

Next Connections: An Integrated Rapid Transit Network to Stop Congestion in Toronto

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Executive Summary

This document recommends a set of rapid transit infrastructure initiatives that will generate the volume of modal shifts to transit that are *necessary* if increases in road congestion, negative impacts on the environment, and overall well-being of residents and commerce in the Toronto area are to be avoided.

Altogether, the Government of Ontario’s recently-announced rapid transit initiatives, GO Transit enhancements that are currently being implemented, and the City of Toronto’s unfunded LRT plans will not reduce Toronto’s overall traffic congestion problem. They will cost approximately \$47 billion, and may generate 260 million new transit trips per year – a substantial two-thirds increase from the Toronto transit 2018 ridership of 539 million. However, after their implementation, and taking into account rapid population growth and growth in cross-boundary trips from ‘905’ area municipalities, the number of trips taken by automobile on Toronto roads will still increase by almost 900,000 per day by 2051, plus thousands more trucks. Moreover, implementation of these expansion plans remains uncertain. Toronto’s LRT plans are unlikely to have Provincial financial support for the foreseeable future, and the Ontario subway expansion plan is dependent on cost-sharing that has not yet been fully secured.

Estimate of Trips in Toronto	By Auto	Municipal Transit	GO	Other	Total
Toronto population 2051, adj. from Min. of Finance, ages 11+ only					4,092,709
Total daily trips, Toronto residents, @ 1.95 per day					7,964,100
Modal split, per 2016 TTS	57%	27%	1%	15%	100%
Estimated daily trips by mode, 2051, Toronto residents	4,539,500	2,150,300	79,600	1,194,600	7,964,100
Trips into Toronto from other municipalities, by 2051	340,900	161,500	6,000	89,700	598,000
Total trips in Toronto, by 2051	4,880,400	2,311,800	85,600	1,284,300	8,562,100
TTS 2016 trips in Toronto	3,150,000	1,492,100	55,300	828,900	5,526,300
Increase in total trips, before major transit initiatives*	1,730,400	819,700	30,300	455,400	3,035,800
Less major announced rapid transit enhancements:	<u>Ann.</u>				
GO Transit Enhancements (net; to 200m)	173	-563,800	563,800		0
Eglinton Crosstown LRT	20	-65,000	65,000		0
Est. increase in transit trips arising from the 2019 Ontario rapid transit plan (excl. Hurontario LRT)	68	-222,000	222,000		0
Net Increase in trips in Toronto, 2016 to 2051, after modal shifts resulting from current commitments	879,600	1,106,700	594,100	455,400	3,035,800

* For Municipal transit, it is assumed that the TTC will undertake a variety of day-to-day enhancements over years to existing TTC services, e.g. adding buses & more trains to existing routes, to keep pace with population growth. Excludes new subway and LRT routes or extensions.

N.B. Toronto plans for LRTs on Jane, Sheppard East, Eglinton Avenue East and the waterfront are not included, and may add 110,000 new transit trips per day.

Importantly, the struggle against the serious and rapid destabilization of our climate lags far behind what is needed, as the 2015 United Nations Conference on Climate Change in Paris and more dire warnings in 2018 have pointed out. Much more needs to be done, and some things done differently, if the situation is not to worsen. Despite the historically slow pace of progress in transit development, it is important that intensive efforts be made to complete the transit network additions proposed in this document within a very short time. Without urgent effort, the costs of life in the Toronto area will increase. More information about the precipitous climate change losses and damage to our life support systems, please refer to **Appendix 2**.

The transit expansion initiatives recommended in this document, collectively named **Next Connections**, are in addition to rapid transit initiatives currently under construction or operational, and will generate significant economic stimulus and approximately 307 million *new* transit trips per year by 2051. Overall, the **Next Connections** initiatives are significantly more effective than the current Ontario rapid transit plan for the Toronto area.

Rapid Transit	New Trips (Millions/yr)	Gross Infra. Cost (\$Mil)
Ontario Rapid Transit Plan	76	28,500
Next Connections*	307	33,000
Comparative Ratio	4.05	1.16

*Assumes 401RT+Eglinton West BRT replaces Eglinton West LRT.

They will require a net infrastructure investment of \$33 billion that, if financed over 30 years at 4.5%, would cost \$1.9 billion per year in peak years, and be shared by all levels of government. Overall, compared to the new Ontario Subway Plan, the updated initiatives will generate four times as many new transit trips, at about 16% more cost.

The **Next Connections** infrastructure costs are affordable, and are necessary as the Greater Toronto Area population grows, and if genuine progress is to be realized in reducing road congestion and greenhouse gas emissions. It has been estimated that more than \$1.9 billion in annual benefits would be generated after full implementation, and that this benefit would grow in years thereafter, in addition to \$34 billion in benefits that would accrue during implementation. The projects should be completed by no later than 2040.

The recommended rapid transit initiatives include:

1. A continuous east-west rapid transit line across the northern half of Toronto. It is *the* most significant missing element in the rapid transit network in the core of the GTA, and is essential if worsening congestion on Highway 401 and city streets is to be avoided. Today, 1.7 million people per day in non-commercial vehicles use the Highway between Pickering Town Centre and Hurontario Street in Mississauga. Highway 401 in Toronto is near a critical point, where highway improvements will not be able to accommodate future growth in travel demand. A recent bus proposal by Metrolinx for HOV lanes on the highway will not be enough. A 401RT operating between Pickering Town Centre and Hurontario Street in Mississauga would connect with up to ten rapid transit lines and at least 25 surface bus routes across the region. It would be aligned largely at grade in the leftmost lane of Highway 401 in each direction, with tunneled diversions to critical destinations such as Pearson International Airport and its surrounding employment area, and Scarborough Centre. The 401RT proposal also includes 480 additional buses for intersecting arterial roads. The 401RT, because of its length, linkages and location, would generate at least 205 million new TTC users per year by 2051, plus transfers from existing transit services.

The 401RT will more than double the trip capacity of the Highway 401 corridor, prevent future growth-related gridlock in the corridor, enable travelers to rapidly access downtown Toronto and points across northern Toronto (for example, Yonge Street subway at Sheppard Avenue to Pearson Airport in 26 minutes, or from Yorkdale to the University of Toronto's Scarborough campus (UTSC) in 32 minutes), reduce greenhouse gas emissions by approximately 440,000 tons per year, revitalize the employment area surrounding the airport, promote urban development across the city and in Mississauga and Pickering, and reduce travel costs for many thousands of households.

The 401RT would cost approximately \$16.3 billion to build, with an overall per-kilometre cost approximately the same as for the Eglinton Crosstown LRT. If Ontario and Canada governments fund 100% of all on-highway costs and some tunneled diversions from the 401 corridor, and 67% of all other costs, the municipal cost to the average Toronto household could be approximately 9 cents per day in peak financing years.

With a 401RT providing faster and better service, the proposed Sheppard East subway or LRT, Jane Street LRT, SmartTrack Eglinton West LRT to Pearson, and Eglinton East LRT to Malvern would experience significant decreases in ridership demand and would be better served by dedicated bus lanes providing both local and express services. Altogether, an infrastructure cost avoidance of \$7.9 billion can be realized. The Eglinton Crosstown LRT can be extended 4.5 kilometres eastward to Kingston Road only, and no further, for approximately \$700 million. Ridership on the extension may reach 1.8 million new transit trips per year.

2. A northern extension of the Ontario Line subway is an essential addition to Toronto's rapid transit system. The currently-planned line from the Pape subway station to Eglinton Avenue East should be extended to intersect with the 401RT, preferably at Victoria Park Avenue, and from there to Sheppard Avenue. This new

connection will divert enough automobile drivers to rapid transit that it will rescue the Don Valley Parkway from worsening congestion.

3. Extend the Ontario Line west of University Avenue without diversion to the CNE GO station. Due to increased ridership pressures on the Spadina subway portion of the Line 1 subway created by the Eglinton Crosstown LRT, GO Rail enhancements and the 401RT, the Ontario Line should be extended westward from University Avenue to the Dundas West subway station, and be subsequently extended further northward to intersect with the 401RT at Jane Street, creating a multitude of rapid transit options for travelers. This 15.2-kilometre westward extension of the Ontario Line would generate approximately 55 million new transit riders a year (plus millions of transfers from existing transit buses) shortly after it becomes operational, and will reduce greenhouse gas emissions by 120,000 tons per year. This Ontario Line extension westward from University Avenue would cost \$10.6 billion to construct, and eliminates the \$1.37 billion University-to-CNE diversion.

Because King Street serves 50% more transit riders than Queen Street, and will better serve ongoing residential and non-residential growth between Queen Street and the waterfront, a King Street alignment for the downtown portion of the Ontario Line is a more beneficial alignment. Unfortunately, Toronto and the Ontario government approved a Queen Street alignment to more closely serve City Hall rather than the high-employment financial district. The City's evaluation criteria gave no importance to the increased ridership with a King Street alignment.

4. The 401RT will divert a significant ridership volume from the "SmartTrack" Eglinton West LRT between Mt. Dennis and Pearson, rendering it unnecessary. An extension of the **Eglinton LRT to Jane Street only** is recommended, and westward from there a curb-lane **Rapid Bus** priority service should be implemented that is fully integrated with the Mississauga Transitway, to enable transfer-free travel between Mississauga and the Jane/Eglinton LRT station. This Rapid Bus Lane service would be able to accommodate both local and express services (which the LRT cannot provide), and can include diversion access to Pearson International Airport as may be appropriate. The gross capital cost of the LRT extension to Jane Street and the Rapid Bus service would be \$600 million.

5. Once the Ontario Line from University Avenue to Dundas West subway station is operational, a West Commuter LRT should be built that extends westward from the QuRK subway station (Queen/Roncesvalles/King) around Humber Bay and onto the Gardiner Expressway corridor west of the river, in a manner similar to the 401RT, and extend to Kipling Avenue. Modal shifts to the LRT would be supported by multi-level fee-based parking garages constructed above five West Commuter LRT stations. A Parklawn GO station that has been proposed to serve the Humber Shores community of Etobicoke would not be needed. The West Commuter LRT would cost \$900 million to build. New transit ridership is estimated at 12 million trips per year, plus transfers from existing TTC services.

The West Commuter LRT enables a significant opportunity: Along with enhanced GO Transit rail services, the Ontario Line, and linkages created by the 401RT and rapid transit along Eglinton Avenue West, the LRT can divert enough car drivers onto public transit that it will be possible to **remove the entire elevated portion of the Gardiner Expressway**. With this scenario, the Toronto City Council's approved \$1.4 billion "hybrid" reconstruction option for the eastern portion of the expressway should be abandoned to allow time to evaluate the effect of rapid transit improvements on expressway volumes. The closure of the Gardiner Expressway east of the Humber River would enable Lakeshore Boulevard around Humber Bay to be rerouted onto the Gardiner roadbed, doubling the size of the shoreline parks around the bay. The closure of the Gardiner Expressway east of the Humber River, and its deconstruction, would cost roughly \$1.67 billion.

6. A realigned **Waterfront West LRT** can be built that would run along Lakeshore Boulevard for almost all of its route once the West Commuter LRT is operational and Lakeshore Boulevard is re-aligned, except for a northward segment to link to the GO Transit Union Station at York Street, the Line 1 subway and the Ontario Line subway (most effectively at King and University Avenue). It would operate at grade, and directly serve the enlarged parkland around Humber Bay, the Humber Shores community, Ontario Place and the CNE grounds, and the downtown core north and south of Lakeshore Boulevard. It would be integrated with streetcar services west of Parklawn Road, and generate approximately 9 million new transit trips a year. The LRT would cost \$1.2 billion to build, excluding upgrades to tracks west of Parklawn Road.

7. The 401RT will generate a significant increase in ridership on the 3-station **Scarborough Subway Extension (SSE)** of the Danforth subway. To better serve the Malvern community and nearby employment areas, the SSE should be extended beyond Sheppard Avenue East by 2.3 kilometres to Finch Avenue. The Scarborough Subway enhancements would cost \$1.4 billion to build, and generate 7.2 million new transit trips per year.

8. Greenhouse gas emissions in western industrialized countries must drop to almost zero by 2050, Next Connections recommends an **electrification of a large portion of bus services** in Toronto and near-Toronto municipalities be electrified with conductive infrastructure and new buses. The overall cost for this conversion is \$2.2 billion, net of the sale of existing buses.

In addition to the recommended Next Connections initiatives, Metrolinx’s 2041 Regional Transportation Plan for the Greater Toronto and Hamilton Area identifies numerous light rail transit, bus rapid transit, and priority bus service opportunities for the existing arterial road network, as well as Frequent Rapid Express Bus services on most limited-access highways in the GTHA. The costs and benefits of these have not been identified. Notably, the Jane LRT, Eglinton East LRT to Malvern, Eglinton West LRT to Pearson, and Sheppard Avenue East extensions are recommended not to be built.

NEXT CONNECTIONS RAPID TRANSIT RECOMMENDATIONS	Km. Track or Bus Lane	Stations or stops	New Users (Millions/yr)	Gross Capital Cost (\$M)	\$m Cost per Kilometre
401RT (excl. Sheppard subway segment)	53.7	30	204.8	16,300	\$304
Ontario Line Eglinton E to Sheppard E	7.5	5	14.2	3,800	\$507
Ontario Line University Ave to Dundas W via King & Roncesvalles	6.8	8	32.5	5,700	\$838
Ontario Line Dundas W to 401RT	8.4	7	23.1	4,900	\$583
E-W buses + electrification of 30 bus routes				2,200	
Add: Eglinton W LRT to Jane only	0.9	1	1.0	400	\$444
Eglinton Rapid Bus to Miss'ga Transitway	6.7	0	3.7	200	\$30
Scarborough Subway enhancement	2.3	3	5.0	1,400	\$609
Eglinton East LRT- to Kingston Rd only	4.5	8	1.8	700	\$156
West Commuter LRT	8.6	5	11.8	900	\$105
Waterfront W LRT to Long Branch	8.4	17	9.2	1,200	\$143
New Rapid Transit	107.8	84	307	37,700	\$350
Recommended offsetting cost avoidance:					
Delete: Eglinton W LRT to Pearson (replaced by 401RT)				-4,700	-\$412
Net Effect of Next Connections	107.8	84	307	33,000	

File: Consol GTA Rapid Transit \$\$ Dec 2018/Compare to City

Recommendations

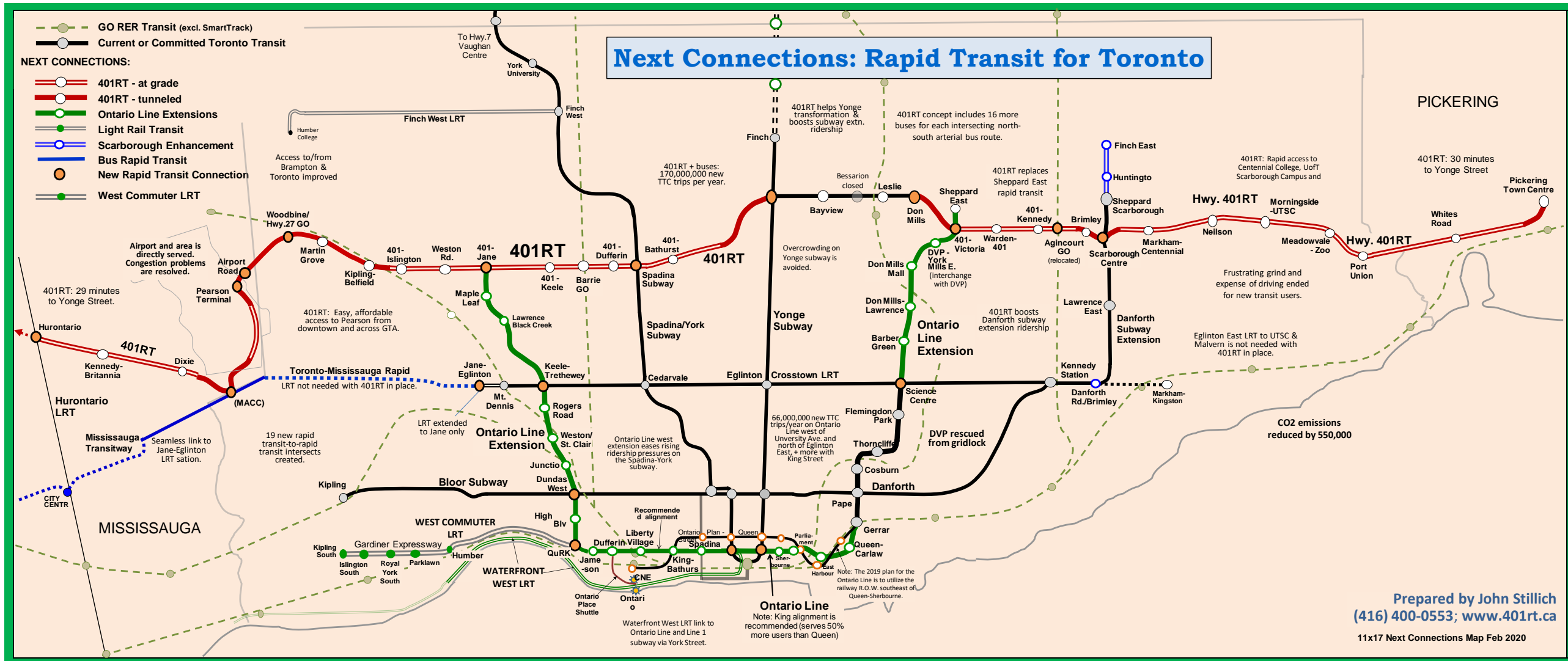
It is recommended to the government of Ontario, the City of Toronto, other cost-sharing partners and transit planning decision-makers that they, within current planning cycles, and in consultation with affected funding partners:

