INFORMATION REPORT

TO:	Mayor and Members General Issues Committee
COMMITTEE DATE:	August 8, 2016
SUBJECT/REPORT NO:	Hamilton Light Rail Transit (LRT) Project – Traffic Modeling Update (PED16180) (City Wide)
WARD(S) AFFECTED:	City Wide
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SUBMITTED BY: **SIGNATURE:**	Jason Thorne General Manager Planning and Economic Development Department

Council Direction:

On August 14, 2015 Council ratified the report Fostering the Light Rail Transit (LRT) Project (CM15014) (City Wide) (Item 7.2) which, in parts (a) and (c), provided the following direction:

(a) That the City Manager create a light rail transit (LRT) office as a means to coordinate work with Metrolinx and engage the broader community in the building of an LRT in Hamilton;

(c) That Steer Davies Gleave be retained, subject to Metrolinx approval, in order to complete the conceptual design and Environmental Assessment (EA) work for any necessary and required changes to the original A and B Lines, including the pedestrian corridor and the maintenance and storage facility; subject to the A-Line extension to the Waterfront being included in the original $1.2B Metrolinx budget, to be fully funded by the Province.

INFORMATION:

Key Messages Related to Traffic Modeling Work to Date:

- By 2031, regardless of whether or not Light Rail Transit (LRT) is built in Hamilton, congestion will increase as a result of population growth and other planned changes to the road network;
- Initial results of the updated traffic modeling study are generally consistent with the previous impacts identified in the 2011 approved Transit Project Assessment Process (TPAP) for the B-Line LRT; and,
- Initial results of the updated traffic modeling study are worst case scenarios. Mitigation strategies exist for the LRT impacted portions of the network and staff will explore the best strategies to implement, as additional modelling work is completed in the coming months.

Background:

The Hamilton Light Rail Transit (LRT) office is currently coordinating work with Metrolinx while engaging the broader community with respect to building an LRT in Hamilton. Staff are also managing the consultant, Steer Davies Gleave (SDG), who is working towards the necessary and required changes to amend the original Environmental Assessment (EA) based on the revised LRT alignment. The purpose of this Information Report is to provide a status update on the traffic modelling work for the LRT Project that has been undertaken to date, based on the alignment as identified in Figure 1. The results and interim findings compiled in this Report are preliminary and only show the impact on the AM Peak Hour.

During 2010 and 2011 the Hamilton LRT B-Line project was developed through Preliminary Design and Engineering, and an Environmental Assessment (EA) was prepared in accordance with the Ontario Transit Project Assessment Process (TPAP). The project comprised of an LRT route from McMaster University to Eastgate Square via Downtown Hamilton, running along Main Street West, King Street West, King Street East, Main Street East and Queenston Road. In December 2011 the Ontario Ministry of Environment approved the EA.

On May 26, 2015, the Ontario Provincial Government announced $1B in provincial funding for the LRT project, from McMaster University to Queenston Traffic Circle (B-Line), with a spur (A-Line) from Downtown to serve the West Harbour GO Station and possibly the Waterfront, funding permitting. A High Order Pedestrian Connection to the GO Centre on Hunter Street is also included as part of the project.

The City of Hamilton and Metrolinx are co-proponents under the EA process and are working together to obtain TPAP approval of the revised McMaster to Queenston Traffic Circle alignment, the A-Line spur, and the Operating, Maintenance and Storage Facility (OMSF). It is expected that the submission will be made in the Spring of 2017 to allow for the procurement process to be completed by mid-2018 which, in turn, will allow major construction to begin in 2019.

Figure 1: Hamilton LRT Project Overview

Recap of the 2010 Traffic Model for the Previously Approved TPAP Design:
Traffic Modeling occurred during the City of Hamilton's Transit Project Assessment Process in 2010/2011. This work was based on an LRT design that was primarily "side running" and the modeling used base year volumes of 2008 with projected impacts and volumes of 2021.

The previous modeling work identified that by 2021 without LRT, the network would experience increased traffic flows on York Boulevard, Main, King and Cannon Streets. With LRT, alternative corridors such as Barton Street, King Street East, Cannon Street and Wilson Street generally had sufficient capacity to accommodate the level of re-assigned traffic.

