Region of Waterloo

Cambridge to Union GO Rail Feasibility Study

PHASE 2 REPORT

Final – February 2021

Dillon Consulting Limited | Hatch Ltd.
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Executive Summary

Connecting Cambridge to GO Rail Service

The City of Cambridge is a dynamic urban centre located within Waterloo Region, with a population of over 130,000 projected to grow to 176,000 by 2031. It is the only urban municipality of over 100,000 residents in Ontario that is presently not served by passenger rail service. With a highly congested Highway 401 providing the only direct transportation connection to the Greater Toronto Area, regional rail connectivity is critical for maintaining Cambridge's competitive economic advantage within the Greater Golden Horseshoe.

The Region of Waterloo (the Region) has undertaken two previous studies to assess the feasibility of providing GO rail service to Cambridge: a Passenger Rail Feasibility Study in 2009 (the 2009 Study) and a Cambridge to Milton Passenger Rail Business Case and Implementation Strategy in 2014 (the 2014 Study). Both studies investigated providing rail service to Cambridge either via the Milton Line Extension or via the Fergus subdivision and concluded that the Milton Line extension would be the preferred alternative.

More recently, significant implementation barriers related to track sharing with freight service along the Milton Line have created an impetus to review the potential to connect Cambridge to GO Rail Service on the Kitchener Line via Guelph instead, which is the focus of this City of Cambridge to Union Station GO Train Feasibility Study (2019 Study). While the potential to revisit the Milton connection may be revived through future discussions with CP, there is potential to explore multiple alternatives to connect Cambridge to GO service in a phased approach.

This Study was completed in two Phases. The Study was conducted in general alignment with the Metrolinx Business Case Manual Volume 2: Guidance (April 2019); however, this Report does not represent a full Initial Business Case, and further work would need to be completed to further explore aspects of the economic, financial, and deliverability and operations aspects of the analysis presented herein.

Phase 1 of the Study examined the current and future market context in Cambridge for GO Service and explored potential sites for the Station to be located, as well as providing a high-level overview of the service scenarios, deliverability, economic, and financial aspects of providing the service. This high-level analysis concluded that providing GO rail service to Cambridge via the Fergus subdivision has the potential to provide overall net benefits and

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reasonably affordable delivery. This conclusion is based on reasonable progress being made by Metrolinx on improving mainline Kitchener GO train service. Phase 2 of the Study, which is the focus of this Report, delved deeper into the economic and financial feasibility of the service, creating more detailed service scenarios and undertaking a closer technical review of the Fergus Subdivision in order to identify any constructability challenges to delivering passenger rail along the corridor. The results of the Phase 2 analysis confirmed that there is high feasibility and potential for service between Cambridge and Guelph along the Fergus Subdivision, and that in comparison to the Milton corridor, this service represents a highly viable and cost efficient alternative to providing access to regional rail for Cambridge residents.

A preferred GO Station location in Cambridge was identified near the future Pinebush ION Light Rail Transit station (at the Hespeler Road and Pinebush Road area), where there is connectivity to the Region’s transit system, the Highway 401 corridor and a well-established commercial area with future growth potential. The primary ridership markets for the service are destined for Guelph and Toronto, with acknowledged potential for other intermediate markets to develop over time, including Pearson International Airport and the surrounding major employment centre.

Diesel Multiple Units (similar to those in use on the Union-Pearson Express Line in Toronto) were assumed in the analysis of the service operability, which was considered reasonable for the level of work completed to date. Subsequent analysis is recommended to investigate other vehicle technology alternatives, including battery powered electric trains. Diesel Multiple Units would only run on the Fergus subdivision between the Cambridge and Guelph GO Stations, where passengers would need to transfer to the Kitchener GO Line or Guelph Transit routes. This creates an independent service that will not impact the operations of the 12-car GO Train on the Kitchener GO line.

Connecting a city the size of Cambridge to the regional rail network is a critical component of connectivity across the Greater Golden Horseshoe, and the Fergus Subdivision is a practical and beneficial way to provide this passenger rail service.

The Regional Context

Waterloo Region is one of the largest population and employment centres in Ontario and home to 585,500 residents and a workforce of 303,400 employees (Region of Waterloo Community Profile, 2018). The Region is located northwest of the Greater Toronto Area along the Highway 401 corridor. Despite being within the commuter shed of Canada’s largest City it is approximately 100 km away from Toronto which makes it far enough to be self-contained with its own economic activity. The region provides access to over 73,000 post-secondary students, 150 research centres, over 1,000 technology companies and a growing skilled labour force that makes it a key destination within Southwest Ontario.

The Region has made significant investments in rapid transit over the past five years, with the ION LRT corridor, connecting major hubs in Kitchener and
Waterloo being launched in 2019 and future plans to extend the service to Cambridge. The Provincial government, through Metrolinx, has also invested in direct connections to Waterloo Region, with a terminus station on the Kitchener GO line in downtown Kitchener, offering peak hour, and peak direction passenger rail service to downtown Toronto via Union Station. A Provincial commitment to two-way all-day service on the Kitchener corridor is based on the recognition of the strategic economic and growth potential along this corridor and across Waterloo Region.

In addition, Waterloo Region and Guelph have already established themselves as significant markets for post-secondary education, healthcare, high-tech industries and innovation. The service proposed in this study can provide Cambridge and south Kitchener residents with fast and reliable access to education and employment locations in Guelph and the GTA, while Cambridge employers and Conestoga College would benefit from improved connections for students and business travellers, as well as access to a greater labour force from Guelph and the Greater Toronto Area.

Highway 401 is a key economic corridor within Ontario with significant business travel and goods movements by truck. The Province would benefit from reduced road congestion (this rail transit corridor runs parallel to Highway 401); deferred or eliminated need for expansion to road infrastructure; reduced environmental impacts; leverage Provincial investments in service improvements on the Kitchener Line: enhanced productivity and economic activity, and support for the ‘Places to Grow’ intensification targets.

Selection of a Station Location

Five potential station sites along the rail corridor in Cambridge were identified for consideration, as shown in Table ES-1.

<table>
<thead>
<tr>
<th>Station Option</th>
<th>Location Description</th>
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<tbody>
<tr>
<td>1: Preston Alternative</td>
<td>At proposed ION Station north of Eagle Street North, west of Speedsville Road</td>
</tr>
<tr>
<td>2: Pinebush ION Station</td>
<td>At proposed ION Station Hespeler Road south of Pinebush Road/Eagle Street</td>
</tr>
<tr>
<td>3: Hespeler Village</td>
<td>Rail corridor at Guelph Avenue north of Hespeler Village downtown</td>
</tr>
<tr>
<td>4: Preston at Bishop</td>
<td>Rail corridor at Bishop Street North close to Preston Downtown</td>
</tr>
<tr>
<td>5: Delta ION Station</td>
<td>At proposed ION Station north east of Hespeler Road and Dundas Street North</td>
</tr>
</tbody>
</table>

The Metrolinx Business Case Manual and a review of published Business Case examples were used to identify evaluation criteria. The attractiveness of these sites was measured by considering reasonable catchment areas for three types of access:
Based on the high-level assessment undertaken, the Pinebush ION Station location emerged as the preferred alternative for a future GO Station in Cambridge. The key reasons for this include:

- High connectivity based on the potential for integration with the future Phase 2 ION LRT Station and close proximity to Highway 401;
- Relatively short travel time to the Guelph Station and the interface with the Kitchener Line based on proposed service via the Fergus Subdivision (See Chapter 4 for more details);
- Ease of access to residential areas and amenities based on the 2031 population forecast. Planned active transportation improvements to the area are anticipated to improve access to the proposed station;
- Ease of access to employment, innovation, and prosperity opportunities aided by integration with the ION LRT route;
- High short-term potential for intensification and redevelopment based on the policy review and anticipated direction of the Hespeler Road Corridor Secondary Plan.

The limited potential space for parking at this location was noted, but as part of any transit-oriented development some structured parking could be explored.

**Service Scenarios**

The level of ridership expected on a possible future passenger rail service via the Fergus Subdivision will be determined to a significant degree by the competitiveness of rail linking Cambridge to other trip markets compared to other modes of travel. Today, GO rail services linking Guelph and Toronto are slow – however there is significant potential for service speeds and frequencies to be improved. Given the extreme levels of congestion on parallel Highway 401, significant population and employment growth projections, and much better rail service observed in comparable urban areas, improvements to rail for reasons beyond the Cambridge-Guelph link considered here are deemed warranted.

The service scenarios were derived considering current GO Rail and VIA schedules on the Kitchener corridor, drawing on the Metrolinx 2015 GO Regional Express Rail Initial Business Case estimation for potential journey time reduction for the proposed improvements. Scenarios for 2026 (Opening Day), 2031 (Two Way All Day), and 2041 (Build Out) were developed, for each of the six options presented in Table ES-2.
Three main operating scenarios were developed for the Cambridge-Guelph line with two different track infrastructure specification levels for a total of 6 operating scenarios. The Options offer bidirectional service that will operate between Guelph Central Station and the Pinebush ION Station. Option 1 recommends a single-track layout, while Option 2 recommends single track with a siding to allow for train meets in the middle of the line and twice the frequency. Option 3 requires a double track layout along the length of the Cambridge-Guelph service corridor to enable highly reliable and high-frequency service.

Each of the three operating scenarios offers two sub-options, denoted as ‘A’ and ‘B’. Sub-option A’s allows service at a recommended speed of 75 km/h, while sub-option B’s offer service at 85km/h, enabling more frequent service or fewer required operating trainsets. It is expected that operation at higher speeds would require a potential upgrade of track infrastructure in certain sections (from Class 3 to Class 4), adjustments to curve geometry in horizontal curves, higher speed turnouts through junction locations, and the potential flattening of existing horizontal curves along the track. Any increases to speed of service would require further examination to ensure adequate braking distance, i.e. distance between rail signals may need to be adjusted.

### Table ES-2 Rail Service Options for Cambridge to Guelph

<table>
<thead>
<tr>
<th>Option</th>
<th>Track Type</th>
<th>Train Quantity</th>
<th>Train Speed</th>
<th>Travel Time (one-way)</th>
<th>Dwell Time</th>
<th>Headway Time</th>
<th>Frequency (train per hour)</th>
<th>Cost Level</th>
</tr>
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<tbody>
<tr>
<td>Option 1A</td>
<td>Single track</td>
<td>1 running, 1 spare</td>
<td>75 km/h</td>
<td>16 min</td>
<td>14 min</td>
<td>60 min</td>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td>Option 1B</td>
<td>Single track</td>
<td>1 running, 1 spare</td>
<td>85 km/h</td>
<td>14.5 min</td>
<td>8 min</td>
<td>45 min</td>
<td>1.25</td>
<td>Low</td>
</tr>
<tr>
<td>Option 2A</td>
<td>Single track with a siding</td>
<td>2 running, 1 spare</td>
<td>75 km/h</td>
<td>17 min</td>
<td>13 min</td>
<td>30 min</td>
<td>2</td>
<td>Medium</td>
</tr>
<tr>
<td>Option 2B</td>
<td>Single track with a siding</td>
<td>2 running, 1 spare</td>
<td>85 km/h</td>
<td>15.5 min</td>
<td>7 min</td>
<td>22.5 min</td>
<td>2</td>
<td>Medium</td>
</tr>
<tr>
<td>Option 3A</td>
<td>Double track</td>
<td>4 running, 1 spare</td>
<td>75 km/h</td>
<td>16 min</td>
<td>14 min</td>
<td>15 min</td>
<td>4</td>
<td>High</td>
</tr>
<tr>
<td>Option 3B</td>
<td>Double track</td>
<td>3 running, 1 spare</td>
<td>85 km/h</td>
<td>14.5 min</td>
<td>8 min</td>
<td>15 min</td>
<td>4</td>
<td>High</td>
</tr>
</tbody>
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Trips to mid-line stations were based on transit mode share, growth in population and employment, and change to station area characteristics. Trips to Union...
Station were calculated using the existing trip rate generated from the Kitchener GO Station, which is believed to be conservative for future projections given a number of factors including: capacity limits to the regional highway network even with proposed expansion; urban region agglomeration including higher degrees of specialization and long-distance commuting to match labour and jobs efficiently; and, reasonable expectations for increased mode share with faster and reasonable commute times by rail.

The six scenarios were evaluated as described further below; however, it should be noted that while one alternative was identified to have high potential at this stage, this Study does not recommend any specific alternative, instead in keeping with the technical best practice for a feasibility study, hold the door open for any of the other options to be further explored in future exercises related to delivering GO Rail connectivity to Cambridge.

**Phasing & Delivery**

At the current stage of the Cambridge feasibility study, the following early principles are recommended:

- Service on the Cambridge-Guelph route would ideally be introduced concurrent with improved service speeds and frequency on the Kitchener Corridor;
- ‘Train meets’ would be timed for dominant travel flows to minimize interchange time between services, even if relatively infrequent services were initially employed; and
- Delivery time will depend on funding decisions and required time to complete environmental assessments, other studies, and completion of engineering and construction. However, it is understood that there are track improvements required on the Kitchener corridor. If the Cambridge-Guelph service were advanced concurrently with the Kitchener GO line improvements, it is conceivable that the Cambridge-Guelph service could be developed and delivered concurrently with the Kitchener line improvements.

**Ridership Forecast**

Ridership forecasts for the Cambridge to Kitchener corridor were completed using a similar methodology used in the 2009 Cambridge to Union Feasibility Study and follow-up 2014 Cambridge to Milton Passenger Rail Business Case and Implementation Strategy. The forecasts were based on ridership to / from the proposed Pinebush ION Station in Cambridge and each of the stations along the Kitchener Line between the Guelph GO Station and Union Station.

Given the high-level nature of this forecast, a “Low” and a “High” estimate was calculated. Low estimates are based on existing travel patterns and do not take into account potential changes in travel behaviours due to technology, new mobility, societal attitudes on sustainability or increasing road congestion. The
“Low” estimate also does not take into account the potential use of the service from population outside of a 15-minute driving distance of the proposed Pinebush ION Station. The “High” forecast is approximately 50% greater than the “Low”. This was chosen as it represents the same range between “Low” and “High” as used in the 2014 Business Case for GO Train service between Cambridge and Milton. This was done to allow for a more consistent comparison between the proposed GO Rail Service between Cambridge and Milton (2014 report) and between Cambridge and Guelph (the focus of this report).

Within the low estimates, Scenario 1A and 1B produce a range of annual ridership levels for 2026 between approximately 84,000 and 88,000, climbing to between 415,000 and 439,000 by 2041. Scenario 2A and 2B annual ridership values range between approximately 107,000 and 117,000 in 2026, rising to between 495,000 to 538,000 by 2041 respectively. Scenario 3A and 3B offer a modest increase in annual ridership for 2026 ranging from 148,000 to 151,000, with a more significant increase by 2041 ranging from 690,000 to 708,000 annual riders. The high estimates present an order of magnitude increase on annual ridership, more than doubling the low estimate values. For instance, the Scenario 2A values increase from approximately 275,000 annual riders in 2026 to 1.15 million riders in 2041, while the Scenario 3A estimates range from 385,000 in 2026 to 1.62 million riders in 2041.

While the study was being conducted, the Kitchener GO Rail Service Expansion Initial Business Case Update (IBC) was released by Metrolinx in November 2019. The IBC assumed slightly slower travel times and lower frequency on the Kitchener line including 30-minute service during the peak hours and hourly service in the off peak periods. Changing this study’s assumptions to the Kitchener line service pattern described in the IBC would have only minor impacts on scenarios 1A, 1B, and 2A. However, scenarios 2B, 3A, and 3B would have much lower ridership since customers would not be able to connect with a train on the Kitchener line to Union Station on every trip. Therefore, these scenarios require more frequent service on the Kitchener line to meet their ridership potential.

**Strategic Case**

The Strategic Case for implementing passenger rail service connecting Cambridge to GO Rail Service and Union Station along the Fergus Subdivision is designed around five key goals:

- Goal 1: Complete the Network in Southwest Ontario
- Goal 2: Leverage Transit Investments on the Kitchener line and the Region of Waterloo ION Network
- Goal 3: Support Economic Development in Southwest Ontario
- Goal 4: Offer a High Degree of Deliverability
- Goal 5: Support Local Transit Oriented Development in Cambridge and Guelph
These goals provide the basis for the ultimate analysis on feasibility for the Cambridge to Guelph service.

**Deliverability and Operations**

A review of the deliverability potential of the service included an exploration of the approach to have a low-cost deliverability and operations system, while achieving reasonable performance for a good passenger service. A key reference case referred to was the Union-Pearson Express (UP Express) which models a realistic and feasible service aspired by the Cambridge to Guelph train connection. The UP Express model was used as it can be applicable to the Pinebush ION to Guelph GO Station trip in terms of distance, scale, and speeds. The current use of the Fergus Subdivision is freight, with maintained level crossings. Improvements to the track would be needed to support the service and accommodate DMU technology.

One key area of the Fergus Subdivision is the Guelph Junction. This junction poses complications to the operations and deliverability of this line, primarily because it is used by both freight and commuter lines; these include CN, GO Transit and VIA Rail. Both CN and Metrolinx own tracks that are intersecting and branching off at this junction, making it complicated in terms of when and by whom it is used. The track and corridor conditions at the Guelph GO Station has been reviewed and there is a high level of confidence a solution exists that can enable small trains from Cambridge to serve Guelph from a passenger access, infrastructure, and rail operations perspectives.

A closer review of the Fergus Subdivision identified a number of key considerations related to both construction and operational risks, as well as how these might be addressed. The key construction risks are associated with existing bridges and grade crossings, which would need to be reviewed in closer detail and upgraded to support passenger rail service. Key operating risks from shared freight rail traffic are expected to be manageable, albeit with collaboration and agreements required from CN; some restrictions on certain freight movements during certain periods will be required depending on track improvements. In exchange, freight customer access will be maintained and the rail corridor will be significantly upgraded, benefitting passengers and freight services.

Further analysis of both construction and operation risks is required in future studies to both quantify and prioritize risks as well as to identify the cost of mitigation.

**Rolling Stock**

Based on a high-level assessment of the study area and deliverability and operation needs of this system, DMUs were considered a viable alternative in terms of applicable vehicle technology in Phase 1 of the Study. However, as a result of Phase 2 of this Study, the EBMU rolling stock type is recommended. The capital expenditure comparison for delivery of travel scenario Option 2A is estimated at $143 million for DMU, $174 million for EMU, and $157 million for EBMU, placing the EBMU alternative in the middle of the cost range across the
three rolling stock types. The EBMU technology also has reasonable climate adaptability, operational reliability and some delivery risk, and offers a reduction in runtime when the train operates at a speed is 85km/h or greater. Additionally, operation and maintenance costs for EBMU are low relative to DMU and EMU rolling stocks. Standard EMU trains can be difficult to operate as a stand-alone service, as there would be no connection to a heavy rail maintenance facility along the Cambridge-Guelph corridor. EBMU's are the more flexible option as this transport technology can be propelled on battery until the Bramalea Station, where electrification ends on the Kitchener line, providing a route to existing GO heavy maintenance facility.

**Constructability**

Potential reconfiguration options for the Guelph Junction and Guelph Central Station are presented to optimize the Cambridge-Guelph passenger service. Additionally, high-level analysis of the potential for Station integration with the Pinebush ION Rapid Transit Station has been carried out. Finally, a location for a storage and maintenance facility to support the Cambridge-Guelph service is proposed, in close proximity to the Pinebush ION Rapid Transit Station.

**Governance and Operations**

The Region of Waterloo has taken a leading role in the planning, and delivery of the ION light rail system – a system which makes use of both roads and traditional railway rights of way for its rail corridor rights-of-way and operation.

Recently, under processes enabled by Metrolinx referred to as “market-led” development, Metrolinx has taken a regulator and approver role and encouraged private sector and municipalities to propose new transit system improvements – primarily new stations, but in some cases, new stations have led to impacts and proposals for improved service in conjunction with station and rail corridor infrastructure.

It is worth noting two recent innovations: the recent advent of the Canada Infrastructure Bank, and the advent of the Metrolinx developer-led station development model(s) - potentially create a hybrid public-private delivery solution for the Cambridge-Guelph line and service. Furthermore, the delivery of the infrastructure could be managed by any one government or a new agency that is co-owned by one or more than one government. It in turn could be delivered through Design-Build packages, perhaps with an operating component. Finance, Maintenance, and Operating components could all be included or considered separately.

The conclusion is that any level of government could conceivably champion the planning of a new rail service, including the negotiating and funding of necessary capital improvements and operating funding. However, it could be difficult for a single Municipal government to implement the Cambridge-Guelph service due to multiple jurisdictions requiring negotiations, the Provincial Environmental Assessment process, and associated costs. As such, a joint partnership-based
model with collaboration from the proponent municipalities in conjunction with Metrolinx would likely prove the most efficient.

This can and should be looked at in subsequent phases of exploring delivery of service between Cambridge and Guelph, parallel to the specification of the technical elements of the service and infrastructure.

**Financial and Economic Considerations**

The economic and financial components of the assessment at this stage of the project consisted of the following key elements:

- **Financial Considerations (high level estimate)**
  - Capital cost
  - Operating cost and maintenance cost
  - Revenue forecast

- **Economic Considerations (high level benefits-cost review)**
  - Transportation user impacts (overview of travel time change, reliability, congestion, amenity, user costs, etc.)
  - External impacts (consideration of wellbeing and environmental impacts)
  - Wider economic impacts (connectivity, productivity, labour market)

The Business Case Guidance for Metrolinx was applied, along with rules of thumb high-level analysis techniques appropriate for this stage of analysis.

In terms of capital cost, a number of track improvements to the Fergus Subdivision would be required with a high-level estimated cost of $85M for construction, which is considered to be a reasonable level of investment to upgrade the existing track and sidings, as well as cover the cost of basic station facilities.

The financial implications of investments including the capital, operation and maintenance costs of providing passenger rail service between Cambridge and Union Station via Guelph via the Fergus subdivision were developed in Phase 1 of the Study and refined in Phase 2, with a more detailed review of the assumptions and more conservative application of the contingency component for the capital expenditure estimate.

