

TORONTO TRANSIT COMMISSION REPORT NO.

MEETING DATE: January 21, 2013

SUBJECT: RESPONSE TO COMMISSION ENQUIRY:
SERVICE/TECHNOLOGY CHOICES FOR SHEPPARD EAST AND
SCARBOROUGH RT CORRIDORS

INFORMATION ITEM

RECOMMENDATION

It is recommended that the Commission receive this report for information, noting that:

- from a technical and engineering perspective, it is feasible to build either subway or light-rail transit in either of the Sheppard East or Scarborough RT corridors;
- the TTC has formally transferred its authority over decision-making on these corridors to Metrolinx so, from a jurisdictional and financing perspective, it is no longer “feasible” for the Commission to direct a change in the technology to be implemented in these corridors;
- when planning, designing, and building transportation infrastructure, the TTC abides strictly by industry best practices, with the objective of determining how much future travel demand needs to be accommodated, and designing a transportation facility which will have the right capacity to meet that demand in the most cost-effective way possible;
- for the Sheppard Avenue East corridor, both subway and light rail offer distinct advantages but, overall, the corridor would be effectively served by light-rail transit, with greater overall coverage, ample capacity for future growth, and a much-lower cost than a subway. Metrolinx has formally approved funding and implementation of light rail transit in this corridor;
- for the Scarborough RT corridor, both subway and light rail offer distinct advantages, and the corridor could be effectively served by either technology. A subway replacement would offer the benefit of a transfer-free ride through Kennedy Station and a higher speed than light rail. A light rail replacement would offer the benefit of greater geographic coverage and better local walk access for twice as many residents and workers, and would cost less to build. Metrolinx has formally approved funding and implementation of light rail transit in this corridor; and

- after almost thirty years of continuous operation, the Scarborough RT's vehicles have reached the end of their normal lifespan. For a variety of reasons, no major investment has been made in this facility, and the situation is now approaching critical, with the line being required to operate at reduced speed and capacity owing to the deteriorating state of the vehicles. The Commission should avoid another prolonged debate over the future of the Scarborough RT, which might jeopardize Metrolinx's commitment to fully rehabilitate and expand the deteriorating Scarborough RT.

FUNDING

This report has no effect on the TTC's operating or capital budgets.

BACKGROUND

At its meeting of October 24, 2012, after hearing a presentation from a member of the public pertaining to upgrading the Scarborough RT to light rail, the Commission approved that:

1. TTC staff report back to the January 21, 2013 Commission meeting on the merits and feasibility of upgrading the proposed Scarborough LRT to a subway extension from Kennedy Station, north through the Scarborough Town Centre, to Sheppard and McCowan, and;
2. TTC staff report back to the January 21, 2013 Commission meeting on the merits and feasibility of completing a subway loop from Sheppard and McCowan to Sheppard and Don Mills.

This report responds to those requests.

DISCUSSION

Feasibility of Subway and Light Rail

From a technical and engineering perspective, it is feasible to build either subway or light-rail transit in either of the Sheppard East or Scarborough RT corridors. However, given that the TTC has formally transferred its authority over decision-making on these corridors to Metrolinx, it is likely no longer "feasible" for the Commission to effect any changes to the choice of technology for the corridors. This is the result of these actions:

At its meeting of May 30, 2012, after considering a report pertaining to the delivery of LRT projects in Toronto, the Commission passed a number of motions, including:

- confirm its commitment to work with the Province of Ontario, Metrolinx, & Infrastructure Ontario to deliver Toronto's Light Rail Transit (LRT) program;
- note that TTC has been program managing the delivery of the LRT program in Toronto since 2008 and now that responsibility will transfer to Metrolinx; and
- that the TTC direct staff to expedite the signing of a Master Agreement with Metrolinx and Infrastructure Ontario that outlines provisions such as a governance model, dispute resolution mechanism, and amendment clauses, by the September 2012 Commission Meeting.

At its meeting of October 24, 2012, the Commission approved:

- That the Commission authorize the CEO to sign any and all agreements necessary with Metrolinx and the City of Toronto, if applicable, relating to the delivery of the LRT Projects in Toronto, in a form satisfactory to TTC's General Counsel.

On November 28, 2013, the Master Agreement was executed between the TTC and Metrolinx, thus formally transferring all responsibility and authority for the engineering, design, construction, and delivery of the former "Transit City" light rail lines to Metrolinx. Further, after extensive debate over transit technologies and choices, Toronto City Council voted to implement light rail transit in the Finch, Sheppard, Eglinton, and Scarborough RT corridors.

