



SRT Life Extension Project Options Analysis

Date: February 10, 2021

To: TTC Board

From: Chief Capital Officer

Summary

The Toronto Transit Commission's (TTC) Line 3 Scarborough (originally named "Scarborough RT" or "SRT") is a 6.4 kilometer at-grade and elevated intermediate capacity rapid transit line with six stations, opened in 1985. After 35 years of continuous operation, the SRT vehicles have been in service ten years past their design life of 25 years. Efforts are currently underway to extend the life of the vehicles to 2026 in line with the previously scheduled opening of the Line 2 East Extension (L2EE, also known as Scarborough Subway Extension or SSE), at which time the SRT would be decommissioned. Previously, SRT vehicles underwent their first limited overhaul in 2012 with focus on cosmetic upgrades to continue the service through the 2015 Pan-American/Parapan American Games. A subsequent overhaul program was initiated in 2018, currently in its final stages.

In 2019, the SRT was carrying 35,000 customers per day. Since the beginning of the COVID-19 pandemic, ridership has reduced to 30% of 2019 ridership, or about 10,500 customers per day.

Line 3 is not fully accessible. Only Kennedy and Scarborough Centre Stations are accessible, with limited step-free access to southbound trains at Lawrence East Station. The TTC is committed to achieve compliance with the Accessibility for Ontarians with Disabilities Act (AODA) by the legislated deadline of 2025.

Customers use the SRT primarily for home to work and home to school trips. Currently 52% of SRT customers are travelling between home and the workplace while an additional 24% are travelling between home and school. These values are slightly higher than the TTC average of 49% and 21% respectively. According to the Transportation Tomorrow Survey, 18% of SRT users come from households with an income below the StatsCan low-income cut off for families of \$40,000 per year. The TTC average is 22%. The stations at Kennedy and Scarborough Centre are significant transit hubs in the TTC's multimodal network, accounting for over 75% of all ridership on the SRT line.

Currently, the SRT is scheduled to operate with five trains temporarily to support the ongoing targeted overhaul program. SRT vehicles are becoming increasingly more difficult to maintain due to the age of the vehicles and obsolescence of key parts. As a result, there have been times when the SRT was operating with four trains.

As the overall vehicle reliability continues to degrade with equipment failures, it will result in more frequent and unscheduled service interruptions, negatively impacting the service level. Consequently, customer crowding will get progressively worse over time and may not meet the minimum service level.

In the summer of 2019, the Province, through legislation, assumed responsibility for the delivery of the SSE project, and revised the scope of the project back to a three-stop subway extension, with revised completion date of 2030. To ensure ongoing transit service is provided until the completion of SSE in 2030, several options were reviewed to provide transit service along the corridor. All options are interim service options, until the Province opens the subway extension in 2030. A summary of the following three short-listed options is provided in this report:

- Option 1: Hybrid SRT and bus service to 2030.
- Option 2: SRT to 2023 and Bus Replacement service 2023 to 2030 with new buses.
- Option 3: SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030.

Option 1 includes:

- Investment in another overhaul program to extend the life of SRT vehicles to 2030,
- Enhanced express bus service to supplement reduced SRT service during the overhaul period from 2021 to 2024 as trains would be removed from service in order to undertake the targeted overhaul; and,
- Supplementary bus service from 2025 to 2030 to provide an accessible transit service option given existing SRT facilities are not accessible and do not meet AODA requirements.

Under Option 2 and Option 3:

- SRT service would continue to 2023, after which train service would end;
- Express bus replacement service would commence in 2023 and operating to 2030, largely through the extension of existing service from Scarborough Centre Station to Kennedy Station;
- In Option 2, new buses would be added to the bus fleet in 2023/24 to implement the bus replacement service; and
- In Option 3, purchase of new buses would be deferred to 2027/29 by using buses within current fleet from 2023 to 2026, temporarily reducing the operating spare ratio. From 2027 through to 2029, operating spare ratio would be built back up by purchasing 20 buses per year.

The targeted overhaul of the SRT trains and systems under Option 1 may not achieve the service reliability outcomes desired due to the age and condition of the systems as well as the complexity involved with the overhaul work. Furthermore, with the complexity of integrating new propulsion, control and signaling systems, there is a higher risk of cost and schedule overruns and subsequent further customer impacts may be experienced under Option 1. Simply put, with Option 1 being the highest cost option

with life cycle costs of \$522.4 million and with high risk of not achieving the required service reliability; Option 1 is not recommended for further consideration.

Option 2 and Option 3 are both low risk options for achieving the required service reliability and with lower life cycle costs of \$374.8 million for Option 2 and \$357.4 million for Option 3. Furthermore, both are low risk options from a cost, schedule, and deliverability perspective and therefore are recommended for further consideration.

The following chart summarizes the risk profile of three options based on service quality, customer impact, maintenance/overhaul program and cost.

		Total Risk Score >>						Risk Weight	Option #1:			Option #2:			Option #3:		
		Total Weighted Risk Score >>							42			22			24		
									48			24					
Threat / Opportunity ID	Risk Description	Impact Type					Risk Weight	Probability	Impact	Risk Score	Probability	Impact	Risk Score	Probability	Impact	Risk Score	
		Cost	Project Schedule	Service Level	Customer Perception/ TTC Network	Operation											
1.00 Operations																	
T - 1.01	Service Level/Quality Unable to meet the minimum required service level to support ridership resulting in temporary service interruptions. - Option 1: SRT requires minimum 4 trains. If service delays are 15 min. or greater, emergency replacement buses will have to be deployed impacting other services in the network and customer satisfaction. - Option 2 & 3: Buses minimum headway is 1 minute. If minimum headway is not achieved, buses will be over crowded impacting customer satisfaction.	X		X	X	X		1.25	3	3	9	2	1	2	2	2	4
T - 1.02	Customer Perception and Ridership Impact Customer dissatisfaction with the service even if minimum service requirements are met impacting ridership and/or increasing customer complaints.	X			X			1.10	2	2	4	3	2	6	3	2	6
2.00 Maintenance / Overhaul Program																	
T - 2.01	Overhaul Program Scope Additional scope of work may be discovered during the overhaul program leading to increased cost.	X						1.00	2	3	6	2	1	2	2	1	2
T - 2.02	Overhaul Program Timeline Delay completing overhaul/upgrade work impacting vehicle availability and service.	X	X					1.00	2	1	2			0			0
3.00 Procurement																	
T - 3.01	Vehicle and Supplies Procurement Delay procuring new buses impacting the implementation timelines. SRT service will have to be extended for a longer period of time until replacement buses are available.	X	X					1.00	0	0	0	1	2	2	1	2	2
4.00 Implementation (schedule, cost, duration)																	
T - 4.01	Construction Work Delays in constructing the bus replacement supporting infrastructure (queue jumping lanes, signalling, Bus Terminal upgrades and additional bus bays) impacting the timeline for shutting down the SRT and switching to the bus service. - Planned Queue jumping lanes construction: Jun 2022 - Jun 2023. - New bus bays at Kennedy Station construction: Aug 2022 - Mar 2023	X	X					1.00	0	0	0	2	2	4	2	2	4
T - 4.02	Exclusion of AODA Upgrades to SRT Accessibility upgrades to the SRT stations are not included in the scope of work. Shuttle plan may not be acceptable and TTC may be required to comply with the standards for accessibility if the SRT is planned to be in service until 2030.	X				X		1.25	2	3	6	0	0	0	0	0	0
O - 4.03	Bus Bays at Kennedy - ECLRT Temporary Bus Bays available for the project Cost savings if Metrolinx agrees with maintaining the temporary bus bays at Kennedy.	X						1.00	0	0	0	1	2	2	1	2	2
O - 4.04	Bus Bays at Scarborough Town Centre (STC) Cost savings if GO lease is not renewed or, on-street bus bays are an acceptable solution.	X						1.00	0	0	0	2	2	4	2	2	4
T - 4.05	Scarborough Subway Extension (SSE) Completion Date SRT Program needs to be extended beyond 2030 due to delays to the planned revenue service date of the SSE project (managed by Metrolinx).	X				X		1.10	2	3	6	2	3	6	2	3	6
T - 4.06	Requirement for Vehicle Storage Unavailability of storage at existing TTC bus facilities would require the project to construct and operate new facilities of the storage of buses							0	0	0	0	0	0	0	0	0	0
5.00 Financial																	
T - 5.01	Project Funding Risk of not obtaining sufficient funding to complete the program. Available funding from the legacy SSE project is \$132M (capital cost) with a current balance of \$50M at the end of 2020.	X		X		X		1.10	3	3	9	2	3	6	2	3	6

The express bus service travel time would be longer, compared to the scheduled train service running at an acceptable level of reliability. Part of the travel time increase would be offset by the elimination of transfers between buses and train service at Scarborough Centre, with most customers having a one-seat through service to Kennedy Station. In order to further mitigate the effects on passengers, various transit priority measures would be examined to further increase the speed and reliability of the express bus service. These include:

- Transit signal priority,
- Queue jump lanes for buses,
- Reserved bus lanes.

The TTC will continue to work with partners at the City of Toronto to introduce these measures.

Communication and outreach is important to inform TTC customers, local communities and stakeholders in greater detail of the state of the SRT as well there is significant risk and challenges operating the SRT until the opening of the SSE in 2030. Therefore, customer engagement would be undertaken in various channels to provide information and collect customer as well as community input to inform routing for bus services in the SRT corridor. The aim of these consultation is to ensure a high quality transit service will be planned and communicated well in advance of decommissioning the SRT.

Recommendation

It is recommended that the TTC Board:

1. Approve moving forward with assessing the remaining two preferred options, Option 2 – SRT to 2023 and Bus Replacement Service 2023 to 2030 with new buses and Option 3 – SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030, in conjunction with:
 - a. Conducting public consultation to seek input from customers, community and stakeholders on bus network changes for bus replacement service; and,
 - b. Advancing the details of transit priority measures to optimize bus service in consultation with the City of Toronto Transportation Services.
2. Direct staff to report back to the TTC Board in the third quarter of 2021 with the final recommendation.

Financial Summary

Funding totalling \$47.2 million for the SRT Life Extension Project is included in the 2021-2030 Capital Budget and Plan. In addition, the 2021 Operating Budget, includes approximately \$20 million to fund the current operation of the SRT effectively representing \$200 million in base operating funding over a 10-year basis. The 2021 Operating Budget and 2021-2030 Capital Budget and Plan were approved by the TTC Board on December 21, 2020 and are currently pending City Council approval.

All options under consideration will require funding increases in future year operating and capital budgets as summarized in Table 1 below.

