism bias. Optimism bias is the tendency of individuals to expect better than average outcomes. In the context of infrastructure projects, optimism bias can lead to underestimation of costs and project duration.

The PDBC includes an uplift to the expected value of capital costs in order to balance optimism bias. The uplift associated with optimism bias decreases as the level of design of the project increases (i.e. reduces in future iterations of the work). For this PDBC, capital costs for portions of the program are at a higher level of design than others; however, since the analysis is at the PDBC stage, a uniform 18% uplift was applied across the program. Rehabilitation costs and terminal values are calculated based on capital costs, and also include an 18% uplift.

No optimism bias uplift was applied to operating and maintenance costs.

User Impacts

User Impacts are a key area of analysis for transport investments. They capture 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 Kitchener rail service since both groups benefit from travellers switching to GO rail services from other modes.

The Kitchener Expansion program will change the cost of travel to three main groups:

- Existing GO Bus/Rail Passengers - The Kitchener Expansion program will reduce the generalized cost of travel below the current cost of travel for GO users by increasing frequency and reducing the travel time on the corridor. This investment will provide a direct benefit to existing users, especially bus users who have new opportunities to shift their journeys from bus to the rail for off-peak and counterpeak travel.
- New GO Rail Passengers - The Kitchener Expansion program will reduce the generalized cost of travel on GO. This will attract new users to GO that used to travel via other modes. These 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 Kitchener Expansion program 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 11: User Impacts (2020\$, present value)

Category	Impact Measure	BAU+SOG Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
Transit	Travel Time Benefits	\$379.6M	\$849.4M	\$916.5M
	Crowding Impacts	\$0M	\$159.9M	\$159.9M
Automobile	Congestion Reduction	\$6.8M	\$69.5M	\$69.5M
	Operating Cost Reduction	\$3.2M	\$32.8M	\$32.8M
Total User Impacts		\$389.6M	\$1,111.6M	\$1,178.7M

External Impacts

Every auto trip taken can contribute negative impacts to society and the environment through emissions that pollute the air or injuries that can 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 impacts per passenger kilometre).

For instance, motorists switching to GO rail services or choosing a more sustainable mode, such as walking, cycling or local transit, to access a GO station decreases the number of trips on the GGH's road network. This will lead to fewer collisions and emissions, making the GGH's transportation network safer and healthier and contributing to the province's greenhouse gas emissions reduction targets.

External impacts are estimated through the mode changes generated by the proposed investment. If travellers move from a less efficient mode to GO rail services then there is an impact equivalent to the externalities per trip on GO rail services, minus the externalities on their previously used mode. These benefits are calculated based on the change in automobile vehicle kilometres travelled (VKT).

Table 12: External Impacts (2020\$, present value)

Category	Impact Measure	BAU+SOG Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
Safety	Accident Reduction	\$1.1M	\$11.3M	\$11.3M
Environmental	Greenhouse Gas Emission Reductions	\$0.4M	\$3.6M	\$3.6M
Total External Impacts		\$1.5M	\$14.9M	\$14.9M

Wider Economic Impacts

The 2019 IBC noted the potential for two-way all-day service to generate wider economic impacts as a result of increased mobility along the Kitchener corridor. These include the impacts of reduced cost of travel on economic activity, land use and spatial development, labour markets and economic competition, such as:

- Improved economic productivity due to improved choice of inputs in production; greater exchange of information between workers and firms, and faster learning from increased face-to-face contact;
- Improved competition by connecting new markets or reducing the cost of travel within existing markets leading to increased accessibility and choice for consumers; and
- Expansion of the labour market by increasing the 'commuter shed', which is the number of employees that can reach a destination in a given time frame.

A 2016 report by McKinsey & Company on the Toronto-Waterloo Innovation Corridor estimated a potential increase of \$50 billion in direct equity value, \$17 billion in direct annual GDP and 170,000 jobs if the potential of the technology supercluster is realized².

² McKinsey & Company, Primer on technology superclusters and a fact base on Canada's Toronto-Waterloo Innovation Corridor

These potential wider economic impacts have not been quantified in this business case analysis. Metrolinx is undertaking further research and analysis to quantify these benefits in future iterations of the business case.

Economic Case Summary

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

These benefits are greater than the total program costs under the BAU+SOGGR scenario, are approximately equal to the total program costs in the Two-Way Service to Kitchener with Existing Crossing at Silver Junction option, and are less than the total program costs in the Two-Way Service to Kitchener with Grade Separated Silver Junction option.