For operations between Cambridge and Guelph, the service, at a very high level, has been modelled on the Union-Pearson Express DMU-only service, albeit with very basic service patterns. The Phase 1 assumptions on infrastructure improvements, bus service for off-peak periods, and Pinebush ION Rapid Transit Station integration costs were reviewed and enhanced in the Phase 2 cost estimate analysis. The updated capital cost breakdown provided in this Section provides more clarity on the itemized cost estimates.

**Table ES-3** highlights the capital costs for each rail service option and different types of rolling stock. The most expensive option to implement would be Option 3B for EBMU trains, while the cheapest is Option 1A for DMU.
Between the various Options identified in Table ES-3, the main difference is the amount of trackage that requires signaling and electrifying and the amount of rolling stock required to operate the service. The capital expenditure for the rolling stock could be reduced if the order were bundled into the procurement process for the wider GO network however, this would require using similar technology as the GO network which may not be appropriate. The cost estimate also includes track improvements, grade separations where required, and the cost of developing the Pinebush ION Rapid Transit Station with basic station building, platform, and passenger pick up and drop off has been carried in the capital cost estimate. A small siding to store trains and a small building for light maintenance provision was also included in the capital cost estimate.

The total operational expenditure includes maintenance costs which vary between the equipment types. It was assumed an additional upfront maintenance costs (under capital expenditure) would be associated with the EBMU as there is no existing facilities to maintain this type of vehicle, however, the operational expenditure is lower compared to a traditional EMU as there are no OCS (overhead catenary system) to maintain. Ultimately the choice of vehicle has to be assessed by several factors such as speed profile in the corridors, costing of carbon emissions from diesel and equipment savings from journey times and increased ridership. The EBMU represents the best balance between performance, cost, and future proofing.

The high-level cost estimate for operating and maintenance of the track, trainsets, and rail infrastructure is estimated at $10-20M per year (depending on service specification and design) and captures a spectrum of opportunities for service delivery. This estimate is based on UP Express which utilizes similar DMU vehicles to the service proposed, albeit with less onboard and in-station staffing compared to UP Express.

The cost of developing the Pinebush ION Rapid Transit Station with basic station building, platform, and passenger pick up and drop off has been carried in the capital cost estimate. A small siding to store trains and a small building for light maintenance provision was also included in the capital cost estimate.
Revenue Forecast

Passenger revenue forecasts were developed using the fare from the Kitchener GO Station as a proxy for service to/from the proposed Pinebush ION Rapid Transit Station in Cambridge. An average fare considering distance and concession type was calculated to/from each station on the Kitchener Line and applied to the ridership forecast.

By 2026, the service is anticipated to generate between $1.6 and $4.2 million dollars (depending on the ridership forecast), growing to between $6.3 and $15.3 million by 2041 due to ridership growth as a result of population and employment increase along the corridor and improvements to the service.

Transportation User Impacts

The transportation user impacts are based on a number of key base criteria that influence a traveller's perception of the journey or service, including such factors as convenience, comfort, predictability, and the ‘costs’ in terms of travel time as well as financial costs.

Wider Economic Benefits

Introduction of the new service and GO Station in Cambridge will result in wider economic impacts including productivity and agglomeration benefits, reduced GHG emissions, improved air quality, land use shaping and social value of improved housing accessibility and affordability, reduced vehicular accidents and health benefits.

Benefit Cost Analysis

The Benefit Cost Analysis mimicked the Metrolinx Business Case Guidance, assessing economic considerations. The six rail service options (Option 1A, 1B, 2A, 2B, 3A, and 3B) were compared against two Economic Feasibility Scenarios paired with the High and Low Ridership Scenarios to estimate the total monetary benefits. The two Economic Feasibility scenarios considered, based on the Metrolinx Business Case Guidance (2019), were:

- Base Case, with a benefit discount rate of 3.5% and a cost inflation rate of 2.0%; and
- Aggressive Scenario, with a benefit discount rate of 5.5% and a cost inflation rate of 3.5%.

The corresponding numerical values of the economic benefits, and associated assumptions and considerations are presented in Appendix E. A summary of the Benefits Cost Analysis is shown on Figure ES-1. It can be concluded that the Option 3B generates the highest economic benefits among all service scenarios, while the Option 1A generates the lowest.
<table>
<thead>
<tr>
<th>Option 1A, Low</th>
<th>Option 1A, High</th>
<th>Option 1B, Low</th>
<th>Option 1B, High</th>
<th>Option 2A, Low</th>
<th>Option 2A, High</th>
<th>Option 2B, Low</th>
<th>Option 2B, High</th>
<th>Option 3A, Low</th>
<th>Option 3A, High</th>
<th>Option 3B, Low</th>
<th>Option 3B, High</th>
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<td>110</td>
<td>27</td>
<td>60</td>
<td>246</td>
</tr>
</tbody>
</table>

Figure ES-1 Economic Benefits for all Service Options: Low Ridership, Aggressive Scenario vs High Ridership, Base Scenario
Comparison with the Milton Extension Alternative

As noted, the feasibility review for the extension of intercity passenger rail service to Cambridge undertaken through the 2009 Study determined that the preferred routing option to connect Cambridge to the GO Rail network was to extend the Milton Line GO Train service from Milton to Cambridge, rather than connecting to the GO Train service on the Kitchener Line at Guelph. A follow-up 2014 study looked at several scenarios to connect to the Milton line, and provided more detailed estimates for capital and operating costs, as well as ridership and revenue forecasts for the 2021 and 2031 horizon years. The 2009 Study assumed that the service extension would follow GO Transit's traditional approach of starting the new service with four peak period trains and increasing the number of peak period trains in response to demand.

Scenario 2A in this study estimated 2031 ridership projections that are substantially higher than those in the 2014 Business Case. However, note that the scenarios in this study include weekend service, while the 2014 scenarios did not (they focus on a peak service). Furthermore, the Milton scenarios do not offer a direct connection to Guelph. In the Guelph (2A) scenario, trips to and from Guelph are expected to account for approximately 30% of trips on the line. While identifying service on a different route to Union Station, Scenario 2A has ridership that is similar to the Milton scenario in the 2009 Feasibility Study.

The 2009 Feasibility Study has significantly higher ridership than the 2014 Study due to higher frequency of service. Scenario 2A in this study via Guelph projects significantly higher ridership than the 2014 Study due to a combination of higher mid-day service frequency, slightly faster journey time, and service to better markets (via Guelph). Scenario 2A is expected to improve fairly significantly between 2031 and 2041 as significantly better service is envisaged to be possible on the Kitchener Line, improving journey choice and travel times between Guelph and Toronto (Table ES-4).

While an enhanced journey time program in the 2030s that would be necessary is not currently committed to by Metrolinx, the Kitchener corridor which was significantly enhanced to support UP Express service has future potential for additional speed improvements. In comparison, there are relatively poor prospects for enhanced journey time via the Milton corridor.

The Guelph-Cambridge connection explored in this study has a higher potential for ridership to mid-line stations than an extension of the Milton Corridor. This is largely due to the expected ridership between Cambridge and Guelph. Excluding trips to Milton and Guelph, both the Milton Line extension and the Kitchener Line offer similar ridership potential to mid-line stations. However, there is a significantly larger travel market for trips from Cambridge to Guelph than from Cambridge to Milton. Furthermore, there is significant two-way travel demand.
from Guelph to Cambridge, making better use of the two-way service, while there is little AM peak travel demand in the “reverse direction” from Milton to Cambridge.

Currently, there are no services provided by Grand River Transit, Guelph Transit, or GO Transit for travel between Cambridge and Guelph that do not require a transfer. The Guelph-Cambridge connection to the Kitchener Line would fill this gap in the tri-cities area, while the Milton Line extension would act primarily as a link to Union Station.

Table ES-4 Comparison of Projected Ridership on Milton and Guelph Corridors (2031)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Average Travel Time to Union (mins)</th>
<th>Frequency of Service from Cambridge</th>
<th>Service</th>
<th>2031 Annual Ridership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guelph (2A)</td>
<td>96 (including 5 minute transfer penalty)</td>
<td>30 mins (All Day)</td>
<td>Both Directions</td>
<td>310,219 711,640</td>
</tr>
<tr>
<td>Milton #1 (2009 Feasibility Study)</td>
<td>92.5</td>
<td>20 mins (AM) 20-30 mins (PM)</td>
<td>Peak Direction</td>
<td>389,100 715,700</td>
</tr>
<tr>
<td>Milton #2 (2014 Business Case)</td>
<td>93.5</td>
<td>30 mins (AM) 60 mins (Mid) 30-45 mins (PM) 60 mins (Eve)</td>
<td>Peak Direction (Both Directions between Cambridge and Milton)</td>
<td>192,000 376,200</td>
</tr>
<tr>
<td>Milton #3 (2014 Business Case)</td>
<td>95.5</td>
<td>30 mins (AM) 60 mins (PM)</td>
<td>Peak Direction</td>
<td>195,200 377,700</td>
</tr>
</tbody>
</table>

Revenue Comparison with the Milton Corridor

Annual revenue in 2031 is expected to be similar to that of the options explored in the 2009 and 2014 studies regarding a Milton Line extension, as shown in Table ES-5. Figures from past studies have been adjusted to match current fare policy using average fares from past editions of the Canadian Urban Transit Association (CUTA) Factbook on Conventional Operating Data (2017). Therefore, the annual revenue is comparable and in 2019 dollars.
Table ES-5 2031 Annual Review Comparison with Milton Corridor Options

<table>
<thead>
<tr>
<th>Scenario</th>
<th>2031 Annual Revenue (2019 Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Guelph (2A)</td>
<td>$4.0M</td>
</tr>
<tr>
<td>Milton #1 (2009 Feasibility Study)</td>
<td>$5.3M</td>
</tr>
<tr>
<td>Milton #2 (2014 Business Case)</td>
<td>$2.7M</td>
</tr>
<tr>
<td>Milton #3 (2014 Business Case)</td>
<td>$2.7M</td>
</tr>
</tbody>
</table>

**Summary & Next Steps**

The findings of the Study highlight the viability and comparative benefits of connecting Cambridge to the GO Rail network by way of the Fergus subdivision to Guelph, relative to providing a connection via the Milton Line extension. The analysis completed and documented in this Report concludes that the Guelph connection option has the potential to provide overall net benefits and reasonably affordable delivery, particularly in the longer term as ridership grows. This conclusion is based on reasonable progress being made by Metrolinx on improving mainline Kitchener GO train service to 2031, as laid out in the Kitchener GO Rail Service Expansion Initial Business Case Update (November 2019), and beyond.

The following summarizes the key benefits of connecting Cambridge to the GO network via the Fergus subdivision:

- Connect Cambridge (as one of the fastest growing centres in the Province) to the GTA;
- Improve economic growth and investment potential in Cambridge, creating access to skilled jobs and more affordable housing;
- Leverage local investments in the Stage 2 ION Rapid Transit network and improvements to the Fergus Subdivision sections in Cambridge, and create seamless integration with regional transit;
- Potential to facilitate the land use intensification and rail-oriented development prospects in north Cambridge on a faster timeline with development spurred by investment in regional transit;
- Provide relief for congestion along Highway 401, which currently does not have sufficient capacity to meet growing demand, and will continue to struggle to provide capacity once all widenings are completed between the Region and the GTA;
● Offer a high degree of deliverability of the service compared to the Milton extension; and
● Leverage investments made on the Kitchener GO line.

There are strategic benefits to supporting and investing in rail-oriented transit rather than bus or other road-based transit options. Rail service has the ability to shape travel behaviour in more substantial ways than bus service. It provides an opportunity to take significant vehicle users off road corridors, reducing congestion and creating environmental benefits through reduced air emissions. Rail investment creates other investment opportunities, as evidenced by the growth of new urban centres around GO Transit Stations across Southwestern Ontario. Cambridge has been disconnected from the GO Rail network, creating a gap in service that stakeholders across Waterloo Region have been working with the Province to address. Designating Cambridge’s future commuter rail service and candidate station is essential to connect regional centres and sub-centres and support intensification.

From a process perspective, the roadmap diagram in Figure ES-2 provides an overview of the potential directions to move the Study through subsequent stages of design and implementation to make Pinebush-Guelph rail service a reality. The roadmap focusses on five key areas of the rail service phasing which consist of:

- Design and Planning
- Contracting and Procurement
- Financial Planning and Considerations
- Legal and Business
- Stakeholder Engagement

These processes run in parallel, ensuring each aspect of the design and phasing of the project is accounted for and on schedule. The Region should establish a plan with Metrolinx and other stakeholders to determine the appropriate lead for each of the key processes in establishing this rail service. In addition, ongoing coordination with core stakeholders will need to be undertaken to assess local benefits and impacts of the service, and assess potential mitigation measures through future stages of the process.
Figure ES-2 Pinebush-Guelph Rail Service Design & Implementation Roadmap
1.0 Introduction

1.1 Study Background

The Region of Waterloo is one of the largest population and employment centres in Ontario, home to 585,500 residents and a workforce of 303,400 employees (Region of Waterloo Community Profile, 2018). Its location west of the Greater Toronto Area and on the Highway 401 corridor is within the commuter shed of Toronto as Canada's largest city, but is also far enough to be self-sustaining. The Region provides access to over 69,000 post-secondary students\(^2\), 150 research centres\(^3\), over 1,500 technology companies\(^4\), and a growing skilled labour force that makes it a key destination within the Greater Golden Horseshoe.

To support the continued growth of the Region, investments have been made in rapid transit. In 2019, the Region began service on its ION Rapid Transit corridor, connecting major hubs in Kitchener and Waterloo, with future plans to extend Stage 2 of the service to Cambridge. As a rapidly growing municipality with a skilled workforce, connections to regional rail from throughout the Region are an essential service to foster future growth potential and ability to attract labour from across the GTA.

The province, through Metrolinx, has also invested in direct connections to the Region with a terminus station on the Kitchener GO Line in Downtown Kitchener, offering peak hour and peak direction passenger rail service to and from Toronto’s Union Station. Ongoing improvements of this service will help connect the Region and solidify its economic importance as an innovation hub in the Greater Golden Horseshoe.

The City of Cambridge is located at the southern end of the Region, straddling Highway 401, and is not connected to the GO Rail or VIA Rail network. The growth of a diverse workforce and attraction to an affordable housing market has seen a rise in the skilled labour force and number of knowledge economy jobs in Cambridge over the past decade.

Cambridge has a population of nearly 137,000, and ease of access has made the city a sought after location for both population and employment growth, with plans to grow to nearly 176,000 by 2031\(^5\). Its location on the Highway 401 corridor provides economic benefits through access to labour and goods movements. However, population growth can also be seen as a constraint as increasing congestion may be a deterrent to continued growth. Without alternative modes of transportation services to and from Cambridge, maintaining the City’s competitive economic advantage within the Greater Golden Horseshoe will be a challenge. Hence, the

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expansion of the Regional Rail network, connecting the City to adjacent population centres, is of strategic importance.

In recognition of this, the Region of Waterloo has been working with the City of Cambridge to undertake studies on the feasibility and market potential for connecting Cambridge to GO Train service. A feasibility study to provide GO Rail service to Cambridge was first undertaken by the Region in 2009. The study explored two options to connect the City of Cambridge to Union Station via an expansion of GO Rail service. The first option looked at the extension of the Milton Line on the Canadian Pacific-owned railway corridor between the Milton GO Station and the City of Cambridge. The second option looked at the use of the Fergus Subdivision spur line between the City of Cambridge and the Guelph GO Station, using Diesel Multiple Units (DMUs) to connect Cambridge to the Kitchener line (with a transfer at the Guelph GO Station). This study identified the Milton extension as the preferred alternative, primarily due to the shorter travel time to Union Station and greater frequency of service on the Milton GO Line.

A follow-up business case study was undertaken in 2014 in conjunction with the City of Cambridge to further develop the rationale for this connection. Subsequently, the Milton extension was identified to have implementation challenges related to sharing the corridor with the railway owner, Canadian Pacific Railway (CP). This triggered the need to reconsider the potential to connect Cambridge to GO Rail service via the Fergus Subdivision to Guelph.

In addition, Provincial investments in the Kitchener corridor since 2014 provide a strong impetus for renewed consideration of the Guelph connection alternative. Two-way frequent service is expected to be implemented along the Kitchener corridor by 2025. Improved Kitchener rail services will be supported by new track additions, signal upgrades and the electrification of the corridor, which will improve travel times, increase frequency, and encourage more regional transit travel between communities along the corridor. Since the potential rail travel time between Cambridge and Guelph could be less than the existing travel time between Kitchener and Guelph, the case for this Fergus subdivision connection to a significantly enhanced Kitchener corridor service becomes even more compelling, particularly with a good integration of services at the Guelph Central GO Station.

While travel to Union Station is important, the new service through Guelph would also provide connections to additional markets and key destinations. For example, the Pearson Airport area is a major employment and travel market, and last-mile transit improvements such as Brampton’s planned Airport Züm service from Malton GO Station as well as the Union-Pearson Express (UP Express) service from Weston GO Station will improve connectivity to the second largest employment area in the GTA.

A Provincial commitment to provide two-way all-day service on the Kitchener corridor is based on the recognition of the strategic economic and growth potential along this corridor and in the Region of Waterloo. The Region of Waterloo and the City of Guelph have already established themselves as significant markets for post-secondary education, healthcare, high-tech industries and innovation. The expansion of ION Rapid Transit to Cambridge and a train connection between Cambridge and Guelph would help complete a regional rapid transit network and further transform a rapidly-growing area. This transformation, in conjunction with policy and market
forces currently acting around the emerging transit network of this dynamic region of Southern Ontario, can support the Region of Waterloo and the City of Cambridge’s goals for its growth and intensification areas.

The proposed service can provide Cambridge and south Kitchener residents with fast and reliable access to education and employment locations in Guelph and the GTA, while Cambridge employers and Conestoga College would benefit from improved connections for students and business travel, as well as access to a greater labour force from Guelph and the Greater Toronto Area.

The 2014 study highlighted the many potential benefits of using Diesel Multiple Unit (DMU) or Electric Multiple Unit (EMU) train technology to complement the use of traditional 10 or 12 car trains. Demonstrating the improved cost, performance, and energy efficiency of this technology may be a key element in the acceptance of the business case.

The Province would benefit from reduced road congestion (this rail transit corridor runs parallel to Highway 401); deferred or eliminated need for expansion to road infrastructure; reduced environmental impacts; enhanced productivity and economic activity, and support for the ‘Places to Grow’ intensification targets.

1.2 Scope and Purpose

The focus of this study is to assess the feasibility of connecting Cambridge to the Guelph Central GO Station via the Fergus Subdivision corridor, which is under ownership of the Canadian National Railway (CN). The Study examines the current and future market context in Cambridge for GO Rail service, potential sites for a GO Rail Station to be located, required corridor improvements and constructability, and the ridership and revenue generation potential of the service, as well as high-level costs for capital investment, operation and maintenance. The Metrolinx Business Case Guidance document was used to provide the general framework for the analysis and reporting.

The Study was conducted in two phases as described in the following section, and this Report provides a complete summary of the key findings from both phases, with a key focus on the Phase 2 work. A more detailed analysis of the Phase 1 technical work was provided in a separate report completed at the culmination of Phase 1 (May 2019). The Study was conducted in general alignment with the Metrolinx Business Case Manual Volume 2: Guidance (April 2019); however, this Report does not represent a full Initial Business Case, and further work would need to be completed to further explore aspects of the economic, financial, and deliverability and operations aspects of the analysis presented herein.
1.3 Overview of Study Approach

The Study was divided into two key phases, as follows:

- **Phase 1: High Level Feasibility Review**: The first phase of the study re-evaluated, at a high level, the feasibility of a passenger rail service between Cambridge and Union (via Guelph). Three service and ridership scenarios were presented, for the 2026, 2031 and 2041 horizon years. The year 2016 was used as the “base year” in the design of the service scenarios and ridership forecast. The scenarios were then compared with the preferred option recommended along the Milton corridor, based on findings from the 2014 Study which was structured to be easily adaptable to the Metrolinx Business Case process. The results of the Phase 1 Study indicated that there was a strong case for considering a connection between Cambridge and Guelph to facilitate GO connectivity to Union Station as a viable alternative to a Milton corridor connection, warranting closer examination of the high-level financial, economic, deliverability and operational considerations.

- **Phase 2: Detailed Operability and Constructability Review**: The second phase of the project provided a higher level of detailed assessment of the corridor, including the physical condition of the track on the Fergus subdivision, an assessment of vehicle technology, integration with other GO train services, and a more in-depth cost estimate and business case.

The Study assessed new station options in Cambridge, taking advantage of planned intensification of these communities and future connections to Phase 2 ION Rapid Transit services.
A Communications Strategy has been separately developed to convey key messages from the Phase 1 and Phase 2 Studies on quality of life, economic development and achieving broader policy objectives.
2.0 Connecting Cambridge to Regional Rail: Context and Rationale

2.1 Problem Statement

A new service to Cambridge that connects to the GTA via the City of Guelph would serve a number of key issues and opportunities, including:

- Filling a service gap in connecting this part of the Province to wider regional passenger rail and the GTA;
- Supporting more complete GO rail network connectivity and enhancing ridership and revenues on the Kitchener line;
- Supporting economic development and innovation in Cambridge by connecting it to a broader employee market;
- Supporting local Transit-Oriented Development (TOD) in Cambridge and Guelph; and
- Reducing auto-congestion and travel time to the GTA via Highway 401.

2.2 Key Drivers

The Study was underpinned by several factors relating to the local context in Cambridge, as well as the broader regional context extending to the GTA and connectivity to Union Station. As highlighted in Section 1.1, there are a number of considerations that create the impetus for the Study, including:

- The ridership potential for commuter market between Cambridge and the GTA via Guelph;
- Potential to leverage Provincial investments in service improvements and two-way all-day service to Union Station on the Kitchener line, and expected further improvements on the Kitchener line;
- Population growth and intensification potential in Cambridge, bolstered by ongoing planning studies and growth in demand in the residential market;
- Potential to leverage Region investments in the ION Rapid Transit network connecting area municipalities from Waterloo through to south Cambridge;
- Labour market potential in the science and technology sectors; and
- Housing affordability in Cambridge creating an attraction for skilled workers from the GTA.

