If this information is required in an accessible format, please contact 1-800-372-1102 ext. 3702

Transit Executive Committee Agenda

Council Chambers
Regional Headquarters Building
605 Rossland Road East, Whitby

Wednesday, June 8, 2022 **1:30 PM**

Please note: In an effort to help mitigate the spread of COVID-19 and to comply with public health measures, this meeting will be held in a hybrid meeting format with electronic and limited in-person participation. It is encouraged that members of the public view the Committee meeting via live streaming, instead of attending the meeting in-person. If in-person attendance is required, arrangements must be made by emailing clerks@durham.ca prior to the meeting date. Individuals are required to complete passive screening prior to entering Regional Headquarters and must wear a mask or face covering while on the premises.

1. Roll Call

2. Declarations of Interest

3. Adoption of Minutes

A) Durham Region Transit Executive Committee meeting – May 4, 2022 Pages 3-10

4. Delegations

5. Presentations

A) Bill Holmes, General Manager, re: General Manager's Verbal Update

B) Jamie Austin, Deputy General Manager, Business Services, Durham Region Transit, re: E-Mission Zero - DRT Fleet Electrification Plan (2022-DRT-10) [Item 7.B] Pages 11-25

6. Correspondence

7. Reports

A) General Manager's Report – June 2022 (2022-DRT-09) Pages 26-40

B) E-Mission Zero – DRT Fleet Electrification Plan (2022-DRT-10) Pages 41-104

C) Amending Agreement to the Metrolinx - 905 PRESTO Operating Agreement (2022-DRT-11) Pages 105-109

D) Durham Region Transit Advisory Committee (TAC) Terms of Reference (2022-DRT-12) Pages 110-119

E) Update Demand Response Service (2022-DRT-13) Pages 120-125

8. Advisory Committee

9. Confidential Matters

Confidential Report of the General Manager – matters subject to labour relations/employee negotiations and advice subject to solicitor-client privilege with respect to DRT Collective Bargaining Update (2022-DRT-14) Under Separate Cover

10. Other Business

11. Date of Next Meeting

Wednesday, September 7, 2022 at 1:30 PM

12. Adjournment

Notice regarding collection, use and disclosure of personal information:

Written information (either paper or electronic) that you send to Durham Regional Council or Committees, including home address, phone numbers and email addresses, will become part of the public record. This also includes oral submissions at meetings. If you have any questions about the collection of information, please contact the Regional Clerk/Director of Legislative Services

If this information is required in an accessible format, please contact 1-800-372-1102 ext. 2097.

The Regional Municipality of Durham

MINUTES

DURHAM REGION TRANSIT EXECUTIVE COMMITTEE

Wednesday, May 4, 2022

A regular meeting of the Durham Region Transit Executive Committee was held on Wednesday, May 4, 2022 in the Council Chambers, Regional Headquarters Building, 605 Rossland Road East, Whitby, Ontario at 1:30 PM. Electronic participation was offered for this meeting.

Present: Commissioner Collier, Chair
Commissioner Barton, Vice-Chair
Commissioner Anderson
Commissioner Carter
Commissioner Drew
Commissioner Mulcahy
Commissioner Pickles
Commissioner Smith
Regional Chair Henry

Also Present: Commissioner Crawford attended the meeting at 1:43 PM
Commissioner Grant

Staff Present: E. Baxter-Trahair, Chief Administrative Officer
W. Holmes, General Manager, Durham Region Transit
J. Austin, Deputy General Manager, Business Services, Durham Region Transit
M. Binetti, Transportation Service Design, Durham Region Transit,
R. Inacio, Systems Support Specialist, Corporate Services – IT
A. Naeem, Solicitor, Corporate Services – Legal Services
C. Norris, Deputy General Manager, Operations, Durham Region Transit
N. Ratti, Manager, Policy & Planning, Durham Region Transit
N. Prasad, Assistant Secretary to Council, Corporate Services – Legislative Services
K. Smith, Committee Clerk, Corporate Services – Legislative Services

At the request of the Chair, Vice-Chair Barton assumed the position of Chair for the remainder of the meeting.

1. Declarations of Interest

There were no declarations of interest.

2. Adoption of Minutes

Moved by Commissioner Carter, Seconded by Commissioner Smith,
(12) That the minutes of the regular Durham Region Transit Executive Committee meeting held on Wednesday, April 6, 2022, be adopted.
CARRIED

3. Delegations

3.1 Tina Henderson, Durham Resident, re: Inability to reliably use Durham Region Transit's On Demand Service

Tina Henderson, Durham Resident, appeared before the Committee regarding challenges using Durham Region Transit's On Demand Service.

T. Henderson provided her experience with using DRT's On Demand service throughout the pandemic. She stated that she is required to place an online order for an arrival or departure time and has had the system fail once every 3 to 4 weeks over the last 18 months.

T. Henderson stated that due to the challenges she has faced with the On Demand service, she received a letter of reprimand in her personnel file at work because of tardiness. She also stated that she has been employed with the same company for 17 years and indicated that has never happened before.

T. Henderson stated that she has put in multiple complaints with DRT about the On Demand Service. She stated that when she is booking her trip and puts in a "to depart time" and not a "to arrive time", the bus route at times takes her all through Ajax and Pickering causing her to miss 2-3 trains by the time she arrives at the Ajax GO station. She was told that to prevent this from happening she needs to put in a "to arrive time", but that results in her pickup time being several hours before the arrival time.

T. Henderson stated that it is impossible to use the On Demand service to get to and from work and that she has put in over 22 complaints about the On Demand service. She requested that the DRT regular service busses get put back in service now, not when the ridership increases.

T. Henderson responded to questions of the Committee.

B. Holmes responded to questions with regards to reintroducing scheduled service in areas across Durham Region; On Demand is increasingly being adopted across the County to support areas of low transit ridership; continued enhancements to the On Demand service; resource availability challenges recently and throughout the pandemic; the DRT service model adjusting to

ridership demand through the pandemic within budget; and continued adjustments and transit network investment required in years ahead.

4. Presentations

4.1 Bill Holmes, General Manager, re: General Manager's Verbal Update

B. Holmes, General Manager, Durham Region Transit, provided a verbal update regarding On Demand trips; funding announcements; annual sod repair; new vendor supporting demand response; 2021 safe driver awards; and enhancing the transit network for residents.

B. Holmes stated that at the request of Commissioner Smith, DRT will now be reporting monthly On Demand Trips by municipality. He advised that Clarington accounted for 50 per cent of the On Demand trips for the rural areas of Durham Region and Brock accounted for 35 per cent of the On Demand trips for northern municipalities averaging over 550 trips per month.

B. Holmes advised that the federal government recently announced it would provide up to $750 million in additional operating support for public transit, which was contingent on matching funds from the provinces. He noted that, the recent Ontario budget confirmed the commitment to match the $316 million funding

B. Holmes stated that they have began their annual sod repair to bus stops and any adjacent lawns that were damaged by DRT salting and snow clearing activities. He advised that the work is expected to be completed by June.

B. Holmes advised that there will be a new vendor Voyago Transit, beginning to operate on June 1, 2022 supporting demand response services (specialized services and On Demand). He also advised that an update on the transition to amalgamate demand response services will be provided at the June 8th meeting.

B. Holmes also advised that the 2021 Safe Driver awards will recognize the 32 bus operators as highlighted in the General Manager's Report.

B. Holmes stated that the transit network is evolving and improving access and reducing travel times for residents. Citing a recent review for service to the north campus complex in Oshawa, he noted 90,000 additional Durham residents can now access the north campus with a direct trip compared to the pre-COVID transit network, and 221,000 additional residents can access the north campus with a one transfer or less trip compared to the pre-COVID transit network. He also stated that the transit network is evolving, improving access and reducing travel times by advancing the transit network to enhance access, improve frequency, and increase reliability of the network.

B. Holmes discussed that increasing frequency of transit services will contribute to higher increase in ridership than other interventions such as fare incentives, and headways of 15 minutes or less provide a competitive transportation alternative that increases service quality for current and discretionary customers.

B. Holmes stated that there are other factors that affect ridership and impact the cost to deliver public transit, such as density.

B. Holmes shared that DRT is not looking backward at what used to be, rather, DRT continues to respond to current realities while planning forward. The Region is building a transit network for all residents, increasing revenue services and capacity that will support the necessary modal shift to public transit, supporting livable communities across the Region, and benefiting all sectors of the local economy.

4.2 Christopher Norris, Deputy General Manager, Operations, re: Upcoming Service Updates

C. Norris, Deputy General Manager, Durham Region Transit, provided a PowerPoint presentation regarding the Upcoming Service Updates. A copy of the presentation was provided to Committee members prior to the meeting.

C. Norris introduced M. Binneti, Supervisor Service Design, who provided the presentation.

Highlights of the presentation included:

- Service Implementation Considerations
  - The Route Ahead – Service Strategy 2022-2025
  - Service Guidelines
  - Social Equity Guidelines
- June 2022 – Highlights
  - Expanding the PULSE rapid bus network
  - Supporting seasonal travel patterns
- 224C to Ajax Waterfront
  - Service Change: weekday evening, weekend and holiday seasonal service to Ajax waterfront reinstated
  - Developing Markets: recreational/seasonal travel
- PULSE 901/N2 to Windfields Farms
  - Service Change: service extended from North Campus to Simcoe and Windfields Farm Drive and 10-minute frequency reinstated on weekday daytime
  - Expanding PULSE Rapid bus: aligns with The Route Ahead to expand PULSE rapid bus service
  - Developing Transit along High Demand Corridors: density of development in the area supports PULSE rapid bus service
- 917Z to Toronto Zoo/Rouge Park
  - Service Change: weekend and holiday seasonal service to the Toronto Zoo and Rouge National Urban Park and every 30 minutes between 8:30 and 20:00
  - Service Integration: additional integration with TTC
  - Developing markets: recreational/seasonal travel and expanding service levels compared to Summer 2021 due to growing demand

- September 2022 – Highlights
  - Align service levels with projected demand
  - Supporting general ridership growth including secondary and post-secondary student markets
- Frequency Increases
  - Service Change – PULSE 900 and 920
- 211 Northwest Ajax and East Pickering
  - Service Change: new route linking Ajax Station and Pickering Parkway Terminal via Church and Ravenscroft
  - Service Integration: GO Rail and Bus
  - Developing Markets: secondary school travel
- 216, 216C to Williamson Drive
  - Service Change: service increase to every 15-minutes during weekday AM & PM peak periods and every second trip during the weekday AM/PM period to extend to Williamson Drive and Audley Road
  - Developing markets: secondary school travel
- 222 Audley South
  - Service Change: New route between Ajax Station and southeast Ajax during weekday AM and PM peak period
  - Service Integration: GO Rail and Bus
  - Developing Markets: secondary school travel
- 409 West Oshawa and East Whitby
  - Service Change: new weekday daytime route between Oshawa Centre and Taunton and Thicken via Garrad Road and Stevenson Road
  - Developing Markets: secondary school travel and employment in commercial areas
- 411 Routing Updates
  - Service Change: updates to routing in south Courtice and extension of weekday AM/PM peak service to Oshawa station
  - Service Integration: GO Rail and Bus
  - Developing Markets: secondary school travel and employment in industrial areas

5. Correspondence

There were no correspondence items to be considered.

6. Reports

A) General Manager's Report – May 4, 2022 (2022-DRT-05)

Report #2022-DRT-05 from B. Holmes, General Manager, Durham Region Transit, was received.

Moved by Commissioner Mulcahy, Seconded by Commissioner Pickles,
(13) That Report #2022-DRT-05 of the General Manager, Durham Region Transit, be received for information.

CARRIED

B) 2022 to 2026 Transit Executive Committee Meeting Schedule (2022-DRT-06)

Report #2022-DRT-06 from B. Holmes, General Manager, Durham Region Transit, was received.

Moved by Commissioner Mulcahy, Seconded by Commissioner Pickles,
(14) That the Durham Region Transit Executive Committee adopt a monthly meeting schedule with meetings held at 1:30 PM on Wednesday of the first week of the Regional Council Committee meeting cycle for the 2022 to 2026 term of Council.

CARRIED

C) Youth Monthly Pass Incentives for the 2022/23 Secondary School Term (2022-DRT-07)

Report #2022-DRT-07 from B. Holmes, General Manager, Durham Region Transit, was received.

Moved by Commissioner Mulcahy, Seconded by Commissioner Pickles,
(15) That we recommend to the Finance and Administration Committee for approval and subsequent recommendation to Regional Council:

A) That an extension of the Y10 Youth Loyalty Pass for the 2022-23 academic year at a monthly cost of $76.05, providing a savings of $174.50 for the ten-month school year, be approved;

B) That the pilot bulk monthly youth pass program available to school boards and their school board transportation consortium within Durham Region, be revised providing a graduated fare discount based on the total number of monthly youth passes collectively purchased by a school board and/or their respective transportation consortium, be extended to the 2022/23 school term (September 2022 through June 2023);

C) That the graduated discount rate for the pilot bulk monthly youth pass program as shown below, for school boards and their transportation consortium, be approved effective for the 2022/23 academic year:

Less than 126 monthly passes	Youth rate or 20 percent discount on standard fare ($93.50)
126-250 monthly passes	25% discount on standard fare ($87.75)
More than 250 monthly passes	35% discount on standard fare ($76.05); and

D) That further revisions to the Y10 Youth Loyalty Pass and pilot bulk monthly youth pass program be considered during the 2023 Strategic Issues and Financial Forecast and DRT Business Plan and Budget processes.

CARRIED

This matter will be considered by the Finance and Administration Committee on May 9, 2022 and presented to Regional Council on May 25, 2022.

D) Sole Source Purchase for Supplemental Washroom Facilities to Support Daily Operations (2022-DRT-08)

Report #2022-DRT-08 from B. Holmes, General Manager, Durham Region Transit, was received.

Moved by Commissioner Mulcahy, Seconded by Commissioner Pickles,

(16) That we recommend to the Finance and Administration Committee for approval and subsequent recommendation to Regional Council:

That a sole source agreement extension with K.J. Camper's Ltd. (also known as Classy Potties To Go) for portable washroom facilities, extending the term of the contract from January 1, 2022 to August 31, 2022 at a total estimated cost of up to $175,000, to be funded from the approved 2022 Durham Region Transit Business Plans and Budget, be approved.

CARRIED

This matter will be considered by the Finance and Administration Committee on May 9, 2022 and presented to Regional Council on May 25, 2022.

7. Advisory Committee Resolutions

There were no advisory committee resolutions to be considered.

8. Confidential Matters

There were no confidential matters to be considered.

9. Other Business

9.1 Transit Passes for Ukrainian Refugees

Discussion ensued with regards to providing free Durham Region Transit bus passes to Ukrainian refugees coming to Durham Region.

Staff advised that Durham Region Transit and the Diversity, Equity and Inclusion Division are working together to provide PRESTO passes to Ukrainian immigrants

E. Baxter-Trahair advised that there will be a report to Council in the May or June meeting cycle regarding this topic.

9.2 Tina Henderson's Delegation

Discussion ensued with regards to T. Henderson's delegation earlier in the meeting regarding concerns raised with the reliability of the On Demand Service.

B. Holmes advised that scheduled service will be returning to the area identified. Chair Collier requested that staff follow up with T. Henderson.

10. Date of Next Meeting

The next regularly scheduled Durham Region Transit Executive Committee meeting will be held on Wednesday, June 8, 2022 at 1:30 PM in the Council Chambers, Regional Headquarters Building, 605 Rossland Road East, Whitby.

11. Adjournment

Moved by Regional Chair Henry, Seconded by Commissioner Mulcahy,
(17) That the meeting be adjourned.
CARRIED

The meeting adjourned at 2:26 PM

Respectfully submitted,

D. Barton, Vice-Chair

K. Smith, Committee Clerk

E-Mission Zero:
DRT Fleet Electrification Plan

Transit Executive Committee

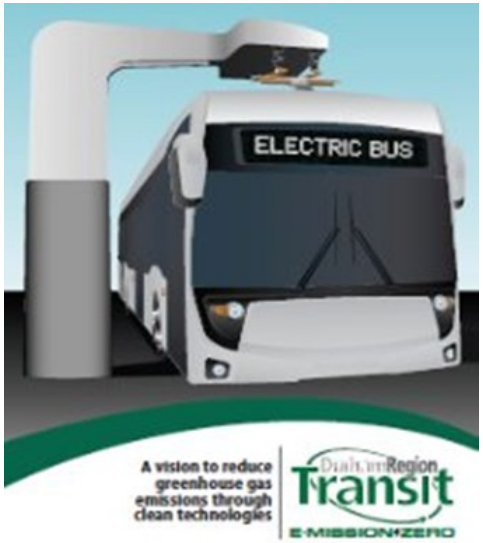
June 08, 2022

Overview

- DRT's electrification plan will advance Region goals to reduce greenhouse gas (GHG) emissions from transportation
- The recommended pathway will transition DRT's fleet to zero emission vehicles by 2037
- Battery electric technology is currently recommended, with further assessment as plan progresses
- Endorsement will enable DRT to pursue funding supporting transit agencies in shifting to zero emission vehicles

E-Mission Zero

- DRT's vision to transition to zero GHG emissions through a suite of emission-reducing initiatives
    1. Battery Electric Bus and Charging Infrastructure Pilot
    2. Autonomous Vehicle Pilot Project
    3. New Zero Emission Storage and Maintenance Facility
    4. Zero Emission Feasibility Study and Transition Plan
- Aligned with the Region's Corporate Climate Change Action Plan (CCAP) and Durham Community Energy Plan (DCEP)



Feasibility Study

Objective:

Complete a feasibility study on DRT's fleet and facilities, to develop a recommended business and transition plan (25-year outlook) to zero emissions vehicles

Scope:

- Industry scan (vehicles and fuel supply network)
- Data modelling; depots assessment
- Technology pathway; phasing plan; investment plan

14

Technology Assessment

	Battery Electric Bus	Hydrogen Fuel Cell Electric Bus
Capital Cost	High	High
Annual Operating Cost	Low	Medium
Route Flexibility	Low	High
Facility Constraints	Medium	High
Maintenance Complexity	Low	Medium
Technology Maturity	Medium	Low

Recommended Technology: Battery Electric Bus

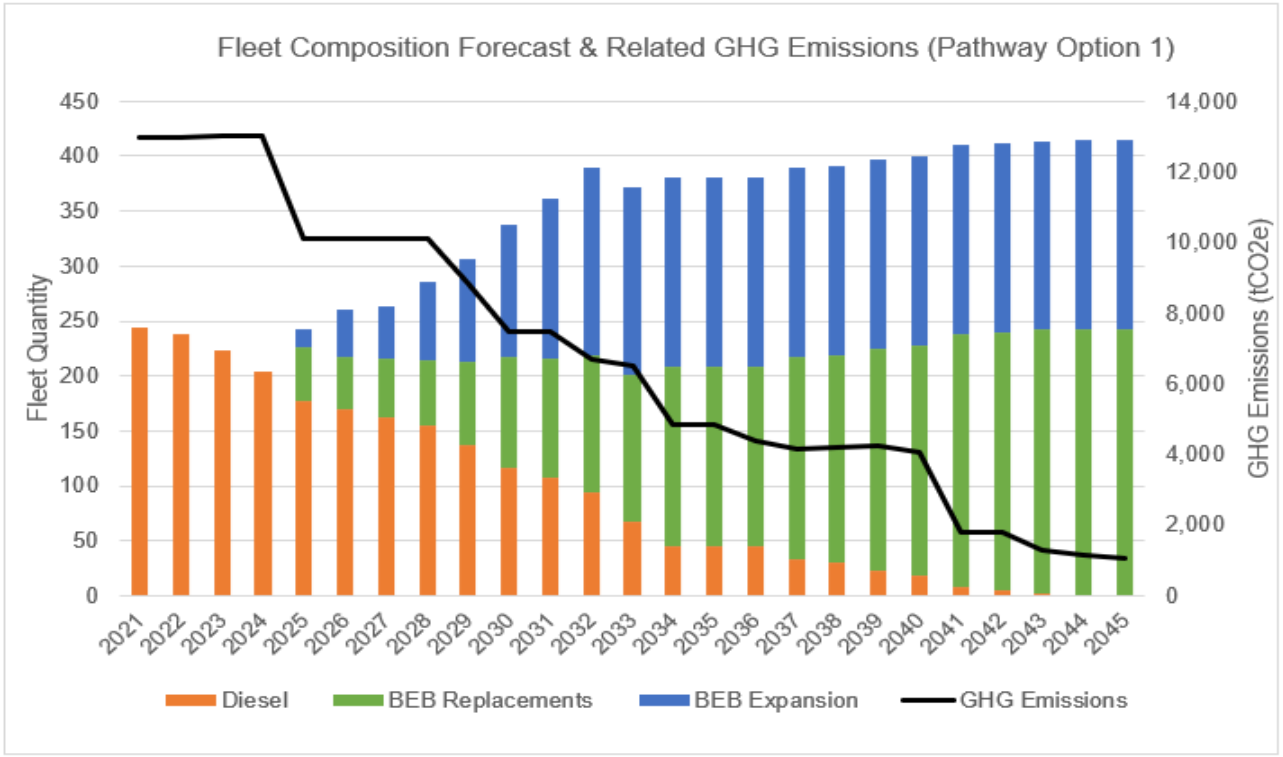
Fleet Transition Plan - Objectives

Achieve annual GHG emission reductions (in alignment with the approved Climate Change Action Plan targets), while considering:

- Infrastructure upgrades
- Depot retrofits
- Bus retirement schedules
- Service constraints
- Projected growth and future service
- Available funding opportunities

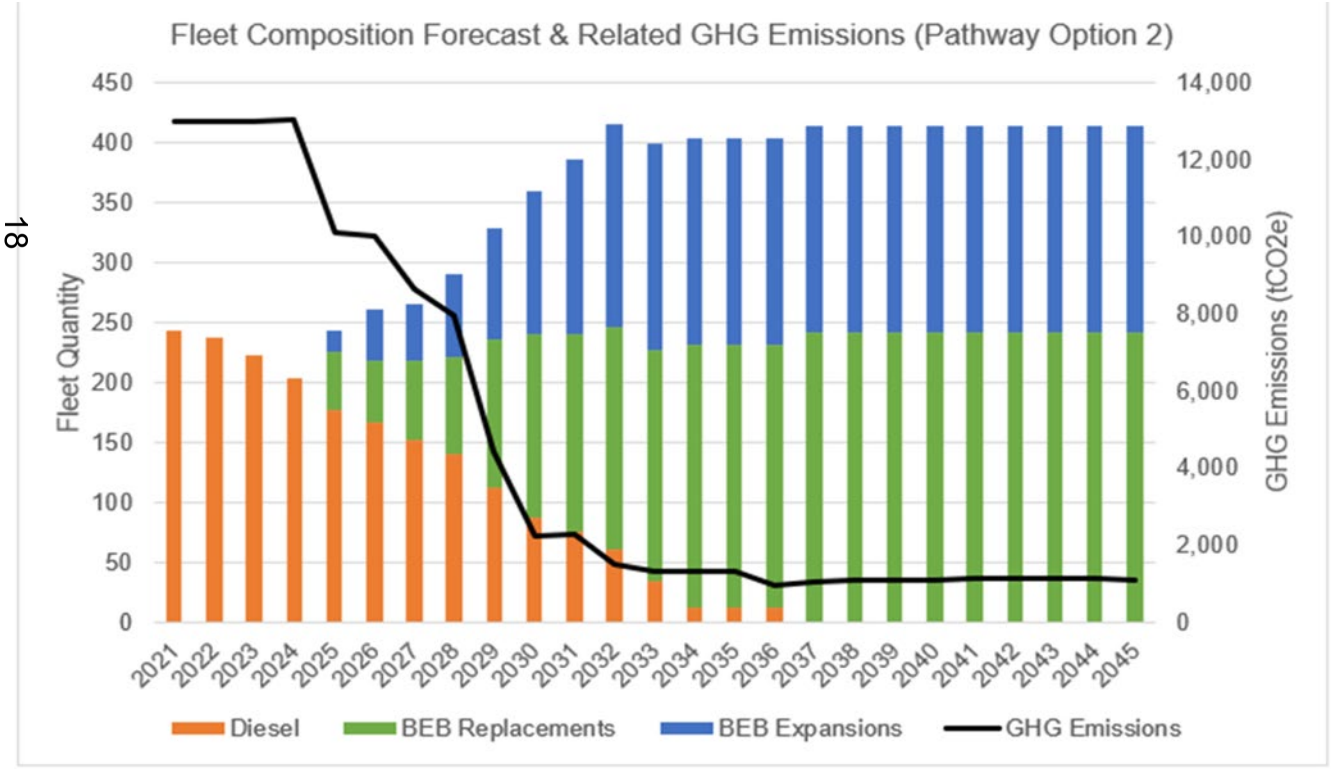
16

Pathway Option 1 – Standard, complete transition by 2044



Year	GHG Emissions (tCO_2e)
Baseline Actual 2019	21,925
Forecast 2030	7,459 (66% reduction)
Forecast 2045	1,074 (95% reduction)

Pathway Option 2- Accelerated, complete transition by 2037



Year	GHG Emissions (tCO_2e)
Baseline Actual 2019	21,925
Forecast 2030	2,232 (90% reduction)
Forecast 2045	1,074 (95% reduction)

Depot and Charging Strategy

- Prioritize in-depot charging as the primary approach
- Phased approach to implementation at existing and planned DRT facilities
- En-route charging may be introduced beginning in 2027 for more difficult to transition routes

19

Financial Analysis

Description	Cumulative Nominal ($000's) through 2045		
	Business as Usual	Pathway Option 1	Pathway Option 2
Capital Costs	$513,592	$899,964	$922,214
Total Capital Difference over BAU		**$386,372**	**$408,621**
Operating Costs	$3,508,681	$3,398,451	$3,411,686
Total Operating Difference over BAU		**($110,230)**	**($96,996)**
Total	$4,022,273	$4,298,417	$4,333,900
Total Difference over BAU	-	**$276,144**	**$311,627**
Per cent Difference over BAU	-	6.87	7.75

Recommendation – Pathway Option 2

Presents an opportunity for the Region to demonstrate strong leadership in reducing total GHG emissions from the DRT fleet

- Achieves full fleet transition by 2037
- Only battery electric buses purchased 2024 onwards
- Maximizes funding opportunities in the short term to support the accelerated transition timeline
- Less than 1% cost increase over Pathway Option 1
- Reduces GHG emissions by an additional 53,000 tonnes of CO_2e over Pathway Option 1

Opportunities

- Reduce the forecasted battery electric bus quantities through technology advancements and operational efficiencies
- Reduce electricity costs by participating in the Industrial Conservation Initiative (ICI)
- Anticipated reduction in bus pricing with increased demand for electric buses and technology maturity
- Complete a future assessment of extending the bus life for potential operating savings over the bus life cycle

Financing and Funding Opportunities

1. The Canada Infrastructure Bank (CIB)

2. Infrastructure Canada – Zero Emissions Transit Fund (ZETF)

3. Natural Resources Canada – Infrastructure Funding Programs

23

Next Steps

- Work with the CIB on financing arrangement and finalize submission to Infrastructure Canada for grant funding
- Prepare long-term service and financing strategy to be presented to Council as part of the 2023 Business Plans and Budget process
- Explore and evaluate joint procurement and partnership opportunities to acquire electric buses, charging equipment and supporting infrastructure to achieve best value for the Region
- Collaborate with industry partners to inform internal planning, scheduling, training and business support to implement the fleet electrification plan

Thank you

Durham Region Transit
605 Rossland Road East
Whitby, Ontario L1N 6A3
Phone: 1-866-247-0055
durhamregiontransit.com

If this information is required in an accessible format, please contact 1-800-372-1102 ext. 3702

The Regional Municipality of Durham Report

To:	Durham Region Transit Executive Committee
From:	General Manager, Durham Region Transit
Report:	#2022-DRT-09
Date:	June 8, 2022

Subject:

General Manager's Report – June 2022

Recommendation:

That the Transit Executive Committee recommends

That this report be received for information.

Report:

1. Purpose

1.1 This report is submitted at each Transit Executive Committee (TEC), for information.

2. Background

2.1 The General Manager Report provides regular updates on key performance measures and summaries of current activities and transit issues in Attachment #1.

3. Previous Reports and Decisions

3.1 Not applicable

4. Financial

4.1 The General Manager's Report focuses mainly on performance and service standards. There are no financial impacts associated with TEC's receipt of this report.

5. Relationship to Strategic Plan

5.1 This report aligns with/addresses the following strategic goals and priorities in the Durham Region Strategic Plan:

a. Service Excellence

6. Conclusion

6.1 For additional information, contact: Bill Holmes, General Manager, at 905-668-7711, extension 3700.

7. Attachments

Attachment #1: General Manager's Report – June 2022

Attachment #2: Memorandum of Understanding (MOU) between Durham Region Transit and Durham school boards

Respectfully submitted,

Original Signed by

Bill Holmes
General Manager, DRT

Recommended for Presentation to Committee

Original Signed by

Elaine C. Baxter-Trahair
Chief Administrative Officer

General Manager's Report
June 8, 2022
TEC
Attachment #1

Performance Measures Dashboard

Safety

Key performance indicator	Description	Latest Measure	Current	Target[1]	Current Variance to Target (per cent)	YTD Status[2] (per cent)
Collisions	Number preventable collisions per 100,000 km	April	0.10	0.60	✓ -83.3	✓ -42.3

Ridership

Scheduled						
Ridership (x1,000)	Number passengers	April	516	259	✓ 99.0	✓ 68.5
PRESTO Ridership	Customers paying using PRESTO (per cent)	April	83.2	78.5	✓ 4.7	✓ 3.9
Bus full occurrences	Number operator reported occurrences	April	26	1[3]	NA	NA
Demand Responsive						
Ridership - Specialized	Number customer trips	April	6,989	4,469	✓ 59.7	✓ 47.4
Unaccommodated Rate - Specialized	Trip requests not scheduled (per cent)	April	3.6	0.4	✗ 3.2	⚑ 1.2
Ridership – On Demand	Number customer trips	April	12,224	8,292	✓ 47.4	✓ 49.8

Service Delivery

Scheduled						
On time performance	On-time departures from all stops (per cent)	Service Period 1[4]	77.1	78.5	NA	NA
Service availability	Scheduled service delivered (per cent)	Service Period 1[4]	97.6	99.6	NA	NA
Mean Distance Between Failure (MDBF)	Average number of revenue service kilometres between occurrences of vehicle defects impacting service (revenue service kilometers)	April	26,666	NA	NA	NA

[1]Target is 2021 measure for the same period

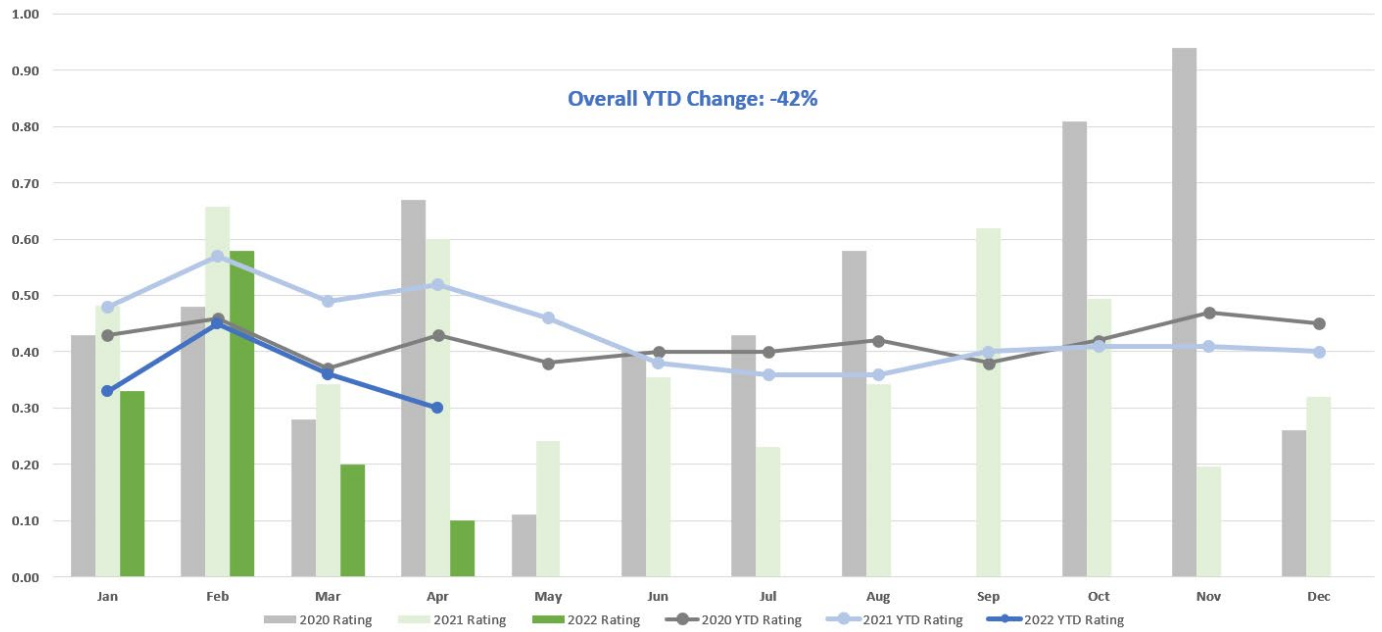
[2]Year to Date (YTD) compared to previous year

[3]Bus capacity limited to seated load, reduced ridership during pandemic

[4]Service Period 1: January 10 – April 3, 2022

Safety

Preventable collisions rate per 100,000 km



Definition: A preventable collision is one in which the driver failed to do everything reasonable to avoid the collision. The preventable collision rate is the number of preventable collisions per 100,000 kilometres of travel for all Durham Region Transit (DRT) vehicles.

A collision may not be reportable to police based on the Highway Traffic Act, but for DRT purposes all collisions are documented and investigated. DRT's objective is to reduce annual preventable collisions by ten per cent relative to the previous year.

Analysis

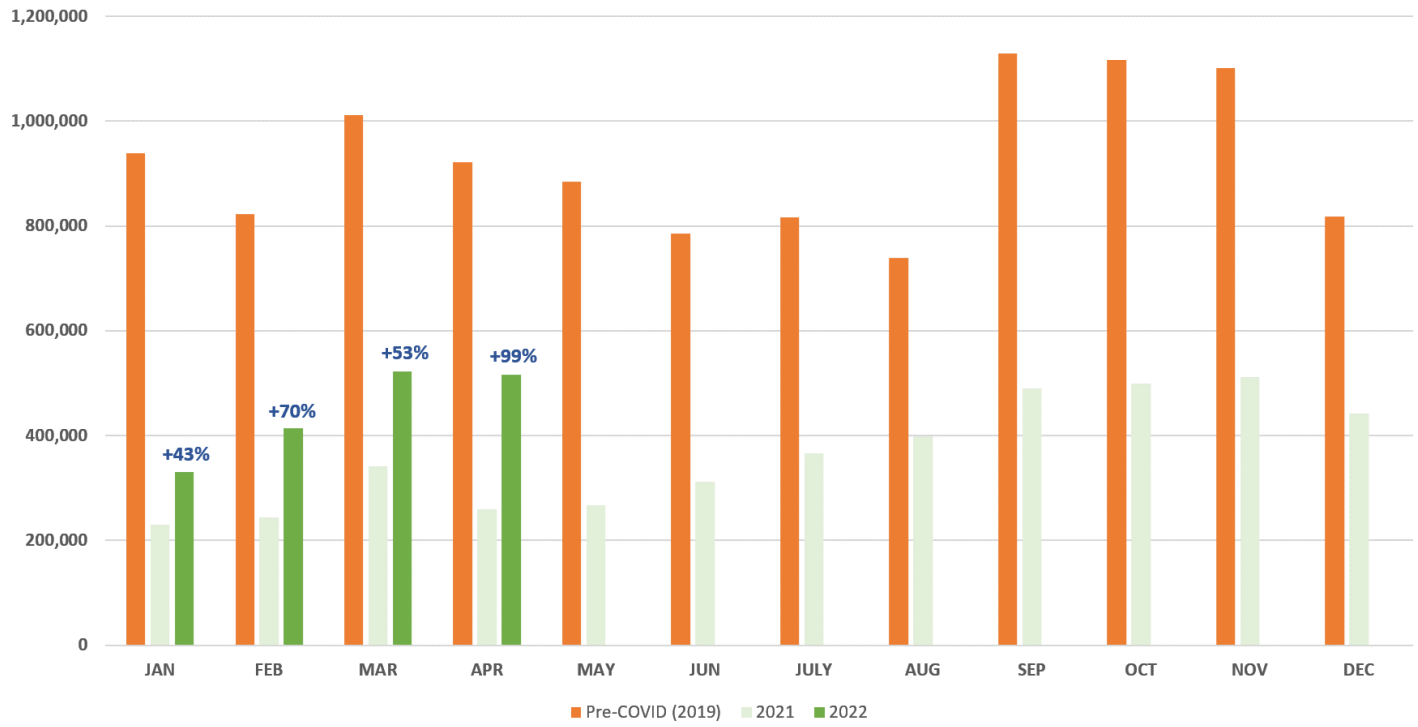
The April preventable collision rate was 0.10 per cent, compared to the rate of 0.60 per cent in 2021. Year to date, the preventable collision rate is 42 per cent lower than the previous year.

Action Plan

In addition to established processes to identify and resolve root causes of collisions, the DRT Safety and Training team has implemented the first multi-year safety plan including specific actions to realize the objective to reduce annual preventable collisions. The plan includes annual cyclical training, prioritizing defensive driving practices, mandatory refresher training for staff involved in a preventable collision prior to returning to service, and cognitive assessment and driving skills screening during the recruitment process.

Ridership

Scheduled transit



Definition: Ridership is the sum of all passenger trips. A passenger trip is a one-way trip from origin to destination regardless of the number of transfers that may be required. Ridership data is calculated from fare box data and data from PRESTO, GO Bus One Fare Anywhere, and On Demand.