This 2021 model also identified the most significant impacts were due to the reduction of capacity of King Street West which resulted in additional volumes on York Boulevard and Dundurn Street.

In summary, the previous design and traffic modeling done in 2010/2011 identified that the implementation of LRT could be accommodated by the existing network, albeit with a general reduction in performance for other road users on certain corridors, and the introduction of some intersection and other corridor improvements to mitigate the impact.

The impacts of the new design will be consistent with this previous work, identifying similar concerns with the west end of Downtown. However, some of the previously identified impacts on local streets may not be as significant due to a "centre running" reconfigured design.

Traffic Modeling Update for Current LRT Project:

As part of the Council direction in August 2015, the City, through its consultant Steer Davies Gleave, is currently refining the traffic model as part of updating the previous EA. This work is incorporating the inputs from the current City of Hamilton Transportation Master Plan, current traffic counts, current signal timings, current intersection configurations, current and proposed roadway cross sections, etc. This traffic modeling is used to determine the anticipated impacts on the traffic network up to 2031 with or without LRT.

Steer Davies Gleave are running various iterations of the model for the 2011 base year and 2031 "with" and "without" LRT scenarios. The output of the traffic model will identify the mitigation measures required on the peripheral network. It is anticipated that a majority of the modeling work will be completed in August.

Road Network Design Changes:

The current alignment of the LRT determines the overall traffic model and therefore the following road network design changes, based on the most recent design, are as follows:

- Two lanes in each direction on Main Street West, west of Hwy 403 (to accommodate bike lanes);
- New eastbound lane on King Street from Dundurn Street to the Delta (except from Queen Street to Hess Street and James Street to John Street);
- One lane westbound on King Street from Dundurn Street to the Delta (except from Wellington Street to Catharine Street);
- One lane in each direction on Main Street East from the Delta to the Queenston Traffic Circle (currently two lanes in each direction);
- Minimized number of locations where road vehicles are permitted to cross the LRT tracks. The majority of side road intersections thus become right-in/right-out only;
- U-turns at signalized intersections are permitted to maintain local access; and,
- Provide 'Far Side' stops where possible. Far side stops are platforms that allow the Light Rail Vehicle (LRV) to "pull through" an intersection, so that advance notice of a LRV arrival can be provided to the traffic signal controllers, maximizing the opportunity for LRT priority through the signals. This layout also allows left turn lanes and U-turn traffic movements to be provided ahead in the 'shadow' of the platforms.

Other road network changes include the City's already planned and committed changes:

- Select two-way conversions;
- Cycling infrastructure (Cycle Track, Bike lanes etc.);
- Road "Diets"; and,
- Select intersection improvements.

LRT Modeling Approach:

Steer Davies Gleave has been working on a series of three forecasting models that provide ridership projections and traffic assessments. The methodology builds on the approach developed to support the business case and traffic impact assessment for the previous B-Line project in the approved TPAP. The updated approach makes best use of available models and data, providing consistency with wider Transportation Master Plan (TMP) activities, and updated versions of modeling software packages to examine area-wide and local traffic impacts.

The City of Hamilton has developed a model, using EMME (modeling) software, as part of the Transportation Master Plan Update currently underway. This includes 2011 base data and projections for 2031. This EMME model is used as the basis for developing LRT ridership forecasts. Land use projections to 2041, as well as changes to the supporting transit (bus) network and GO services, are also considered in the EMME model. The model has regional coverage and has been developed to assess AM peak period conditions (for baseline and future conditions).

EMME is a good tool for understanding high level traffic impacts; however it does not fully reflect the impact of congestion in a signalized network, which is the key reason why VISUM and VISSIM software packages are also required to provide a more thorough assessment of traffic impacts.

VISUM examines area-wide traffic impacts around the LRT alignment. Signal timings, area-wide changes to traffic flows, and intersections are assessed using this model.

VISSIM, a micro-simulation model, focuses on the detailed review of the performance of the LRT alignment (including run times) and changes to traffic arrangements. Both traffic models will examine 2011 and 2031 scenarios in AM and PM time periods.