This Study also focused on the post-secondary market within Cambridge (Conestoga campus), Guelph and along the Kitchener GO corridor. Adding these markets to the traditional Toronto Union Station commute enhances the business case for connecting Cambridge to Guelph, and further to Toronto. Furthermore, the rail network is being improved and connected to growing activity centres of interest; For example, Liberty Village and East Harbour in Toronto bring transit-oriented high-density jobs and talent hubs with direct access to the Kitchener GO Line services. Plans to develop a "Union Station West" around the Pearson Airport Area and its Regional Transit Centre has the potential to further drive ridership and connectivity on the Kitchener GO Line, which this study begins to consider in light of potential Cambridge-Guelph connectivity.
2.3 Constraints and Concurrent Initiatives Overview

In addition to the Key Drivers identified in Section 2.2, the following key constraints and interdependencies with concurrent initiatives were identified for the feasibility of a GO Station in Cambridge and service to the Guelph GO Station:

- The development of the Stations and the lands around it to support transit-oriented development would be dependent on market potential and partnership opportunities with non-Provincial partners;
- Metrolinx has recently completed an Initial Business Case for two-way all-day service on the Kitchener line, and the assumptions and ridership forecast developed for this Study are considered in this analysis;
- Service along the Fergus Subdivision into Guelph GO Station will require more detailed study to investigate the platform integration at the Guelph GO Station due to the space constraints at the station;
- The ridership catchment area for a Station in Cambridge may overlap with that of the planned Breslau Station in Kitchener; however, it is anticipated that the form and function of the two Stations would differ, with the Breslau Station catering more to commuters requiring parking space and the Cambridge Station being more oriented towards urban/transit based commuters. The status of the Breslau GO Station is also unknown at this time due to the recent Provincial direction towards a market-driven approach requiring municipalities and private sector partners to lead the development of new stations or redevelopment of existing stations;
- Station integration at the proposed Pinebush ION Rapid Transit Station would provide both Regional ION LRT service as well as GO Service to Guelph, and will need to be examined further in the context of station design and development potential to integrate mixed uses on the Station site; and
- Introducing passenger rail service on the Fergus Subdivision will increase train traffic within Guelph and potentially create constraints on the service frequency, particularly at the "Guelph-Junction" where there are space constraints for accommodating existing freight service.

2.4 Key Stakeholder Engagement

A number of key stakeholders were engaged as part of Phase 1 of the Study, including:

- Metrolinx;
- Ministry of Transportation (MTO);
- Canadian National Railway (CN)
- City of Cambridge;
- City of Guelph;
- Wellington County; and
- Guelph/Eramosa Township.

Regular progress meetings were held at key milestones during Phase 2 which were attended by Regional staff, as well as representatives of Metrolinx and the City of Cambridge. Additional meetings and teleconferences were held with other stakeholders to communicate the Study progress and findings, including Connect the
Corridor Coalition, an advocacy group working with regional partners to support improved rail service between the GTA and Waterloo Region.

The input received from stakeholders, particularly Metrolinx and the City of Cambridge, was invaluable towards the analysis of potential Station locations in Cambridge, and the broader feasibility assessment related to service scenarios, ridership, and the benefit-cost analysis.

2.5 Fergus Subdivision Corridor Today

The Fergus Subdivision is an approximately 48km length of rail spur in Southwestern Ontario, and was under a 21-year lease to the Goderich Exeter Railway (GEXR) from CN Rail until November 2018, when CN resumed ownership of the track and rail yards. The track is currently used for freight service by CN as well as GEXR, and requires upgrades in various locations, particularly the roadway at-grade crossings in Cambridge and Guelph.

The lands adjacent to the corridor are primarily employment-based between Cambridge and Guelph, particularly through the Township of Guelph-Eramosa. Industries located along the rail spur are actively utilizing it for freight transportation of goods and materials, and intend to continue doing so into the future. Within Cambridge and Guelph, sections of the corridor abut residential and commercial lands, particularly in proximity to Guelph Junction and the rail shunting yards located there.

A more complete review of the track condition and at-grade crossings is provided in Section 6.5 of this report.

2.6 Proposed Station in Cambridge – A Review

2.6.1 Methodology

The process for identifying criteria used to evaluate a potential end Station location in Cambridge involved:

- Developing a list of potential sites taking into account their proximity to the Rail Corridor, potential connection with Stage 2 ION LRT Stations, and existing land uses;
- Reviewing the list with project team stakeholders and selecting five short listed sites based on feedback;
- Identifying three types of Catchment Areas around each of the short-listed station locations, to aid in the analysis:
  - Walking (Population and Employment): 800 metre distance or 10-minute walk away from subject station (calculated using network analyst service coverage)
  - Transit: average speed of 20.79 km/hr at 15 minutes away from station (speed acquired from GRT)
  - Auto: 15 minutes in traffic at 6:45 PM on Tuesday-Thursday away from station using Google Maps traffic (first evening train arriving in Kitchener)
- Developing an evaluation criteria based on a review of Metrolinx Business Case Manual Volume 2: Guidance (Draft March 2018) to identify the key strategic and economic case criteria applicable to this project;
- Reviewing published Business Case examples to assess if there were additional variables that should be considered (such as the Cambridge to Milton GO Business Case and Breslau Initial Business Case);
- Providing consideration for the level of detail that is applicable at this point

The evaluation criteria were then applied to the short-listed stations, and the results presented to the project stakeholder team for review and discussion.

### 2.6.2 Candidate Locations

The station locations identified in Table 2-1 were short-listed as part of the evaluation process.

**Table 2-1 Short-Listed Station Candidate Locations**

<table>
<thead>
<tr>
<th>Station Option</th>
<th>Location Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Preston Alternative</td>
<td>At proposed ION Station north of Eagle St N, west of Speedsville Road</td>
</tr>
<tr>
<td>2: Pinebush ION Rapid Transit Station</td>
<td>At proposed ION Station Hespeler Road south of Pinebush/Eagle</td>
</tr>
<tr>
<td>3: Hespeler Village</td>
<td>Rail corridor at Guelph Avenue north of Hespeler Village downtown</td>
</tr>
<tr>
<td>4: Preston at Bishop</td>
<td>Rail corridor at Bishop St N close to Preston Downtown</td>
</tr>
<tr>
<td>5: Delta ION Station</td>
<td>At proposed ION Station north east of Hespeler Road and Dundas St N</td>
</tr>
</tbody>
</table>

Figure 2-1 identifies the locations of the five candidate stations, along with catchment areas for the Kitchener, Breslau, and Guelph GO Transit Stations for reference.
2.6.3 Evaluation of Candidate Locations

The evaluation results for all five candidate stations utilizing the criteria identified in Appendix A. A summary of the differentiating criteria that highlight the key advantages and disadvantages of each station is provided in Table 2-2.

Table 2-2 Candidate Station Evaluation Results

<table>
<thead>
<tr>
<th>Station</th>
<th>LRT Integration</th>
<th>Proximity to HWY 401</th>
<th>Travel time to Guelph</th>
<th>Relative Access to Residential Areas (Based on 2031 Population Forecast)</th>
<th>Relative Access to Employment Areas (Based on 2031 Employment Forecast)</th>
<th>Policy Alignment &amp; Urban Land Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Preston Alternative</td>
<td>Near</td>
<td>~ 2km</td>
<td>~17 minutes</td>
<td>Walking: Low Transit: Low Auto: Intermediate</td>
<td>Walking: Low Transit: High</td>
<td>Moderate; Long-term</td>
</tr>
<tr>
<td>2. Pinebush ION Rapid Transit Station</td>
<td>√</td>
<td>&lt; 1km</td>
<td>~17 minutes</td>
<td>Walking: Low Transit: High Auto: High</td>
<td>Walking: High Transit: High</td>
<td>High; Short-term</td>
</tr>
<tr>
<td>3. Hespeler Village</td>
<td>x</td>
<td>~ 3km</td>
<td>~13 minutes</td>
<td>Walking: Intermediate Transit: Low Auto: Low</td>
<td>Walking: Intermediate Transit: Low</td>
<td>Low; Long-term</td>
</tr>
</tbody>
</table>
2.6.4 Conclusion

Based on the high-level assessment undertaken, the Pinebush ION Rapid Transit Station location emerged as the preferred alternative for a future GO Station in Cambridge. The key reasons for this include:

- High connectivity based on the potential for integration with the future Phase 2 ION LRT Station and close proximity to Highway 401;
- Relatively short travel time to Guelph based on proposed service via the Fergus Subdivision (See Chapter 4 for more details), allowing for the ability to make use of the Regional Rail network through the Kitchener line;
- Ease of access to residential areas and amenities based on 2031 population forecast, which would improve for walking through planned active transportation improvements to the area;
- Ease of access to employment, innovation, and prosperity opportunities aided by integration with the ION LRT route;
- Limited space for parking, but as part of any transit-oriented development some structured parking could be explored; and
- High short-term potential for intensification and redevelopment based on the policy review and anticipated direction of the Hespeler Road Corridor Secondary Plan.

Figure 2-2 provides an overview of the existing conditions and catchment area for the Pinebush ION candidate station.
Cambridge to Union Rail Feasibility Study

Pinebush ION Station Catchment Areas

Figure 2-2

- Cambridge Station Alternative
- Walking Catchment (800 Metres)
- Transit Catchment (21 km/hrs)
- Auto Catchment (Outbound Weekday 6:45 PM)
- GO Train Station
- GO Rail Alignment
- ION LRT Alignment
- Road
- Existing Rail Track
- Municipal Boundary

Map Drawing Information: Scale 1:XXX
DATA PROVIDED BY MNR
REGION OF WATERLOO, OPEN DATA

Map Created By: S W
Map Checked By: DK
Map Projection: NAD 1983 UTM Zone 17N
File Location: \DILLON.CA\DILLON DFS\LONDON\LONDON CAD\GIS\VISUAL COMMUNICATIONS DRAWING TEMPLATES\BEIGE - 11 X17 LANDSCAPE - LEGEND RIGHT.MXD

Project: 18-8403
STATUS: DRAFT
DATE: 06/24/11
3.0 Fergus Subdivision Service Scenarios

3.1 Background and Context

The level of ridership for the Cambridge-Guelph service, travelling along the Fergus Subdivision corridor, will be largely driven by the competitiveness of the Kitchener line services which will link Cambridge to not only Guelph and Toronto Union Station, but also to other intermediate trip markets. The key would be to make rail competitive with, or more attractive than, other modes of travel. Today, GO rail services linking Guelph and Toronto are not supportive of an efficient commute; however, there is a great potential for improved service speeds, frequencies, and reliability.

Given the extreme and growing levels of congestion on Highway 401, significant population and employment growth projections within Cambridge and the Region of Waterloo, as well as superior rail service seen in comparable urban areas in Ontario, it is expected that improvements to rail infrastructure along the Fergus Subdivision has strong potential to provide an efficient passenger service connecting Cambridge to Guelph and Toronto. The potential to boost labour mobility between Cambridge and the GTA would provide key benefits in supporting the growth of the local economy in Waterloo Region, as well as facilitating life transitions for more senior residents in the GTA looking for a lifestyle change while also maintaining social and family connections across the GTA which are connected by fast, efficient transit service.

In 2015, substantial improvements to the Kitchener rail corridor were considered by the Province of Ontario, albeit at a substantial capital cost. In November 2019, The Kitchener GO Rail Service Expansion Initial Business Case (IBC) Update was published, which suggests comprehensive conventional rail operations and infrastructure improvements to the GO Kitchener service. The Metrolinx Business Case was approved by the Metrolinx Board, identifying a preferred concept of working within the existing Kitchener GO Corridor to expand infrastructure and rail service.

Further analysis considered in this report that dovetails with the 2019 Metrolinx Kitchener IBC Update, and goes further to consider the role of VIA Rail in the corridor, identifies that reasonably rapid trip times on the Kitchener rail corridor can be achieved through incremental improvements to conventional rail equipment, proper utilization of track (i.e. optimization of service scheduling and track layout) and an evolution of VIA Rail service. The projected result would be three tiers of passenger service, two provided by GO, and one provided by VIA Rail, in addition to the Union Pearson Express service elsewhere on the Kitchener corridor.

In assuming incremental speed improvements within the Kitchener rail corridor, the proposed journey time used in this Study was considered reasonable based on the comparison to similar networks both locally and internationally, and utilizing the professional judgement of the technical team. The journey time is considered achievable for rail service linking Cambridge, Guelph and Toronto over the next ten to twenty years. Regular VIA services combined with GO services to the outer areas of the GO Kitchener line, including Guelph, would enable rapid travel and reasonable frequency of service to Toronto’s Union Station – the primary market. There are
ridership markets to other stops on the Kitchener Corridor – such as Pearson Airport and the employment lands adjacent to Pearson Airport that are harder to predict because of current low ridership but are expected to be more significant in the future. In the future, it is possible that Brampton – another mid-line trip market – may also be a notable market for its growing post-secondary opportunities. Guelph is also a potential notable market for its connection to post-secondary opportunities and other employment activity.

This chapter reviews the analysis of various service scenarios of the Fergus Subdivision which factor in the Kitchener line improvements and provides the rationale for the incremental travel time improvements along the corridor. The travel times used in this Study are based on current schedules of the GO Kitchener line (November 2019). Trip travel times improve considerably across the horizon years as connections from Brampton to Union Station get progressively faster.

It is worth noting that GO service by Metrolinx increased significantly as of August 2019. More GO train trips were added to the Lakeshore East, Lakeshore West and Kitchener lines, with new or extended trips. In particular, GO service on the Kitchener line increased with extended service – a new westbound express train added in the evening, and the 6PM train adjusted to operate as an express train (with no stops between Union and Bramalea Stations). Additional bidirectional weekday and evening services were added for customers in Scarborough, Markham, Etobicoke, Brampton, Georgetown, Acton, Guelph and Kitchener. Improved passenger rail service across the Greater Golden Horseshoe creates further anticipation and expectation for a rail connection linking Cambridge to the rest of the Greater Golden Horseshoe rail network.

3.2 Methodology and Assumptions

3.2.1 Methodology

In Phase 1 of the Study, basic service scenarios for the Cambridge-Guelph line were developed to estimate train scheduling, travel times, and frequency of travel in each direction. Additionally, a plausible service scenario on the Kitchener Corridor was developed linking the Pinebush ION Rapid Transit Station and Toronto, since Toronto is such an important travel market. Early thinking was developed to consider the options of single-track and double track lines between Guelph and Cambridge.

In Phase 2, these potential service scenarios for the Cambridge-Guelph line were further developed to improve the understanding of capital and operating costs, and service plans. A number of service plans were developed and analyzed to help identify the most effective combination of service, capital investment, and ridership. External influences are considered, such as the need for integration and compliance of infrastructure and service as described in the 2019 Metrolinx Kitchener GO Rail Service Expansion, Initial Business Case Update and the need for maintaining freight service along this subdivision.

The Cambridge-Guelph service would have a direct connection to the GO Kitchener line rail service. From discussions with Metrolinx, interpretation of available GO Kitchener line publications and professional opinion on the provision of an improved future Via Rail service in the Kitchener corridor in addition to further GO service evolution, a likely future service plan for the Kitchener GO Corridor can be
constructed. For clarity, there is likely to be a Union-Pearson service stop at future Woodbine Station, which will provide interchange between Kitchener trains from west of Toronto and trains destined to/from Pearson Airport. While Pearson Airport has articulated a conceptual vision for an airport transit hub referred to as ‘Union Station West’, until plans are clear as to what (if any) changes would be made to the rail network, the future Woodbine Station transfer is the most appropriate rail network plan for the purposes of this report. This is illustrated in Figure 3-1, showing the five future services along the future Kitchener line:

- VIA Limited stopping;
- GO Express for all outer stops;
- GO All-stopping for all inner stops;
- GO Express (Union-Pearson Express) Union-Pearson route;
- GO All-stopping (Union-Pearson with more stops) Union-Pearson route; and
- Cambridge-Guelph line with interchange at Guelph.

Figure 3-1 Illustration of plausible future service on the Kitchener line and a future connection from Guelph to Cambridge on the proposed Cambridge-Guelph line.

In Phase 1, a model was created to estimate travel times from the Pinebush ION Rapid Transit Station to Union Station given the suggested Cambridge-Guelph passenger rail service integrating with the GO Kitchener line. In order to develop reasonable speeds and trip times, two techniques were applied. First, travel times were calculated for the Kitchener line and Fergus Subdivision line for the years 2026, 2031, and 2041 using reasonable rates of improvement for trip segments, applied to the schedule for services in 2018. To provide confidence that the calculated journey times made sense, resultant speeds for trip segments were then compared to reasonable service examples currently in operation within the GGH GO Train network. The goal was to get to a level of confidence that speeds over conventional
trackage and between urban stations as suggested for 2026, 2031, and 2041 were reasonable. The reference services to identify trip times included:

- Lakeshore GO Lines – Toronto Region, Canada;
- Lakeshore West: Peak AM, Eastbound (Aldershot to Union), all-stopping and express service times;
- Lakeshore East: Peak AM, Westbound (Oshawa to Union), all-stopping and express service times;
- UP Express – Toronto Region, Canada;
- Peak AM, Eastbound (Pearson to Union), all-stopping service;
- Great Western Mainline serving London Paddington Station – London Area, UK; and
- Peak AM, Eastbound (Hanborough to London Paddington), all-stopping and express service times.

The travel times determined from Phase 1 were verified and refined in Phase 2 with an OpenTrack\(^6\) rail-train software simulation of the Kitchener corridor. The OpenTrack rail-train software simulation indicated that very small adjustments to the Phase 1 trips speeds were required, giving good confidence that a) the Phase 1 assumptions were well developed, and b) that Phase 2 trip times being employed here are very reasonable and represent an appropriate and achievable service. Significant improvements to the track in particular, could yield faster journey times than those presented here; the presented journey times are considered achievable based on a conservative, phased approach to improvements to the rail corridor and equipment.

Total trip times from the Pinebush ION Rapid Transit Station to Guelph and Union Station are presented in Table 3-1. Trip times get faster over the years due to service specification, service improvements, track improvements and use of electrified rolling stock equipment on the Kitchener corridor. A range of fast and faster trip times are expressed for 2041 as it is assumed that an express and “super-express” train (2041 upgraded VIA Rail train) pattern to run by 2041, not unlike the way train trips operated by GO Express and VIA Rail run today. Trip times for analysis here include a 10-minutes interchange for those making a transfer at the Guelph Central Station. Ideally, service solutions will be developed that can reduce the interchange to less than 10 minutes; however, at this stage of analysis 10 minutes is a typical and safe interchange time to be using. Subsequent analysis should begin to break out perceived and actual times of various components of the journey since the interchange time between trains may have a less onerous actual time, but equally onerous perceived time\(^7\). The Cambridge-Guelph travel time is assumed as 16-

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\(^6\) OpenTrack was developed by the Swiss Federal Institute of Technology, as a simulation software designed to analyse a range of railway systems including High Speed Rail, commuter rail, and light rail. The software is widely used across the industry to support system design for railway infrastructure, including capacity analysis, timetable construction, calculation of power and energy consumption, and calculation of minimum headways.

\(^7\) Perceived trip times versus actual trip times are useful for further understanding how people will use a rail service; perceived times can identify where people are particularly inconvenienced by a service.
minutes average time for all rail service Options that were examined in Phase 2 of the Study, and are discussed further in Section 3.2.

Table 3-1 Total All-stop trip times from the Pinebush ION Rapid Transit Station to Guelph and Union Station

<table>
<thead>
<tr>
<th>Station</th>
<th>2026 All-stopping Time</th>
<th>2026 Express Time</th>
<th>2031 All-stopping Time</th>
<th>2031 Express Time</th>
<th>2041 All-stopping Time</th>
<th>2041 Express Time</th>
<th>VIA Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>ION Pinebush-Guelph Central Station</td>
<td>16 min</td>
<td>16 min</td>
<td>16 min</td>
<td>16 min</td>
<td>16 min</td>
<td>16 min</td>
<td></td>
</tr>
<tr>
<td>ION Pinebush-Union Station</td>
<td>109 min</td>
<td>102 min</td>
<td>101 min</td>
<td>95 min</td>
<td>93 min</td>
<td>88 min</td>
<td>86 min</td>
</tr>
</tbody>
</table>

Note: The interchange time of 10-minutes is included in the total travel time from the Pinebush ION Rapid Transit Station to Union Station.

3.1.1 Assumptions

Trips to mid-line stations were based on transit mode share, growth in population and employment, and future changes to station area characteristics. The population projections were provided by the Region of Waterloo (2018), and station area characteristics identified based on the Draft Hespeler Road Corridor Secondary Plan. The Transportation Tomorrow Survey (TTS) 2018 also provided a key data source for current trips between the Region and other zones along the Kitchener Line. The Trips to Union Station were calculated using the existing trip rate generated from Kitchener GO Station, which is believed to be conservative for future projections given several factors, including:

- Capacity limits to the regional highway network even with expansion;
- Urban region agglomeration (including higher degrees of specialization and long-distance commuting to match labour and jobs efficiently); and
- Reasonable expectations for increased mode share with faster and reasonable commute times by rail.

Changing trains is a good example where perceived times are longer than actual times. For the purposes of this analysis, where perceived and actual times have not yet been identified, 10 minutes is an appropriate interchange time to include in the analysis.
2026 Horizon - Opening Day

For the purposes of the Study, an assumed 2026 opening day service was based on an extrapolation of today’s service from current GO and (relatively limited) VIA schedules on the Kitchener corridor; however, benefitting from Brampton-Toronto infrastructure and service improvements as per GO Expansion plans. This phase initially assumed a 20% journey time reduction for GO all-stopping service links and a 10% journey time reduction for GO express service links attributed to service specification, infrastructure and equipment improvements (as per GO Expansion as presented in the Metrolinx GO Expansion Full Business Case). Trip times were modified slightly as a result of the OpenTrack rail-train software simulation in Phase 2. VIA train service would be very limited, similar to current conditions. In 2026, it is assumed that the Cambridge-Guelph rail service would operate on weekday peak hours to meet GO Trains at Guelph; while buses would operate on weekday off-peak hours and all-day during weekends.