Results

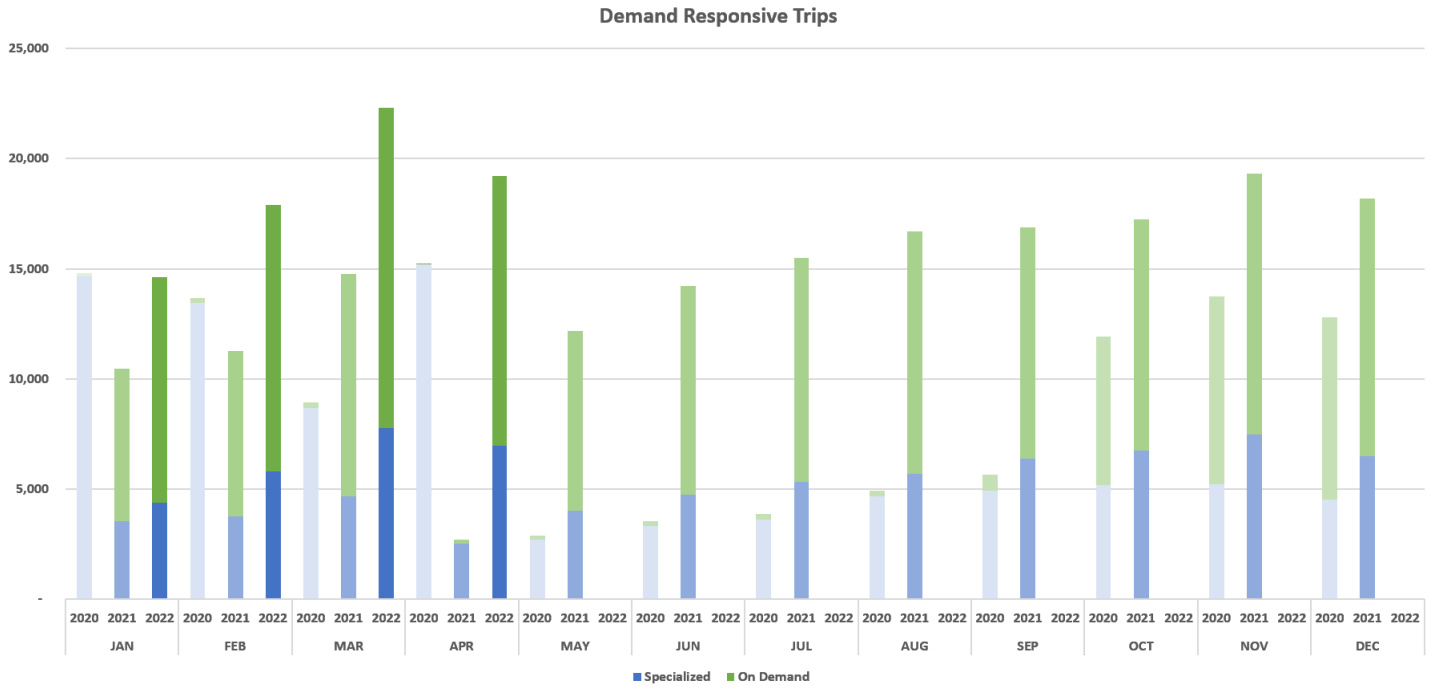
April ridership was 99 per cent higher than 2021, and approximately 55 per cent of pre-pandemic (2019) ridership for the same period.

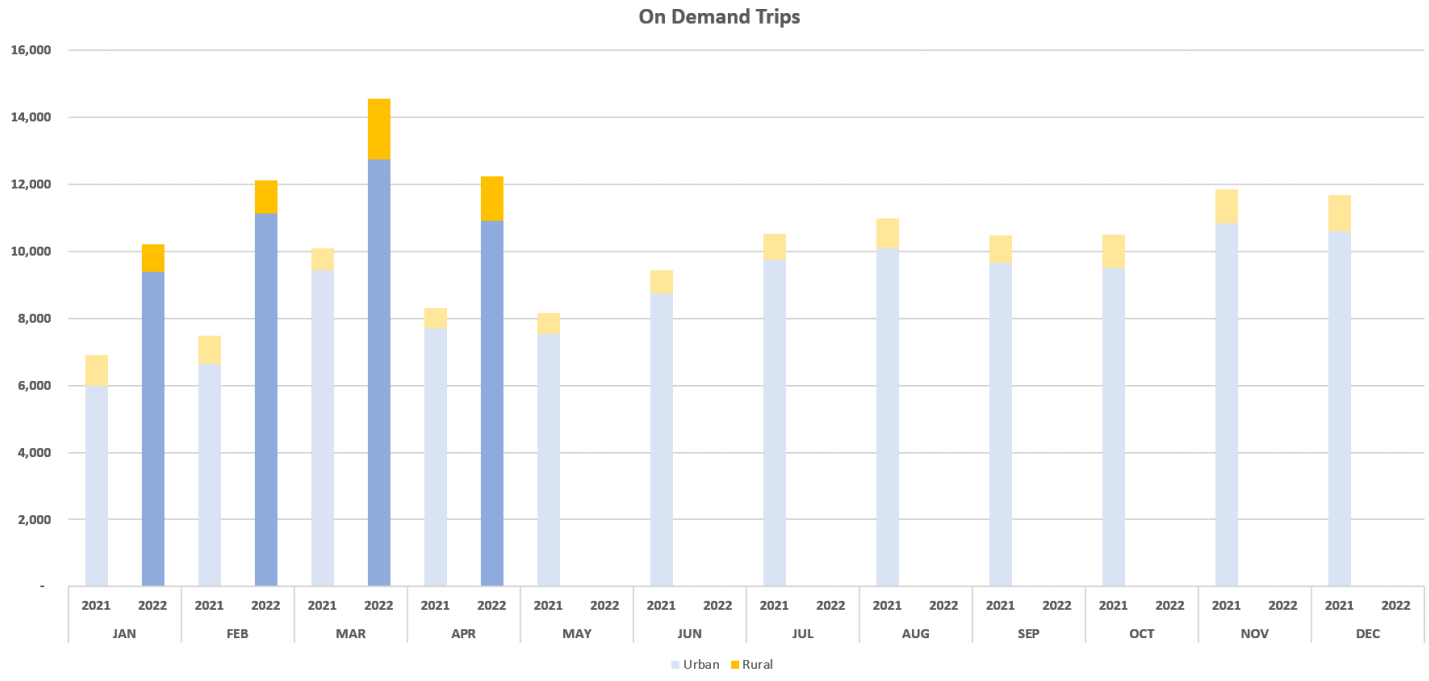
Year to date, Adults account for 54 per cent of ridership, 20 per cent are U-Pass customers, 11 per cent Youth, six per cent TAP/Access pass, six per cent seniors, and one percent are children.

Action Plan

Additional revenue service will continue to be re-introduced as ridership recovers including additional service planned for June and September.

Demand Response Transit

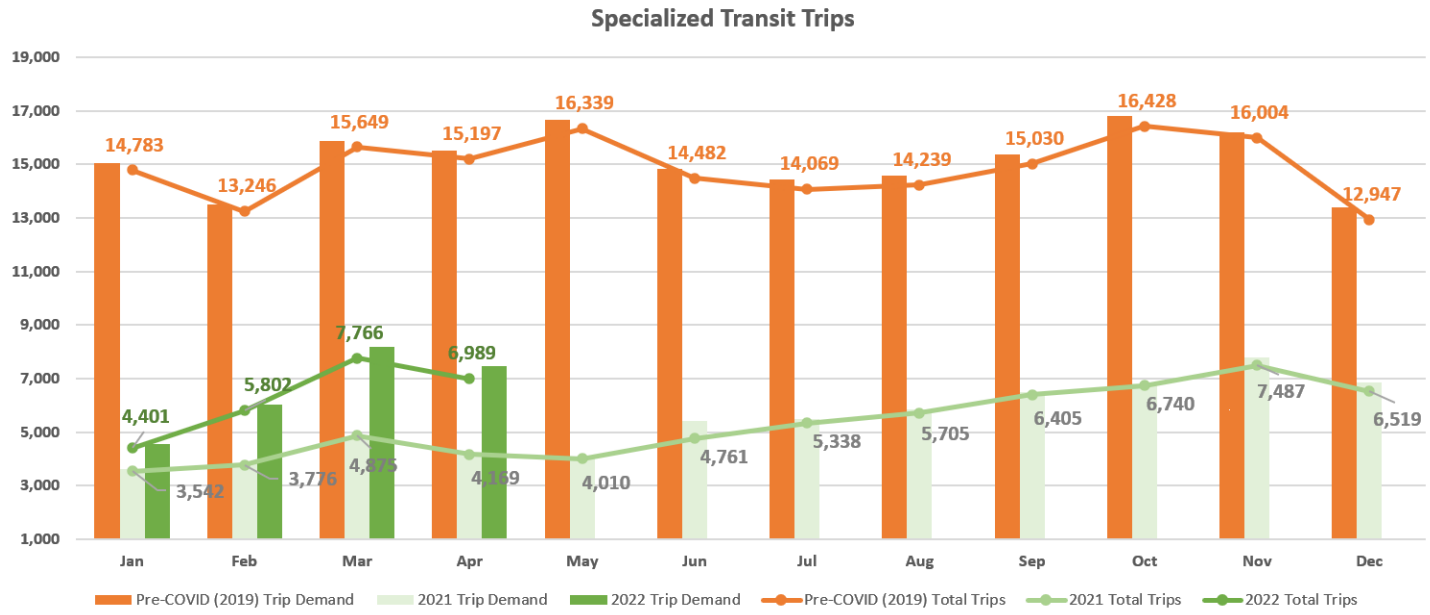




		APR 2022	YTD 2022
R U R A L	Uxbridge	643	2,009
	Brock	613	2,285
	Scugog	612	2,379
	Pickering	171	471
	Whitby	50	110
	Oshawa	-	-
	Clarington	1,785	6,929

		APR 2022	YTD 2022
U R B A N	Pickering	1,944	7,894
	Ajax	1,627	5,861
	Whitby	1,808	6,959
	Oshawa	1,885	6,812
	Clarington	1,966	10,971

Note: Rural Uxbridge and Scugog figures include trip pickups within urban Uxbridge and Port Perry areas.



Definitions:

Trips: A trip is considered a one-way passenger trip from origin to destination, regardless of the number of transfers that may be required.

Trip Demand (Specialized): Specialized transit trip demand is the sum of all trips delivered, no-shows and cancelled at the door, and unaccommodated trips.

Unaccommodated Rate (Specialized): An unaccommodated Specialized transit trip is one where DRT is unable to schedule a trip for the specific requirement requested by the customer, or the customer declined to accept the trip option provided by the booking agent.

Results

On Demand continues to experience strong ridership delivering 12,224 trips in April 2022, a 47 per cent improvement compared to April 2021, contributing to a 50 per cent increase year to date compared to 2021.

Specialized service ridership delivered 6,989 trips in April 2022, a 60 per cent improvement compared to April 2021, contributing to a 47 per cent increase year to date compared to 2021.

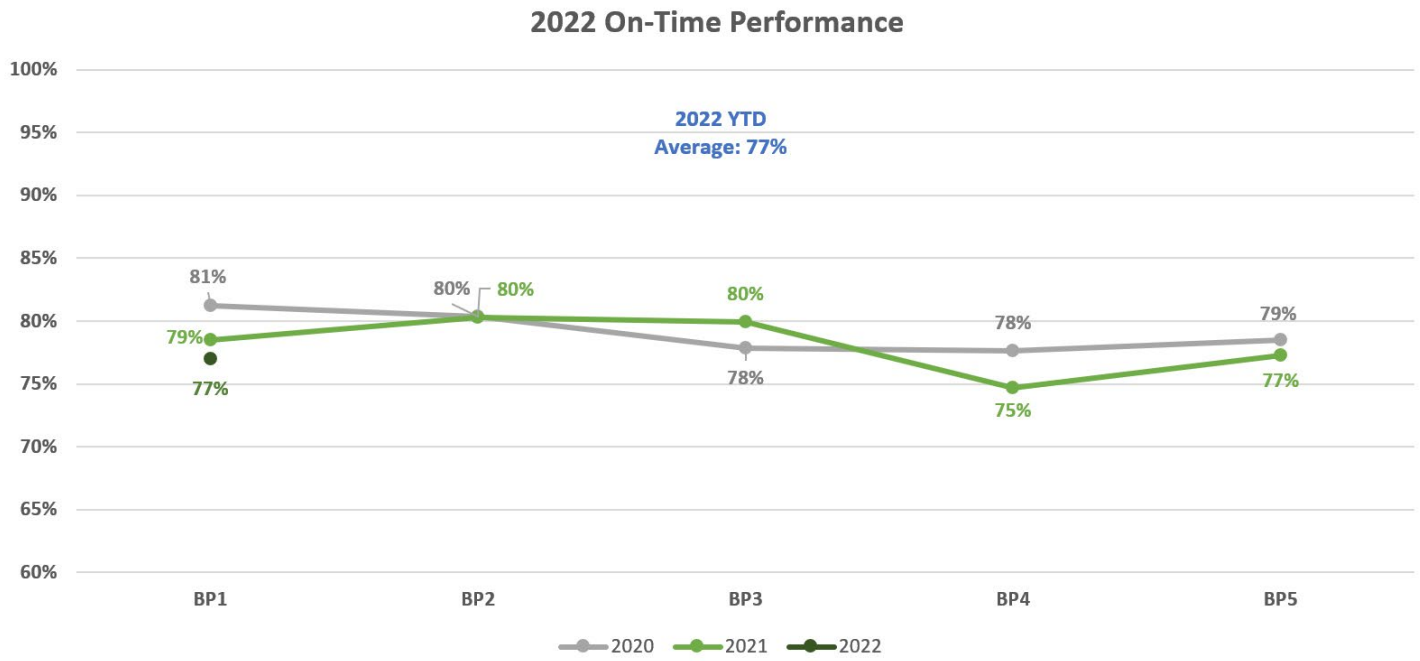
Increasing ridership on Specialized Services contributed to an unaccommodated rate of 3.6 per cent.

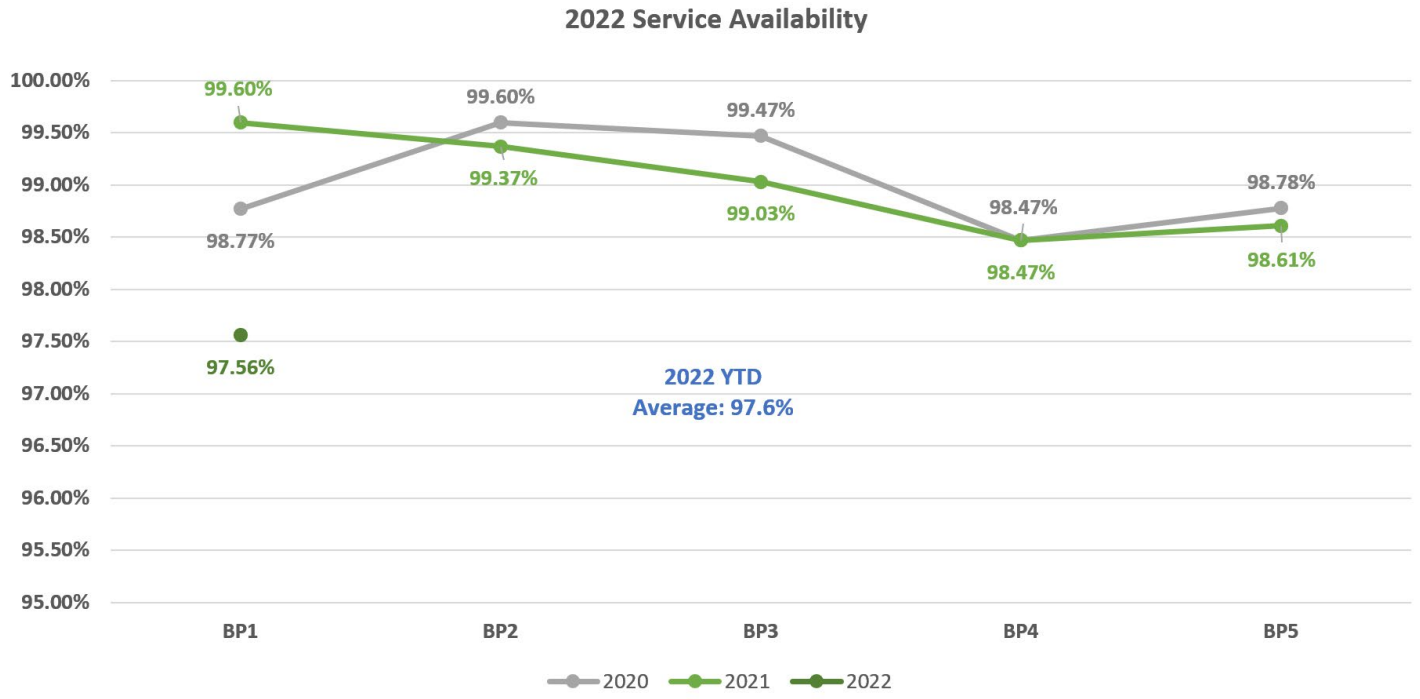
Action Plan

In mid-April, the Province announced two changes to pandemic-related restrictions that took effect April 17 and April 1, 2022. As a result of these changes and to align with practices across the transit industry, effective Monday April 7, 2022, DRT ended vehicle capacity limits for demand response services. Removing capacity limits will support more customers to access demand response services. During the pandemic the contracted service provider supporting Specialized Services was not required. However, as Specialized Services ridership returns and the new contractor begins service on June 1, trips will be assigned to the contractor to improve system capacity.

Service Delivery

On Time Performance and Availability (conventional)





Definition

On Time Performance (OTP) is a measure of the percentage of buses departing a bus stop no more than zero minutes early and five minutes late. The annual OTP target is 80 per cent. OTP is reported for each service period.

Service availability is a measure of the actual service delivered by DRT as a percentage of scheduled revenue service. The service availability target is 99.5 per cent. Service availability is reported for each service period.

Results

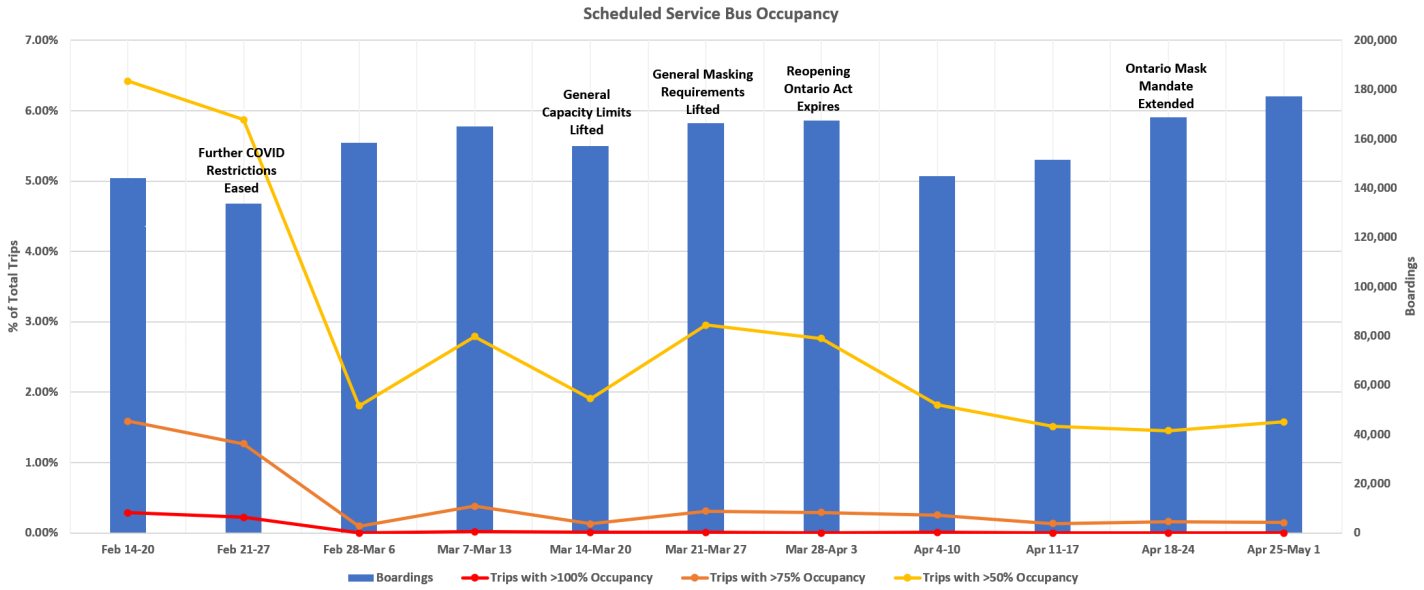
OTP for the 2022 service period 1 (BP1) was 77 per cent, lower than the 78.5 per cent recorded for the same period in 2021.

Service availability was 97.6 per cent compared to 99.6 per cent recorded for the same period in 2022.

Action Plan

Service availability was mainly impacted by two factors; the snow event on January 17, 2022 and the subsequent service impacts experienced over days following the event, and increasing staff absences resulting from the Omicron variant. Weather events also contributed to the availability of service, and Operations and scheduling staff are reviewing data to identify other factors that may have contributed to lower OTP performance.