Therefore, the TTC no longer has decision-making authority over the technology or construction of rapid transit in these corridors and, from a jurisdictional and financing perspective, it is no longer "feasible" for the Commission to direct a change in the technology to be implemented in these corridors.

Transportation Planning and Investment Decisions – Industry "Best Practice"

When planning, designing, and building transportation infrastructure -- whether a road, a highway, or a transit line -- the objective is to determine how much future travel demand needs to be accommodated, and to design a transportation facility which will have the right capacity to meet that demand in the most cost-effective way possible.

Toronto's Official Plan determines which areas will be residential, industrial, commercial, and green space, as well as how many, and where, people will live and work in the city in the future. The Official Plan, together with survey information about where people currently travel, allow projections to be developed regarding how many people will travel between different areas of the city. The forecasts include projections of what routes people will most likely take through the city and whether they will take cars, transit, bicycles, or walk. The forecasts reflect expected road congestion and fuel costs along with government policies such as transit fare levels. These travel demand projections are then used to forecast how much carrying-capacity will have to be provided to meet that demand.

For transit, the demand can be accommodated using a variety of vehicles and systems ranging from buses, to light rail, to subways, to regional commuter trains. The selection of transit technology must also take into account local community concerns and objectives such as compatibility with surrounding land uses, effects on the local economy, convenience of access to a transportation facility, and environmental issues such as noise and emissions. Finally, the advantages of the different transit technologies must be weighed against cost and affordability in order to select the transit technology which would satisfy the projected demand as cost-effectively as possible.

While reasonably-reliable future projections can be made for 20 or 30 years out, as rapid transit investments will last 50 years or more, it is always desirable to have flexibility to expand capacity to provide for very long-term growth. However, the immediate costs to provide such long-term capacity can be prohibitive. The challenge is to choose the transit technology which meets the expected demand, while avoiding technologies with high costs that provide far more capacity than will likely ever be needed in any particular corridor.

LRT or Subway in the Sheppard Avenue Corridor?

As previously discussed, selecting the right transit technology for a corridor depends on what land uses and densities you're trying to serve and, therefore, what capacity you need. Toronto's land-use, development, and economic outlook have changed significantly since the mid-1980's when plans called for concentrations of high-density employment nodes at urban centres which would be linked together by subways, and when Toronto's neighbouring municipalities were much less developed. Toronto's current Official Plan de-emphasizes the "centres" concept and, instead, calls for more-dispersed, lower-density development spread out along the city's major arterial roads, referred to as "Avenues". At the same time, Toronto's neighbouring municipalities are now all cities unto themselves, and they have competed fiercely, through taxation and economic incentives, to attract employment. This has resulted in the employment originally envisioned for Toronto's centres, not materializing.

The two centres which were intended to anchor the Sheppard Avenue corridor – North York Centre and Scarborough Centre – today have a total employment of 44,000, compared to the 1980's projection of almost 160,000 by 2011. So, the travel demand which these centres now generate is much lower than what was expected back when a Sheppard Subway was conceived.

There is already a subway on Sheppard Avenue between Yonge Street and Don Mills Road, so the matter of transit on that section of Sheppard Avenue is settled. The question is: what transit should be provided on Sheppard Avenue east of Don Mills, where the subway stops?

Two options are discussed here:

1. A continuation of the existing subway, east along Sheppard Avenue, and south to Scarborough Civic Centre (McCowan Avenue).
2. A light-rail transit line, connecting with the subway at Don Mills, and proceeding east along Sheppard Avenue to Morningside/Conlins Road in its own right-of-way, except at signalized intersections. Metrolinx has formally approved funding and implementation of light rail transit in this corridor.

These two options are illustrated in Exhibit 1.

Toronto's Official Plan projections of future population and employment in the areas which would be served by either a light-rail line or subway on Sheppard Avenue, result in a projected future (2031) travel demand on Sheppard Avenue, east of Don Mills Road, of between 3,000 and 4,500 passengers per hour. As a comparison, the 504 KING Streetcar - the busiest route among all of the TTC's bus and streetcar routes -- carries approximately 2,000 passengers per direction during the busiest hour. Even with extremely-optimistic assumptions about additional future growth and possible future transit expansion, the demand on Sheppard, east of Don Mills, would increase to 6,000 passengers per hour. As Exhibit 2 helps illustrate, none of these projections justify the expense or capacity of a subway east of Don Mills Road, which could carry over 30,000 passengers per hour. The projected demand on Sheppard can be accommodated by light rail, whose capacity, when operating in a semi-exclusive right-of-way, at grade, through signalized intersections, is 5,000 passengers per hour, using two cars together, or 8,000 passengers per hour, when using three cars together, thus providing capacity for future additional demand on Sheppard Avenue.