2031 Horizon – Two-way All-Day Service

The 2031 service builds off foundational GO Expansion plans assumed to be in service, with assumed additional track and service enhancements between Brampton and Kitchener to realize a two-way all-day service between Kitchener and Union Station. The added frequency and all-day nature of the rail service assumed by 2031 is a significant upgrade from 2026, including additional speed enhancements. Both all-stopping and express GO service links are a further 10% faster than 2026, attributed to track, signal system, equipment and operational improvements. Trip times were modified slightly as a result of the OpenTrack rail-service software simulation in Phase 2. In 2031, it is assumed that the Cambridge-Guelph rail service will operate all-day on weekdays to meet trains at Guelph; while a bus service would operate on weekends all-day.

2041 Horizon – Build-out

The 2041 horizon builds on the 2031 service scenario, by considering additional speed enhancements that will result in journey times consistent with other non-high-speed routes seen in other large metro areas with reasonable rail networks. Both GO all-stopping and express service links are a further 10% faster than 2031, attributed to further track, operation and rolling stock improvements. Trip times were modified slightly as a result of the OpenTrack rail-train software simulation in Phase 2. VIA rail service is frequent, bringing a reasonably fast GO service and even faster VIA service connecting Kitchener, Guelph, and Toronto in 2041. It is assumed that the Cambridge-Guelph rail service will operate all-day on weekdays and weekends, thus, no bus service will be required in 2041.

3.2 Service Scenario Development

Three main operating scenarios were developed for the Cambridge-Guelph line with two different track infrastructure specification levels for a total of 6 operating scenarios. The Options offer bidirectional service that will operate between Guelph Central Station and the Pinebush ION Rapid Transit Station. Option 1 recommends a single-track layout, while Option 2 recommends single track with a siding to allow for train meets in the middle of the line and twice the frequency. Option 3 requires a
double track layout along the length of the Cambridge-Guelph service corridor to enable highly reliable and high-frequency service.

Each of the three operating scenarios offers two sub-options, denoted as ‘A’ and ‘B’. Sub-option A’s allows service at a recommended speed of 75 km/h, while sub-option B’s offer service at 85 km/h, enabling more frequent service or fewer required operating trainsets. It is expected that operation at higher speeds would require a potential upgrade of track infrastructure in certain sections (from Class 3 to Class 4), adjustments to curve geometry in horizontal curves, higher speed turnouts through junction locations, and the potential flattening of existing horizontal curves along the track. Any increases to speed of service would require further examination to ensure adequate braking distance, i.e. distance between rail signals may need to be adjusted.

The Cambridge-Guelph service scenarios are summarized in Table 3-2.

**Table 3-2 Cambridge-Guelph Rail Service Options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Track Type</th>
<th>Train Quantity</th>
<th>Train Speed</th>
<th>Travel Time (one-way)</th>
<th>Dwell Time</th>
<th>Headway Time</th>
<th>Frequency (train per hour)</th>
<th>Cost Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option 1A</strong></td>
<td>Single track</td>
<td>1 running, 1 spare</td>
<td>75 km/h</td>
<td>16 min</td>
<td>14 min</td>
<td>60 min</td>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Option 1B</strong></td>
<td>Single track</td>
<td>1 running, 1 spare</td>
<td>85 km/h</td>
<td>14.5 min</td>
<td>8 min</td>
<td>45 min</td>
<td>1.25</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Option 2A</strong></td>
<td>Single track with a siding</td>
<td>2 running, 1 spare</td>
<td>75 km/h</td>
<td>17 min</td>
<td>13 min</td>
<td>30 min</td>
<td>2</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Option 2B</strong></td>
<td>Single track with a siding</td>
<td>2 running, 1 spare</td>
<td>85 km/h</td>
<td>15.5 min</td>
<td>7 min</td>
<td>22.5 min</td>
<td>2</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Option 3A</strong></td>
<td>Double track</td>
<td>4 running, 1 spare</td>
<td>75 km/h</td>
<td>16 min</td>
<td>14 min</td>
<td>15 min</td>
<td>4</td>
<td>High</td>
</tr>
<tr>
<td><strong>Option 3B</strong></td>
<td>Double track</td>
<td>3 running, 1 spare</td>
<td>85 km/h</td>
<td>14.5 min</td>
<td>8 min</td>
<td>15 min</td>
<td>4</td>
<td>High</td>
</tr>
</tbody>
</table>
3.2.2 Options 1A and 1B

Figure 3-2 Cambridge-Guelph line Track Infrastructure Improvements for Options 1A and 1B

Option 1A and 1B for connecting the Pinebush ION Rapid Transit Station to Guelph Central Station are conceptualized in Figure 3-2. Option 1A represents the minimum service level and the smallest infrastructure build out, where only a single-track layout is required. This service level consists of one train set running at 75 km/h cycling between the two stations at a frequency of 1-hour. Since there is only one train set on the system at a given time, only single track is required in all locations with no provisions for a train meet. In this situation, the travel time (one way) is 16-minutes, with a headway time of 60-minutes.

Option 1B requires similar track infrastructure, however runs at 85 km/h. This would reduce the travel time to 14.5-minutes, and increase the headway time to 45-minutes, with a service frequency of 1.25 trains per hour. There would be only one train operating on the track at a time; therefore, no provisions would be required for passing trains.

3.2.3 Options 2A and 2B

Figure 3-3 Cambridge-Guelph line Track Infrastructure Improvements for Options 2A and 2B

Option 2A and 2B for connecting the Pinebush ION Rapid Transit Station to Guelph Central Station are conceptualized in Figure 3-3. Option 2A requires a single-track layout with rail siding in certain sections, and offers a headway time of 30-minutes,
with a service frequency of 2 trains per hour in each direction at a speed of 75 km/h. Two trainsets would be required; therefore, a train meet will occur at some point along the corridor. Rail siding must be provided to allow trains to pass one another. This train meet would increase the service run time to 17-minutes, accounting for slower speeds through switches and possible delays incurred by missed train meets.

Option 2B utilizes the same track layout, however would offer service at 85 km/h. In turn, the Cambridge-Guelph trip time would be reduced to 15.5-minutes. This allows for the headway to be increased to 22.5-minutes, with a service frequency of two trains per hour in both directions. Two running trainsets would be required, as well as a rail siding to accommodate train meets.

### 3.2.4 Options 3A and 3B

**Figure 3-4 Cambridge-Guelph line Track Infrastructure Improvements for Option 3A and 3B**

Option 3A and 3B for connecting the Pinebush ION Rapid Transit Station to Guelph Central Station are conceptualized in Figure 3-4. Option 3A requires a double track layout and steps up service travel time to 16-minutes, with a frequency of 4 trains per hour running in each direction at 75 km/h. To accommodate this service level, four train sets are required. This requires the entire length of the Cambridge-Guelph corridor to be double tracked for reliable operation. This removes the need for a train meet, therefore the headway time is 15-minutes.

Option 3B also runs on a double track at a speed of 85 km/h, which reduces the runtime to 14.5-minutes. This faster operation means that one train set can be eliminated, allowing for a 15-minute service headway, operating with only three trainsets. Some of the major obstacles for providing service Scenario 3A and 3B are discussed in Section 3.3.

### 3.3 Phasing and Delivery

The phasing and delivery of the Cambridge-Guelph rail service are subject to further work as the Study progresses.

At the current stage of the Cambridge feasibility study, the following early principles are recommended:

- Service on the Cambridge-Guelph route would ideally be introduced concurrent with improved service speeds and frequency on the Kitchener Corridor;
• ‘Train meets’ would be timed for dominant travel flows to minimize interchange time between services, even if relatively infrequent services were initially employed; and
• Delivery time will depend on funding decisions and required time to complete environmental assessments, other studies, and completion of engineering and construction. However, it is understood that there are track improvements required on the Kitchener corridor. If the Cambridge-Guelph service were advanced concurrently with the Kitchener GO line improvements, it is conceivable that the Cambridge-Guelph service could be developed and delivered concurrently with the Kitchener line improvements.

Consistent with best practice and practical advice for advancing large projects, a preferred service option is not presented at this time – further investigation, design, and planning work should “hold the door open” for a number of scenarios so that the project may be optimized through a number of delivery models, and/or as new information becomes available. Nevertheless, given Options 1A, 1B, 2A, and 2B are predominantly single track, these would make sense to implement in the first phase in conjunction with Kitchener service improvements. This phased approach could also be more feasible than directly implementing Options 3A and 3B, given the intent of stakeholders and CN Rail to continue to integrate freight services.

The delivery time may further vary based on the procurement model, permitting regime and requirements, and lead time for construction.

3.4 Ridership Forecasting

3.4.1 Methodology

To reflect minor changes in service assumptions during Phase 2, Phase 1 ridership forecasting was updated. This section briefly outlines the changes to the ridership forecast. The full details of the ridership forecast, including methodology, are available in Appendix C. While the methodology remains similar to Phase 1, the underlying travel time and frequency assumptions have been updated to reflect several different scenarios outlined in Table 3-3.
Table 3-3 Service Scenarios for Ridership Forecasting

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Travel Time</th>
<th>Headway Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>16 min</td>
<td>60 min</td>
</tr>
<tr>
<td>1B</td>
<td>14.5 min</td>
<td>45 min</td>
</tr>
<tr>
<td>2A</td>
<td>17 min</td>
<td>30 min</td>
</tr>
<tr>
<td>2B</td>
<td>15.5 min</td>
<td>22.5 min</td>
</tr>
<tr>
<td>3A</td>
<td>16 min</td>
<td>15 min</td>
</tr>
<tr>
<td>3B</td>
<td>14.5 min</td>
<td>15 min</td>
</tr>
</tbody>
</table>

Ridership forecasts for the proposed Cambridge GO Station to Toronto Union Station (via Guelph) corridor were completed using a similar methodology to that used in the 2009 Cambridge to Union Feasibility Study and follow-up 2014 Cambridge to Milton Passenger Rail Business Case and Implementation Strategy. The forecasts were based on ridership to / from the proposed Pinebush ION Rapid Transit Station in Cambridge and each of the stations along the Kitchener line between the Guelph GO Station and Union Station.

The forecasts below represent the total ridership on the future Cambridge-Guelph line, not the increase in GO Transit ridership. A small amount of this ridership may come from GO Rail trips that currently begin or terminate at the Milton GO or Guelph GO Station. However, data from the 2016 Transportation Tomorrow Survey estimates only 57 daily GO Rail trips originating in Cambridge, so the impact is expected to be minimal.

Ridership forecasting was performed in two stages:

1) Passenger trip rates from comparable GO Transit Stations were extracted from the 2017 GO Rail Passenger Survey and relevant rates were applied to the proposed Pinebush ION Rapid Transit Station and associated catchment area population.
2) Forecasts for ridership to mid-line stations were based on their ability to attract significantly higher ridership in the future due to the changing nature of these stations over the next 30 years. To reflect this, a transit mode share target based on the potential of each station to attract transit ridership over time was applied to each of the mid-line stations on the Kitchener line.

A ridership forecast was conducted for each of the six scenarios outlined in Table 3-3 to show the sensitivity of the ridership to factors such as travel time and frequency.
Given the high level nature of this forecast and the variability in the trip rate per population at different GO Stations, a “Low” and a “High” estimate was also calculated for each scenario. The low estimates assume that this station will have a similar travel demand (adjusted for frequency and speed) to the Kitchener GO Station, while the high trip rate assumes travel demand 50% higher than Guelph GO Station.

The current travel times for the Kitchener and Guelph GO Stations were used as proxies for the ridership modelling as they have similar characteristics to the proposed Cambridge Station, including geography, accessibility by multiple travel modes, and limited parking availability. There is a high variability between the high and low ridership forecasts and different scenarios. A preferred scenario is expected to emerge from these alternatives, narrowing the range of the forecast in the future.

The 50% increase in ridership for the high scenario represents the potential for much higher ridership demand due to new technologies such as autonomous vehicles that could dramatically increase trip rates for commuter rail service in the future. Furthermore, there is significant variation in trip rates at stations across the GO Network, some with much higher trip rates than those used in this study. The 50% figure is also the difference between the “Low” and “High” estimates in the 2014 Business Case for GO Train service between Cambridge and Milton. This allows for a more consistent comparison between the proposed GO Rail Service between Cambridge and Milton (2014 report) and between Cambridge and Guelph.

The existing and future service frequency and speed of the Kitchener line greatly impacts the ridership potential of the proposed Cambridge-Guelph connection. Many passengers using this new connection would transfer to the Kitchener line to reach other destinations. This study assumes that the Kitchener line will have a VIA or GO Train every 15 minutes all day on weekdays in all future horizon years and the Cambridge-Guelph train will always connect to the Kitchener train at Guelph Station. This assumption was made so that each Cambridge-Guelph train would connect with a Union bound train on the Kitchener line.

While the study was being conducted, the Kitchener GO Rail Service Expansion Initial Business Case Update (IBC) was released by Metrolinx in November 2019. The IBC assumed slightly slower travel times and lower frequency on the Kitchener line including 30-minute service during the peak hours and hourly service in the off peak periods. Changing this study’s assumptions to the Kitchener line service pattern described in the IBC would have only minor impacts on scenarios 1A, 1B, and 2A. However, scenarios 2B, 3A, and 3B would have much lower ridership since customers would not be able to connect with a train on the Kitchener line to Union Station on every trip. Therefore, these scenarios require more frequent service on the Kitchener line to meet their ridership potential.

**Appendix C** provides further details on the methodologies and assumptions used to develop the ridership forecast.
3.4.2 Results

Figure 3-5 and Figure 3-6 display the annual ridership estimates in 2026, 2031, and 2041 for each of the six service scenarios. It should be noted that the substantial difference between the low and high scenarios is due to a difference in the assumptions described in detail in Appendix C. Furthermore, the scenarios with 15-minute headways on the Cambridge-Guelph Line have a much higher projected ridership than those with less frequent service. These scenarios, however, require a higher level of investment as described in Section 6.2, and would require the Kitchener line to operate every 15 minutes.

The forecasted ridership also grows substantially in the 2031 and 2041 horizon years, as the Kitchener line service is assumed to travel faster and operate all day by 2041.

![Annual Ridership (Low Estimates)](image_url)

Figure 3-5 Annual Ridership Estimates by Scenario (Low)
Within the low estimates, Scenario 1A and 1B produce a range of annual ridership levels for 2026 between approximately 84,000 and 88,000, climbing to between 415,000 and 439,000 by 2041. Scenario 2A and 2B annual ridership values range between approximately 107,000 and 117,000 in 2026, rising to between 495,000 to 538,000 by 2041 respectively. Scenario 3A and 3B offer a modest increase in annual ridership for 2026 ranging from 148,000 to 151,000, with a more significant increase by 2041 ranging from 690,000 to 708,000 annual riders. The high estimates present an order of magnitude increase on annual ridership, more than doubling the low estimate values. For instance, the Scenario 2A values increase from approximately 275,000 annual riders in 2026 to 1.15 million riders in 2041, while the Scenario 3A estimates range from 385,000 in 2026 to 1.62 million riders in 2041.

Given the 30-minute peak hour frequency described in the Kitchener IBC released by Metrolinx, Scenario 2A is the most frequent scenario for the Cambridge-Guelph connection that gives each Cambridge train an opportunity to connect to a train on the Kitchener line. Table 3-4 provides a summary of the daily ridership forecast results for the outbound (Cambridge to Toronto) and inbound (Toronto to Cambridge) journey directions assuming Scenario 2A. For further details on all service scenarios, see Appendix C.
Table 3-4 Daily Weekday Ridership Forecast (Scenario 2A)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>SCENARIO</th>
<th>TRIPS</th>
<th>IN-BOUND</th>
<th>OUT-BOUND</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>AM PEAK</td>
<td>MID-DAY</td>
</tr>
<tr>
<td>2026</td>
<td>LOW</td>
<td>Mid-Line Trips</td>
<td>21</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trips to/from Union</td>
<td>150</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Trips</td>
<td>170</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>HIGH</td>
<td>Mid-Line Trips</td>
<td>42</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trips to/from Union</td>
<td>383</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Trips</td>
<td>425</td>
<td>N/A</td>
</tr>
<tr>
<td>2031</td>
<td>LOW</td>
<td>Mid-Line Trips</td>
<td>77</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trips to/from Union</td>
<td>198</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Trips</td>
<td>275</td>
<td>119</td>
</tr>
<tr>
<td></td>
<td>HIGH</td>
<td>Mid-Line Trips</td>
<td>120</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trips to/from Union</td>
<td>507</td>
<td>161</td>
</tr>
<tr>
<td>YEAR</td>
<td>SCENARIO</td>
<td>TRIPS</td>
<td>IN-BOUND</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>------------------------</td>
<td>----------</td>
<td>----------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AM PEAK</td>
<td>MID-DAY</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Trips</td>
<td>627</td>
<td>253</td>
</tr>
<tr>
<td>2041</td>
<td>LOW</td>
<td>Mid-Line Trips</td>
<td>128</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trips to/from Union</td>
<td>265</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Trips</td>
<td>393</td>
<td>183</td>
</tr>
<tr>
<td></td>
<td>HIGH</td>
<td>Mid-Line Trips</td>
<td>215</td>
<td>177</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trips to/from Union</td>
<td>678</td>
<td>216</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Trips</td>
<td>892</td>
<td>392</td>
</tr>
</tbody>
</table>
Currently, 95% of all trips on the Kitchener line are destined for Union Station in the morning Toronto-bound direction. This is a typical travel pattern for other GO Rail lines in the network, and would be expected to continue for Cambridge-originating riders as well. Trips from Cambridge to Mid-Line stations are expected to increase over time. This takes into account the growing importance of mid-line stations as destination stations on the network with the emergence of mobility hubs, transit-oriented developments around GO stations, and growing employment. In particular, the emergence of on-demand transit solutions, particularly with vehicle automation, will increase the potential to solve the ‘last-mile’ issues around existing GO Stations and allow passengers to access employment, education and recreational opportunities within a short distance to each destination station.

Guelph Station is of particular significance to the Cambridge GO Train extension. With the introduction of two-way all-day GO Rail service on the Kitchener line (providing higher frequency connections at Guelph for onward-bound riders) and the added service between Cambridge and Guelph, travel demand between these two stations is anticipated to account for 30-39% of the total travel demand to/from Cambridge on the Rail corridor in 2041. This signifies the strategic importance of this rail connection in connecting the innovation and education hub around the Region of Waterloo and the City of Guelph. Union Station would remain the most popular origin/destination accounting for 55% to 64% of all daily trips associated with the Cambridge GO Station.
4.0 **Strategic Case**

4.1 **Overview and Evaluation**

The Strategic Case for implementing passenger rail service connecting Cambridge to GO Rail Service and Union Station along the Fergus Subdivision is designed around five key goals, building on the Vision and Purpose outlined in Chapter 1:

- Goal 1: Complete the Network in Southwest Ontario
- Goal 2: Leverage Transit Investments on the Kitchener line and the Region of Waterloo ION Network
- Goal 3: Support Economic Development in Southwest Ontario
- Goal 4: Offer a High Degree of Deliverability
- Goal 5: Support Local Transit Oriented Development in Cambridge and Guelph

Each of these goals is discussed in the following section.

4.1.1 **Goal 1: Complete a High Quality Commuter Rail Network in Southwest Ontario**

The Region of Waterloo is currently connected to GO Rail service via the Kitchener VIA/GO Rail Station located in Downtown Kitchener, which provides convenient access to residents of Kitchener and Waterloo. Cambridge does not currently have rail service, and is currently only directly connected to Union Station by Greyhound service (Figure 4-1). With a population of 130,000 and growing, Cambridge is the only municipality in Ontario with a population of over 100,000 without passenger rail service. This critical gap in the regional rail network can be closed by creating a connection to the GO Kitchener Line or the GO Milton Line.

As noted previously, the Milton option is currently impeded by the technical and operational challenges of connecting to the CP-owned corridor used by the Milton Line. In addition, connecting to the Kitchener line offers greater potential for improved travel time savings into the future as improvements to commuter service are implemented between Kitchener and Union Station. While the potential to connect to Milton may continue to be explored in the future, a connection to Guelph presents a more immediately viable alternative to providing passenger rail service for Cambridge residents.

When compared with all other potential transportation options between Cambridge and Union Station (see Figure 4-1), the Fergus Subdivision offers a highly attractive and viable opportunity to support a more complete inter-regional rail and commuter transit network linking Central Ontario, the
Toronto Region and the Region of Waterloo. While bus services including GO and Greyhound may have shorter current estimated travel times, they rely on congested routes including Highway 401, reducing reliability and limiting the potential for future reductions in travel time through improvements to the corridor.

<table>
<thead>
<tr>
<th>Option</th>
<th>Hourly Frequency</th>
<th>Travel Time</th>
<th>Total Fare/Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2019</td>
<td>2026</td>
</tr>
<tr>
<td>via Guelph</td>
<td>TBD</td>
<td>160 min</td>
<td>96 min</td>
</tr>
<tr>
<td>via Milton</td>
<td>TBD</td>
<td>94 min</td>
<td>N/A</td>
</tr>
<tr>
<td>Car + Bike</td>
<td>4</td>
<td>110 min</td>
<td>110 min +</td>
</tr>
<tr>
<td>Car + Train</td>
<td>1</td>
<td>140 min</td>
<td>90 min</td>
</tr>
<tr>
<td>Greyhound</td>
<td>1</td>
<td>105 min**</td>
<td>N/A</td>
</tr>
<tr>
<td>N/A</td>
<td></td>
<td>120 min</td>
<td>120 min +</td>
</tr>
</tbody>
</table>

* Driving option includes parking and fuel costs
** Travel time varies based on time of day and day of week

Figure 4-1 Travel Options to Union Station from Cambridge

4.1.2 Goal 2: Leverage Transit Investments on the Kitchener line and the Region of Waterloo ION Network

The ION Rapid Transit Network is a major investment for Waterloo Region, with a cost of approximately $900 Million for Stage 1 funded by the Region of Waterloo, the Province of Ontario, and federal support. Additional investments in Stage 2 to continue Light Rail construction and connect Kitchener to Cambridge represent close to $1.4 Billion, with funding mechanisms currently under review.