Table 13: Economic Case Summary (2020\$, present value)

Economic Case Metric	BAU+SOGGR Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
Total Costs	\$237.3M to \$284.8M	\$1,347.2M to \$1,490.7M	\$1,531.1M to \$1,685.7M
Infrastructure, Rehabilitation and Replacement Costs	\$240.8M to \$289.0M	\$806.6M to \$952.2M	\$993.1M to \$1,150.1M
Bus Fleet Savings	\$0	\$(25.8)M	\$(25.8)M
Operating and Maintenance Costs	\$0	\$578.2M	\$578.2M
Terminal Value	\$(4.2)M to \$(3.5)M	\$(13.9)M to \$(11.8)M	\$(16.8)M to \$(14.5)M
Total Economic Impacts	\$413.7M	\$1,377.1M	\$1,485.0M
User Impacts	\$389.6M	\$1,111.6M	\$1,178.7M
External Impacts	\$1.5M	\$14.9M	\$14.9M
Incremental Fare Revenue Adjustment	\$22.7M	\$250.5M	\$291.3M
Benefit-Cost Ratio	1.45 to 1.74	0.92 to 1.02	0.88 to 0.97
Net Benefits (NPV)	\$128.9M to \$176.4M	\$(113.6)M to \$29.9M	\$(200.7)M to \$(46.1)M

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. The Financial Case is agnostic with regard to procurement and delivery method but cost estimates are prepared based on a traditional design-bid-build approach.

The Financial Case analysis assumes a financial discount rate of 5.5% (nominal) and an inflation rate of 2%.

Capital Costs

The capital cost of building and delivering the proposed investment options forms the largest component of overall project costs. Estimates of probable capital costs are provided in present value terms (2020\$), and include a contingency allowance, property acquisition, as well as a professional services allowance to account for the completion of designs, procurement activities and support activities during construction. Both Two-Way Service to Kitchener options also assume savings from bus fleet reductions, since parallel GO bus services are assumed to be discontinued once two-way all-day rail service is in place.

Table 14: Capital Cost in Financial Terms (2020\$, present value)

Item	BAU+SOGT Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
Infrastructure, Rehabilitation and Replacement Costs	\$252.5M	\$861.7M	\$1,052.3M
Bus Fleet Savings	\$0	\$(26.2)M	\$(26.2)M
Terminal Value	\$(3.2)M	\$(10.9)M	\$(13.3)M
Total Capital Costs	\$249.3M	\$824.6M	\$1,012.8M

Operating and Maintenance Costs

The operation and maintenance of additional GO rail service will incur additional costs for staffing, fuel, vehicle and track maintenance and other state of good repair costs. The operating and maintenance costs also include track access fees that Metrolinx pays to CN to utilize the Halton Subdivision, as well as cost reductions from the elimination of parallel GO bus services that currently operate to serve counterpeak and off-peak travel.

Table 15: Operating and Maintenance Costs in Financial Terms (2020\$, present value)

Item	BAU+SOGGR Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
GO Rail Operating and Maintenance Costs	\$0	\$751.8M	\$751.8M
GO Bus Operating and Maintenance Costs	\$0	\$(160.7M)	\$(160.7M)
Incremental Operating Costs	\$0	\$591.1M	\$591.1M

Revenue Impacts

The Kitchener Expansion program will generate additional revenue from net new riders on the service. Average fares based on the home stations of the new riders were applied to the annual ridership estimate to derive the incremental change in fare revenues.

Table 16: Revenue Impacts in Financial Terms (2020\$, present value)

Item	BAU+SOGGR Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
Incremental Fare Revenue	\$23.1M	\$255.1M	\$296.7M

Funding Sources

The proposed infrastructure works will be completed through funding in the State of Good Repair program for rehabilitation of the Guelph Subdivision, as well as committed funding from the Government of Ontario to implement two-way all-day service on the Kitchener corridor

The current funding commitment is sufficient to complete the improvements proposed under the BAU+SOGGR scenario and Two-Way Service to Kitchener with Existing Crossing at Silver Junction option. The cost estimates for the Two-Way Service to Kitchener with Grade Separated Silver Junction option exceed the available budget, and would require commitment of additional funding for implementation.

Financial Case Summary

The overall net present value (NPV) of the investment is negative over the 60-year time horizon, indicating that the project is not profitable on a strictly financial basis.

Table 17: Financial Case Summary (\$2020 M, present value)

Financial Case Metric (Incremental to BAU)	BAU+SOG Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
Total Revenue	\$23.1M	\$255.1M	\$296.7M
Total Capital Costs	\$249.3M	\$824.6M	\$1,012.8M
Total Operating and Maintenance Costs	\$0	\$591.1M	\$591.1M
Net Operating Cash Flow	\$23.1M	\$(336.0M)	\$(294.5M)
Net Revenue (NPV)	\$(226.2)M	\$(1,160.6)M	\$(1,307.3)M
Operating Cost Recovery Ratio	N/A	0.43	0.50
Return on Investment (ROI)	0.09	0.18	0.18

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 to 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.