Table 1 – 10 Year Funding Summary

10 Year Funding Summary: Options Under Consideration			
(\$ '000)	Option 1 Extend SRT to 2030	Option 2 Bus Replacement New Buses in 2023/2024	Option 3 Bus Replacement New Buses in 2027-2029
CAPITAL			
Estimated 10 Year Cost	273,835	108,697	76,555
Estimated 10 Year Funding Available	47,188	47,188	47,188
Capital Funding Required	226,647	61,509	29,367
OPERATING			
Estimated 10 Year Cost	248,544	266,110	280,770
Estimated 10 Year Funding Available	200,350	200,350	200,350
Operating Funding Required	48,194	65,760	80,420
COMBINED			
Estimated 10 Year Lifecycle Cost	522,379	374,807	357,326
Estimated 10 Year Funding Available	247,538	247,538	247,538
Combined Additional Funding Required	274,841	127,269	109,788

Due to the extensive overhaul work required to keep the SRT in operation until 2030, Option 1 has the highest overall cost at \$522.4 million, with an additional funding requirement of \$274.8 million that is more than double that of Options 2 & 3.

Option 2 has lower operating costs than Option 3, but requires \$80 million in capital funding between 2022 and 2024, including amounts advanced from later years.

Option 3 has the lowest overall costs, due to the use of the existing bus fleet for bus replacement service between 2023 and 2026.

Cost components and additional annual funding requirements for each of the three options are summarized in the following tables. Each option includes SRT capital costs as the SRT is past the end of its design life and required end-of-life replacements will be

ongoing until service on the SRT ceases. For Options 2 and 3, \$39.4 million in SRT life extension costs have been attributed to capital between 2021 and 2023. These costs may, in part, be reclassified to operating, especially for any costs incurred in the final year of SRT operation.

Option 1: Hybrid SRT and Bus Service to 2030

This option has the highest overall cost, due to the \$265 million required to extend the SRT's life to 2030 and also requires a combined \$21.5 million in 2021 which is unfunded.

Table 2 – Annual Funding Requirement for Option 1

Option 1: SRT Life Extension to 2030								
(\$'000)	Total	2021	2022	2023	2024	2025	2026	2027-2030
Capital Costs								
To extend SRT to 2030	265,627	24,449	43,839	40,835	43,876	18,783	20,687	73,159
Buses, Net of residual value	8,208	15,000						(6,792)
Total Capital Costs	273,835	39,449	43,839	40,835	43,876	18,783	20,687	66,366
Capital Funding Available	47,188	19,644	13,248	4,050	4,062	3,347	2,837	
Capital Funding Required	226,647	19,805	30,591	36,785	39,814	15,436	17,850	66,366
Operating Costs								
SRT Operations	219,376	20,035	20,436	20,844	21,261	21,686	22,120	92,994
Service During SRT Overhaul								
SRT Reduction	(13,095)	(3,177)	(3,241)	(3,306)	(3,372)	-		
Bus Supplement	20,388	4,891	4,989	5,089	5,419	-		
Accessible Bus Service	21,875		-	-	-	3,468	3,537	14,870
Total Operating Costs	248,544	21,749	22,184	22,628	23,308	25,154	25,657	107,864
Operating Funding Available	200,350	20,035	20,035	20,035	20,035	20,035	20,035	80,140
Operating Funding Required	48,194	1,714	2,149	2,593	3,273	5,119	5,622	27,724
Combined Additional Funding Required	274,841	21,519	32,740	39,377	43,087	20,555	23,472	94,090

Option 2: SRT to 2023 and Bus Replacement Service 2023 to 2030 with new buses

This option has the lowest operating costs, but requires higher funding levels between 2022 and 2024 than Option 3 due to the requirement to purchase new buses. Of the \$127 million of additional combined funding required, \$90 million of this amount is required between 2022 and 2024, most of which are capital costs.

Table 3 – Annual Funding Requirement for Option 2

Option 2: SRT to 2023; Bus Replacement 2023-2030 With New Buses								
(\$'000)	Total	2021	2022	2023	2024	2025	2026	2027-2030
Capital Costs								
To extend SRT to Q2, 2023	39,442	20,144	14,248	5,050	-	-	-	-
Buses & Mid-Life Overhaul	85,005	-	-	48,590	12,415	-	-	24,000
Residual Value of Buses	(37,300)							(37,300)
Kennedy & Scarborough Centre Changes	14,200	-	9,600	4,600	-	-	-	-
Traffic Priority Measures	7,350	-	4,350	3,000	-	-	-	-
Total Capital Costs	108,697	20,144	28,198	61,240	12,415	-	-	(13,300)
Capital Funding Available	47,188	19,644	13,248	4,050	4,062	3,347	2,837	-
Capital Funding Required	61,509	500	14,950	57,190	8,353	(3,347)	(2,837)	(13,300)
Operating Costs								
SRT Operations	50,892	20,035	20,436	10,422	-	-	-	-
Bus Replacement	214,968	-	-	12,560	25,834	26,577	28,366	121,630
Lost Parking Revenue at Kennedy	250	-	27	28	28	28	28	112
Total Operating Costs	266,110	20,035	20,462	23,010	25,862	26,605	28,394	121,742
Operating Funding Available	200,350	20,035	20,035	20,035	20,035	20,035	20,035	80,140
Operating Funding Required	65,760	(0)	427	2,975	5,827	6,570	8,359	41,602
Combined Additional Funding Required	127,269	500	15,377	60,166	14,179	3,223	5,522	28,302

Option 3: SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030

This option has the lowest capital funding and overall funding requirement. Operating costs, particularly for 2023 to 2026 are higher for this option than Option 2, due to the use of existing buses for these years as opposed to new buses in Option 2.

Table 4 – Annual Funding Requirement for Option 3

Option 3: SRT to 2023; Bus Replacement with Spares and New for 2027-2029								
(\$'000)	Total	2021	2022	2023	2024	2025	2026	2027-2030
Capital Costs								
To extend SRT to Q2, 2023	39,442	20,144	14,248	5,050	-	-	-	-
New Buses 2027-2029	67,363	-	-	-	-	-	-	67,363
Residual Value of Buses	(51,800)							(51,800)
Kennedy & Scarborough Centre Changes	14,200	-	9,600	4,600	-	-	-	-
Traffic Priority Measures	7,350	-	4,350	3,000	-	-	-	-
Total Capital Costs	76,555	20,144	28,198	12,650	-	-	-	15,563
Capital Funding Available	47,188	19,644	13,248	4,050	4,062	3,347	2,837	-
Capital Funding Required	29,367	500	14,950	8,600	(4,062)	(3,347)	(2,837)	15,563
Operating Costs								
SRT Operations	50,892	20,035	20,436	10,422	-	-	-	-
Bus Replacement	229,628	-	-	14,721	30,246	31,081	31,949	121,630
Lost Parking Revenue at Kennedy	250	-	27	28	28	28	28	112
Total Operating Costs	280,770	20,035	20,462	25,171	30,274	31,109	31,977	121,742
Operating Funding Available	200,350	20,035	20,035	20,035	20,035	20,035	20,035	80,140
Operating Funding Required	80,420	(0)	427	5,136	10,239	11,074	11,942	41,602
Combined Additional Funding Required	109,788	500	15,377	13,736	6,177	7,727	9,105	57,165

In all options examined, there is a requirement for funding beyond what is currently available to extend the SRT beyond its current life to coincide with the anticipated completion of the Line 2 East Extension. TTC will continue to work with the Province to secure the additional funding required.

The Interim Chief Financial Officer has reviewed this report and agrees with the financial summary information.

Equity/Accessibility Matters

The TTC is dedicated to promoting and supporting diversity, accessibility and inclusion in all of its corporate policies, programs and services. Currently, Line 3 (SRT) is partially-accessible with elevators and other accessibility features provided at Kennedy and Scarborough Centre Stations, and limited step-free access to southbound trains at Lawrence East Station. Ellesmere, Midland and McCowan Stations are not accessible, as well as northbound service at Lawrence East Station. Accessibility improvements for these stations were removed from the scope of TTC's Easier Access (EA) Program in 2014 due to the expectation at the time that Line 3 would be upgraded or replaced by the Provincially legislated Accessibility for Ontarians with Disabilities Act (AODA) deadline of 2025.

Under the Option 1, the SRT Life Extension Project, would maintain the existing partially-accessible transit service along the SRT corridor until the SRT is permanently replaced by the fully accessible Scarborough Subway Extension, currently expected to be completed by 2030. As extending the life of the SRT alone would not include accessibility improvements such as elevators to meet the AODA deadline given that these improvements would not be cost-effective or feasible given the short timeline, supplemental accessible bus service would need to be provided along the SRT corridor to bridge the accessible service gap to 2030

Options 2 and 3, would replace the SRT with accessible bus service starting in 2023 by extending most existing bus routes that terminate at Scarborough Centre Station to Kennedy Station. Both Options 2 and 3 would meet all applicable AODA requirements in terms of vehicles and accessible transit stops.

Line 3 and connecting bus routes serve numerous Neighbourhood Improvement Areas (NIA) and equity-seeking groups in Scarborough. All Options in this report would maintain frequent transit service to NIAs and to serve equity-seeking groups. Options 2 and 3 are expected to provide more reliable and dependable service for our customers and would result in more direct service to Kennedy Station with fewer transfers for most customers; however, travel times would, on average, be longer when compared to Option 1.

Decision History

At the August 2006 Commission Meeting, Scarborough RT Strategic Plan – A Study Report was presented with recommendation to replace the SRT vehicles with the next generation vehicles before the current fleet of SRT vehicles reaches the end of its useful service life.

[https://www.ttc.ca/About the TTC/Commission reports and information/Commission meetings/2006/Aug 30 2006/Other/Scarborough Rt Strat.pdf](https://www.ttc.ca/About%20the%20TTC/Commission%20reports%20and%20information/Commission%20meetings/2006/Aug%2030%202006/Other/Scarborough%20Rt%20Strat.pdf)

At its meeting in March 2007, the Commission endorsed the Toronto Transit City Light Rail Plan as the basis for rapid transit expansion in the City of Toronto. This plan included the replacement of SRT and the addition of seven new LRT lines.