By providing direct access to ION Rapid Transit, a GO Transit Station in Cambridge would facilitate integration between the two networks, support first and last mile connectivity, and reduce traffic congestion on Regional roads. Based on a review of potential Station locations (see Table 4-1), a site close to or integrated with the future Pinebush ION Rapid Transit Station would provide greater access to higher intensity uses in the short to medium term, compared to a potential Station that would connect Cambridge to the Milton Corridor (close to the Delta ION Station). Given the transit-oriented development and market based approach to station delivery currently adopted by Metrolinx, co-locating with the Pinebush ION Rapid Transit...
Station would improve the potential and market interest in the development of the GO Station.

4.1.3 Goal 3: Support Labour Mobility and Economic Development in Southwest Ontario

Waterloo Region is a key economic hub in its geography, and continues to attract highly qualified talent to support the growth of local business and this is a key driver of future growth in Cambridge. The Canadian Urban Transit Association (CUTA) notes the power of transit investment to stimulate economic development, and has identified that transit produces the highest level of return on investment in the way of job creation compared to all modes of transportation (CUTA, 2003, 2010).

Providing efficient connectivity between Cambridge and GO Rail service via Guelph would support greater job access in Cambridge, and provide opportunities for commuters along the Kitchener line service corridor to tap into this growing economic and commercial centre. As residents in Cambridge are three times more likely to work outside the City and commute daily beyond the Region compared to residents of Kitchener and Waterloo, there remains a strong impetus to provide viable options for commuter transit to the city.

4.1.4 Goal 4: Offer a High Degree of Deliverability

The deliverability of the service is most strongly represented by a review of the potential operational and constructability considerations related to improving the Fergus Subdivision corridor and potential to run a bidirectional rail service between Cambridge and Guelph.

There are no major obstacles or risks identified through the analysis conducted that would indicate an issue with the feasibility of the potential service along the Fergus Subdivision. The Fergus Subdivision is under CN Rail ownership, and Metrolinx has achieved strong success in facilitating passenger rail service on CN-owned corridors as compared to the Milton corridor, which is under CP authority and for which there is no current plan to expand frequency of passenger rail service. It is understood through discussions with CN that freight service will be maintained along the Fergus Subdivision, and as such coordination on timetables to limit disruption and support peak travel would be necessitated.

In addition, the comparison with the Milton Corridor illustrates a comparatively higher level of performance with respect to potential ridership generation for a service between Cambridge and Guelph (Table 4-2).
### Table 4-1 Comparison of Cambridge-Guelph and Cambridge-Milton Connections to GO Service

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Travel Time to Union</th>
<th>Frequency</th>
<th>Low Ridership</th>
<th>High Ridership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guelph (2A)</td>
<td>96</td>
<td>30 mins (All Day)</td>
<td>310,219</td>
<td>711,640</td>
</tr>
<tr>
<td>Milton Option #2 (Recommended in the 2014 Business Case)</td>
<td>93.5</td>
<td>30 mins (AM) 60 mins (Mid) 30-45 mins (PM) 60 mins (Eve)</td>
<td>192,000</td>
<td>376,200</td>
</tr>
</tbody>
</table>

### 4.1.5 Goal 5: Support Urban Intensification and Transit Oriented Development in Cambridge and Guelph

The current policy context in Cambridge is an important component of the basis for a potential GO Station. Table 4-3 provides an overview of the relevant policies reviewed as part of this exercise. In the context of a changing climate driving the need to develop reliable transportation alternatives to personal vehicles, and a Provincial-led drive to meet urban intensification targets, providing GTA-oriented service via Guelph in an integrated way with local rapid transit within Cambridge to connect across Waterloo Region would support the policies of the City of Cambridge Official Plan, the goals of the City of Guelph Strategic Plan, and align with Provincial policy.

### Table 4-2 Policy Alignment Summary for the Pinebush ION Rapid Transit Station

<table>
<thead>
<tr>
<th>Policy Document</th>
<th>Policy Alignment</th>
<th>Station Considerations/Conformity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Provincial Policy Statement (PPS) 2014 (Province of Ontario)</strong></td>
<td>• Support for increased use of transit and active transportation over other modes of travel; • Land use and settlements patterns are geared towards TOD where transit is planned, exists, or may be developed; • Energy conservation, air quality, and climate change related direction in the PPS is geared towards supporting transit and TOD, and facilitating establishment of transit in the future.</td>
<td>• The Station location in Cambridge will need to consider parallel rapid transit initiatives and leverage these investments to support integrated mobility; • The development potential for the Station will also need to be considered from the perspective of intensification and TOD.</td>
</tr>
</tbody>
</table>

| **A Place to Grow: Growth Plan for the Greater Golden Horseshoe 2019 (Province of Ontario)** | • Support for complete communities with access to higher-order transit; • Support for a wider regional transit network through Provincial investments beyond the GTHA; | • The Station location will consider intensification and growth opportunities, with preference to sites in proximity to Region investments in higher order transit facilities; |
The City's Official Plan as well as the Regional Official Plan provide direction on the importance of transit-oriented development. Cambridge is also currently undertaking a Secondary Plan for the Hespeler Road Corridor which encompasses the Pinebush ION Rapid Transit Station. The Secondary Plan (May 2019 Draft) supports higher density uses along Hespeler Road, and supports the rationale for co-location of a GO Transit Station with the Pinebush ION Rapid Transit Station, given the plan to integrate mixed uses and improve active transportation connections in proximity to the planned Station site.
5.0 Economic Feasibility

5.1 Overview and Approach

As part of Phase 1 and Phase 2 of the Study, a preliminary economic feasibility analysis of the Cambridge to Guelph service was undertaken. The economic components of the assessment consisted of the following key elements:

- Transportation User impacts (overview of travel time change, reliability, congestion, amenity, user costs, etc.)
- External impacts (consideration of wellbeing and environmental impacts)
- Wider Economic impacts (connectivity, productivity, labour market).

The criteria that fed into the assessment of economic considerations identified below provide the basis for quantification of economic benefits as part of Phase 2 of the Study. The high-level assessment of the criteria is described in this section.

The Metrolinx Business Case methodology for assessing the economic and financial case for potential Pinebush-Guelph service was applied. The Benefit Cost Analysis mimicked the Metrolinx Business Case Guidance, assessing economic considerations. The level of precision is consistent with the level of assessment appropriate at this stage of project development.

5.2 Impact Assessment

5.2.1 Transportation User Impacts

The transportation user impacts are based on a number of key base criteria that influence a traveller’s perception of the journey or service, including factors such as convenience, comfort, predictability, and the ‘costs’ in terms of travel time as well as financial costs.

In Phase 2 of the Study, the cost-benefit analysis used a 35-year time period (up to 2061) of rail service operation to calculate the full range of benefits associated with the rail project. The summary of impacts is provided in Table 5-1.

---

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
<th>Assessment Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Time Change</td>
<td>The total trip time including first and last mile, access, transfer time penalty at Guelph GO Station</td>
<td>The travel time from Cambridge to Guelph is estimated at approximately 16 minutes (average of all rail service scenarios considered), plus the transfer time required to change trains at the Guelph GO Station. The catchment area for the Pinebush ION Rapid Transit Station is approximately 15 minutes for both auto modes and local transit modes. Active transportation modes are anticipated to be highly supportive, once planned improvements are completed to the pedestrian and cycling infrastructure along Hespeler Road. There are opportunities to integrate with future ION LRT and BRT, in addition to other local transit routes, and other modes of transportation.</td>
</tr>
<tr>
<td>Amenity (Urban context)</td>
<td>The surrounding content at a potential station in Cambridge and perceived environment/public realm</td>
<td>The potential Pinebush ION Rapid Transit Station location would be located at the heart of the City's main commercial corridor, and would share a location with the future Stage 2 ION LRT. The Station is in the Hespeler Corridor area, which is the subject of an ongoing Secondary Plan exercise to create a higher density, mixed use area with improved public realm amenities at and directly adjacent to the Station.</td>
</tr>
<tr>
<td>User Cost</td>
<td>Monetary costs of undertaking the trip including fares, tolls, and parking</td>
<td>The fare cost from Cambridge to Guelph is likely to be similar to the cost of a similar trip from Kitchener to Guelph. While Union Station may not be the ultimate destination for some travellers, the average fare cost from Cambridge to Union Station would come out between $12.50 and $15.25 depending on the horizon year and scenario. The Pinebush ION Rapid Transit Station is anticipated to have limited parking, subject to the site design and potential partnership with a developer and as such parking costs may be at a premium. The potential direct connection to ION LRT, along with planned improvements to active transportation routes, would allow for reduced vehicle parking at the Pinebush ION Rapid Transit Station and lower first and last mile connectivity costs.</td>
</tr>
<tr>
<td>Change in Congestion</td>
<td>Potential for reduction in congestion on adjacent highway corridors as a result of the service</td>
<td>Providing a transit linkage to Guelph would potentially service a 2031 ridership of between 173-318 travellers to Guelph from Cambridge per day, and ridership to Union Station of approximately 331-514 travellers per day. This would represent a potentially equivalent number of cars being removed from highway and major road corridors between Cambridge and Guelph and Toronto, and create an additional benefit in new ridership from passengers</td>
</tr>
</tbody>
</table>
5.2.2 External Impacts

The external impacts of implementing GO service along the Fergus corridor and developing a Transit Station in Cambridge would include:

Environment: The short-term environmental impacts of introducing a new service along the Fergus Subdivision would be related to construction of the track and station facility in Cambridge. These impacts need to be further explored through a future Environmental Assessment process. In the longer term, the key considerations from an environmental standpoint are related to the following impacts:

- **Greenhouse Gas (GHG) Emissions:** The vehicle type of choice for the service along the new corridor could be Electric Battery Multiple Unit (EBMU), which has lower emissions and are a more energy-efficient vehicle. In addition, there would be a reduction in overall GHG emissions (CO2e).

- **Local Air Quality:** The local air quality impacts as a result of the new service and GO Station would stem from air emissions from trains during service operation, which are expected to be minimal with the use of EBMU technology. A net benefit would be expected based on the potential in vehicle kilometres travelled by automobile users who are now being accommodated through transit.

- **Noise:** The Fergus Subdivision runs through largely commercial areas and employment lands, with a limited number of sensitive noise receptors adjacent to the corridor north of Highway 401. There may be an increase in residential development in close proximity to the Pinebush ION Rapid Transit Station and generally in areas neighbouring the Fergus Subdivision south of Highway 401, which may call for some noise mitigation measures.

Wellbeing: There are a number of health benefits from encouraging transit use and selecting a Station site that would facilitate access via active modes such as walking or cycling. The incentive to utilize such modes is provided through limited parking availability and the planned high-quality public realm in the vicinity to the Pinebush ION Rapid Transit Station, as well as direct access to commercial and retail amenities. Similarly, the Guelph GO Transit Station is located in the downtown core of the city, supporting active mode selection for last mile trips in Guelph.

In addition, there would be benefits associated with supporting transit-oriented development adjacent to the Pinebush ION Rapid Transit Station, and attracting more mixed-use development and public realm design to support travellers to and from the Station. These benefits were not monetized for purposes of this analysis, but should be noted.
5.2.3 Wider Economic Impacts

The key factors with respect to wider economic impacts of the new service and GO Station in Cambridge are:

- **Productivity:** The City of Cambridge is located broadly within the Waterloo Region-Toronto Innovation corridor, a large high-order economic zone that includes Canada’s fastest growing technology clusters, Waterloo Region and Toronto. A reliable and efficient rail service within an urban area characterized by highway congestion will provide significant potential to leverage the existing innovation hub and enable more skilled workers to work in jobs of choice.

- **Connectivity:** Cambridge is connected to a number of adjacent markets by Highway 401. There is the potential to develop a new market or expand existing markets, both related to technology sector employment as well as other economic areas including higher education and manufacturing.

- **Labour Markets:** While linked to productivity, GO Rail service between Cambridge and Guelph could unlock potential labour attraction to Cambridge and to Waterloo Region more broadly. A direct link to the Kitchener line via the Fergus Subdivision would support commuting between Cambridge and the GTA, taking advantage of population and employment growth potential in Cambridge and creating new investment opportunities in the local market.

- **Housing Affordability Benefits:** By improving the ability of Cambridge residents to access labour markets in the GTA, there is potential to provide access to more affordable housing in Waterloo Region and shape land use around more Transit Oriented Development. If trip times along the Kitchener line can be further reduced, the resultant increase in ridership would support more sustainable commute times and drive improved service along the Fergus Subdivision to Guelph. Housing affordability is presented here qualitatively.

A typical rail project such as the one proposed in the Study might achieve agglomeration and productivity benefits of 30% of the transport user benefits for the conservative and optimistic ridership scenario. Buses and more local projects typically generate smaller wider economic benefits as a percentage of travel time savings. Regional and intercity rail projects typically achieve a higher level of wider economic benefits. The nature of the Guelph-Cambridge service suggests that a balance in between these two extremes would be appropriate, and 30% is a reasonable estimate at this stage of the Study.

Table 5-2 highlights the wider economic impacts.
Table 5-2 Wider Economic Impacts Summary

<table>
<thead>
<tr>
<th>Factor</th>
<th>Evaluation Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agglomeration and Productivity</strong></td>
<td>Typical rail projects like these might achieve agglomeration benefits of 30% of transport user benefits (travel time savings, auto operating cost savings). (For reference, slower urban rail projects generate agglomeration benefits of 5-20% and regional and high-speed rail projects can generate agglomeration benefits of 50% or more)</td>
</tr>
<tr>
<td><strong>Environmental Impacts</strong></td>
<td>Land use shaping/redevelopment potential would be more significant driver of benefits.</td>
</tr>
<tr>
<td><strong>Housing Affordability</strong></td>
<td>Land use shaping and social value of improved housing accessibility and affordability (For reference, even if these benefits are not included in the cost-benefit ratio but important unmonetizable benefit to the Cambridge-Guelph corridor)</td>
</tr>
<tr>
<td><strong>Summary</strong></td>
<td>Overall potential for net benefit, facilitating the transition from auto-based to transit-based modes to access Guelph and the GTA from Cambridge/Waterloo Region. Faster journeys achieved sooner on the Kitchener line will drive higher benefits on the Cambridge-Guelph line.</td>
</tr>
</tbody>
</table>

5.3 Economic Feasibility Summary

The Benefit Cost Analysis mimicked the Metrolinx Business Case Guidance, assessing economic considerations. The six rail service options (Option 1A, 1B, 2A, 2B, 3A, and 3B) were compared against two Economic Feasibility Scenarios paired with the High and Low Ridership Scenarios to estimate the total monetary benefits, as presented in Figure 5-1 through Figure 5-5. The two Economic Feasibility scenarios considered, based on the Metrolinx Business Case Guidance (2019), were:

- Base Case, with a benefit discount rate of 3.5% and a cost inflation rate of 2.0%; and
- Aggressive Scenario, with a benefit discount rate of 5.5% and a cost inflation rate of 3.5%.

The corresponding numerical values of the economic benefits, and associated assumptions and considerations are presented in Appendix E. It can be concluded that the Option 3B generates the highest economic benefits among all service scenarios, while the Option 1A generates the lowest.
Figure 5-1 Economic Benefits for all Service Options: High Ridership, Base Scenario

Figure 5-2 Economic Benefits for all Service Options: High Ridership, Aggressive Scenario
Figure 5-3 Economic Benefits for all Service Options: Low Ridership, Base Scenario

Figure 5-4 Economic Benefits for all Service Options: Low Ridership, Aggressive Scenario
Figure 5-5 Economic Benefits for all Service Options: Low Ridership, Aggressive Scenario vs High Ridership, Base Scenario
6.0 Deliverability and Operational Feasibility

6.1 Overview
The deliverability and operations case provides a high level qualitative analysis of key issues that may impact the deliverability and operations of rail service Options and rolling stock types, as well as a discussion of mitigation measures that may be undertaken or considered. As this Study has been conducted at a high level, the deliverability case has been framed around identifying potential issues that warrant further review and analysis in future project stages. In addition, it provides background material on project delivery to support future studies and research into different methods of procuring, delivering, and operating the Cambridge-Guelph rail service.

Phase 2 of the Cambridge Study expanded on the physical and geometric elements along the Cambridge to Guelph rail service corridor, vehicle technologies appropriate for the rail corridor, and detailed service scenarios. Further, Phase 2 evaluated how the proposed GO rail line between Cambridge and Guelph would be integrated with other planned rail services.

6.2 Background and Context
The current use of the Fergus Subdivision is freight, and the tracks are owned by CN. Further, Figure 6-1 illustrates Metrolinx rail corridor ownership, including the Kitchener GO line. Figure 6-2 shows the rail connection to Cambridge via the Fergus Subdivision on this GO network.

The design of the Cambridge-Guelph passenger rail connection is based on the framework of a low-cost deliverability and operations system, while achieving reasonable performance for passenger service. A key reference case is the Union Pearson (UP) Express service which models a realistic and feasible service aspired by the Cambridge-Guelph train connection. The UP Express model was used since it is applicable to the Cambridge-Guelph proposed GO Rail corridor in terms of distance, scale, and speeds.

This chapter will review key deliverability opportunities and risks, while providing recommendations on rolling stock types, construction, governance and operation requirements of the Cambridge-Guelph rail corridor.
Figure 6-1 Metrolinx Rail Corridor Ownership (Metrolinx, January 2019)
6.3 Key Opportunities and Risks

Since this Study has been conducted at a high level, the risks and challenges discussed in this section will require further analysis to clarify the range of expected impacts.

Based on the existing physical and geometric elements assessment and assumed operations plan, the following risks and opportunities have been identified:

6.3.1 Opportunities

There are opportunities for a subsequent study and/or through operating procurement methods to discover further technology innovations to support an improved service, with higher financial performance, and generally better methods of optimizing operations, capital design, and maintenance.

By far the most important factor for a successful Guelph-Cambridge service is a properly specified and sufficiently good Kitchener line service with which the Cambridge-Guelph service will interchange at Guelph.
6.3.2 **Construction Risks**

While the Cambridge-Guelph rail corridor along the Fergus Subdivision has been able to sustain today’s freight needs, higher speeds such as 75-85 km/h to support passenger rail service would require a higher class of track with more demanding tolerances that must be maintained for safe operations.

Existing bridges along the corridor may not be designed for higher speeds. As the speed of operations influences the vibrations and other forces exerted on the bridges, existing structures may need to be rehabilitated and/or replaced to accommodate higher operation speeds, as well as to support double track service if Options 3A and 3B are pursued.

Construction phasing for the Cambridge-Guelph corridor infrastructure upgrades would be required to maintain existing freight operations. Current freight operation is a demanding service with relatively high costs associated with service disruptions, as well as smaller time frames to schedule service suspensions along the corridor.

Depending on the preferred service scenario, the Fergus subdivision might require grade separations with intersecting roadways, which currently cross the rail corridor at-grade. Grade separations can impact traffic flow during construction. Implementing measures to maintain temporary arrangements for traffic during construction is a common practice, but can be difficult to implement in some urban areas. Grade separation projects must undergo an environmental assessment, as well as address subsurface utilities such as hydro, water, wastewater, fibre-optic and gas, and may have property impacts.

6.3.3 **Operation Risks including consideration of Freight**

The Cambridge-Guelph service and Kitchener Line would share service along the Guelph line segment, which extends from the Guelph Junction to the Guelph GO Central station. Therefore, blended operations should not be disruptive. A service priority agreement, if possible, could mitigate such risks.

Operating risks from freight rail traffic are expected to be manageable, albeit with collaboration and agreements required from CN; some restrictions on certain freight movements during certain periods will be required depending on track improvements. In exchange, freight customer access will be maintained and the rail corridor will be significantly upgraded, benefitting passengers and freight services.

Further analysis of both construction and operation risks is required in future studies to both quantify and prioritize risks as well as to identify the cost of mitigation.

6.4 **Rolling Stock**

Different train technologies have been considered to provide service from Cambridge to Union Station. There are limitations on the number of trains that can run on the CN-owned portions of the track, as this portion currently serves (and will continue to serve) as a freight corridor as well. It is important to ensure
that the new rolling stock is compatible with current GO rolling stock for maintenance and parts, because the nearest maintenance facility is in Etobicoke. With the modernization of the GO network as part of the GO Expansion program, the forthcoming new VIA Rail fleet, a considered look at additional services to Niagara as well as Kitchener, and recent advancements in rail motive technology – particularly in smaller trains - there is a real opportunity and moment in time to now consider a variety of train/fleet arrangements, particularly those that will be smaller than the traditional ten or twelve car GO bilevel arrangement. The Cambridge-Guelph corridor is a potentially ideal location to pilot technologies and try some new-to-Ontario train arrangements, including smaller trains and different motive power.

In Phase 1 of this Study, DMUs were assumed as the service operability technology, and would only be run on the Fergus Subdivision between the Pinebush ION Rapid Transit Station in Cambridge and the Guelph GO Station. Phase 2 of this Study looks at different vehicle technologies to determine which ones are most appropriate for the Fergus Corridor and which technology is recommended. Given the potential demand and characteristics of the corridor various rolling stock technology types were analysed: diesel multiple unit technology (DMU), electric multiple unit (EMU), electric battery multiple unit (EBMU), hybrid multiple unit, and hydrogen cell fueled trains.

### 6.4.1 Target Average Speeds to be Achieved

A list of key minimum standards for average speeds are highlighted in the *Long-Term Rail Strategy*[^9], where these desirable standards have been set by Transport for the North and its Northern Partners in Canada. These key targets are set to ensure greater rail connectivity:

- Long-distance services to achieve average journey speeds (of at least 80mph or 129 km/hr);
- Inter-urban services to achieve average journey speeds of at least 60mph or 97 km/hr; and
- Local and suburban services to achieve average journey speeds of at least 40mph or 64 km/hr.

These standards are feasible for the Cambridge-Guelph line service.

