



**For Action
with Confidential Attachment**

Automatic Train Control Contract Amendment

Date: July 14, 2023
To: TTC Board
From: Chief Capital Officer

Reason for Confidential Information

This report contains information about a trade secret or scientific, technical, commercial or financial information that belongs to the City or local board and has monetary value or potential monetary value.

Summary

The purpose of this report is to request the Board to approve a required contract amendment for the Line 1 Automatic Train Control (ATC) project. ATC has been successfully implemented on 79% of Line 1 Yonge-University, from Vaughan Metropolitan Centre to Eglinton Station, including Wilson Yard and Davisville Yard. The design, supply, testing and commissioning of the Line 1 ATC System is provided by Alstom Transport Canada Inc. (Alstom).

As identified in the previous Board report from December 8, 2021 entitled Lessons Learned and Program Update, the ATC Team has worked collaboratively with Alstom to identify functional enhancements to the ATC system which will be deployed as part of a Phase 6.

Phase 6 will commence after the system is in operation between Vaughan Metropolitan Centre to Finch Station. The extension of time to support the Phase 6 implementation requires an increase in the contract value awarded to the Alstom contract to support prolongation of substantial completion to Q1/Q2 2023.

As well as the changes for Phase 6, Alstom is required to relocate the station stopping location to support improved passenger exchange between Line 1 and the Eglinton Crosstown LRT. The station stopping location has moved approximately 24 metres North and requires software and changes to equipment at the station platform which is already in service.

Recommendations

It is recommended that the TTC Board:

1. Approve the recommendations set out in the Confidential Attachment.
2. Authorize that the information in the Confidential Attachment remains confidential until such time as the negotiations with Alstom are finalized and a contract amendment(s) are issued.

Financial Summary

Line 1 Yonge-University

Funds for this expenditure are included in the TTC's 2022-2031 Capital Budget and Plan, as approved by the TTC Board on December 21, 2021 and City Council on February 17, 2022 under Program 2.4 Signal Systems – YUS ATC Resignalling.

The total project budget for the YUS ATC Resignalling Project is \$737 million, comprising of costs to the end of 2021 of \$609.9 million and approved funding in the 2022-2031 Capital Budget and Plan of \$127.1 million. Of the total project cost, approximately \$638 million has been committed to date. Of the approved funding in the 2022-2031 Capital Budget and Plan, approximately \$28 million has been committed to date.

Some of the benefits realized to date from this project include service improvements, increased safety and cost savings:

- Travel times between the Vaughan Metropolitan Centre and Rosedale stations have improved on average by 3.5 minutes in each direction;
- Through run-as-directed trains, proactive station management and ATC service, on average the service delivered now meets the schedule, and on many occasions had exceeded a throughput of 28 trains per hour;
- By improving the reliability of the system and reducing the wayside equipment, maintenance activities have been able to refocus efforts to support other state-of-good-repair work;
- Reduction of Signal Violations on Line 1 by approximately 50% from 2017 to 2020;
- The TTC has realized \$0.921 million in annual savings as of 2022 from operator, traction power and maintenance savings due to less trains as a result of shorter ATC running time;
- TTC insurance renewals have benefitted from the implementation of ATC, as the industry acknowledges the safety benefits derived from ATC.

Additional financial details are contained within the Confidential Attachment.

The Chief Financial Officer has reviewed the report and agrees with the financial impact information.

Equity/Accessibility Matters

A cornerstone of the TTC's Corporate Plan 2018-2022 is accessibility, and we are committed to ensuring reliable, safe and inclusive transit services for all our customers. This is supported through the continued work of the ATC project, which will allow increased capacity and reliability on the TTC's Line 1 Yonge-University.

Implementation of the new ATC system requires numerous scheduled subway closures to safely install and test new signalling equipment. Frequent accessible shuttle buses are provided during these subway closures in order to accommodate all customers, as well as ensure Wheel-Trans service is available. Communications about the closures are made in numerous formats, including: audible announcements, posters in subway stations, media releases, TTC website and social media postings, and onsite Customer Service Ambassadors who are available throughout the closure zone to provide assistance.

