OVERVIEW:

- Queen Street Rapid Transit, GO Rail Service Expansion, and Hurontario-Main Light Rail Transit (LRT) are major elements of the regional transit network required to address mobility constraints and to ensure an integrated urban strategy for Downtown Brampton and the Central Area.
- LRT is required to meet transit ridership demands of 35 million people annually along the Hurontario-Main corridor, which will exceed the capacity of Züm services.
- The Province announced full capital funding of $1.6 billion and needs a decision from the City of Brampton on the LRT alignment north of Steeles Avenue.
- An assessment of alternative alignments north of Steeles Avenue determined that all options except the tunnel option had major technical issues.
- The tunnel option comes at an additional cost of $380 million to be borne by the City of Brampton.
- A third party peer review confirmed that the findings of the alternative alignments assessment report are appropriate and defensible.
- Staff seeks Council endorsement of the Transit Project Assessment Process (TPAP) approved surface route as the preferred alignment for the Hurontario-Main LRT project including north of Steeles Avenue to the Brampton GO Station.
- The TPAP approved surface route supports the Council approved land use policy for the corridor and Downtown Brampton, protects for a future extension to the Brampton-Caledon boundary, and allows events in Downtown Brampton including the Farmers Market, parades, etc. to still occur.
- Through the south Main Street area between Nanwood Drive and Wellington Street, the road cross-section will remain relatively the same as existing: two lanes per direction, full moves access for driveways, and mature trees lining the road. All works will take place within the existing road right-of-way (no additional property required) and no impacts to existing buildings.
RECOMMENDATIONS:

1. THAT the report from C. Duyvestyn, Manager, Infrastructure Planning, Capital Construction, Maintenance & Operations, dated June 9, 2015, to the Planning & Infrastructure Services Committee Meeting of June 22, 2015, re: Recommendation Report – Hurontario-Main Light Rail Transit Project Update (File HA.a (EA 10-3130-101)) and appendices be received; and,

2. THAT Council endorse the Hurontario-Main Light Rail Transit (LRT) surface route that was recommended in the Transit Project Assessment Process (TPAP) and approved by the Minister of the Environment and Climate Change as the preferred alignment for the Hurontario-Main LRT Project, including north of Steeles Avenue to the Brampton GO Station; and,

3. THAT the City Clerk be directed to forward a copy of this report and Council Resolution to the City of Mississauga, Region of Peel, Metrolinx, Ministry of Transportation, and 407ETR for information.

BACKGROUND:

Metrolinx and the cities of Brampton and Mississauga are developing an efficient transit system, to build vibrant, safe, prosperous and connected communities. The proposed Hurontario-Main Light Rail Transit (LRT) system is a key element of Brampton’s vision for the Hurontario-Main Street corridor, and in particular for the growth and evolution of the Downtown and Central Area. The three Council priority Metrolinx projects – Queen Street Rapid Transit, GO Rail Service Expansion (two-way all-day) and Hurontario-Main LRT – are major elements of the regional transit network that support one another and converge at the Brampton GO station.

Pre-Planning Phase and Transit Project Assessment Process (TPAP)

The cities of Brampton and Mississauga initiated the pre-planning phase of the Hurontario-Main LRT project in late 2011 to build on the Council approved Hurontario Main Street Corridor Master Plan. Public consultation included four rounds of public meetings and several meetings with stakeholders, which was used as input into the preliminary design of the project. This phase of work was in preparation for the provincially mandated six-month Transit Project Assessment Process (TPAP) to satisfy Environmental Assessment requirements.

City Council authorized the issuance of the Notice of Study Commencement to initiate the TPAP for the Hurontario-Main Light Rail Transit project at its meeting of November 20, 2013 (C307-2013) (See Appendix 1 for Council resolutions from its meeting of November 20, 2013). In addition, Council directed staff to undertake a study of alternative routes north of Steeles Avenue to the downtown Brampton GO station, including north of Nanwood Drive to connect to the Peel Memorial Hospital site. A final decision on the alignment of the Hurontario-Main LRT
north of Steeles Avenue and any commitment to its construction within Brampton is also subject to the approval of Council.

These recommendations were reiterated in a Notice of Motion approved by City Council at its meeting of September 10, 2014 (CW282-2014) (See Appendix 2 for Council resolutions from its meeting of September 10, 2014). In addition, City Council stated that it is a priority that the Hurontario-Main LRT be extended up to the City’s northern boundary.

Metrolinx and the cities of Brampton and Mississauga issued the Notice of Study Commencement to initiate the TPAP for the Hurontario-Main LRT project on February 19, 2014. A Notice to Proceed was issued by the Minister of the Environment and Climate Change on August 25, 2014 allowing Metrolinx and the cities of Brampton and Mississauga to proceed with implementation of the Hurontario-Main LRT project.

The TPAP approved alignment for the Hurontario-Main LRT is a surface route between the mobility hubs at the Brampton GO station and the Port Credit GO station (see Appendix 3 for Highlights of Hurontario-Main LRT TPAP Approved Surface Route).

Need for Light Rail Transit

Without LRT, the following issues will arise:

1. Worsening traffic congestion will negatively impact Brampton’s economy and impair the quality of life for citizens.
2.Disconnected or poorly integrated transit systems create an inconvenience for users and transit becomes an unattractive option for travellers.
3. Expansion of local transit and Züm bus rapid transit (BRT) will not be sufficient on its own to support Brampton’s forecasted growth.

By 2031 it is estimated that transit ridership along the Hurontario-Main Street corridor will reach 35 million people annually, exceeding the carrying capacity of Brampton’s Züm BRT. BRT has a capacity of 2200 passengers per hour per direction (pphpd) compared to LRT (2 light rail vehicles coupled together) with a capacity of 4800 pphpd, which is equivalent to approx. 2.5 lanes of freeway capacity on Highway 410. Three light rail vehicles coupled together can carry up to 7200 pphpd, which is equivalent to approx. 4 lanes of freeway capacity on Highway 410.