1. Recognize that current rapid transit plans of the Government of Ontario and the City of Toronto will not keep pace with travel demand growth, and will result in an increase in road traffic congestion and its negative effects;
2. Recognize that the recommended transit initiatives are a necessary part of efforts to cut greenhouse gas emissions;
3. Recognize the vital importance of accelerating rapid transit planning and implementation, beyond current commitments;
4. Take immediate steps, particularly at the Provincial level of government, to undertake a detailed analysis of the benefits, costs and overall feasibility of the Next Connections initiatives;
5. Recognize the urgent need to create a Mississauga-to-Pickering rapid transit line through the northern half of Toronto, known as the 401RT and described herein, and which will generate a modal shift to transit of approximately 205 million trips per year by 2051, and include it in current transportation plans for completion in less than 20 years;
6. Recognize the significant and necessary positive effects of the 401RT for Toronto, Pearson International Airport and its surrounding employment area;
7. Work quickly to construct the Ontario Line subway northward from Eglinton Avenue East to Sheppard Avenue at Victoria Park Avenue, and include in current transportation planning processes extensions west of University Avenue as described herein;
8. Consider, on an urgent basis, a realignment of Toronto's downtown portion of the Ontario Line from Queen Street to King Street, where travel demand for transit is 50% higher than on Queen Street;
9. Recognize the need for and benefits of the following additional rapid transit initiatives, and take urgent steps to bring them to operational status:
 - a. An extension of the Eglinton West LRT from Mt. Dennis to Jane Street and no further;
 - b. A Rapid Bus priority service on dedicated road lanes on Eglinton Avenue west of Jane Street that is fully integrated with the Mississauga Transitway, as a replacement for the Eglinton West LRT extension to Pearson International Airport;
 - c. A West Commuter LRT to operate between Kipling Avenue in the Gardiner Expressway corridor and an Ontario Line subway station at the Queen/Roncesvalles/King intersection; recognize that this LRT can enable Toronto City Council to remove the elevated portion of the Gardiner Expressway and avoid the city's "Hybrid" reconstruction plan for the expressway;
 - d. An extension of the Danforth subway beyond Sheppard Avenue East, to Finch Avenue East;
 - e. A Waterfront West LRT aligned as described herein that more directly serves communities and destinations along the Toronto waterfront;
 - f. An extension of the Eglinton Crosstown LRT to Kingston Road, and no further;
 - g. An electrification of bus services on 30 routes that intersect with the 401RT and Ontario Line.
10. Remove from current transportation plans the rapid transit infrastructure made unnecessary by the recommended Next Connections initiatives, those being the Eglinton West LRT to Pearson International Airport, the Eglinton East LRT extension to the University of Toronto Scarborough campus and Malvern, the Jane Street LRT, the Sheppard East LRT or Subway, and the Scarborough-Lawrence SmartTrack station; and
11. Recognize the short-term and long-term affordability of the recommended initiatives, and its substantial benefits to the residents, economy and environment in the core of the GTA.

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Figure 1



Next Connections – Introduction

Travel demand is increasing with population growth in Toronto and its surrounding municipalities. By 2046, the population of the Greater Toronto and Hamilton Area (GTHA) will have grown from 7 million to 10.2 million people; within this, Toronto will have increased from 2.9 million to 4.27 million. Travel demand will have grown by close to 50%.

GO Transit enhancements, the Eglinton Crosstown LRT, the Ontario government's new rapid transit plan for Toronto, and incremental increases in existing TTC services will not stop an explosion of road traffic in Toronto. By 2051, there will be almost 900,000 more trips taken per day by automobile in Toronto by 2051 (see Appendix 1). This increase may be reduced by 110,000 if the City of Toronto's unfunded LRT plans are implemented. New initiatives are needed if declines in the quality of life of individuals and families in Toronto are to be prevented.

The Toronto area must do its fair share in reducing greenhouse gas emissions, including from transportation sources. The United Nations' Intergovernmental Panel on Climate Change has issued repeated warnings that significant reductions must be achieved by 2030; in October of 2018 it warned that global emissions must drop by 40% to 45% to avoid serious, permanent and perhaps unstoppable damage to life support systems. View the list in Appendix 2. Western industrial nations need to cut emissions much more. **This is critical information.** If additional rapid transit infrastructure beyond current plans is not put into place, including those described in this document, climate change goals cannot be met.

This **Next Connections** document recommends the addition of several important rapid transit network components for Toronto that would be considered long term if not for the urgency of congestion and climate change issues facing the region. The proposed initiatives reflect the magnitude of effort necessary in the transportation sector. Described below, they are

- A transformative continuous cross-boundary rapid transit line extending from Pickering to Mississauga across the northern half of Toronto, using for the most part the Highway 401-corridor – a rapid transit line known as the 401RT;
- 480 additional buses for arterial roads intersecting the 401RT;
- An extension of the Ontario Line northward from Eglinton Avenue East, to Sheppard Avenue at Victoria Park Avenue;
- Extensions to the Ontario Line subway westward from University Avenue to the Dundas West subway station, and further northward beyond the Eglinton Crosstown LRT to the 401RT at Jane;
- A cross-boundary Rapid Bus Lane priority transit service west of an extension of the Eglinton Crosstown LRT to Jane Street, and which is fully integrated with the Mississauga Transitway;
- A “West Commuter” light rail transit line as described, to reduce traffic volumes on the Gardiner Expressway, and to enable removal of the elevated portion of the expressway;
- A Waterfront West LRT realigned to more closely serve the waterfront area;
- An extension of the Eglinton LRT eastward to Kingston Road;
- An extension of the Danforth/Scarborough subway to Finch Avenue and an improvement to the existing plan; and
- Electrification of approximately 30 bus routes, including conduction infrastructure and new buses.

Importantly, a 401RT would render the following LRTs planned for Toronto unnecessary: the Sheppard East subway or LRT, the westerly extension of the Eglinton Crosstown LRT to Pearson, the easterly extension of

the Eglinton LRT beyond the Elginton/Kingston Road intersection, and the Jane Street LRT. Their ridership would decline, particularly because, for many trips, the 401RT would be significantly faster and more effective in delivering travelers to the primary destinations envisaged for the LRTs.

Altogether, the recommended **Next Connections** rapid transit infrastructure will

- Generate an approximate 60% increase in the number of TTC trips, and major increases in transit trips in Mississauga and Pickering;
- Prevent a worsening of congestion on major highways and reduce congestion on city streets as travel demand increases;
- Decrease greenhouse gas (GHG) emissions by more than 630,000 tons per year;
- Create more than 400,000 job years during implementation, and permanent jobs thereafter;
- Promote economic development and improve social well-being;
- Provide financial relief for many households across the region; and
- Combined with the current rapid transit projects proposed by the Ontario government for the City of Toronto, generate a small decrease traffic congestion on major highways and local streets by 2051, even as population-generated travel demand increases.

The **Next Connections** proposals can be seen as affordable within the timeframe recommended when brought down to the level of the average daily cost per Toronto household and, additionally, for the variety and magnitude of benefits they convey to individuals and families. It is estimated that, altogether, the municipal cost to the average Toronto household of its proposed transit expansions will grow to an approximate net of 22 cents per day over a 10-year peak period once all initiatives become operational, and may cost the Ontario government 0.7% of a projected 2041-2042 budget, after considering one-third federal capital cost sharing.

The **Next Connections** proposals reflect the view that it is more affordable for people to invest in the expansion of the public transit system than to bear the environmental, social, congestion, financial, and economic consequences of not doing so.

It is recommended that efforts to achieve a sustainable urban transportation network not be delayed, curtailed or limited by existing budgetary concerns and tax fears. It is time that public sector budgets be enabled to achieve aggressive goals with intensive effort, to avoid declines in the collective well-being of people. Constraining rapid transit to save households a few dollars per annum is false economy. People in Toronto and the Greater Toronto Area want an end to daily congestion and want a clean environment.

The Critical Missing GTA Rapid Transit Link

The most critical missing element to generating major modal shifts to public transit in Toronto is the lack of a singular east-west inter-municipal rapid transit line across the suburban middle of northern Toronto. Existing rapid transit service are inadequate. **GO Transit** provides a radial service to and from the downtown core that is used by only 1% of Toronto residents per day. The **Sheppard subway** is too short to have an effect on traffic congestion. The 19 stops planned for the 11-kilometre **Finch West LRT** will make that service too slow to attract a significant modal shift, although existing TTC riders will be better served. The **Eglinton Crosstown LRT** now under construction is too far south in Toronto to produce a significant reduction in trips by automobile to and from most suburban locations, especially longer distance trips.

Getting across the Greater Toronto Area from Scarborough to Pearson Airport, or from Hurontario Street in Mississauga to any point in North York, or to and from thousands of destinations in suburban Toronto, Mississauga, Pickering and downtown Toronto normally means driving a car. Most people will not take a bus

from Etobicoke or Scarborough to ride the Yonge Street or University/Spadina/York subways – it’s simply too slow. The result is congestion and gridlock on Highways 401, 427, 409, the 404/Don Valley Parkway, the Gardiner Expressway and on city streets, and high emissions of greenhouse gases. Overall, traffic congestion on Highway 401 contributes more than a billion dollars in time lost each year for drivers and their passengers.

A review of MTO’s AADT and commercial vehicles survey files indicates that on a typical weekday there are 1.8 million vehicles on Highway 401 between Hurontario Street in Mississauga and Liverpool Road in Pickering. Of these, approximately 1.5 million are non-commercial automobiles, carrying almost 1.7 million persons. This figure, representing a potential transit market, will grow as populations in the GTA continue to increase.

The **Greater Toronto Airports Authority** (GTAA) is concerned that more than 90% of all trips to Pearson International Airport and its surrounding employment area are by personal automobile. Forecasted growth in air travel will strain the GTAA’s ability to provide access and car parking, and daily trips by 300,000 workers to the area are clogging roads on Highway 401 and other roads. Because of the threats posed by growth-related congestion in the airport area, the GTAA is advocating the creation of a **Transit Hub** on its property at Airport Road. Its intention is to provide linkages among various current and planned bus and rail-based transit services.

Overall, without practical public transit alternatives, travel demand for trips taken by automobile to, from and across northern Toronto and to/from the downtown area will continue to increase as the years go by. *A major new rapid transit option is necessary if increases in motor vehicle traffic and gridlock are to be avoided.*

Highway 401RT

Next Connections recommends that a 54- to 58-kilometre suburb-to-suburb rapid transit line with up to 34 stations be created from Hurontario Street in Mississauga to Pickering Town Centre, mostly at grade within the Highway 401 corridor. This 401RT is urgent, practical and affordable, and **with effort** can and should be fully completed in a 15-year timeframe.

It is estimated that the 401RT plus 480 new buses for intersecting bus services will generate 205 million *new* transit trips per year by 2051, and more in subsequent years as the city continues to grow (see Ridership Analysis section below). Another 12 million or more per year may transfer from existing parallel bus routes. Importantly, the 401RT will reduce greenhouse gas emissions by more than 360,000 metric tons a year. With capital cost sharing from upper levels of government, the daily municipal tax cost per average Toronto household to build the 401RT may be as low as 9 cents per day during peak funding years for the Toronto portion of the capital cost (see section on Affordability below). This assumes that the government of Canada would fund one-third of the gross 401RT cost, and the Province of Ontario would fund 100% of 401RT segments within highway corridors, and 67% of all other costs.

The 401RT would require a barrier-separated conversion to transit of the leftmost express lane in each direction on Highway 401, plus shoulder lanes at stations. The 401RT would divert underground to intersect with the Sheppard Subway, incorporating it into the overall 401RT concept. Other tunneled diversions to and from key off-highway destinations include Pearson International Airport, a station on the Kitchener GO Rail line (at Hwy. 27), the Mississauga Airport Corporate Centre, Scarborough Town Centre, Pickering Town Centre, and can include other destinations as may be desired – in particular, a diversion to the Yorkdale subway station, depending on cost-sharing with the Yorkdale Mall.

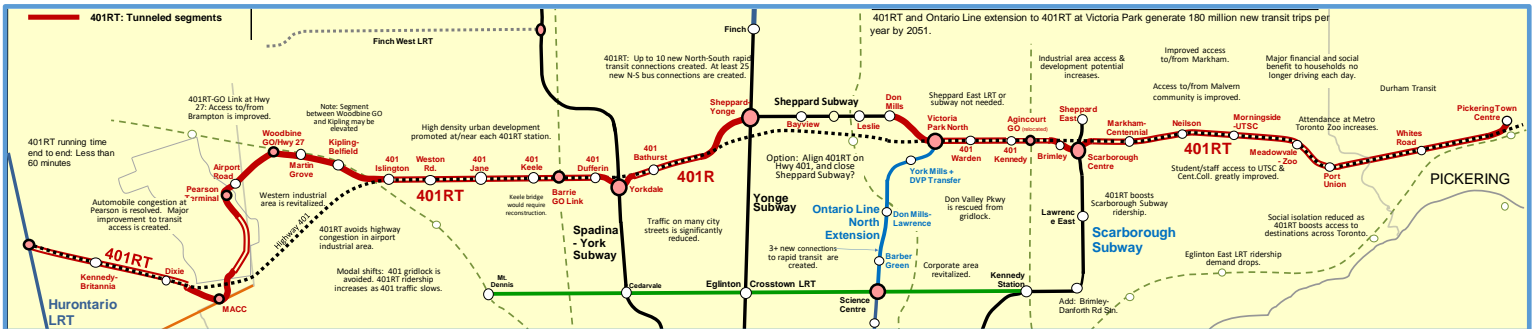
401RT stations in the highway corridor would use a centre platform, accessed by station entrances above the highway where intersecting roads run above the highway, and below the highway where arterial roads run

below the highway. Platforms would be 24 or more feet wide, and would not require movement of pillars that support overhead roadways, except for a station at Keele Street.

An alternative alignment is to bypass the Sheppard subway and continue the 401RT on the surface of the highway corridor, with new stations at Yonge, Bayview, Leslie and Don Mills. This may cost \$400 million more than tunneling to/from Sheppard Avenue, but would enable a link to/from the Oriole GO station at Leslie Street. Travel on the 401RT would also be somewhat faster, with one fewer station and a slightly shorter distance. In this scenario, the Sheppard subway would be closed. Sheppard Avenue would be served by enhanced bus services running seamlessly from Scarborough through Yonge Street to west of the Spadina/York subway. An illustrative map of the 401RT is shown below.

Modal shifts to rapid transit would ensure that highway traffic would continue to flow well, as a modal volume balance would be struck based on relative speeds and convenience. Overall, the conversion of one lane in each direction reduces Highway 401 road capacity between Hurontario Street and Pickering Town Centre by about 16% and, taking truck traffic into account, would require an average modal shift of cars of approximately 20% during peak periods for most highway segments to maintain current highway speeds. It is suggested that this is realistic: a large portion of the people who use the 401 do so because there is currently no practical public transit alternative (see Transit Ridership Analysis section below).

The 401RT diverts from Highway 401 west of Islington Avenue, and rejoins it east of Dixie Road. By doing so, it avoids reducing lanes on one of the most congested part of Highway 401, while at the same time modal shifts to transit will reduce highway traffic volumes on that highway segment.



Importantly, the 401RT concept includes 480 additional buses to improve service frequencies on intersecting arterial roads, and transit shelters at every bus stop. Most transit trips begin with a bus ride, and ensuring maximum comfort and convenience is essential. These improvements will tend to make the first/last mile segments of trips more acceptable. The use of electric scooters in suburban areas, as a convenient and effort-free means to access bus stops, can become an important generator of new transit trips; lock-ups for scooters and bicycles should be installed at transit stops. Overall, the 401RT itself will generate 158 million new transit trips per year, while improved TTC bus services on north-south routes that intersect with the 401RT will attract 47 million new non-401RT trips per year (see Transit Ridership Analysis section).

Because the overall number of new and transfer trips on the 401RT will continue to increase, plus integration with the Sheppard subway, and because longer average trip lengths means higher occupancy on trains, subway technology rather than light rail transit is the preferred mode. Peak one-hour volume may average more than 30,000 travelers by 2051 per direction, depending on location (for example, between Yonge Street and the airport employment area).

Without a 401RT or other singular rapid transit line of similar length and location across Toronto and into Pickering and Mississauga, traffic congestion and its problems and costs **WILL NOT BE RESOLVED, and will**

worsen. Highway 401 will become more congested and may at times be non-functional. The Ontario Ministry of Transportation has indicated that the highway will not be able to accommodate growing travel demand growth much longer, as segments of the highway in Toronto cannot be widened further. It is critical that work on developing the 401RT begin now. Widening the highway is also contrary to the promotion of transit ridership and the reduction of GHG emissions and congestion on city streets.