Decision History

At its meeting on September 18, 2008, the TTC Board approved award of a contract (C31PV07834) for the design, supply and installation of a Computer Based Interlocking (CBI) signal system on the south Yonge portion of Line 1 (St Patrick to Eglinton stations) to Ansaldo STS USA Inc. This was initiated through a pre-qualified competitive procurement process.

At its meeting on April 27, 2009, the TTC Board approved a contract award (C31PV08752) to Alstom for the design, supply and installation of an Urbalis 400 ATC/CBTC (Automatic Train Control/Communication Based Train Control) system on the entire Line 1, and supply of ATC equipment for installation on 39 Toronto Rocket subway trains through a publicly advertised competitive procurement process.

At its meeting on April 6, 2011, the TTC Board approved a contract change (issued June 2011) to Alstom to increase the supply of ATC/CBTC equipment for Toronto Rocket subway trains to 60 trains from 39 (21 sets of equipment). Minutes of the Board meeting are available on the TTC website. Refer to agenda Item 5 in the following link:

https://ttc-cdn.azureedge.net/-/media/Project/TTC/DevProto/Documents/Home/Public-Meetings/Board/2011/April-6/Reports/Procurement_Auth_Ame.pdf

At its meeting on March 30, 2012, the TTC Board approved award of contracts in March 2012 for design, supply and installation of a Computer Based Interlocking (CBI) signal system for the remainder of Line 1 in four phases, including a CBI signal system for a test track in Wilson Yard [C31PV11825] and for the addition of a new CBI-based signal system for the TYSSE line [Contract A70-9] to Ansaldo STS USA Inc. through a pre-qualified competitive procurement process. Minutes of the Board meeting are available on the TTC website. Refer to agenda Item 13 in the following link:

https://ttc-cdn.azureedge.net/-/media/Project/TTC/DevProto/Documents/Home/Public-Meetings/Board/2012/March-30/Reports/13_PA_Design_Supply_Ins.pdf?rev=e484174a4fe84e4f954602b9f33a9000&hash=6FE3CB79E69DE8DAB8FCCDF1008F27E0

A contract change was issued January 2013 to Alstom to increase the supply of ATC/CBTC equipment for Toronto Rocket subway trains to 70 trains from 60. Approval for this contract change was within staff's signing authority under the Authorization for Expenditures and Other Commitments Policy.

At its meeting on April 30, 2014, the TTC Board approved changes to the contract scope and schedule with Alstom for design, supply and installation of ATC/CBTC on the entire Line 1, and supply of ATC/CBTC equipment for an additional 10 Toronto Rocket subway trains. Minutes of the Board meeting are available on the TTC website. Refer to agenda Item 5a in the following link:

https://ttc-cdn.azureedge.net/-/media/Project/TTC/DevProto/Documents/Home/Public-Meetings/Board/2014/April-30/Reports/Procurement_Authorization_Amendment_TYSSE_Contract_No_A8570_.pdf

At its meeting on March 26, 2015, the TTC Board approved the changes to the TTC's resignalling contract transferring the previously contracted work from Ansaldo STS USA Inc. to Alstom. This change had no impact to the existing approved budget of \$563 million and scheduled completion date of 2020.

<https://ttc-cdn.azureedge.net/-/media/Project/TTC/DevProto/Documents/Home/Public-Meetings/Board/2015/March-26/Reports/52StaffReportAttachment.pdf?rev=85d2e580283b40de91a6ba5b6d3ede47&hash=C5FAD5F9D8D5D38272AD2EC0C6DC6A72>

At its meeting on January 24, 2019, the TTC Board received the Financial Update for the period ended September 29, 2018, including the update on the ATC/CBTC project identifying the requirement for an additional \$98 million as a result of the longer project duration, additional required subway closures, and additional scope for Automatic Train Protection for workcars.