Project Delivery

Project Sponsor and Governance Arrangements

Metrolinx is the overall project sponsor, while CN will be a key technical stakeholder. As the Halton Subdivision is owned by CN, all decisions on infrastructure and services on that subdivision require working with CN to agree and deliver the optimal solution.

For the Halton Subdivision, Metrolinx and CN are negotiating an overall agreement on the delivery of the Kitchener Expansion program, and the maintenance and operation of the shared-use corridor. The agreement will outline the roles and responsibilities of each party, parameters and the service, and the operating protocols on the corridor.

Major Project Components

The PDBC assessed three infrastructure scenarios and options to enhance the speed, frequency and reliability of GO rail service. Major components of the project for each railway subdivision and infrastructure option are summarized in Table 18.

Table 18: Major Project Components

Scenario / Option	Halton Subdivision	Guelph Subdivision
BAU+SOG Scenario	• None	• rehabilitation and upgrade of existing track, drainage, structures and level crossings • optimization of curves to allow for higher train speeds
Two-Way Service to Kitchener with Existing Crossing at Silver Junction	• additional train storage near Mount Pleasant GO station • construction of third and / or fourth tracks along portions of the corridor • new switches and platforms at Bramalea, Brampton, Mount Pleasant and Georgetown GO stations	Items above, plus: • double tracking of portions of the corridor and extension of existing sidings • new platforms at Acton and Guelph Central GO station
Two-Way Service to Kitchener with Grade Separated Silver Junction	Items above, plus: • rail-rail grade separation at Silver Junction • additional passing track east of Silver Junction	Items above, plus: • additional passing track west of Silver Junction

The Two-Way Service to Kitchener with Existing Crossing at Silver Junction and Two-Way Service to Kitchener with Grade Separated Silver Junction options do not anticipate full double tracking of the Guelph Subdivision or four-tracking of the Halton Subdivision. Instead, specific passing locations were identified based on the results of railway operational simulations. Specifically on the Halton Subdivision, the location and extent of additional passing tracks on the Halton Subdivision will continue to be refined as more information on operational requirements and greater cost certainty on infrastructure components become available.

Environmental Assessment

The Georgetown to Kitchener Expansion Class Environmental Assessment (EA) was completed in 2009 for the proposed service extension to Kitchener. The EA included infrastructure works on the corridor between Mount Pleasant GO station and Baden, located west of Kitchener. The scope of the EA included full double-tracking of the Guelph Subdivision.

The proposed improvements on the Guelph Subdivision fall under the scope of the 2009 EA, and further assessment and approval through a new EA or addendum to the existing EA is not required. Metrolinx is completing updates and studies to confirm that the findings of the 2009 EA continue to be valid. Metrolinx is also undertaking works to secure the required permits and approvals for construction identified in the 2009 EA.

The majority of the improvements on the Halton Subdivision have not been assessed through the EA process. In particular, the rail-rail grade separation proposed under the Two-Way Service to Kitchener with Grade Separated Silver Junction option is a major infrastructure work that has not been previously assessed. The Halton Subdivision is owned by CN, which is a federally regulated railway company. An EA for the Halton Subdivision will be carried out by CN, in collaboration with Metrolinx, under the federal process prior to the start of construction.

Project Management Plan

Detailed design for the proposed infrastructure is currently underway. Infrastructure works on the Guelph Subdivision have an approved environmental assessment and designs are nearing completion, while improvements on the Halton Subdivision require further environmental assessments and design. Construction is proposed to be undertaken through a series of geographically separate work packages over the length of the corridor, each beginning as the required design work is completed. Metrolinx anticipates that the program can be completed within 66 months.

Proposed service levels and train speed enhancements can be implemented once infrastructure works are complete. There may be an opportunity to incrementally increase service as portions of the corridor works are completed. These increases will need to be balanced against ongoing construction requirements, CN freight schedules, fleet availability, and interactions with other GO rail corridors, especially in the vicinity of Union Station. Opportunities for incremental service increases will be further explored as the program advances through to the construction phase.

The program is expected to encounter typical constructability challenges associated with a rail corridor program. These include the potential for delays as a result of:

-
- delayed delivery of works by third parties, such as utility companies for the protection or relocation of conflicting utilities;
 - market conditions, including construction resources and labour market capacity;
 - delayed receipt of required permits and agreements for construction;
 - discovery of unexpected ground conditions or soil contamination, previously unidentified environmentally sensitive areas or species, unknown utilities, or other conditions requiring further assessments or mitigations; and
 - excessive construction impact on the local community, such as dust, noise or traffic, requiring a change to the construction schedule or methodology.