With stop-spacing of 400-500 metres, light rail would provide convenient local walk access to transit along Sheppard Avenue, compared to a subway with stop-spacing of 1 - 1.5 kilometres. The stop-spacing for light rail transit, coupled with physically-separated right-of-way operation, signal priority, and all-door boarding, means that a light rail line would operate at an average speed of 23 kilometres per hour (including station and terminal times), compared to 31 kilometres per hour for subway, and 13 kilometres per hour for a typical streetcar line.

The main benefits of the subway option are:

- higher speed
- most-reliable, highest-quality service
- elimination of transfer at Don Mills Station
- higher ridership (higher speed and elimination of transfer attract people away from other services).

Exhibit 1

Rapid Transit Options for Sheppard Ave East

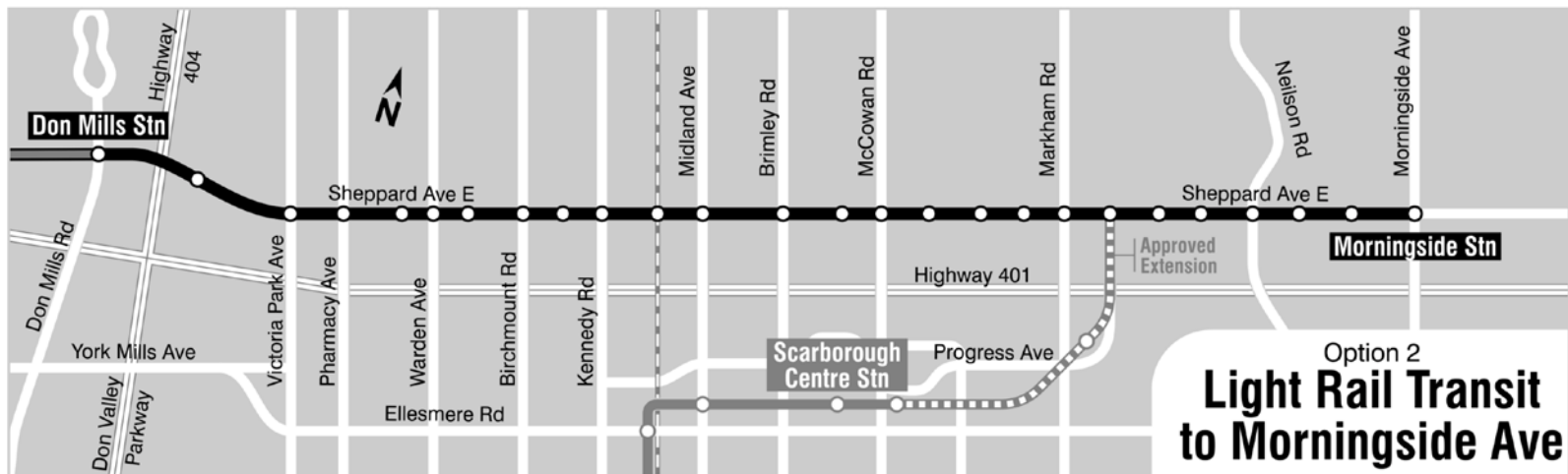
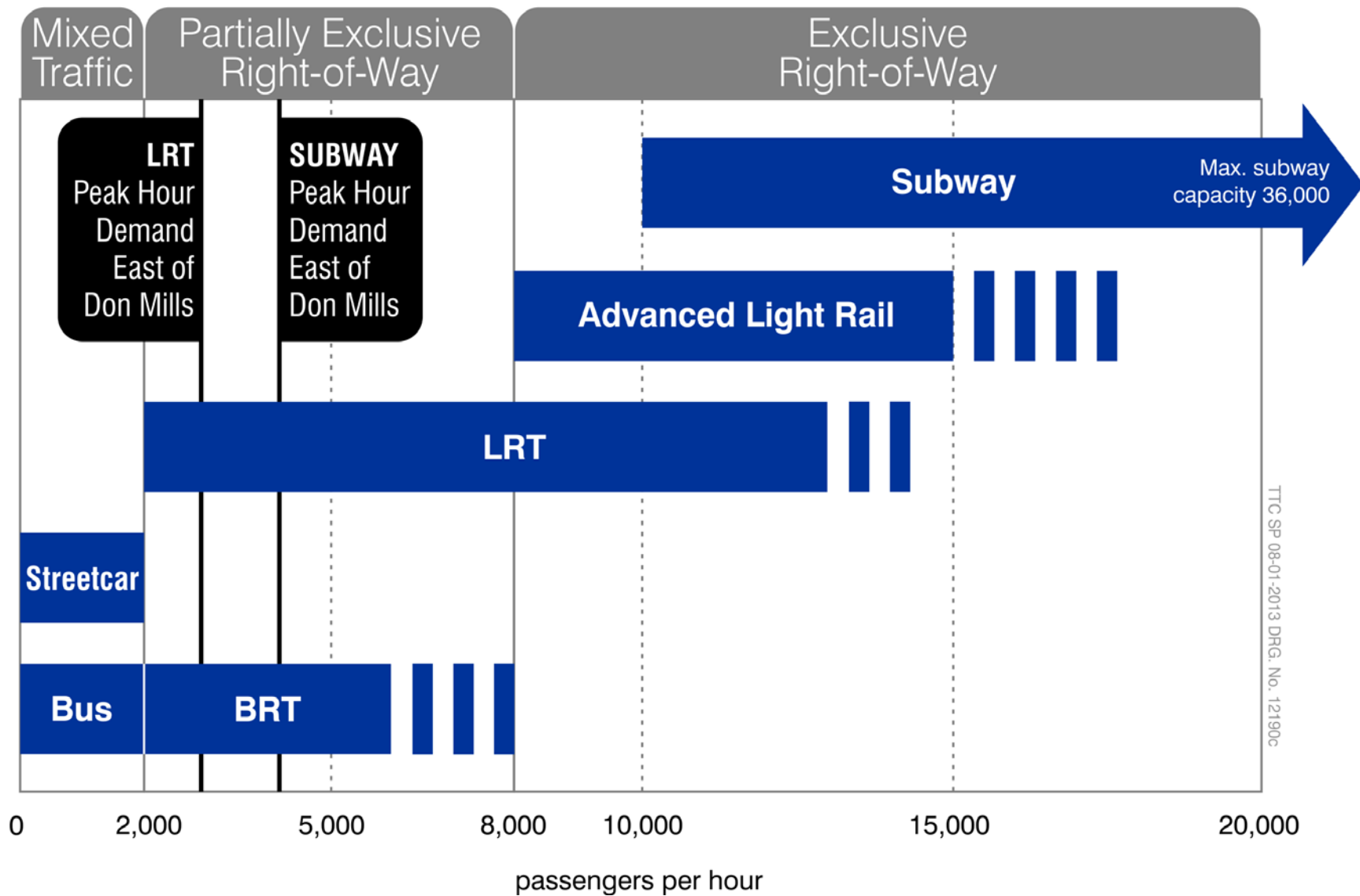