https://ttc-cdn.azureedge.net/-/media/Project/TTC/DevProto/Documents/Home/Public-Meetings/Board/2019/January_24/8_Financial_Update_for_the_Period_Ended_September_29_2018.pdf?rev=627dd31fc5b04f1b978e186385d4eed3&hash=E32BF4E6BFF517CF7F8ADF2E4E2188E5

At its meeting on January 24, 2019, the TTC Board approved the TTC's 15-Year Capital Investment Plan and 2019-2028 Capital Budget and Plan, including the increase of \$98 million identified in the January Board Report for the ATC/CBTC project.

https://ttc-cdn.azureedge.net/-/media/Project/TTC/DevProto/Documents/Home/Public-Meetings/Board/2019/January_24/10_TTC_15_Year_CIP_2019_2028_Capital_Budget.pdf?rev=f310dd76b14841528800852b783d6a2b&hash=8DFFF4330DE1C50943EBAFEA0AB9330D

At the Special City Council Meeting on March 7, 2019, City Council approved the TTC's 2019-2028 Capital Budget, including the increase of \$98 million identified in the January Board Report for the ATC/CBTC project.

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2019.EX2.5>

At its meeting on April 11, 2019, the TTC Board endorsed the re-baselining of the ATC/CBTC project. This baseline included a revised project completion date of September 2022.

https://ttc-cdn.azureedge.net/-/media/Project/TTC/DevProto/Documents/Home/Public-Meetings/Board/2019/April_11/Reports/17_Automatic_Train_Control_Re-Baselining_and_Transit_Systems.pdf?rev=6b74a5815ecf491f8a07079526a724f0&hash=B536B0CA2BECA9D9DA5222673BD66AF0

At its meeting on January 27, 2020, the TTC Board approved the Confidential Attachment associated with the re-baselining of the ATC/CBTC project identified in the April 11, 2019 meeting. As part of the decision, the ATC program was asked to conduct an extensive Lessons Learned on Line 1 implementation prior to Line 2.

https://ttc-cdn.azureedge.net/-/media/Project/TTC/DevProto/Documents/Home/Public-Meetings/Board/2020/January_27/Reports/3AutomaticTrainControlContractAmendment.s.pdf?rev=504ae4089cb344b987f6389795e5d1b3&hash=5A2F5031B78405BC654D12A798A8DEE6

https://ttc-cdn.azureedge.net/-/media/Project/TTC/DevProto/Documents/Home/Public-Meetings/Board/2020/January_27/Reports/Decisions/3_Automatic_Train_Control_Alston_Contract_Amendment_Decision.pdf?rev=eac56505c2c3483a9cc8e29ba67bfd8a&hash=ED7E57B0776659C2BFD7250E9D45F0C5

At its meeting on December 8, 2021, the TTC Board approved to receive a report on Lessons Learned and Program update on the ATC program. This report identified a set of Lessons Learned and Updates, including the identification of a new Phase 6 to provide operational functional improvements after full system deployment.

https://ttc-cdn.azureedge.net/-/media/Project/TTC/DevProto/Documents/Home/Public-Meetings/Board/2021/December-8/5_Automatic_Train_Control_Lessons_Learned_and_Program_Update.pdf?rev=0e8dd0616d2f483a842016806ed5ef16&hash=862470A6592ED5E028EBD7FA351FD8F3

https://ttc-cdn.azureedge.net/-/media/Project/TTC/DevProto/Documents/Home/Public-Meetings/Board/2021/December-8/Decisions/2060_5_Automatic_Train_Control_Lessons_Learned_and_Program_Update_Decision.pdf?rev=09ae3e0035f343009ed65c5b7eac8318&hash=322228C9DCA22BCEDE54E088D37F8F5C

Issue Background

Line 1's conventional "fixed block" signal system has been in place since the subway opened on March 30, 1954, more than 68 years ago. A fixed block signal system divides the subway line into geographical blocks. Only one train at a time is allowed in each block, while the adjacent blocks provide a buffer zone. While this system remains safe for operations, and despite staff's significant focus on preventive and corrective maintenance, its reliability is diminishing. The replacement of the current signalling system will improve the journeys for 825,000 customers (2019, pre-COVID-19) that use Line 1 every weekday by improving reliability and providing faster travel times. Furthermore, the new signalling system will provide the capacity required to serve more than 1.1 million weekday customers that are projected to use Line 1 in 2041.