[https://www.ttc.ca/About the TTC/Commission reports and information/Commission meetings/2007/Mar 21 2007/Other/Toronto Transit City.pdf](https://www.ttc.ca/About%20the%20TTC/Commission%20reports%20and%20information/Commission%20meetings/2007/Mar%2021%202007/Other/Toronto%20Transit%20City.pdf)

In June 2007, the Province of Ontario announced the MoveOntario 2020 rapid transit plan for the Greater Toronto and Hamilton area. The plan included the Toronto Transit City Light Rail Plan, including the Scarborough LRT, Eglinton Crosstown LRT and Scarborough-Malvern LRT lines

[http://www.ttc.ca/PDF/About the TTC/Transit City/ TC LRT Plan Evaluation and Comparison of Routes.pdf](http://www.ttc.ca/PDF/About%20the%20TTC/Transit%20City/TC%20LRT%20Plan%20Evaluation%20and%20Comparison%20of%20Routes.pdf)

In May 2013, City Council indicated support for the extension of the Bloor-Danforth subway line from Kennedy Station to Scarborough Centre and Sheppard Avenue with an alignment along the McCowan corridor, as an alternate to the Scarborough LRT.

[https://www.ttc.ca/About the TTC/Commission reports and information/Commission meetings/2013/May 24/Reports/City of Toronto Item.pdf](https://www.ttc.ca/About%20the%20TTC/Commission%20reports%20and%20information/Commission%20meetings/2013/May%2024/Reports/City%20of%20Toronto%20Item.pdf)

At its meeting of September 2013, the TTC Board supported the Scarborough subway alignment along the McCowan corridor, through Scarborough City Centre and north to Sheppard Avenue East.

[https://www.ttc.ca/About the TTC/Commission reports and information/Commission meetings/2013/September 25/Supplementary Reports/Scarborough Subway O.pdf](https://www.ttc.ca/About%20the%20TTC/Commission%20reports%20and%20information/Commission%20meetings/2013/September%2025/Supplementary%20Reports/Scarborough%20Subway%20O.pdf)

At its meeting of October 2013, City Council approved the SSE project extending the Bloor-Danforth subway line approximately 7.5 km from Kennedy Station along McCowan Road with stations at Lawrence, Scarborough Centre and Sheppard Avenue. Included in the project were funds in the amount of \$132M to extend the life of SRT until the opening of the SSE project in 2023.

<https://www.toronto.ca/city-government/accountability-operations-customer-service/city-administration/city-managers-office/key-initiatives/transit-in-toronto/transit-expansion/line-2-east-extension/>

At its meeting of July 2016, City Council adopted the concept of a one-stop subway extension from Kennedy to Scarborough Centre. The SSE project was scheduled to open for revenue service in 2026.

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2016.EX16.1>

At its meeting of March 22, 2017, the Commission received report informing the TTC Board on City Executive Committee Report EX23.1 Next Steps on the Scarborough Subway Extension, including screening assessment to remove from consideration options that require closure of SRT.

[http://www.ttc.ca/About the TTC/Commission reports and information/Commission meetings/2017/March 22/Reports/4 Next Steps on the Scarborough Subway Extension.pdf](http://www.ttc.ca/About%20the%20TTC/Commission%20reports%20and%20information/Commission%20meetings/2017/March%2022/Reports/4%20Next%20Steps%20on%20the%20Scarborough%20Subway%20Extension.pdf)

Toronto's Transit Expansion Program – Update and Next Steps

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2019.EX4.1>

In April 2019, a report to City Council from the City Manager, prepared in consultation with the TTC outlined the project baseline scope and schedule for the express SSE project. A supplementary report was also considered that introduced the Province's proposal to amend the scope of the SSE to a three –stop subway. City Council directed the City in consultation with the TTC to report on an assessment of the cost, schedule and operational impacts to the TTC network associated with changing the scope and/or delivery model of the Line 2 East Extension project and principles to guide future discussions with the Province of Ontario.

In the summer of 2019, the Province through legislation uploaded the SSE project, along with the Relief Line project and Yonge North Subway Extension project. Metrolinx and Infrastructure Ontario (IO) is now responsible for the planning and delivery of the SSE project. The anticipated schedule for the delivery of a three stop SSE project by Metrolinx/IO is reported to be 2030.

In October 2019, the City in consultation with the TTC, reported on the “*Toronto-Ontario Transit Update*”

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2019.EX9.1>

The report included a technical assessment of the Province's proposed changes to the SSE project. The report also indicated that *"the City and Province, pursuant to further negotiations, will continue to discuss responsibility for funding costs to maintain the Line 3 (Scarborough RT) and/or replacement transit service in Scarborough due to the delay in the scheduled completion of the L2EE as a result of the change in scope and delivery of the project"*. The report also noted that the TTC is undertaking a review of the impacts on the SRT of extending the in-service date of the SSE to 2030. City Council also directed the Deputy City Manager, Infrastructure and Development Services and the Chief Executive Officer, Toronto Transit Commission to ensure there will be enough buses available should the Scarborough Rapid Transit fail earlier than the completion date of the Line 2 extension, and that this does not impact other services provided by the Toronto Transit Commission.

This report was considered by the TTC Board at its meeting on October 24, 2019.

[http://www.ttc.ca/About the TTC/Commission reports and information/Commission meetings/2019/October 24/Reports/11 City of Toronto Report EX9 1 Toronto-Ontario Transit Upda.pdf](http://www.ttc.ca/About%20the%20TTC/Commission%20reports%20and%20information/Commission%20meetings/2019/October%2024/Reports/11%20City%20of%20Toronto%20Report%20EX9%201%20Toronto-Ontario%20Transit%20Upda.pdf)

Issue Background

The SRT entered revenue service in 1985. After 35 years of continuous operation, the SRT vehicles have been in service 10 years past their design life of 25 years.

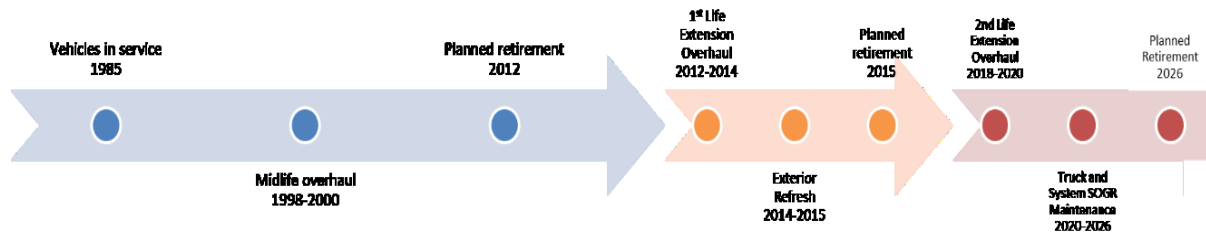
The TTC has undertaken a limited and targeted overhaul program to address structural, mechanical and cosmetic requirements of the SRT as outlined in Figure 1.

The vehicles underwent a first targeted overhaul in 2012-2014. This overhaul was intended to keep the vehicles operational through the 2015 Pan-American/Parapan-American Games. The scope of overhaul was largely routine state of good repair (SOGR) activities and cosmetic upgrades, with no vehicle structural concerns at the time.

A second overhaul was initiated in 2018 with a scheduled completion in 2020. The scope was targeted to only include routine SOGR activities, major car body structural repairs, HVAC system upgrades, and addition of pre-boarding announcement systems for AODA compliance.

Following completion of the second overhaul, additional maintenance activities are planned including ongoing, routine SOGR refurbishments, replacement of critical end of life truck structural elements and brake system end-of-life replacement to allow vehicle maintainability and operability in line with previously planned opening of the SSE project in 2026.

Figure 1: Timeline of SRT Vehicle Maintenance History



However, due to the age of the vehicles, they are becoming increasingly more difficult to maintain.

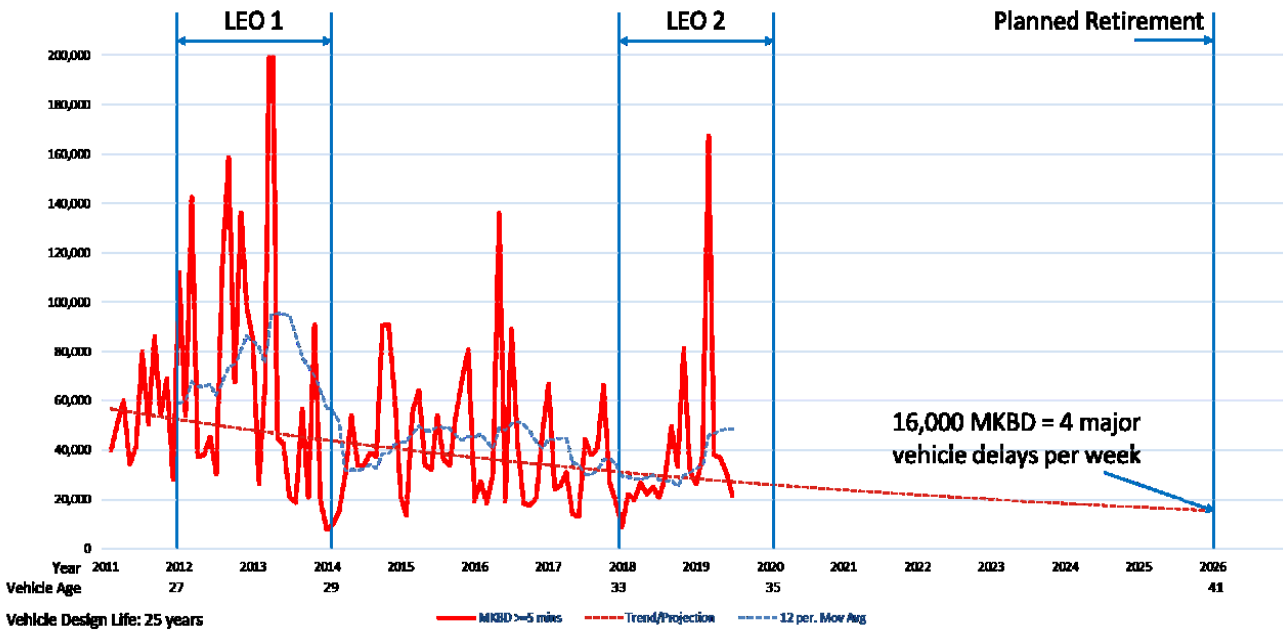
In September of 2020, the number of SRT trains was temporarily reduced further to three trains for several weeks due to concerns with a critical bearing in the truck assembly.

Furthermore, the SRT is susceptible to inclement weather. During the hot summer weather, the SRT propulsion equipment tends to overheat, culminating in propulsion system shut-down. Consequently, speed restrictions are implemented to ensure the propulsion equipment operates within tolerable limits. There have been 70 days where speed restrictions were implemented in 2020. During the extreme winter months, snow and ice also affects the operation of SRT with the system being suspended for 6 days in 2018 and 2019.