Exhibit 2 Transit Technologies and Capacities



The main benefits of the light-rail option are:

- greater overall geographic coverage
- more stations – better local access
- larger population served
- reliable, high-quality service
- significantly-lower cost

Here is a summary of the approximate costs and relative merits of two transit options for Sheppard Avenue, east of Don Mills:

Comparison of Rapid Transit Options for Sheppard Avenue East

	Sheppard LRT (Don Mills – Morningside)	Sheppard Subway Extension to Scarborough Centre
Route Length	13.6 km	8.0 km
Number of Stations/Stops	25	7
Speed	23 km/h	31 km/h
New Population Served	58,000	34,000
Priority Neighbourhoods Served	2	2
Annual Ridership	17 million	27 million
Annual New Ridership	7.7 million	12.2 million
Cost (\$ billions) (2011 \$'s)	\$1.0 billion*	\$3.5 billion

*based on Metrolinx's "5-in-10" plan costs, escalated to 2011

Sheppard Avenue would be effectively served by light-rail transit, with greater overall coverage, capacity available for future growth, and at a much-lower cost than a subway.

The *Expert Advisory Panel Regarding Transit on Sheppard Avenue East*, in their March 2012 report (page 19) to City Council, summarized the findings of City of Toronto Planning regarding this corridor:

Unless [a number of specific] conditions can be met, a subway is not warranted, and the LRT would be a viable option to meet transit needs in the corridor over the next 20 – 30 years, and may be sufficient beyond that.