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

Construction Impacts

The infrastructure improvements will involve work on, over or under rail corridors and municipal roads. The proposed infrastructure scope primarily involves rehabilitation and upgrade of existing infrastructure and construction of new passing tracks and station platforms adjacent to the existing track. These works are not expected to require long term closures of the railway, and can be conducted under planned protections, or during overnight or weekend closures. Works would need to be planned to maintain safety of construction and railway operations.

Construction of the infrastructure would need to be planned to maintain operations and connectivity while works are completed. Any track closures, diversions or speed restrictions will require agreement from both CN and Metrolinx. In addition, any works on the existing grade crossings will require coordination with local and regional municipalities to mitigate the impacts to road operations.

Works around stations, such as the construction of tunnels, may impact platforms and station access infrastructure. These will be coordinated with day-to-day operations to ensure that stations remain open throughout the duration of construction. This may involve platform restrictions at stations during construction, and should be coordinated on a corridor basis to manage passenger loading levels at affected stations.

Operations and Maintenance

Roles and Responsibilities

Metrolinx and CN will generally be responsible for the delivery, maintenance and operation of infrastructure on the Guelph and Halton Subdivisions, respectively. A detailed assignment of roles and responsibilities, as well as apportionment of related costs, will be established as part of future discussions between Metrolinx and CN.

Improvements and operations on the Weston Subdivision to enable the service improvements will be undertaken through the GO Expansion program. In addition, some of Metrolinx's responsibilities on the Halton and Guelph Subdivisions may also transition to the successful proponent of the GO Expansion program once it has been awarded.

Changes in Service Provision

GO Rail Services

The Kitchener corridor currently offers frequent peak period peak direction service, as well as limited off-peak two-way service. This includes a series of service increases implemented in 2019 based on preliminary negotiations with CN. During peak periods, a mix of all-stop and express trips is offered. The average journey time between Kitchener GO station and Union Station is 117 minutes for all-stop trips, and 108 minutes for express trips.

The BAU scenario assumes pre-negotiation service levels, as per the September 2018 timetable, if investment on the Halton Subdivision is not pursued. Affected services include several peak period trips, all off-peak trips beyond Mount Pleasant GO station, and all evening off-peak trips beyond Bramalea GO station.

With the future implementation of frequent two-way all-day service on the Weston Subdivision through the GO Expansion program, all trips to Bramalea GO station and beyond are assumed to operate as express trips. Stopping patterns for express trips will be adjusted to provide stops at Malton and Woodbine GO stations to improve connections to Pearson International Airport. These changes will result in an average journey time of 111 minutes.

The BAU+SOGGR scenario will lift slow orders on the Guelph Subdivision and improve journey times between Kitchener GO station and Union Station. Average journey times are expected to decrease to 98 minutes. This scenario does not include capital investments on the Halton Subdivision, and similar to the BAU scenario, assumes pre-negotiation service levels.

The Two-Way Service to Kitchener with Existing Crossing at Silver Junction option will provide additional corridor infrastructure on both the Halton and Guelph Subdivisions. The infrastructure investments will enable half-hourly two-way all-day service to Mount Pleasant GO station and hourly two-way all-day service to Kitchener GO station, as well as improved peak period peak direction frequencies. The average journey time for this option is also 98 minutes.

The Two-Way Service to Kitchener with Grade Separated Silver Junction option will deliver a rail-rail grade separation and additional passing tracks in the vicinity of Silver Junction. These improvements will remove the operational constraints at this location and allow for faster and more flexible service. The service pattern will also provide two-way all-day service along the full length of the Kitchener corridor, while the average journey time will be reduced to 90 minutes.

GO Bus Services

Train-supportive GO bus routes currently provide connectivity during periods without rail service. These include the Route 30 bus service between Kitchener GO station and Bramalea GO station, and the Route 31 bus service between the University of Guelph and Union Station. In addition, the Route 33 regional bus service connects passengers between the University of Guelph and Mount Pleasant GO station, before continuing on to serve Brampton GO station and York Mills bus terminal.

Under the BAU and BAU+SOGGR scenarios, off-peak rail service will continue to terminate at Mount Pleasant GO station, and GO bus service will be required to support off-peak and counterpeak travel

west of Mount Pleasant GO station. These scenarios also assume the reinstatement of GO bus trips that were removed as part of the 2019 service increases.