Additionally, obsolescence of key parts is becoming critical and further contributes to maintenance difficulties. Between 2018 to 2020, there were a total of 184 incidents related to obsolete propulsion, braking, or battery systems. Of these 184 incidents, 158 incidents resulted in delays greater than or equal to five minutes.

Consequently, overall vehicle reliability is slowly degrading as the vehicle ages well past its design life and obsolescence erodes maintainability. The current 12-period mean kilometers between delays (MKBD) for the SRT fleet is approximately 50,000 km. At current trend, reliability is expected to average approximately 16,000 mean kilometers between delays greater than or equal to five minutes (MKBD>5) by 2026, which equates to approximately four major vehicle delays per week as shown in the Figure 2 below.

Figure 2: Mean Kilometers Between Delays Trend



As the overall vehicle reliability continues to degrade with equipment failures, it would result in more frequent and unscheduled service interruptions, negatively impacting service level. Consequently, sufficient trains may not be available to provide the required service, and passenger crowding would get progressively worse over time to a point where it may not meet the minimum service level.

In the summer of 2019, the Province through legislation assumed responsibility for the delivery of the SSE project with the anticipated delivery being delayed by up to four years from 2026 to 2030. Pursuant to ongoing discussions with Metrolinx and IO, they were kept abreast of the impact to SRT due to the delay in the scheduled completion of the SSE project and were advised that detailed assessment would be required for further discussion. Thus the assessment on whether extending the life of SRT to 2030 is feasible and cost effective or bus replacement service would need to be implemented as an alternate service option.

Comments

SRT Life Extension Option Assessment

To determine the feasibility of extending the life of SRT to 2030, technical assessments were undertaken by the original equipment manufacturers, Thales and Bombardier and peer reviewed by Jacobs, an independent consultant. Their findings include:

- SRT vehicle life could be extended to 2030 but will require a significant investment to overhaul and upgrade technology.
- Significant maintenance actions are needed to the truck and key areas of the car bodies to achieve a state of good repair.

- Track quality is a driving force behind truck stresses and fatigue life, pointing to the need for ongoing track remediation.
- Vehicle car body structural concerns have been addressed as part of the current life extension overhaul program but critical areas require frequent and regular monitoring to ensure the safety of vehicles.
- Many components of existing equipment have become unavailable, necessitating active obsolescence management to keep systems operational.
- Keeping the Vehicle On-Board Controller (VOBC) equipment operational through 2030 may be best achieved by replacing the original 1980's equipment with the new updated equipment.
- There are significant risks, cost and schedule factors associated with either replacement or refurbishment of critical VOBC. Over the 30+ years of revenue operation to date, the currently installed SRT VOBC units have undergone modifications as part of needed on-going maintenance just to keep the system operational, which as a result is likely to introduce integration problems with the installation of the added proposed new equipment.
- Given that the length of time for the recommended implementation of the new third generation VOBC upgrade is four years, out of the projected 10-year service life extension to 2030, only six years of beneficial use will be realized even though the onboard equipment itself has a design life of 25 years, with little or no residual value, thus representing a loss in capital.

The VOBC is 1980s era technology and allowed for one of the first Automated Train Control systems in North America. Integrating new technology into the 1980s-vintage SRT train and wayside infrastructure would require several years of engineering, prototyping, testing, and installation, and presents significant risk of challenges, schedule and cost overruns, and inability to fully realize upgrade benefits. Additional, unforeseen vehicle and infrastructure upgrades may also be required to interface with the new technology, further driving up costs and risk of delays. Moreover, until such time as the new VOBC is fully rolled out, there remains considerable risk of reliability degradation in the older equipment and quality of service cannot be guaranteed.

The SRT vehicles will need to be taken out of service to perform the overhaul, thus reducing the SRT service level. To make up the service level reduction, an additional 15 hybrid buses would be procured to supplement existing bus express service between Kennedy and Scarborough Centre stations during the overhaul period from 2021 to 2024. Additional bus service was introduced in previous years to supplement Line 3 service, however the ridership on the increased bus service was minimal. Customers either found alternative travel options, adjusted commuting times and continued using Line 3, or left the TTC entirely to avoid using the bus. Eventually, additional bus service was removed before the end of overhaul work.

Since the SRT was planned to be replaced by the SSE project initially by 2023, four SRT stations, Lawrence East, Ellesmere, Midland and McCowan, were not included in the EA program to make them accessible. Therefore, starting in 2025, supplementary accessible bus service would be provided, paralleling the SRT route, in lieu of making the these SRT stations accessible.

Therefore, the Option 1: Hybrid SRT and Bus Service to 2030 would include:

- Continue to operate SRT until the SSE opens for revenue service in 2030.
- Perform a life extension overhaul on the fleet of SRT vehicles from 2021 to 2024, specifically addressing obsolete, unmaintainable, and low reliability systems including:
 - Propulsion System
 - Automatic Train Operation (ATO)* system including Vehicle On-Board Controller (VOBC)
 - Linear Induction Motor (LIM)*
 - Propulsion Control Unit (PCU)*
 - Truck Assembly
 - Structural Side Frames
 - Axle and Wheel Assemblies
 - Brake System
 - Hydraulic Brake Actuators*
 - Magnetic Track Brakes
 - Hydraulic Power Unit
 - Hydraulic Control Unit
 - Door System
 - Door Frames
 - Door Mechanisms & Electrical Controls
 - Accessible Features
 - Upgrade of the Station Stop Announcement System*
 - Closed Circuit Television (CCTV) System
 - Design and installation of a CCTV system

*Note: * denotes components and systems that require engineering re-design to address obsolescence*

- Continue track and wayside SOGR maintenance to maintain high level of infrastructure performance including conducting regular grinding sessions in SRT each year, regularly maintaining rail and track component inspection and replacement as per tack standard of key components such as switches, grout pads, ties, ballasts, etc.
- An additional 15 buses are required to supplement existing bus express service between Kennedy and Scarborough Centre during the overhaul period.
- Starting 2025, provide supplementary accessible bus (six buses) service in lieu of making the SRT stations accessible.
- Transfer SRT infrastructure to SSE project for decommissioning.

Bus Replacement Service Option Assessment

As an alternative to continuing train operations on SRT until the SSE opens, two alternate options have been examined that would replace SRT with a high-capacity and high-quality temporary express bus service.

Option 2 - SRT to 2023 and Bus Replacement Service 2023 to 2030 with new buses entails:

- Maintain the current four to five train service in order to undertake SOGR work from 2021 to 2023.
- Increase the bus fleet plan by 60 buses; procure new hybrid buses in 2023/24.
- Provide additional bus terminal capacities at Kennedy and Scarborough Centre stations by 2023.
- Implement roadway infrastructure improvements along the bus routing corridors to facilitate enhanced bus movement including queue jump lanes and signal timing changes.
- Perform mid-life overhaul of buses in 2029/30.
- Buses will continue to be in service after 2030.
- Transfer SRT infrastructures to SSE project for decommissioning.

Option 3: SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030 entails:

- Maintain the current four to five train service in order to undertake SOGR work from 2021 to 2023.
- Use buses within current fleet from 2023 to 2026, by temporarily reducing operating spare ratio.
- Build operating spare ratio back up by buying 20 buses per year from 2027 to 2029.
- Provide additional bus terminal capacities at Kennedy and Scarborough Centre stations by mid-2023.
- Implement roadway infrastructure improvements along the bus routing corridors to facilitate enhanced bus movement including queue jump lanes and signal timing changes.
- Buses will continue to be in service after 2030.
- Transfer SRT infrastructures to SSE project for decommissioning.

If short term disruption were to occur to the SRT train service, that substantially reduces the capacity, a bus shuttle service would be implemented. For example, if only 3 trains are available the train service would be replaced temporarily by buses.

The bus service plan under Option 2 and 3 would consist of extending eight major bus routes that currently terminate at Scarborough Centre Station to operate express to Kennedy Station. The routes would operate express via north-south streets between Ellesmere Road and Eglinton Avenue, as shown in the maps below. Detailed plan for bus routings and transit priority measures would be discussed and determined with City of Toronto staff, and would be developed through community and stakeholder consultations.

Figure 3: Scarborough Transit Network (2023) – including Line 3

Line 3 Scarborough
Connecting Bus Network 2023

Route List

Connecting route numbers, names, and routings are preliminary and subject to change.

9	Bellamy	Warden Stn - Scarborough Centre Stn
12A	Kingston Rd	Victoria Park Stn - Kennedy Stn
12B	Kingston Rd	Victoria Park Stn - Kennedy Station via Variety Village
16	McCowan	Warden Stn - Scarborough Centre Stn
20	Cliffside	Main Street Stn - Kennedy Stn
21	Brimley	Kennedy Stn - Steeles via Scarborough Centre Stn
38A	Highland Creek	Scarborough Centre Stn - U of T Scarborough
38B	Highland Creek	Scarborough Centre Stn - Rouge Hill GO Stn
43A	Kennedy	Kennedy Stn - Steeles
43B	Kennedy	Kennedy Stn - Scarborough Centre Stn
54A	Lawrence East	Science Centre Stn - Starspray Loop
54B	Lawrence East	Science Centre Stn - Morningside
57	Midland	Kennedy Stn - Steeles
86A	Scarborough	Kennedy Stn - Toronto Zoo
86B	Scarborough	Kennedy Stn - Highland Creek
86C	Scarborough	Kennedy Stn - Sheppard
95A	York Mills	York Mills Stn - Sheppard
95B	York Mills	York Mills Stn - U of T Scarborough
113	Danforth	Main Street Stn - Kennedy Stn
116	Morningside	Kennedy Stn - Steeles
126A	McCowan North	Scarborough Centre Stn - Major Mackenzie
126B	McCowan North	Scarborough Centre Stn - Steeles
130	Middlefield	Scarborough Centre Stn - Steeles
131	Nugget	Scarborough Centre Stn - Old Finch
132	Milner	Scarborough Centre Stn - Hupfield/McLevin
133	Nelson	Scarborough Centre Stn - Morningside Heights
134A	Progress	Scarborough Centre Stn - Finch
134B	Progress	Scarborough Centre Stn - McNicoll
134C	Progress	Scarborough Centre Stn - Centennial College
169	Huntingwood	Don Mills Stn - Scarborough Centre Stn
178	Brimorton	Scarborough Centre Stn - Beechgrove
905A	Eglinton East Express	Kennedy Stn - U of T Scarborough Express
905B	Eglinton East Express	Kennedy Stn - Conlins Express
913	Progress Express	Scarborough Centre Stn - Centennial College Express
938	Highland Creek Express	Scarborough Centre Stn - U of T Scarborough Express
939A	Finch Express	Finch Stn - Scarborough Centre Stn Express
939B	Finch Express	Finch West Stn - Scarborough Centre Stn Express
943	Kennedy Express	Kennedy Station - Steeles Ave Express
954	Lawrence East Express	Science Centre Stn - Starspray Loop Express
985A	Sheppard East Express	Don Mills Stn - Scarborough Centre Stn Express
986	Scarborough Express	Kennedy Stn - Sheppard Express
995	York Mills Express	York Mills Stn - U of T Scarborough Express

