February 2012

Making Tracks to Torontonians 2012

An analysis of today's transit options for Toronto

Transit in Toronto is at a standstill as Toronto city council once again debates transit plans. New options are being generated and old plans are being resurrected. In the meantime, transit is not being built, congestion continues to grow worse and Torontonians suffer. Simply put, Toronto can no longer afford to delay new transit; the city must fully commit to a cost-effective transit plan and get shovels in the ground.

This report provides information and analysis to inform city councillors, policy makers and the public in determining a cost-effective transit plan that delivers the greatest benefits to Torontonians.

Key Findings[1]

- Not burying the entire Eglinton LRT could redirect $2 billion to build another 23 km of LRT to the neighbourhoods of 200,000 Torontonians who need transit the most.
- In terms of serving Scarborough — a priority for Mayor Ford — an LRT along Sheppard is the best option. It would serve a greater number of seniors, low-income people and Torontonians overall per dollar invested than either a Sheppard subway or a Finch East BRT.
- The LRT plan would bring transit to 120,000 more Torontonians than Mayor Ford's full plan (including an unfinanced Sheppard subway) at about 70% of the cost.
- The 2012 compromise proposed by Councillor Stintz would build a rapid busway longer than the lines in the other plans, but phase one of the original LRT plan would serve more Torontonians due to higher densities alongside a Sheppard LRT.
- Per dollar invested, the LRT plan would have the greatest impact on greenhouse gases and local air quality.

Standing in our tracks

In March 2011, Mayor Rob Ford and the Province of Ontario transportation authority Metrolinx signed a memorandum of understanding a transit plan (the "MOU plan") for Toronto which combined a reduced revision of the original provincially-funded light rail transit (LRT) plan (formerly known as "Transit City"). Mayor Ford's plan also included a Sheppard subway that would require private funding to build. In January 2012, Toronto City Councillor Karen Stintz, chair of the Toronto Transit Commission, proposed a compromise transit plan which maintained the MOU plan's lines but would no longer bury the entire Eglinton LRT underground. Stintz' compromise plan proposed that resurfacing a portion of the Eglinton LRT would save about $2 billion which could be redirected towards building additional transit lines elsewhere in the city, in particular a bus rapid transit (BRT) line along Finch Ave. west and east.

In March 2011 the Pembina Institute conducted a detailed analysis[2] comparing the MOU plan that was signed at the time against the original light rail plan ("LRT plan") that Mayor Ford had cancelled. Pembina's report found that the original light rail plan (widely known as the first phase of Transit City) was a better investment and would bring transit to significantly more Torontonians and in particular to neighbourhoods that have no rapid transit and need it most.

This short report re-presents that analysis but also compares costs and benefits of Councillor Stintz' recently proposed compromise plan ("2012 Compromise proposal") and how it stacks up to the others. In addition, it examines what options best serve Scarborough and Finch West neighbourhoods, and presents a cost-benefit comparision of Eglinton underground and redirecting the $2 billion cost of burying the entire line to other options.

If I had 2 billion dollars

One of the major decisions at hand in Toronto is how to spend $2 billion in provincial funding: is it better to bury the full Eglinton line with this money, or use these scarce provincial funds to bring transit to other corners of Toronto? A comparison is presented below in Table 1. With this $2 billion, more Torontonians could be served by building the Finch West LRT and Sheppard East LRT. These lines would lead to more riders on transit, reducing congestion, and a larger reduction in air pollution than would occur from burying the Eglinton LRT. In short, moving the Eglinton LRT above ground and spending the $2 billion in savings on other rapid transit lines would have a positive impact for Toronto.