### 6.4.2 Diesel Multiple Unit

The DMU technology consists of multiple cars powered by one or more on-board diesel engines. DMUs operating on this rail corridor would be similar to those currently operating on UP Express. These have two and/or three-car trains per trainset. The seat capacity on these trains are 115-173 people. DMUs are powered by a diesel hydraulic drive with a six-speed automatic transmission and regenerative braking.

### 6.4.3 Electric Multiple Unit

Successfully implemented around the world, electric multiple units are self-propelled carriages using electricity. An EMU does not require a separate locomotive, as electric traction motors which provide the motive power for the train are incorporated within some number of carriages and are distributed along the length of the train. EMUs are potentially cheaper to implement than DMUs as they do not require the construction and operation of fueling facilities. However, construction of overhead lines is required, which may pose an issue when integrating with freight trains. EMU has a proven technology with many operating examples in North America and around the world.

6.4.4  Electric Battery Multiple Unit

A more experimental pilot rolling stock technology that could run on this route is EBMU, which is an electrically driven multiple car unit whose energy is derived from rechargeable batteries that drive its traction motors. The maximum speed that this technology will run at is 140 km/h and the units have an approximate battery range of 80 km. The estimated energy usage per trip is 17 kWh. A typical 250 kW charger will allow for a charge time of approximately 4-minutes at either end of the corridor to support EBMU. Since it is possible for the trains to charge at either end of the route between journeys, no external power supply is required. Therefore, no wires are required along the corridor and no traditional diesel fueling stations are needed. This alternative technology eliminates the cost of corridor electrification and associated maintenance.

The pilot EBMU would consist of a three-car unit, with 154 seats and a passenger capacity of 310 passengers. The EBMU has already been piloted in Germany in 2019; it is assumed to be a feasible transport technology to pilot on the Cambridge-Guelph corridor.

6.4.5  Hybrid Multiple Unit

A hybrid multiple unit is a locomotive, railcar or train that uses an onboard Rechargeable Energy Storage System (RESS), placed between the power source (often a diesel engine prime mover) and the traction transmission system connected to the wheel. Most diesel locomotives are diesel-electric, and they have all the components of a series hybrid transmission except for the storage battery. The storage system can consist of electric traction batteries, or a flywheel. This option was not considered further as it has many of the disadvantages of both the EBMU and DMU options (not production ready, delivery risks, and increased environmental footprint), while offering insignificant advantages.

6.4.6  Hydrogen Fuel Cell Multiple Unit

The first-ever contract to supply and support a fleet of 27 fuel cell multiple-units has been awarded to Alstom (to be in-service for the German Rhein-Main transport authority, RMV, in December 2022), which is one of Europe’s largest railway manufacturers. This technology, called the Coradia iLint, is equipped with
fuel cells which convert hydrogen and oxygen into electricity\textsuperscript{10}. This eliminates pollutant emissions related to propulsion. As a result, this hydrogen fuel cell multiple unit locomotive is a cleaner and more sustainable alternative as it results in steam instead of diesel soot. Another advantage of this locomotive is that it is ideal on secondary lines, where overhead lines are too costly or are not yet available.

Since September 2018, two Alstom Coradia iLint multiple-units have been in regular service on the Elbe-Weser network in Niedersachen. As of 2021, a fleet of 14 is expected to be in service between Cuxhaven, Bremerhaven, Bremervörde and Buxtehude. Additionally, Southern California’s San Bernardino County Transportation Authority has awarded Stadler a contract to supply a Flirt H2 hydrogen fuel cell powered multiple-unit to enter passenger service in 2024\textsuperscript{11}.

The hydrogen fuel cell powered multiple-unit is a quick and feasible alternative to EMU, and it helps to address the commuting needs while preserving the environment. It would require rail infrastructure improvements, including a hydrogen filling station(s). A hydrogen fuel cell train was not assessed as it was deemed feasible but not the preferred option for optimizing the economic feasibility. If hydrogen-powered trains were deemed an appropriate demonstration technology the Cambridge-Guelph line could be considered a good candidate.

\section*{6.4.7 Evolving Rail Technology}

According to a study\textsuperscript{12} undertaken by the Association for Electrical, Electronic & Information Technologies, the most efficient and cost-saving option of replacing DMUs is through electrification and the use of battery power and fuel cells. As the rail industry worldwide heads towards their target of decarbonizing rail transport by 2050 (and earlier than 2050), the use of these alternative technologies is encouraged. It is recommended that busier routes are electrified as soon as possible, and it is recognized that routes that are more lightly used or are just starting, such as the Cambridge to Guelph route, may not be as economically viable. In this case, a viable alternative to diesel technology is vehicles run on battery operation.


\textsuperscript{12} Association for Electrical, Electronic & Information Technologies. \textit{Alternatives to DMUs in Rail Passenger Transport}. May 2019 (https://www.vde.com/resource/blob/1885872/5f42b90859412b8590d0c7539604 b0bc/studie-alternativen-zu-dieseltriebzuegen-im-schienenpersonennahverkehr-data.pdf).
According to the same study, battery operation works best for routes with unelectrified sections of up to 80 km, with the traction batteries being charged from overhead lines elsewhere on the route. For routes with long gaps in the electrification, fuel cell technology would be an ideal alternative. These would, however, require supply infrastructure and hydrogen production infrastructure for operation. Electro-diesel or diesel-battery trains were not assessed in this report, as these would be expensive and only be used as interim options to other rolling stock technology.

6.4.8 Rolling Stock Speeds Feasibility

Another parameter to consider when choosing rolling stock is the impacts on travel time. The most significant influence on trip travel time is a rolling stock’s power to weight ratio. This allows us to delineate two distinct groups, which will have broadly the same performance: Electric Vehicles and Diesel vehicles. Several simulations were performed on OpenTrack rail-train software that determined the runtime for representative vehicles for these two groups, as shown in Table 6-1.

Table 6-1 Rolling Stock Travel Times

<table>
<thead>
<tr>
<th>Corridor Speed</th>
<th>75 km/h</th>
<th>85 km/h</th>
<th>95 km/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Time DMU</td>
<td>16.1 min</td>
<td>14.5 min</td>
<td>13.3 min</td>
</tr>
<tr>
<td>Travel Time EMU/EBMU</td>
<td>15.9 min</td>
<td>14 min</td>
<td>12.6 min</td>
</tr>
</tbody>
</table>

The overall results show that for slower maximum speeds there is essentially no difference between a diesel performance and an electric vehicle’s performance. Although the electric in general will accelerate and decelerate quicker, the diesel’s performance is sufficient and the speed slow enough that the differences are immaterial. At higher speeds the electric vehicle’s performance starts to show. Thus, it would be optimal to migrate to electric vehicles if the corridor’s speed is at least 85km/h and over.

6.4.9 Rolling Stock Type Recommendation

Based on a high-level assessment of the study area and deliverability and operation needs of this system, DMUs were considered a viable alternative in terms of applicable vehicle technology in Phase 1 of the Study. However, as a result of Phase 2 of this Study, the EBMU rolling stock type is recommended. The capital expenditure comparison for delivery of travel scenario Option 2A is estimated at $143 million for DMU, $174 million for EMU, and $157 million for EBMU, placing the EBMU alternative in the middle of the cost range across the three rolling stock types. The EBMU technology also has reasonable climate adaptability, operational reliability and some delivery risk, and offers a reduction in runtime when the train operates at a speed is 85km/h or greater. Additionally, operation and maintenance costs for EBMU are low relative to DMU and EMU rolling stocks. Standard EMU trains can be difficult to operate as a stand-alone service, as there would be no connection to a heavy rail maintenance facility along the Cambridge-Guelph corridor. EBMU’s are the more flexible option as this
transport technology can be propelled on battery until the Bramalea Station, where electrification ends on the Kitchener line, providing a route to existing GO heavy maintenance facility.

6.5 Constructability

This section provides an overview of the technical constraints to implementing the Cambridge-Guelph service, and related mitigation measures. The conditions of the grade and structure crossings along the Guelph line and Fergus Subdivision are summarized. Potential underpass and overpass options of these aforementioned crossings are discussed.

A track infrastructure improvements assessment was conducted in order to identify the track class required to deliver and operate the potential Pinebush-Guelph rail service.

Potential reconfiguration options for the Guelph Junction and Guelph Central Station are presented to optimize the Cambridge-Guelph passenger service. Additionally, high-level analysis of the potential for Station integration with the Pinebush ION Rapid Transit Station has been carried out. Finally, a location for a storage and maintenance facility to support the Cambridge-Guelph service is proposed.

6.5.1 Fergus Subdivision Crossings

A high-level review was conducted to assess the existing conditions of the grade-crossings and structures along the Fergus Subdivision (from the Pinebush ION Rapid Transit Station to Guelph Junction), feeding into the capital costs calculated for this Study. The majority of the rail crossings along the future Cambridge-Guelph line are surrounded by residential or industrial land uses. Some crossings are subject to cost-prohibitive adjacency constraints such as hydro corridors or property impacts. Each of these crossings along the Fergus Subdivision would need to be assessed if the speed along the corridor is to be raised above its current level to ensure compliance with rail infrastructure standards. Additionally, the feasibility of double tracking the corridor would need to be examined.

The portion of the Fergus Subdivision from Silvercreek Parkway South to the Pinebush ION Rapid Transit Station has 20 crossings in total, as listed in Table 6-2. The significant crossings along the corridor have been highlighted in Figure 6-3. Significant grade-crossings and structures along the Fergus Subdivision corridor (not all grade crossings are shown). Eleven crossings are at-grade, five are structures (e.g. overpasses/underpasses, bridges), and four are local property accesses. Of the eleven at-grade crossings, nine are only equipped with lights; while two crossings have neither lights nor gates. A detailed summary of the Fergus Subdivision grade crossings is indicated Table D-1, found in Appendix D. When evaluating the existing condition of these structures, it was assumed that they were largely structurally sound, and may require less rehabilitation works in the future. As a comparison, the Mill Pond Bridge may require significant infrastructure rehabilitation and improvements. There are four local agricultural accesses along the Fergus Subdivision – three of which are located between
Whitelaw Road and Wellington Road 32; while the other is located between Wellington Road 32 and Wellington Road 124/ County Road 124.

Table 6-2 Grade Crossings along the Fergus Subdivision.

<table>
<thead>
<tr>
<th>Grade-Crossings</th>
<th>Structures</th>
<th>Local Property Accesses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fergus Subdivision</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silvercreek Parkway South</td>
<td>Blackbridge Road</td>
<td>Hanlon Parkway/ Highway 6 and Exit Ramp</td>
</tr>
<tr>
<td>Fife Road</td>
<td>Winston Boulevard*</td>
<td>Imperial Road South</td>
</tr>
<tr>
<td>Whitelaw Road</td>
<td>Mill Pond</td>
<td></td>
</tr>
<tr>
<td>Wellington Road 32</td>
<td>Regional Road 24*</td>
<td></td>
</tr>
<tr>
<td>Wellington Road 124/Country Road 124</td>
<td>Highway 401</td>
<td></td>
</tr>
<tr>
<td>Guelph Avenue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highway 32/ Beaverdale Road</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eagle Street North</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Road*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

*These grade-crossings, structures and local accesses are not illustrated on the following map, Figure 6-3.
Figure 6-3 Significant grade-crossings and structures along the Fergus Subdivision corridor (not all grade crossings are shown).
When considering potential infrastructure improvements, an environmental assessment of at-grade crossings along the Fergus Subdivision corridor will be required, as well as consideration for utility relocation, property impacts, construction staging, groundwater table effects, visual impacts, and future road capacity requirements.

**Wellington Road 124 Crossing**

![Land use map surrounding the Wellington Road 124 crossing along the Fergus Subdivision corridor. Source: Wellington Road 124 Class Environmental Assessment (Class EA) Study (MTE Consultants Inc., December 2019)](image)

Surrounding the intersection of the Fergus Subdivision and Wellington Road 124, there is a small hamlet, a rural employment zone, a prime agricultural area, and a Built Heritage Resource to the northeast of the crossing at 6974 Wellington Road 124. The land uses are shown in Figure 6-4. As well, the roadway and the Greater Western Railway are considered as historical elements by the City of Cambridge. According to the Wellington Road 124 Class Environmental Assessment (Class EA) Study (MTE Consultants Inc., December 2019), there is archaeological potential located to the south and north of Wellington Road 124, requiring both test pit and pedestrian surveys. Additionally, there is a major aerial hydro transmission corridor along the north side of Wellington Road 124; while a local aerial hydro distribution corridor runs along the south side of the roadway.

The Wellington Road 124 crossing is slightly skewed, posing some safety concerns. To address this issue, either a road underpass or overpass may be considered. Both of these options would require a road realignment to reduce the length of the proposed bridge structure, as shown in Figure 6-5.

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13 Wellington County Official Plan, 2019
14 Wellington Road 124 Class Environmental Assessment Study, 2019
During construction, the existing level crossing will need to be maintained, or a temporary level crossing constructed to accommodate traffic. As well, a service road for residential units will be required along the south side of the crossing, unless the properties are acquired.

Figure 6-5 Example of (1) road over rail (Plains Road, Burlington, ON) and (2) road under rail (Appleby Line, Burlington, ON) constructed to mitigate the safety challenges of a skewed railway crossing (Google Maps, 2019)

**Eagle Street North Crossing**

The Eagle Street North crossing lies within the Hespeler Road mixed-use corridor in Cambridge. The crossing is adjacent to an employment corridor and a low/medium density residential area\(^\text{15}\). A vegetated buffer separates the railway and the surrounding residential properties. There are no identified natural heritage features in the immediate surrounding area\(^\text{16}\).

Eagle Street North is an arterial road. There is a minor aerial hydro distribution corridor on the south side of Eagle Street North. To the west of the rail corridor, Eagle Street North consists of a two-lane roadway with a paved shoulder on the

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\(^{15}\) City of Cambridge Official Plan, 2018

\(^{16}\) City of Cambridge Heritage Master Plan, 2008
south side and a gravel shoulder on the north side. To the east of the rail corridor, Eagle Street North consists of a four-lane roadway with a two-way-left-turn-lane and there is a multi-use trail on the south side.

The perpendicular crossing currently has lights and pavement markings to signify the crossing. Depending on the need and justification (vehicular and train volumes), similarly to Wellington Road 124, a road underpass or overpass may be considered. Under both options, access during construction will need to be considered, including whether Eagle Street North will need to be closed, or a temporary level crossing maintained to accommodate traffic. However, given the existing land use constraints within close proximity of the crossing, there is limited space available to construct the structure adjacent to the travelled portion to maintain traffic flow.

For each aforementioned crossing, depending on the surrounding groundwater and soil conditions, an underpass may require a pumping station. The construction of an underpass will require a rail diversion to maintain rail travel during construction and is generally more costly to construct when compared to an overpass. As an example, a recent Class EA completed by Hatch Ltd. for the City of Barrie\cite{17}, determined that an underpass was 2.5 times more expensive than an overpass to construct, although this cost could vary in other locations based on the specific physical context for construction of the overpass. Other considerations include potential property impacts, roadway capacity requirements, construction staging, visual impacts, as well as potential noise restrictions.

**Mill Pond Bridge**

The Mill Pond Bridge over the Speed River, near Hespeler Road - approximately 12 km from the Guelph Junction - is currently structurally sound; however, may require rehabilitation to support the Pinebush-Guelph service. More detail on these repairs was highlighted in the Speed River Bridge Inspection Report (May 2016) by the Goderich Exeter Railway (GER), indicating the need for the replacement of the bridge’s wooden ties. Further studies will be required to assess the structural integrity of the bridge to support the proposed passenger service.

**6.5.2 Guelph Line Crossings Overview**

A high-level review was conducted to assess the existing conditions of the grade-crossings along the Guelph line (from Guelph Junction to Guelph Central Station). Similarly, each of the crossings along the Guelph line would need to be assessed if the speed along the rail corridor is to be increased to ensure compliance with rail infrastructure standards.

Currently, the Guelph line has six crossings, as shown in Table 6-3. Four of these crossings are at-grade and equipped with lights and gates. These include the crossings at Edinburgh Road, Yorkshire Street, Glasgow Street, and Dublin Street. Additionally, two bridges are present on the Guelph line crossing over Wyndham

\cite{17} City of Barrie, Hewitt’s Secondary Plan Class Environmental Assessment, Sept 2017
Street and Norfolk Street. Since these crossings are on the Kitchener line, any improvements would be undertaken as part of various expansion plans of the Kitchener corridor.

Table 6-3 Grade Crossings along the Guelph Line (Not Exhaustive).

<table>
<thead>
<tr>
<th>Grade Crossings</th>
<th>Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lights &amp; Gates</td>
<td></td>
</tr>
<tr>
<td>Guelph Line</td>
<td></td>
</tr>
<tr>
<td>Edinburgh Road</td>
<td>Norfolk Street</td>
</tr>
<tr>
<td>Yorkshire Street</td>
<td>Wyndham Street</td>
</tr>
<tr>
<td>Glasgow Street</td>
<td></td>
</tr>
<tr>
<td>Dublin Street</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>4</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Class N</strong></th>
<th>Maximum allowable operating speed for freight trains, km/h</th>
<th>Maximum allowable operating speed for passenger trains, km/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1 track</td>
<td>16</td>
<td>24</td>
</tr>
<tr>
<td>Class 2 track</td>
<td>40</td>
<td>48</td>
</tr>
<tr>
<td>Class 3 track</td>
<td>64</td>
<td>96</td>
</tr>
<tr>
<td>Class 4 track</td>
<td>96</td>
<td>129</td>
</tr>
<tr>
<td>Class 5 track</td>
<td>129</td>
<td>156*</td>
</tr>
</tbody>
</table>

*for LRC Trains, 161

6.5.3 Track Infrastructure Improvements

A high-level review of the track infrastructure along the Fergus Subdivision was conducted through aerial and ground-level site imaging. Track class standards, as set out by Transport Canada, dictate train operating speeds for freight and passenger trains based on track infrastructure, as shown in Table 6-4. These are typically expressed in miles per hour, and have been converted to km/hr for ease of comparison. Higher classes of rail track have greater permissible operating speeds; however, are subject to stricter requirements for rail maintenance.

Table 6-4 Transport Canada Track Classes and Associated Maximum Allowable Operating Speeds

The Fergus Subdivision corridor is currently operational, however, the class of track relevant to the prospective Cambridge-Guelph line is too low for the proposed passenger rail operation. The current conditions are well-suited to support only freight trains at lower speeds. Average speeds of 75 km/h (for Options denoted as ‘A’) and 85 km/h (for Options denoted as ‘B’) are assumed over the entire Cambridge-Guelph corridor for the Phase 2 constructability analysis. It is recommended that the class of track is upgraded to at least Class 4 (allowing a maximum of approx. 96 km/h) and possibly Class 5 (allowing a maximum of approx. 129 km/h) in certain areas.
The reconfiguration for the Guelph line (i.e. a shared corridor between Guelph Junction to Guelph Central Station) depends on the chosen rail service scenario. Track layouts and the integration with other operating services on the line will vary. The chosen configuration will also be heavily dependent on the cooperation of another stakeholder. However, it is assumed that they would share the financial costs in upgrading this section of the Kitchener rail corridor.

The planned infrastructure should accommodate a range of train speeds along the route, which will allow for a range in required classes of track. For example, where tracks are curving, speeds will lower, so Class 3 tracks are acceptable. However, along long, straight portions of the corridor where higher speeds can be achieved, Class 4 tracks are optimal. These considerations will ensure the appropriate track infrastructure to achieve an optimized service and will allow for cost savings.

6.5.4 Guelph Junction

A component of the future Cambridge-Guelph rail corridor within the Fergus Subdivision is the Guelph Junction. This junction poses potential complications to the operations and deliverability of this service, primarily because it is used by both freight and commuter lines – including CN, GO Transit, and VIA Rail. Both CN and GO own tracks that intersect and branch off at this junction, creating a complex scheduling situation. As part of Phase 2 of this Study, the Guelph Junction was examined to determine how it could be optimized, given its importance in ensuring the fast and reliable operation of existing and future Kitchener-Guelph GO services, VIA services, and the proposed Cambridge-Guelph passenger service.

The existing layout of the Guelph Junction can be seen in Figure 6-6. There are two potential configurations for the Guelph Junction, dependent on the track layout chosen for the Cambridge-Guelph passenger service. The first short-term configuration would support a single-track on the Cambridge-Guelph line, while the second configuration represents build-out conditions, supporting a double-track on the Cambridge-Guelph line.
Figure 6-6 Existing track layout of the Guelph Junction

Figure 6-7 Guelph Junction supporting single-track layout of the Cambridge-Guelph line
The short-term single-track configuration, as shown in Figure 6-7 requires the relocation of the freight switching tracks from the west end of the junction to the east end. This will allow freight trains to serve industries in the surrounding area without impacting the Cambridge-Guelph passenger service. Additionally, a single turnout would be installed for access to the Fergus Subdivision. To minimize impacts on runtimes, a high-speed turnout is recommended.

The double-track layout, as shown in Figure 6-8, assumes that one freight alignment on the Guelph junction would be utilized as the additional track for the Cambridge-Guelph service. This may require the construction of an additional set of tracks to ensure that freight trains are appropriately serviced. In addition, three crossovers should be built to allow for parallel routes from either of the two tracks of Ferguson Subdivision.
Figure 6-8 Guelph Junction supporting double-track layout of the Pinebush-Guelph line
6.5.5  Guelph Central Station

The development of the area surrounding the existing Guelph GO Station is heavily constrained by the presence of two rail-overpasses located on either side of the platforms, as shown in Figure 6-9. These include a bridge over Wyndham Street and a bridge over Wellington Street. The two station configuration alternatives presented here do not consider the expansion of these grade separations; however, these locations may see expansions as part of other stakeholders’ plans.

Option GCS-1 for the reconfiguration of Guelph Central Station is recommended to be a pocket track and platform immediately to the east of the bridge over Wyndham Street, as shown in Figure 6-9. This would require a turnout off the second main line (currently a passing track) to connect to the pocket track. There appears to be adequate space for this; however, based on the high-level conceptual design presented, it would likely require the purchasing of land and potentially impacts to nearby buildings. These impacts would need to be further investigated through future studies including an Environmental Assessment, to confirm potential to support preservation of heritage assets based on the preliminary design impacts to adjacent properties.