Connections

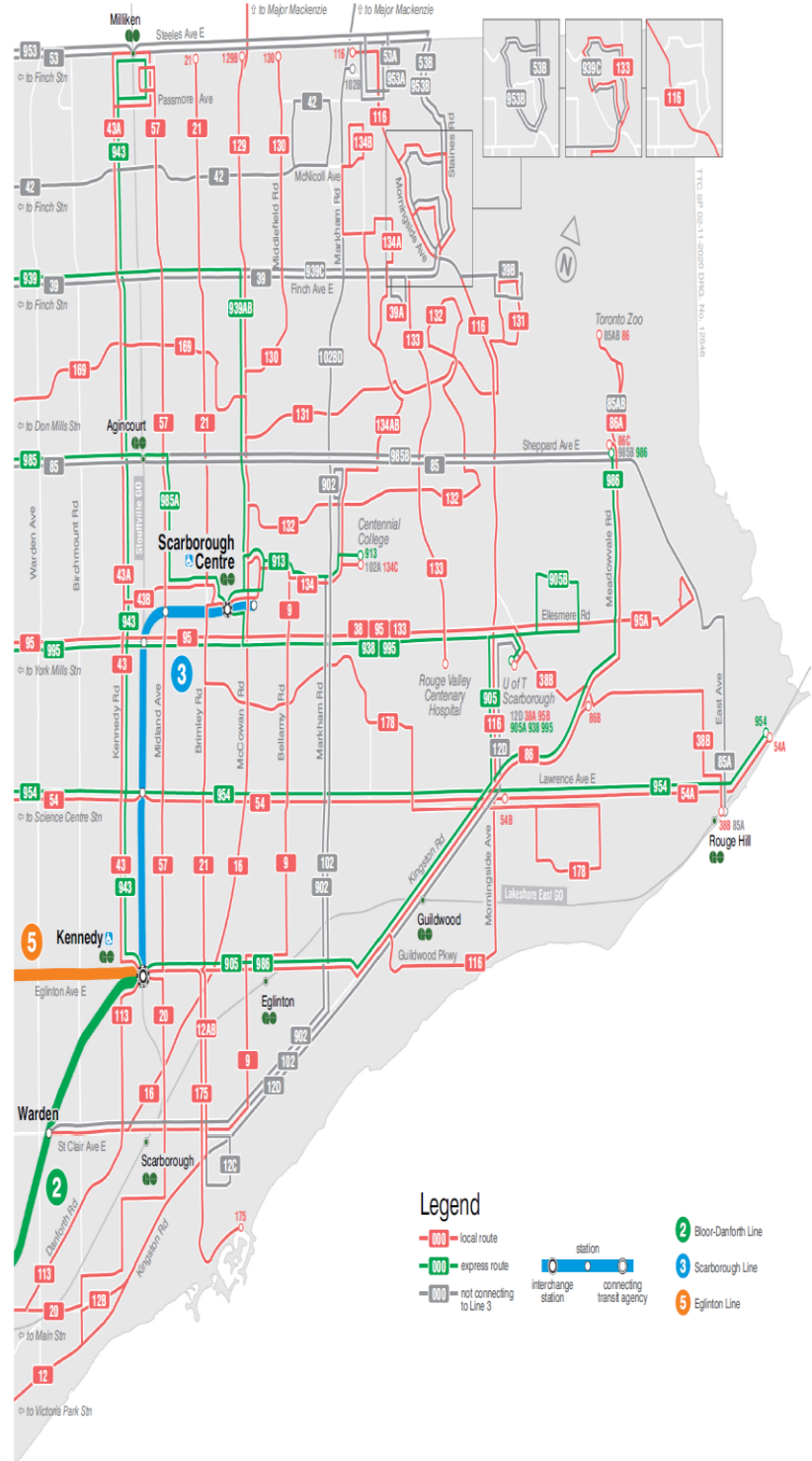
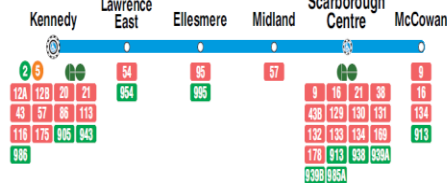


Figure 4: Scarborough Transit Network (2023) – Conceptual Bus Service Plan



2023 Bus Replacement Service for Line 3 Scarborough

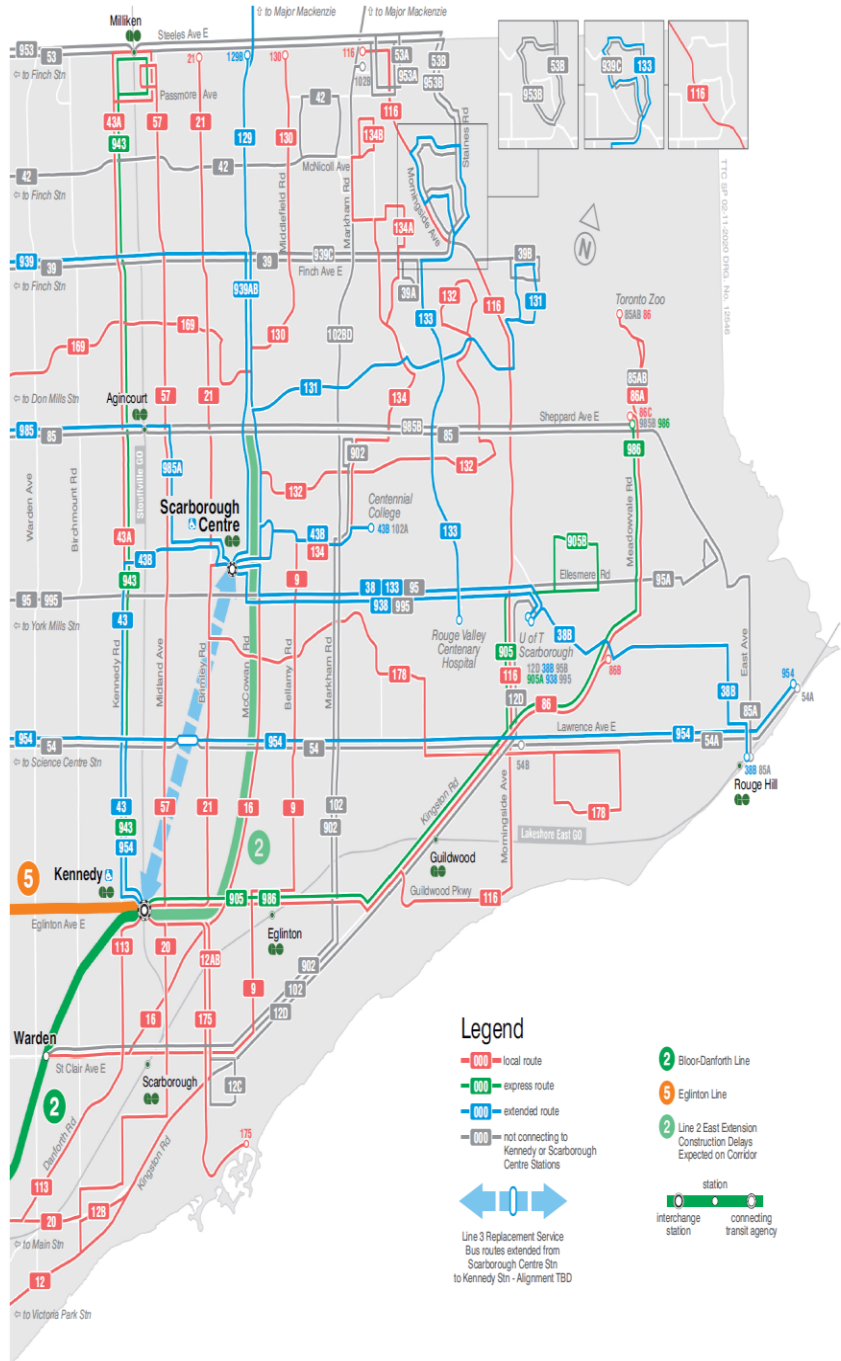
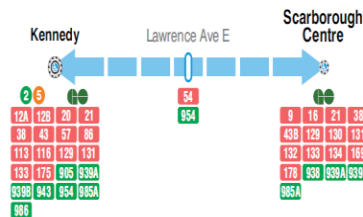
Route List

Future route changes shown for information only and subject to Board approval.

9	Bellamy	Warden Stn – Scarborough Centre Stn
12A	Kingston Rd	Victoria Park Stn – Kennedy Stn
12B	Kingston Rd	Victoria Park Stn – Kennedy Station via Variety Village
16	McCowan	Warden Stn – Scarborough Centre Stn
20	Cliffside	Main Street Stn – Kennedy Stn
21	Brimley	Kennedy Stn – Steeles via Scarborough Centre Stn
38A	Highland Creek	Kennedy Stn – U of T Scarborough
38B	Highland Creek	Kennedy Stn – Rouge Hill GO Stn
43A	Kennedy	Kennedy Stn – Steeles
43B	Kennedy	Kennedy Stn – Centennial College via Scarborough Centre Stn
57	Midland	Kennedy Stn – Steeles
88A	Scarborough	Kennedy Stn – Toronto Zoo
88B	Scarborough	Kennedy Stn – Highland Creek
88C	Scarborough	Kennedy Stn – Sheppard
113	Danforth	Main Street Stn – Kennedy Stn
116	Morningside	Kennedy Stn – Steeles
129A	McCowan North	Kennedy Stn – Major Mackenzie
129B	McCowan North	Kennedy Stn – Steeles
130	Middlefield	Scarborough Centre Stn – Steeles
131	Nugget	Kennedy Stn – Old Finch
132	Milner	Scarborough Centre Stn – Hupfield/McLevin
133	Neilson	Kennedy Stn – Morningside Heights
134A	Progress	Scarborough Centre Stn – Finch
134B	Progress	Scarborough Centre Stn – McNicoll
169	Huntingwood	Don Mills Stn – Scarborough Centre Stn
176	Brimont	Scarborough Centre Stn – Beechgrove
905A	Eglinton East Express	Kennedy Stn – U of T Scarborough Express
905B	Eglinton East Express	Kennedy Stn – Conlins Express
938	Highland Creek Express	Kennedy Stn – U of T Scarborough Express
939A	Finch Express	Finch Stn – Kennedy Stn Express
939B	Finch Express	Finch West Stn – Kennedy Stn Express
943	Kennedy Express	Kennedy Station – Steeles Ave Express
954	Lawrence East Express	Science Centre Stn – Starspray Loop Express via Kennedy Stn
985A	Sheppard East Express	Don Mills Stn – Kennedy Stn Express
986	Scarborough Express	Kennedy Stn – Sheppard Express