Scheduled Service Maximum Bus Occupancy



Definition

Maximum bus occupancy is a measure of the maximum number of riders on a scheduled service vehicle at any point of a trip, currently expressed as a percentage of the seated capacity. The data accounts for the differences in capacity for regular and articulated buses.

For planning purposes, maximum capacity is considered the vehicle seating capacity during the pandemic recovery period. There are no mandated/legislated bus passenger capacity limits and, at times, capacity on a trip may exceed the maximum seated capacity.

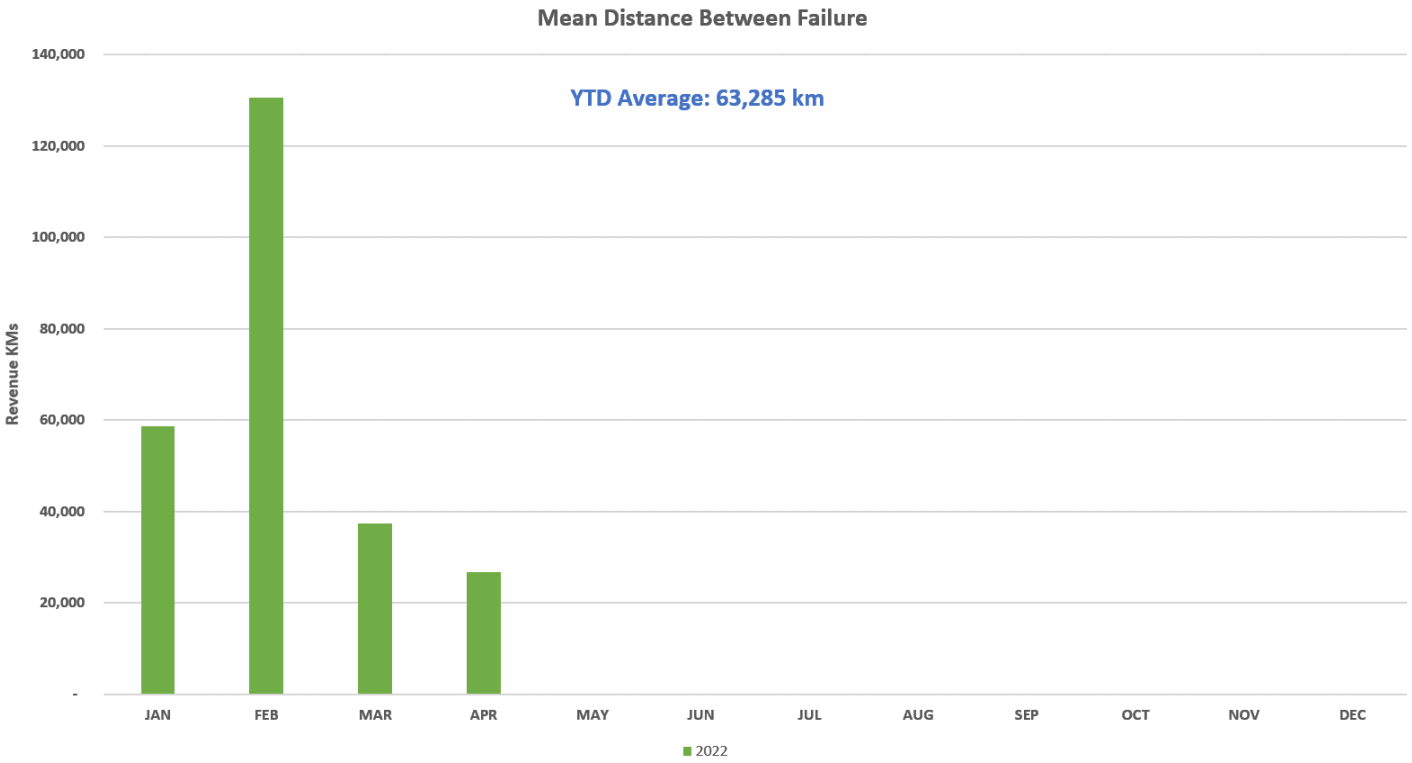
Results

During the last week of April (April 25-May 1), approximately 98 per cent of all trips were below 50 per cent of maximum occupancy, with less than one per cent of trips exceeding 75 per cent maximum occupancy.

Action Plan

The transit network continues to provide adequate capacity for current customer demand. DRT removed the seated load capacity limit on April 7, 2022, to align with provincial changes and best practices currently adopted across the transit industry.

Mean Distance Between Failure (conventional)



Definition

Mean Distance Between Failure (MDBF) measures the reliability of the fleet by tracking the mean distance between bus breakdowns or mechanical failures that result in cancelled or missed service. A bus breakdown or mechanical failure is any incident that precludes a revenue vehicle from completing its trip or beginning its next scheduled trip and is measured by the total number of revenue vehicle kilometers (conventional service fleet) divided by the total number of chargeable vehicle defects during the reporting period.

Chargeable vehicle defects (or chargeable mechanical failures) are consistent with guidelines from the Ontario Public Transit Association (OPTA) which does not consider failures resulting from passenger-related events (i.e., sickness on the bus), farebox or other technology defects such as PRESTO readers.

In consideration of MDBF outcomes in 2021, DRT has established the 2022 average MDBF target at 40,000 km. Moving forward, the objective is to realize an annual improvement in MDBF performance as a result of continuous enhancements to preventative maintenance practices.

Results

MDBF for April 2022 was 26,666 kilometers.

Action Plan

Not applicable

Updates

1. Fuel pressures

Due to various economic and geo-political factors, there have been significant increases in fuel prices since the Durham Region Transit's 2022 fuel budget was approved. The financial impact of the price variance has been partially offset by decreases in current and projected fuel consumption. Based on current fuel price and consumption projections a year-end deficit of $1.25 million is projected. Should the recently announced provincial reduction in fuel rates from July to December proceed, the projected year-end deficit would be reduced to $1.08 million. Efforts will be made to accommodate the projected fuel budget deficit within the overall approved 2022 Durham Region Transit Business Plans and Budget.

There continues to be significant price volatility for fuel. Staff closely monitors fuel price forecasts, consumption patterns and senior government policy on fuel pricing and will advise TEC of any changes to these year-end projections.

2. Memorandum of Understanding with Durham District School Boards

Further to direction from the Transit Executive Committee in December 2021, DRT has continued to work with the Durham District School Board, Durham Catholic District School Board, and Durham Student Transportation Services to review residual capacity on the transit network near secondary schools. The parties have also agreed to a Memorandum of Understanding (MOU) that establishes shared principles to guide on-going collaboration. The MOU is attached to the June 2022 report from the General Manager.

ATTACHMENT #2

Dated as of the _____ day of _____, 2022

MEMORANDUM OF UNDERSTANDING (MOU)

BETWEEN:

Durham District School Board (DDSB)

Durham Catholic District School Board (DCDSB)

Durham Region Transit (DRT)

RECITALS:

1. The parties to this MOU agree to the cause and initiative as herein described and detailed in this MOU and agree to work with best efforts and good faith with regard to the cause and initiative with the guiding principles as detailed herein.
2. Increased public transit usage has immense benefits including socioeconomic and environmental benefits, as well as reduced traffic for the residents of Durham Region.
3. DRT public transit services are available to all fare-paying passengers and the service is planned and delivered based on an approved service strategy, guidelines, and budget.
4. Public transit customers are required to adhere to all policies regarding the use of DRT public transit services.
5. Durham Student Transportation Services (DSTS) is a consortium formed by agreement between DCDSB and the DDSB, for the purpose of providing a common administration of student transportation services based on each Board's policy governing transportation eligibility of students.
6. DDSB and DSDSB already purchase PRESTO transit passes for some of their students.

NOW THEREFORE, the parties agree to collaborate in good faith based on these guiding principles.

1. The parties commit to enhancing the use of public transit by youth, including secondary school students, within a fiscally responsible framework.
2. The DRT transit network is planned in consideration of key trip generator locations and resident demand across the Region, including secondary schools.
3. The school boards will ensure that the number of PRESTO passes purchased can be accommodated within DRT's scheduled capacity available in identified areas.

4. When purchasing PRESTO products, DDSB and DCDSB will administer the products in accordance with the terms and conditions established by PRESTO.
5. Any fare rate change to the bulk purchase youth pass program will be communicated to DSTS within thirty days following approval of the annual DRT Business Plan and Budget.
6. DRT, DDSB and DCDSB will share ridership and other appropriate data subject to availability and legal/privacy considerations.
7. The parties endeavour to collaborate to promote public transit usage among students, including educational programs for customer safety and etiquette, developing life skills to navigate a public transit system, and activities to highlight the benefits of public transit.

All REVIEW:

1. This MOU shall be reviewed by the parties once per year.
2. DSTS and DRT shall meet at least semi-annually to monitor progress and review priorities, and the projected capacity on the public transit network.

If this information is required in an accessible format, please contact 1-800-372-1102 ext. 3702

Durham Region Transit Report

To:	Durham Region Transit Executive Committee
From:	General Manager, Durham Region Transit
Report:	#2022-DRT-10
Date:	June 8, 2022

Subject:

E-Mission Zero – DRT Fleet Electrification Plan

Recommendations:

That the Transit Executive Committee recommends to Regional Council:

A. That Durham Region Transit's Fleet Electrification Plan, transitioning its revenue and non-revenue fleet vehicles to zero emission technologies by 2037 based on the battery electric technology Pathway Two with the procurement of only electric buses starting in 2024, be endorsed as TEC's preferred option and be referred for consideration of multi-year phasing and financing as part of the long-term servicing and financing strategy to be presented to TEC, Committee and Council in advance of the 2023 Business Plans and Budget.

Report:

1. Purpose

1.1 This report provides an overview of key findings and pathway options developed from the Durham Region Transit (DRT) fleet and facilities feasibility study, aimed at reducing greenhouse gas (GHG) emissions and aligning with the Region's corporate Climate Change Action Plan (CCAP) and 2020-2024 Strategic Plan.

1.2 The report outlines the proposed DRT zero emission fleet transition plan (25-year horizon), and anticipated capital and operating impacts for the fleet and infrastructure, that will be considered as part of the DRT long-term servicing and financing strategy currently underway.

2. Background

2.1 In 2019, the Durham Community Energy Plan (DCEP) found that transportation is responsible for more energy use, costs, and GHG emissions than any other source.

2.2 In March 2021, Council approved the Corporate Climate Action Plan (CCAP) with targets to reduce corporate GHG emissions by 100 per cent by 2045. This includes the transition of corporate fleets, such as public transit vehicles, to low carbon alternatives. Furthermore, the 2022 Annual Corporate Climate Change Action Plan reported that Transit accounted for 10 per cent of the Region's total corporate GHG emissions in 2020.

2.3 In July 2021, DRT retained HDR Inc. through a competitive procurement process to conduct a feasibility study and develop a zero-emissions fleet transition plan. The results of this study are described in this report, identifying a multi-year zero emission bus (ZEB) fleet transition, infrastructure requirements, and anticipated financial impacts.

2.4 In August 2021 the Region launched the E-Mission Durham program focused on creating a cleaner, low-carbon future by supporting and empowering Durham residents in making the transition to lower and zero emission vehicles. As part of these efforts, E-Mission Zero is DRT's commitment to adopt zero emission vehicles in its fleet to help reduce overall GHG emissions from the transportation sector in Durham.

3. Previous Reports and Decisions

3.1 In November 2019, Regional Council approved the purchase of up to eight (8) electric buses and associated charging infrastructure for a total of $10.1 million using one-time allotted Canada Community-Building funds (previously known as Federal Gas Tax funds (Report #2019-COW-31)). This pilot allows for the assessment of battery electric bus and charging technology, including its performance in local conditions to inform the long-term fleet transition and deployment.

3.2 In September 2021, the Transit Executive Committee received the E-Mission Zero – Towards Zero Emission Public Transit in Durham Region (Report #2021-DRT-21) which provided an overview of DRT's commitment to transition to zero GHG emissions by advancing a coordinated suite of initiatives supporting the assessment and deployment of clean technologies aimed at reducing GHG emissions from public transit in Durham.

3.3 In November 2021, the Region approved the proposed strategy to implement DRT's Electric Bus and Charging Infrastructure Demonstration Pilot (Report #2021-DRT-28

and Report #2021-F-30) including approving an additional $2.0 million from one-time Canada Community-Building funds to increase the total approved financing to $2.9 million for the supply of electric bus charging equipment from Oshawa Power and Utilities Corporation and $0.1 million in one-time Canada Community-Building funds to finance the design and construction of facility upgrades to be performed by eCamion necessary to implement integrated charging and energy storage equipment.

3.4 In February 2022, Regional Council received the 2021 Annual Corporate Climate Change Action Plan Update (Report #2022-COW-3), which included an update on DRT's 2020 GHG inventory and the short-term reduction forecast

4. Feasibility Study and Transition Plan

Feasibility Study

4.1 Prior to developing the transition plan for DRT, staff worked with HDR Inc. to complete a feasibility study, consisting of an industry scan of zero emissions vehicles (ZEVs), reviewing commercial availability and the supply chain network including available fuel sources and suppliers in Canada. Additionally, this work included a data modelling exercise based on current service operations and a review of DRT's existing fleet and depots to define requirements for the transition to a zero emissions fleet.

4.2 The scope of work focused on transitioning the fleet to ZEVs, defined by Transport Canada as vehicles with the potential to produce no tailpipe emissions, such as battery-electric (BEV), plug-in hybrid-electric (PHEV) and fuel cell electric vehicles (FCEVs). Federal government financing and funding programs (described further below in Section 6) are also currently structured to support the transition to ZEVs.

4.3 The key findings from this feasibility study are described below

a. Battery electric buses (BEBs) are a favourable option in North America because the technology is efficient in converting energy to power, more developed, readily available, requires less infrastructure upgrades and is relatively cost effective compared to other ZEV options. BEBs also contain fewer mechanical parts, which typically results in lower long-term maintenance costs than diesel and hydrogen fuel cell buses (FCEBs).

b. Electricity is used to directly charge batteries in BEBs and comes mostly from the electrical grid and other off-board electrical power sources, which in Ontario can come from nuclear, hydroelectric, biomass, natural gas, solar and wind energy. In Ontario, there is a well-established and reliable supply for electricity from generation to transmission and distribution (suppliers of electricity).

c. In 2021 about 92 per cent of electricity generated in Ontario was produced from zero-carbon sources: 58 per cent from nuclear, 24 per cent from hydroelectric generation, 8 per cent from wind, and 1 per cent each from solar and biomass/geothermal. The remaining 8 per cent is primarily from natural gas and petroleum-based sources.[1]

d. Hydrogen is less readily available in Canada, but the technology is rapidly evolving and should continue to be monitored over the period of DRT's transition plan. The provincial government recently developed a hydrogen strategy to develop the hydrogen economy, so progress may be made in the coming years.

e. Hydrogen, based on its inputs and production process, can yield carbon intensive to low carbon hydrogen gas[2]. When hydrogen is produced in its cleanest form ("green" hydrogen), this fuel needs to be produced at mass volumes to be the same price or less expensive than diesel or Compressed Natural Gas (CNG).

f. The data modelling exercise HDR completed on DRT service operations resulted in classifying the existing fleet based on the difficulty of transition due to the range requirements for specific routes. Additionally, the average bus replacement ratios[3] (electric bus: diesel bus) based on existing service was determined to be 1.39 for Conventional service and 1.48 for Pulse service.

g. Review of the average and maximum daily mileage from DRT operated demand-responsive and non-revenue vehicles determined that these vehicles can be replaced on a one-to-one basis using existing battery electric vehicles in the market.

h. Infrastructure upgrades, depot retrofits, and energy systems are required at the DRT depots in Ajax and Oshawa to support the transition to zero emission buses, including charging, storage and maintenance.

i. Potential en-route charging[4] locations were also identified to support range requirements and maintain service hours for the difficult to transition replacement and future expansion buses.

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1 IESO 2021 Year in Review 2021 Year in Review (ieso.ca)

2 Hydrogen is typically classified as Grey Hydrogen, Blue Hydrogen and Green Hydrogen based on emissions generated during production. Grey Hydrogen is the most common form of Hydrogen, created from fossil fuels, releasing carbon dioxide which is not captured. Blue Hydrogen uses the same process as Grey but the carbon is captured and stored but comes with added technical challenges and increased cost. Green Hydrogen is the production of hydrogen through electrolysis, powered by renewable energy sources such as wind or solar

3 Average bus replacement ratios derived by taking the ratio between the fleet requirement of the business-as-usual scenario and the fleet requirement of the BEB conversion scenario from the modelling exercise based on 2021 service.

4 En-route charging is typically the application of fast high-power charging, placed at strategic locations along a route, typically at the end points or terminals, increasing the available range of the bus in between charges.

4.4 Based on the feasibility assessment, battery electric technology was the recommended zero emissions propulsion system for DRT's fleet. However, given rapid advancements in zero emission technologies, staff will continue to assess the commercial availability and technical feasibility of battery electric buses and hydrogen fuel cell vehicles, and associated fueling infrastructure, at key phases of the transition plan.

Transition Plan

4.5 The fleet transition plan is a year-over-year acquisition plan (up to 25 years) for the phased implementation of battery electric vehicles, charging equipment and infrastructure that aims to meet Durham Region's strategic goals and priorities, along with DRT's operational requirements.

4.6 Key objectives and requirements include achieving practical levels of annual GHG emissions reductions (in alignment with the approved CCAP targets[5]) with consideration for commercial and technical feasibility – including infrastructure upgrades, depot retrofits, bus retirement schedules, service constraints, projected growth and future service, and available funding opportunities.

4.7 The transition plan considers the replacement of the entire Region owned fleet, including expansion vehicles and charging equipment required to support them. Additionally, infrastructure upgrades required at the existing DRT owned depots have been considered.

4.8 The transition plan includes the assessment and development of pathway options for implementation based on transition timeline targets. Each pathway option includes an economic analysis (described further in Section 8 – Financial Summary) and an assessment of the operational requirements. The pathway options include:

a. **Pathway Option 1 – Standard, complete transition by 2044:** An acquisition plan that uses the CCAP GHG emissions reductions targets as the baseline, whereby DRT would begin a gradual transition[6] to electric buses starting in 2023 and purchase only electric buses starting in 2031. The expected fleet composition and projected GHG emissions reductions are depicted below.

