

Date: 2022-04-13

Subject: eBus Trial Update (Phase I)

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Report Number: Brampton Transit-2022-403

Recommendations:

1. That the report from Alex Milojevic, General Manager, Transit, dated April 13, 2022, to the Committee of Council Meeting of April 27, 2022 re: eBus Trial Update (Phase I) (Report Number Brampton Transit-2022-403, IB.C), be received.

Overview:

- Update on the status of the CUTRIC Pan-Canadian Battery Electric Bus Demonstration & Integration Trial - Phase I (Trial).
- Eight (8) battery electric zero tailpipe emission buses (BEBs) were introduced into service with two BEBs beginning on May 4, 2021 and full deployment of eight BEBs on June 28, 2021.
- The BEBs have now travelled over 270,000 kilometres and operated over 12,000 service hours.
- The efficiency performance of the BEBs, based on average energy consumed (kWh/km), is surpassing the predictive modelling generated by CUTRIC for the Trial.

Background:

This report provides an update of the Brampton Transit eBus Trial (Phase I). Council approved the following (which was number two of seven recommendations) on September 30, 2020 (CW216-2020):

2. *That the General Manager, Transit will report back in 2022 on the status of battery-electric bus trial (eBus) Phase I following a period of one year after the official start of service with the new electric buses;*

With City Council's unanimous support and approval, Brampton Transit, publically introduced the City's first-ever zero tailpipe emission battery electric buses (BEBs) on May 3, 2021, as part of the Pan-Canadian Battery Electric Bus Demonstration and Integration Trial - Phase I (Trial).

Brampton Transit has shown how industry collaboration and utilizing technological advancements can provide better service for our residents. The successful launch of the Brampton Trial represented the largest global deployment to date of standardized and fully interoperable battery electric buses and high-powered overhead on-route charging systems. This was an amazing achievement by our partners in the face of a global pandemic; Canadian Urban Transit Research and Innovation Consortium (CUTRIC), York Region Transit (YRT), TransLink, New Flyer and Nova Bus, Siemens, and ABB.

Current Situation:

Eight BEBs were introduced into service on two routes, in a phased approach, as noted in Table 1 below:

Table 1 – BEB Trial – Phase I: Routing and Fleet

| BEB Trial Phase | Launch Date | BEBs |
|--|---------------|--|
| Stage 1: Route 23 – Sandalwood | May 4, 2021 | (x2) Nova Bus LFSe; - 76 kWh batteries on board |
| Stage 2: Route 26 – Mount Pleasant Village | June 28, 2021 | (x6) New Flyer Xcelsior Charge; - 213 kWh batteries |

The BEBs are charged with four (4) high-powered 450 kW overhead opportunity chargers: one (1) from Siemens installed at the Sandalwood Transit Facility and three (3) ABB installed on street with two (2) at Mount Pleasant Village and one (1) at Queen Street and Highway 50 Züm station stop. Refer to Appendix A for additional route and eCharger location details.

BEB Performance

After almost 8 months of service, the BEBs are performing as expected. Efficiency results are in keeping with the predictive modelling previously completed by CUTRIC for these two routes. Refer to Tables 2 and 3 below for a BEB service summary (life-to-date or LTD) for the period July 19, 2021 through March 27, 2022:

Table 2 – BEB Trial - Phase I: LTD Statistics

| Item | Unit | Value |
|---------------------|-----------------------|--------------------|
| In-Service Duration | Months / days / hours | 8 / 235 / 12,000 |
| In-Service Distance | Kilometers | 270,000 (combined) |

As noted in Table 3 below, one of the key performance indicators of a BEB fleet is the amount of energy consumed while the BEB is operating, on a per kilometer basis. This includes energy recovered through regenerative braking, and is indicative of how efficient the BEB is operating.

As part of the Phase I Trial planning, the expected energy consumption for the eight BEBs operating in the trial was completed by CUTRIC as part of a techno-economic predictive modelling exercise of the two Trial routes.

Table 3 – BEB Trial – Phase I: LTD Performance Indicators

| Item | Unit | Value |
|--------------------------------------|---------------|--------------------------------|
| Service Distance | Kilometers | 270,000 (combined) |
| Diesel Fuel Saved | Litres | 109,000 (combined) |
| Actual BEB Energy Consumed | kWh/km | 1.04 to 1.31 (averaged) |
| <i>Predicted BEB Energy Consumed</i> | <i>kWh/km</i> | <i>1.08 to 1.78 (averaged)</i> |

Based on the results LTD over the course of the Trial, actual energy consumption is favourable when compared to the *predicted values prepared by CUTRIC (noted in Table 3 above)*. Additionally, it is encouraging to note that these average values are reflective of cabin heating demands during the harshest winter months (December through March). Overall staff have been pleased with the performance of the BEBs thus far.

eCharger Performance

After almost 8 months of service, the eChargers are generally operating as expected. The eCharger reliability is steadily improving as our collective experience grows. Staff actively monitor the operation of the eChargers on a daily basis and communicate closely with our Trial partners to resolve issues as expeditiously as possible, providing the maximum available uptime on a consistent basis.