From 2006, the TTC has incrementally awarded contracts to address the immediate-, medium- and long-term challenges related to the resignalling of Line 1 and the Toronto-York Spadina Subway Extension (TYSSE), which opened in 2017.

Resignalling of Line 1 with ATC/CBTC includes the design, installation testing and commissioning of an interface to the existing Centralized Signalling System (CSS). It also includes the design, installation, testing and commissioning of ATC train-borne equipment on the Line 1 Toronto Rocket fleet.

The ATC/CBTC system is very complex and the installation, testing and commissioning activities can only be performed during non-revenue hours or scheduled subway closures. The replacement of the legacy "fixed block" system with an ATC/CBTC system allows the system to govern train movements, and rather than develop defined blocks to separate trains, an ATC/CBTC system allows the system to determine safe train movements based on a number of factors, including train speed, track geometry and obstructions along the line. The system sets a movement authority to allow trains to travel safely and efficiently along the guideway. This allows trains to safely run closer and improves system capacity.

The resignalling of Line 1 will improve reliability and increase capacity on Canada's busiest subway line. The ATC/CBTC system provides the benefit of real-time central train control with precise train location. With ATC/CBTC, train speed and separation between trains controlled automatically through a moving block system, as opposed to a fixed block system, allowing for reduced travel times and more reliable service.

The completion of ATC deployment on Line 1 and Line 2 are integral objectives set out in the Capital Investment Plan and form a key element to improving the overall system capacity to support the growing and future demand on the TTC subway system.

Line 1 and Line 2 are part of Capacity Enhancement Programs to improve the reliability and system capacity of each line. ATC is part of this larger initiative that includes: traction power upgrades; new and/or replacement subway trains; improvements to station layout; second exits to improve station capacity; and making safety-related improvements, such as expanding emergency exit buildings and installing new or upgraded ventilation plants.

In Q3 2021, Phase 4 (Rosedale to Eglinton) was commissioned, enabling ATC/CBTC from Vaughan Metropolitan Centre Station to Eglinton Station. ATC/CBTC is progressing well in the next phase on Line 1, Phase 5 (Eglinton to Finch) and is scheduled for revenue service in September 2022. As well, 19 subway work cars have been equipped to support safe operation of maintenance vehicles.

Benefits to Date

ATC operates between Vaughan Metropolitan Centre and Eglinton stations, which represents approximately 79% of Line 1. Travel times between Vaughan Metropolitan Centre and Rosedale stations have improved on average by 3.5 minutes in each direction. Before the COVID-19 pandemic, customers riding southbound from St George to Museum stations experienced an approximate 8% increase in the number of trains per hour. This is the equivalent to 1.8 additional trains or capacity for an additional 2,000 passengers, more reliable service and fewer delays due to signalling issues. The introduction of ATC on Line 1 has also resulted in a significant reduction of Signal Violations on Line 1 by approximately 50% from 2017 to 2020.

ATC's positive impact extends throughout the entirety of Line 1, even where ATC is currently not installed. Before the pandemic, the scheduled southbound service in the morning peak at Bloor-Yonge Station was 25.5 trains per hour, whereas previously achieved service was approximately 22 trains per hour. Through run-as-directed trains, proactive station management and ATC service, on average the TTC operates 25.5 trains per hour as scheduled, and has exceeded a through-put of 28 trains per hour prior to the pandemic. As the city recovers, this improved service reliability and capacity will be critical to attracting customers back to the system.