Table 1. Cost and benefits comparison: burying the Eglington line or LRT construction

	Cost of burying all of Eglinton LRT	Cost of Finch West LRT + Sheppard LRT
Cost	$2 billion	$1.95 billion
Addition km of rapid transit	0 km	23 km
Additional Torontonians served	0	200,000
Additional riders per year	14.3 million	20.8 million
GHG reductions	25,000 tonnes	34,000 tonnes

Serving Scarborough

The northeast neighbourhoods of Toronto are currently underserved by transit and follow closely behind Finch West in terms of proportion of low-income population. Ensuring that transit improves for this area of the city is an important element of any transit plan. It is for this reason that Mayor Ford has made a commitment to build a Sheppard subway for Scarborough residents. However, a Sheppard subway is neither the only nor the most effective way to bring rapid transit to the residents of Scarbrough; a number of proposals have been made for an east-west rapid transit line to serve this area including:

- A subway along Sheppard East (Mayor Ford's Sheppard subway, to be privately financed)
- 2 km of subway along Sheppard between Don Mills and Victoria Park Ave.
- An LRT along Sheppard (part of the LRT plan)
- Finch East BRT

Table 2 compares these options. Because of limited provincial funding it makes sense to invest in only one of these options to avoid geographic overlap and ensure transit is also brought to other areas of Toronto.

Of these options, an LRT along Sheppard would serve the greatest number of seniors, low-income people and Torontonians overall per dollar invested. The other options all come with downsides:

- A Sheppard subway to Scarborough City Centre is prohibitively expensive and would require significant increases in density along Sheppard to make it cost effective.
- The cost of extending the Sheppard subway two kilometres to Victoria Park would take a large portion ($600 million) of the potentially available $2 billion — a lot of money to spend on a small subway extension. This cost could be even higher given that starting costs of tunnel construction are not spread over a great enough tunnel length to be cost effective.[3]
- A Finch East BRT overlaps with the existing Sheppard subway and future rapid transit along Sheppard East, diminishing the business case for new rapid transit on Sheppard, the busier corridor.
- The MOU plan omits a Sheppard line from provincial funding; if a Sheppard line cannot find private funds then the neighbourhoods of Sheppard East may be without rapid transit for decades to come. The LRT would guarantee rapid transit for Sheppard east.

Table 2. Comparing northeast line options

	Sheppard East Subway	Sheppard East Subway to Victoria Park	Sheppard LRT Phase 1	Finch East BRT
Length (km)	8	2	12	17
Cost ($2010 billions)	$2.70	$0.60	$1.01	$0.68
Cost per km ($2010 millions)	$338	$300	$85	$40
Torontonians served	81,600	20,400	122,400	73,600
Seniors served	7,000	1,800	10,600	8,000
Low-income residents served	4,800	1,200	7,200	5,400
Construction cost per Torontonian served	$33,100	$29,400	$8,300	$9,200

Finding funds for Finch West

The LRT plan aimed to bring rapid transit to four corners of the city, including Finch West. Finch West is identified as a priority location for a rapid transit line for the following reasons:

- Finch West 36 is currently one of the busiest bus routes in Toronto and will only get busier.
- The city's north-west region has the highest and fastest-growing population of low-income, immigrant, single-parent and youth populations in the city.[4]
    - Many of these residents cannot afford vehicles and have to travel further to find employment, and currently they are the most underserved by rapid transit. The combination of these factors limits the mobility of these residents and reduces the opportunities they can take advantage of.

There are a number of benefits to building rapid transit along Finch West including:

- A right-of-way rapid transit line along Finch West would not take lanes of traffic away from vehicles, except for 300 metres at the CPR bridge.
- Finch surface rapid transit is the most cost-effective transit line under consideration (see Table 2).
- Replacing diesel buses along Finch with cleaner transit options will result in less-polluted air in the neighbourhood, an important health benefit for residents that could lead to cost savings to the health care system.

The MOU plan concentrates provincial funds on burying the entire Eglinton line, leaving no funds for a Finch line. Councillor Stintz' compromise proposal aims to resurface a section of the proposed Eglinton LRT and redirect funds to a BRT along Finch, both east and west. A comparison of a Finch West BRT versus LRT is shown in the following table.