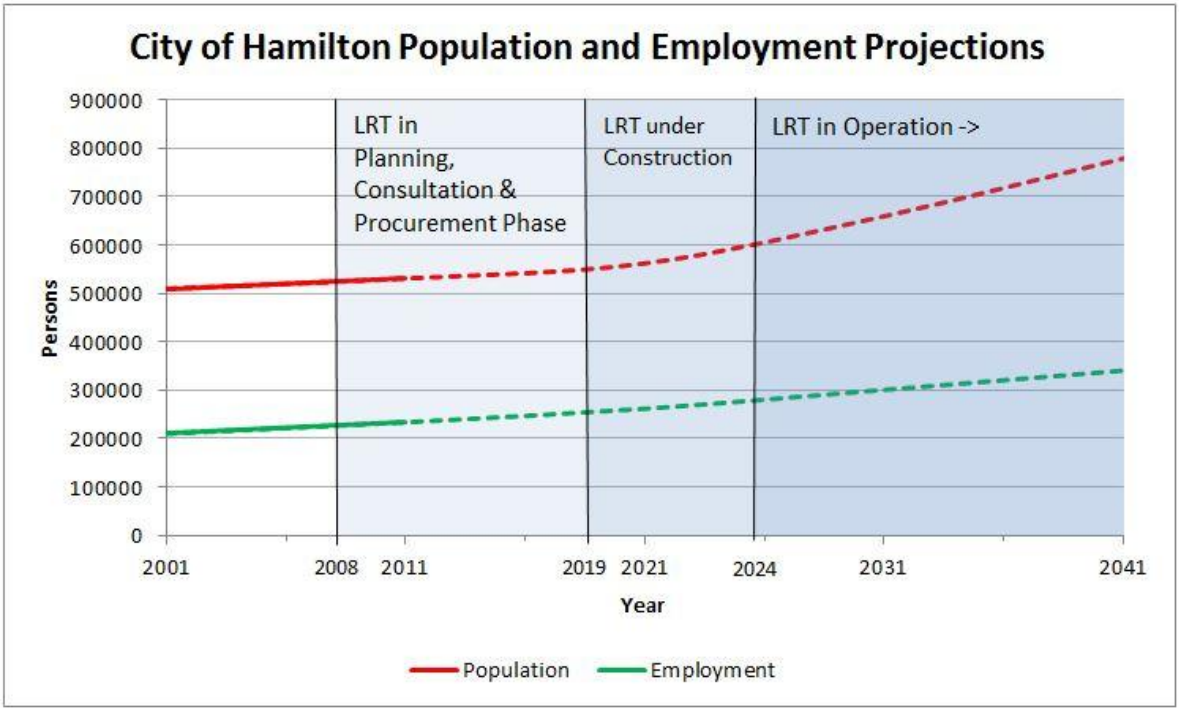
As noted previously, data shown in this report is preliminary and reflects initial results for the AM Peak Hour. These results can be considered worst case scenarios of the AM Peak Hour. As the model progresses throughout the month of August further refinement, potential mitigation strategies and solutions will be forthcoming and the PM Peak Hour model will be completed and evaluated. It is important to note that some impacts may change with the various iterations of the model that are yet to be undertaken.

Background Planning Projections:

Based on projected population and employment growth, between the base model year of 2011 and the traffic impacts forecast year of 2031, a significant amount of background traffic growth is forecast. Schedule 3 of the Growth Plan for the Greater Golden Horseshoe (2013) forecasts the City of Hamilton will have a population of 660,000 by 2031 and 780,000 by 2041 and jobs of 300,000 by 2031 and 350,000 by 2041. Figure 2 illustrates the changes in the planning data inputs into the traffic model between 2011 and 2031.

Population and employment growth leads to an increased number of trips for all modes within the network, and congestion is expected to increase, with or without LRT.

Figure 2 – Trend line of City of Hamilton Population and Employment Projections



Traffic Impacts Without LRT (2011-2031):

The City has implemented and is planning to implement several changes to the transportation network between the years of 2011-2031. These changes are programed into the model forming the base network for the 2031 with or without LRT scenarios. The model incorporates several changes that promote modal change but also affect vehicular capacity such as: bike lanes, two-way conversions, road diets, additional signals, etc. These changes made to the network have impact on the flow of vehicular traffic, while providing more livable streets, but essentially reducing vehicular capacity that particularly affects the west of Downtown.

Overall, the preliminary modeling exercise identifies that even without the introduction of LRT the City's roadway network is forecast to become more congested.