Measurements of potential ridership demand for the 401RT concept can be ascertained via surveys of the general public, and can be subsequently tested over two or three years, using buses on a modified alignment, with up to 25 stops and not linked to the Sheppard subway. This test would require dedicated highway collector lanes or shoulder lanes, plus construction to adjust most off- and on-ramps to Highway 401, and traffic signal priority at ramp/arterial intersections wherever possible. Marketing of this express services test to encourage use should be aggressive. The test should include a distribution of additional buses that are proposed for the 401RT, assigned to the test and to arterial bus routes, and which provide both arterial express and local services. The capital cost of the test may be approximately \$220 million, and may achieve an operating revenue-to-cost ratio of 50%.

Travel Times

The 401RT would have a substantial positive effect on travel times for transit users, when compared to existing transit services and other proposed increases in LRT services. On average, stations on the 401RT are 1.7 kilometres apart, enabling speeds between stations to reach 80 kilometres per hour. The following illustration shows a selection of trip origins and destinations, and their trip times when using the 401RT compared to other modes.

Traveling on the 401RT:		Keele at Lawrence to Centennial College in Scarborough:		Kipling subway stn. to Bathurst at Sheppard:	
Pickering Town Centre to Yonge subway	29	Using Eglinton LRT +		Using Eglinton LRT	60
Yonge & Sheppard to Pearson Terminal	23	Markham bus	49	Using B-D & Yonge subways	58
Pearson Airport to Hurontario Street LRT	7	Using 401RT	39	Using 401RT	48
	<u>59</u>				
Average speed - 54 km per hour					
St. Andrew subway station to Pearson Terminal:		York Mills subway station to U of T in Scarborough:		Yonge & Lawrence to Pearson:	
Using Eglinton LRT	42	Using Eglinton East LRT	59	Using Eglinton LRT	0
Using UP Express train (walk, wait, ride)	46	York Mills bus to Morningside	46	Using 401RT	0
Using Spadina subway & 401RT	43	401RT to Morningside + shuttle	32		
				Eglinton/Don Mills to Pearson Terminal:	
				Using Eglinton W LRT	37
				Using 401RT to terminal	43
Martin Grove at Albion to Spadina subway at Eglinton:		Union station to Scarborough Centre:		Keele at Sheppard to UTSC:	
Using MartinGrove bus + Eglinton LRT	38	Using Bloor-Danforth subway	38	Using Keele bus + Eglinton LRT	84
Using MG bus + 401RT + Spadina subway	38	Using 401RT	43	Using Sheppard bus + 401RT + shuttle at Morningside	44
		Eglinton LRT + McCowan bus	56		

44 Listed Benefits of a 401RT

The 401RT is of transformative significance, and would affect almost all other transit enhancement decisions Toronto. It would be the most substantial single public works project planned for the Toronto area. The size of the project reflects the magnitude of the transportation problems facing the region, **and is the most urgent.** A list of general benefits follows below. Most local benefits are not included in this list.

1. The 401RT transforms today's mostly radial rapid transit system north of Eglinton Avenue into a true network as up to eleven new rapid transit connections are created.
2. More than 25 new surface bus route connections to rapid transit are created.
3. The first practical transit alternative to driving across northern Toronto is created, bringing rapid transit much closer to many thousands of today's car-driving commuters.

4. Gridlock on Highway 401 is avoided as high volumes of transfers to rapid transit occur.
5. The viability of Highway 401 as an effective transportation corridor is maintained.
6. The trip capacity of the highway corridor is more than doubled.
7. Traffic congestion on the Don Valley Parkway and Highway 427 is reduced as access to north-south rapid transit via the 401RT becomes a viable option for many travelers.
8. Traffic congestion on city streets throughout Toronto and in parts of Mississauga and Pickering is reduced as major modal shifts to transit occur. All road trips begin and end on local streets.
9. Travel times across Toronto are significantly reduced when compared to current rapid transit plans or current transit services.
10. The 401RT and its proposed increases in intersecting bus services increases municipal transit ridership by 205 million per year by 2051.
11. Intersects with GO Rail services (northern Etobicoke, potentially Leslie-Oriole GO and relocated Agincourt GO, Barrie GO) increase planned GO ridership beyond its current forecasts.
12. Modal shifts from travel by automobile to transit far exceed those for planned eastern and western Eglinton LRT extensions, the Jane Street LRT and the Sheppard East LRT, whose ridership will be largely transfers from existing TTC bus services rather than being new users.
13. Rapid, affordable, and direct rapid transit access to Pearson International Airport from downtown and from suburban locations across the region is created (Approximately 85% of trips to the airport do not originate from downtown Toronto).
14. The Greater Toronto Airports Authority's plans for a regional transit hub are transformed to be more effective. Rapid and direct access to Pearson International Airport via the 401RT from locations across Toronto makes the planned SmartTrack extension of the Eglinton Crosstown LRT to Pearson International Airport unnecessary; a \$4.7 billion infrastructure cost avoidance can be achieved. (However, an extension to Jane Street is recommended.)
15. Access to the employment areas surrounding Pearson airport is greatly improved; these employment areas in Mississauga and Toronto revitalize as they become more attractive to business and to workers.
16. Employment opportunities and labour market conditions are enhanced as fewer people will decline employment opportunities near the airport due to congestion and travel times.
17. The 401RT's intersect with the Bloor-Danforth subway's extension at Scarborough City Centre increases ridership on the extension, and creates a direct access to the Bloor-Danforth subway.
18. Enhanced access from across all of Toronto to Centennial College (Scarborough), York University, the University of Toronto Scarborough Campus, and the UofT downtown campus is created.
19. Many post-secondary students no longer need to decide on courses of study based on travel time and distances to campuses.
20. A 401RT makes it unnecessary to build a Sheppard Avenue East LRT or subway, as many of its potential users would opt to use the nearby and faster 401RT. Infrastructure cost savings are approximately \$1 billion for an LRT and \$2.8 billion for a subway.
21. In general, access to services and employment across Toronto and to/from Mississauga, Pickering and Brampton becomes much faster and easier for all, including for those who are economically or socially disadvantaged.
22. Social isolation is reduced for people who do not own cars or cannot drive, as many destinations across the region become more easily accessible.
23. Current and forecasted road overcapacity situations in the eastern and western airport employment areas are alleviated or avoided.
24. Direct rapid transit access to Mississauga's Airport Corporate Centre from across northern Toronto and Mississauga is created.
25. As an economic stimulus, 160,000 job years are created as the 401RT is constructed – far more than any other single public job creation project in the GTA has achieved.
26. Canada and Ontario government capital cost contributions will result in an influx of approximately \$14.6 billion into the Toronto area economy.

27. Approximately 3,400 ongoing transit operating jobs are created.
28. Economic losses from traffic congestion are reduced; business efficiency is improved.
29. Economic losses from motor vehicle fuel and automobile imports are reduced – at least \$75 million per year.
30. Greenhouse gas emissions are reduced by more than 440,000 metric tons per year. Meeting and exceeding greenhouse gas reduction targets is essential for the future well-being of all people and their natural life support systems.
31. Toxic vehicle emissions are reduced, and the incidence and severity of respiratory diseases and medical costs is reduced.
32. The number of deaths and injuries from motor vehicle collisions, and the traumas born by the families and friends of crash victims, are reduced, as are associated daily congestion impacts of collisions.
33. The operational effectiveness of the Toronto area’s pre-existing transit system is improved; for example, more people using existing buses and new buses, as service frequencies improve.
34. Suburban sprawl is eased, as development in the central area of the GTA is attracted by the 401RT, including at, above, or near the highway at 401RT stations.
35. Property tax revenues are increased from new urban development at/near 401RT stations, and from increased property values in parts of Toronto, Mississauga, Pickering and some ‘905’ areas served by GO Transit.
36. Travel costs are reduced for thousands of households as fewer cars need to be owned or used less. Money saved can be redirected towards other household priorities. After-tax household savings can range up to \$9,000 per year per vehicle, less the cost of using public transit.
37. Truck transport is improved as gridlock on highways 401 and 409 is avoided, even as road lanes are reduced, as car drivers transfer to transit when transit is seen to be as fast or as convenient as driving.
38. The operational revenue-to-cost ratio of the Hurontario light rail transit line in Mississauga is improved; additional high-density urban nodal development at and near Hurontario Street is supported.
39. Improved and rapid access to Malvern and the University of Toronto’s Scarborough campus using the 401RT reduces anticipated ridership volumes on the proposed Eglinton Crosstown East LRT extension via Morningside Avenue. Savings from eliminating the LRT extension are at least \$1.7 billion. Enhanced bus services on Eglinton East, Kingston Road, and Morningside Avenue are recommended.
40. The 401RT provides a significant long-term relief valve against future global energy shocks, and addresses potential future energy shortages head-on.
41. The Jane Street LRT proposed by Toronto is unnecessary as east-west connections provided by the 401RT and Eglinton Crosstown LRT (extended by one stop, from Mt. Dennis to Jane) reduce passenger volumes on Jane Street buses. Savings are approximately \$1.5 billion.
42. The overall operating revenue-to-cost ratio for the 401RT should reach 90% or higher, better than the overall public transit system of the City of Toronto.
43. In **Durham Region** and the city of Pickering, the prospects for further development at the Pickering Town Centre area at Liverpool Road and Highway 2, and at Whites Road, would be enhanced. Future extensions of the 401RT to Brock Road and beyond are possible. A 401RT would be a very welcome alternative to what is now a forced daily drive on congested highways.
44. In **York Region**, the 401RT would ease road congestion to and from Toronto as connecting north-south bus services improve.

[The Ontario Line](#)

The Ontario government’s April 2019 announcement to fund new rapid transit lines for Toronto includes an “Ontario Line”, meant to replace and extend pre-existing plans for a “Relief Line” subway that would operate between University Avenue and the Pape subway station on Danforth Avenue. The Ontario Line is primarily intended to divert subway riders from the very overcrowded Yonge Street subway. The new Ontario Line will extend to Eglinton Avenue East to provide an additional diversion from Yonge Street, it will not become

operational until eight to ten years after the Eglinton Crosstown LRT becomes operational. Until then, crowding on the Yonge Street subway will worsen.

The Ontario Line as envisaged in late 2019 will run between Eglinton Avenue East and the Exhibition GO station. Its downtown segment between Sherbourne Street (Moss Park station) and Spadina Avenue is planned to run under Queen Street, although far more people – close to 50% more – use the King and St. Andrew subway stations and the King streetcar service, compared to the Queen and Osgoode subway stations and the Queen streetcar. East of Sherbourne Street, the Ontario Line is planned to divert southward to run above the existing CN railway tracks as far as Gerrard Street, and then northward to Eglinton Avenue East at Don Mills Road. This effort to reduce infrastructure costs is false economy; over the long term, service quality is more important than shorter term dollar savings. West of Spadina Avenue the Ontario Line turns southwestward to a station at King and Bathurst Streets, and from there runs further to terminate at the Exhibition GO station.

The City of Toronto's current streetcar-based transit priority service along a short portion of King Street will not resolve crowding on the King streetcar. **Next Connections** recommends that the Ontario Line west of the Don River be constructed to run continuously under King Street, including a station at the new Liberty Village SmartTrack station, and that the current transit priority service on King be eliminated or moved to Queen Street. Exhibition Place and Ontario Place can be well served by the Bathurst streetcar and a Waterfront LRT, and by a separate express transit shuttle that extends southward from the King/Dufferin station; the diversion to Exhibition station makes any future westward extension more expensive. For an evaluation of the King Street alignment advantages, see Appendix 4.

Ontario Line North of Eglinton East: It is *essential* that the Ontario Line (OL) be extended further northward by 6.7 kilometres from Eglinton Avenue East to a terminus at the 401RT, and then to Sheppard Avenue East. Without this extension, high volumes of transit riders transferring from the 401RT will create severe overcrowding on the Yonge Street subway. The most effective alignment is to turn the OL northeastward underground to intersect with the 401RT at Victoria Park Avenue, where it would provide the fastest service for trips to and from Scarborough. This alignment includes a multi-level commuter parking lot and OL station at the Don Valley Parkway/York Mills Road intersect. More than 1.8 million trips by automobile can be diverted from the DVP onto transit.

The 7.5-kilometre Eglinton East-to-Sheppard segment of the Ontario Line would cost approximately \$3.8 billion, tunneled or elevated for its entire length. This segment of the Ontario Line would

1. Create direct access to and from the 401RT east of Yonge Street, and its stations across Toronto;
2. Create rapid transit access for transit users on Sheppard Avenue, Don Mills Road/Ellesmere Road, Lawrence Avenue East, and Barber Green Road;
3. Avoid overcrowding on the Yonge Street subway by creating an alternative access to downtown Toronto for significant numbers of new and current transit users;
4. Provide an important new rapid transit connection between Scarborough and the downtown Toronto area, and to and from destinations in between;
5. Eliminate much of the congestion on the Don Valley Parkway (DVP);
6. Increase utilization of the Eglinton Crosstown LRT;
7. Generate 14 million new transit trips, including a significant transfer of current Don Valley Parkway trips, plus transfers from existing bus services (primarily Don Mills buses);
8. Enable fast transit access to/from the corporate employment area at and north of Eglinton Avenue East and Don Mills Road;
9. Promote urban infill and intensification at and near the corridor to accommodate ongoing population growth and economic growth in Toronto;

10. Reduce overall road traffic along Don Mills Road, Overlea Boulevard, and nearby streets;
11. Increase utilization of intersecting east-west surface transit services;
12. Reduce crowding on Don Mills Road buses;
13. Reduce greenhouse gas emissions from modal shifts to transit, including by DVP drivers who would otherwise drive long distances to destinations in Toronto; and
14. Improve access to, and increase attendance at, the Ontario Science Centre.

Ontario Line West of University Avenue: In the past, studies by transit planners have said that over a relatively short term there would not be enough new ridership to justify an extension from University Avenue to Dundas West station (known as the Relief Line West), because enhancements to GO Transit at fares integrated with the TTC would reduce Relief Line ridership demand. However, GO Transit cannot provide a practical advantage for Toronto residents of the area due to its limited station locations.

Several factors support an Ontario Line extension to the Dundas West subway station. The new extension of the University/Spadina/York subway to Highway 7 in the city of Vaughan is now adding to ridership volumes on that subway line. The Eglinton Crosstown LRT will add more volumes. The essential 401RT will add still more. It is necessary to create an alternative rapid transit route between the downtown core and western Toronto. The Ontario Line is recommended to run westward from University Avenue to a station at the Queen/Roncesvalles/King intersection (QuRK station) and then northward under Roncesvalles Avenue to Dundas West station at Bloor Street.

The University Avenue to Dundas West segment of the Ontario Line would:

1. Include stations at University Avenue, Spadina Avenue, Bathurst Street, Liberty Village station (GO/SmartTrack link), Dufferin Street, Jameson Avenue, QuRK station, High Park Boulevard and Dundas West station;
2. Create a fast and direct linear subway service across all of the downtown Toronto core;
3. Overall, generate 26 million new transit riders per year by 2046, plus 20 million transferring from the existing TTC services along Queen and King;
4. Significantly cut travel times: for example, travel time between King Street and Jameson Avenue to St. Andrew subway station is reduced from 23 minutes to 9 minutes;
5. Enable an express shuttle service between Dufferin South station and Ontario Place and Exhibition Place, at Lakeshore Boulevard;
6. Reduce peak period crowding on the University Avenue portion of the Line 1 Subway;
7. Promote new transit trips to and from destinations outside the downtown area;
8. Serve people whose trip origins or destinations will not be well served by GO/RER enhancements, and which may be more local in nature;
9. Draw new transit riders from across the downtown core, from north of Queen Street to south of King Street;
10. Draw ridership from residents east of Yonge Street who have destinations west of University Avenue at or near King or Queen Street;
11. End overcrowding on the Queen Street streetcar routes;
12. Eliminate the King Street transit priority service and its road restrictions, and if desired, move the service to Queen Street or Dundas Street;
13. Free up road space across the downtown core for bicycle/e-scooter lanes or wider sidewalks;
14. Improve the flow of road traffic to and from the west through the downtown core;
15. Provide rapid access to and from Toronto's financial district, major entertainment and sports venues, dense highrise residential areas, Queen Street, and the populous underserved downtown area south of King Street to the waterfront;