Table 3. Comparing Finch line options

	Busway (BRT)	Light Rail Transit (LRT)
Cost/km ($2010 millions)	$40	$85
Maximum capacity (people/hour per direction)	2700	8400 – 25,200*
Projected peak ridership for Finch West (people/hour per direction)	4500	

* 8400 for one-vehicle trains; 25,200 for three-vehicle trains based on 2-minute headways and the maximum capacity of LRT cars (280). At design loads and 2 minute headways, capacity range is 4,890-14,670[5]

BRT is generally cheaper to build than LRT, although the cost savings are less in systems that involve construction of a segregated busway.[6] Right-of-way BRTs can be implemented quickly and replaced by LRT over time, but given the high and growing ridership along Finch, investing in the appropriate technology first will save the cost of conversion later. Projected peak ridership for Finch West is approximately 4,500 people per hour per direction. A BRT, which can only move 3,000 people per hour per direction, is insufficient to meet this this demand; an LRT that can accommodate over 8,000 people per hour per direction is required to effectively service Finch West.

LRTs are cleaner and better for local air quality, and the speed and 'attractiveness' or 'newness' of an LRT can draw more new riders (the train factor). And BRT is not as effective as surface LRT at promoting urban renewal.[7] Furthermore, this analysis does not factor in operating costs, which would be higher for BRT per passenger since buses carry fewer riders and require more personnel.[8]

Comparing plans

With limited government capital available for transit in Toronto, we need to ensure this money is spent effectively. Table 4 compares a number of metrics of costs and benefits of the following transit plans:

1. **2012 compromise proposal:** Put forward by Councillor Karen Stintz in January 2012
2. **LRT plan:** Phase One of 4 priority LRT lines (first phase of Transit City) committed provincial funding in 2009
3. **2011 MOU plan:** Signed between the province and Mayor Ford in March 2011 for provincial funding
4. **Mayor Ford's full plan**: The MOU plan plus a Sheppard East and West subway extensions (requiring private funds).

Table 4 below shows that Mayor Ford's full plan (including the Sheppard subway) and the MOU plan are the least effective plans in terms of delivering service and benefits. Per dollar invested, these two plans create fewer kilometres of rapid transit, serve fewer Torontonians, have fewer riders and reduce air pollution less than the LRT plan and the 2012 compromise proposal.

- The compromise proposal would bring transit to almost 100,000 more Torontonians than Mayor Ford's full transit plan (including an unfinanced Sheppard subway) at about 67% of the cost.

- The LRT plan would bring transit to 120,000 more Torontonians than Mayor Ford's full plan (including an unfinanced Sheppard subway) at about 70% of the cost.
- The compromise proposal builds the most kilometres of rapid transit with provincial dollars compared to the other options; however, it may render future rapid transit along Sheppard line — either subway or LRT— redundant due to its geographic overlap with Finch East.
- Per dollar invested, the LRT plan would have the greatest impact on greenhouse gases and local air quality. Its advantage compared to the compromise proposal is due to the use of electric LRTs instead of diesel buses.
- Both the compromise proposal and the LRT plan connect about twice as many Torontonians with rapid transit per dollar invested than the MOU plan does.
- In terms of serving Scarborough — a priority for Mayor Ford — an LRT along Sheppard is the best option. It would serve a greater number of seniors, low-income people and Torontonians overall per dollar invested than either a Sheppard subway or a Finch BRT.