Subway or Light Rail for the Scarborough Rapid Transit (SRT) Corridor?

The Scarborough RT line opened for revenue service in 1985 and it operates between Kennedy Station on the Bloor-Danforth subway and McCowan Station, as shown in Exhibit 3. Notwithstanding criticisms and misinformation over the years, the Scarborough RT has been the single most-reliable service operated by the TTC. The service has been very successful at attracting ridership and has been operating over-capacity for a decade. For many years, it has carried daily passenger volumes of 40,000 people, with peak-period passenger volumes maxed-out at 4,000 passengers per hour, due to the limited number of vehicles in the SRT fleet.

Exhibit 3: The Scarborough RT



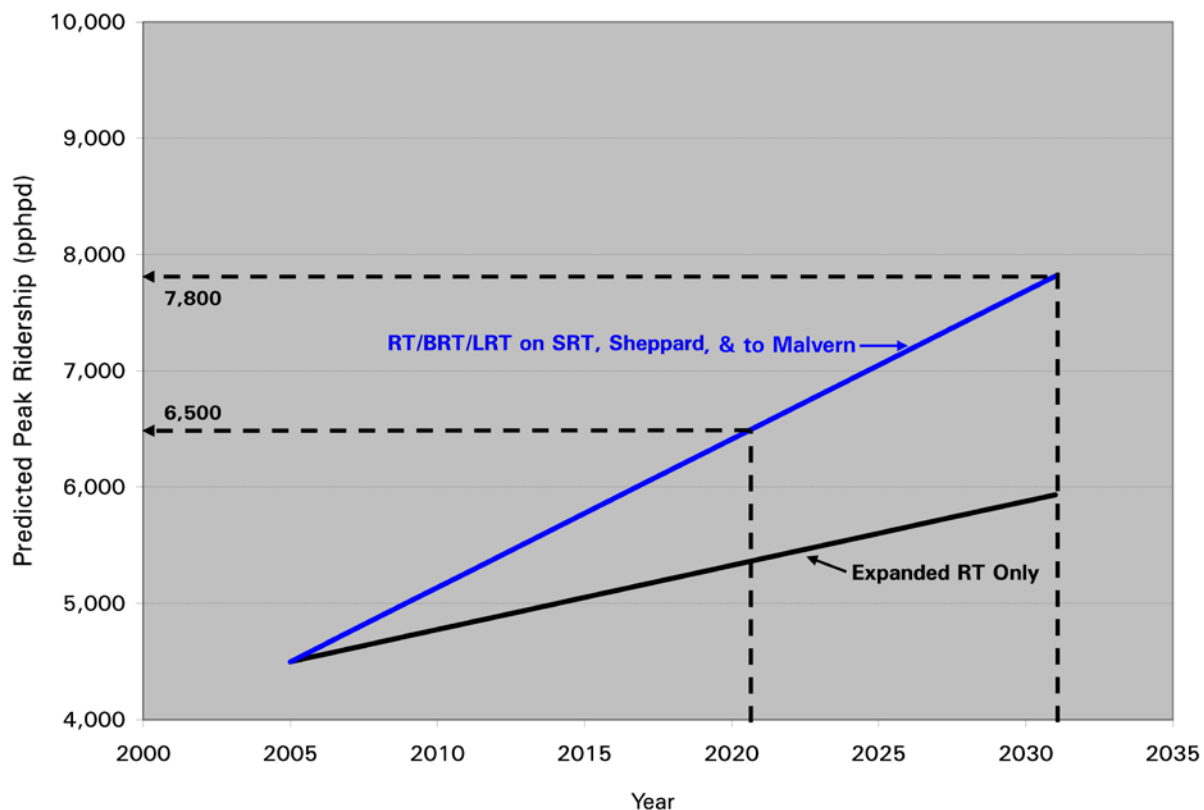
After almost thirty years of continuous operation, the Scarborough RT's vehicles have reached the end of their normal lifespan. Consistent with the TTC's absolute priority of keeping its existing services and infrastructure in safe, reliable, operational condition -- known as state-of-good-repair -- the Scarborough RT needs rehabilitation, new vehicles, and updated technology. For over a decade, TTC staff have been strongly recommending that the Scarborough RT be overhauled and rehabilitated with a larger fleet of modern, reliable, higher-capacity vehicles and with necessary improvements to stations and infrastructure to allow the line to deliver service reliably and consistently to the high volume of customers wishing to use the service. Unfortunately, for a variety of reasons, no major investment has been made in this facility, and the situation is now approaching critical, with the line being required to operate at reduced speed and capacity owing to the deteriorating state of the vehicles.