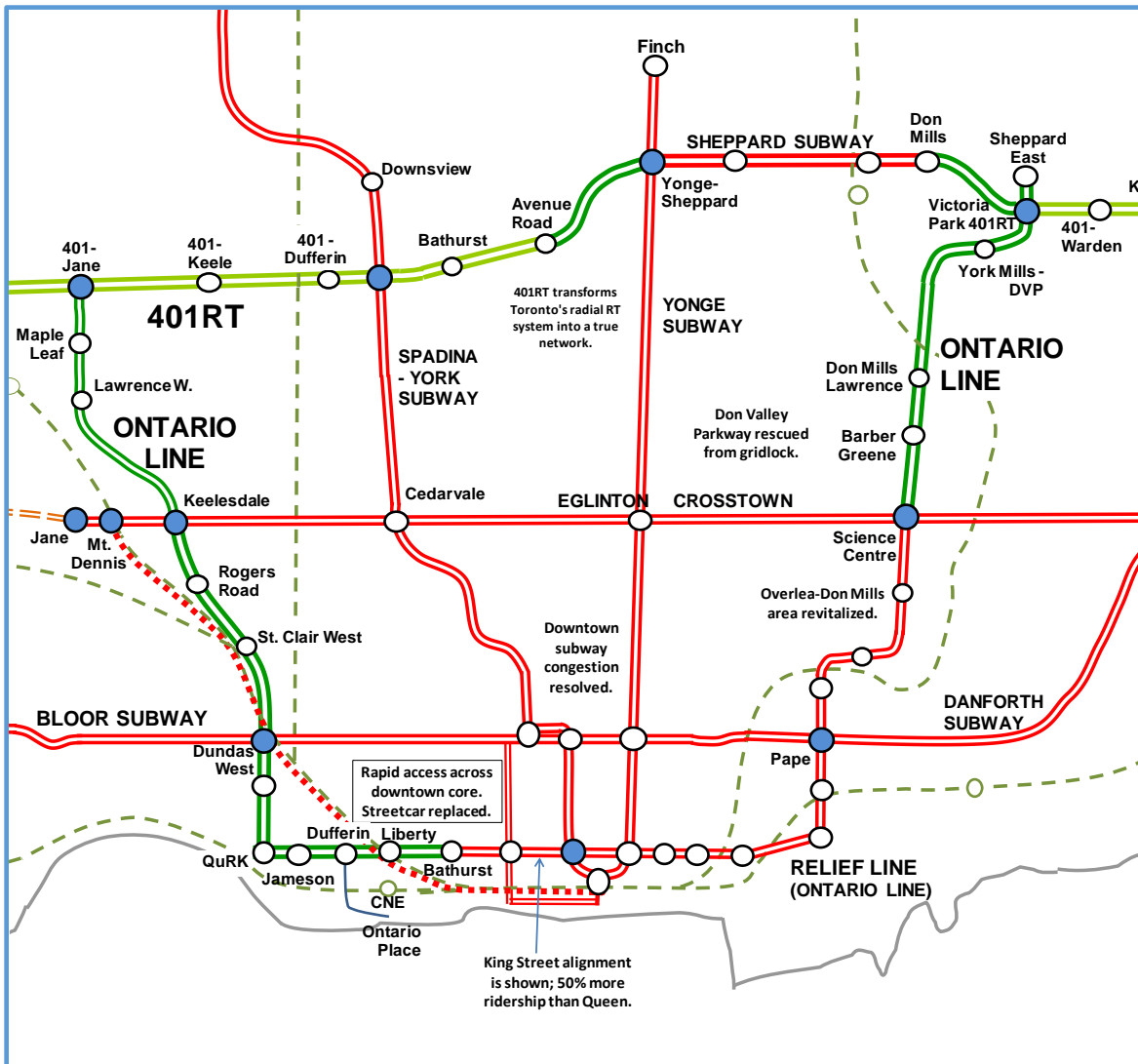
16. With a King Street alignment, enable GO Transit users to directly access the financial district via the Liberty Village SmartTrack station;
17. Encourage redevelopment along or near its route west of University Avenue;
18. Contribute to greenhouse gas emission reductions;
19. Enable rapid access to and from the downtown core for travelers using Queensway TTC services west of Roncesvalles Avenue;
20. Improve access to destinations across Toronto for residents Parkdale, designated by Toronto as a Neighbourhood Improvement Area.

Ontario Line North of Dundas West Subway Station: The GTA west of Toronto is more heavily populated than in the East, and population growth in the City of Brampton, the City of Vaughan, Oakville, the Town of Milton, and the City of Mississauga, will continue to add to the number of automobiles on the region's roads and highways, including trips to and from Toronto. Highway 401 west of Yonge Street is heavily traveled, and is congested daily.

Although GO Transit's Kitchener rail line and new "SmartTrack" stations in the rail corridor will improve service to travelers, an extension of the Ontario Line north of Dundas West should be built that would serve a different customer set, with more stations serving local communities east and west of the rail corridor. Stations north of Dundas West would be located at Annette/Rogers/Dundas ("Junction" station), St. Clair West at Weston Road, Rogers/Keele, Keele/Trethewey at Eglinton Avenue, Lawrence Avenue West at Black Creek Drive, Jane Street at Maple Leaf Drive, and the 401RT at Jane. An alternate route under Trethewey to Jane Street at Lawrence West is an option if tunneling under Black Creek is problematic.

This 8.2-kilometre tunneled extension would cost \$4.9 billion. This extension would

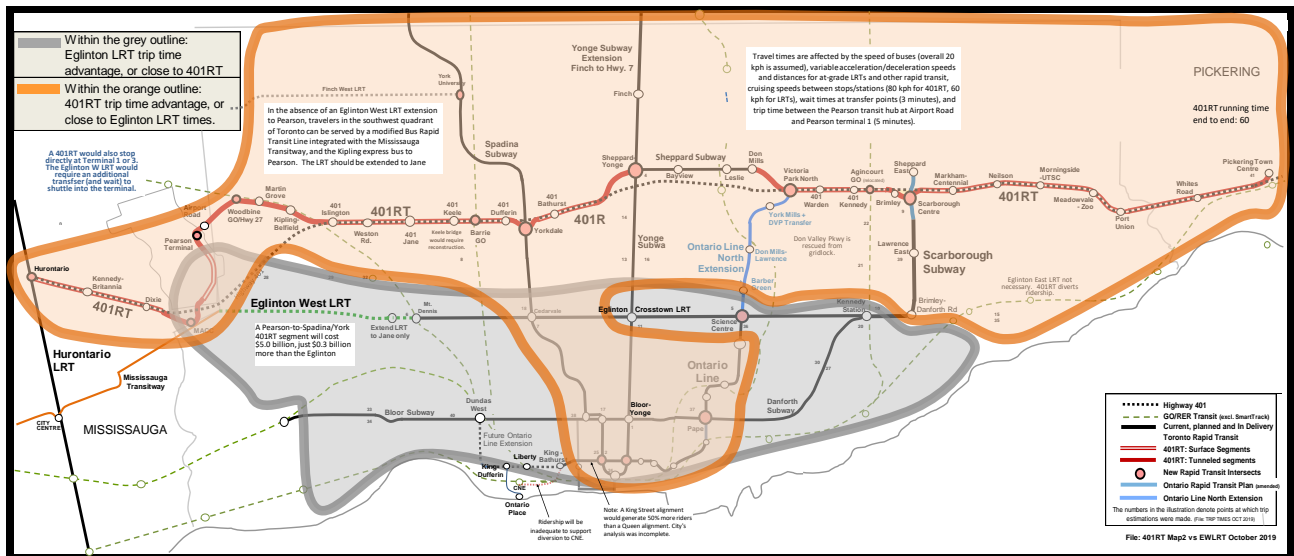
1. Intersect with at least eight existing TTC surface routes (35, 41, 59, 52, 171, 512, 26, 161) plus the Eglinton Crosstown LRT;
2. Attract existing TTC users from surface routes north of Maple Leaf and Keele-Trethewey stations;
3. Eliminate the need for a Jane Street LRT. The Ontario Line extension would provide much faster north-south service for many travelers who now use Jane buses; capital cost avoidance would be \$1.5 billion;
4. Generate 23 million new transit trips per year by 2046;
5. Increase transit ridership on the Ontario Line south of Dundas West subway station as access to more destinations by rapid transit north of Bloor Street are created;
6. Encourage redevelopment and intensification in response to population growth pressures;
7. Enhance the economic and community profile of adjacent neighbourhoods;
8. Reduce road traffic congestion on local streets;
9. Further reduce travel by automobile and emissions of GHGs; and
10. Enable an enhanced Wilson-Albion bus or BRT service between Steeles Avenue in Brampton and the Ontario Line at the 401-Jane 401RT station. A Wilson-Jane station 1,000 feet north of the 401RT may be appropriate, to avoid detouring the Wilson bus; this short extension may cost \$400 million to construct.



The 'SmartTrack' Eglinton West LRT Extension

As part of its subway plan for Toronto, the Ontario government has committed to building a mostly-tunneled westerly extension of the Eglinton Crosstown LRT. It would operate for approximately 8.4 kilometres from the Mt. Dennis LRT station to the Mississauga Airport Corporate Centre (MACC), with 8 to 12 stops, plus a further 3-kilometre extension to Pearson International Airport's proposed \$11 billion regional transit hub at Airport Road and Highway 409. The project, part of Toronto Mayor John Tory's "Smart Track" LRT plans, had been delayed due to local residents' objection to the city's recommended design.

With a 401RT in place, trips to the MACC and Pearson from near the University/Spadina subway and points east are as fast as or faster than would be achieved with the Eglinton LRT extension. For example, a trip to Pearson International Airport from the St. Andrew subway station would take 59 minutes using the University/Spadina subway and Eglinton West LRT, while using the University/Spadina subway and 401RT the trip would take 43 minutes. A trip from Yonge Street and Sheppard Avenue to the MACC using the 401RT would take 28 minutes, while using the Yonge subway and Eglinton LRT to the MACC would take 39 minutes. The illustration below shows the geographic and ridership effect of the 401RT on the Eglinton West LRT, based on a selection of travel times from various trip origins in Toronto.



Ridership on the Eglinton LRT extension to Pearson would decrease. The extension of the Eglinton Crosstown LRT from Mt. Dennis station should be limited to a \$0.37 billion extension to Jane Street, to intersect with Jane Street buses. West of Jane, plans for the LRT extension can be replaced by a much less expensive \$0.2 billion Rapid Bus alternative using dedicated curb lanes, with ‘go-thru’ signal priority for express buses, high frequency service, superior-quality buses, and shelters at every stop.

This Rapid Bus service would include both express and local stop services. Importantly, this service can be fully integrated with the Mississauga Transitway, to provide a seamless rapid service between the Jane/Eglinton LRT station and Mississauga City Centre, and further west to Winston Churchill Boulevard. Bus transfers at the Mississauga-Toronto border would end. The Rapid Bus service would also have the flexibility to accommodate an express service to Pearson International Airport and the larger employment area using several road options. The Rapid Bus service would increase ridership on the Mississauga Transitway. An enhancement of the existing express bus service to Pearson from the Kipling subway station can provide an additional alternative to the Eglinton West LRT extension. Overall, a \$4.7 billion cost avoidance can be realized by not building the Eglinton West LRT extension to Pearson. The savings can be applied to the \$0.57 billion cost of the Rapid Bus service and LRT extension to Jane Street, and towards the construction of a more effective Pearson-to Spadina/York subway segment of the 401RT (\$4.9 billion).

Curb lane transit service provides better and safer accessibility for travelers with children and the increasing number of people with mobility issues, and enables larger bus shelters with bicycle/e-scooter lockups to be included at every stop. For most of the Eglinton Avenue right-of-way west of Jane Street, an additional lane plus stopping bays and turn lanes in each direction where they are needed are possible.

Other Light Rail Transit Services

In addition to rendering the western extension of the Eglinton Crosstown LRT unnecessary, the 401RT will make another four light rail transit services planned by Toronto unnecessary:

- Sheppard East Subway:** The Ontario government proposes to fund an extension of the Sheppard Subway from the Don Mills station to Scarborough Town Centre, replacing Toronto’s plans for a Sheppard East LRT. The 401RT would run closely parallel to Sheppard Avenue East, and would attract significant numbers of travellers who would otherwise board the Sheppard subway from intersecting arterial roads. The Sheppard subway extension would no longer be operationally viable. A cost avoidance of

approximately \$2.8 billion can be realized. The 401RT replacement for the Sheppard East subway extension is a tunneled segment of the Sheppard subway between the Don Mills station and west of Victoria Park Avenue, and at grade eastward from that point to Scarborough Town Centre, at a cost of \$2.4 billion.

- Eglinton East LRT:** Although a rationale for the Eglinton East LRT extension was in part to serve local destinations across part of Scarborough, a main focus has been to connect people to the University of Toronto campus at Morningside Avenue and Military Trail. The 401RT would deliver workers and staff to/from the UTSC and Centennial College at Markham Road, and to/from the Malvern community north of Highway 401, and many other destinations in northern Scarborough, faster and from many more points across Toronto than the proposed LRT extension. Ridership on the LRT would drop significantly, and can be replaced by a reserved bus lane service. The dedicated lanes can accommodate both express and local services. A \$1.7 billion cost avoidance can be realized. The City’s report on options for the Eglinton/Kingston Road/Morningside service did not consider the benefits of enhanced bus services as an option (<https://www.toronto.ca/legdocs/mmis/2016/ex/bgrd/backgroundfile-94623.pdf>). An extension of the Eglinton Crosstown LRT to Kingston Road and no further is recommended, at a cost of \$700 million.
- Jane Street LRT:** The volume of transit users on Jane Street buses is high enough (32,000 boardings per day) that a Jane Street LRT is planned, to run from north of Steeles Avenue to Bloor Street. A short extension of the Eglinton Crosstown LRT to Jane Street and a 401RT and Eglinton LRT in place will provide new rapid transit alternatives for Jane bus riders who wish to access both suburban and downtown destinations east of Jane Street. The Jane-401RT and Maple Leaf Ontario Line stations would provide additional transfer options. \$1.5 billion can be saved by not building the Jane LRT.
- Finch West LRT to Pearson:** In addition to the above, a proposed \$551 million extension of the Finch West LRT from Humber College to Pearson International Airport will attract few new TTC users because of the LRT’s relatively remote location in Toronto. Even with a potential future extension of the Finch West LRT to the Yonge Street subway, most travelers to Pearson would elect to use the much faster 401RT. Residents along the Finch West LRT corridor who wish to access the airport should be able to use a bus service between Humber College and Pearson, or travel south to the 401RT at various intersecting north-south bus routes.

The Eglinton West, Jane, Sheppard East, Eglinton East, and Finch LRT to Pearson are included in Metrolinx’s 2041 Regional Transportation Plan for the Greater Toronto and Hamilton Area, although they are together much less effective than the 401RT and Ontario Line extension north of Eglinton East described in this document.

The Plan also identifies numerous other light rail transit, bus rapid transit, and priority bus service opportunities for the existing arterial road network across the GTA, as well as a Frequent Rapid Express Bus service on most limited-access highways. The costs and benefits of these are beyond the scope of **Next Connections**.

Capital Cost and New Transit Ridership of Potential Rapid Transit Initiatives:	(\$'000s)	New Transit Trips
401RT - Pearson to Spadina Subway	5,484	
401RT - Don Mills to Scarborough Centre	1,785	
401RT - Scarborough Ctr to Pt. Union Rd.	2,149	
Eglinton LRT - Mt. Dennis to Jane	370	
Rapid Bus BRT to Mississauga	210	
Eglinton E LRT extn to Kingston Rd	700	
Total - Recommended items	10,698	125*
Not recommended:		
Eglinton W LRT to Pearson	4,700	7.5
Eglinton East LRT to Malvern	1,700	8.0
Sheppard East subway to Scarb. Ctr.	2,800	8.4
Jane Street LRT	1,500	6.0
Finch W LRT - Humber Coll. to Pearson	550	4.4
Total - Items not recommended	11,250	34.3

* Estimate for segments shown. Full-length 401RT (Liverpool Road in Pickering to Hurontario Street in Mississauga generates 205m new transit trips per year.

File: 401RT Costs & Riders Dec 2018.xls

If there is to be a future consideration of funding for these LRTs and a Sheppard East subway, it is much better to apply those funds to the construction of the 401RT. The figure above summarizes the potential cost comparisons between building the 401RT and Toronto’s desired four initiatives described above. Applying the savings to the 401RT indicates an approximate break-even cost scenario. Importantly, new ridership

would be approximately 125 million per year for the 401RT, while the potential Toronto initiatives may generate just 35 million new transit trips per year, plus trips by current users of nearby TTC services.

In a general sense, when located on city streets, with delays from traffic signals and stops at times just 400 meters apart, LRTs would be something less than 'rapid' transit; they would be semi-local. While some LRT services can run at close to 28 kilometres per hour on city streets, subways are faster. Overall, the overall end-to-end speed for the 401RT would average 58 kilometres per hour.

Light Rail, or Buses?

Light rail services on city streets can provide only one level of service, while forms of bus rapid transit (BRT) can provide both express and local services in the same right-of-way. The demographics of aging suggest that transit access needs to remain close to home, which means that local bus services should be maintained. In the Rapid Bus Lane scenario for Eglinton Avenue west of Jane Street, express and local services would operate together, and some trips between Mississauga's western border and the Eglinton LRT (25 kilometres) can be planned to have just four or five stops.

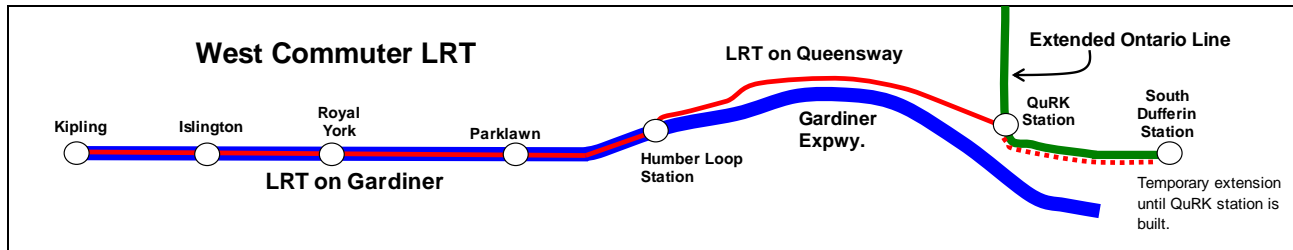
Speed is the most important element in attracting new transit users, when reducing the use of automobiles for travel is at a critical point. For travelers whose trip destinations are relatively distant, an LRT on city streets is normally not useful for people who currently drive cars: it is simply too slow. Because traffic congestion on roads is directly proportional to the distances traveled by automobile, attracting longer distance drivers to transit in the Toronto region is very important.