Table 4. How the plans stack up[9]

	2012 Compromise Proposal	LRT Plan	2011 MOU Plan	Mayor Ford's Full Plan
Length (km)	61	52	25	37
Cost ($2010)	$8.2 billion[10]	$8.7 billion[11]	$8.2 billion	$12.4 billion
Cost/km	$134 million	$168 million	$328 million	$335 million
Torontonians served *	431,700	457,300	217,000	339,400
Cost per Torontonian served	$19,000	$19,000	$38,000	$37,000
Low income population served	33,900	32,600	15,500	22,700
Total GHGs reduced annually (tonnes)	120,000	133,000	112,000	160,000
Cost per unit GHG reduced ($/kg) (one year)	$68	$65	$73	$78
Projected annual ridership	88 million	86 million	69 million	111 million
Construction cost per rider (one year)	$93	$101	$119	$112

* Within 500 metres of rapid transit each way

Mapping it out

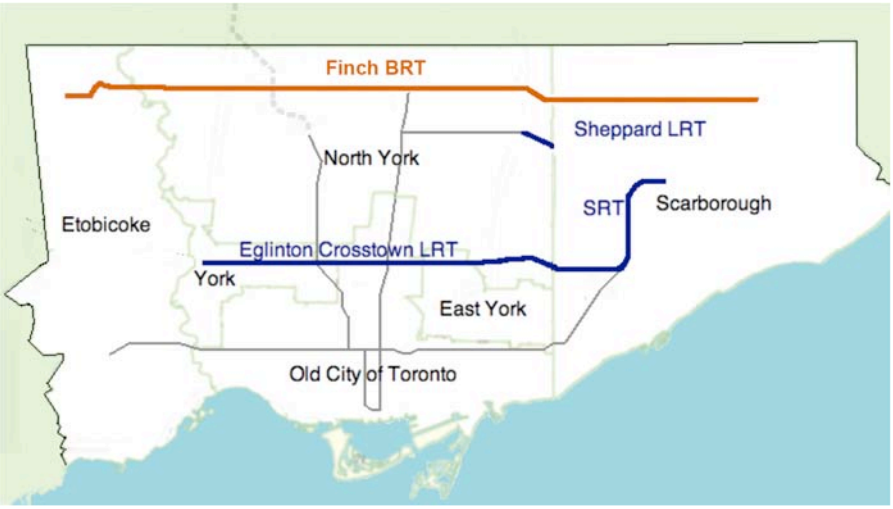
The following maps show the lines and the cost for the plans compared in Table 4 above.

2012 Compromise Proposal

Recent alternative plan brought forward by Councillor Karen Stinz

Cost: $8.2 billion

Length: 61 km



- Bus Rapid Transit (BRT) for Finch West — 17 km
- BRT for Finch East — 17 km
- Section of Sheppard subway from Don Mills to Victoria Park — 2 km
- Scarborough LRT (SRT) to Scarborough City Centre — 6 km
- Eglinton LRT (8 km surface/ 11 km underground) — 19 km

LRT Plan: The original 4 LRT priority projects (Phase One)

Cost: $8.7 billion

Length: 52 km

- Finch West LRT (Phase One) — 11 km
- Sheppard East LRT (Phase One) — 12 km
- Scarborough LRT (SRT) linking to Sheppard LRT — 10 km
- Eglinton LRT (8 km surface/ 11 km underground) — 19 km

MOU plan

Mayor Ford's current plan for provincial transit funding

Cost: $8.2 billion

Length: 25 km

- Scarborough LRT (SRT) to Scarborough City Centre — 6 km
- Eglinton LRT fully underground — 19 km
- Does not include Sheppard subway

Mayor Ford's full plan

Cost: $12.4 billion

Length: 37 km

Committed provincial funds for LRT (in blue): 25 km for $8.2 billion

Sheppard Subway (in red): 12 km for $4.2 billion requires private financing

- Scarborough LRT (SRT) to SCC — 6 km
- Eglinton LRT fully underground — 19 km
- Sheppard subway west linking Yonge and University/Spadina lines — 4 km
- Sheppard subway east from Don Mills to Scarborough City Centre — 8 km

Greenhouse gas emissions and air quality

Reductions in emissions of greenhouse gases (GHGs) and other pollutants are calculated based on the number of vehicles removed from traffic and the technology of transit mode (subway, LRT or diesel bus). In terms of total GHG reductions, Mayor Ford's full plan, which includes a Sheppard subway, would remove the largest amount of GHGs, with the lowest cost efficiency. When looking at cost efficiency — the construction cost per annual GHG reduction — the LRT plan is most cost effective, followed closely by the compromise proposal. Both the MOU plan and Ford's full plan deliver far fewer reductions in emissions per dollar invested.