Comparison of Traffic Impacts in 2031 With or Without LRT

In addition to the impacts of the 2031 without LRT scenario, the introduction of LRT will both increase and decrease traffic volumes in certain areas of the corridor. For example, the westbound traffic flows are significantly reduced on King Street, which is attributed to a reduction in lane capacity in many sections (a typical reduction is from

three lanes to one lane), and there are increased volumes on some parallel routes. More specifically:

- The capacity along the route of Queen Street (southbound)/King Street (westbound) is reduced because of the LRT alignment. Vehicles choose the alternative route of York/Dundurn/King. The model shows a congestion issue at the intersection York/Dundurn for the westbound left turning lane which slightly reduces the capacity on York Street. The mitigation priority in the next iteration of the model is to address this congestion issue. (Note: The previous TPAP model also identified a concern with this intersection.)

- Due to the reduction of capacity on King Street, some westbound traffic has diverted onto parallel routes such as Aberdeen Avenue, Wilson, Cannon and Barton Streets. With King Street converted to two-way in many sections, there has been some shift of eastbound traffic using Main Street in the Downtown core onto King Street. There is some reduced traffic accessing Downtown via York Boulevard, traffic is instead accessing Downtown via Main Street. (Note: This is similar to the previous TPAP model, other than the reduction of eastbound Main Street traffic.)

Work to date has identified emerging network issues and work is ongoing to improve the network operation. This effort is directed at identifying and applying mitigation measures for the areas of the network that are affected. Potential mitigation measures being investigated include lane reallocation, turn bans and as a last resort, potentially reducing the level of priority offered to the LRT at specific pinch points in the network.

Impact on Level of Service (LOS)

Description of Level of Service (from the Transportation Master Plan**):**
Historically, the most common form of measuring transportation system performance has been a level of service (LOS) grading that is based on a letter grading system, which ranges from LOS A to LOS F. In general, the term “level of service” is typically associated with traffic operations; however, a LOS measure is equally applicable for all modes of travel.

There is no universal tool for measuring LOS for all road users in a transportation system. The primary reason is that road user expectations of transportation system service and the quality of service is a function of the travel mode and the type of facility. For example:

- Mode of Travel – A motorist travelling along an arterial roadway may measure the quality of service of the roadway based on travel speed, delay at intersections and freedom to manoeuvre; whereas a cyclist may evaluate the same system based on the bicycle facilities provided, the roadway condition and the safety and security associated with adjacent vehicle travel lanes. A pedestrian walking along the same roadway, would reflect quality of service measures such as the presence of a

sidewalk, controlled crossing opportunities and presence of potential conflicts with other road users.

- Type of Facility – A motorist driving on an uninterrupted system such as a freeway, would base the LOS performance of the facility on travel speed and their ability to manoeuvre. Alternatively, the same motorist on an arterial roadway would expect to be periodically stopped by traffic signals and other interruptions; therefore, performance measures on these facilities would also include stopped delay.

As a result of the above, LOS for traffic, bicycle, transit and pedestrian modes are centred on a variety of criteria calculated through different methods. The intent of the traffic modeling analysis being done for the LRT project is to determine the effect of LRT on traffic operations. The following section identifies the traffic modeling impacts as determined through a LOS analysis. LOS within this model can be defined as a function of the average vehicle control delay for a signalized intersection. The following table outlines the various stages from "A" to "F" of LOS.

LOS	Signalized Intersection
A	0-10 sec
B	10-20 sec
C	20-35 sec
D	35-55 sec
E	55-80 sec
F	> 80 sec

The following tables show the most affected intersections in the network. These include intersections that have fallen below a Level of Service D between 2011 and 2031 (without or with LRT) based on average turn delays. This is the first iteration of the model; therefore, these tables may change due to further refinements of the model and the application of mitigation strategies.