Another advantage of bus-based services over rail-based transit on city streets is that service disruption is minimal or avoided if a vehicle becomes disabled. Before a final decision is made on LRT infrastructure, dedicated bus lane or BRT options can be tested over multi-year period. This may require adding a road lane in each direction on selected routes (an advance on road widenings that would be necessary if an LRT is subsequently approved). Because the overall passenger capacity of articulated buses is less than for a typical LRT, the test should weigh customer service and satisfaction against potentially higher operating costs per passenger of running more buses, compared to LRTs. However, service frequency is an important factor for people as they consider the transit option.

West Commuter LRT

Metrolinx, the provincial agency responsible for GO Transit, is planning to implement all-day two-way GO Transit service on almost all of its commuter rail lines by 2025. This should produce a reduction in longer distance trips by automobile to and from the downtown Toronto core. However, GO Transit cannot adequately serve the myriad destinations of commuters driving to the downtown Toronto area from the west, and in the absence of good rapid transit alternatives, and population growth in Toronto and the GTA, congestion pressures on the Gardiner Expressway will increase. However, a rapid transit opportunity exists that can divert many trips by automobile into the downtown area from the west end of the city. If successful, and with some road adjustments to Lakeshore Boulevard, motor vehicle volumes can be reduced such that it would be possible to close the Gardiner Expressway east of Humber River, and to remove its entire elevated portion.

Next Connections recommends that the Ontario Line be constructed to continue westward from the King/Bathurst intersection to the Dundas West subway station, and that a West Commuter LRT be constructed that would run westward from the QuRK subway station (Queen/Roncesvalles/King) on the Ontario Line. This LRT is recommended to operate around Humber Bay on the existing Queen streetcar right-of-way, and then divert via a short tunnel onto a separated right-of-way at grade in the centre of the Gardiner Expressway west of Humber River, in a configuration similar to the 401RT), and which would extend at least



as far west as Kipling Avenue. In the shorter term, the link to the Ontario Line can be at a King/Dufferin Ontario Line station, until the extension to QuRK station is completed. Double-ended LRVs with pantographs would be needed to avoid the need to construct turnarounds at Kipling and QuRK or Dufferin.

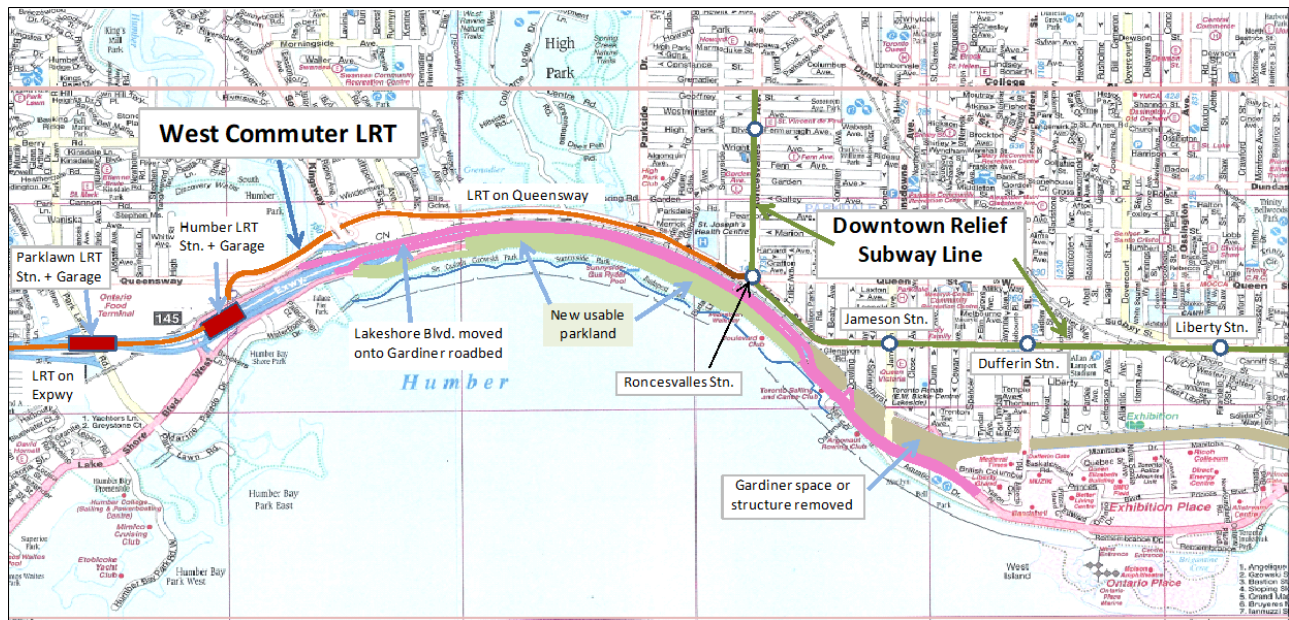
This West Commuter LRT concept between Kipling and QuRK would be 8.6 kilometres long and include stations at Kipling, Islington, Royal York, Parklawn and Humber River that would include financially self-supporting user-pay multi-level parking garages built above the Gardiner right-of-way. East of Humber River, Lakeshore Boulevard would be removed, and its traffic diverted onto the non-elevated portion of the Gardiner roadbed. It would return to its current Lakeshore Boulevard alignment immediately west of Dowling Avenue. **This would double the usable area of the existing lakefront parklands around the bay.** The larger park can be transformed to include new sports fields and courts, and accommodate more special events. An illustration of changes around Humber Bay is shown below.

The Humber and Parklawn West Commuter LRT stations deliver a key benefit to the growing and densely-populated Humber Shores community. It would enable rapid transit access to Toronto’s downtown core via the Ontario Line. Current pressures to create a Parklawn GO station, which is close to the Mimico GO station and would increase travel times on the Lakeshore West GO line, would no longer be relevant.

The removal of the elevated Gardiner Expressway would create myriad opportunities for urban development across the waterfront. The modal shifts to transit generated by increased GO Rail services and the downtown portion of the Ontario Line would enable a redesigned Lakeshore Boulevard to replace the perceived need for the current “hybrid” option for the eastern portion of the expressway. **The City of Toronto should not commit to any further expenditure on rebuilding the portion of the expressway east of Jarvis Street, known as the ‘Hybrid Option’.**

The capital cost of the West Commuter LRT is estimated to be \$910 million, plus \$1.67 billion to remove the elevated expressway and make other road adjustments. In comparison, the City of Toronto’s cost of the “hybrid option” east of Jarvis Street has been identified as \$1.4 billion. The staff report (released November 24, 2016) also identified a \$3.6 billion overall cost for maintaining the entire expressway. The eastern portion of the Ontario Line (the ‘Relief Line’), the 401RT and the Eglinton Crosstown LRT would reduce travel demand to the downtown core via the Don Valley Parkway, enabling a ‘grand boulevard’ east of Yonge Street to replace the elevated expressway.

New transit ridership on the West Commuter LRT is estimated to be 12 million per year, based on 6,000 new parking garage spaces, 20% daily turnover and 1.1 persons per vehicle, plus a portion of Humber Shores residents and new TTC ridership from intersecting bus routes.



Waterfront West LRT

Proposals for the LRT by the City of Toronto have varied, but a recent alignment is an attempt to economize on capital costs by using five existing streetcar route tracks between Union Station and Long Branch GO station. The Toronto Transit Commission estimates 21 million boardings per year. Most of these would be existing TTC users.

A route that more directly serves the shoreline is recommended, including an alignment around Humber Bay south of the Gardiner Expressway roadbed, where the West Commuter LRT has enabled the amount of usable parkland to be doubled. As part of the West Commuter LRT concept, the Gardiner Expressway ramp to Lakeshore Boulevard east of Parklawn Road would be closed. The proposed alignment includes a connection to Union Station at York Street rather than at Bay Street, with an at-grade segment to the St. Andrew subway station where a direct connection to the Ontario Line and the Line 1 Subway would be enabled (assumes a King Street Ontario Line route). The alignment would not use Queen's Quay and would run along Lakeshore Boulevard south of the CNE grounds. The number of new TTC trips per annum on the realigned Waterfront West LRT is estimated to be 9.2 million. An illustration is attached as **Appendix 3**.

Danforth Subway Extension into Scarborough

The Ontario government has announced that it will construct an eastward extension of the Bloor-Danforth subway – also known as the Scarborough Subway Extension (SSE) – into the centre of Scarborough. This subway will consist of stations at Lawrence East, Scarborough Centre and Sheppard Avenue East, and be aligned mostly under McCowan Road. The subway option was approved as a replacement of the current Scarborough Rapid Transit line, which is to be closed.

The 401RT would intersect with the SSE at Scarborough Centre, adding approximately 6,000 daily trips to the SSE, and would also, in combination with other intersecting transit routes, provide fast access to campuses across Toronto, including the University of Toronto Scarborough Campus, Centennial College, Seneca College and York University, from many more trip origins than would be less practically provided by the Eglinton LRT. For example, a UTSC student or worker traveling from Lawrence Avenue West at Keele Street could ride a

bus north to the 401RT, which would then deliver him or her, including a short university shuttle bus ride, to the University of Toronto Scarborough campus in approximately 54 minutes, compared to 77 minutes using the Eglinton LRT.

Next Connections recommends that the Scarborough Subway be extended northward by 2.2 kilometres, from Sheppard Avenue East to Finch Avenue East with new stations at Middlefield/Huntingwood and Finch Avenue East, to better serve nearby employment and residential areas, including the Malvern community. A station at the intersection of Brimley Road, Danforth Road and Eglinton Avenue, and where there is potential for significant urban intensification. These stops and the 401RT with its Scarborough Centre station, and more aggressive land use intensification by the City, would help travelers access destinations across Toronto, and increase overall ridership on the Scarborough Subway. New transit ridership is estimated at 7.2 million per year for the Scarborough Subway extension north to Middlefield and Finch Avenue, and the addition of a Brimley/DanforthRd station, plus the ridership effect of closer access to and from the City of Markham.

Although not included in Next Connections figures, future extensions to Steeles Avenue, and to Highway 7 (with stations possible enroute at McNicoll, Dennison and 14th Avenue) can be added to increase transit ridership between Toronto and Markham. Generally speaking, adding length and new stations to a rapid transit line will increase ridership geometrically, as ridership will come at not only the new stations, but from areas near pre-existing that would now have rapid access to areas newly-served.

Eglinton East LRT extension: With the existence of the 401RT and the enhanced Scarborough Subway, Toronto's proposed Eglinton East LRT extension to UTSC and Malvern, estimated to cost \$1.7 billion to build, is not needed. As an alternative, dedicated Rapid Bus services using curb lanes can be established between Kennedy station and the UTSC. They would be able to provide high-quality express *and* local bus services, with 'go-thru' signal priority and shelters and lock-ups at every stop. However, the Eglinton East LRT can be extended 4.5 kilometres eastward to Kingston Road (plus turnaround loop) and no further, connecting with the Danforth/Brimley Scarborough Subway station, and Markham Road. This extension may cost up to \$700 million, and generate 1.8 million new transit trips per year.

Transit Ridership Analysis

Further analyses by the Ontario government, the City of Toronto and others regarding transit ridership impacts of the **Next Connections** initiatives are welcome. However, the proposed rapid transit improvements are sufficient in magnitude, connectivity and service speed to generate very significant modal shifts to transit, that will increase steadily over time.

Some general points:

- The addition of up to 19 new rapid transit intersects will create many travel options not available today, including
 - 401RT connections: Hurontario LRT; Mississauga Transitway; Union-to-Pearson Express; Woodbine/Hwy27 GO; Jane/Ontario Line; Barrie GO, Spadina/York Subway (station above the 401 or at Yorkdale station); Yonge at Sheppard; Ontario Line at Victoria Park North station at Hwy 401; possibly a relocated Agincourt GO at Highway 401; Scarborough Centre.
 - Ontario Line Connections: Jane/401RT; Keele/Eglinton LRT; St. Clair/Old Weston Rd; Bloor subway at Dundas West; QuRK station (Queen/Roncesvalles/King) at West Commuter LRT; Liberty Village SmartTrack station (if a King alignment of the Ontario Line); University Avenue (Line 1); Don Mills Road at the Eglinton LRT; Victoria Park Avenue at the 401RT.
 - Mississauga Transitway connections: 401RT at Mississauga Airport Corporate Centre; Eglinton Crosstown LRT at Jane;

- West Commuter LRT connections: Ontario Line at QuRK station.
- Shorter bus trips to and from rapid transit will attract new transit users.
- Speed on rapid transit lines and express buses in dedicated lanes are crucial for attracting people who normally would drive an automobile; the 401RT is a particular example of speed – 58 km/hr overall – with stations averaging 1.9 kilometres apart.
- Congestion on city streets and on limited access highways in the Toronto area is a default situation because of the lack of adequate rapid transit services. “If you build it, they will come.”
- Bus shelters at every stop (*every stop*) in Toronto and neighbouring municipalities, and bicycle/e-scooter lock-ups wherever possible, will further attract transit ridership, and should be a part of all transit plans; this is an important and inexpensive measure.
- The 401RT would attract new longer-distance travelers from across Toronto and from Mississauga and Pickering; the Ontario Line would draw new users from the centre of Toronto, including from downtown Toronto.
- Populations and employment in Toronto and close to Toronto will continue to increase significantly for the foreseeable future. Toronto’s population will increase by 1.3 million in 30 years, and the near-Toronto 905 area by perhaps another 500,000.
- Urban development via infill and intensification will increase the use of transit close to new rapid transit lines.
- Construction of high-density buildings above, at or near 401RT stations and other rapid transit stations produces a higher-than-average modal split for transit, and is a strategy for private sector partnerships.
- Across suburban Toronto, many thousands of people who are today forced to carry the cost burden of driving because of poor access to rapid transit will be encouraged to shift to transit.
- 401RT intersections with GO Rail at Agincourt, Woodbine/Hwy27, St. Clair and Barrie GO will increase 401RT ridership to and from the Stouffville, Barrie, and Kitchener GO lines, and also enable some Lakeshore GO riders to make longer-distance connections to the 401RT.
- The 401RT’s ridership can be compared to that of GO/RER enhancement initiative: the 401RT’s forecast of 158 million new rail transit trips compares to GO Transit’s forecast of 200 million new trips for GO by 2051. Roughly 58 million of GO trips would be on the mostly-suburban Lakeshore line, which has less frequent service, has a similar number of stops as the 401RT, and is more expensive for users. The 401RT would draw riders from north and south of its alignment, whereas the GO Lakeshore line’s draw is largely from north of it.
- A transit surcharge levied on subways as a level-of-service premium and/or a fare-by-distance premium is appropriate and would not be a significant deterrent to transit use. An offsetting decrease in fares for local bus services can generate additional transit ridership.
- Note: The estimated percentage of new transit users compared to transfers from existing transit services for the Ontario Line would benefit from further analysis.

Overall, planners have avoided considering that many of the daily 1,700,000 trips by non-commercial car drivers and passengers on Highway 401 in the core of the GTA are taken so only because there is no practical alternative. A 401RT provides that alternative. Additionally, the Ontario Line, particularly its eastern portion, provides a practical alternative to driving downtown on the congested Don Valley Parkway.

Estimating new transit trips for the 401RT:

Because of the uniqueness of the 401RT, no comparable ridership forecasting methodology was found. However, it has estimated that the 401RT itself would generate 124,000,000 **new** transit trips per year soon after it becomes operational. The estimate is based on the Ontario Ministry of Transportation’s 2011 Transportation Tomorrow Survey’s origin-destination matrix for trips by residents by automobile for 24 hours for 44 wards in Toronto plus 16 close-by wards in neighbouring municipalities, and was adjusted to 2041 and

2051 for population growth. Modal shift factors to transit were assigned based on the proximities of trip origins and destinations to the Highway 401/409 corridor and by length of trip. Additional ridership was added as a result of worsening road traffic congestion from travel demand growth after 2041 (including growth in truck traffic), new high-density urban development encouraged at/near 401RT stations (including station construction partnerships with the private sector that includes air rights construction), trips to Toronto by residents living beyond the 60 Wards, positive impacts on GO/RER ridership, the added effect of direct access to Pearson International Airport from across Toronto, and driving costs.

The 401RT's 480-bus component assumes that ridership would increase on bus routes in Mississauga, Toronto and Pickering that intersect with the 401RT for trips not involving a transfer to or from the 401RT itself, due to improvements in service frequencies, a mix of express and local services, shelters at every bus stop, and more comfortable buses. It is estimated that overall ridership volumes on intersecting bus services would increase by 21%, or 47,000,000 by 2051. It is recommended that the bus ridership increase estimates be further reviewed.