Refer to Appendix B for additional experiential commentary regarding Successes, Challenges, Operations & Maintenance, and Future Considerations.

GHG Reductions

Transit accounts for almost 71% of the Corporate City of Brampton GHG emissions¹. The total GHG emissions produced by the Brampton Transit Bus fleet in 2020 was estimated to be approximately 54,400 tCO₂eq/year, based on CUTRIC's analysis.

Based on the predictive modelling completed by CUTRIC for the two Trial routes, emission savings of 235 tCO₂eq/year/bus, or a total reduction of approximately 1,900 tCO₂eq/year for the eight (8) BEBs should be realized.

These reductions directly support the City of Brampton's interim GHG reduction targets:

- Short-term: 20% GHG emission reduction target by 2024.
- Long term: targets to achieve GHG emission reductions of 30% in 2030 and 80% in 2050.

¹ Based on the 2018 data; City of Brampton Community Energy & Emissions Reduction Plan (CEERP) and Environmental Master Plan Refresh (Brampton Grow Green).

CUTA Award

In October 2021, at the Canadian Urban Transit Association's (CUTA) Annual Conference and Transit Show (Virtual 2021), Brampton Transit was nominated for and was the proud recipient of an Environmental Sustainability Award from CUTA² for the City's milestone electric bus Trial.

The CUTA Environmental Sustainability award category recognizes businesses and transit systems whose activities or projects achieved a positive impact on current environmental issues and challenges facing the transit industry. The outcomes may include entirely new concepts, processes or the redevelopment of existing equipment that result in protection of scarce resources, cost saving or measurable environmental benefits, in alignment with CUTA's Transit Vision 2040.

ZEB Trial - Phase II

The scope of the Phase I BEB Trial is being expanded to include additional ZEB propulsion technologies. Based on funds approved within the 2022 Capital Budget, as part of an expanded Phase II ZEB Trial, the following zero-tailpipe emission buses are proposed to be added to the Brampton Transit fleet in 2023/24:

- An additional ten (10) BEBs to fully electrify the Route 23 – Sandalwood; and,
- Two (2) hydrogen fuel cell battery electric buses (FCEB); and,
- Conversion of up to three (3) diesel / diesel-electric hybrid buses to fully electric, zero-tailpipe emission buses.

EOI's have been submitted to INFC for ZETF funding of these Phase II projects, and staff are continuing to work closely with INFC to submit the required full applications.

Phase I Trial Funding:

Both the federal and provincial governments made funding commitments to Brampton's eBus Phase I Trial. However, following the 2018 provincial elections, the province eliminated the Provincial Carbon Tax and Greenhouse Gas Reduction Account, which withdrew the provincial funding previously committed to the Trial. Staff worked diligently with Council, and our (then) Brampton MPs to identify alternate funding sources to cover the \$3.8M gap.

In strong support of this Trial, the Government of Canada decided to fund the provincial shortfall, and contributed 70% of the total project costs with funding totaling \$11.2M. Natural Resources Canada (NRCan) provided funding under two funding streams: \$3.5M through the Electric Vehicle Infrastructure Demonstration (EVID) program, and \$7.7M through the Energy Innovation Program (EIP). The City funded the remaining 30% of the project. NRCan will release the final 10% holdback to the City upon closure of the Trial, ending in December of 2023.

² <https://www.brampton.ca/EN/City-Hall/News/Pages/Media-Release.aspx/972#:~:text=%E2%80%99CCongratulations%20to%20Brampton%20Transit%20on,Canada%20meet%20its%20climate%20targets.%E2%80%99>

Corporate Implications:

Financial Implications:

There are no financial implications regarding the Trial at this time.

Term of Council Priorities:

Transitioning to a green and sustainable transit fleet through electrification supports the Brampton 2040 Vision and the 2019-2022 Term of Council Priorities, which established commitments to improve transit, implement a green framework for sustainable growth, and lead in environmental innovation. It also builds on Council's Climate Emergency declaration in support of building a Green City, and helps to achieve the goals established by the Government of Canada including the ultimate goal of becoming net zero emissions by 2050.

The Trial has contributed to global interest in Brampton furthering our reputation as a well-connected, environmentally sustainable, and innovative transit network.

Conclusion:

With about 8 months of full operation, including the harsher winter months, the Brampton Phase I BEB Trial with eight (8) BEBs in service has logged about 270,000km of service. The Trial has been successful to date by demonstrating and exceeded the expected vehicle energy efficiencies predictively modelled by CUTRIC for the two routes.

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Attachments:

Appendix A – BEB Trial – Phase I: Routes and eCharger Locations

Appendix B – BEB Trial – Phase I: Successes, Challenges, Operations & Maintenance, Future Considerations.