LRT will reduce the travel time by transit from Brampton GO to Port Credit GO from approximately 75 to 46 minutes in 2031. In comparison, travelling by car in 2031 will take approximately 53 minutes, which will get progressively worse in the future while the LRT will remain at approximately 46 minutes. LRT will also provide faster and easier access to the GO Rail and bus services. Only LRT can meet the transit ridership demands for 2031 and beyond.
CURRENT SITUATION:

The Province announced full capital funding of $1.6 billion for the TPAP approved Hurontario-Main LRT project on April 21, 2015. Metrolinx is now preparing for the implementation phase (design and construction) of this project and needs a decision from the City of Brampton on the LRT alignment north of Steeles Avenue to the Brampton GO station in order to finalize the project scope of work.

Alternative Alignments Assessment North of Steeles Avenue

Further to Council’s direction, an assessment of alternative alignments north of Steeles Avenue to Downtown Brampton has been completed (see Appendix 4 for Executive Summary of Hurontario-Main LRT – Brampton Alignment Alternatives Assessment Report – by SNC-Lavalin Inc.). Eleven options were identified and evaluated, which are illustrated in Appendix 5 – Map of Alternative Alignments North of Steeles Avenue. All options were compared to the TPAP approved Hurontario-Main LRT (HMLRT) surface alignment (base HMLRT).

Based on the assessment, all options except the tunnel option had major technical issues such as regulatory floodplain impacts, major property impacts, and Orangeville Brampton Railway (OBRY) train operational impacts, which dropped them from further consideration. Therefore, only the tunnel option is considered technically feasible in addition to the TPAP approved HMLRT surface alignment. Additional studies, a revised preliminary design, and TPAP amendment are required if the tunnel option is pursued, which will have an impact on the timing of LRT north of Steeles Avenue and potential cost implications.

The advantages and disadvantages of all options considered including the tunnel option and the base TPAP approved alignment are shown in Appendix 6 – Summary of Advantages & Disadvantages for Alternative Alignments North of Steeles Avenue, which also includes further details on the Etobicoke Creek valley and tunnel options.

Peer Review of Alternative Alignments Assessment North of Steeles Avenue

Following the alternative alignments assessment, the City hired a third party consultant to undertake a peer review of the assessment report (see Appendix 7 – Executive Summary of Hurontario-Main LRT – Brampton Alignment Peer Review – by Hatch Mott MacDonald). The peer review confirmed that the findings of the alternative alignments assessment report are appropriate and defensible including the conclusion that none of the alternatives, save and except the tunnel option, are feasible.

Following the peer review, the business case analysis (BCA) that was previously undertaken in accordance with Metrolinx BCA requirements for the TPAP approved alignment was updated for the tunnel option. The tunnel option when combined with the rest of the project has a benefit cost ratio (BCR) of 0.93 compared to the TPAP approved alignment with a BCR of
1.14. A BCR of greater than 1.0 indicates there are more benefits than costs for that option. When considering only the incremental change in benefits and costs between the two options (assessing merits of the tunnel option on its own), the incremental BCR for the tunnel option is only 0.19, indicating the tunnel is poor value for the additional cost.

**Funding of Tunnel Option**

The funding of $1.6 billion by the Province includes the estimated cost of approximately $190 million for the TPAP approved surface alignment north of the Gateway Terminal to Brampton GO. The total cost of the tunnel option, which includes a portion of surface route between the Gateway Terminal at Steeles Avenue and the tunnel opening just south of Nanwood Drive, is $570 million. However, the incremental cost of the tunnel option above the TPAP approved surface alignment is $380 million, which is not included in the $1.6 billion capital funding. Metrolinx has stated that any additional cost above the TPAP approved surface alignment including the tunnel option will be solely the responsibility of the City of Brampton to fund. Therefore, if the tunnel option is pursued, the additional $380 million will be at Brampton's cost.

**LRT Technology**

Following the TPAP approval, Metrolinx undertook a review of catenary-free power supply operations ("catenaries" are the overhead wires that deliver power to the vehicle). Metrolinx determined that because such wireless technology is still relatively new and not yet proven under the challenging climatic conditions that are present in the Greater Toronto Hamilton Area (GTHA), they have concerns with reliability, particularly in the long-term. However, Metrolinx has indicated that rather than using a typical two-wire overhead system (per vehicle), they would propose to use a single wire overhead system per vehicle.

**Transit Servicing the New Peel Memorial Centre**

Currently, the 501 Züm Queen serves the Queen Street corridor near the former Peel Memorial Hospital site including a nearby stop at Centre Street (one block away). Local transit also services Queen Street (Route 1) and Centre Street (Route 8), which will both enter the new Peel Memorial Centre for Integrated Health and Wellness upon its completion in 2016. Route 1 Queen also connects to the Downtown Bus Terminal and Bramalea Terminal. A bus bay with related amenities (benches, shelter, etc.) will be constructed at the Peel Memorial Centre to help support the two routes that are accessing the site. In addition, the Queen Street Rapid Transit project will look at the next level of higher order transit along the Queen Street corridor, which could be BRT or LRT in dedicated lanes.
Options for the Alignment North of Steeles Avenue

As stated earlier, the Province is preparing to proceed with the implementation phase of the Hurontario-Main LRT project and needs a decision from the City of Brampton on the LRT alignment north of Steeles Avenue to the Brampton GO station.