The LRT plan presents significant GHG emission reductions due to the extent of transit built and the fact that LRTs are powered by electricity. While the compromise proposal would build 10 km more rapid transit than the LRT plan, its use of diesel busses instead of LRT vehicles means more GHGs are generated.

Total GHG emission reductions are important at a global scale; however, local air quality and health are affected by pollution occurring at street level. Since LRTs emit less local pollution than diesel buses, their use will also result in cleaner air in the neighbourhoods they serve.

The right fit

When examining transit routes it is important to consider the transit mode and technology, particularly ensuring that population density is served by appropriate capacity.

Capacities vary greatly between subways, BRTs and LRTs. If the capacity is too high for a projected density, there will not be the ridership needed to pay for the operation of the higher order transit. If capacity is too low, crowding may occur and deter ridership, and more funds will have to be spent on retrofitting a new mode (such as BRT to LRT) and the new vehicles.

Table 5. Appropriate population density for each transit mode

Transit Line	Current Density*	Projected Density in 2031*	Density Range Suited to Transit Mode**
PROPOSED ROUTES			
Sheppard Extension Subway or LRT	68	102	LRT: 70-140 Subway: 115-195
Eglinton Crosstown LRT	72	82	
Finch West LRT	59	71	
Scarborough RT	Unavailable	Unavailable	
EXISTING ROUTES			
Existing Sheppard Subway	83	113	Subway 115-195
Yonge-University-Spadina Subway	273	341	
Bloor-Danforth Subway	130	157	

* jobs and people/ hectare
** people/hectare

Source: *Making Tracks to Torontonians* (The Pembina Institute, 2011), 13.

A train by any other name

Light rail transit often gets compared to Toronto's existing streetcar network. Apart from the fact that the some of the proposed LRT lines will run along existing streets, the comparison should largely end there — in reality LRT is much more similar to subway trains than streetcars.

Light Rail Transit…

…does not block traffic. As with subways, LRT operates in a dedicated right of way isolated from traffic. This means LRT has minimal impact on traffic and vice versa.

…has stops/stations spaced further apart than streetcar stops (but closer than subways).[12] These factors combined with signal priority make LRT more reliable and predictable, akin to subways.

…is faster than a streetcar, approaching the speed of subways. In optimal condtions, LRT trains travel at about 22 km/hr[13] and subways at 30 to 40 km/hr, while streetcars travel at 10 to 20 km/hr.[14]

…can carry more people than streetcars. Unlike streetcars, LRT cars/trains can be linked together to provide higher levels of service as needed. LRT has a capacity of up to 25,000 passengers per hour per direction versus 10,000 for streetcar and 40,000 for subways.[15]

…board faster than a streetcar with four door boarding (instead of one), payment before entry and level boarding (no steps).[16]

…is the mode of choice in other cities. In North America a variety of cities of have LRT lines in place or under construction, including Boston, Calgary, Dallas, Houston, Los Angeles, Ottawa, Philadelphia, San Diego, Seattle and Washington D.C.

…is designed for commuting. The new LRT lines will be different than existing dedicated streetcar right of ways in Toronto, such as the one along St. Clair Avenue. The new LRT lines will feature longer distances between stops, and be better suited for commuting purposes.

…is good for neighbourhoods. Running mostly at street level, LRTs encourage shopping and activity in local businesses along the street unlike subways that take business underground.