To ensure access to the south mainline track, a new high-speed crossover would be required, as close to the platform as possible. As a result, the option GCS-1 would require an underground access for passengers to disembark from the Cambridge-Guelph service, cross under the track and come up on the other side of the rail corridor to access the Kitchener line train.

Option GCS-2 of the Guelph Central Station reconfiguration is similar to Option GCS-1; however, the existing second mainline becomes the pocket track, and an additional set of tracks would be constructed on the north side of the track, as shown in Figure 6-10. This would connect back to the other mainline on the west end of the platform. A new island platform (cross-platform interchange) would be required, which could allow for boarding trains to service either direction, providing passengers connecting from Cambridge to easily transfer to the Kitchener line. As a result, the option GCS-2 would keep all access at surface level, eliminating the need for an underground access.
Figure 6-9 Option GCS-1 of the Guelph Central Station reconfiguration
Figure 6-10 Option GCS-2 of the Guelph Central Station reconfiguration showing the construction of a cross-platform interchange.
6.5.6 Pinebush ION Rapid Transit Station Technical Constraints

The curve in the corridor leading into the Pinebush ION Rapid Transit Station - as highlighted in yellow in Figure 6-11 - has a high degree of curvature potentially limiting train speed. Flattening this curve may prove to be a difficult operation, as the surrounding land would need to be acquired. Nevertheless, this significant track curvature leads directly into the Pinebush ION Rapid Transit Station area; therefore, associated speed limitations may not have an impact on total travel time. A detailed geometric assessment of this portion of track will be required. In addition, the corridor width should be assessed regarding the feasibility of a double track layout.

Highway 401 tunnel – as shaded on Figure 6-11 in red – requires some attention as currently there is a slow speed turnout connecting to the mainline. This would need to be upgraded to allow for faster travel times. Additionally, the tunnel under Highway 401 would need to be assessed by conducting further detailed engineering survey in order to determine the feasibility of double track, and to ensure no part of the bridge structure encroaches on the train dynamic envelope.
6.5.7 Pinebush ION Rapid Transit Station Design and Integration

In the ION Stage 2 preliminary design work, the Pinebush ION Rapid Transit Station design includes a basic station building, rail-adjacent station platforms, passenger pick-up and drop-off (PPUDO) area, and pedestrian walkways linked to the adjacent sidewalks. The existing adjacent roadway environment has limited pedestrian facilities and multi-lane intersections spanning up to nine lanes. In addition, traffic conditions along Hespeler Road are less compatible with pedestrian movements, as a result of the large number of driveways and high traffic volumes.

However, the station is envisioned to be in line with a more urban setting, with limited onsite parking. To support this, active transportation infrastructure will be provided throughout the Station, connecting with adjacent infrastructure. The station will support cycling connections and will offer bicycle parking. In addition, separated cycle tracks are currently planned on both sides of Hespeler Road. While large automobile parking lots were not included in cost estimates; opportunities for the provision of parking is anticipated to be organized through future partnerships with adjacent developers. A creative direction for station development would be to pursue a third-party developer model, consistent with other stations being planned and constructed along the GO network. It is imperative that the area surrounding the station be protected for planned intensification as per the Draft Hespeler Road Corridor Secondary Plan. The large lots surrounding the station provide opportunities for future infilling and intensification. Similarly, the Hespeler Road Corridor is planned to support one of the City's main intensification areas.

The Rapid Transit and local transit network will also provide access to local destinations in Cambridge. Access to the Pinebush ION Rapid Transit Station is facilitated by integration with the second phase of the ION LRT route plans approved by Cambridge council, providing direct connectivity to south Cambridge, as well as Kitchener and Waterloo. To achieve this ultimate configuration, the required infrastructure would include two LRT tracks and platforms, as well as a third rail track for the Cambridge-Guelph trains and platform. A platform would need to be built that provides transfer access from ION rapid transit to the Cambridge-Guelph service. PPUDO locations, bus stops and shuttle loops will be located at the corner parking lot to allow for optimum connectivity at this multi-modal transit hub.

Phase 1 will require a single-track layout to meet with a platform on the north side of the rail corridor, as shown in Figure 6-12. There is the potential for the station platform to be integrated with properties on the north side of the future tracks.

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PPUDO area is proposed on the west side of the plaza, north of the tracks as highlighted in orange.

Integration Phase I: platform on north side; a possible integration with properties north (and/or south in phase II)

Figure 6-12 Phase 1 of the Pinebush ION Rapid Transit Station integration with the Cambridge-Guelph service.

Phase 2 will further develop the mini multi-modal hub at the Pinebush ION Rapid Transit Station, as shown in Figure 6-13, with the construction of a platform on the south side of the tracks that will be fully integrated with the future LRT service along Hespeler Road. There is potential for the platform on the south side of the tracks to be integrated with the adjacent plaza as highlighted in yellow.

Integration Phase II: platform on south side, integrated with adjacent plaza

Figure 6-13 Phase 2 of the Pinebush ION Rapid Transit Station integration with the Cambridge-Guelph service and future LRT service.
Further detailed studies, including a redevelopment strategy for this area, are recommended to protect for a seamless integration of the future Cambridge-Guelph rail service with ION LRT.

### 7.1.1 Storage and Light Maintenance Facility Cambridge

A small storage facility will be required to support the Pinebush-Guelph service. A potential site highlighted in Figure 6-14 is an abandoned industrial area with existing rail access, within close proximity to the Pinebush ION Rapid Transit Station. This location could provide train storage and light maintenance facilities, while the convenient location will increase revenue operating time. For all operating service scenarios, it is assumed that one spare trainset will be stored at this location, but revenue trainsets will vary over time. The light maintenance facility initially can be built to accommodate three trainsets for rail service Options 1A, 1B, 1A and 2B, and it can be expanded to accommodate five trainsets for rail service Options 3A and 3B. Additionally, it is recommended that all freight activities will be rescheduled to the night hours. This will allow the freight operators to serve their clients without impacting the passenger service operations.

While this site will only offer light maintenance services such as cleaning, all heavy maintenance is assumed to be completed at the GO Transit Willowbrook Rail Maintenance Facility in Etobicoke. The rolling stock and supporting equipment is expected to cycle periodically to the Willowbrook Rail Maintenance Facility.

Further, it is important to confirm that the rolling stock equipment used on this line is compatible with other Metrolinx corridors, such as electric battery- or diesel-powered trains operating between Guelph and Bramalea GO stations.
6.6 Governance and Operations

6.6.1 Planning

Launching a new rail service in Ontario on heavy rail freight tracks historically has been led by the Province of Ontario through the Ministry of Transportation of Ontario (MTO) and GO Transit. Since the merger of GO Transit and Metrolinx in 2009, Metrolinx has been responsible for leading the planning of GO Transit expansion, and GO Transit and Metrolinx have initiated discussions with freight railway ownership, led capital improvements, and led the operations. In parallel to Metrolinx, Ontario Northland as a separate operating agency has been responsible for rail services including capital improvements and operations of the Ontario Northland rail service for Northern Ontario.

In parallel, the Federal Government operates Via Rail as a rail service operator in a variety of markets across Canada. In some markets, particularly the Greater Toronto and Hamilton Area (GTHA), Via Rail compliments GO Rail services by providing faster, higher priced express services to GO Rail stations. Via Rail's
official website enables customers to purchase tickets for its services and connecting Metrolinx services – including GO and UP.

The Region of Waterloo has taken a leading role in the planning, and delivery of the ION light rail system – a system which makes use of both roads and traditional railway rights of way for its rail corridor rights-of-way and operation.

Recently, under processes enabled by Metrolinx referred to as “market-led” development, Metrolinx has taken a regulator and approver role and encouraged private sector and municipalities to propose new transit system improvements – primarily new stations, but in some cases, new stations have led to impacts and proposals for improved service in conjunction with station and rail corridor infrastructure.

The conclusion is that any level of government could conceivably champion the planning of a new rail service, including the negotiating and funding of necessary capital improvements and operating funding. However, it could be difficult for a single Municipal government to implement the Cambridge-Guelph service due to multiple jurisdictions requiring negotiations, the Provincial Environmental Assessment process, and associated costs. As such, a joint partnership-based model with collaboration from the proponent municipalities in conjunction with Metrolinx would likely prove the most efficient.

6.6.2 Construction, Operations and Ownership

It is worth noting two recent innovations: the recent advent of the Canada Infrastructure Bank, and the advent of the Metrolinx developer-led station development model(s) - potentially create a hybrid public-private delivery solution for the Cambridge-Guelph line and service.

For example, the following models are all conceivable:

- Via Rail owns and operates over CN owned right of way, with GO providing new infrastructure in Guelph
- GO Transit owns and operates over CN rail
- GO buys the rail corridor from CN and operates a service
- GO buys the rail corridor from CN and Region of Waterloo operates a service.

Furthermore, the delivery of the infrastructure could be managed by any one government or a new agency that is co-owned by one or more than one government. It in turn could be delivered through Design-Build packages, perhaps with an operating component. Finance, Maintenance, and Operating components could all be included or considered separately.

This can and should be looked at in subsequent phases of the Study, parallel to the specification of the technical elements of the service and infrastructure.
6.7 Conclusions

The deliverability review did not identify substantial construction or operational risks that cause critical problems to the project. At this stage, some of the key recommendations for the operation and deliverability are as follows:

- Ensure that rolling stock used is compatible with the existing infrastructure;
- Ensure infrastructure repairs are complete; and
- Ensure required infrastructure is accounted for prior to the implementation of the Cambridge-Guelph corridor.

The Deliverability and Operations analysis will need to be further reviewed as part of a future study to advance the Business Case, following the selection of the preferred rail service scenario. Both the level of the track improvements required to operate the rail service and the rolling stock type set the key criteria for subsequent Deliverability and Operations analysis of the Cambridge Study.
7.0 Financial Feasibility

7.1 Overview

The Metrolinx Business Case methodology for assessing the financial case for a new GO Station was considered and applied for Phase 2 of this study. The financial case assesses the financial implications of each rail service scenario and rolling stock type. This analysis covers the hypothetical construction period (2021-2025) along with a 35-year operating window (2026-2061).

This analysis was conducted as a base review of the financial requirements to deliver the rail service options. This analysis does not constitute a fiscal impact assessment and further financial analysis will be required as the Study advances. The analysis does not include depreciation or financial transaction and debt costs.

The financial components of the assessment at this stage of the project consist of the following key elements:

- Total capital costs with 30% for contingency incurred during construction, and 15% for soft costs,
- Operating and maintenance costs – incurred to provide the service starting in 2026 with increases in 2031 and 2041 as the service frequency increases, and
- Revenue (total lifecycle revenue from passenger fares) – generated by ridership, with a steady growth over the 35 years.

7.2 Cost Analysis

7.2.1 Capital Costs

The financial implications of investments including the capital, operation and maintenance costs of providing passenger rail service between Cambridge and Union Station via Guelph via the Fergus subdivision were developed in Phase 1 of the Study and refined in Phase 2, with a more detailed review of the assumptions and more conservative application of the contingency component for the capital expenditure estimate.

For operations between Cambridge and Guelph, the service, at a very high level, has been modelled on the Union-Pearson Express DMU-only service, albeit with very basic service patterns. The Phase 1 assumptions on infrastructure improvements, bus service for off-peak periods, and Pinebush ION Rapid Transit Station integration costs were reviewed and enhanced in the Phase 2 cost estimate analysis. The updated capital cost breakdown provided in this Section provides more clarity on the itemized cost estimates.

Table 7-1 highlights the capital costs for each rail service option and different types of rolling stock. The most expensive option to implement would be Option 3B for EBMU trains, while the cheapest is Option 1A for DMU.
Table 7-1 Capital Cost Technology Comparison Summary

<table>
<thead>
<tr>
<th>TOTAL CAPEX, with Contingency (30%), Soft Costs (15%), in $2020 CAD millions</th>
<th>Option 1A</th>
<th>Option 1B</th>
<th>Option 2A</th>
<th>Option 2B</th>
<th>Option 3A</th>
<th>Option 3B</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMU</td>
<td>$153</td>
<td>$160</td>
<td>$162</td>
<td>$174</td>
<td>$243</td>
<td>$252</td>
</tr>
<tr>
<td>EMU</td>
<td>$184</td>
<td>$191</td>
<td>$194</td>
<td>$205</td>
<td>$306</td>
<td>$315</td>
</tr>
<tr>
<td>EBMU</td>
<td>$167</td>
<td>$174</td>
<td>$177</td>
<td>$188</td>
<td>$258</td>
<td>$266</td>
</tr>
</tbody>
</table>

Between the various Options identified in Table 7-1, the main difference is the amount of trackage that requires signaling and electrifying and the amount of rolling stock required to operate the service. The capital expenditure for the rolling stock could be reduced if the order were bundled into the procurement process for the wider GO network however, this would require using similar technology as the GO network which may not be appropriate.

The main difference between the DMU and EMU is the cost of electrifying the line which comprises a significant cost in all scenarios. For a pure electric EMU train, the increase is substantial which couple with only small benefits. The EBMU technology requires only small sections of electrification at the end of the stations for recharging purposes, which substantially reduces the amount of capital expenditure required. The cost for the supply, maintenance, and disposal of batteries for the EBMU option could be optimized based on the procurement process, and would still result in this option being more cost efficient than the EMU alternative.

Multiple level crossings are present along the existing track, and Google Street View provided the ability to view the track condition at a high level and estimate the cost of upgrades. For costing purposes, two grade separations were assumed to be required along the rail corridor. It is understood, based on guidance from Region of Waterloo staff, that the grade separation at Eagle Street North will be incorporated as part of the ION Stage 2 Rapid Transit implementation plan. Further studies are required to inspect the at-grade crossings which need to be upgraded or modified to a grade separation for quantifying the associated capital costs.

The cost of developing the Pinebush ION Rapid Transit Station with basic station building, platform, and passenger pick up and drop off has been carried in the capital cost estimate. A small siding to store trains and a small building for light maintenance provision was also included in the capital cost estimate.

Table F-1 in Appendix F provides the capital cost breakdown of the rail infrastructure improvements, which include:

- Track upgrades;
- Electrification for EMU;
- Charging stations for EBMU;
- Lights/gates;
• Grade-crossings separation;
• Signalization;
• Bridge repair for Options 1A, 1B, 2A and 2B;
• Two bridges double tracking for Options 3A and 3B;
• Rolling stocks;
• The Pinebush ION Rapid Transit Station structures and rail access improvements;
• Storage and light maintenance facility;
• Pinebush ION Rapid Transit Station;
• Guelph line infrastructure improvements; and
• Bus acquisition costs.

7.2.2 Operating and Maintenance Costs

Operating and maintenance (O&M) costs consist of the costs required to operate the line such as crewing, station maintenance, train and track maintenance, and fuel costs. Additionally, in Phase 2 of the Study, the bus service O&M costs have been included, since the all-day rail service would not start operating sooner than 2041. The bus service O&M costs reduce over time, hence reducing the total operational expenditure indicated in the Phase 2 of the Study compared to the estimated cost in the Phase 1.

A notable operational expenditure is assumed to be a financial contribution to the Kitchener line capacity expansion to accommodate the ridership increase generated by the Cambridge-Guelph line. For the financial analysis purposes, this cost has been distributed by annual Kitchener line capacity expansion O&M cost and included into the operational expenditure starting from 2031.

It is assumed that the service would operate continually at various frequencies as per different time horizons assumptions. As crewing costs is one of the largest components of the operational expenditure, in Phase 2, it is assumed that this line will utilize one-man crews. For clarity, in Phase 1 of the Study, the basic railway operating cost build out was not a proportioned UP Express cost, which includes significant staffing and share of the head office overhead expense; thereby, the total O&M expenditure in Phase 2 is substantially reduced. The reduced staffing and overhead will require special permissions from Transport Canada; however, it is understood that Metrolinx is pursuing this resource optimization for other parts of their network.

The total operational expenditure includes maintenance costs which vary between the equipment types. It was assumed an additional upfront maintenance costs (under capital expenditure) would be associated with the EBMU as there is no existing facilities to maintain this type of vehicle, however, the operational expenditure is lower compared to a traditional EMU as there are no OCS (overhead catenary system) to maintain. Ultimately the choice of vehicle has to be assessed by several factors such as speed profile in the corridors, costing of carbon emissions from diesel and equipment savings from journey times and increased ridership. The EBMU represents the best balance between performance, cost, and future proofing. Table 7-2 provides an overview of the O&M cost across all options and horizon years for the Study.
### Table 7-2 Total Operating Expenditure for each Service Option

<table>
<thead>
<tr>
<th>Horizon Year</th>
<th>TOTAL OPEX, with Contingency (30%), in $2020 CAD millions/year</th>
<th>Option 1A</th>
<th>Option 1B</th>
<th>Option 2A</th>
<th>Option 2B</th>
<th>Option 3A</th>
<th>Option 3B</th>
</tr>
</thead>
<tbody>
<tr>
<td>2026</td>
<td>DMU</td>
<td>$1.18</td>
<td>$1.20</td>
<td>$1.52</td>
<td>$1.60</td>
<td>$2.56</td>
<td>$2.16</td>
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<tr>
<td></td>
<td>EMU</td>
<td>$1.15</td>
<td>$1.17</td>
<td>$1.42</td>
<td>$1.47</td>
<td>$2.17</td>
<td>$1.86</td>
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<tr>
<td></td>
<td>EBMU</td>
<td>$1.15</td>
<td>$1.16</td>
<td>$1.41</td>
<td>$1.46</td>
<td>$2.13</td>
<td>$1.83</td>
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<td>2031</td>
<td>DMU</td>
<td>$1.96</td>
<td>$2.05</td>
<td>$2.88</td>
<td>$3.11</td>
<td>$5.58</td>
<td>$4.75</td>
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<td></td>
<td>EMU</td>
<td>$1.91</td>
<td>$1.97</td>
<td>$2.66</td>
<td>$2.82</td>
<td>$4.71</td>
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<td></td>
<td>EBMU</td>
<td>$1.90</td>
<td>$1.97</td>
<td>$2.64</td>
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<td>$4.62</td>
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<td>2041</td>
<td>DMU</td>
<td>$1.55</td>
<td>$1.63</td>
<td>$2.84</td>
<td>$3.11</td>
<td>$6.55</td>
<td>$5.19</td>
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<td>EMU</td>
<td>$1.49</td>
<td>$1.56</td>
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<td>$5.61</td>
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<td></td>
<td>EBMU</td>
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<td>$1.54</td>
<td>$2.56</td>
<td>$2.75</td>
<td>$5.45</td>
<td>$4.37</td>
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</tbody>
</table>

#### 7.3 Revenue Potential

Revenue forecasts were developed based on the ridership forecasts presented in Section 3.4. The detailed methodology is available in Appendix C. This section describes an overall approach to fare revenue of service for the three horizon years (2026, 2031, and 2041) based on the forecasted passenger. Before calculating potential revenue, an average fare was determined by:

- Defining the proportional ridership by age group and concession type based on the Kitchener line; and
- Determining the cost by distance and concession type.

Ridership estimations from Section 3.4 were multiplied by the average fare between each of the mid-line stations and Union to get the passenger fare revenue.

##### 7.3.1 Average Fare

The average fare by distance and concession type was retrieved through the GO Transit website using the trip planning tool for each of the origin-destination pairs. The fare to/from the Kitchener GO Station was used to calculate the fare-by-distance to/from the proposed Pinebush ION Rapid Transit Station in Cambridge.

The revenue forecast takes into account recent fare changes on GO Transit service, with a $3.70 flat single-ride fare for all trips less than 10km and higher fares for longer distance trips. The average fare estimated between Cambridge to Guelph is $9.50, with a fare of $15 from Cambridge to Union Station on the Kitchener Line.
7.3.2 Revenue Forecast

The annualized result of this analysis for Scenario 2A is shown in Figure 7-1.

By 2026, the service is anticipated to generate between $1.6 and $4.2 million dollars (depending on the ridership forecast), growing to between $6.3 and $15.3 million by 2041 due to ridership growth as a result of population and employment increase along the corridor and improvements to the service.

![Figure 7-1 Revenue Forecast (Scenario 2A)](image)

The different scenarios introduced in Section 3.2 have different ridership levels that generate a range of revenue forecasts. The high and low revenue estimates for each case are outlined in Table 7-3.
### Table 7-3 Revenue Estimates for all Ridership Scenarios

<table>
<thead>
<tr>
<th>Scenario (Headway)</th>
<th>1A (60 min)</th>
<th>1B (45 min)</th>
<th>2A (30 min)</th>
<th>2B (22.5 min)</th>
<th>3A (15 min)</th>
<th>3B (15 min)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2026</strong> LOW</td>
<td>$1,323,307</td>
<td>$1,398,400</td>
<td>$1,604,978</td>
<td>$1,736,332</td>
<td>$2,229,791</td>
<td>$2,278,199</td>
</tr>
<tr>
<td>HIGH</td>
<td>$3,474,967</td>
<td>$3,579,975</td>
<td>$4,172,033</td>
<td>$4,307,603</td>
<td>$5,862,800</td>
<td>$6,051,664</td>
</tr>
<tr>
<td><strong>2031</strong> LOW</td>
<td>$3,313,956</td>
<td>$3,507,929</td>
<td>$4,012,519</td>
<td>$4,348,058</td>
<td>$5,605,147</td>
<td>$5,761,669</td>
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<tr>
<td>HIGH</td>
<td>$8,131,442</td>
<td>$8,475,793</td>
<td>$9,772,236</td>
<td>$10,195,048</td>
<td>$13,828,820</td>
<td>$14,303,510</td>
</tr>
<tr>
<td><strong>2041</strong> LOW</td>
<td>$5,227,034</td>
<td>$5,546,079</td>
<td>$6,270,266</td>
<td>$6,810,386</td>
<td>$8,791,763</td>
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</tr>
<tr>
<td>HIGH</td>
<td>$12,776,499</td>
<td>$13,436,136</td>
<td>$15,318,324</td>
<td>$16,049,250</td>
<td>$21,667,429</td>
<td>$22,459,281</td>
</tr>
</tbody>
</table>
7.4 Financial Feasibility Summary

In Figure 7-2, the Phase 2 cost-benefit analysis outputs indicate that this project is viable since all rail service Options under the high-ridership scenario have benefit-cost ratio (BCR), higher than 1. The financial appraisal was conducted by applying sensitivity test for inflation and discount rates as noted in the financial-economic analysis assumptions presented in Appendix E. This helps to understand how financial impact varies based on changes in expenditure or revenue.