The following options are available to Council regarding a decision on the alignment north of Steeles Avenue:

Table 1: Options for the alignment north of Steeles Avenue

<table>
<thead>
<tr>
<th>No.</th>
<th>Option</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>TPAP approved surface alignment</td>
<td>• Lowest cost and fully funded by Province</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Shorter construction time (1 to 2 years of locally staged construction)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Supports growth and the evolution of Downtown</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Tunnel</td>
<td>• Supports growth and the evolution of Downtown</td>
<td>Additional $380 M to be paid by Brampton</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Cost could increase further depending on findings of additional studies required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Longer construction time (up to 4 to 5.5 years)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Alignment will effectively stop at Steeles Ave since Province will not wait for tunnel studies to be completed (2 years or more). Therefore, timing for tunnel option is unknown and there is the potential loss of Provincial funding for the surface route north of Steeles Ave.</td>
</tr>
</tbody>
</table>
Table 1 (Cont'd): Options for the alignment north of Steeles Avenue

<table>
<thead>
<tr>
<th>No.</th>
<th>Option</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Stop at Gateway Terminal (Steeles Ave)</td>
<td></td>
<td>• LRT unlikely to be extended north in the future including to the Brampton-Caledon boundary</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Ridership will exceed BRT capacity in future. A higher order of transit service above BRT will still be needed, which is LRT.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Does not support growth and the evolution of Downtown with development likely to locate along the LRT corridor south of Steeles Ave</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Loss of Provincial funding of approx. $190 million for TPAP approved surface route north of the Gateway Terminal at Steeles Ave to Brampton GO (part of $1.6 billion)</td>
</tr>
</tbody>
</table>

CORPORATE IMPLICATIONS:

All City departments have provided comments, which have been incorporated into this report.

Financial Implications:

The Province has committed to fully fund the estimated capital cost of $1.6 billion for the Hurontario-Main LRT TPAP approved surface route. Metrolinx will be pursuing funding of up to 25% of the estimated capital cost from the Federal government through PPP Canada and the New Build Canada Fund. If Metrolinx does not receive the full 25% share being requested, the Province will still pay for the balance of the $1.6 billion estimated capital cost.

Metrolinx has also indicated that they will be responsible for operating the Hurontario-Main LRT. Based on the business case analysis, the ridership revenue will be sufficient to cover operating costs in the long-term, although there will likely be a shortfall in the short-term. While not yet determined, it is anticipated that Metrolinx will implement this project through a public-private partnership (P3), which will likely follow a design, build, finance, operate and maintain (DBFOM) model similar to Waterloo Region's ION LRT.

The City may wish to include other works in Downtown Brampton or around the station stops to enhance the urban design or streetscape beyond what is included in the LRT project (e.g. additional landscaping, enhanced sidewalk treatments, etc.). Other City costs for the project
could include in-kind contributions such as staff time and City owned property required for the project including the lease of a portion of the Hurontario-Main Street right-of-way. Metrolinx has indicated that any City staff whose time is 100% dedicated to the project may be eligible to be fully paid through the project funding by the Province. City staff will bring a report to Council once further details about the implementation phase are available including roles and responsibilities and eligible City staff resources for funding from the project.

STRATEGIC PLAN:

This report achieves the Strategic Plan priorities by supporting the management of traffic congestion as part of Growth Management through the expansion of transit on main corridors.

CONCLUSION:

With the approval of this report, the City of Brampton will be embarking on a transformation of Hurontario-Main Street that will help to redirect Brampton from the automobile-dependent suburban development of the past to a more urban community by connecting people with destinations using sustainable transit. The Hurontario-Main LRT is part of an integrated transit network that converges in Downtown Brampton at the Brampton GO station along with two-way all day GO train service and Queen Street Rapid Transit. All three Metrolinx projects are needed to support growth and the evolution of Downtown Brampton.

Stopping at the Gateway Terminal at Steeles Avenue

Stopping the LRT at Steeles Avenue is not a viable option as it undermines any efforts to develop and improve Downtown Brampton and the Central Area; will not alleviate existing and future traffic congestion in the growing communities to the north; will not provide fast and convenient access to GO services in Downtown Brampton; and, will likely eliminate any extension of the LRT north to the Brampton-Caledon boundary in the future. Transit ridership demand will exceed BRT capacity before 2031, so the next level of higher order transit service (LRT) is required.

Tunnel Option

The tunnel option supports growth and development in Downtown Brampton and a future extension further north; however, it comes at an additional cost of $380 million to be borne by the City of Brampton and a longer construction duration of up to 4 to 5.5 years. In addition, if this option is pursued, additional geotechnical and hydrogeological investigations are required to confirm soil and water table conditions, which may further increase the cost of this option. A revised preliminary design and TPAP amendment will also be required, which will require additional time to undertake further technical studies (2 years or more).
If this tunnel option is pursued, it will not be included with construction of the stretch south of the Gateway Terminal at Steeles Avenue to the Port Credit GO station due to the time to undertake additional studies and additional funding required. It may also result in the loss of $190 million in Provincial funding (part of $1.6 billion) for the TPAP approved surface route north of the Gateway Terminal at Steeles Avenue to Brampton GO.

**TPAP Approved Surface Route**

Staff is recommending that Council endorse the TPAP-approved surface route that will not only meet Brampton’s transportation needs along Hurontario-Main Street in 2031, but will also address the long-term future requirements along the corridor for the next 50 years and beyond.