5 The CCAP targets as approved in March 2021 is 20% below 2019 GHG emissions level by 2025, 40% below 2019 GHG emissions level by 2030 and 100% below 2019 GHG emissions level by 2045.
6 The transition describes the budget year for the buses, with a lead-time of two years for bus delivery

Figure 1: Fleet Composition Forecast & Related GHG Emissions (Pathway Option 1)

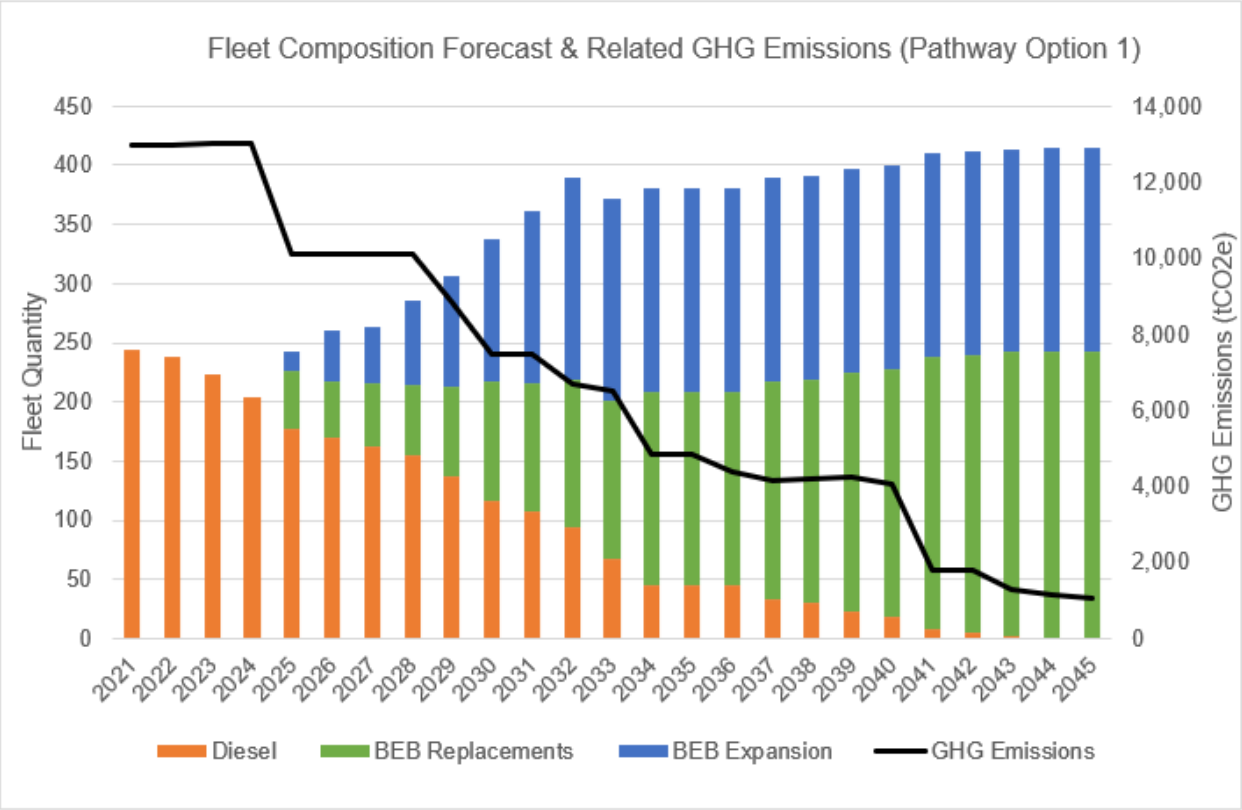


Table 1: DRT GHG Reduction Forecast[7] (Pathway Option 1)

	Baseline Actual 2019	Forecast 2030	Forecast 2045
Annual GHG Emissions (t CO_2e)	21,925	7,459	1,074
% Reduction	N/A	66%	95%

b. **Pathway Option 2 (Recommended) – Accelerated, complete transition by 2037:** An acquisition plan that aims to exceed the CCAP GHG emissions reductions target, whereby DRT would begin an accelerated transition to electric buses, purchasing only electric buses starting in 2024. The expected fleet composition and projected GHG emissions reductions are depicted below.

[7] The GHG forecast includes emissions from buses and depots. Based on today's technology, the electric buses are equipped with a diesel auxiliary heater to support range requirements, which results in some emissions. Additionally, the depot emissions account for indirect emissions from the generation of electricity consumed

Figure 2: Fleet Composition Forecast & Related GHG Emissions (Pathway Option 2)

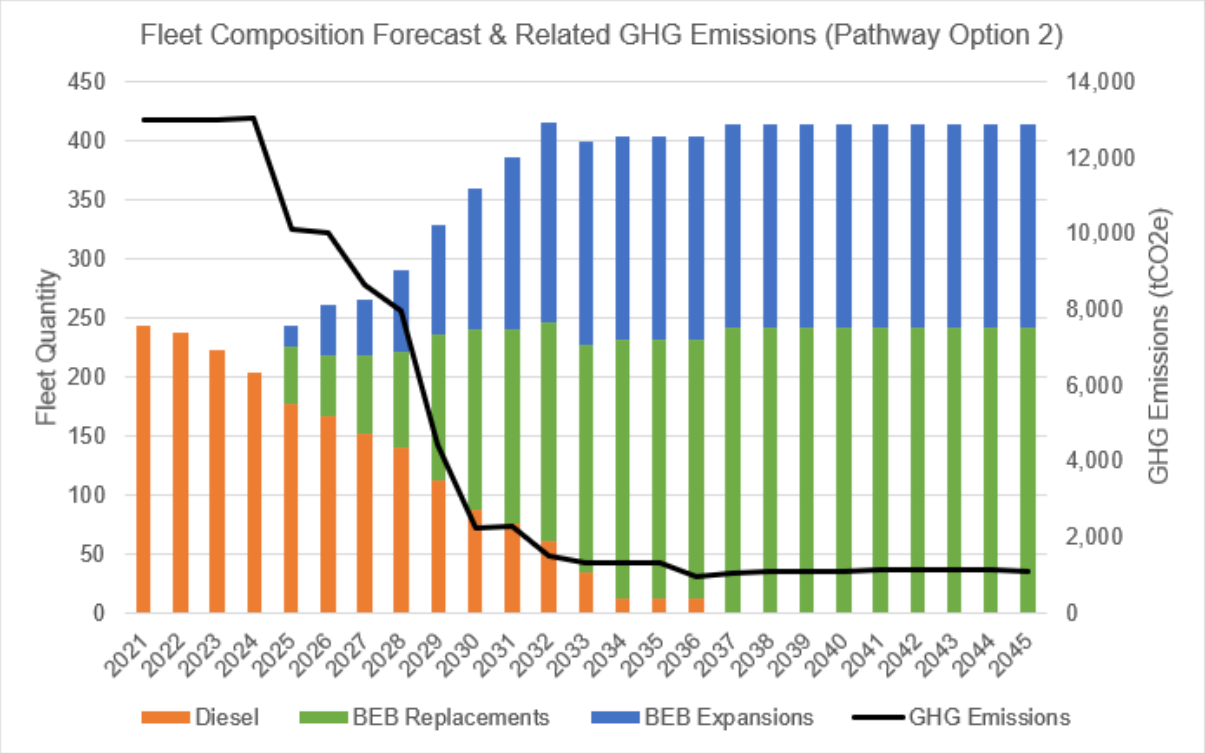


Table 2: DRT GHG Reduction Forecast (Pathway Option 2)

	Baseline Actual 2019	**Forecast 2030**	**Forecast 2045**
Annual GHG Emissions (t CO_2e)	21,925	2,232	1,074
% Reduction	N/A	90%	95%

4.9 Based on the assessment, Pathway Option 2 was recommended as the preferred option. Pathway Option 2 presents an opportunity for the Region to demonstrate strong leadership in reducing total GHG emissions from the DRT fleet by an additional 53,141 tonnes CO_2e over 25 years compared to Pathway Option 1 (equivalent to avoiding nearly 2.5 years of GHG emissions at 2019 baseline levels). In addition to exceeding the GHG emission reduction targets established in CCAP, Pathway Option 2 will also enable DRT to maximize available federal funding opportunities in the short term to support an accelerated transition timeline.

4.10 Under this model, DRT would undertake the following steps:

a. Beginning in 2023, replace some retiring diesel buses with BEBs and all expansion buses[8] will be purchased as BEBs. DRT may elect to replace the retiring diesel buses with hybrid-electric buses in 2023, but starting in 2024 all retiring buses will be replaced with BEBs to achieve complete electrification of the fleet by 2037.

b. Beginning in 2023, replace all demand responsive and non-revenue vehicles with battery electric vehicles.

c. Depot transition and infrastructure upgrades strategy:

- The Oshawa depot will be the primary focus for the first phase of the transition, preparing the depot for an all-electric fleet by 2033, with infrastructure upgrades and depot retrofits to occur between 2023 and 2025.
- The Ajax depot will receive limited electric buses in the first phase of the transition, with a continuous transition to electric buses in the second phase starting in 2026, preparing the depot for an all-electric fleet by 2037.
- The new transit operations and maintenance depot at 2400 Thornton Rd., Oshawa (expected to be commissioned in 2026) will be designed and built to support any relocated buses and expansion ZEBs.
- HDR and DRT have consulted with both OPUC and Elexicon (local distribution service providers in the Region), to review and assess the grid capacity to support the estimated electricity demand and energy consumption during the transition period. Preliminary review led to positive feedback, however, a detailed assessment of site services and infrastructure upgrades will be completed following the approval of the transition plan.

d. The charging strategy employed will include both depot-based overnight charging and en-route charging:

- Overhead-mounted conductive pantograph chargers will be the primary design solution at the DRT depots. Staff will continue to assess charging options based on business requirements and technical feasibility for installation at the depots.
- En-route chargers are proposed to be located at the Oshawa Centre Terminal, Harmony Terminal, Oshawa GO station, Centennial Circle (Toronto), Pickering Town Centre, and Ajax GO Station. Some en-route charging locations will be

8 The expansion electric bus quantities are a rough estimation based on the modelled average ratio data from 2021 service applied against the 2022 Transit Development Charge Background Study expansion quantities. The quantities are not based on where and how service is expected to operate in the future with electric buses

required earlier than others based on the pace of the bus fleet transition, with the earliest installation required in 2027. These early installations may include Oshawa Centre Terminal, Harmony Terminal, Oshawa GO station, and Centennial Circle (Toronto).

- Staff will assess options on the procurement approach for infrastructure upgrades and energy services by considering best value in total cost of ownership and operational efficiencies. It is highly recommended that DRT focus on operating the buses and will investigate options to outsource the delivery of infrastructure upgrades and operations and maintenance of charging infrastructure.

e. With current Federal financing and funding opportunities available until 2026, this pathway allows the Region to maximize opportunities to reduce the expected cost pressures of the transition for the Region (see Section 6 below).

f. DRT will continue to assess the commercial availability, cost and feasibility of battery electric buses (based on future range capabilities) and hydrogen fuel cell buses or other technologies currently in development, as potential options to replace the more difficult to transition routes.

- The first evaluation will occur in 2025, based on technology maturity, the supply chain network, technical and economic feasibility of the technology and fuel supply, with recurring checkpoints thereafter.
- If hydrogen fuel technology and the fuel supply chain (production, distribution, storage and dispensing) has advanced by this time, Phase II expansion for the 2400 Thornton Road, Oshawa facility may be designed to include provisioning for hydrogen fuel cell storage and maintenance.

4.11 The transition plan also includes BEB transition for the demand response and non-revenue fleet. As noted above, analysis of the mileage data of these vehicle types showed that these vehicles can be converted on a one-to-one basis. Therefore, transition of those type of vehicles follows the same requirement and expansion schedule as those for diesel vehicles.

5. Financial Summary

5.1 An analysis has been completed by HDR Inc, with input from DRT and Finance Department staff, to identify the estimated capital and operating impacts for the two transition options. This modelling exercise includes both the Fleet and Facility infrastructure, and was developed using 2021 dollars, a nominal discount rate of 8 per

cent and an inflation rate of 3 per cent. Both options were compared to the business-as-usual (BAU) case, which includes the continued purchase of diesel and/or gas vehicles.

The total capital and operating costs for each pathway option has been provided in nominal dollars for a 24-year window, from 2022 to 2045. The analysis shows a total nominal cost increase of $276 million (6.9 per cent) for Option 1 over business-as-usual (BAU) and a total nominal cost increase of $312 million (7.8 per cent) for Option 2 over BAU. The cost increases in the Pathway Options relative to the BAU are driven by increased capital costs associated with electric vehicles (factoring in the increased bus replacement ratios from 4.3 (f)), charging equipment and other related electrification infrastructure.

Table 3: Pathway Options Cost Analysis vs Business As Usual (Cumulative Nominal Dollars)

Description		Cumulative Nominal ($000's)		
		Business as Usual	**Pathway Option 1**	**Pathway Option 2**
Capital Costs	Fleet Purchase	$513,592	$781,821	$804,145
	Charging Equipment (including en-route stations)	-	$103,742	$103,668
	Infrastructure Upgrades[9]	-	$14,401	$14,401
Incremental capital impact over BAU		**-**	**$386,372**	**$408,621**
Operating Costs	Operations[10]	$2,192,079	$2,575,269	$2,652,104
	Bus Maintenance[11]	$824,661	$423,641	$381, 504
	Fuel[12]	$491,941	$101,566	$54,141
	Electricity[13]	-	$173,773	$197,684
	Charging Equipment Maintenance	-	$124,202	$126,253
Operating savings over BAU		**-**	**($110,230)**	**($96,996)**
Total		**$4,022,273**	**$4,298,417**	**$4,333,900**
Total Difference over BAU		**-**	**$276,144**	**$311,627**
Per cent (%) Difference over BAU		**-**	**6.87**	**7.75**

5.2 As described in 4.8 (a), if DRT elects to replace any remaining diesel buses with hybrid-electric buses in 2023, the total incremental capital cost is expected to be $4.8 million and approximately $675,000 in operating savings to be realized annually.[14]

9 Includes upgrades required on-site such as transformers, distribution equipment, electrical, structural and mechanical upgrades to the depot. Only considers retrofit upgrades to the existing DRT owned depots at Oshawa and Ajax. It does not include the facility build and infrastructure costs associated with 2400 Thornton Road. Additionally, utility service upgrades, storage and back-up generation have not been considered in this analysis.

10 Operations costs are related to additional operator hours required to provide service based on the increased quantity of vehicles.

11 Diesel bus maintenance costs includes mid-life refurbishment costs. The refurbishment costs for battery electric buses (primarily battery replacement) have been considered through extended warranty, reflected in the purchase price of the bus.

12 Diesel fuel pricing is based on estimated wholesale pricing. Future prices are escalated and include applicable taxes include projected federal carbon taxes

13 Electricity pricing is assumed based on the IESO Class B customer rates for Global Adjustment. Future price and global adjustments are inflated based on the consumer price index from Statistics Canada. It does not factor in potential reduction in costs due to system/facility wide demand management with eligibility for Class A customer rates under the IESO's Industrial Conservation Initiative (ICI) program.

14 The financial numbers are based on 15 hybrid-electric buses, with input variables based on DRT provided inputs for diesel buses and industry data for hybrid buses, in 2021 dollars. The operating savings are based on estimated maintenance and fuel savings, considering an average of 70,000 km's annually

5.3 Additionally, a net present value (NPV) analysis has been completed for the BAU scenario and the two transition options. The analysis discounts future costs back to present value terms using the effective real discount rate of 4.9 per cent. The NPV of capital and operational costs in Option 1 is $124 million (5.8 per cent) greater than the BAU and Option 2 is $147 million (6.9 per cent) greater than the BAU. The increased costs of the Pathway Options come from the greater upfront capital investments, which are discounted less than the future operational cost savings.

Table 4: Recommended Pathway Option vs Business As Usual (Net Present Value Analysis)

Description		**NPV ($000's)**		
		Business as Usual	**Pathway Option 1**	**Pathway Option 2**
Capital Costs	Fleet Purchase	$309,473	$480,072	$497,341
	Charging Equipment (including en-route stations)	-	$64,975	$66,951
	Infrastructure Upgrades	-	$13,040	$13,040
Incremental capital impact over BAU		**-**	**$248,614**	**$267,859**
Residual Value of Capital in 2045[15]		($50,102)	($83,022)	($82,930)
Operating Costs	Operations	$1,174,181	$1,331,682	$1,372,048
	Bus Maintenance	$441,388	$243,579	$219,103
	Fuel	$265,008	$73,590	$46,237
	Electricity	-	$80,872	$94,447
	Charging Equipment Maintenance	-	$59,231	$60,236
Operating savings over BAU		**-**	**($91,623)**	**($88,500)**
Total		**$2,139,948**	**$2,264,019**	**$2,286,474**
Total Difference over BAU		**-**	**$124,071**	**$146,531**
Per cent (%) Difference over BAU		**-**	**5.80**	**6.85**

5.5 Based on the data from Table 3 and 4, there are financial pressures resulting from the recommended option, however this is primarily attributed to the increased capital costs for the buses, charging equipment and infrastructure upgrades.

5.6 The cost estimates have been compiled using currently available information and reasonable assumptions, but many unknowns and risks related to the costing remain due to the new and evolving nature of zero emission vehicles, infrastructure, as well as fuel and energy pricing. As electric vehicle implementations are undertaken in Durham

15 A residual value was included to capture the benefit of the remaining useful life of buses at the end of the study period. While the residual value is not a realized financial impact, it does capture the benefit of deferring future capital replacement needs.

and elsewhere, staff anticipate ongoing learning regarding asset performance and lifecycle costs.

5.7 There are also potential opportunities to reduce the financial impact of the transition, based on the current climate, technology maturity and operational efficiencies:

a. There are Federal debenture financing and grant funding opportunities to help off-set a portion of the incremental capital costs of the transition. Staff will continue to work diligently with its Federal counterparts to secure financing and funding following the approval of this Plan.

b. As demand for electric buses increases and the technology matures, it is anticipated that some reduction in bus pricing may be realized. Reduction in component pricing, such as the lithium-ion batteries offers the greatest opportunity for price reduction.

c. As previously described, the financial analysis assumes that the average bus replacement ratio is applied to all future expansion buses. As such, based on technology maturity and operational efficiencies with bus deployment and service, opportunities exist to reduce the required BEB quantities and non-revenue time, leading to a reduced capital and operating impact

d. The analysis has conservatively assumed that electricity costing would be subject to typical distributor level costs and commodity charges including Global Adjustment (GA) costs as applicable to Class B customers. The IESO allows for participation in the Industrial Conservation Initiative (ICI) program for accounts generally over 1 megawatt (MW) in average demand per month which provides an alternative method for allocating GA costs at the billing level. Assuming continuation of the ICI program into the future, the additional loads at DRT depots would be expected to push the accounts into ICI Class A eligibility, which, subject to coordination with facility operations, may be able to allow for greater Regional coordination of demand curtailment and conservation initiatives to lower relative GA costs overall.

e. A future assessment of extending the bus life to 15 years based on the technical feasibility could lead to an increase in operating savings over the bus life cycle

5.8 The long-term service and financing strategy will consider the phasing and financing of this electrification plan within the broader context of Transit’s comprehensive capital and operating pressures over the next 10 years. This long-term service and financing

strategy will be presented to Council in advance of the 2023 Business Plans and Budget.

6. Financing and Funding Opportunities

6.1 To reduce the short-term capital pressures and impacts, staff have been actively working on opportunities that are available through Federal Agencies including the Canada Infrastructure Bank (CIB) for partial bus debenture financing and Infrastructure Canada for Zero Emission Transit Fund (ZETF) grant funding.

6.2 Canada Infrastructure Bank (CIB)

a. The Canada Infrastructure Bank (CIB) has committed to invest $1.5 billion across Canada in zero emission buses through its three-year Growth Plan. The CIB is offering a low interest debt financing program, for a portion of electric vehicle costs. These funds complement Infrastructure Canada's grant funding for zero emission buses.

b. The Region is working towards entering into a Memorandum of Understanding (MOU) with the CIB to continue discussions for low interest debenture financing support towards a portion of the capital acquisition costs of battery electric buses.

6.3 Infrastructure Canada – Zero Emissions Transit Fund (ZETF)

a. Infrastructure Canada has launched a $2.75 billion Zero Emission Transit Fund – a five-year national program that offers support to public transit and school bus operators across Canada towards the purchase of zero emission public transit and school buses and associated infrastructure. The fund also delivers on the Federal government's commitment to help purchase 5,000 zero emission buses over the next five years.

b. The Zero Emission Transit Fund will help remove key barriers impeding the deployment of zero emission buses by providing funding for planning, as well as the procurement of buses and ancillary infrastructure required to support zero emission buses.

c. Following the submission of an expression of interest, Durham Region has been invited to participate in Phase II of the program and submit an application for capital grant financing.

- Infrastructure Canada has encouraged staff to complete discussions with the CIB and finalize potential low interest debenture financing for a portion of the cost of the battery electric buses prior to submitting an application for the ZETF.
- The maximum grant contribution is up to fifty per cent of the total eligible costs.
- Staff to continue discussions, while aiming to submit an application by the fourth quarter of 2022

6.4 Natural Resources Canada (NRCan) continues to accept proposals for funding under the Zero Emissions Vehicle Infrastructure Program (ZEVIP), through which the Region has been successful in securing funding to support the implementation of dozens of EV chargers across the Region to support public charging, workplace and light-duty fleet charging. A new request-for-proposals (RFP) process has been announced and NRCan is accepting applications for funding for all charging applications, including to support the charging of light, medium and heavy-duty fleet vehicles. Staff will continue to review eligibility for this stream (proposals due August 2022) and future streams of ZEVIP funding for opportunities to assist with transition plan implementation.