The service Option 1B, DMU is the most cost effective of all alternatives, which has the highest BCR of 2.7. While this analysis finds DMU rolling stock type to be more viable than other rolling stock types, the EBMU Option is also competitive in most of the scenarios, i.e. BCR is above 2 in almost all scenarios, except for the Option 3A.

Both rail service Options 2A and 2B for DMU rolling stock indicate the highest Internal Rate of Return (IRR) of 10.4% and 10.3%, respectively. This implies the lowest financial commitment in relation to operational costs. Therefore, both rail service Options 2A and 2B are the fastest scenarios to generate positive return in 2036.

The rail service Option 3B, EBMU represents the most favorable capital cost in relation to future benefits, and thus, it yields to the highest Net Present Value (NPV) of $621 million.

Even for the low-ridership scenario, the rail service Option 1B, DMU indicates a BCR above 1, and the NPV of $38 million.

The financial summary for both high- and low-ridership scenarios, all rail service Options for DMU, EMU and EBMU are presented in Appendix E.
8.0 Comparison with the Milton Corridor

A Feasibility Study for the extension of intercity passenger rail service to Cambridge was completed in 2009 and determined that the preferred routing option to connect Cambridge to the GO Rail network was to extend the Milton Line GO Train service from Milton to Cambridge. The 2009 Passenger Rail Feasibility Study (2009 Study) included estimates for capital and operating costs and provided ridership and revenue forecasts for the 2021 and 2031 horizon years. The study assumed that the service extension would follow GO Transit’s traditional approach of starting the new service with four peak-only trains and further increasing the peak period frequency to respond additional increase in GO service demand.

That study was completed well before the current planning and program design that resulted in the step-change approach to advancing the current GO network that is now underway (referred to as “GO Expansion”). In a similar time period and certainly well-after the 2009 study, Toronto Pearson International Airport and other stakeholders advanced the concept of Union Station West in the vicinity of Pearson Airport terminals, and in theory, in service of both the airport and large airport area’s significant employment.

A team of Dillon Consulting Limited and Hatch Ltd. was retained by the City of Cambridge to augment the 2009 Study and a subsequent 2014 report (2014 Study) by developing additional scenarios that build on the previous work; explore the opportunity to start the train service quickly and with lower investment; test other important transit travel markets and promote a transit-oriented approach to station access and commuter service configurations. This involved the assessment of the 2009 scenario, as well as 2 additional scenarios described below.

Scenarios 2 and 3 were designed to use the Cambridge rail service extension to test DMUs (Diesel Multiple Units) in terms of flexibility, performance, operating cost, customer acceptance, infrastructure requirements and its ability to address intercity passenger rail markets. Scenario 2 was based only on using DMU technology for the Cambridge to Milton rail service to assess a variety of transit travel markets. This scenario used four DMU’s to provide peak period service between Cambridge and Milton and allowed passengers to connect with four of the eight peak period 12-car GO Trains at Milton. Scenario 3 uses a blend of DMU vehicles and 12-car diesel trains for the service and features only peak direction service. The 2014 Study ultimately recommended Scenario 2. The 2014 Study noted Metrolinx’s acquisition of DMU vehicles for the Union Station to Toronto Pearson International Airport line (UP Express Line).
Table 8-1 summarizes the results of the 2014 business case and the three new scenarios, compared the results of this study to connect Cambridge to the Kitchener Line via Guelph. The recommendation of the 2014 Study was to implement Scenario 2 for the Milton to Cambridge service extension, due to the significant advantages of DMU technology for the GO Rail network, including the opportunity to address more regional travel markets with a high-quality transit service.

Scenario 2A in this study estimated 2031 ridership projections that are substantially higher than those in the 2014 Business Case. However, note that the scenarios in this study include weekend service, while the 2014 scenarios did not (they focus on a peak service). Furthermore, the Milton scenarios do not offer a direct connection to Guelph. In the Guelph (2A) scenario, trips to and from Guelph are expected to account for approximately 30% of trips on the line. While identifying service on a different route to Union Station, Scenario 2A has ridership that is similar to the Milton scenario in the 2009 Feasibility Study. The 2009 Feasibility Study has significantly higher ridership than the 2014 Study due to higher frequency of service. Scenario 2A in this study via Guelph projects significantly higher ridership than the 2014 Study due to a combination of higher mid-day service frequency, slightly faster journey time, and service to better markets (via Guelph). Scenario 2A is expected to improve fairly significantly between 2031 and 2041 as significantly better service is envisaged to be possible on the Kitchener Line, improving journey choice and travel times between Guelph and Toronto. While an enhanced journey time program in the 2030s that would be necessary is not currently committed to by Metrolinx, the Kitchener corridor which was significantly enhanced to support UP Express service has future potential for additional speed improvements. In comparison, there are relatively poor prospects for enhanced journey time via the Milton corridor.

**Mid-Line Travel Market Comparison with the Milton Corridor**

The Guelph-Cambridge connection explored in this study has a higher potential for ridership to mid-line stations than an extension of the Milton Corridor. This is largely due to the expected ridership between Cambridge and Guelph.

The 2014 Cambridge to Milton Passenger Rail Business Case and Implementation Strategy forecasted trips on the Milton Corridor, should it be extended to Cambridge. Both that study and this study use a similar methodology for forecasting ridership to mid-line stations. Travel data from the Transportation Tomorrow Survey, population and employment projections, and future station area characteristics (local transit connections, parking, etc.) were used to predict both the total number of person trips and GO Rail mode share from Cambridge to the mid-line station areas.

Excluding trips to Milton and Guelph, both the Milton Line extension and the Kitchener Line offer similar ridership potential to mid-line stations. However,
there is a significantly larger travel market for trips from Cambridge to Guelph
than from Cambridge to Milton.

In the 2014 study that contemplated an extension to the Milton Line, roughly
2,000 AM Peak period trips across all modes were forecasted in 2031 from
Cambridge to the catchment areas of the mid-line stations. Roughly half of these
trips were forecasted to go to the Milton Station area, while the rest were split
between the other mid-line stations. In this study, a similar forecasting
methodology was used that predicts roughly 5,000 AM Peak period trips across
all modes to the mid-line stations on the Kitchener Line in 2031. Roughly 4,000
of these trips are forecasted for the Guelph Station catchment area. Therefore,
there is a larger travel market for mid-line travel that can be taken advantage of
on the Kitchener Line compared to the Milton Line.

Furthermore, there is significant two-way travel demand from Guelph to
Cambridge, making better use of the two-way service, while there is little AM
peak travel demand in the “reverse direction” from Milton to Cambridge.

Currently, there are no services provided by Grand River Transit, Guelph Transit,
or GO Transit for travel between Cambridge and Guelph that do not require a
transfer. The Guelph-Cambridge connection to the Kitchener Line would fill this
gap in the tri-cities area, while the Milton Line extension would act primarily as a
link to Union Station.
Table 8-1 Comparison of Projected Ridership on Milton and Guelph Corridors (2031)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Average Travel Time to Union (mins)</th>
<th>Frequency of Service from Cambridge</th>
<th>Service</th>
<th>2031 Annual Ridership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guelph (2A)</td>
<td>96 (including 5 minute transfer penalty)</td>
<td>30 mins (All Day)</td>
<td>Both Directions</td>
<td>310,219 711,640</td>
</tr>
<tr>
<td>Milton #1 (2009 Feasibility Study)</td>
<td>92.5</td>
<td>20 mins (AM) 20-30 mins (PM)</td>
<td>Peak Direction</td>
<td>389,100 715,700</td>
</tr>
<tr>
<td>Milton #2 (2014 Business Case)</td>
<td>93.5</td>
<td>30 mins (AM) 60 mins (Mid) 30-45 mins (PM) 60 mins (Eve)</td>
<td>Peak Direction (Both Directions between Cambridge and Milton)</td>
<td>192,000 376,200</td>
</tr>
<tr>
<td>Milton #3 (2014 Business Case)</td>
<td>95.5</td>
<td>30 mins (AM) 60 mins (PM)</td>
<td>Peak Direction</td>
<td>195,200 377,700</td>
</tr>
</tbody>
</table>

8.1.1. Revenue Comparison with the Milton Corridor

Annual revenue in 2031 is expected to be similar to that of the options explored in the 2009 and 2014 studies regarding a Milton Line extension, as shown in Table 8-2. Figures from past studies have been adjusted to match current fare policy using average fares from past editions of the Canadian Urban Transit Association (CUTA) Factbook on Conventional Operating Data (2017). Therefore, the annual revenue is comparable and in 2019 dollars.

Table 8-2 2031 Annual Review Comparison with Milton Corridor Options

<table>
<thead>
<tr>
<th>Scenario</th>
<th>2031 Annual Revenue (2019 Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Guelph (2A)</td>
<td>$4.0M</td>
</tr>
<tr>
<td>Milton #1 (2009 Feasibility Study)</td>
<td>$5.3M</td>
</tr>
<tr>
<td>Milton #2 (2014 Business Case)</td>
<td>$2.7M</td>
</tr>
<tr>
<td>Milton #3 (2014 Business Case)</td>
<td>$2.7M</td>
</tr>
</tbody>
</table>
9.0 Summary and Next Steps

9.1 Key Findings of Feasibility Review

At the culmination of Phase 2 of the Study, the findings highlight the viability and comparative benefits of connecting Cambridge to the GO Rail network by way of the Fergus subdivision to Guelph, relative to providing a connection via the Milton Line extension. The analysis completed and documented in this Report concludes that the Guelph connection option has the potential to provide overall net benefits and reasonably affordable delivery, particularly in the longer term as ridership grows. This conclusion is based on reasonable progress being made by Metrolinx on improving mainline Kitchener GO train service to 2031, as laid out in the Kitchener GO Rail Service Expansion Initial Business Case Update (November 2019), and beyond.

Proactive planning for future network expansion is an important component of leveraging Provincial investments in regional rail. Examining the feasibility of a potential connection to Cambridge via the Fergus subdivision and confirming its constructability would allow for proactive land use planning and design of local rapid transit to support future integration with GO service. The Region of Waterloo is planning for the implementation of Stage 2 of the ION Rapid Transit network to connect Kitchener and Cambridge, which will also rely upon the use of some sections of the Fergus Subdivision corridor within Cambridge City limits. This provides an opportunity for a future passenger rail service to connect to Guelph to capitalize on planned improvements to the corridor and support greater utility from these investments.

The following summarizes the key benefits of connecting Cambridge to the GO network via the Fergus subdivision:

- Connect Cambridge (as one of the fastest growing centres in the Province) to the GTA;
- Improve economic growth and investment potential in Cambridge, creating access to skilled jobs and more affordable housing;
- Leverage local investments in the Stage 2 ION Rapid Transit network and improvements to the Fergus Subdivision sections in Cambridge, and create seamless integration with regional transit;
- Potential to facilitate the land use intensification and rail-oriented development prospects in north Cambridge on a faster timeline with development spurred by investment in regional transit;
- Provide relief for congestion along Highway 401, which currently does not have sufficient capacity to meet growing demand, and will continue to struggle to provide capacity once all widenings are completed between the Region and the GTA;
Offer a high degree of deliverability of the service compared to the Milton extension; and

Leverage investments made on the Kitchener GO line.

There are strategic benefits to supporting and investing in rail-oriented transit rather than bus or other road-based transit options. Rail service has the ability to shape travel behaviour in more substantial ways than bus service. It provides an opportunity to take significant vehicle users off road corridors, reducing congestion and creating environmental benefits through reduced air emissions. Rail investment creates other investment opportunities, as evidenced by the growth of new urban centres around GO Transit Stations across Southwestern Ontario. Cambridge has been disconnected from the GO Rail network, creating a gap in service that stakeholders across Waterloo Region have been working with the Province to address (Figure 9-1). Designating Cambridge’s future commuter rail service and candidate station is essential to connect regional centres and sub-centres and support intensification.
Figure 9-1 GO Rail service network connecting Southwestern Ontario to the GTA
Cambridge to Union Rail Feasibility Study

GO Rail service network connecting Southwestern Ontario to the GTA

Figure 9-1

Track Ownership
- Other
- Canadian National
- Canadian Pacific
- Metrolinx

Cambridge Station Alternative
GO Train Station
GO Rail Alignment
Waterbody
Municipal Boundary
In addition, housing affordability remains one of the most critical factors in labour attraction and retention in Ontario. Cambridge has a larger market of relatively affordable housing compared to municipalities in the GTA (Figure 9-2 - CTV Kitchener, February 2018).

![Figure 9-2 Comparison of average single-family home price in Ontario Municipalities along the Highway 401 Corridor. Source: CTV News Kitchener, Published Friday, February 23, 2018](image)

Providing fast, convenient, and well-serviced access to the GO Rail network would unlock opportunities for families to settle in Cambridge while accessing the base of employment opportunities in the GTA, particularly the Pearson Airport and Downtown Toronto employment areas. Investing in this connection will yield the benefits of improving affordable housing prospects for families while creating growth, employment, economic diversification, and investment opportunities in Cambridge. Off-peak evening and weekend service would further bolster a behaviour shift towards more transit-oriented mobility.

The service being examined along the Fergus Subdivision would not require heavy diesel locomotives, and instead employ DMUs or other high-efficiency vehicles that are more reliable and can provide cost effective all-day service suitable for low demand inter-municipal applications.

The long-term growth in post-secondary institutions located in the vicinity of GO Transit Stations also supports the need to provide a fully connected network across Waterloo Region and the GTA (Figure 9-3), as all major institutions draw students from the broader region (Figure 9-4). With school-related trips accounting for 20% of travel by GTHA residents in the morning peak period (Metrolinx 2041 Regional Transportation Plan), it is understood that students are heavily pre-disposed to using public transit and the existing market is only projected to grow.
FIGURE 9-4

Academic Institutions

Cambridge Station Alternative

GO Train Station

GO Rail Alignment

Road

Municipal Boundary
9.2 Next Steps

This Study was undertaken with the intent of establishing the potential for a Guelph-based connection between Cambridge and GO Rail service. While there is much to be done to realize a new service resembling what has been described in this report, as described in Section 6.7, there are no major operational or constructability risks or obstacles identified through the analysis completed to date.

There are a number of next steps to advance the introduction of a new service, some of which can be undertaken in parallel, while other aspects will need to follow certain steps. To endorse the new service which will integrate with existing and planned improved Kitchener line services, and to serve as a Province of Ontario gateway for funding consideration, a full Initial Business Case (IBC) would need to be completed, building on the work done through this Study to date and in compliance with Metrolinx guidance. The IBC could be conducted by the Region of Waterloo in partnership with proponent municipalities (Cambridge and Guelph), enlisting Metrolinx support in a Reviewer capacity at pre-determined points throughout the process.

An Environmental Assessment (which would be expected to be completed as a Transit Project Assessment, or TPA), would typically be conducted after project’s viability has been confirmed in the IBC process. Should Metrolinx elect to lead the IBC, It is recommended for the proponent municipality or municipalities to be involved in providing Metrolinx with complete information for input into the business case, to facilitate the completion of a holistic review that reflects all relevant current information.

A Communications Strategy has been developed to go alongside this Report which provides recommendations on stakeholder engagement with agencies, municipalities, and key advocacy groups to be undertaken towards further exploring the potential to move towards subsequent phases of building the business case for the service. Engagement can also serve to gain a better understanding of the business and development communities’ enthusiasm for a new rail service, which can lead to the development and utilization of the new service from ridership and city-shaping perspectives.

From a process perspective, the following roadmap diagram provides an overview of the potential directions to move the Study through subsequent stages of design and implementation to make Pinebush-Guelph rail service a reality. The roadmap focusses on five key areas of the rail service phasing which consist of:

- Design and Planning
- Contracting and Procurement
- Financial Planning and Considerations
- Legal and Business
- Stakeholder Engagement
Figure 9-5 Pinebush-Guelph Rail Service Design & Implementation Roadmap
These processes run in parallel, ensuring each aspect of the design and phasing of the project is accounted for and on schedule. The Region should establish a plan with Metrolinx and other stakeholders to determine the appropriate lead for each of the key processes in establishing this rail service.

The implementation of the Pinebush-Guelph rail service could potentially be implemented over a duration of approximately six years, and encompasses two design and planning aspects: the Pinebush-Guelph rail corridor, and the Pinebush ION Rapid Transit Station, assuming three consecutive years to complete a full 100% design. The Track and Station design timeline has been broken down into i) 1% Design and ii) 2-10% Design. After that, it is assumed that the project will be developed to 30%, 50%, 90%, and 100% Design milestones. It is possible that fewer milestones would be required; this is subject to discussions with CN, Metrolinx, and other stakeholders, and is also subject to the delivery (construction and operation) model employed, which is not known at this time.

A potential contracting and procurement approach is shown in the roadmap in Figure 9-5. At the completion of the 10% Track and Station design phase, early discussions around potential delivery methods could begin to occur, and a project procurement plan would start to take shape. Within the procurement plan, an assessment would be required of the existing industry capacity and experience to deliver the project. Industry capacity refers to the availability of construction and engineering industry labour and expertise, and especially the skilled trades, required to deliver the project. This ideally involves some early market engagement with appropriate contractors.

The procurement plan should include an identification, assessment and mitigation of risks, and how they differ across investment options. The following three potential procurement strategies are identified and require further analysis, each associate with different risks and core required capabilities:

- **Design Build (DB)** – With this model, a single contractor completes the design and builds the assets. This model is well suited to fast-track construction, when project funding is aligned and accessible. Design Build relies on a single point of responsibility and is used to minimize risk for the project owner and to reduce the delivery schedule by overlapping the design phase with the construction phase of a project.

- **Design-Bid-Build (DBB)** – In a DBB model, the owner could establish a contract with separate entities for the design and construction of a project. The three sequential phases to this delivery method are design, bidding, and construction. This delivery method commonly runs into inefficiencies with the lack of collaboration between the design and construction teams. The owner is also left responsible for claims from contractors due to design errors or omissions. However, this process can ensure fairness in the bidding process, and has the added benefit of preserving flexibility throughout the project delivery for the owner. Flexibility, particularly with respect to brownfield assets such as the rail corridor in question, can be attractive but requires the appropriate level of skills, expertise, and good project governance on the owner’s side.
• Integrated Project Delivery (IPD options) – A collaborative alliance between owner, master developer and key specialty trades. This delivery method aims to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction. An IPD approach brings all participants together early in the project cycle for increased communication and collaboration. All rewards and risks are shared by the contracted parties to better integrate resources, processes, and expertise, and align interests. This method can require more resources to be deployed earlier on, and requires strong project management and monitoring; however, for brownfield assets with a combination of transit and real estate considerations, this model could be the optimal route.

At the completion of the 30% design, a procurement model should have been selected, as project delivery will be ready to be undertaken. This will lead to the beginning of construction phase in Year 4, possibly to be completed by the end of Year 6. It is important to note that the different procurement models will have different timelines, but for the purposes of a high-level discussion at this level of knowledge of the project, the descriptions provided here are sufficient and based on current best practices.

Given current knowledge of work proceeding on similar projects, at this time it could be suggested that a model combining the best of DBB and IPD is likely the most appropriate route forward – however, more design work, risk analysis, and procurement thinking that looks at all models of delivery should proceed ahead of any final decisions. DBB and IPD are attractive at this time because they likely maximize opportunities, preserve flexibility, and can manage risks related to development and infrastructure integration, which are the critical issues on this brownfield, Kitchener line integrated project.

The financial case for the Pinebush-Guelph service needs to be further analyzed by developing a project funding and financing model to deliver the project. There are a variety of opportunities for sources of public funding which could be looked at, while also considering the financial benefits accruing to the project, which might result in fare and non-fare revenue opportunities for the project.

Legal and Business agreements established between key stakeholders will need to be progressed to advance the project delivery. The Transit Project Assessment Process (TPAP), which is an expedited Environmental Assessment for transit projects in Ontario, is essential to progress with subsequent phases of design and construction. In particular, the Metrolinx Board Approval of an updated Business Case (which follows the Initial Business Case) by the end of Year 2, along with a funding mechanism, are the first key steps to enable successful project implementation. Thus, associated governance and funding memorandums of understanding (MoU) will need to be negotiated and signed-off on to support further project advancement.

Additionally, associated agreements between the City of Cambridge and the real estate developers of the adjacent development located in the Pinebush ION Rapid Transit Station area will need to be negotiated to support the idea of creating transit-oriented community which maximizes the land use opportunity
at Pinebush ION Rapid Transit Station. Agreements with adjacent landowners all along the corridor and in Guelph will also be paramount to the successful delivery of this service.

A key potential financing source for the project could be the Canada Infrastructure Bank, since the project fulfills public transit and infrastructure goals; this would require establishing the Special Purpose Vehicle (SPV).

Stakeholder engagement is one of the most crucial elements of the process for successful project delivery, and warrants regular meetings and discussions with governmental entities at all levels in the related geography, including the Government of Canada, Province of Ontario, Region of Waterloo, City of Cambridge, Wellington County, and City of Guelph. Consultation with the public is also needed.

At this time, it is not recommended that any party pursue full project funding, but rather an incremental investment is required to pursue the next stages of project development. These next stages of work will bring clarity to project scope, funding requirements, and other relevant details which will make the project ready for full funding application from the variety of available sources.

It cannot be understated that this is a capital project of significance to the Region of Waterloo, City of Guelph, and the communities in the area. A capital project of this significance and inherent complexity requires a project office of some kind, with appropriate staffing and access to expert resources. The project will need a champion and day-to-day resources to see it through.

Finally, the Pinebush-Guelph rail service requires the ideally expedited implementation of faster, more frequent Kitchener line service, and a Kitchener GO service improvement advocacy program must be continued and accelerated on the part of many regional stakeholders to ensure that improved, high quality service is realized, making the Pinebush-Guelph service as attractive and successful as it can be.