Table 1: LOS declines to 2031 are greater with LRT

Intersection	**Average LOS**		
	2011	**2031 without LRT**	**2031 with LRT**
Barton at Frederick	A	C	E
Burlington at Kenilworth	B	E	F
Cannon at Barons	A	B	F
Dundurn at York	D	C	E
Hunter at John at GO Station	B	C	E
Hunter at Wellington	A	C	F
King at Bay	C	B	F
King at Gage	B	D	F
King at Locke	B	C	F

Intersection	Average LOS		
	2011	2031 without LRT	2031 with LRT
King at Queen	C	D	F
King at Sherman	B	C	E
King at Victoria	C	D	F
King at Wentworth	B	C	E
Main at Kenilworth	C	C	E
Main at Longwood	C	C	F
Main at Ottawa	C	C	F
Main at Victoria	C	E	F
Ottawa at Beach	A	C	E
Ottawa at Beach	A	E	F

Table 2: LOS declines to 2031 are equal with or without LRT

Intersection	Average LOS		
	2011	2031 without LRT	2031 with LRT
Barton at MacNab	B	F	F
Barton at Victoria	C	F	F
Barton at Woodward	B	E	E
Burlington at Ottawa	B	F	F
Burlington at Wentworth	C	E	E
Cannon at Gage	C	E	E
Centennial at Arrowsmith	B	E	E
Depew at Industrial	B	E	E
Dundurn at Aberdeen	D	F	F
Dundurn at Charlton	C	F	F
King at Parkdale	C	F	F
Main at Bay	C	F	F
Main at Emerson	C	E	E
Main at James	D	F	F
Main at John	C	F	F
Main at Sherman	B	F	F
Ottawa at Industrial	B	F	F
Queenston at Reid	B	F	F
Wilson at Wellington	C	E	E

Table 3: LOS declines to 2031 are greater without LRT, 2011 to 2031

Intersection	Average LOS		
	2011	2031 without LRT	2031 with LRT
Dundurn at Chatham	A	F	A
James at King	C	E	D
King (South) at Hughson	C	C	A
King at Dundurn	C	E	C
King at Emerald	B	C	A
King at Ferguson	B	C	A
King at Main East	D	E	A
King at Paradise	C	E	A
King at Walnut	B	E	A
Main at Dundurn	C	F	E
Main at Queenston	D	F	C
Queen at Bold	B	E	D
Sherman at Delaware	A	E	C
Stinson at Wentworth	C	E	D
York at Locke	C	E	D
York at Park	C	F	D

Next Steps

This Report is intended to provide an update on initial traffic modelling results with respect to the current LRT design and reflects results to date that will be further refined by SDG and evaluated by staff. Some of the ongoing mitigation work being completed in order to address some of the identified traffic impacts are as follows:

- In order to mitigate the impacts of the implementation of LRT on the surrounding traffic network, it is proposed to introduce various measures to improve traffic operation and ensure impacts are kept to a minimum;
- At the time of writing, the VISUM LRT modelling work is at an early iteration stage, which means that the signal timings on the corridor have been optimized but further optimization is required in both the 2031 with and without LRT scenarios. The process for the early work has also considered some necessary changes to signal staging at certain intersections which must be implemented as a result of the new infrastructure being in place; this includes protected left turns across LRT tracks, providing updated pedestrian crossing times at intersection crosswalks and pedestrian crossings.;

- Ongoing work includes (but is not limited to) analysis of the following mitigation measures:
  - Additional iterations of signal timing optimization;
  - Further changes to signal timing staging. For example, additional protected left turn signals, signal timing overlaps in areas of heavy pedestrian demand and potentially looking at staggered pedestrian crossings;
  - Dedicated left turn lanes; and,
  - Potentially banning specific turning movements at certain intersections.
- When the work above is completed, the potential impact on LRT run time along the corridors, as modelled in VISSIM, must be checked. It is possible that certain measures could be beneficial for improving traffic flow, but to the detriment of LRT operation and runtimes. In these instances, where there could effectively be a choice between LRT operation and traffic impacts, potential solutions must be weighed against a variety of factors. Mitigation measures that do not impact LRT operations are preferred along this corridor;
- Each stage of applying mitigation strategies will include re-running the VISUM LRT model and reviewing the outputs to ensure that the proposed mitigation has had the desired effect (or otherwise). At the end of implementing the steps above, an optimal solution will have been reached; the results of which will be presented to Council at the next update stage; and,
- Discussions with Public Works are occurring to determine if adjustments are required to the capital program in 2017 and 2018 to ensure that roadwork on corridors required to accommodate traffic flows during and after LRT construction are completed prior to the start of LRT construction in 2019.

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