The Hurontario-Main LRT TPAP approved surface route will connect to the Brampton GO station, which will:

- Be fully funded by the Province at a capital construction cost of $1.6 billion
- Support development and intensification in Downtown Brampton as well as along the rest of the Hurontario-Main Street corridor including Shopper’s World, Brampton Mall, and south of Steeles Avenue
- Connect to the other two Metrolinx “Next Wave” projects - Brampton Queen Street Rapid Transit and all-day two-way GO Rail Service Expansion (Kitchener Line) as part of an integrated transit network
- Pass through the south Main Street area between Nanwood Drive and Wellington Street with no impacts outside of the road right-of-way to existing buildings and trees while maintaining two lanes of vehicular traffic in each direction and full moves access to driveways
- Accommodate events in Downtown Brampton including the Farmers Market, parades, etc.
- Limit the duration of staged construction in Downtown Brampton to one to two years
- Maintain the option of a northerly extension to the Brampton-Caledon boundary in the future

LRT is required to meet the transit ridership demands along the Hurontario-Main Street corridor as bus rapid transit (Züm) cannot meet this demand in Brampton, which is forecast to grow to a population of 890,000 and employment of 320,000 by 2041.
LRT has been successful at attracting mixed-use development, job growth, and housing choices throughout North America and around the world, and will be a key element of an integrated urban strategy for Downtown Brampton and the Central Area.

Chris Duyvestyn, P. Eng.  
Manager, Infrastructure Planning  
Capital Construction

Jayne Holmes, P. Eng.  
Director, Capital Construction  
Maintenance & Operations

APPENDICES:

1. Council resolutions from its meeting of November 20, 2013
2. Council resolutions from its meeting of September 10, 2014
3. Highlights of Hurontario-Main LRT TPAP Approved Surface Route
5. Map of Alternative Alignments North of Steeles Avenue
6. Summary of Advantages & Disadvantages for Alternative Alignments North of Steeles Avenue
7. Executive Summary of Hurontario-Main LRT – Brampton Alignment Peer Review – by Hatch Mott MacDonald

<table>
<thead>
<tr>
<th>Approval for Submission:</th>
<th>Initials</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chair, SMT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Department Chief</td>
<td></td>
<td>15/06/11</td>
</tr>
<tr>
<td>Chief Administrative Officer</td>
<td></td>
<td>15/06/11</td>
</tr>
</tbody>
</table>
APPENDIX 1:

Council resolutions from its meeting of November 20, 2013

C307-2013

1. That the report from H. Zbogar, Acting Director, Planning Policy and Growth Management, Planning and Infrastructure Services, dated October 22, 2013, to the Committee of Council Meeting of November 12, 2013, re: Hurontario-Main Street LRT and Queen Street Rapid Transit Projects (File T53) and appendices be received; and,

2. That Council authorization be provided to issue the Notice of Study Commencement for initiating the Ontario Ministry of the Environment Transit Project Assessment Process (TPAP) for the Hurontario-Main LRT project, and that the TPAP include the portion of the corridor north of Steeles Avenue to Downtown Brampton; and,

3. That a final decision on the configuration of rapid transit in the Hurontario-Main Corridor north of Steeles Avenue, and any commitment to construct the Hurontario-Main LRT project within Brampton be subject to the approval of Council; and

4. That preliminary studies be undertaken, subject to staff seeking the cooperation of Metrolinx, for all alternative routes north of Steeles Avenue to the downtown GO Station, including north of Nanwood Drive to connect to the Peel Memorial Hospital site, and report back to Committee of Council prior to the conclusion of the environmental assessment process (TPAP) for the Hurontario-Main LRT project; and,

5. That a final recommendation on a Hurontario-Main rapid transit alignment north of Steeles Avenue be informed by further input from consultation and ongoing planning and design studies for the Downtown and Central Area; and,

6. That staff be directed to undertake a Queen Street Master Plan exercise to determine a preferred technology and alignment for enhanced rapid transit at an approximate cost of $1.2 million, and that a Capital Project be included in the 2014 Capital Budget submission for Council’s consideration; and,

7. That the City Clerk be directed to forward a copy of this report and Council Resolution to the City of Mississauga, Metrolinx, Ministry of Transportation, and 407ETR for information.
APPENDIX 2:

Council resolutions from its meeting of September 10, 2014

CW282-2014  Whereas by resolution of August 11, 2010 Council approved the Hurontario-Main Street Corridor Master Plan with Light Rail Transit (LRT) endorsed, in principle, as the recommended rapid transit solution and that a final decision on LRT for the segment between Steeles Avenue and Downtown Brampton be subject to further study and exploration of alternative alignments that benefit the downtown;

And Whereas by resolution of May 22, 2013 Council advised Metrolinx that the priority order for Brampton transportation infrastructure projects under the Big Move is as follows:

1. Queen Street Rapid Transit;
2. GO Rail Service enhancement to achieve 2-way all-day services as soon as possible;
3. Hurontario-Main Street LRT;

And Whereas the design team presented a surface route for the LRT along Main Street through the Main Street South Heritage Area and Downtown Brampton to the Brampton GO station as the preferred alignment for that segment;

And Whereas by resolutions of November 20, 2013 Council directed that a study be undertaken of alternative routes north of Steeles Avenue including to the Peel Memorial Hospital site and report back to Council prior to conclusion of the environmental assessment process (TPAP); that further consultations and planning studies be undertaken; and that the final decision on the alignment and configuration of rapid transit in the Hurontario-Main Corridor north of Steeles Avenue and any commitment to construct the Hurontario-Main LRT in Brampton be subject to Council approval;

And Whereas a Notice of Completion of the TPAP process was issued on June 19, 2014 for a 30-day review period and the Environmental Project Report was submitted to the Minister of the Environment on July 19, 2014, with the alignment being a surface rail route on Main Street through the Main Street South Heritage Area and Downtown Brampton, without a further report to Council or consideration by Council;

And Whereas the Main Street South Heritage Area and Downtown Brampton are unique civic areas and the cultural centre of Brampton;
And Whereas the nature of the Main Street South Heritage Area and Downtown Brampton and the enjoyment of them by the citizens of Brampton would be severely negatively impacted by a surface rail line along Main Street;

Now Therefore Let It Be Resolved That:

1. The Hurontario-Main LRT alignment north of Nanwood Drive, as contained in the Transit Project Assessment Process (TPAP), not be studied further as a surface route;