The implementation of either of the Two-Way Service to Kitchener options presents an opportunity to rationalize the parallel bus services. This business case assumes that the majority of the train-meet and train-bus trips will be discontinued once two-way all-day rail service is in place; with buses only operating during the low-demand late night and early morning periods. In addition, the segment of Route 33 between Brampton GO station and York Mills bus terminal is also assumed to remain in service.

For all options, the PDBC does not assume any changes to other regional bus routes that partially overlap with the proposed train service, such as Route 25 and Route 29 which connect Kitchener-Waterloo and Guelph, respectively, to Square One bus terminal in Mississauga. There may be opportunities to optimize these services as well to reduce the route length and operating costs.

Changes to bus services will need to be considered in conjunction with the impact on current passengers. The current bus service offers additional local on-street stops that may better meet the needs of some customers. Discontinuation of the GO bus service would require passengers to connect onto local transit services or find alternate means to access GO rail stations. These operational changes should be investigated in subsequent phases of project development, prior to implementation of rail service increases on the corridor. In particular, the rationalization of parallel GO bus services could free bus bay slots at GO rail stations, and provide an opportunity to repurpose the capacity for additional local transit connections. Metrolinx will work with municipal transit providers, as more detailed train timetables become available, to improve integration between GO rail and local transit services.

Operations Plan

Corridor Track Capacity

The Kitchener corridor consists of three main sections:

- Weston Subdivision, owned by Metrolinx, is primarily used for passenger rail operations. Through the GO Expansion program, the corridor will consist of three to four tracks for passenger rail operations.
- Halton Subdivision, owned by CN, is used for both passenger and freight rail operations. The corridor consists of two to three tracks, with two tracks primarily used for freight traffic and the remaining track(s) primarily used for passenger service.
- Guelph Subdivision, owned by Metrolinx, is primarily used for passenger rail operations. The corridor generally consists of a single track.

Due to the configuration of the Halton and Guelph Subdivisions, Metrolinx typically operates on a single track west of Bramalea GO station. This allows for either high frequency service in one direction or low frequency bi-directional service, with train meets occurring on the Weston Subdivision where Metrolinx has access to multiple tracks. The BAU scenario and BAU+SOGGR scenarios do not propose any increases in track capacity, and will operate a service pattern that is similar to current operations.

Both Two-Way Service to Kitchener options will construct additional passing tracks on the Halton and Guelph Subdivisions to allow for the operation of two-way all-day service over the full length of the

Kitchener corridor. Where possible, trains will be scheduled to meet at two-track segments on the Guelph Subdivision and four-track segments on the Halton Subdivision. On constrained three-track sections of the Halton Subdivision, there is also an opportunity to operate with a greater degree of co-production (where passenger and freight trains share the use of tracks and are dynamically routed to facilitate passing movements). Metrolinx will also provide additional rail crossovers and station platforms to support these operations.

Silver Junction

Silver Junction is the intersection of the Halton Subdivision and the Guelph Subdivision, located west of Georgetown GO station. In this area, GO trains must crossover from the south side of the corridor to the north side in order to access the Guelph Subdivision. During these movements, the GO train will occupy multiple main tracks and severely restrict corridor capacity. As a result, Metrolinx is limited to a single crossover movement per hour during off-peak periods.

The Two-Way Service to Kitchener with Existing Crossing at Silver Junction option proposes a new south side platform at Georgetown GO station and crossovers on either side of the station. Opposing passenger trains will meet at Georgetown GO station and crossover simultaneously, allowing for hourly two-way service on the Guelph Subdivision, while limiting disruptions to once per hour.

The Two-Way Service to Kitchener with Grade Separated Silver Junction option proposes a rail-rail grade separation and additional track capacity near Silver Junction, which will allow Metrolinx to crossover and access the Guelph Subdivision without interfering with CN freight rail traffic. The rail-rail grade separation will remove the restrictions on the number of movements over Silver Junction and the requirement to schedule train meets at Georgetown GO station. The removal of restrictions on the number of train movements would also enable future service expansions west of Georgetown GO station beyond what has been considered in this business case.

Layover / Train Storage Capacity

The operation of the rail service requires capacity to store trains during the midday near downtown Toronto and overnight near the western terminus of service. The BAU and BAU+SOG scenario will operate service that is equivalent to or less than current operations. The existing layover capacity on the corridor would be sufficient to accommodate this service pattern.

Both Two-Way Service to Kitchener options assume the expansion of storage capacity to accommodate seven trains near Kitchener GO station, and four trains near Mount Pleasant GO station, subject to further refinement of train timetables and fleet cycling plans.