6.5 Staff will continue to seek other financing and funding opportunities to reduce pressures and support this transition plan, and collaborate with transit industry associations as part of government advocacy efforts.

6.6 In addition, the potential for using Development Charge (DC) financing will also be explored. Staff will further examine the grant funding, growth related needs, timing and capital costs of the electric buses to determine if an amendment to the Transit DC By-law may be necessary

7. Additional Operational Considerations

7.1 The transition to zero emission vehicles adds another layer of complexity to service planning and scheduling where bus range, charging time and equipment availability will need to be incorporated into bus planning and scheduling activities.

7.2 Software and control systems will play a critical role in the transition, enabling bus and equipment to be integrated into the existing system for maximum operational efficiencies.

7.3 Staff will work closely with the Works – Facilities department to plan for and support the depot retrofits and infrastructure upgrades required to enable this transition. These upgrades will require detailed planning and phasing of work, since the depots are active Operational sites.

7.4 The transition to electrification also requires different skills set, with new training programs and resources that ensure staff are prepared to maintain high voltage equipment.

8. Relationship to Strategic Plan

8.1 This report aligns with/addresses the following strategic goals and priorities in the Durham Region Strategic Plan:

a. Environmental Sustainability

- Goal 1.1 - Accelerate the adoption of green technologies and clean energy solutions through strategic partnerships and investment
- Goal 1.4 - Demonstrate leadership in sustainability and addressing climate change

b. Economic Prosperity

- Goal 3.4 - Capitalize on Durham's strengths in key economic sectors to attract high-quality jobs

9. Next Steps

9.1 Upon approval of recommendations contained in this report, Staff will:

a. Prepare the long-term service and financing strategy which considers the phasing and financing of the fleet transition plan as part of DRT's overall service strategy for presentation to Council in advance of the 2023 Business Plans and Budget

b. Execute an MOU with the CIB and complete due diligence on the CIB's financing framework, with the objective to return to Council to seek approval on a credit agreement in early 2023

c. Complete further assessments with HDR to prepare deliverables that will support the capital project submission to Infrastructure Canada as part of the ZETF program

d. Explore and evaluate joint procurement and partnership opportunities to acquire electric buses, charging equipment and supporting infrastructure to achieve best value for the Region

e. Prepare for Phase II planning studies to support the fleet electrification plan on the following:

- Service planning and scheduling process
- Detailed depot planning and design for charging equipment and infrastructure

9.2 A similar report will be brought forward to the June 14, 2022 Finance and Administration Committee for information purposes and referral to the Transit Long-term Servicing and Financing Study.

10. Conclusion

10.1 Based on the study results, economic analysis and funding opportunities currently available, the Transition Pathway Option 2 is recommended as the preferred option as DRT's fleet electrification strategy.

10.2 Approval of this recommendation enables DRT to take the necessary steps to support the deployment of clean technologies that will reduce greenhouse gas emissions from public transit in Durham Region.

10.3 For additional information, contact: Jamie Austin, Deputy General Manager, Business Services, Durham Region Transit, at 905-668-7711, extension 2624.

11. Attachments

Attachment #1 – DRT Fleet Feasibility Study and Transition Plan Summary

Respectfully submitted,

Original Signed by

Bill Holmes
General Manager, DRT

Recommended for Presentation to Committee

Original Signed by

Elaine C. Baxter-Trahair
Chief Administrative Officer

Attachment #1: HDR Report: DRT Fleet Feasibility Study and Transition Plan

Executive Summary

In March 2021, Durham Region Council approved the Corporate Climate Action Plan (CCAP) which targets to reduce corporate greenhouse gas (GHG) emissions of Durham Region by 25 per cent below 2019 levels by 2025, 40 per cent below 2019 levels by 2030 and 100 per cent by 2045. To reach those targets, the CCAP outlined action items which include the transition of corporate fleets, such as public transit vehicles, to low or zero carbon alternatives.

In July 2021, DRT retained HDR Inc to conduct a feasibility study and develop a zero-emissions fleet transition plan. The aim of the study is to identify a multi-year ZEB fleet transition, infrastructure requirements, and the anticipated financial impacts.

HDR first conducted an industry scan and technology review of the current state of zero emission bus (ZEB) technologies. These included battery electric buses (BEBs), fuel cell electric buses (FCEBs), and the associated charging, fueling and parts supply chain. Five major BEB manufacturers currently operate in the Canadian market versus only two for FCEBs. Likewise, BEB charger and parts availability is better than FCEB fueling supply and parts availability in the Canadian market as of the writing of this report.

Should either technology be chosen for adoption, a number of considerations will need to be made for DRT's facilities. For BEBs, serious considerations need to be given to the space and positioning of charging positions and the required charging and electrical equipment. For FCEBs, considerations need to be given to the location of the hydrogen fueling equipment, and the retrofitting of required safety equipment.

After completion of the technology review, energy modelling of the existing DRT services was carried out based on service plans from September 2021. Three scenarios were modelled for BEBs, FCEBs:

1. Overnight Charging/Fueling
2. Overnight and Midday Charging/Fueling
3. Overnight, Midday and En-route Charging/Fueling

For BEBs, each scenario was modelled with and without diesel auxiliary heaters on buses. For FCEBs, only scenarios 1 and 2 were modelled. Conventional Diesel buses were also modelled in a separate scenario as point of comparison. Outputs from the model showed that midday and enroute charging were both beneficial to the operating flexibility and fleet size requirement of BEBs. The model also show that the addition of diesel heaters makes a significant difference in reducing the fleet need for BEBs. For FCEBs, the model outputs show that FCEBs can replace diesel buses on the existing services with little to no increase in fleet size need or modification to the service schedule. Charging and fueling requirements were also estimated to support the fleet for the existing 2021 services based on the model outputs.

Based on draft cost estimates quantitative outputs from the energy model and the qualitative assessment of DRT's existing fleet and facilities and each ZEB technology, a transition to BEBs was chosen as the preferred zero emissions propulsion system for DRT's fleet. Qualitatively, BEBs ranked lower on route flexibility but had the advantage as it related to technology maturity for vehicles and supporting infrastructure, facility upgrades and maintenance complexity. Subsequently, two transition pathways towards a full BEB fleet were drawn up guided by the CCAP targets and a number of other key objectives:

1. Pathway Option 1 – Standard – Full transition by 2045
2. Pathway Option 2 – Accelerated – Full transition by 2037

The two pathways primarily differ in their speed of ZEB adoption, with option 1 being the more conservative option, reaching full conversion by 2045, and option 2 reaching full conversion by 2037. Nominal cost and net present value analysis were carried out for both pathways. In both analyses, the transition pathways have a net negative return compared to the business as usual (BAU) scenario with diesel buses, largely driven by large up front capital investments which were offset by savings in operational costs. Emission projections were also estimated for each of the options, with both reaching near zero emission in line with the time of their respective full ZEB conversion year.

Based on the assessment presented, the Transition Pathway Option 2 should be adopted by DRT as the preferred transition strategy towards a full zero emission fleet as it is able to demonstrate benefits over both the BAU scenarios and the Pathway Option 1 while maximizing opportunities to reduce the financial impact of the transition such as leveraging available Federal government financing and funding. The next step should be to further develop the transition and produce depot layouts and design to support the future fleet, charging equipment and infrastructure. Given the rapid development of both

BEBs and FCEBs, DRT should also closely monitor the development of both technologies and revisit its transition plan, if necessary, in the 2024 to 2026 timeframe.

Industry Scan/Technology Review

Bus and Fuel Availability

Battery Electric Buses (BEBs)

BEBs are currently available in the Canadian marketplace with a limited number in operation in Canada but operating in several markets in the United States. Heavy duty BEBs in the standard 40 foot size are available in the Canadian market through five manufacturers – New Flyer Industries (NFI), Nova Bus, Proterra, BYD Motors, and GreenPower Motor Company. 60-foot BEBs are available from NFI and BYD while 45-foot double decker BEBs are available through Alexander Dennis, a subsidiary of NFI Group. These buses carry batteries varying in size from 210 to 660 kWh with driving ranges from 200 km to over 500 km.

Medium duty BEBs (cutaway shuttle buses, 30’ and 35’) are available through GreenPower, Proterra, BYD, Forest River, El Dorado, Grande West and Lighting eMotors, Vicinity Motor Corp, Pheonix Motorcars and Motiv. These BEBs carry batteries ranging in size from 63 to 440 kWh.

Based on experience in the US, BEBs require a lead time of about 12-18 months while chargers have a lead time of 6-8 months from Notice to Proceed to delivery.

Fuel Cell Electric Buses (FCEB)

The major manufacturers of FCEBs in North America are ElDorado National and New Flyer Industries, which produce FCEBs from 35 foot to 60 foot in size, with range capabilities from 400 km to more than 550 km.

Parts Supply Chain

The supply chain for BEBs is well established and parts are readily available from the manufacturers listed in the previous section. Those manufacturers are also Buy America compliant for the US market, meaning most parts will be from the US (up to approximately 70%). With some major components such as batteries and motors that can come from Canada, China, or Europe. In comparison, supply chain for FCEBs is still limited, but the industry around hydrogen fuel cell technology is rapidly evolving, so the situation could improve rapidly in the coming years.

Electricity Availability
Standard grid electricity, which is readily available, can be used to charge batteries in BEBs, though other off-board electrical power sources can also be used. However, electrical utility upgrades, both on-site and off-site, may be required at facilities hosting BEBs to ensure sufficient supply to the facility to charge the BEB fleet.

Hydrogen Fuel Availability
Air Products, Air Liquide and Linde are the major hydrogen fuel producers in North America, with Enbridge, AVL, Hydrogenics, ITM Power, and Next Hydrogen also playing a part in Canada. At this time, hydrogen can be supplied in either gas or liquid form via pipeline or truck similar to Compressed Natural Gas (CNG) or produced on-site.

Hydrogen is less readily available than electricity and diesel fuel in Canada, but there are a few facilities currently online or soon to be online in Ontario which could supply hydrogen to transit agencies within the GTHA. An electrolysis facility jointly managed by Enbridge and Hydrogenics is now in production in Markham, Ontario, while OPG and Altura Power are in the process of obtaining electrolyzers for a future facility. There are also other options such as procuring hydrogen from existing steam methane reformation (SMR) supply chains in Canada, but the SMR process is more carbon intensive. The Ontario provincial government also recently developed a hydrogen strategy to build up the hydrogen economy in the province, so hydrogen supply should further improve in the coming years.

Infrastructure Requirements

BEB Facility Requirements
Major considerations for in-depot BEB charging include:

- Bus storage
    - Current and future fleet size, storage space and charging requirements (overnight, mid-day, etc).
    - Charging infrastructure
    - Bus to charger ratio
        - Consider spare chargers for maintenance or malfunctions.
        - For initial deployments, it is best practice to have one charger per depot-charged bus with a redundant charger to limit service interruptions.

        - Floor space for dispensers or ceiling space for reel dispensers or overhead pantographs
        - The potential phasing of the equipment as well as access requirement to the equipment should be considered.

Electrical equipment (transformers, switches, and additional service feeds from the local utility)

- Available electrical utility service capacity and upgrade needs
- The location and space of this equipment, including phasing and access requirements for maintenance

- Structural upgrades (if overhead pantograph or dispenser is chosen), HVAC (to deal with added heat from charging) and safety (high powered equipment) upgrades to the facility.
- New maintenance procedures for BEBs and accompanying charging infrastructure

- Fall arrest for working on top of buses where batteries are typically stored or on gantry systems if overhead charging solution is chosen
- Electrical protection on charging equipment

FCEB Facility Requirements

There are multiple different arrangements of equipment for FCEB fueling infrastructure depending on type of generation, type of storage, and whether the generation and dispensing are co-located or not. The components for hydrogen refueling can also vary depending on whether hydrogen will be stored as a high-pressure gas or to condense it into a liquid.

Some of the primary considerations for FCEB refueling are:

- There are stringent requirements for fueling FCEBs indoors
- Retrofits to storage and maintenance garages for hydrogen storage and distribution. These retrofits can include upgrades to:

- Air circulation systems
- Gas detection systems
- Fire suppression systems
- Modifications to exhaust fans
- Modifications to electrical systems

- Inspection of electrical systems, such as ceiling mounted fixtures and connections, for sources of ignition
- Garage infrastructure must be reviewed to see if it can be upgraded to have hydrogen buses with pressurized reservoirs.
- Location of the production and/or storage equipment on site and their space requirements
- The dispensing processes and infrastructure required for storage of both gaseous and liquid hydrogen and on-site production from the source to the vehicle are shown in **Figure 1**

Figure 1: Dispensing process for gaseous and liquid hydrogen

Fueling/Charging Equipment

BEB Charging Equipment

The major BEB charging components are:

- Transformer
- Switchgear
- Charger(s)
- Dispenser(s)

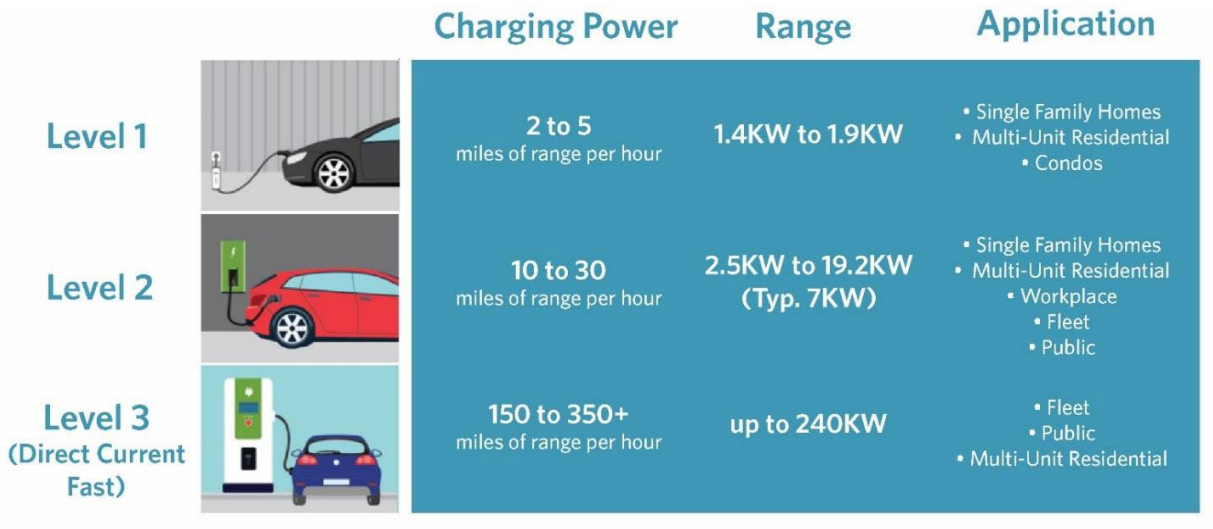
More might be needed based on size of deployment, requirements from electric utility, and charging method. The chosen charger type also influences what other components are needed.

Low-powered in-depot charging

Low-powered in-depot charging operates at 150 kW or lower and is typically used in storage or garage facilities to charge slowly during the day or night at a lower power

level. There are 3 levels of plug-in chargers for in-depot charging– levels 1, 2 and direct current fast chargers (DCFC). In most cases, charging with Level 1 and Level 2 is impractical for larger vehicles due to the larger battery sizes, shorter charging windows, and service availability requirements. **Figure 2** describes the differences further including the charging power ranges and types of vehicles each level is suitable for.

Figure 2: Plug-in electric vehicle charger types



Mid-powered Inductive Charging

Mid-powered inductive charging utilizes a stationary charger buried under the pavement to wirelessly charge a vehicle stationed over the charger. Several different manufacturers are currently working on this technology for buses and heavy-duty vehicles as well as light-duty vehicles. Their charging power ranges from sub-100kW up to 300kW and can be deployed for either en-route charging or in-depot charging.

High-powered Overhead/Opportunity Charging

Opportunity charging extends the distance and use of heavy-duty electric vehicles, particularly buses, away from their base facilities. These chargers often operate at a higher wattage (i.e., 450 kW) to deliver a quicker charge and are effective at extending the bus range by charging while the bus is stopped to load or unload passengers, such as at a transit center. It can also be installed in garages in the form of an overhead pantograph system. Typically, an overhead charging station with a charging power

range of 150 to 600kW can add 20 to 50km of driving range to a BEB in 5 to 10 minutes depending on geographical conditions.[1]

High-Powered Megawatt Charging

The goal of this type of charger is to develop a universal (non-proprietary) method for charging electric heavy-duty vehicles within a reasonable time. The self-imposed requirements are that the charger utilizes a single conductive plug that is touch safe and bi-directional to charge a commercial vehicle (and possibly other forms of transportation) at 1 MW or greater of DC load. CharIN has tested several plugs and is working to develop the standard by the end of 2021.

Hydrogen Refueling Station (HRS) Components

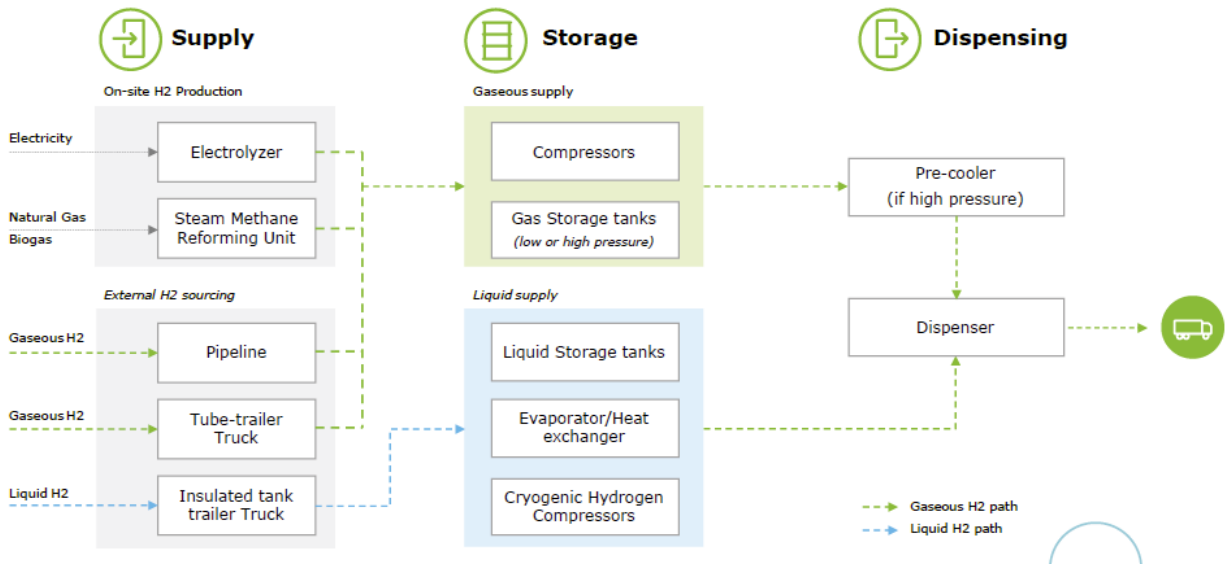
A typical HRS includes:

- Hydrogen delivery system, where hydrogen is delivered by a supplier or produced on-site
- Hydrogen storage tank(s)
- Vaporizer (for liquid storage)
- Compressor
- Chiller
- Dispensing system that delivers the fuel to the vehicle

There are multiple options for where an FCEB can be refueled so how the hydrogen is produced, delivered, and stored (if applicable) are the main components to consider when a transit agency is choosing a hydrogen fueling station site location. **Figure 3** shows the different considerations for hydrogen storage, supply and dispensing.