2. The studies undertaken for alternative routes and alignments north of Steeles Avenue, including an alternative north of Nanwood Drive to connect to the Peel Memorial Hospital site and GO transit line, be finalized and reported to Council;

3. A recommendation on a Hurontario-Main rapid transit alignment north of Steeles Avenue be informed by further input from consultation and ongoing planning and design studies for the Downtown and Central Area;

4. A final decision on the configuration of rapid transit in the Hurontario-Main Corridor north of Steeles Avenue, and any commitment to construct the Hurontario-Main LRT project within Brampton, be subject to the approval of City Council;

5. It is a priority of this Council that the Main Street LRT alignment continue north to the City's northern boundary;

6. The City Clerk is directed to forward a copy of this Council Resolution to the Minister of the Environment as a supplement to the Environmental Project Report, the City of Mississauga, and Metrolinx for information.
APPENDIX 3:

Highlights of Hurontario-Main LRT TPAP Approved Surface Route

The TPAP approved alignment for the Hurontario-Main LRT is a surface route between the mobility hubs at the Brampton GO station and the Port Credit GO station, and includes the following:

- 23.2 km of two-way LRT tracks including 5.6 km within Brampton (25% of corridor).
- 26 LRT stops including 8 Brampton stops at:
  - Highway 407
  - Ray Lawson
  - Sir Lou
  - Gateway Terminal
  - Charolais
  - Highway 407 Nanwood
  - Ray Lawson Wellington (southbound)
  - Sir Lou and Queen (northbound)
  - Gateway Terminal Brampton GO
- The Maintenance & Storage Facility including the LRT control centre will be located south of Highway 407ETR on the east side of Hurontario Street within Brampton.
- A light rail vehicle (LRV) is approx. 30 m long, which can be coupled together in groups of two or three LRVs. Based on ridership demand, two LRVs will be required on opening day for a total length of 60 m. The station platforms have been protected for 90 m for possible expansion in the future.
- The LRV’s are electric powered, requiring traction power substations (TPSS) which will be located in the vicinity of:
  - Highway 407 Nanwood Drive
  - Ray Lawson Boulevard Brampton GO
  - Bartley Bull Parkway
- The electric power in the area extending from Nanwood Drive to the Brampton GO Station is proposed as Catenary free (i.e. no overhead power cables).
- The proposed Hurontario-Main Street lane configuration within Brampton is:
  - South of Nanwood Drive – 2 lanes for dedicated centre-running LRT, 4 lanes for general purpose traffic (2 lanes per direction)
  - Nanwood Drive to Wellington Street – 4 lanes for general purpose traffic (2 lanes per direction). Centre lanes in each direction are shared with LRT. Traffic operations same as existing.
  - Wellington Street to Brampton GO – 2 lanes for dedicated curb-running LRT, 2 lanes for centre-running general purpose traffic (1 lane per direction)
- Within the Main Street South area, in addition to catenary free (wireless) operation and shared running, all properties fronting onto the street will maintain full moves access as today. All work will be within the existing road right-of-way and the mature trees will remain.
• There will be on-street cycling lanes south of Steeles Avenue, and multi-use path connections to the existing trail system along Etobicoke Creek just north of Steeles Avenue.
• During events in Downtown Brampton including the Farmers Market, parades, etc., the LRT will stop at Wellington Street or Steeles Avenue rather than at the Brampton GO.
APPENDIX 4:

Executive Summary of Hurontario-Main LRT – Brampton Alignment Alternatives Assessment Report – by SNC-Lavalin Inc.

Executive Summary

Over the past five years, the Cities of Brampton and Mississauga have worked toward the development of a plan to deliver a fast, reliable higher order transit solution along the Hurontario-Main Street Corridor. This work most recently culminated in the Ministry of the Environment and Climate Change granting approval under the provincial Transit Project Assessment Process (TPAP) for a low-floor light rail transit system along the Hurontario-Main corridor. Approval was received on August 25, 2014 and defined the project. “A 23.2km light rail transit system running along Hurontario and Main Streets from a south terminus at Park Street in Port Credit, Mississauga to a north terminus at the Brampton GO Train Station in Brampton. The system includes service on all sides of Downtown Mississauga and a maintenance and storage facility in the Parkway Belt West lands south of Highway 407.”

During the consultation phases of the project, a question was raised whether the alignment segment north of Steeles Avenue to Brampton GO would be better served by an alternate route to that defined in the TPAP approved project. In response to this issue, Brampton Council directed city staff to undertake a review of potential alternative alignments north of Steeles Avenue outside the bounds of the TPAP.

This report, “Hurontario-Main LRT Brampton Alignment Alternatives Assessment Report” represents the technical report describing the alternate alignment options assessed, the results of the screening performed and identifies potential alignment alternatives that might be considered for the segment north of Steeles Avenue.

Assessment Approach

The technical analysis was conducted in two stages following an initial alignment options identification process which established a total of eleven options, drawn from eight main options, with five sub-variations, as listed further below. The purpose of each stage was as follows:

- Stage 1 – A screening of the 11 options to determine overall technical feasibility
- Stage 2 – A more detailed assessment of feasible options carried forward from stage one, aimed at addressing specific issues in comparison to the HMLRT TPAP approved base alignment.

The options evaluated in stage 1 were:

- Option 1 - Base HMLRT (TPAP approved)
- Option 2A – Tunnel Via Main
- Option 2B – Tunnel Via George - 2 downtown stops
- Option 2C – Tunnel Via George - 1 downtown stop
- Option 3A – Valley Lands – At Grade
- Option 3B – Valley Lands Elevated
- Option 4 – Steeles - Kennedy
- Option 5 – Steeles - McLaughlin - Queen – Orangeville Brampton Railway (OBRY)
During the stage one screening process each option was evaluated at a high level against 30 specific factors, organized by infrastructure, operations, environment, cost and construction. Each evaluation was classified ranging from least impact, some impact, most impact, to unacceptable impact. Items determined to have unacceptable impacts were removed from consideration and were not carried forward into the stage two evaluation phase.