…can have more frequent service than subways. Since each LRT train has a lower capacity than a subway train, LRTs can run more frequently than subways while serving the same peak load. Frequency of service — how long one has to wait for transit — is generally a greater concern to suburban riders than crowding is.

Endnotes

[1] Data for this analysis was derived from *The Big Move: Modelling Backgrounder*, Greater Toronto Transportation Authority (2008), http://www.metrolinx.com/mx/Docs/big_move/RTP_Backgrounder_Modelling.pdf. All numbers and calculations in this report are based on publicly available information and data in Metrolinx and TTC documents and details of our analysis are referenced extensively in *Making Tracks to Torontonians* (The Pembina Institute, 2011) http://www.pembina.org/pub/2151 and *A New Transit Plan for Toronto* (The Pembina Institute, March 2011) http://www.pembina.org/pub/2186. Data for Finch East was derived from *Transit City Bus Plan, 2009*.

[2] *A New Transit Plan for Toronto.*

[3] Adam Giambrone, "Picking up the pieces: It's time for all to remember why it was we chose light rail in the first place," *NOW Toronto*, February 2-9, 2012, http://www.nowtoronto.com/news/story.cfm?content=185048

[4] J David Hulchanski, *The Three Cities Within Toronto: Income Polarization Among Toronto's Neighbourhoods, 1970 – 2005* (University of Toronto, 2010), 31.

[5] Metrolinx (2012), *Eglinton-Scarborough Crosstown LRT, 2012 Project Update.* http://www.metrolinx.com/en/projectsandprograms/transitexpansionprojects/EglintonScarboroughCrosstownUpdate_Feb72012.pdf

[6] Bottineau Boulevard Partnership, "Back on Tracks? A renewed LRT v. BRT debate surfaces along Bottineau Boulevard," 2005, http://www.bottineaupartnership.org/improving/LRTv.BRT.php

[7] Graham Currie, *Strengths and Weakness of Bus in Relation to Transit Oriented Development* (Institute of Transport Studies, Monash University, 2005), http://policy.rutgers.edu/vtc/tod/newsletter/vol4-num1/Currie%20Paper%20V1.3.pdf

[8] "Back on Tracks?"

[9] Data for Finch East was derived from*: Transit City Bus Plan, 2009*. All other data was derived from *The Big Move: Modelling Backgrounder*, Greater Toronto Transportation Authority (2008), http://www.metrolinx.com/mx/Docs/big_move/RTP_Backgrounder_Modelling.pdf. All numbers and calculations in this report are based on publicly available information and data in Metrolinx and TTC documents and are referenced in detail in *Making Tracks to Torontonians.*.

[10] Total provincial funding is $8.4 billion. At the time of the MOU $200 million was allocated as provincial contribution to the Sheppard subway.

[11] The cost of phase one of the four priority projects is $8.15 billion in 2008 dollars or $8.7 billion in 2010 dollars. The province approved $8.4 billion in funding, and $333 million was to come from the federal government. Cited in J. Robert S Prichard, Metrolinx. "On Track Moving Transit Forward in the GTHA," presentation to the Toronto Board of Trade, May 17, 2010.

[12] Approximately every 500 metres vs. every 250 metres.

[13] A stop spacing of 800 metres resulted in a route speed of 26-27 km/h, while a stop spacing of 400 metres for a route speed of 22-23 km/h. Toronto Transit Commission / City of Toronto *Etobicoke-Finch West Light Rail Transit Transit Project Assessment Environmental Project Report*, March 2010. http://www.toronto.ca/involved/projects/etobicoke_finch_w_lrt/pdf/epr/chapter_2.pdf. Also see *Eglinton-Scarborough Crosstown LRT, 2012 Project Update.*

[14] Metrolinx, *The Big Move: Transit Technologies Backgrounder.*

[15] Actual operating capacities are dependent on speeds, frequency and train length/capacity.

[16] *Eglinton-Scarborough Crosstown LRT, 2012 Project Update.*