401RT: New Ridership Estimate	
112,000	New 401RT trips 2051 by residents per day: modal shifts by auto driver and psngr
1.020	Factor re non-resident trips using 401 (i.e. travelers living outside the 60 Wards)
114,000	
308	Annualization factor
35,112,000	Annual new transit trips from auto driver & passenger
23,000,000	New urban development at/near/above 26 401RT stations; @ higher transit % share
58,112,000	
4,010,000	Estimated effects of GO RER intersects with 401RT (stouffville, Kitchener lines + some trnsfrs re Lakehr).
62,122,000	
84,000,000	Add'l. Hwy 401 congestion shift 2041 to 2051 (hwy unable to accommodate 50% of demand growth).
4,170,000	Reduction in 90% auto share of air passenger trips to/from Pearson, (i.e. more than in the basic modal shift)
150,292,000	Total
1.05	Driving cost Increases (tolls, energy)
1.00	Other factors
157,800,000	TOTAL - New TTC Riders using 401RT by 2051
47,000,000	Bus component new ridership
204,800,000	
205,000,000	by 2051
12,000,000	Transfers from nearby TTC routes (FYI only)
217,000,000	Total users by 2051

401RT Bus Component Ridership:	
2011 Daily Boardings on 36 intersecting bus routes	558,700
Travel demand growth to 2041	27%
Boardings 2041	709,549
Number of existing buses	551
401RT: Additional buses	480
Ridership spread over all buses	1,031
Boardings per bus	688
Assumed ratio fares to boardings	70%
Total fare boardings per bus 2041	482
Assumed effect of improved service frequency + comfort	25%
New fare ridership per bus	120
Total buses on 36 intersecting routes	1,031
New ridership/day re 401RT impact	124,171
Annual equivalent @ 308 FTE days	38,245,000
Increase 2041 to 2051	12.0%
	42,834,000
Add'l modal shifts re road congestion , e.g. shared AVs, transit priorities	1.05
Driving cost increase scenario	1.05
	Annual 47,000,000
	Daily 152,597

The extended Ontario Line is estimated to generate at least 63,000,000 new transit user trips per year, plus transfers from existing transit routes, such as the King Street and Queen Street streetcars, and from buses on Don Mills Road, Jane Street, Keele Street, Weston Road, and other routes. The ridership projection for the Ontario Line is based on variable estimates of new fares per peak AM hour per station (both directions), extrapolated to a full day and then year, and based on a 308-day annual conversion factor. More detailed analyses can refine estimates.

Phasing

Despite a historically slow pace for urban rapid transit development in the Toronto area, a timetable for completion of *the* recommended rapid transit components by 2046 is warranted by the seriousness of rapid climate destabilization and by road congestion crises. **Intensive efforts that overcome political fears and biases are needed for success.**

Because the lack of a single, fast rapid transit service across northern Toronto is a principal cause of road congestion to, from, across and within all of Toronto, the Ontario Line portion north of Eglinton Avenue East, and the 401RT itself, should be the first implementation priorities of the overall transportation strategy for the central area of the GTA.

Within that first priority, the 401RT segment between Pearson International Airport and the Yonge Street subway is highly important, providing more than a dozen key linkages to and from downtown Toronto, the City of Vaughan, Brampton (via the Woodbine/Hwy27 GO station), Mississauga, York University, the airport and its surrounding industrial area, and other destinations.

Construction of the 401RT would temporarily increase highway congestion. To minimize disruptions, construction of tunneled segments (18 km, plus 2km diversions to Maintenance Yards) can originate at off-highway locations, with construction of at-grade segments in the highway corridor coordinated to be constructed as tunneled portions rise to the surface of the highway. Multiple crews working simultaneously on numerous segments of the 401RT will minimize the overall period of disruption. With effort, at-grade tracks between most stations can be constructed within one year. 401RT stations within the highway corridor are intended to be of simple and practical design; the involvement of the private sector in construction of stations and additional building volumes over 401RT stations and tracks may add to construction timelines.

Beyond an estimated 2030 completion timetable for the Ontario Line to Eglinton Avenue East, the additional extension to the 401RT at Victoria Park Avenue and to Sheppard Avenue should be constructed to be completed to coincide with completion of the 401RT's eastern segments. These are needed to avoid further overcrowding of the Yonge subway from new transit users of the 401RT and Eglinton Crosstown LRT.

Without a 401RT and an extended Ontario Line to the 401RT, there is NO possibility of reducing road congestion in the core of the GTA. Highway 401, the Don Valley Parkway, and city streets in Toronto would experience increasing levels of congestion. Importantly, if the Jane LRT and Eglinton West and East LRT extensions are built, a 401RT would still be needed. Alternatively, with an operating 401RT, ridership on these LRTs would decline, and would *not* be needed. In effect, these LRTs would be an unnecessary expenditure ***that should be avoided***. As mentioned previously:

- The 401RT, the extensions of the Ontario Line north of the Dundas West subway station and the Eglinton Crosstown LRT extended one kilometre westward to Jane Street will divert many Jane Street transit users from long trips to Jane subway station on Bloor Street;
- An inexpensive Rapid Bus service in dedicated lanes on Eglinton Avenue West into Mississauga, and an enhanced Kipling station to Pearson express bus, can easily replace the Eglinton West LRT extension to Pearson;
- With a 401RT and Ontario Line east of Yonge Street operational, and the Scarborough Subway extended to Finch Avenue East, ridership volumes on the Eglinton East LRT will decrease significantly; the LRT can be replaced by enhanced bus services in reserved bus lanes.
- Previous plans for a Sheppard East subway or LRT are no longer applicable; many commuters who use Sheppard Avenue East transit would choose to use the 401RT.

Other recommended rapid transit initiatives – the extension of the Ontario Line west of University Avenue and the creation of the West Commuter LRT – are important steps towards sustainable city-building across the downtown area of Toronto. A new Waterfront West LRT that provides better service to lakefront communities and attractions is made possible by the realignment of Lakeshore Boulevard, enabled by the West Commuter LRT.

Environmental Considerations

The dire consequences for all Ontarians of the ongoing pace of GHG emissions must be mitigated. Ontario and the Toronto area must do their share both as necessity and to be able to demonstrate to others the magnitude of effort that needs to occur in a short period of time. ***The prospect of unstoppable climate destabilization and rapid global heating is real.*** Natural life will, in many cases, not be able to adapt quickly enough, causing tremendous damage and die-offs of ecosystems and habitats. The overall costs to human society will be great. **This is critical information.** Refer to Appendix 2 for more information.

Rapid transit projects that generate significant numbers of new transit users produce positive environmental benefits for many years, and in this case, a reduction of more than 630,000 tons of greenhouse gas emissions each year once all components of the recommended **Next Connections** rapid transit initiatives are operational, based on estimates of car-use kilometres avoided. Additionally, significant environmental damage from the production, maintenance and disposal of automobiles is avoided. Every delay in creating new transit infrastructure means that levels of environmental damage are continued. Environmental assessment processes for the initiatives recommended in this document should be streamlined. Conditional Declaration Orders can be issued that recognize the trade-offs between short term environmental costs during construction and the environmental damages that are avoided as projects are more quickly implemented.

Electrification of TTC Services: Greenhouse gas emissions in western industrialized countries must drop to almost zero by 2050. **Next Connections** recommends that an electrification of a large portion of bus services in Toronto and near-Toronto municipalities be electrified with conductive infrastructure and new buses. The cost for this conversion may reach \$2.2 billion, net of the sale of fossil fuel powered buses. Alternatively, buses themselves can be battery-powered, without the use of overhead wiring networks.

Autonomous Electric Vehicles

The positive effects of autonomous vehicles (AVs) on road traffic congestion in Toronto are likely to be limited. Over the longer term, travel demand growth will overtake space savings speculated for AVs. Road congestion will increase as more people use shared AVs, especially people who cannot drive. They take up to twice the road space as privately-owned AVs, because each one-way trip will be a round trip (from an originating location to the client to each client’s destination). Overall, transit vehicles are more space-efficient, carrying many more times the number of travelers than single-person occupied AVs, and are more energy-efficient. The technology for autonomous vehicles will likely evolve to enable the use of short-distance transit shuttles to deliver travelers to and from rapid transit stations, reducing operating costs while improving the attractiveness of transit. Ridership on those shuttles may be reduced if the use of e-scooters to/from transit stops on major arterial roads becomes commonplace.

On major highways, AV space savings will be less for trucks, especially larger trucks, as the ratio of vehicle length to space between vehicles is less; truck traffic will grow. Some truck owners will opt not to convert to full AV, because trucks will need a human presence for security and loading and off-loading of freight.

However, technology that prevents rear-ending and dangerous lane changes, as is now available on some automobiles, will come into widespread use for both trucks and cars.

In heavy traffic on highways, merging by autonomous vehicles across three or four lanes will likely slow vehicle speeds. On local streets, which would be shared by AVs and person-driven automobiles, AVs’ speeds will be limited, as traffic lights will still be needed to facilitate pedestrian and bicycle/carriage crossings, and turns will have to be slow enough not to disturb the physical comfort of passengers.

Technical problems with AVs are not fully resolved, such as ‘seeing’ through snow and rain, dealing with blowing leaves and debris, and seeing potholes, and slick surfaces on the road. Human drivers may have difficulty dealing with AVs in traffic. Mapping will be incomplete, because changes to roads occur on an ongoing basis. Legal, ethical and jurisdictional issues also remain.

The sophisticated components of vehicles will create affordability problems for many, who will as a consequence want or need to keep drivered cars. The limited availability of rare earth metals may prevent universal availability of electric vehicles; efforts to develop substitutes for rare earth metals may improve affordability of AVs.

Affordability

The rapid transit initiatives recommended by **Next Connections** reflect the magnitude of effort needed to achieve a sustainable urban transportation network that will contribute significantly to critical climate change goals and traffic congestion reduction. Both capital and operating costs for the 401RT, and the capital costs of other of its recommended initiatives, have been estimated and compared to a limited estimate of savings.

The table below summarizes the capital cost components of the overall scenario. The cost is \$33 billion, excluding items that are already in Ontario and Toronto plans, and ignoring savings from LRT projects not needed (the Eglinton West LRT extensions to Pearson, the eastern extension of the Eglinton LRT, and the Jane Street LRT; altogether, a cost avoidance of \$7.9 billion). The removal of the elevated portion of the Gardiner Expressway as a potential outcome of the West Commuter LRT is not included in the figures. It is assumed that current capital funding for the Eglinton Crosstown LRT and GO Transit expansion will be freed up by their completion between 2022 and 2025, and can be applied towards construction of the Ontario Line, the Scarborough Subway, and the extension of the Yonge Street Subway to Highway 7.

An important comparison is appropriate: The previous government of Ontario proposed a high-speed rail (HSR) service between Toronto and Windsor, at a cost of approximately \$21 billion. The 401RT and Ontario Line extension north of Eglinton Avenue East would cost \$20 billion. However, while the HSR plan has been estimated to serve 10 million passengers per year, the 401RT and Ontario Line extension would carry *219 million* new transit riders per year – 22 times more than the HSR. This advantage makes a priority implementation of the 401RT component of Next Connections highly appropriate.

A comparison between Next Connections and the Ontario Subway Plan is useful. As shown in the accompanying table, **Next Connections** achieves four times as many new transit trips than estimated for the Ontario plan, at approximately 16% more cost. This indicates a relative appropriateness for implementing Next Connections.

Rapid Transit	New Trips (Millions/yr)	Gross Infra. Cost (\$Mil)
Ontario Rapid Transit Plan	76	28,500
Next Connections*	307	33,000
Comparative Ratio	4.05	1.16

*Assumes 401RT+Eglinton West BRT replaces Eglinton West LRT.

The recommended rapid transit initiatives assume that capital investment costs would be phased in, and financed over a 30-year period. This deferral of costs would enable earlier starts to implementation, and spreads costs to the future users of the new transit services. At an average lending rate of 4.5%, the annual cost of the \$33 billion investment would phase in to \$2.0 billion once all initiatives are fully implemented (20+ years from now), and would be shared by Toronto, Mississauga, Durham Region, Ontario and Canada governments, and the Greater Toronto Airports Authority.

If the government of Canada funds 33% of the gross capital cost and the government of Ontario funds variable amounts (depending on the project) totalling \$19 billion, Ontario’s annual cost would grow to \$1.15 billion once all transit elements are completed, or approximately 0.7% of its projected 2041 budget. The Toronto share would phase in to be \$2.7 billion, or \$160 million per year during peak years; the average municipal cost per day per household would be 22 cents (30 years from now). Peak years’ annual cost can be reduced if an investment fund is established that would equalize contributions over the 30-year period.

The critical factor in achieving sustainable transportation is whether the people of Toronto and the governments of Ontario and Canada are willing to adopt a “can do” attitude and take aggressive action to reduce the negative effects of rapid climate destabilization and resolve widespread transportation problems, and to create a better city for the people of Toronto.

NEXT CONNECTIONS RAPID TRANSIT RECOMMENDATIONS	Km. Track or Bus Lane	Stations or stops	New Users (Millions/yr)	Gross Capital Cost (\$M)	\$m Cost per Kilometre
401RT (excl. Sheppard subway segment)	53.7	30	204.8	16,300	\$304
Ontario Line Eglinton E to Sheppard E	7.5	5	14.2	3,800	\$507
Ontario Line University Ave to Dundas W via King & Roncesvalles	6.8	8	32.5	5,700	\$838
Ontario Line Dundas W to 401RT	8.4	7	23.1	4,900	\$583
E-W buses + electrification of 30 bus routes				2,200	
Add: Eglinton W LRT to Jane only	0.9	1	1.0	400	\$444
Eglinton Rapid Bus to Miss'ga Transitway	6.7	0	3.7	200	\$30
Scarborough Subway enhancement	2.3	3	5.0	1,400	\$609
Eglinton East LRT- to Kingston Rd only	4.5	8	1.8	700	\$156
West Commuter LRT	8.6	5	11.8	900	\$105
Waterfront W LRT to Long Branch	8.4	17	9.2	1,200	\$143
New Rapid Transit	107.8	84	307	37,700	\$350
Recommended offsetting cost avoidance:					
Delete: Eglinton W LRT to Pearson (replaced by 401RT)				-4,700	-\$412
Net Effect of Next Connections	107.8	84	307	33,000	

File: Consol GTA Rapid Transit \$\$ Dec 2018/Compare to City

The daily benefits of reduced motor vehicle congestion and frustration, reduced air pollution, reduced travel times for TTC users, enhanced property values and redevelopment potential, and long term economic, financial benefits to individuals, families and government, suggest that the Next Connections proposals are very affordable. The section below provides more information regarding benefits.

Operating outcomes for new rapid transit infrastructure have not been calculated other than for the 401RT, which is estimated to have a revenue-to-cost ratio of at least 1.0. The estimate is based on an average fare of \$2.32 for subways and LRTs and \$2.07 for bus services, an annual operating cost of \$400,000 per light rail vehicle or bus, and \$7 million per subway station.

Summary of Next Connections Benefits

The \$37.7 billion infrastructure development cost of the initiatives proposed will be significantly exceeded by the value of benefits generated. 13 of the 30 benefits listed below were quantified at a conceptual level, totaling an ongoing gross benefit of approximately \$1.9 billion per year beyond 2041 for Ontario, including \$1.5 billion for Toronto. During the phase-in of the initiatives proposed, benefits accumulate to an estimated \$34 billion. For the residents of Toronto, the benefit grows to approximately \$3.54 per day for the average household.

In no particular order, overall benefits for the recommended **Next Connections** infrastructure initiatives include the following, some of which are costed:

1. 307,000,000 new transit users per year by 2051 (compared to 539,000,000 TTC riders anticipated for 2018).
2. The Next Connections initiatives add 108 kilometres of new rapid transit.
3. 19 new rapid transit intersects (Huronario LRT, UP Express at Pearson, Woodbine/Hwy27 GO, Jane/401RT, Barrie GO, 401RT/NW subway, Yonge Subway, 401RT/Ontario Line East, Agincourt GO (relocated), Scarborough Centre, Don Mills/Eglinton LRT, Trethewey/Eglinton LRT, St. Clair GO, Mississauga Transitway, Dundas West stn./Ontario Line, QuRK station, Liberty Village (if King RL alignment), University Av/Ontario Line) and more than 50 new rapid-transit-to-local-bus route connections are created.
4. At long last, fast and affordable transit access directly to Pearson International Airport and its surrounding employment areas becomes available from anywhere in Toronto and parts of Mississauga and Pickering.
5. Peak hour crowding on the Yonge and Spadina/York subway lines is resolved.
6. Peak hour crowding on the King and Queen streetcars is resolved.
7. Gridlock on Don Valley Parkway is resolved as the 401RT and Ontario Line attract drivers (\$20 million annual ongoing household savings).
8. The functionality of Highway 401 is maintained; passenger capacity of the corridor is more than doubled.
9. 400,000 job years are created during the construction of the 401RT, Ontario Line extensions, the West Commuter LRT, Sheppard Subway enhancements, Waterfront West LRT, and the Eglinton West Rapid Bus Lane transit lines.
10. Almost 5,000 ongoing new transit operating jobs are directly created (\$484m/ann.), plus those created by Metrolinx projects.
11. Thousands of jobs are created as a result of new urban development attracted to Toronto (\$207m benefit/annum).
12. Unemployment and unemployment costs decrease (\$18m/ann).
13. Tax revenues increase from incomes of the newly-employed.
14. Nearly 640,000 metric tons of CO₂ per year are not emitted as a result of modal shifts to transit; Toronto leads Canada in reducing transportation emissions.
15. For many thousands of people, the frustrations of driving are reduced as they are able to use rapid transit. Quality of life and health of Ontarians increases.
16. Many thousands of families are relieved of the financial burden of car ownership (\$238m/annum).
17. Imports of automobiles and motor vehicle fuels into Ontario are reduced by more than \$160 million annually; approx. 80% of automobiles purchased in Ontario are imported (\$32.3m/ann saved).
18. Economic losses from road congestion, totalling by one estimate at \$7 billion per year, are reduced (conservatively estimated as \$588m/ann).
19. Today's radial rapid transit system is transformed into a true network as the Yonge, Spadina/York and Scarborough rapid transit lines are connected at 401RT stations.