[1] CUTRIC, Best Practices and Key Considerations for Transit Electrification and Charging Infrastructure Deployment to Deliver Predictable, Reliable, and Cost-Effective Fleet Systems, 2020, p. 22, https://cutric-crituc.org/research-resources/

Figure 3: Typical hydrogen refueling station operating model



Commercial Availability

BEB Charging

Plug-in chargers for in-depot charging

As listed in **Table 1**, there are six major DCFC manufacturers available in the North American market that have wide use with bus manufactures. The table also provides the typical plug-in charging sizes utilized by bus manufacturers. These charger manufacturers may also offer larger plug-in chargers, but they are not typically used in the transit bus industry and not included within this report. En-route, opportunity charging through overhead or inductive chargers are often available through these manufacturers as well.

Table 1: Typical Charger Manufacturers

Charger Manufacturer	Charging Capacity (kW)	Number of Dispensers per Charger	Type of Charging
ABB[2]	50	1	Single
	100	3	Sequential
	150	3	Sequential
ChargePoint[2][3]	62.5 kW (single) 125 kW (paired)	Up to 2	Sequential or Simultaneous
	Varies	Multiple	
Efacec[4]	90	1	Single
	150	1	Single
	160	1	Single
Heliox[5]	180	3	Sequential or Simultaneous
Proterra[6]	75	4	Sequential
	150	4	Sequential or Simultaneous

[2] https://new.abb.com/ev-charging/products/depot-connector-charging, April 1, 2021

[3] https://www.chargepoint.com/products/commercial/, April 1, 2021

[4] New Flyer Infrastructure Solutions Charger Catalog, January 2021

[5] https://www.heliox-energy.com/products-and-services/our-products, April 6, 2021

[6] https://www.proterra.com/energy-services/charging-infrastructure/, April 1, 2021

Mid-powered Inductive Charging
Inductive charging is currently under development, with limited commercial use.

High-powered Overhead/Opportunity Charging
Overhead charging is widely utilized in Europe and Asia, with increasing use in North America. Several tests are currently ongoing within North America to obtain additional information regarding these chargers and their compatibility with BEB models offered here. One such test is currently being conducted by CUTRIC, while a second will be conducted by King County Metro in Seattle, WA using multiple charger and bus manufacturers.

High-Powered Megawatt Charging
A megawatt charger system (MCS) is currently being developed by CharIN. However limited information is publicly available.

Supply chain
The supply chain for BEB chargers is fairly new and the components for the chargers, and energy storage systems (ESSs) if needed, need to be carefully reviewed.

FCEB Fueling
Hydrogen production, storage and fueling equipment is less “off the shelf” than BEB charging solutions. Cummins, HyGear, NEL, and Siemens currently provide hydrogen production equipment. Manufacturers such as Air Products and Linde produce storage tanks for liquid hydrogen and manufacturers such as NEL provide fuel dispensers and related equipment such as station modules and fueling storage. These can be purchased directly from the manufacturer or leased for a monthly cost.

Enbridge and OPG have also indicated that they are interested in providing hydrogen equipment and infrastructure, though the actual arrangement of this is currently unclear.

Hydrogen fueling systems are more complex than a BEB charging systems due to the need to develop a local supply chain for hydrogen and install an electrolysis-based fueling system. OPG is in the process of obtaining an electrolyzer but the lack of hydrogen fuel commercially available is important when considering installing a hydrogen-generating fuel station as there will likely be more capital costs and discussion with the energy suppliers involved.

Other Considerations

Considerations for BEB

Coordinate with electric utility company early on in process to ensure supply availability and reliability

Determining charging costs and opportunities for demand management

Understand consumption patterns and utility rate structure

Backup plan for power outages or disruptions should be developed considering what is needed for transit agency operations to continue in different times of day, days of the week, and types of events (e.g. significant weather events). Additional infrastructure might be needed, such as dual power feeds, backup power generator, on-site energy generation utilizing wind or solar, fuel cells, or dual-grid operation. Options should be discussed with the utility provider.

Considerations for FCEB

- Pre-cooling might be needed for hydrogen stored on-site
- FCEB systems require power for fueling infrastructure to operate. A backup plan should be considered in a similar way discussed in the BEB considerations and options should be discussed with the utility provider

Current State Assessment

Energy Modelling

Energy consumption modelling for the conventional DRT Fleet was done using HDR's Zero+ Tool. The service data used was based on GTFS data for September 2021, representing post-covid service considerations. Contractor operated buses were modelled separately as they operate independently from their own depot, and modelling their infrastructure was not part of the scope of this study.

HDR's tool simulates the energy consumed by each vehicle as they operate the day's service patterns. The model takes into consideration the route topography, duty cycles, vehicle weight, auxiliary loads (including heating) and physics-based parameters such as the coefficient of rolling resistance.

Energy modelling for any non-conventional vehicles (specialized, on-demand service and support vehicles) was done at a high-level due to less available data and the less structured nature of the services.

Battery Electric Bus Analysis

Key Assumptions

BEBs are assumed to have the best battery capacities on the market today. This creates a reasonable baseline, as battery capacity are expected to increase in the future. For hydrogen fuel cell buses, a 50 kg tank was assumed. This is slightly larger than tanks available on current models such as those from New Flyer, however industry trends indicate that capacity will likely increase.

A 20% reduction of battery capacity was applied to reflect the loss of capacity by the end of life of the bus. This is consistent with bus manufacturers warranties which typically guarantee 80% of battery capacity for 12-years. The bus's onboard battery management system may restrict battery capacity in operation as well.

Energy consumption was modelled for the 10th percentile lowest temperature in Ajax in January which is about -17 ° C and assuming an electric heater (which requires a loading of about 24 kW). This is a relatively conservative assumption as a heater would likely not need to be run the full day but is reasonable for the purposes of this technical feasibility analysis.

Diesel heater scenarios were also tested, which reduces power requirements while increasing the range of vehicles. In this case, the new worst-case scenario is a hot summer day as cooling should still be provided by an electric A/C system. Assuming a temperature of 30° C which is in the 10th percentile of hottest days in Ajax, this translates to a demand of about 7 kW from the electric AC system.

In depot charging is modelled with 150 kW chargers, while 450 kW pantograph chargers were assumed for en-route charging, both with a 95% efficiency.

Model Scenarios

Three scenarios were modelled for the analysis with different assumptions about the charging strategy used:

1. Overnight Charging/Fueling - Overnight charging only with modifications to block schedules
2. Overnight and Midday Charging/Fueling - Overnight charging and midday charging with modifications to block schedules
3. Overnight, Midday and En-route Charging - Overnight charging, midday charging and en-route charging. Only applicable to BEBs

For scenario 3, the following locations were tested for potential opportunity chargers based on review of DRT's current schedules for high number of bus hours spent at these stops:

- Pickering Parkway Terminal
- Oshawa Centre Terminal
- Harmony Terminal
- Ajax GO
- Oshawa GO
- Centennial Circle
- Ontario Tech University

Whitby GO station was also tested for the contractor operated service due to the high number of hours spent there.

To develop a feasible schedule for DRT, currently scheduled blocks have been split to be compatible with the range capability of a BEB. The schedule developed is only meant to be a minimum viable schedule. Each scenario is modelled with either electric heating or diesel auxiliary heating, with **Table 2** and **Table 3** showing the summary model output statistics for internal services and contractor services respectively.

Table 2: Operating Statistic Summary, Conventional Internal DRT Service

Metric (Weekday)		Diesel Baseline	Battery Electric Buses						Hydrogen Fuel Cell Buses	
			Electric Heating			Diesel Heating				
			Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route Midday Charging	Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route, Midday Charging	Overnight Fuelling	Midday Fuelling
Number of Blocks		89	256	256	145	163	162	98	100	100
Number of Splits	0	89	20	20	52	26	27	80	78	78
	1	-	8	8	20	52	51	9	11	11
	2	-	33	33	15	11	11	-	-	-
	3	-	23	23	2	-	-	-	-	-
	4	-	1	1	-	-	-	-	-	-
	5	-	4	4	-	-	-	-	-	-
Minimum 40' buses to run schedule		68	206	107	82	128	96	73	78	68

Metric (Weekday)		Diesel Baseline	Battery Electric Buses						Hydrogen Fuel Cell Buses	
			Electric Heating			Diesel Heating				
			Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route Midday Charging	Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route, Midday Charging	Overnight Fuelling	Midday Fuelling
Minimum 60' buses to run schedule		6	33	13	10	16	12	6	6	6
Revenue-Km		28,227	28,227	28,227	28,227	28,227	28,227	28,227	28,227	28,2287
Non-Revenue-Km		1,890	5,123	5,123	3,035	3,088	3,045	1,957	2,113	2,113
Revenue-Hours		1,114	1,114	1,114	1,114	1,114	1,114	1,114	1,114	1,114
Non-Revenue-Hours		35	96	96	58	60	59	37	39	39
Westney	Energy Consumption (kWh)	-	36,495	36,495	21,103	22,079	22,024	8,957	-	-
	Daily Hydrogen Fuel	-	-	-	-	-	-	-	1,441	1,441

Metric (Weekday)		Diesel Baseline	Battery Electric Buses						Hydrogen Fuel Cell Buses	
			Electric Heating			Diesel Heating				
			Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route Midday Charging	Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route, Midday Charging	Overnight Fuelling	Midday Fuelling
	Consumption (kgH2)									
	Number of 150 kW Chargers	-	39	27	15	24	13	6	-	-
	Peak Power (kW)	-	5,250	3,000	1,650	3,000	1,650	750	-	-
Raleigh	Energy Consumption (kWh)	-	36,573	36,573	12,405	20,286	20,286	4,051	-	-
	Daily Hydrogen Fuel Consumption (kgH2)	-	-	-	-	-	-	-	1,569	1,569

Metric (Weekday)		Diesel Baseline	Battery Electric Buses						Hydrogen Fuel Cell Buses	
			Electric Heating			Diesel Heating				
			Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route Midday Charging	Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route, Midday Charging	Overnight Fuelling	Midday Fuelling
	Number of 150 kW Chargers	-	36	22	6	20	10	3	-	-
	Peak Power (kW)	-	5,400	2,700	900	3,000	1,500	450	-	-
En-Route	Energy Consumption (kWh)	-	-	-	35,595	-	-	27,790	-	-
	Number of 450 kW Chargers	-	-	-	12	-	-	12	-	-
	Peak Power (kW)	-	-	-	900	-	-	900	-	-

Table 3: Operating Statistic Summary, Conventional Contractor DRT Service

Metric (Weekday)		Diesel Baseline	Battery Electric Buses						Hydrogen Fuel Cell Buses	
			Electric Heating			Diesel Heating				
			Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route Midday Charging	Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route, Midday Charging	Overnight Fuelling	Midday Fuelling
Number of Blocks		22	50	50	40	33	33	29	26	26
Number of Splits	0	22	8	8	12	13	13	17	18	18
	1		5	5	5	7	7	3	4	4
	2		5	5	3	2	2	2	-	-
	3		3	3	1	-	-		-	-
	4		1	1	1	-	-			-
Minimum 40' buses to run schedule		16	42	22	19	27	19	17	23	16
Revenue-Km		5,446	5,446	5,446	5,446	5,446	5,446	5,446	5,446	5,446

Metric (Weekday)		Diesel Baseline	Battery Electric Buses						Hydrogen Fuel Cell Buses	
			Electric Heating			Diesel Heating				
			Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route Midday Charging	Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route, Midday Charging	Overnight Fuelling	Midday Fuelling
Non-Revenue-Km		574	1,163	1,163	1,078	804	804	743	645	645
Revenue-Hours		186	186	186	186	186	186	186	186	186
Non-Revenue-Hours		11	22	22	19	15	15	13	12	12
Contractor Depot	Energy Consumption (kWh)	-	13,114	13,114	9,231	8,029	8,029	5,373	-	-
	Daily Hydrogen Fuel Consumption (kgH2)	-	-	-	-	-	-	-	565	565
	Number of 150 kW Chargers	-	13	8	5	8	5	2	-	-

Metric (Weekday)		Diesel Baseline	Battery Electric Buses						Hydrogen Fuel Cell Buses	
			Electric Heating			Diesel Heating				
			Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route Midday Charging	Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route, Midday Charging	Overnight Fuelling	Midday Fuelling
	Peak Power (kW)	-	1,950	900	750	1,200	750	300	-	-
En-Route	Energy Consumption (kWh)	-	-	-	3,721	-	-	2,579	-	-
	Number of 450 kW Chargers	-	-	-	5	-	-	5	-	-
	Peak Power (kW)	-	-	-	900	-	-	900	-	-

Model Summary
Operating services with overnight charging only would require the largest increase in non-revenue hours, non-revenue kilometers, and peak vehicles required. Non-revenue hours, non-revenue kilometers refer to hours and distances where the bus is in operation but is not in revenue earning service. At the same time, the scenario also requires the highest peak power demand.

Introducing midday charging does not improve the amount of non-revenue hours and non-revenue kilometer increase significantly but does reduce the peak vehicle requirement and peak power demand substantially.

Introducing en-route charging substantially reduces all three operating metrics. In addition, en-route charging also slightly reduces the total energy consumption from the BEBs, while reducing the peak power demand at the depots by spreading them out to the various en-route charging locations.

Results from both hydrogen fuel cell scenarios are nearly identical and show operating metrics and peak fleet requirements that matches the best of the BEB scenarios.

Electric Heating vs. Diesel Heating
In each of the scenarios, equipping the buses with diesel heating offers significant improvements in both operating metrics, fleet requirement, peak power demand and energy consumption.

Specialized and Non-Revenue Fleet
High-level energy modeling of the specialized and non-revenue fleet analysing milage data of vehicles from 2019 and 2020 was able to show that these vehicles can be converted to battery electric vehicles on a one-to-one basis given the range capabilities of commercially available options.

Facility Assessment/Infrastructure Review

Existing Facilities

Ajax Depot
The Ajax is located at 110 Westney Road South in Ajax, Ontario. It is constrained, with little room for expansion due to the proximity of environmentally sensitive lands to the west, and Metrolinx owned properties (Ajax GO station) the north, east and south. The facility currently services and stores 40’ and specialized service 26’ buses. Room for storage in the facility itself is limited, most of the conventional fleet is currently stored

outdoors on the south side of the facility. Some vehicles are also stored to the south of the facility on property leased from Metrolinx.

In terms of potential for transitioning the facility to be used for ZEBs, the location is constrained. Besides the space constraints noted above, which limits the deployable size of ZEB fleet at the facility using either ZEB technology, site visit conducted by HDR also found low ceiling height in the storage bay which will also limit the installation options of charger dispensers.

Oshawa Depot

The DRT depot in Oshawa is comprised of a bus storage facility at 710 Raleigh Avenue and a maintenance depot directly to the north at 715 Farewell Street. 710 Raleigh (the south and middle buildings) includes administration offices, indoor storage for buses and parking for transit employees while the north building located at 715 Farewell Street is a newer vehicle maintenance and servicing building. The conventional fleet based at Raleigh are parked in the storage facility while the specialized and non-revenue fleet based there are parked outdoors along with the 60’ buses. The Raleigh facility will be storing and servicing eight new BEBs in the near future. Electrical equipment for the eight pilot BEBs is planned to be sited at the existing parking spaces near the facility south entrance, next to the south building.

In terms of potential for transitioning the facility to be used for ZEBs, the space currently sited for electrical and charging equipment to support the eight pilot BEBs should also be able to support additional equipment for a full deployment. The storage facility does not have the same low ceiling issue as the Westney and should be able to accommodate ZEBs in terms of spacing. The ceiling height is more than sufficient for overhead dropdown plug-in dispensers, though will require a detailed design process to determine whether pantograph dispensers can be deployed. Outdoor dispenser equipment for 60’ buses and specialized and non-revenue fleet can also be accommodated without much impact on other uses, though location of the electrical and charger equipment will need to be considered based on a balance of impact to existing operation and distance to the dispensers.

Future North Oshawa Facility

DRT is also planning a new bus depot off Thornton Road and south of Highway 7. This facility will be designed and built to be a net zero energy building, enabling the storage and maintenance of a ZEB fleet. Current DRT routes will likely not be re-routed to this depot, and so this facility will be intended for expansion buses. This assumption is reflected in the modelling done on existing service.

Charging/Fueling Requirements

BEB

Based on the energy modeling outputs summarized above, which is based on the DRT service plan as of September 2021, a preliminary electrical infrastructure requirement is provided in **Table 4** below. It is important to note that the number of chargers provided below represents a minimum number based on the peak charging requirement as determined in the model. The model assumes an ideal where buses can be moved in and out of charging positions at any time during the day, which may not always be practically feasible. However, considerations have been taken in this study, to the extent possible, to ensure sufficient charging positions for all BEBs at a facility.

Table 4: Preliminary Electrical Infrastructure Needs

Depot/Location	Parameter	Battery Electric Buses					
		Electric Heating			Diesel Heating		
		Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route, Midday Charging	Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route, Midday Charging
Westney	Chargers (150 kW)	39	27	15	24	13	6
	Number of 2 MVA transformers	4	3	2	2	2	1
	Charger footprint [sqft]	4,070	2,993	1,649	2,527	1,649	638
	Transformer footprint [sqft]	1,245	1,245	623	623	623	368
Raleigh	Chargers (150 kW)	36	22	6	20	10	3

Depot/Location	Parameter	Battery Electric Buses					
		Electric Heating			Diesel Heating		
		Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route, Midday Charging	Block Splits, Overnight Charging	Block Splits, Midday Charging	En-Route, Midday Charging
	Number of 2 MVA transformers	3	2	1	2	1	1
	Charger footprint [sqft]	3,591	2,527	638	2,022	1,237	452
	Transformer footprint [sqft]	1,245	623	368	623	368	368
En-Route	Chargers (450 kW)	-	-	12	-	-	12

Hydrogen

On a weekday under worst case assumptions (cold winter day), 1441 kilograms of hydrogen would be required at the Westney depot, 1569 kilograms at Raleigh, and 565 kilograms at the contractor depot.

Gaseous vs. Liquid Storage

One of the most important attributes of a fuel is the energy density, with high energy density being more desirable. Hydrogen is a gas at standard temperature and pressure (STP) and is the smallest and lightest element on earth. This means that it is not very dense. There are two ways to increase the density of stored hydrogen to make it feasible as a stored fuel. One is to store it as a high-pressure gas, and the other is to condense it into a liquid.

As shown in **Table 5**, much less storage space is needed for liquid hydrogen, however the infrastructure needs are much greater as cryogenic storage tanks, and a vaporizer are required. Given the hydrogen fuel requirements of DRT, gaseous storage would

require multiple shipments of hydrogen gas per day, which will likely make liquid storage the only practical solution.

Table 5: Equipment Requirements for Gaseous vs Liquid Storage

Attribute	Gaseous Hydrogen	Liquid Hydrogen
Storage Size	32.5 cubic meters per 1,000 kg (50 bar, 77°F)	14 cubic meters per 1,000 kg (1 bar, −252.9°C)
Transportation Efficiency	560 kg per tanker truck at 560 bar[1] or 300 kg per trailer at 165.5 bar[2]	4000 kg per tanker truck[2]
Equipment	Hydrogen generation, gaseous compressor, gaseous storage tanks, and dispenser	Hydrogen generation, liquid compressor, cryogenic storage tanks, vaporizer, and dispenser

1. Capacity of a Hexagon X-STORE DOT 20 ft long tube truck.
2. Air Products Smart Fuel Supply Options

On-Site Generation versus Transportation

Hydrogen can be generated on-site either through steam-methane reformation (SMR) using natural gas or electrolysis. Given the high capital cost and ongoing operating costs of hydrogen generation (with minimal reduction in the cost of hydrogen per kg), a truck and tanker solution was focused on for this task.