Trade-offs between Capital and O&M Phases

The Two-Way Service to Kitchener with Existing Crossing at Silver Junction option identifies the minimum infrastructure required to implement more frequent two-way service. The train operations rely on scheduled train meets at precise locations on the Guelph and Halton Subdivisions. This reduces the capital costs required to construct additional track capacity, but has the potential to negatively impact the reliability and resiliency of the service. A delay on one train could also result in a delay for the

opposing train movement since it must wait for the scheduled train meet. The preliminary timetable includes additional time to allow for schedule recovery in the event of a delay.

Additional capital investments in corridor infrastructure will enhance service reliability and resiliency by removing restrictions on train meet locations. In particular, the rail-rail grade separation proposed under the Two-Way Service to Kitchener with Grade Separated Silver Junction option will eliminate the requirement to meet at Georgetown GO station. The elimination of the associated recovery time to accommodate this train meet is expected to reduce run times by approximately eight minutes.

The Kitchener Expansion program has designed and costed additional segments of passing track along the corridor that are not critical to the proposed service pattern, but provide additional resiliency in the event of delays. If additional funding becomes available or costs of required infrastructure components are lower than expected, the program proposes to implement this additional infrastructure to improve the quality of service.

Project Dependencies

The Kitchener Expansion program proposes co-production on the Halton Subdivision with CN. Infrastructure improvements to enable the service on the Halton Subdivision will also be delivered by CN. As such, the program is dependent on confirming an agreement with CN on the delivery of the new infrastructure, as well as the ongoing maintenance and operation of the Halton Subdivision.

The Kitchener Expansion program also assumed the delivery of parallel capital programs to provide the required capacity and infrastructure on other portions of the Kitchener corridor and within the Union Station Rail Corridor. While these other initiatives are assumed to be part of the BAU scenario, and are therefore not included in the cost of the program, they contribute to the operation of the proposed service levels on the Kitchener corridor and the realization of the program's benefits. These include:

- construction of a fourth track on the Weston Subdivision and new tunnel under Highway 401 through the early works program;
- accessibility upgrades at Georgetown GO station through the early works program;
- capacity improvements in the Union Station Rail Corridor through the GO Expansion program;
- station access improvements at stations along the Kitchener Corridor through the GO Expansion program;
- delivery of a GO station at Breslau, which has PDBC approval, through transit oriented community;
- delivery of a GO station at Woodbine-Highway 27, which has PDBC approval and a private sector partner, through transit oriented community; and
- relocation and provision of a second platform at Kitchener GO station, as part of the Region of Waterloo's proposed King-Victoria Transit Hub.

Delays in advancing the project dependencies may result in delays or adjustments to the Kitchener Expansion program, its associated service increases and the total benefits of the program

Procurement Plan

Procurement Options

Based on the project scope, the project team considered possible delivery options including:

- use of Metrolinx's existing maintenance contractor;
- procurement of a general contractor through a design-bid-build delivery model; or
- procurement of a private sector partner through an Alternate Financing and Procurement (AFP) project delivery model, such as Design-Build-Finance (DBF) or Design-Build-Finance-Operate-Maintain (DBFOM).

Industry Capacity and Experience to Deliver Project

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

Risk Management

The Kitchener Expansion program is expected to encounter risks typical of a rail corridor program. The nature of the scope of work does not provide opportunities to transfer a significant amount of risk to the private sector.

Future Proofing and Long-Term Contracts

The GO Expansion program is proposed to include the design, construction, financing, operation and maintenance of GO rail services across the rail network, including the Kitchener corridor. Therefore, the Kitchener Expansion program will not include any long-term contracts that would preclude the handover of operations and maintenance to the successful proponent for the GO Expansion program.

In addition, Metrolinx and other stakeholders are considering a set of potential long-term future enhancements to the Kitchener corridor to further improve and expand rail services. These include, but are not limited to:

- further improvements to existing infrastructure, such as additional double tracking;
- electrification of the Kitchener corridor beyond Bramalea GO station;
- realignment of the Kitchener corridor to directly serve Pearson International Airport;
- service extension to Southwestern Ontario, and
- future new stations proposed by third parties under the transit oriented communities program.

Where possible, the design of the Kitchener Expansion infrastructure considers protections for future works on the corridor. Metrolinx does not anticipate the Kitchener Expansion program to preclude further investment if these opportunities are pursued.

Recommended Procurement Method

On the Halton Subdivision, CN owns the rail corridor and will be responsible for delivering the infrastructure improvements. As such, the method of procurement and selection of contractors will be at the discretion of CN. Metrolinx will review, inspect, and/or audit the project as it progresses to verify the costs incurred and the quality of the work.