● Route extended to Kennedy Station; 43B extended to Centennial College

Connections



The following major bus routes would be extended to serve Kennedy Station and replace SRT:

- 38 Highland Creek – currently Scarborough Centre Station to University of Toronto Scarborough Campus, through the Rouge Hill community to Rouge Hill GO Station
- 129 McCowan North – currently Scarborough Centre Station to Steeles Avenue and into York Region
- 131 Nugget – currently Scarborough Centre Station to Malvern Town Centre and Morningside Avenue
- 133 Neilson – currently Scarborough Centre Station to Centenary Hospital, Malvern Town Centre, and Finch Avenue East
- 134C Progress – currently Scarborough Centre Station to Centennial College, to be combined with 43B Kennedy branch to terminate at Kennedy Station via Progress Avenue and Kennedy Road
- 939A/B Finch Express – currently Scarborough Centre Station to Finch Station and Finch West Station
- 954 Lawrence East Express – currently Lawrence East Station to Starspray Loop, extended to Kennedy Station – future extension to Science Centre Station on Line 5 Eglinton
- 985A Sheppard East Express – from Scarborough Centre Station to Don Mills Station

The buses would operate on one or more north-south streets between Ellesmere and Eglinton (i.e. Kennedy Road, Midland Avenue, Brimley Road, Danforth Road). Appropriate transit priority measures would be identified for these routes, and would be subject to approval by City Council. The routes would operate express, with some routes serving an intermediate stop at Lawrence Avenue East to replace the current Lawrence East Station connection.

The final routing is expected to be impacted by SSE construction, which is to begin in 2021 along Eglinton Avenue, with extensive tunneling work at Midland Avenue. Several of the possible routings would travel through Midland and Eglinton. Delays to service and additional running time requirements caused by SSE work are expected for the full duration of the bus plan. The effects of these delays would be factored into the routing options chosen and the service levels that would be scheduled.

The bus service will increase peak bus volume along the selected corridor(s) to Kennedy Station, compared to the service that operates today. There would be more than one express bus per minute, or about 75 bus trips per hour. The table below shows the planned service frequency for each weekday period, and the resultant capacity of the service. The aim is to replace beyond SRT's current planned capacity, as bus service is expected to be more susceptible to delays compared to trains, which could affect the consistent delivery of service on the corridor and cause uneven crowding on buses.

Table 5 - Planned Service Levels and Capacity by Period

	AM Peak	Midday	PM Peak	Early Eve	Late Eve
2023 Planned Bus Service Frequency	73 trips/hr 0 min 49 s	60 trips/hr 1 min 00 s	75 trips/hr 0 min 48 s	51 trips/hr 1 min 11 s	29 trips/hr 2 min 04 s
2023 Planned Bus Service Capacity (passengers per hour)	3720	2090	3800	1770	1000
Planned Line 3 Frequency	13 trips/hr 4 min 30 s	12 trips/hr 5 min 00 s	13 trips/hr 4 min 30 s	12 trips/hr 5 min 00 s	12 trips/hr 5 min 00 s
Planned Line 3 Capacity (passengers per hour)	2930	1560	2930	1560	1560

The additional bus volume planned between Scarborough Centre Station and Kennedy Station is expected to have a noticeable impact on the residential neighborhoods along the north-south streets. The bus volume would create more traffic congestion on the roadway, resulting in more noise, higher emissions, and could make residential driveway access more difficult for people travelling in private automobiles.

Bus service would operate similar hours as SRT does today, from approximately 6:00 a.m. to 1:30 a.m. Most of the local bus routes to be extended (38, 129, 131, and 133) already operate in all periods, and with a similar service span to SRT. The remaining routes (134C, 939, 954, and 985) would continue to operate in their current periods, and would provide the additional passenger capacity to meet customer demand during the busiest periods. Additional service and periods of operation would be added, as required by customer demand.

Overall, the bus service plan would require approximately 45 additional in-service peak buses and 5,000 weekly service hours to begin in 2023, and up to 60 additional in-service peak buses and 5,600 weekly service hours by 2030.

Customer Travel Time Difference

The bus service plan would result in more direct service compared to Line 3 train service, as many customers on the eight extended bus routes would have a direct ride to Kennedy Station and avoid the transfer at Scarborough Centre Station. The eight routes are used for approximately 21,000 daily customer-trips, and account for

approximately 75% of the bus customers who currently transfer between bus and train at Scarborough Centre Station. The remaining customers will have to transfer from their local bus route to the eight extended routes in the fare-paid bus platform at Scarborough Centre Station.

While 75% of customers will no longer have to transfer to reach Kennedy Station, customers travelling on SRT will have a longer journey time with the extended bus routes. Current travel time from Scarborough Centre Station to Kennedy Station is approximately 10 minutes one-way. The bus service is expected to take 15 to 18 minutes, an increase of 50% to 80% in travel time for SRT customers. The table below shows the scheduled journey time of a customer travelling in the morning peak period from northeastern Scarborough (Malvern Town Centre) to Kennedy Station under three different scenarios.

Table 6 - Customer Travel Times – Morning Peak Period

	Malvern Town Centre to Scarborough Centre Station	Transfer Time	Scarborough Centre Station to Kennedy Station	Total Time
Scenario 1: Via Line 3 Scarborough	16-24 mins	5 mins	10 mins	31-39 mins
Scenario 2: Via 131 or 133 (extended route from Scarborough Centre to Kennedy)	16-24 mins	0 mins	15-18 mins	31-42 mins
Scenario 3: Via 132 or 134 (transfer required at Scarborough Centre)	16-24 mins	1 mins	15-18 mins	32-43 mins

The current condition via Line 3 (*Scenario 1*) has a comparable total travel time to *Scenario 2: Via 131 or 133* and *Scenario 3: via 132 or 134*. Scenario 1 offers shorter travel time from Scarborough Centre Station to Kennedy Station at the cost of a longer transfer time at Scarborough Center Station (customers have to traverse three levels to reach the Line 3 platform). Meanwhile, Scenarios 2 and 3 have more variable travel time between Scarborough Centre Station and Kennedy Station due to mixed traffic operations, but have no or little transfer time at Scarborough Centre Station.

One of the main concerns with the bus replacement options is increased travel time variability due to operating in mixed traffic. In 2019, the 903 Kennedy-Scarborough Centre Express experienced travel time variability of up to eight minutes per direction.

This variability will be experienced by all customers on the bus replacement options, and transit priority measures will be required to ensure service reliability.

Overall, the bus service plan is expected to decrease ridership on the SRT corridor in 2023. These changes are largely due to the resultant increase in travel time for all customers, and the less reliable transfer between bus services at Scarborough Centre Station.

Operational Requirements – Transit Priority

To provide reliable bus service along the proposed route, the TTC is working with the City of Toronto Transportation Services to examine a variety of transit priority measures that would form part of an overall contingency planning strategy for the permanent shutdown of SRT. In the short term, changes to signal timing and bus lane designation could provide immediate benefits to bus operations from Scarborough Centre Station to Kennedy Station. In the medium term, treatments such as queue jump lanes, transit signal priority, and expanded bus stops could be implemented to further improve bus operations as well as customer experience on the bus replacement services. In the travel times identified in the section above, the low range of travel time reflects the highest level of transit priority measures.

Operational Requirements – Platforms at Bus Terminal

The bus service plan will require additional service platforms at Scarborough Centre Station and Kennedy Station. At Scarborough Centre Station, six to eight additional bus bays will be required to accommodate two-way service on the eight extended routes. At Kennedy Station, a minimum of four bays are required for the new routes terminating at the station, as well as considerations for layover and circulation.

Further discussions are required between the TTC, Metrolinx and the City of Toronto to identify potential locations for expansion including using the temporary bus platform built by ECLRT project in the commuter parking lot at Kennedy station and using bus bays currently leased to Metrolinx at Scarborough Centre station bus terminal when the current lease expires.

Other Options Not Recommended

Following options were initially considered but not recommended:

- SRT Life Extension to 2026

The current approved plan for the SRT LE project includes capital restoration work to the SRT vehicle, track, and wayside to enable continued operation to 2026, at which time the SSE was meant to take over transit operations and SRT decommissioned. This is no longer the case as the SSE will not be completed until 2030. Discontinuing the SRT in 2026 as planned would leave riders of that transit corridor with few alternate transit options, and ridership along existing bus routes would spike far beyond capacity without investment to implement a bus replacement service.

Furthermore, while the efforts are underway with the targeted overhaul and follow-on SOGR work is to extend the life of the SRT fleet until 2026, work being performed focuses on replacement or refurbishment of safety critical components, assemblies and systems. The work does not include nor address reliability improvements or parts obsolescence in non-safety-critical systems. Consequently, despite the ongoing maintenance effort, the vehicle's overall reliability continues to degrade and obsolescence of parts are becoming more critical. It may become necessary to remove vehicles from service and salvage serviceable parts for maintenance resulting in a permanent reduction of service to a point where it may not be able to meet the minimum service level, necessitating emergency shuttle bus service.

- Purchasing Used Vehicles from the British Columbia Rapid Transit Company (BCRTC)

To address the shortage of critical parts, the possibility of acquiring decommissioned vehicles from Vancouver's BCRTC Mark I fleet, operating on Translink's Sky Train system, to supplement SRT vehicle fleet was assessed. While the BCRTC Mark I trains are substantially similar to the TTC's SRT vehicles, several key differences in the designs would necessitate a high capital expenditure to retrofit the BCRTC vehicles. Moreover, it is likely these vehicles would present similar structural concerns due to their advanced age. Finally, BCRTC has indicated decommissioned trains would not be available for sale until 2024, which will be too late to avoid cannibalizing SRT vehicles for maintenance parts.

- Replacing with New SRT Vehicle

An option to replace the SRT Mark I fleet with new, modern Mark III vehicles was previously considered as a possible means to extend the SRT service. The current SRT Mark I fleet would have been replaced with new trains employing similar but updated technology. However, this would have resulted in significant infrastructure changes to accommodate the Mark III vehicles which are significantly longer and wider, and cannot navigate the existing track geometry entering Kennedy Station. Additional alignment changes at McCowan Yard would also be required. With the high cost of buying new vehicles along with the extensive infrastructure work required and with the anticipated beneficial use of only few years, this option is not considered.