Assessment Results and Findings

Results from the stage one assessment phase determined only the three underground alignment schemes associated with Option 2 should be carried forward to the second stage. All other alignment options were dismissed as outlined further in the report.

The more detailed analysis conducted through the Stage 2 work assessment concluded Options 2A (Main Street) and 2C (VIA George – 1 Downtown stop) offered the more feasible alternative solutions to the TPAP approved baseline. All three underground alignment options were similar in that the LRT continued at-grade along the centre of Main Street north of Steeles Avenue to an underground portal south of Nanwood located with its threshold just above the Etobicoke Creek Regulatory flood plain level. The underground alignments all passed under Etobicoke Creek, and progressed northwards beneath Main Street through the Main Street Heritage Area. Just south of Wellington Street the alignment schemes diverged with each offering alternate alignment and station locations within the Downtown core.

Technically, all three underground alignment options are feasible but all three schemes involve significantly more costs to design, construct and to operate over the life of the system. Preliminary cost estimates prepared for Options 2A and 2C compared to the TPAP baseline scheme indicate premiums ranging from $260 million to $380 million, without accounting for property and operational costs. These amounts represent an increased capital cost of approximately 20% to the overall HMLRT budget and have not been provisioned in budget estimates prepared to date.

A principal technical benefit offered by an underground alignment results from segregating LRT operations from general purpose traffic to improve LRT service reliability in the segment North of Nanwood Drive, which is the narrowest along the project corridor. The increased investment would also be to eliminate the shared running of LRT and vehicular traffic entirely from this segment of the alignment.

Relative comparison of the two preferred underground options showed Option 2A (via Main) offers the most direct route and strongest connections to Main Street and support of the Main Street as the focus point of Downtown Brampton. Option 2C had the greatest travel benefits by providing faster service with only one stop, and the least cost.
As indicated by references in the report to other major transit projects, the planning of downtown underground stations warrants much greater study and consultation to achieve an optimal location that supports broader city policy and vision objectives. Thus, the options presented to date should only be considered a starting point of discussion should an underground alignment ever be pursued. Construction of a tunnel option would involve longer construction durations using heavier equipment than the base scheme. Precedence from other similar scaled projects would suggest a 48-month to 66-month construction period. Localized impacts at the portal south of Nanwood Drive will be greater than surface construction and in the immediate vicinity of the stations; however, the surface impacts will be more isolated and overall the construction disruption will be less widespread than the at-grade scheme. Due consideration must be given to where the main tunnel mucking out and mobilization sites will be located.

While the tunnel evaluation was based on a sequential excavation method for this initial phase of assessment, the use of bored tunnel construction combined with open cut and cover stations, or decked over cut and cover stations may prove a more feasible and cost effective solution with additional development, investigation and engineering.

Recommendations

While a solution of underground alignment and stations is feasible north of Steeles Avenue, the associated construction and operational costs are substantially more than the current TPAP approved scheme. The relative benefits of the grade segregated solution versus the TPAP at-grade LRT baseline scheme needs further assessment to justify the increased capital investment.

Should it be determined that there is a desire to pursue an underground solution further, conducting a Business Case Analysis to more comprehensively assess the relative benefits of the at-grade scheme with these underground options should be a priority.

If the initial screening results in a positive initial business case and the City of Brampton, in consultation with Mississauga and Metrolinx, determine that it is the preferable option, then it should be developed through preliminary engineering, supported with a comprehensive geotechnical and hydrogeological investigation program. The HMLRT Environmental Project Report would also need to be modified via addendum, and it would be necessary to consult with the Ministry of the Environment and Climate Change.
APPENDIX 5: Map of Alternative Alignments North of Steeles Avenue

Note: There are eight families of alternative alignments with Options 2 and 3 having sub-alternatives for a total of eleven alternative alignments in addition to the TPAP approved HMLRT alignment (Option 1 - base HMLRT).
APPENDIX 6: Summary of Advantages & Disadvantages for Alternative Alignments North of Steeles Avenue

All differences in travel times and costs are in comparison to the TPAP approved HMLRT alignment (base HMLRT) north of Steeles Avenue. Costs do not include property acquisition.