Metrolinx will be responsible for procuring and delivering the corridor improvements on the Guelph Subdivision. While the scope of the project is within the expertise of Metrolinx's existing maintenance contractors, the scale is likely beyond the capacity of these contractors, considering the other routine maintenance that will continue to be required. The scope does not present significant innovation opportunities or the opportunity to transfer a significant amount of risk to the private sector. As a result, there is limited benefit in adopting an Alternate Financing and Procurement model to deliver the program, which would extend the project schedule and incur additional ancillary costs. Therefore, Metrolinx recommends advancing the Guelph Subdivision improvements through a traditional design-bid-build delivery model.

Conclusion

All options analyzed through this business case are technically feasible, but have challenges in the deliverability and operations of the service. Generally, options with less infrastructure requirements perform better on deliverability considerations, but present greater operational challenges. Table 19 summarizes the key findings of the Deliverability and Operations case.

Table 19: Deliverability and Operations Case Summary

Deliverability and Operations Consideration	BAU+SOG Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
Constructability & Environmental Impacts	• Typical constructability challenges associated with a rail corridor program • Risks will be tracked and managed by the Metrolinx project team		
Environmental Assessment Requirements	• N/A; improvements limited to the Guelph Subdivision; which has received EA approval	• EA required for Halton Subdivision improvements	• EA required for Halton Subdivision improvements, especially the rail-rail grade separation
Implementation Schedule	• Assumed 66 month delivery timeline, with phased availability of select infrastructure earlier • Service improvements could be incrementally phased as portions of the works are completed		
Third Party Agreements	• Continue existing agreement with CN to operate at pre-negotiation service levels	• New / updated agreement with CN to operate enhanced service levels	

Deliverability and Operations Consideration	BAU+SOG Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
Service Changes	• Pre-negotiation service levels beyond Bramalea GO station • Reinstate bus services that were discontinued as a result of the 2019 service increases	• Implementation of two-way all-day rail service along the full length of the Kitchener corridor • Rationalize parallel bus services, and explore opportunities to optimize regional bus routes	
Operating Impacts	• Metrolinx continues to operate on a single track west of Bramalea GO station • Restricted to 2018 service levels on the Halton Subdivision	• Requires scheduled train meets at specific locations on the Guelph and Halton Subdivisions • Restricted to one crossover movement per hour at Silver Junction, and requires a train meet at Georgetown GO station	• Requires scheduled train meets at specific locations on the Guelph and Halton Subdivisions • Eliminates restrictions on train movements at Silver Junction and the requirement for a train meet at Georgetown GO station
Future Expansion	• Does not preclude future infrastructure expansion		
Procurement Plan	• Design-Bid-Build procurement for delivery of infrastructure on the Guelph Subdivision	• CN responsible for infrastructure delivery on the Halton Subdivision • Design-Bid-Build procurement for delivery of infrastructure on the Guelph Subdivision	

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 procurement, and highlights additional work or investigations that are required to confirm the findings of this business case

Investment Review

Strategic Case

The BAU+SOGGR scenario does not achieve the strategic goals of the program. While it reduces the travel times on the corridor, the existing Halton Subdivision infrastructure configuration does not allow for two-way all-day rail service west of Bramalea. The assumed pre-negotiation service levels also results in a net loss of service relative to current operations, and does not provide sufficient capacity to accommodate future ridership growth on the corridor.

Both Two-Way Service to Kitchener options achieve the strategic objective to provide two-way all-day service along the entirety of the Kitchener corridor, and supports Provincial and municipal plans and policies. These options also provide enhanced peak period service to accommodate projected ridership demand. The Two-Way Service to Kitchener with Grade Separated Silver Junction option further enhances the quality of service by eliminating a potential source of delay and providing additional travel time reductions.

Economic Case

The BAU+SOGGR scenario generates the highest benefit cost ratio. These results, however, are primarily driven by the low implementation cost, and the total benefits generated are the lowest of the options considered.

The other two options generate over \$1 billion in benefits over the 60-year evaluation lifecycle, but results in a lower benefit cost ratio due to the higher costs. The Two-Way Service to Kitchener with Existing Crossing at Silver Junction option generates benefits that are approximately equivalent the cost to deliver the program, while the benefits of the Two-Way Service to Kitchener with Grade Separated Silver Junction option do not outweigh the costs for implementation.

Financial Case

The BAU+SOGGR scenario generates minor increases in ridership and revenue without additional incremental operating and maintenance costs, resulting in a positive net operating cash flow. The additional revenue generated is relatively small compared to the capital cost, resulting in the lowest return on investment out of the options considered.

Both Two-Way Service to Kitchener options generate significantly higher revenues and improve the return on investment for the program. Due to the increased service levels, the operating and maintenance costs also increase resulting in a negative net operating cash flow for these options.