Options Analysis

Analysis of three options are summarized in the table below.

Option 1: Hybrid SRT and Bus Service to 2030	Option 2: SRT to 2023 and Bus Replacement Service 2023 to 2030 with new buses	Option 3: SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030
Option Description – Service		
<p><u>2021 – 2024 (Hybrid SRT Train and Bus Service Model)</u></p> <ul style="list-style-type: none"> • Reduce current 4 to 5 train service to three to four train service, in order to undertake targeted overhaul. Resulting in a service frequency of six to nine minutes. • 15 additional buses required to supplement existing bus express service between Kennedy and Scarborough Centre. This provides a service frequency of two to three minutes. <p>Note: Per current practice, if short term disruption were to occur to the SRT train service, that substantially reduces the capacity, a bus shuttle service would be implemented.</p>	<p><u>2020 – 2023 (SRT Service)</u></p> <ul style="list-style-type: none"> • Maintain the current four to five train service in order to undertake state of good repair work. Resulting in a service frequency of five to six minutes. <p>Note: Per current practice, if short term disruption were to occur to the SRT train service, that substantially reduces the capacity, a bus shuttle service would be implemented. For example, if only three trains are available the train service would be replaced temporarily by buses.</p>	<p><u>2020 – 2023 (SRT Service)</u></p> <ul style="list-style-type: none"> • Maintain the current four to five train service in order to undertake state of good repair work. Resulting in a service frequency of of five to six minutes. <p>Note: Per current practice, if short term disruption were to occur to the SRT train service, that substantially reduces the capacity, a bus shuttle service would be implemented. For example, if only three trains are available the train service would be replaced temporarily by buses.</p>

Option 1: Hybrid SRT and Bus Service to 2030	Option 2: SRT to 2023 and Bus Replacement Service 2023 to 2030 with new buses	Option 3: SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030
<p><u>2025 – 2030 (Hybrid SRT Train and Bus Service Model)</u></p> <ul style="list-style-type: none"> • Five to six train service, providing a service frequency of four to five minutes. Note – subject to all overhaul activity completed in 2025, and success of reliability improvements (see risks identified below). • Six buses required to address AODA compliance requirements, operating a 10 to 15-minute parallel accessible service. Two of six stations remain accessible. • Bus shuttle service in event of SRT shutdown. 	<p><u>2023 – 2030 (Bus Replacement Service)</u></p> <ul style="list-style-type: none"> • 60 buses providing a one-minute bus service, which is the equivalent of five minute train service, due to lower capacity of bus. • All bus terminals/stops are AODA compliant • Bus service would be provided by extending several major bus routes from Scarborough Centre Station to Kennedy Station, thereby saving a transfer for some customers • Service reliability improvements to bus service contingent on transit priority measures being implemented. 	<p><u>2023 – 2030 (Bus Replacement Service)</u></p> <ul style="list-style-type: none"> • 60 buses providing a one-minute bus service, which is the equivalent of five minute train service, due to lower capacity of bus. • All bus terminals/stops are AODA compliant • Bus service would be provided by extending several major bus routes from Scarborough Centre Station to Kennedy Station, thereby saving a transfer for some customers • Service reliability improvements to bus service contingent on transit priority measures being implemented.
Option Description – Infrastructure and Vehicles		
<p><u>Vehicle Requirements:</u> 4-year vehicle overhaul program (2021 -2024) to Address safety and reliability of vehicle assemblies and systems to ensure service to 2030. Scope of work to include re-engineering and overhaul of the following major systems of the SRT trains:</p> <ul style="list-style-type: none"> • Propulsion System <ul style="list-style-type: none"> - Automatic Train Operation (ATO)* system including Vehicle On-Board Controller (VOBC) - Linear Induction Motor (LIM)* Propulsion Control Unit (PCU)* 	<p><u>Bus Requirements:</u></p> <ul style="list-style-type: none"> • 60 additional hybrid buses for procurement in 2023/24. • Additional bus terminal capacity to accommodate the increased customers and higher bus volumes at both stations. • Implementation of various transit priority measures, including transit priority signaling, queue jump lanes for buses, improved bus stop locations and reserved transit lanes, in partnership with City of Toronto Transportation Services. 	<p><u>Bus Requirements:</u></p> <ul style="list-style-type: none"> • Use existing buses within current fleet from 2023 to 2026, by temporarily reducing the spare ratio. • Build the spare ratio back up by buying 20 buses per year from 2027 to 2029. • Additional bus terminal capacity to accommodate the increased customers and higher bus volumes at both stations.

Option 1: Hybrid SRT and Bus Service to 2030	Option 2: SRT to 2023 and Bus Replacement Service 2023 to 2030 with new buses	Option 3: SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030
<ul style="list-style-type: none"> • Truck Assembly <ul style="list-style-type: none"> - Structural Side Frames - Axle and Wheel Assemblies • Brake System <ul style="list-style-type: none"> - Hydraulic Brake Actuators* - Magnetic Track Brakes - Hydraulic Power Unit - Hydraulic Control Unit • Door System <ul style="list-style-type: none"> - Door Frames - Door Mechanisms & Electrical Controls • AODA System <ul style="list-style-type: none"> - Upgrade of the Station Stop Announcement System* • CCTV System Design and installation of a Closed Circuit Television (CCTV) system <p><i>Note: * denotes components and systems that require engineering re-design to address obsolescence.</i></p> <p><u>SRT Infrastructure, Signaling and Traction Power Equipment Requirements:</u></p> <ul style="list-style-type: none"> • Enhancing the current SOGR program so that SRT infrastructure and signaling systems are maintained to 2030. 	<p>Soon after the start of replacement bus service, SRT infrastructure would be transferred to SSE project for decommissioning and demolition.</p>	<ul style="list-style-type: none"> • Implementation of various transit priority measures, including transit priority signaling, queue jump lanes for buses, improved bus stop locations and reserved transit lanes, in partnership with City of Toronto Transportation Services. <p>Soon after the start of replacement bus service, SRT infrastructure would be transferred to SSE project for decommissioning and demolition.</p>

Option 1: Hybrid SRT and Bus Service to 2030	Option 2: SRT to 2023 and Bus Replacement Service 2023 to 2030 with new buses	Option 3: SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030
<ul style="list-style-type: none"> Ongoing inspection and repair of infrastructures such as tunnels, elevated guideway and stations. Enhanced maintenance program including the end of life replacement of various wayside systems consisting of communications, power distributions, electrical, tracks, station stop announcement system and others. <p><u>Bus:</u></p> <ul style="list-style-type: none"> 15 Additional hybrid buses 		
Customer Impact		
<p><u>2021 – 2024:</u></p> <p>SRT Train Service</p> <ul style="list-style-type: none"> 10-12 minute average one-way travel time for customers (Kennedy to Scarborough Centre) Two to four minute increase in customer wait times, as service levels will be reduced for train overhaul work; 40 percent increase to crowding on trains due to reduced service level. Train crowding would be slightly higher, and train wait time would be slightly longer for customers, compared to pre-pandemic conditions. 	<p><u>2021 - 2023:</u></p> <p>SRT Train Service</p> <ul style="list-style-type: none"> 10-12 minute average one-way travel time for customers (Kennedy to Scarborough Centre), with potential for intermittent failure. No change in customer wait times compared to today, except in event of failure. Service levels will maintain at 2020 levels, with five minute headways. No change in crowding relative to pre-pandemic conditions. 	<p><u>2021 - 2023:</u></p> <p>SRT Train Service</p> <ul style="list-style-type: none"> 10-12 minute average one-way travel time for customers (Kennedy to Scarborough Centre), with potential for intermittent failure. No change in customer wait times compared to today, except in event of failure. Service levels will maintain at 2020 levels, with five minute headways. No change in crowding relative to pre-pandemic conditions.

Option 1: Hybrid SRT and Bus Service to 2030	Option 2: SRT to 2023 and Bus Replacement Service 2023 to 2030 with new buses	Option 3: SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030
<p>Bus Service</p> <ul style="list-style-type: none"> Customers have the alternative of supplemental bus service, which has shorter wait time, but slower travel time than the train. Bus service would take an additional five to eight minutes of travel time. Bus crowding would be within service standards. The additional travel time for customers who use the bus service is expected to reduce TTC ridership on the corridor. Analysis is underway to identify the projected ridership loss. <p><u>2025 – 2030:</u></p> <p>SRT Train Service</p> <ul style="list-style-type: none"> 10-12 minute average one-way travel time for customers (Kennedy to Scarborough Centre) 	<ul style="list-style-type: none"> Crowding, travel time and wait time for customers would remain relatively unchanged from pre-pandemic conditions. Moderate to high risk of service delay during extreme weather. <p><u>2023 - 2030:</u></p> <p>Bus Service</p> <ul style="list-style-type: none"> The average one-way travel time expected to increase by 15% to 20% (an additional five to eight minutes, Kennedy to Scarborough Centre) 	<ul style="list-style-type: none"> Crowding, travel time and wait time for customers would remain relatively unchanged from pre-pandemic conditions. Moderate to high risk of service delay during extreme weather. Minor risk of less reliable bus service across the system, as a result of older average bus fleet age and resulting less reliability of older buses. <p><u>2023 - 2030:</u></p> <p>Bus Service</p> <ul style="list-style-type: none"> The average one-way travel time expected to increase by 15% to 20% (an additional five to eight minutes, Kennedy to Scarborough Centre).