<table>
<thead>
<tr>
<th>Option</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1 – Base HMLRT (TPAP approved)</td>
<td>- Direct route along Main St</td>
<td>- Passes through south Main St area</td>
</tr>
<tr>
<td>Option 2A – Tunnel via Main St</td>
<td>- Lowest cost at $186 M</td>
<td>- Travel time delay from shared running with vehicular traffic</td>
</tr>
<tr>
<td>Option 2B – Tunnel via George St – 2 downtown stops</td>
<td>- Travel time savings of 3 to 3.5 min</td>
<td>- High additional cost of $260 M to $380 M</td>
</tr>
<tr>
<td>Option 2C – Tunnel via George St – 1 downtown stop</td>
<td>- Less conflicts with vehicular traffic</td>
<td>- Construction duration increases significantly (from 1-2 yrs to up to 4-5.5 yrs)</td>
</tr>
<tr>
<td></td>
<td>- Passes underground through south Main St area</td>
<td>- Options 2B &amp; 2C: Access to LRT stations on George St only and not Main St</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Option 2C: One downtown station will increase walk times and potentially reduce the catchment of transit users</td>
</tr>
<tr>
<td>Option 3A – Etobicoke Creek Valley Lands – At grade</td>
<td>- Does not pass through south Main St area</td>
<td>- Additional cost of $61 M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Travel time increased 0.7 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Not supported by TRCA due to significant impacts on regulatory floodplain</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- May negate majority of options to reduce flooding in Downtown Brampton</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Significant property impacts including parklands</td>
</tr>
<tr>
<td>Option</td>
<td>Advantages</td>
<td>Disadvantages</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
<td>---------------</td>
</tr>
</tbody>
</table>
| Option 3B – Etobicoke Creek Valley Lands – Elevated | - Travel time savings of 0.4 min  
- Does not pass through south Main St area | - Additional cost of $172 M  
- Not supported by TRCA due to significant impacts on regulatory floodplain  
- May negate majority of options to reduce flooding in Downtown Brampton  
- Significant property impacts including parklands |
| Option 4 – Steeles-Kennedy-Queen | - Does not pass through south Main St area | - Additional cost of $168 M  
- Travel time increased 4.4 min  
- Major property impacts (55-65 properties), especially on Steeles Ave  
- Accesses on Kennedy Rd restricted to right-in/right-out  
- Overlap/conflict with Rapid Transit on Steeles Ave and Queen St |
| Option 5 – Steeles – McLaughlin – Queen - Orangeville Brampton Railway (OBRY) | - Provides direct service to Sheridan College  
- Does not pass through south Main St area | - Additional cost of $336 M  
- Travel time increased 5.2 min  
- Impacts on OBRY freight train operations during day  
- Accesses on McLaughlin Rd restricted to right-in/right-out  
- Significant property impacts  
- Overlap/conflict with Rapid Transit on Steeles Ave and Queen St |
| Option 6 – Charolais – McLaughlin - Orangeville Brampton Railway (OBRY) | - Does not pass through south Main St area | - Additional cost of $314 M  
- Travel time increased 4.6 min  
- Impacts on OBRY freight train operations during day  
- Significant property impacts |
| Option 7 – Charolais – McMurchy - Orangeville Brampton Railway (OBRY) | - Does not pass through south Main St area | - Additional cost of $307 M  
- Travel time increased 3.5 min  
- Impacts on OBRY freight train operations during day  
- Significant property impacts  
- Accesses on McMurchy Ave restricted to right-in/right-out  
- Impacts to character of McMurchy Ave (exist. 2 lanes) |
<table>
<thead>
<tr>
<th>Option</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Option 8 – Steeles Ave to Bramalea GO | - Does not pass through south Main St area | - Additional cost of $184 M  
- Travel time increased 2.9 min  
- Major property impacts (55-60 properties)  
- Accesses restricted to right-in/right-out  
- Overlap/conflict with Rapid Transit on Steeles Ave |
| Option 9 – George St Loop to Main St    |                                                                                     | - Additional cost of $48 M  
- Travel time increased 2 min  
- Passes through south Main St area  
- Unable to accommodate a northbound stop in Downtown Brampton on George St  
- Impacts to vehicular traffic on George St and Main St |

Further Details of Etobicoke Creek Valley and Tunnel Options

Etobicoke Creek Valley Alignment

Two options along the valley (surface and elevated) were considered, but determined not to be feasible for the following reasons:

- Not supported by TRCA due to significant impacts on regulatory floodplain (can cross a floodplain, but not travel parallel within it).
- TRCA stated these options may negate the majority of options to reduce flooding in Downtown Brampton (flooding solutions trying to increase the flow capacity of the watercourse while presence of LRT would decrease the flow capacity).
- Significant property impacts along the channel realignment and the facilities in Centennial Park
- Overlap with Queen Street Rapid Transit since HMLRT needs to connect back to Hurontario-Main Street to be extended to the Brampton-Caledon boundary in the future

The regulatory floodplain impacts in particular were considered an unacceptable impact and dropped from further consideration as part of the assessment of alternative alignments north of Steeles Avenue to Downtown Brampton.
Tunnel Option

The main advantages of the tunnel options include a travel time savings of 3 to 3.5 minutes and it does not pass through the south Main St area.

The main disadvantages include the high additional cost of approx. $380 Million and significant increase in construction duration from 1 to 2 years for locally staged construction increasing up to 4 to 5.5 years. The cost and timing of tunnel construction can vary depending on the method of tunnel construction.

The detailed Stage 2 assessment results recommended the following:

- All of the tunnel options (2A, 2B and 2C) are feasible and should be carried forward for further preliminary design work
- Option 2A (tunnel via Main St) is preferred since it fully supports the City's goal to revitalize Downtown Brampton by focusing place making efforts along Main Street, which includes an at-grade station stop at Charolais Boulevard and underground station stops at Nanwood Drive, Wellington Street and Brampton GO at an additional cost of $380 Million. The total cost for this option north of the Gateway Terminal is $570 Million, which includes a portion of surface route between the Gateway Terminal and the tunnel opening just south of Nanwood Drive.
- While not desirable from a City Building perspective, the additional cost of the tunnel option could be reduced by relocating the Nanwood stop further south to an at-grade stop near Elgin Drive, and by combining the two downtown stops into one stop for a reduced total additional cost of approx. $180 to $220 Million. However, this would effectively eliminate a stop in downtown with only a stop at the Brampton GO. This option basically bypasses downtown and services primarily Brampton GO.

Further work is required for the tunnel option if pursued including:

- Additional geotechnical and hydrogeological investigations to confirm soil and groundwater conditions, which may also increase the cost of this option
- Revised preliminary design and TPAP amendment
Executive Summary

Over the last five years, the Cities of Brampton and Mississauga have worked towards the development of a plan to deliver fast, reliable higher-order transit along the Hurontario-Main Street corridor. This work culminated with the approval of the Transit Project Assessment process (TPAP) by the Minister of the Environment and Climate Change in the summer of 2014.