In terms of affordability, the BAU+SOGGR scenario and Two-Way Service to Kitchener with Existing Crossing at Silver Junction option are achievable under the current committed funding for upgrades on the Kitchener corridor. The Two-Way Service to Kitchener with Grade Separated Silver Junction option requires additional capital investment that exceeds the available funding and cannot be pursued without further investment.

Deliverability and Operations Case

The BAU+SOGGR scenario is the simplest to deliver, due to its smaller scope and existing environmental assessment approvals, while both Two-Way Service to Kitchener options will require further environmental approvals and design for infrastructure on the Halton Subdivision.

Operationally, the BAU+SOGGR scenario will only operate low frequency off-peak two-way service up to Mount Pleasant GO station. All train meets can be scheduled to occur on the Weston Subdivision. The Two-Way Service to Kitchener options will operate two-way service over the full length of the Kitchener corridor. Additional passing track at select locations on the Halton and Guelph Subdivision will be used to facilitate train meets. The need for precise train meets at specific locations creates the potential for delays. The Two-Way Service to Kitchener with Grade Separated Silver Junction option proposes a rail-rail grade separation and additional double tracking to mitigate operational restrictions at Silver Junction and improve service resiliency. The rail-rail grade separation will also remove the limits on Metrolinx traffic volumes through Silver Junction, and could enable further service increases beyond what has been considered in this business case.

Appendix – Sensitivity Analysis

Several tests were conducted on key input assumptions and parameters to determine the range of benefits and disbenefits possible for each investment option. Tests were conducted on the following items:

- Purchase of new rolling stock to operate the proposed service patterns (no rolling stock purchase assumed in reported results); and
- Uncertainty on economic parameters assumed in the business case evaluation.

Rolling Stock Purchase

The PDBC assumes that no new rolling stock is required in order to operate the Kitchener rail service. As parts of the GO rail network are electrified through the GO Expansion program, diesel locomotives may become available in the mid to late 2020s. Tests were run to determine impacts on the benefit cost ratio if additional train consist are required, in the event that excess rolling stock is not available for operations to/from Kitchener.

The BAU+SOG scenario has the same service pattern as the BAU, therefore no additional rolling stock would need to be procured. Under the Two-Way Service to Kitchener with Existing Crossing at Silver Junction and Two-Way Service to Kitchener with Grade Separated Silver Junction options, seven additional train consists (one locomotive and twelve bi-level coaches) are assumed to be required to operate the proposed service patterns. Costs for new fleet are based on the assumptions in the GO Expansion Full Business Case model.

Table 20: Rolling Stock Sensitivity Benefit-Cost Ratios

Rolling Stock Purchased	BAU+SOG Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
None	1.45 to 1.74	0.92 to 1.02	0.88 to 0.97
Seven train consists	1.45 to 1.74	0.77 to 0.84	0.75 to 0.81

With additional rolling stock costs, the benefit cost ratios decrease for the Two-Way Service to Kitchener with Existing Crossing at Silver Junction and Two-Way Service to Kitchener with Grade Separated Silver Junction options. This decrease is expected as costs for these options increase while benefits remain stationary.

Economic Parameters Sensitivity Tests:

The sensitivity tests are focused on uncertainties that have a substantial impact on the business case.

The values of key economic parameters were varied to determine how the options would perform under different circumstances to reflect these uncertainties. These include the value of time growth rate, economic discount rate, and ridership growth rate. The operating cost growth rate sensitivity not included, since operating costs were calculated in the GO Expansion Full Business Case model.

Parameter	Metrolinx Assumption	Tested Value	BAU+SOG Scenario	Two-Way Service to Kitchener with Existing Crossing at Silver Junction	Two-Way Service to Kitchener with Grade Separated Silver Junction
Benefit Cost Ratios using Standard Metrolinx Assumptions			1.45 to 1.74	0.92 to 1.02	0.88 to 0.97
Value of Time Growth Rate:					
A parameter used to escalate the Value of Time across the investment lifecycle. Value of Time is a factor used to monetize changes in generalized time to determine the overall welfare benefit to transport network users.	0.0%	0.7%	1.69 to 2.03	1.10 to 1.21	1.04 to 1.15
Economic Discount Rate:					
Over time, the value of a cost or benefit will decrease – as a result, an economic discount rate is applied. The economic discount rate reflects society's time preference for money.	3.5%	2.5%	1.83 to 2.21	1.07 to 1.17	1.03 to 1.13
Ridership Growth Rate:					
A parameter used to escalate ridership throughout the investment lifecycle.	2%	1%	1.45 to 1.74	0.92 to 1.02	0.88 to 0.97

These tests noted the following conclusions:

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