In 2006, the TTC undertook the *Scarborough RT Strategic Plan* -- a comprehensive study of options for replacing the aging and decreasingly-reliable vehicles, upgrading the system's infrastructure as necessary, and potentially expanding the line. Despite the fact that the Scarborough RT is an established and well-patronized service, this study started with first principles: a complete revisiting of projected future demand for travel in this corridor, based on future population and employment data from the City of Toronto's Official Plan, and detailed information about current travel patterns and volumes from the *Transportation for Tomorrow Survey* ("TTS"), a large inter-regional travel survey of people in the Greater Toronto and Hamilton Area.

Information on current travel patterns showed that a large number of customers using the Scarborough RT were destined for the central downtown of the City of Toronto, thus explaining the very-high percentage of Scarborough RT passengers who transfer at Kennedy Station and continue their journey on the Bloor-Danforth subway. Modeling and forecasting work produced projections of total travel demand in this corridor for 2021 and 2031, on both an all-day basis and busiest-time-of-the-day (peak hour) basis

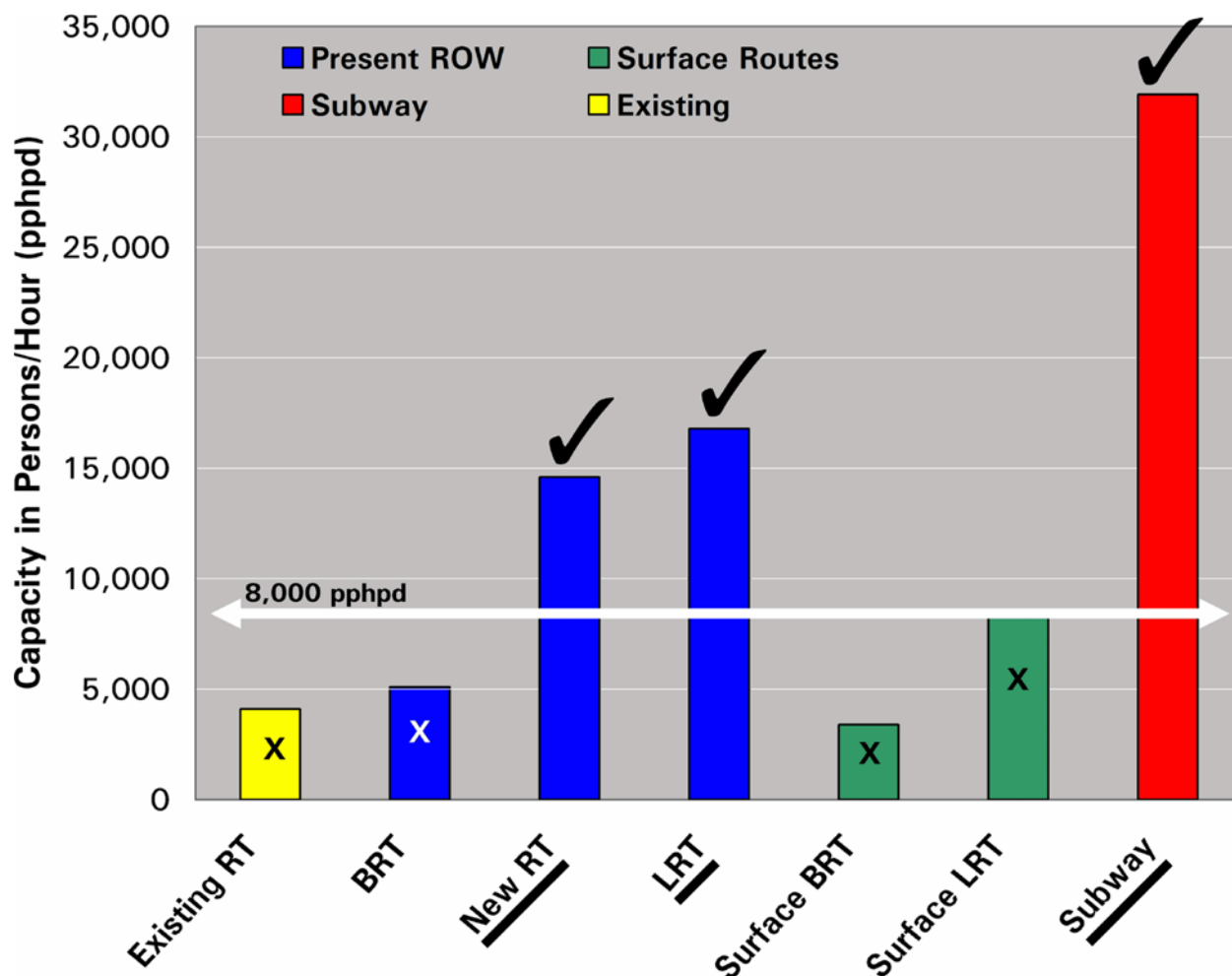
As shown in Exhibit 4, the forecasts resulted in a projected 2021 transit travel demand on the Scarborough RT of 6,500 passengers per hour per direction, growing to approximately 8,000 passengers per hour per direction by 2031, assuming a connection to rapid transit on Sheppard Avenue. This represents a doubling of demand relative to the line's current peak-hour carrying-capacity of approximately 4,000 per hour per direction.