Though Ministerial approval of the Project was granted, a question was raised as to “whether the alignment segment north of Steeles Avenue to the Brampton GO Station would be better served by an alternate route to the TPAP approved route or alignment.” Subsequently, Brampton Council directed staff to conduct a review of potential alternative alignments north of Steeles Avenue to Downtown Brampton that is separate from the TPAP process. The original study team of SNC-Lavalin Inc. (SLI) was engaged to identify, review and evaluate potential alignment alternatives for possible future consideration and prepare the Hurontario-Main LRT Brampton Alignment Alternatives Assessment Report (dated September 26, 2014).

Following the preparation of the SLI report, City staff then engaged Hatch Mott MacDonald Ltd. (HMM) to undertake a peer review of the aforementioned report. This report, “Hurontario-Main LRT Brampton Alignment Peer Review” represents the peer review of the SLI report and is structured in seven parts as described below.

Review of alignment alternatives

A desktop review of the alignment alternatives as presented in the SLI report was conducted as well as a number of site tours, some with City staff, to understand local challenges and opportunities.

All of the alignment alternatives presented were believed to be reasonable for consideration and the assessment of the options presented in the SLI report are defensible and appropriate for this level of screening.

An additional option (Valley Lands Tunneled, Option 3C) was reviewed and, for reasons similar to those noted for Options 3A and 3B, should not be carried forward in future phases of design.

Review of assessment methodology

The assessment methodology, including the assumptions, and evaluation criteria were reviewed to confirm their relevance and applicability. SLI developed an evaluation methodology to provide a framework for organizing and using predictions of impacts to establish an order of preference among the alternative routes.

The assessment methodology as documented within the SLI Report involved the evaluation of eleven (11) new options along with the TPAP approved route (Base HMLRT Alignment), using a two-stage approach. Stage 1 involved an initial option screening based on technical feasibility or policy issues. Stage 2 involved a much more detailed review of the options carried forward after completion of Stage 1.
Our conclusion is that the assessment methodology was robust, logical, well laid out and provided conclusions, that when tested, were able to be replicated.

**Review of assumptions**

Various assumptions and limitations associated with the assessment methodology were identified within the SLI report. Though the noted assumptions and limitations are fairly extensive, they are consistent with the level of detail typically available during an EA study.

**Analysis of evaluation criteria**

With respect to the Stage 1 screening, five main categories comprising 30 sub-categories (or evaluation criteria) were used to evaluate the 12 total options (including the Base HMLRT Alignment). The five main categories are pertinent, and relevant to the evaluation, and included Infrastructure, Operations, Environment, Cost and Construction.

The checklist of criteria was applied to enable SLI to evaluate the 12 options, and to eliminate alternatives from further consideration in Stage 2. When using an unordered list of criteria in this way, it is necessary to ensure that the list is comprehensive, and that those alternatives discarded do not have offsetting benefits that would emerge only on consideration of a broader list of criteria. It is noted that the broad range of evaluation criteria applied included all aspects of the environment, which is in keeping with Ontario’s *Environmental Assessment Act*.

It is agreed that the evaluation criteria, comprised of 5 main categories and 30 sub-categories, and the methodology for which they were applied, is appropriate for this level of screening.

**Examination of constraints**

The constraint criteria was used to both comparatively evaluate the 12 options, as well as set a standard to exclude alternatives from further consideration in Stage 2. This is common in EAs as a means to reduce the alternatives to be considered further to a “manageable” number, by eliminating those that are deemed “unacceptable”, as occurred with this assessment.

In addition, SLI also used a cursory cartographic approach known as constraint mapping, which is commonly used in EAs. In this approach, “unacceptable” characteristics were identified and taken into consideration as part of the analysis.

The constraints, as identified and applied against each alignment alternative option are reasonable and the conclusions are able to be replicated.

**Review of agency responses**

Through the course of the Alternative Alignment Assessment Study, SLI identified a number of stakeholders that would be engaged as part of the study. The agencies having jurisdiction that would be contacted by SLI were:

- Toronto Region Conservation Authority (TRCA);
- Region of Peel, and
- Orangeville Brampton Railway (OBRY).
The responses provided by the agencies were reviewed and summarized in Section 9 of this report. While each stakeholder is interested in different aspects of the project, the responses received were in line with expectations for this type of a complex project.

Review of team responses and recommendations
After review of the SLI report and the correspondence received from the agencies having jurisdiction, it is believed that the Stage 1 evaluation conclusions respected those comments and that the recommendation to carry forward the tunnelled options for Stage 2 assessment was an appropriate course of action.

Conclusions and Recommendations
All of the alignment alternative options, including the tunnel options which passed through the Stage 1 screening assessment, were appropriate. It is noted that an additional tunnel option in the Valley Lands (Option 3C) was reviewed and, for reasons similar to those noted for Options 3A and 3B, should not be carried forward in future phases of design.

The SLI Report is well written, concise, and includes significant detail regarding the assessment approach, alternatives evaluated, results of the evaluation, and study recommendations. With the exception of a few noted minor shortcomings, the Report findings are clear, logical, traceable, and replicable. Given the level of detail of the information available, the SLI Report notes that further studies, investigations, and evaluation is required to confirm the feasibility of constructing a short tunnel section under Downtown Brampton. This is congruent with a study of this nature, and a valid recommendation. As such, the overall Report findings are defensible, and no additional alignments need to be identified and evaluated.

It is recognized that the evaluation method must produce a result that is clear, logical and traceable. Most importantly, it must allow anyone with the same information to reach the same conclusion, without any additional assumptions. Lastly, the method should clearly identify the relative differences and key impacts so as to select a preferred alternative. After carrying out a detailed review of the 12 options, coupled with their anticipated impacts, the results as presented in the Report can be replicated, and is thus deemed defensible.

The following are recommendations for consideration in future phases of the project:

- Undertake the necessary additional geotechnical and hydrological studies for all options carried forward.
- Undertake the necessary additional utility investigation for all options carried forward.
- Undertake the necessary TPAP amendments and updates to the Business Case Assessment should Brampton City Council decided to carry forward one of the recommended options.