20. A single, direct east-west rapid transit line across the geographic centre of population of the GTA is created that is highly convenient for travelers.
21. Residential and non-residential property taxes on properties at locations near the 401RT and Ontario Line increase significantly.
22. Access between Brampton and Mississauga and northern Toronto is improved.
23. Travel times across the downtown area of Toronto are significantly reduced as the downtown portion of the Ontario Line (King Street alignment recommended) becomes operational (\$17.8m savings/ann).
24. The complete removal of the elevated portion of the Gardiner Expressway and replacement by an improved Lakeshore Boulevard is made possible with the creation of the West Commuter LRT, the Ontario Line and improvements to GO/RER Rail services. New construction is made possible in removed roadways.
25. The use of surface bus services is increased across the city, as the number of buses is increased by more than 480 as part of the 401RT initiative (\$60m hshld savings/ann in car costs to households).
26. Urban infill and intensification at/near 401RT and Ontario Line stations is significantly increased.
27. More people are attracted to transit as bus shelters at *every* stop protect them from the GTA's harsh climate. First/Last mile deterrents are reduced.
28. New opportunities to access destinations across the region are created for elderly and socially, economically and otherwise disadvantaged persons; isolation is decreased (\$122m/ann).
29. Toronto becomes a renewed leader in sustainable transportation in North America and beyond.

The quantified value of benefits is conservatively estimated, and also excludes a number of quality-of-life benefits, such as the value of reductions in greenhouse gas emissions, reduced frustrations arising from driving in congested conditions, the maintenance of vehicles, reduced crowding, access improvements for existing and new transit users, functionality of the road system, and other factors.

When compared with overall costs to Toronto, the overall estimated impact is a large net benefit for the residents of Toronto, especially after debts related to capital costs are retired. Overall, it is unaffordable to not implement the recommended Next Connections rapid transit services, or variants thereof that produce a similar magnitude of benefits.

Recommendations

It is recommended to the government of Ontario, the City of Toronto, other cost-sharing partners and transit planning decision-makers that they, within current planning cycles, and in consultation with affected funding partners:

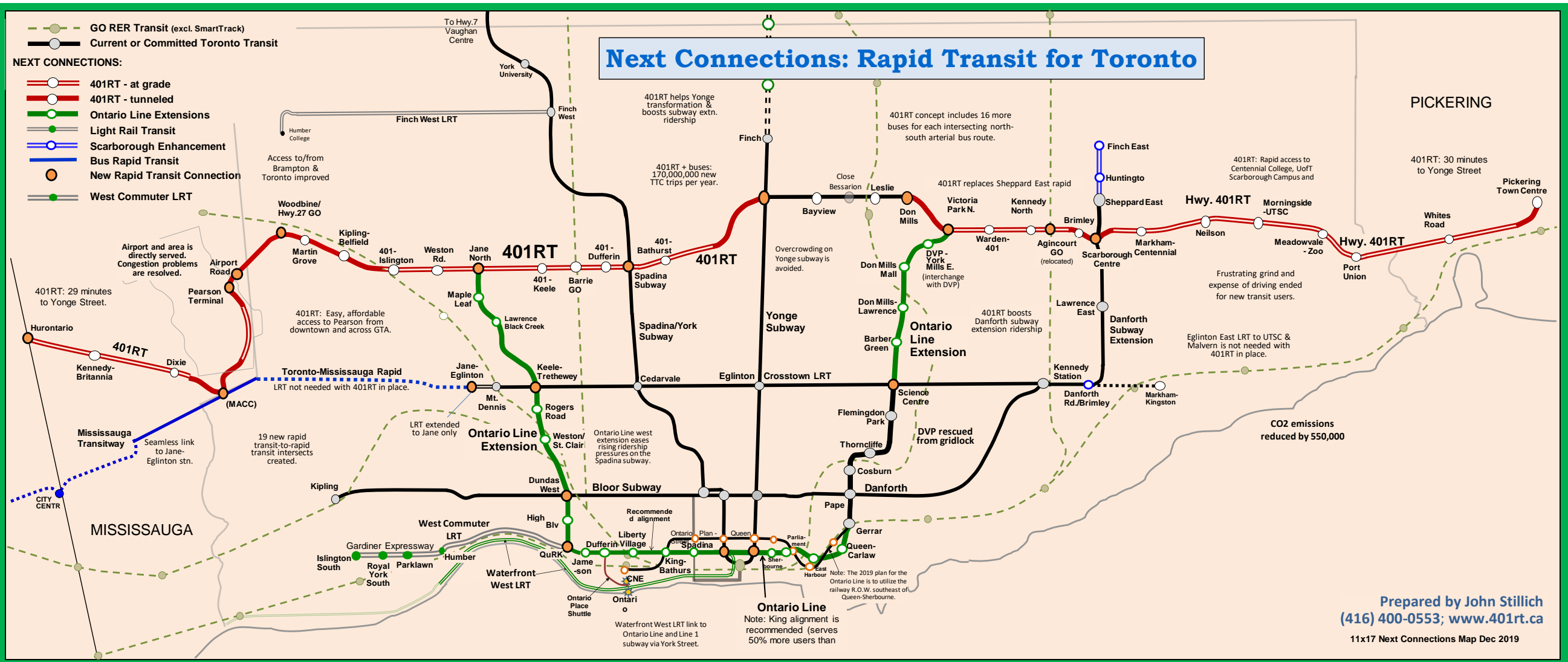
1. Recognize that current rapid transit plans of the Government of Ontario and the City of Toronto will not keep pace with travel demand growth, and will result in an increase in road traffic congestion and its negative effects;
2. Recognize that the recommended transit initiatives are a necessary part of efforts to cut greenhouse gas emissions, and that very significant reductions in GHG emissions are vital to the well-being of all people;
3. Recognize the vital importance of accelerating rapid transit planning and implementation, beyond current commitments;
4. Take immediate steps, particularly at the Provincial level of government, to undertake a detailed analysis of the benefits, costs and overall feasibility of the Next Connections initiatives;
5. Recognize the urgent need to create a Mississauga-to-Pickering rapid transit line through the northern half of Toronto, known as the 401RT and described herein, and which will generate a

- modal shift to transit of approximately 205 million trips per year by 2051, and include it in current transportation plans for completion in less than 20 years;
6. Recognize the significant and necessary positive effects of the 401RT for Toronto, Pearson International Airport and its surrounding employment area;
 7. Work quickly to construct the Ontario Line subway northward from Eglinton Avenue East to Sheppard Avenue at Victoria Park Avenue, and include in current transportation planning processes extensions west of University Avenue as described herein;
 8. Consider, on an urgent basis, a realignment of Toronto's downtown portion of the Ontario Line from Queen Street to King Street, where travel demand for transit is 50% higher than on Queen Street;
 9. Recognize the need for and benefits of the following additional rapid transit initiatives, and take urgent steps to bring them to operational status:
 - h. An extension of the Eglinton West LRT from Mt. Dennis to Jane Street and no further;
 - i. A Rapid Bus priority service on dedicated road lanes on Eglinton Avenue west of Jane Street that is fully integrated with the Mississauga Transitway, as a replacement for the Eglinton West LRT extension to Pearson International Airport;
 - j. A West Commuter LRT to operate between Kipling Avenue in the Gardiner Expressway corridor and an Ontario Line subway station at the Queen/Roncesvalles/King intersection; recognize that this LRT can enable Toronto City Council to remove the elevated portion of the Gardiner Expressway and avoid the city's "Hybrid" reconstruction plan for the expressway;
 - k. An extension of the Danforth subway beyond Sheppard Avenue East, to Finch Avenue East;
 - l. A Waterfront West LRT aligned as described herein that more directly serves communities and destinations along the Toronto waterfront;
 - m. An extension of the Eglinton Crosstown LRT to Kingston Road, and no further;
 - n. An electrification of bus services on 30 routes that intersect with the 401RT and Ontario Line.
 10. Remove from current transportation plans the rapid transit infrastructure made unnecessary by the recommended Next Connections initiatives, those being the Eglinton West LRT to Pearson International Airport, the Eglinton East LRT extension to the University of Toronto Scarborough campus and Malvern, the Jane Street LRT, the Sheppard East LRT or Subway, and the Scarborough-Lawrence SmartTrack station; and
 11. Recognize the short-term and long-term affordability of the recommended initiatives, and its substantial benefits to the residents, economy and environment in the core of the GTA.

Prepared by John Stillich

Updated to February 29, 2020

Recommended Rapid Transit Network



Prepared by John Stillich
 (416) 400-0553; www.401rt.ca
 11x17 Next Connections Map Dec 2019

Appendix 1

Updated to February 29, 2020

Estimates of Trips in Toronto		By Automobile	Municipal Transit	GO Transit	Other	Total
Toronto population 2051, adj. from Min. of Finance, ages 11+ only						4,092,709
Trips per day per person, adjusted downward for aging demographics						1.95
Total daily trips						7,964,100
Modal split, per 2016 TTS	Millions per Year	57%	27%	1%	15%	100%
		Daily	Daily	Daily	Daily	Daily
Estimated daily trips by mode, 2051, Toronto residents		4,539,500	2,150,300	79,600	1,194,600	7,964,100
Cross-boundary trips into Toronto by 2051		340,900	161,500	6,000	89,700	598,000
Total trips in Toronto by 2051		4,880,400	2,311,800	85,600	1,284,300	8,562,100
TTS 2016 trips in Toronto		3,150,000	1,492,100	55,300	828,900	5,526,300
Increase in total trips, before major transit initiatives*		1,730,400	819,700	30,300	455,400	3,035,800
Less major announced rapid transit enhancements:						
GO Transit Enhancements (net; to 200m)	173.7	-563,800		563,800		0
Eglinton Crosstown LRT	20.0	-65,000	65,000			0
Est. increase in transit trips arising from the 2019 Ontario rapid transit plan:						0
Ontario Line - University Ave. to Pape Station	15.7	-51,000	51,000			0
Ontario Line - Pape Stn. To Eglinton Avenue East	9.9	-32,000	32,000			0
Ontario Line - University Ave. to CNE	3.4	-11,000	11,000			0
Ontario Line New Ridership Adjustment (Feb 2020)	15.4	-50,000	50,000			0
Eglinton West LRT extension to Pearson airport	7.4	-24,000	24,000			0
3-Stop Scarborough Subway to Sheppard Ave. East	5.5	-18,000	18,000			0
Yonge subway extn. to Richmond Hill	5.5	-18,000	18,000			0
Hurontario LRT (assumed to be 100% Mississauga)	0.0	0	0			0
Allowance for trip increases 2041 to 2051	5.5	-18,000	18,000			0
Effect of major transit enhancements	262.0	-850,800	287,000	563,800	0	0
Net increase in trips in Toronto, 2016 to 2051, after modal shifts resulting from current commitments		879,600	1,106,700	594,100	455,400	3,035,800
* For Municipal transit, it is assumed that the TTC will undertake a variety of day-to-day enhancements over years to existing TTC services, e.g. adding buses & more trains to existing routes, to keep pace with population growth. Excludes new subway and LRT routes or extensions.						
N.B. Toronto plans for LRTs on Jane, Sheppard East, Eglinton Avenue East and the waterfront are not included, and may add 110,000 new transit trips per day.						

	Auto Driver + Pssnger	Municipal Transit	GO	Other	Total	
Estimated increase in number of daily trips in Toronto, after implementation of current transit plans, by 2051	879,600	1,106,700	594,100	455,400	3,035,800	
Next Connections – Recommended transit infrastructure:	<u>Ann.</u>	<u>Daily</u>	<u>Daily</u>			
401RT - Pickering Town Ctr. To Hurontario Street	205.1	-666,000	666,000		0	
Ontario Line extension - Eglinton East to Sheppard E	14.2	-46,000	46,000		0	
Ontario Line - extn. Univ.Ave. to Dunds West stn.	32.6	-105,700	105,700		0	
DELETE Ontario Line University Ave to CNE	-3.4	11,000	-11,000		0	
Ontario Line - extn. Dundas West to Eglinton West	11.1	-36,000	36,000		0	
Ontario Line - extn. Eglinton W to 401RT at Jane	11.1	-36,000	36,000		0	
West Commuter LRT - QuRK station to Islington Ave.	11.7	-38,000	38,000		0	
DELETE Eglinton W LRT to Pearson's Union Station West	-7.4	24,000	-24,000		0	
Extend Eglinton LRT W to Jane Street only (1 stop)	0.9	-3,000	3,000		0	
Rapid Bus - Jane/Eglinton to Miss'ga Transitway	3.7	-12,000	12,000		0	
Eglinton E LRT extn. to Kingston Road/Markham Road	11.8	-38,300	38,300		0	
Extension of Scarborough Subway to Finch Ave. E.	4.9	-16,000	16,000		0	
Waterfront W LRT - Long Branch GO to Univ.Ave.	9.2	-30,000	30,000		0	
Totals for 'Next Connections' infrastructure	305.5	-992,000	992,000	0	0	
Combined effect of all initiatives - Change in trips in Toronto by mode, by 2051		-112,400	2,098,700	594,100	455,400	3,035,800
Approx. average vehicle occupancy		1.16				
Decrease in automobile traffic	-29.9	-97,000				

Appendix 2

The Devastating Blows to Survival from Rapid Climate Change

Climate change is happening now, hundreds of times faster than natural changes in the past. It has consequences that will dramatically damage us in our lifetimes, and become far, *far* worse for our children and grandchildren.

An indication of a frightening global change is in the past: 250 million years ago, the Permian-Triassic extinction that left only a few species of life on earth alive was caused by rising carbon dioxide levels in earth's atmosphere, and also by huge releases of methane, resulting in a 5° Celsius warming of the planet. We are adding carbon dioxide into the atmosphere at a rate that is, by most estimates, ten times faster, and humanity is also now causing methane to be released from permafrost. There is right now a third more carbon in the atmosphere than at any time in the last 800,000 years*.

The rapid destabilization and heating of the earth requires actions much greater in scale than are currently planned, and they must be undertaken **now**. The UN's Intergovernmental Panel on Climate Change (IPCC), reflecting the conclusions of thousands of scientists around the world, said bluntly in October of 2018 that unless global GHG emissions are cut by 40% to 45% by 2030 (now just 10 years away), we will not be able to limit global heating to 1.5° Celsius above pre-industrial norms, and will face devastating consequences.

Instead of decreasing, global GHG emissions are still rising. The 1.5°C target will be exceeded by between 2030 and 2052*. ***According to the IPCC, current nationally stated commitments to cut GHGs, if achieved, will result in a 3.2° increase in global temperatures by 2100, and higher beyond that.*** If we do not meet those reduction targets, the 2100 average temperature increase will be more than 4°, very close to the levels of 250 million years ago. Temperatures in northern latitudes will be higher. Because North Americans produce a very disproportionate share of global GHG emissions, GHG emissions in North America need to decrease to almost zero.

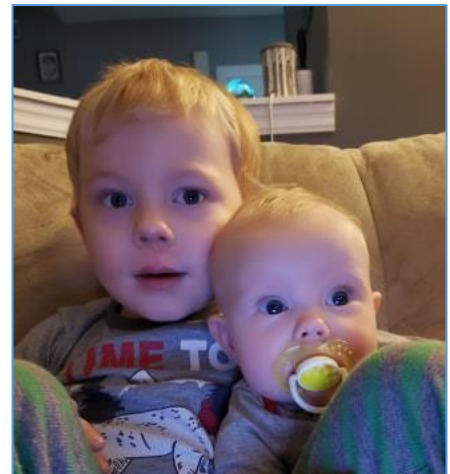
Rapid global warming of 3.2° will have the following devastating and inter-connected impacts. Each of us will be affected as temperatures move rapidly higher to that level by 2100.

1. Every natural ecosystem will be at risk of collapse, and many will have collapsed.
2. There will be a much higher frequency of droughts and precipitation deficits, and lasting for longer periods. This will affect food production; food prices will be much higher than today, where food is available.
3. Extreme heat events will become normal, and will last longer. Costs to cool buildings will more than double. The mid-latitudes (including southern Canada, much of the USA, the Mediterranean, central Europe) will experience an average rise of 4° Celsius (7.2° Fahrenheit).
4. Heat-related morbidity and deaths will multiply, and be especially deadly in low latitude countries. Conflicts and economic dislocations will become widespread.
5. The loss of livestock and declines in livestock health will affect prices and human diets everywhere.
6. The number of wildfires will multiply and be more widespread. Controlling them will become more difficult, and drain public finances. The devastating fires in Australia, at the beginning of its summer season, is a current example.
7. Rising temperatures and dryness in parts of the USA will make much of its southern regions unlivable by 2100. Canada will experience a massive flow of climate refugees that will strain our ability and desire to accommodate them.
8. Heating and habitat loss will decimate plant, insect and other animal populations. Rates of extinction will accelerate beyond already extreme rates.
9. Arctic ice will continue to melt, at a more rapid rate than is happening now, and will not stop. Sea levels will rise by metres (6 metres once all of Greenland becomes ice-free), to the point that coastal cities

will become at least partially flooded, and today's coastal marshes will be lost. By 2100, almost all ocean beaches will have disappeared.