Exhibit 4: Projected Future Demand in the Scarborough RT Corridor



The *Strategic Plan* examined a wide range of possible transit technologies which might be adopted for the Scarborough RT in order to provide the projected required capacity. The options reviewed included semi-exclusive bus rapid transit (reserved lanes, on-street); semi-exclusive light rail transit (reserved lanes, on-street); bus rapid transit operating in the current SRT corridor; light rail operating in the current SRT corridor; larger, new-generation SRT vehicles operating in the current SRT corridor; and a subway replacement for the SRT, as an extension of the Bloor-Danforth Subway, in a new underground alignment. As shown in Exhibit 5, only three of these options were found to be capable of providing the required future capacity on this line, with room for future growth: (1) larger, new-generation SRT vehicles; (2) light rail transit in an exclusive right-of-way; and (3) an extension of the Bloor-Danforth Subway to replace the current SRT, thus abandoning the current SRT corridor and four of the existing six stations. All three of these technologies, operating in their own, fully-exclusive rights-of-way, could provide capacity of 15,000 passengers per hour per direction, well above the projected 2031 demand of 8,000 passengers per hour per direction.

Exhibit 5: Potential Capacities for Scarborough RT Alternatives



The *Strategic Plan* recommended against an extension of the Bloor-Danforth subway because the all-inclusive costs of this option were extremely high. Additionally, the required alternate alignment for a subway extension would have to bypass any development or growth opportunities in the Kennedy-Midland corridor and would pass through areas which the Official Plan designates primarily as stable neighbourhoods and, therefore, would have limited opportunity for development or intensification. The *Plan* also recommended against replacing the SRT with light-rail transit in the SRT corridor, primarily because that option was also very expensive. The *Strategic Plan* concluded that, setting aside system-wide integration and expansion implications, the acquisition of an expanded fleet of larger, new-generation SRT vehicles would be the most cost-effective means of meeting transit needs within the existing Scarborough RT corridor.

In 2007 -- one year after the *Scarborough RT Strategic Plan* -- the TTC introduced its *Transit City Light Rail Plan*, which called for the implementation of seven light-rail lines, forming a network of rapid transit service throughout the City of Toronto. In that context, it was recommended that the Scarborough RT rehabilitation adopt light-rail technology in order to take advantage of the economies-of-scale cost savings which would result from the acquisition of a large fleet of light-rail vehicles to operate on the proposed City-wide network. Cost savings could also be achieved in the areas of maintenance (common parts and service) and shared maintenance yards and facilities, owing to the standardization of vehicle types. Additionally, conversion of the Scarborough RT to light rail technology would introduce the potential to extend this line further north and east, possibly in a lower-cost at-grade configuration.

At present, three of *Transit City's* seven light-rail lines -- Eglinton-Crosstown, Finch West, and Sheppard East -- have been selected by Metrolinx to be funded and implemented as part of the first-priority tranche of projects from the "Big Move" regional transportation plan, and the other four LRT lines remain part of the approved plan, but have later implementation dates. So the benefits of commonality and economies-of-scale of light rail still apply today.

Two options for replacing the current Scarborough RT technology are discussed here, and both include extensions of the line north and east to Sheppard Avenue, as requested by the Commission:

1. A continuation of the existing Bloor-Danforth subway north and east, with three stations, continuing to Sheppard Avenue East; and
2. A light-rail transit line, connecting with the Bloor-Danforth subway at Kennedy Station, and proceeding in a fully-exclusive right-of-way, north and east, following the current SRT alignment, and continuing to Sheppard Avenue East. Metrolinx has formally approved funding and implementation of light rail transit in this corridor.