Option 1: Hybrid SRT and Bus Service to 2030	Option 2: SRT to 2023 and Bus Replacement Service 2023 to 2030 with new buses	Option 3: SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030
<ul style="list-style-type: none"> • SRT service levels will return to current 2020 levels, with five minute headways. (see risk section) • Crowding, travel time and wait time for customers would remain relatively unchanged from pre-pandemic conditions, if train operates reliably • Service reliability cannot be guaranteed during or after overhaul due to complex scope of planned interventions. Possible impact on service quality. • Moderate to high risk of failure during extreme weather over ten-year period. • Four of six stations, used by approximately 25% of SRT customers, will not be AODA compliant <p>Bus Service</p> <ul style="list-style-type: none"> • Customers will have a slower service, when bus service is deployed. • Bus service reliability will be impacted by traffic congestion and depends on level of transit priority on streets. Measures including transit signal priority, queue jump lanes, and/or reserved bus lanes, would reduce travel time for customers and increase reliability of the bus service. 	<ul style="list-style-type: none"> • Bus wait time would be substantially shorter than the scheduled pre-pandemic train service. • Bus crowding would be within service standards. • Expect to see decrease in ridership on the SRT corridor in 2023. • Of the 28,000 weekday customer-trips on buses that begin or end at Scarborough Centre Station, approximately 23,000 or 75% would save a transfer as their bus would be extended from Scarborough Centre to Kennedy. • Bus service reliability will be impacted by traffic congestion and depends on level of transit priority on streets. Measures including transit signal priority, queue jump lanes, and/or reserved bus lanes, would reduce travel time for customers and increase reliability of the bus service. 	<ul style="list-style-type: none"> • Bus wait time would be substantially shorter than the scheduled pre-pandemic train service. • Bus crowding would be within service standards. • Expect to see decrease in ridership on the SRT corridor in 2023. • Of the 28,000 weekday customer-trips on buses that begin or end at Scarborough Centre Station, approximately 23,000 or 75% would save a transfer as their bus would be extended from Scarborough Centre to Kennedy. • Bus service reliability will be impacted by traffic congestion and depends on level of transit priority on streets. Measures including transit signal priority, queue jump lanes, and/or reserved bus lanes, would reduce travel time for customers and increase reliability of the bus service.

Option 1: Hybrid SRT and Bus Service to 2030	Option 2: SRT to 2023 and Bus Replacement Service 2023 to 2030 with new buses	Option 3: SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030
Risk Assessment		
<p>High Risk</p> <p>Service reliability of the SRT train service cannot be guaranteed due to complexity of work to be undertaken. For example, there are zero complete spare VOBCs left in inventory or worldwide stock. Repairs have now moved to cannibalization of components to maintain the existing seven trains.</p> <p>There is a possible risk of two to three trains being available (2021-2024) if additional vehicle failure and obsolescence occurs. This would result in the implementation of a bus shuttle service, as running the SRT train service would no longer be viable.</p> <p>Complexity of targeted overhaul scope of work, has potential to result in high degree of scope, cost and schedule changes due to:</p> <ul style="list-style-type: none"> • Integrated approach required between vehicle and wayside and power upgrades; • Due to parts obsolescence, many major systems such as the brake and propulsion systems will require a complete re-design work on both the vehicle and wayside. 	<p>Low Risk</p> <ul style="list-style-type: none"> • Known ability to operate high-capacity express bus service, as is done currently on many major TTC corridors, and for SRT and other subways when train service disrupted • Speed and reliability of bus service dependent on transit priority measures that must be agreed with City of Toronto • Ability to deliver increased bus terminal facilities • Higher level of confidence in Option 2 cost and schedule estimate compared to Option 1. 	<p>Medium Risk</p> <ul style="list-style-type: none"> • Known ability to operate high-capacity express bus service, as is done currently on many major TTC corridors, and for SRT and other subways when train service disrupted • Speed and reliability of bus service dependent on transit priority measures that must be agreed with City of Toronto • Ability to deliver increased bus terminal facilities • Higher level of confidence in Option 3 cost and schedule estimate compared to Option 1. • Minor risk of less reliable bus service across the system, as a result of older average bus fleet age and resulting less reliability of older buses.

Option 1: Hybrid SRT and Bus Service to 2030	Option 2: SRT to 2023 and Bus Replacement Service 2023 to 2030 with new buses	Option 3: SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030
<ul style="list-style-type: none"> • Re-design work will require significant engineering investigation, prototyping and testing. • Significant engineering and OEM participation will be required. Identification and on-boarding of the proper technical expertise will be a challenge. 		
Community Impact		
<p>2021-2024 – 15 additional buses on corridor increasing traffic:</p> <ul style="list-style-type: none"> • The estimated number of residential properties impacted by additional bus routing on their street is approximately 188 (based on a sample routing) • 66 Commercial /industrial properties would be impacted by additional bus routing (based on sample routing) 	<p>2023-2030 – 60 additional buses on corridor increasing traffic:</p> <ul style="list-style-type: none"> • The estimated number of residential properties impacted by additional bus routing on their street is approximately 188 (based on a sample routing) • 66 Commercial /industrial properties would be impacted by additional bus routing (based on sample routing) 	<p>2023-2030 – 60 additional buses on corridor increasing traffic:</p> <ul style="list-style-type: none"> • The estimated number of residential properties impacted by additional bus routing on their street is approximately 188 (based on a sample routing) • 66 Commercial /industrial properties would be impacted by additional bus routing (based on sample routing)
Lifecycle Cost (2021-2030)		
<p>\$522.4 M High Cost Uncertainty</p> <p><u>Operating: \$248.6 million</u></p> <ul style="list-style-type: none"> • to operate the SRT from 2021 to 2030. • to operate supplementary bus service from 2021-2024. • to run accessible buses for AODA requirement from 2025-2030. 	<p>\$374.8 M Higher Level of Cost Certainty than Option 1</p> <p><u>Operating: \$266.1 million</u></p> <ul style="list-style-type: none"> • to operate the SRT from 2021 to 2023. • to operate replacement bus service with newer fleet from 2023 to 2030. 	<p>\$357.4 M Higher Level of Cost Certainty than Option 1</p> <p><u>Operating: \$280.8 million</u></p> <ul style="list-style-type: none"> • to operate the SRT from 2021 to 2023. • to operate bus service from 2023 to 2030 using spare buses from 2023 to 2026 and with newer fleet from 2027 to 2030.

Option 1: Hybrid SRT and Bus Service to 2030	Option 2: SRT to 2023 and Bus Replacement Service 2023 to 2030 with new buses	Option 3: SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030
<p><u>Capital: \$273.8 million</u></p> <ul style="list-style-type: none"> • \$265.6 million required to overhaul and upgrade the SRT vehicles trains and implement enhanced wayside and track SOGR work to support train service to 2030. Class 5 cost estimate (50 to 100% accuracy range). • \$17 million required to purchase 15 buses and allowance for mid-life refurbishment of buses. Note capital cost estimate for buses are Class 1 (based on existing contract price). • Residual value of buses in 2030 would be \$8.8 million. <p>It is assumed that in 2030, with the opening of SSE, the SRT would be decommissioned with little or no salvage value.</p>	<p><u>Capital: \$108.7 million</u></p> <ul style="list-style-type: none"> • \$85 million required to undertake state of good repair work on the trains to ensure safe operation to Q2 2023. An allowance for mid-life refurbishment of the buses has also been included. It also includes an allowance for the purchase/lease of property at Scarborough Centre for new bus bays, the costs for building new bus bays at Scarborough Centre and Kennedy as well as costs for required transit priority work along the routes (Class 3 estimate). • \$61 million required to purchase 60 buses. Note capital cost estimate for buses are Class 1 based on existing contract price. • Residual value of buses in 2030 would be \$37.3 million. <p>The buses would be in service past 2030 as they would only have been in service for half of their design life when SSE is completed. It therefore, represents beneficial value beyond 2030.</p>	<p><u>Capital: \$76.6 million</u></p> <ul style="list-style-type: none"> • \$61.1 million required to undertake state of good repair work on the trains to ensure safe operation to Q2 2023. Also includes an allowance for the purchase/lease of property at Scarborough Centre for new bus bays, the costs for building new bus bays at Scarborough Centre and Kennedy as well as costs for required transit priority work along the routes (Class 3 estimate). • \$67.3 million required to purchase 60 buses in 2027-2029. Note capital cost estimate for buses are Class 1 based on existing contract price. • Residual value of buses in 2030 would be \$51.8 million. <p>The buses would be in service past 2030 as they would only have been in service for few years when SSE is completed. It therefore, represents beneficial value beyond 2030.</p>

Notes on Costs:

- 1) *Option 1 is currently at Class 5 estimate.*
- 2) *Option 2 and 3 are mixture of Class 1 for buses and Class 3 for infrastructure costs.*

Options Analysis Summary

The targeted overhaul of the SRT trains and systems under Option 1 - Hybrid SRT and Bus Service to 2030 may not achieve the service reliability outcomes desired due to the age and condition of the systems and complexity involved with the overhaul work. Furthermore, with the complexity of integrating new propulsion, control and signaling systems there is a higher risk of cost and schedule overruns and subsequent further customer impacts may be experienced under Option 1. Simply put, with Option 1 being the highest cost option with life cycle cost of \$522.4 million and with high risk of not achieving the required service reliability, the Option 1 is not recommended for further consideration.

Option 2 – SRT to 2023 and Bus Replacement Service 2023 to 2030 with new buses and Option 3 - SRT to 2023 and Bus Replacement Service within current fleet 2023 to 2026 and new buses 2027 to 2030 are both low risk options for achieving the required service reliability and with lower life cycle cost: \$374.8 million for Option 2 and \$357.4 million for Option 3. Both options are also low risk option from a cost, schedule, and deliverability perspective and therefore are recommended for further consideration.

The bus service travel time would be longer, compared to the scheduled train service running at an expected level of reliability. Therefore, to mitigate the impacts on customers, various transit priority measures, including transit signal priority, queue jump lanes, and/or reserved bus lanes, would be implemented to reduce travel time and increase reliability of the bus service. Therefore, the TTC will continue to work with partners at the City of Toronto to introduce transit service priority measures to mitigate the impacts on customers by introducing a bus service under either option.

Public Outreach and Engagement

Communication and outreach is required to inform TTC customers, local communities and stakeholders in greater detail of the state of the SRT and significant risk and challenges of attempting to keep it safely operating until the opening of the SSE in 2030. Pending Board direction on the future of the SRT, staff will communicate this information in various channels and undertake public engagement modelled on the TTC's Annual Service Plan, to collect customer and community input to inform routing for bus services in the SRT corridor.

Metrolinx/Infrastructure Ontario

The TTC has been working closely with Metrolinx and IO throughout the process. In recent discussion, Metrolinx raised a possibility of utilizing the GO Transit's double decker buses for possible use. However, based on options assessed to date, GO buses would not be required.

The TTC will continue to work closely with Metrolinx and IO to ensure close coordination between SRT life extension initiative and SSE and ECLRT projects.

Next Steps

- Implement a public communications and consultation plan to:
 - inform TTC customers, local communities and stakeholders in state of the SRT and significant risk and challenges of operating until the opening of the SSE in 2030; and,
 - collect customer and community input to inform routing for bus services in the SRT corridor.
- Coordinate with key partners on following issues:
 - City of Toronto Transportation Services to develop priority transit measures to optimize the bus service along the corridor; and,
 - Metrolinx and IO for ongoing coordination between SRT Life Extension project and ECLRT project and SSE project.

Once the details of priority transit measures are developed with the City of Toronto and following the public engagement, staff will report back to the Board with the recommendation in the third quarter of 2021.

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Signature

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