10. Less arctic ice means more heat from the sun will be absorbed into the oceans, creating a feedback loop that will melt more ice.
11. Permafrost is thawing now, emitting billions of tons of methane, a greenhouse gas 20 to 25 times more powerful as a GHG than carbon dioxide. The permafrost will thaw faster, and may never freeze again. A feedback loop is already occurring that will accelerate global heating.
12. Boreal forests will be degraded, and some will be lost.
13. Vector-borne diseases will migrate with climate changes.
14. The ocean is becoming and will become more acidic, and will experience oxygen loss. Coral reefs will face total die-off. Populations of fish dependent on them will, in turn, be threatened. Food production from fishing and aquaculture will drop. Land animals will become a greater source of food in many regions; extinction rates of land animals will increase.
15. Armed conflicts will increase as famine and human-caused disasters spread. North America will likely not be without some strife. Military costs and emergency aid to other countries will increase.
16. National, regional and local economies will be strained as more financial resources are allocated towards adaptation and mitigation of climate events and trends. Employment dislocation and poverty rates will increase (with artificial intelligence systems as an additional factor), constraining the ability of governments to keep up with its social costs. Enforcement of laws to limit crimes of desperation will be more difficult. Politically-driven tax cuts to offset increased household costs of climate change will cripple the ability of governments to keep up with change. Delays in moving to net-zero carbon energy production will make necessary actions more difficult to undertake.
17. Political and monetary pressure from fossil fuel industries will make a rapid transition to energy based on non-fossil very difficult, and perhaps dangerous (How far will fossil fuel energy producers go to protect their industries?).
18. A multitude of small regional and local effects will require solutions.

Adequacy of action is and will be constrained by denials of the existence and/or severity of the scientific evidence and, unfortunately for some, climate change has become politicized, at the expense of our children's future well-being.

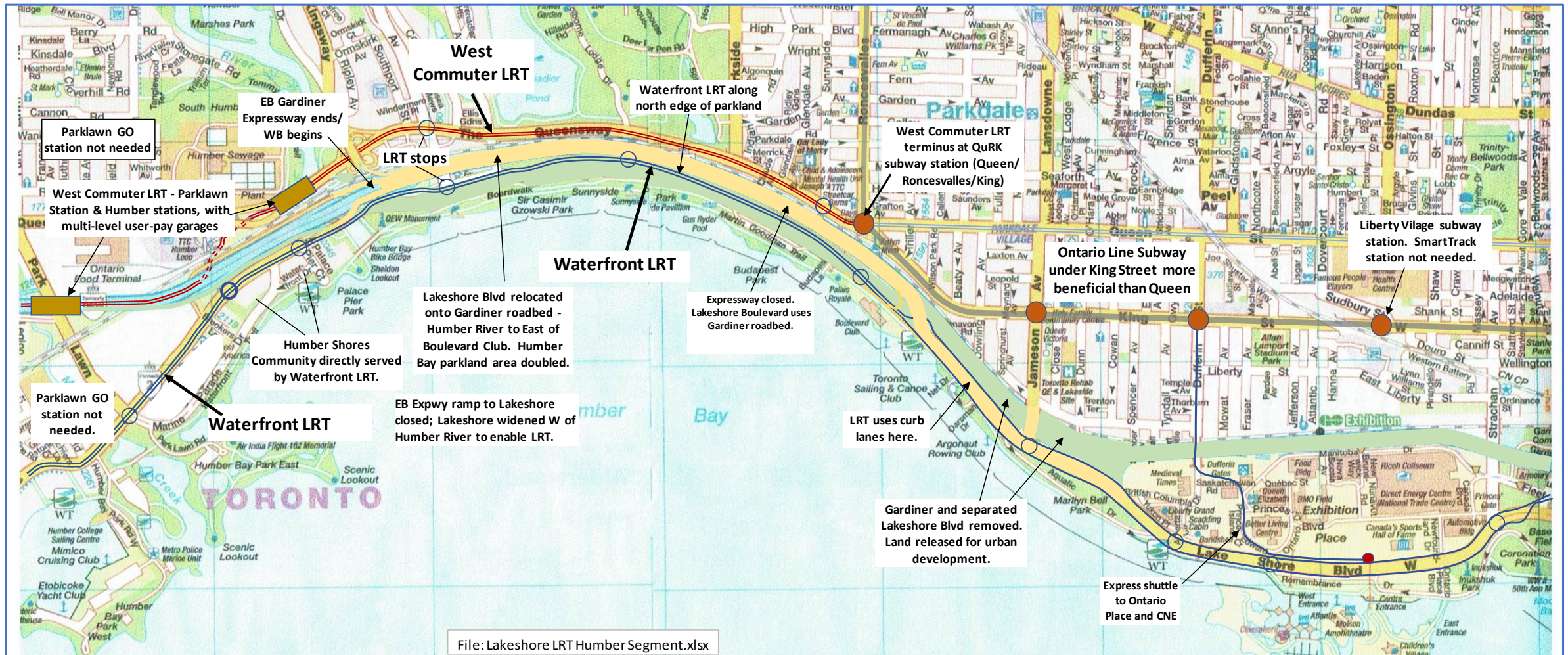


* Per sources identified in the book "The Uninhabitable Earth: Life After Warming", by David Wallace-Wells.

A Longer-Term Scenario for Rapid Transit For Toronto's Downtown and Waterfront Area – Humber Bay Portion Appendix 3

Basic assumptions:

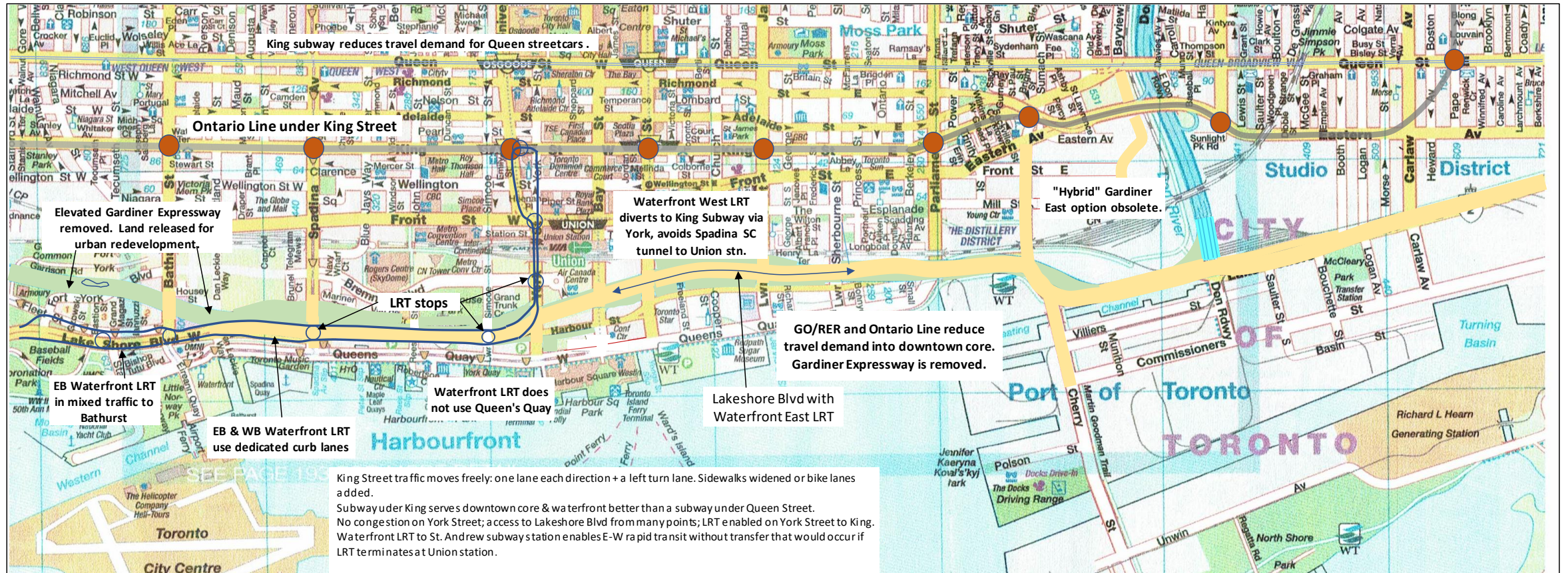
- The Ontario Line subway is built under King Street, not Queen Street, to better serve growing waterfront populations and employment. 50% more people use King Street transit than Queen Street transit.
- A West Commuter LRT extends westward from the QuRK subway station (Queen/Roncesvalles/King), with stations at Humber, Parklawn, Royal York and Islington, and is supported by user-pay multi-story parking garages above the stations.
- GO/RER, and the Ontario Line extended westward to Dundas West subway station, reduce travel demand by automobile into the downtown city core.
- Reduced travel demand by automobile into the downtown Toronto core has enabled the elevated portion of the Gardiner Expressway to be removed.
- A new Waterfront LRT is in place, aligned to maximize convenience, speed, and connectivity, while minimizing interference with other light rail transit.



A Longer-Term Scenario for Rapid Transit For Toronto's Downtown and Waterfront Area – Downtown Portion

Basic assumptions:

- The Ontario Line subway is built under King Street, not Queen Street, to better serve growing waterfront populations and employment. 50% more people use King Street transit than Queen Street transit.
- A West Commuter LRT extends westward from the QuRK subway station (Queen/Roncesvalles/King), with stations at Humber, Parklawn, Royal York, Islington and Kipling, and is supported by user-pay multi-story parking garages above the stations.
- GO/RER and Ontario Line extended westward to Dundas West subway station has reduced travel demand by automobile into the downtown city core.
- Reduced travel demand by automobile into the downtown Toronto core enables the elevated portion of the Gardiner Expressway to be removed.
- A new Waterfront LRT is in place, aligned to maximize convenience, speed, and connectivity, while minimizing interference with other light rail transit.



The Ontario Line's Queen Street alignment: A Mistake

The overall need for a “relief line” subway to avoid serious overcrowding on the Line One subway at and south of Bloor Street is clear. However, the success of the King Street transit (streetcar) priority project relative to previous levels of service has resulted in the significant advantages of an Ontario Line subway alignment under King Street being overlooked. The planned subway alignment under Queen Street is a mistake, and it should be brought to the attention of stakeholders.

The table below provides a succinct commentary of the advantages of the “D1” subway alignment of the Ontario Line under King Street. The differences for people can be measured in millions of transit trips per year, pedestrian crowding, impacts on Union Station and SmartTrack, access to destinations, and other factors. The most critical advantage for a King Street subway alignment is that it would serve far more people than a Queen alignment. Other differences between the corridors are of relatively secondary importance.

The table includes an “opportunity” that Corridor B1 (Queen) may include a Bay Street station at City Hall, which is completely unnecessary, and would slow east-west travelers. The impression is that there is a predisposed and unsupported political bias for a Queen Street alignment that overstates its importance. This bias should not trump a King Street alignment, which would serve many more travelers than a Queen Street alignment. Currently, close to 50% more trips are taken by King streetcars and the St. Andrew and King subway stations than on Queen and at Osgoode and Queen subway stations. This is a key consideration.

A King Street transit priority service is operational and is seen as a success story in the absence of better rapid transit. Yet, overcrowding on the King streetcar remains, and service is relatively slow. A King subway eliminates that congestion and speeds up trip times across the entire downtown core. Eliminating the streetcar lanes on King will enable the street configuration to be transformed, to include one road lane in each direction plus one left turn lane, and wider sidewalks or bike/e-scooter lanes to be created. The transit priority service now on King Street can be moved to Queen Street.

A King Street subway alignment would serve densely populated areas at and south of King (all the way to the waterfront) much better than a Queen subway alignment, and would also draw new transit riders from along Queen Street. Importantly, the City's analysis also gave no apparent attention to the eventual extension of the Ontario Line west of University Avenue to the Dundas West subway station.

Please review the illustration below, and make others aware of the potential for another rapid transit mistake. Please contact me if you'd like to comment, or have questions.

Please note that subsequent to the original Relief Line analysis (2018), the Ontario Line is planned to veer southwestward from Queen and Spadina to King/Bathurst and further to Exhibition GO Station. This diversion will be less effective for travelers than continuing the Ontario Line under King to the Liberty Village SmartTrack station, Dufferin Street, and beyond. Access to Exhibition lace and Ontario Place is more easily improved via an express shuttle service from Dufferin/King.

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The Relief Line Subway: Queen Street or King Street?

The City of Toronto's evaluation of the corridor alignment for the Relief Line subway recommends a "Pape to Queen via Queen-Broadview" alignment, labeled "**B1**". However, the evaluation and conclusions are significantly flawed. As the illustration below shows, the alternative alignment "Pape to King via Queen-Broadview", labeled "**D1**", is superior, and significantly so when considering that 50% more people use (and will use in the future) King Street transit and King, St. Andrew and Union subway stations, compared to Queen Street transit. The B1 alignment will be a costly mistake that should be corrected in favour of alignment D1.

Advantages of Corridor B1 over D1 and D2 identified by City's Assessment process	"Sober Second Thought"	Conclusion	ADVANTAGE D1
→ Creates a dynamic multi-modal hub in the core			
Opportunity to create interchange station in the psychological centre of the city (Nathan Phillips Square at City Hall)	Financial centre of Canada is as, or more, important. City Hall is within 300 metres from two subway stations. Appears to be an item of political bias.	No Queen advantage	√
Supported with strong pedestrian connections to Queen and Osgoode stations on Line 1 and to the Financial District via PATH network	D1 and D2 have strong pedestrian connections to Queen, King, St. Andrew and Union Stations, and is at the centre of the financial district.	Advantage D1 and D2	
→ Fills a rapid transit void in the core			
Improves rapid transit connections to northerly areas of the core (between Union Station and Yonge-Bloor Station)	D1 and D2 also do this.	No Queen advantage	
→ Recognizes that downtown is not just 9-5			
Provides alternative route for people to access jobs in the Financial District	Financial District is better & more directly served with D1 and D2. 50% more people use King transit compared to Queen transit.	Significant advantage for D1 and D2	√
Best for full array of daily travel needs and destinations, such as universities, hospitals and public institutions	No significant difference between venues nearer to Queen or King. D1 better serves CNE, Ontario Place, Ft. York when Relief Line is extended west of University Ave. (See note)	No Queen advantage	
→ Spreads out pedestrians			
Does not add more pedestrian congestion to Union Station area	D1 and D2 do this also. Because walking distances to financial district jobs is shorter, pedestrian congestion is reduced, for many more people than for B1.	No Queen advantage	√
Supports more options for people to access jobs throughout the downtown	There are more jobs south of Queen than at or north of Queen. Jobs north of Queen are already well-served by Line 1 subway.	Advantage D1 & D2	
→ Performs well with other transit initiatives			
Complements SmartTrack / GO RER connections into Union Station	D1 & D2 connects to Liberty Village SmartTrack Station, is closer to Union Station, and also serves Gerrard GO/RER station.	Significant advantage to D1 & D2.	√
Complements planned transit priority corridor along King Street	D1 & D2 eliminates the need for King transit priority corridor, and reduces volume pressures on Queen streetcar. Efficient movement of cars & trucks. Transit priority service can be moved to Queen.	Advantage to D1 & D2.	√
Connects to #6 Bay bus and bus lanes for onward connections north and south	D1 & D2 also connects to #6 bus.	No Queen advantage	
Bike Station under Nathan Phillips Square to open soon	Not a major consideration. Can be added with or without a City Hall subway station.	No Queen advantage	
→ Supports social equity			
Closest to Regent Park Neighbourhood Improvement Area (5 minute walk)	D1 & D2 Cherry Station is extra 200 metres from Regent Park NIA, but D1 & D2 will serve Jameson Ave. community better when RL is extended westward. Focus on RPNIA conflicts with equality principles: far more people are served by D1 & D2.	No Queen advantage	
Closest to Moss Park at Queen & Sherbourne	This is not a significant consideration. However, B1 serves St. Mike's hospital better.	Small B1 advantage	
→ Lowest projected cost			
Minimizes costly soil stabilization needs for crossing Don River south of Queen	D1 could also cross at Queen, eliminating this concern. Focus should be on long term benefit, not short term cost.	No Queen advantage	
Requires a shorter crossing of the Don River	D1 can also cross at Queen, eliminataing this concern. This is not a significant distance.	No Queen advantage	

Note: Opera house, some small theatres, & City Hall are at Queen. AGO & Grange are better with B1. Mt. Sinai, Sick Kids, UHN are all served by Line 1; no significant Queen advantage. Ryerson is 1 subway stop (1 minute) farther via King. Eaton Centre is closer with B1 but most people access it via Line 1. Prince of Wales Alexandra Theaters, Roy Thompson Hall, Design Exchange, CBC, Metro Conventin Ctr, Rogers Ctr, Distillery District & some small theatres are all better served via King. All of Toronto's downtown waterfront is better served by D1 & D2.