Assuming 2019 demand, the economic benefit generated by time savings due to ATC on the converted portion of Line 1 (Rosedale to Sheppard West), based on reduced trip time and fewer delays, is \$219,000 a day (based on a value of time of \$17.50/hour, consistent with Provincial's valuation of customer time). The annualized benefit is approximately \$67 million per year. Even during the pandemic, assuming November 2020 ridership levels (22% of normal ridership), the economic benefit of ATC is valued at \$49,000 per day, due to reduced trip times and fewer delays. November 2020 ridership was referenced as it was the last month prior to lockdown. (Note: the benefit is higher when comparing the stretch from Rosedale to Vaughan Metropolitan Centre. However, there is no previous comparison for the TYSSE segment as it opened with ATC).

The implementation of ATC on Line 1 has also had a benefit to on-going maintenance programs. By improving the reliability of the system and reducing the wayside equipment, maintenance resources have been realigned to support other critical state-of-good-repair work. Signals Maintenance crews have increased switch inspections by 31% from 2019 to 2020, and have further increased inspections by an additional 25% as of June 2021. As a result, switch faults have decreased by 60% on Line 2 and 16% on Line 1, since 2018.

Comments

On Saturday, September 11, 2021, Line 1 ATC/CBTC was extended to Eglinton Station. This was a significant milestone in the delivery of the Line 1 ATC program. The remaining scope for Line 1 is presented below.

ATC Phases	Construction and Installation of ATC Assets	Testing	In Service Date	Status
Phase 1 (Yorkdale to Dupont)	100%	100%	Q4 2017	Completed
Phase 2 (VMC to Sheppard West)	100%	100%	Q4 2017	Completed
Phase 2B/2C (Wilson Yard Interface)	100%	100%	Q4 2018	Completed
Phase 3A (Dupont to St Patrick)	100%	100%	Q2 2019	Completed
Phase 3B (St Patrick to Queen)	100%	100%	Q1 2020	Completed
Phase 3C (Queen to Rosedale)	100%	100%	Q4 2020	Completed
Phase 4 (Rosedale to Eglinton)	100%	100%	Q3 2021	Completed
Phase 5 (Eglinton to Finch)	100%	85%	Q3 2022	On Schedule
Phase 6 (System Wide)	N/A	0%	Q1/Q2 2023	Defined

Phase 6 Deployment

The scope of Phase 6 has been assessed based on the state of the current implementation and testing for Phase 5. The identified scope of Phase 6 includes both functional fixes to ongoing revenue issues as well as functional improvements changes. The functionality involves non-safety critical functional implementations and are focused on the Central Signal System (CSS) and the Data Communication Systems (DCS). Phase 6 updates to the CSS and DCS will include improvements and enhancements to the visual display, additional alarms, routing features, communications enhancements, and final fibre configurations. Phase 6 will also be planned to include the software and hardware updates as required to modify the ATC Eglinton platform station stopping locations.

The expected completion of the Phase 6 is Q1/Q2 2023 followed by a reliability demonstration period of six months resulting in full contract completion in Q3/Q4 2023.

Eglinton Station Modification

Phase 4 went into revenue service in September 2021. At the time, the ATC system had to be deployed with the trains stopping at the existing station stopping location. The ATC system requires accurate station stopping locations to be coded into the system to ensure train operation, and passenger exchange at the platform is safe and efficient.

With the integration of the Crosstown LRT (Line 5), the proposed Eglinton station stopping location is required to move approximately 24m north to facilitate better passenger transfers and improve customer experience. As the station is in operation, the ATC contractor is required to “move” the station stopping point to accommodate this change.

The work involves software updates and changes to signal locations and other trackside equipment. The predicted cost of this change is included in the Confidential Attachment, but remains subject to final negotiations with Alstom.

Future Approvals

In early 2023 the project will be coming back to the Board with a final contract closeout recommendation with respect to finalization of the workcar program and an extended warranty period for the Line 1 ATC system.

Contact

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Signature

Gary Downie
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Attachments

Confidential Attachment 1

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