These are shown in Exhibit 6.

As noted earlier, it is projected that, by 2031, if the SRT were converted to light rail, expanded north to Sheppard Avenue, and increased in carrying capacity, the line would carry passenger volumes of approximately 8,000 passengers per hour per direction (pphpd) in the busiest hour of travel. This level of demand could be accommodated by light rail in an exclusive right-of-way, whose capacity can be as high as 16,000 pphpd. If the SRT were replaced by a continuation and extension of the Bloor-Danforth subway north to Sheppard Avenue, it is projected that, by 2031, the line would carry passengers volumes of upwards of 9,500 pphpd in the busiest hour of travel. This level of demand could be accommodated by a fully-underground subway whose capacity can exceed 30,000 pphpd.

Exhibit 6

Scarborough RT Replacement Options



A subway-extension replacement for the SRT would provide a major improvement in customer convenience because it would completely eliminate the need to transfer between the existing subway and the Scarborough RT service. This would benefit the 32,000 passenger-trips per day which currently make this transfer, and the number of benefitting customers would increase over time as ridership on the line increases. A subway-extension replacement would require a new, alternate alignment, as shown in Exhibit 6 and, because it would be located underneath established, low-density, stable residential neighbourhoods, it would have only three stations north of Kennedy Station, and there would be limited opportunity for intensification and redevelopment which is normally associated with subway investment. The very wide station spacing -- up to 4 kilometres apart -- would result in higher operating speed than a light-rail line, but a subway extension would have only limited local access for residents and workers because of the low number of stations.

A light-rail replacement for the SRT would retain the current alignment and stations and, with the new stations on the extension to the north, would have a total of seven stations north of Kennedy Station. The more-moderate station spacing -- averaging 1.4 kilometres -- would result in a slower operating speed than a subway extension, but would offer convenient walk access to roughly twice as many residents and employees as the subway option would. It would have a station adjacent to Centennial College's main campus.

The main benefits of the subway option are:

- higher speed
- most-reliable, highest-quality service
- elimination of transfer at Kennedy Station
- higher ridership (higher speed and elimination of transfer attract people away from other services)
- no need to shut down the Scarborough RT during construction of a subway extension

The main benefits of the light-rail option are:

- greater overall geographic coverage
- more stations -- better local access
- larger population served
- reliable, high-quality service
- lower cost

Here is a summary of the approximate costs and relative merits of the two transit options to replace and extend the current Scarborough RT.

Comparison of Rapid Transit Options for Scarborough RT Corridor

	Conversion to Light Rail	Extension of Subway
Route Length	9.9 km	7.6 km
Number of Stations	7	3
Speed (Projected)	36 km/h	40 km/h
Customer Convenience Advantage	Improved, easier transfer at Kennedy Station	Eliminate transfer at Kennedy Station
Residents & Employees Within Walking Access of Stations	47, 000	24,000
Priority Neighbourhoods Served	3	1
Annual Ridership	31 million	36 million
Cost (\$ billions) (2011 \$'s)	\$2.3 billion	\$2.8 billion

The Scarborough RT corridor could be effectively served by either light rail or subway. A subway replacement would offer the benefit of a transfer-free ride through Kennedy Station and a higher speed than light rail. A light rail replacement would offer the benefit of greater geographic coverage and better local walk access for twice as many residents and workers, and would cost less to build.

The Scarborough RT has reached the end of its service life. TTC staff have been strongly recommending, for over a decade, that action be taken immediately to replace the existing system with a modern, reliable, high-capacity system which would be capable of accommodating both current passenger demand – which has been suppressed because of capacity constraints -- as well as future projected demand. However, owing to budget pressures and ongoing uncertainty over jurisdictional matters, no action has been taken. Today, owing to continual deterioration of the RT vehicles, the service is now operated at a reduced speed and capacity, thus further exacerbating the capacity and service quality inadequacies with which customers must contend. Metrolinx has formally approved funding and implementation of light rail transit in this corridor to replace the aging Scarborough RT. Given these facts, the Commission should avoid another prolonged debate over the future of the Scarborough RT, which might jeopardize Metrolinx's commitment to fully rehabilitate and expand the deteriorating Scarborough RT.

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January 3, 2013
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