Preliminary Site Requirements

A preliminary evaluation of infrastructure requirements for the Westney and Raleigh depots was done assuming that a truck and tanker solution was used to provide hydrogen to the fleet. Liquid hydrogen storage was assumed due to the quantity of hydrogen required.

The following equipment is required to provide hydrogen:

- Cryogenic Storage Tank
- Vaporizer
- Compressor
- Fueling Storage (for compressed gaseous hydrogen)
- Station Module

- Dispenser

The approximate space and power requirements at the two depots for hydrogen infrastructure are summarized in **Table 6** and **Table 7**. The infrastructure is sized for approximately 3 days' worth of storage at each site (approximately 5000 kg of hydrogen).

Table 6: Hydrogen Infrastructure Space and Power Requirements at Westney Depot

Equipment	Required Area	Power
	sq. ft	kW
Liquid H2 Storage	79	N/A
Compressor	100	393
Vaporizers	90	N/A
Fueling Storage	89	N/A
Station Modules	83	96
Dispensers	3	5
Total	443	494

Table 7: Hydrogen Infrastructure Space and Power Requirements at Raleigh Depot

Equipment	Required Area	Power
	sq. ft	kW
Liquid H2 Storage	79	N/A
Compressor	100	428
Vaporizers	90	N/A
Fueling Storage	89	N/A
Station Modules	83	96
Dispensers	3	5
Total	443	529

Cost estimates for hydrogen infrastructure can be difficult to provide due to local requirements and the emerging nature of the technology. Based on cost estimates for similar depots in the US – the capital cost of infrastructure based on DRT's needs would likely be about $10-$15 million for a truck and tanker-based solution.

Certain vendors may offer a lease and maintain arrangement for all of the hydrogen storage infrastructure. The cost of such an arrangement can vary widely based on the quantity of hydrogen needed and the distance of the depot to the hydrogen plant. Based on scaling similar arrangements in the US, this could potentially cost around $150,000 per month, but is heavily dependent on available suppliers This would only include the cost of infrastructure and not the hydrogen itself.

Service Growth and Expansion

There are future planned services listed in The Route Ahead: Service Strategy 2022-2025 that should be noted to help understand the operational impact of a transition. Some future planned services and partnerships include:

Expanding service to recreational opportunities throughout the Region and in Toronto, including access to the Pickering and Whitby waterfronts.

- Working with regional and municipal partners to enhance connections between transit services and trail and cycling facilities in areas such as the Waterfront Trail and the proposed Durham Meadoway.
- Continuing to support progress of the Durham Scarborough Bus Rapid Transit Corridor to Scarborough City Centre.
- Working in collaboration with Metrolinx and DRT's Rapid Transit Office on the design of the Lakeshore East rail service, and integration of DRT services.
- Maximizing direct routes where possible. Where demand is low, scheduled service may be replaced with Demand Response service.
- Implementing the following future PULSE rapid bus corridors by 2025:

    - Taunton Road, between Westney Road and Harmony Terminal.
    - King Street East, between Oshawa Centre Terminal and Liberty Street in Bowmanville.
    - Rossland Road, between Brock Road (Pickering) and Harmony Terminal.
    - Highway 2 service extended to Scarborough Town Centre.
    - Simcoe Street extended to Windfields Farm Drive.

- Developing Local Area Transit Plans (LATP) that focus on transit services in growth areas of the Region, which include the following areas:

    - Bowmanville (Clarington)
    - Newcastle (Clarington)
    - Courtice (Clarington)
    - Kedron and Windfields (Oshawa)
    - Port Perry (Scugog)
    - Seaton (Pickering)
    - Brooklin (Whitby)

These operating upgrades will help DRT respond to changes and sustain and grow ridership.

Transition Plan

Based on the technology review, energy modelling outputs and the facility and infrastructure assessments above, it became clear that while FCEBs provides operational advantages to BEBs, it is also a less mature technology which has poorer supply chain and fuel availability, less regulatory clarity and would require more complex facility improvement work. While BEBs are less operationally flexible, the loss in flexibility caused by range limitation can be mostly addressed through the use of

diesel auxiliary heaters and strategic siting of en-route opportunity chargers, as shown in the energy modelling. Therefore, using these findings, and combined assessment of DRT's existing fleet and facilities, a set of transition pathway options were identified for the phased implementation of a full BEB transit fleet, charging equipment and infrastructure that aims to meet strategic goals set out in Durham Region's CCAP and fulfils DRT's operational requirements.

The key objective of the transition plan is to achieve levels of annual GHG emissions reductions in line with the CCAP GHG emission targets of:

1. 25% below 2019 levels by 2025;
2. 40% below 2019 levels by 2030;
3. 100% below 2019 levels by 2045

These objectives are to be achieved within the practical constraints of bus retirement schedules, service constraints, future service growth and available funding opportunities, as well as consideration for commercial and technical feasibility – including infrastructure upgrades. With these constraints and considerations in mind, a few other key points also guided the development of the transition pathways besides the CCAP targets:

Prioritize Raleigh facility given current space constraints at the Westney facility
Prioritize any services/blocks which have higher potential for one-to-one diesel to BEB conversion based the energy modelling results.
Adhere to the established bus retirement schedule of the current fleet inventory

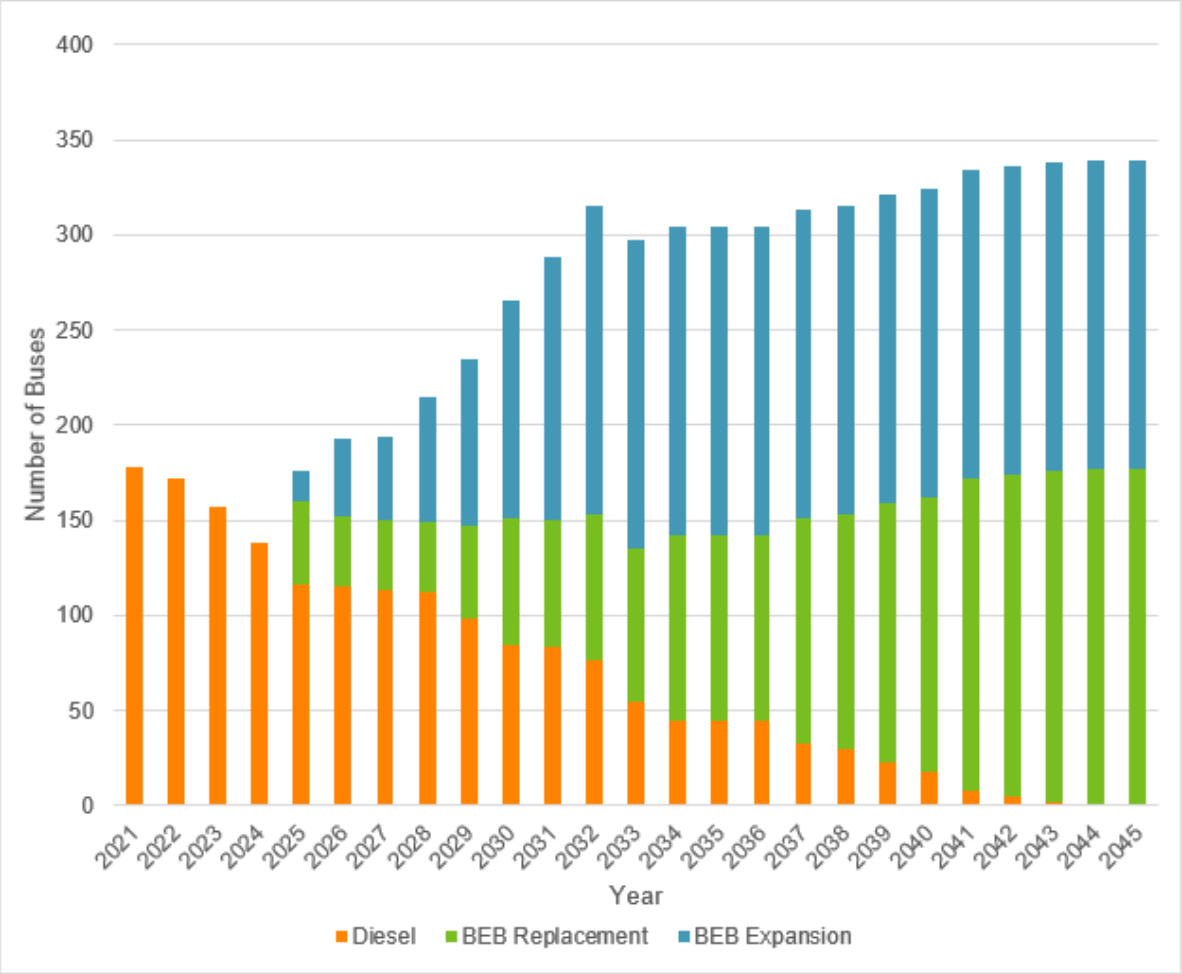
Pathways
Two transition pathways were drawn up based on different pacing of the fleet conversion and accompanying infrastructure upgrades:

1. Pathway Option 1 – Standard
2. Pathway Option 2 – Accelerated

Pathway Option 1 was developed with the CCAP GHG emissions reductions targets and DRT's bus retirement schedule as the basis, with priorities given to services based in Raleigh with one-to-one replacement opportunities. Under Pathway Option 1, DRT would begin a gradual transition to electric buses starting in 2023 by replacing some old diesel buses that had reached end of life with BEBs. This gradual transition will continue until completion in 2045 with only BEBs being procured from 2030 and onwards. Under

this option, the fleet would have a total 341 BEBs, including spares, at completion. The

Figure 4: Pathway Option 1: Fleet Composition Forecast



projected fleet composition by fuel type and service category is shown in **Figure 4**, and the projected fleet composition by bus type is shown in Building on Pathway Option 1, Pathway Option 2 was developed by further fast-tracking BEB conversion of Raleigh-based services and by committing to BEB only procurement from 2027 and onward. Under pathway option 2, DRT would complete conversion by 2037, 8 years earlier than under Pathway Option 1. Under this option, the fleet would have a total 340 BEBs, including spares, at completion. The projected fleet composition by bus type is shown in **Figure 6**, and the projected fleet composition by bus type is shown in **Figure 7.**

Figure 5: Pathway Option 1: Fleet Composition by Propulsion and Service Type

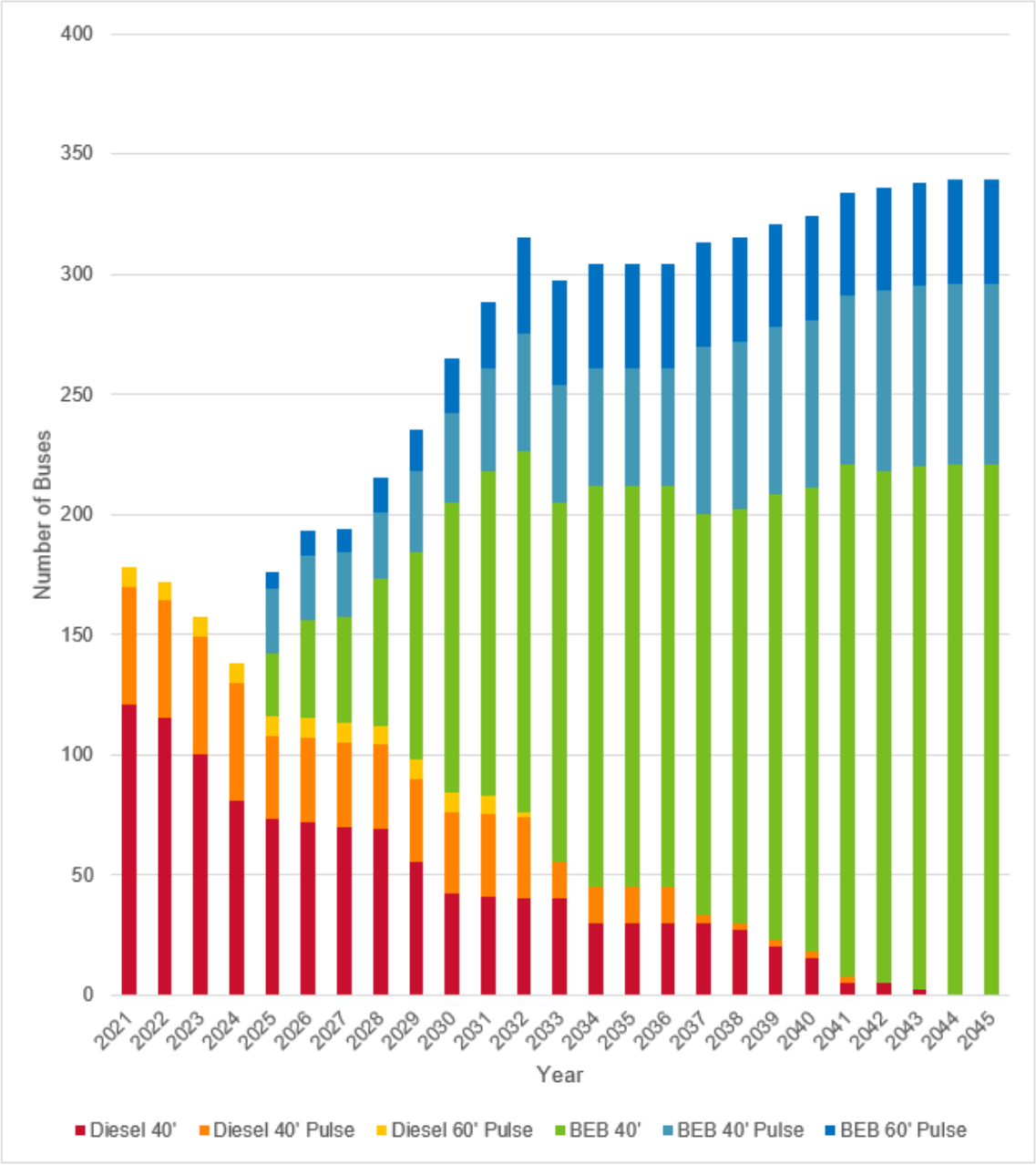


Figure 6: Pathway Option 2: Fleet Composition Forecast

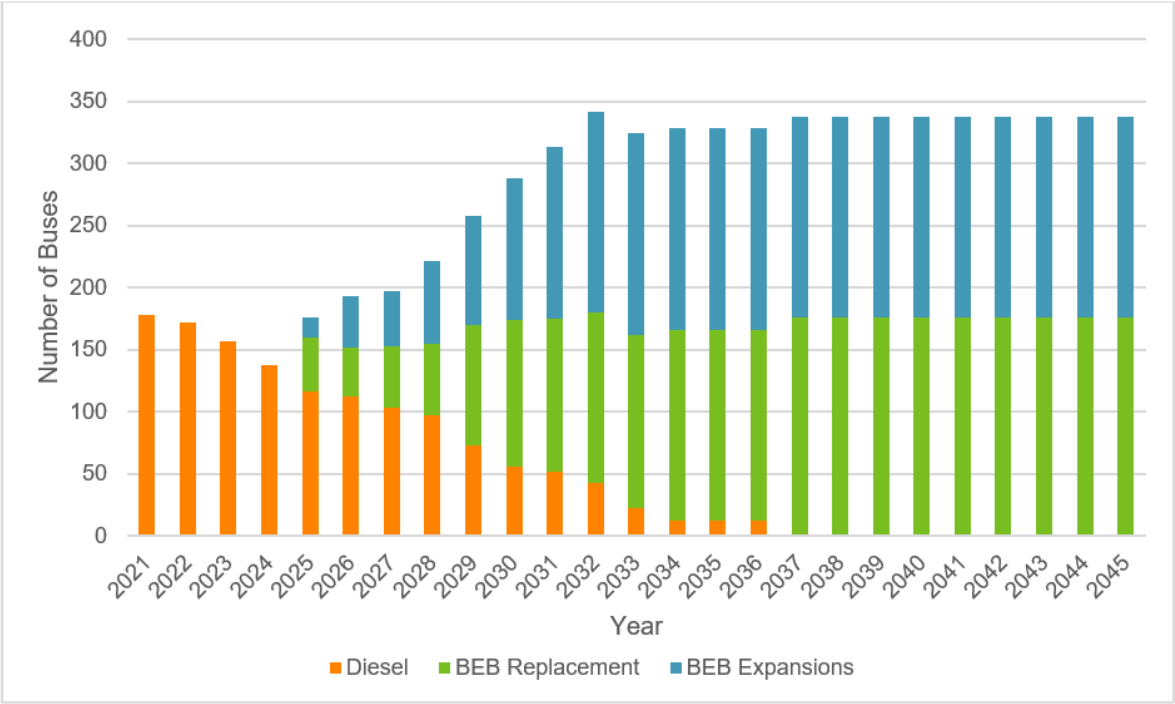
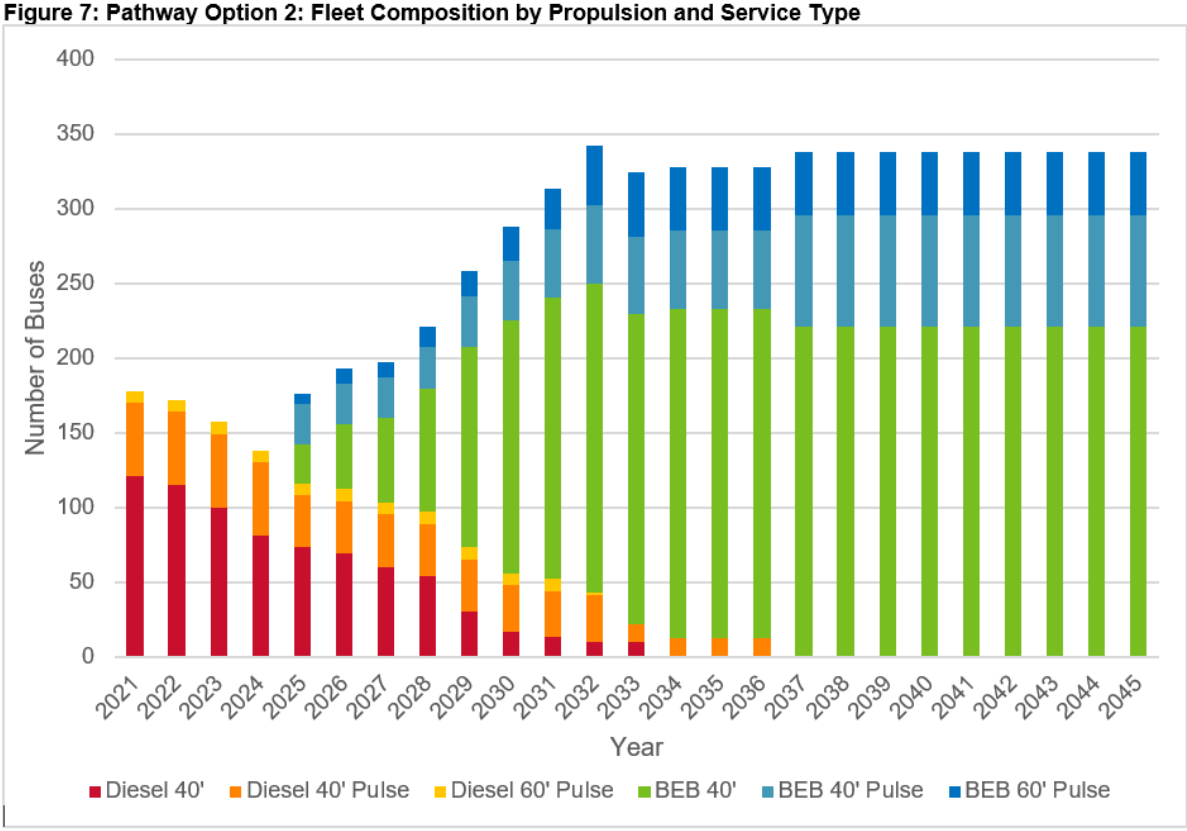


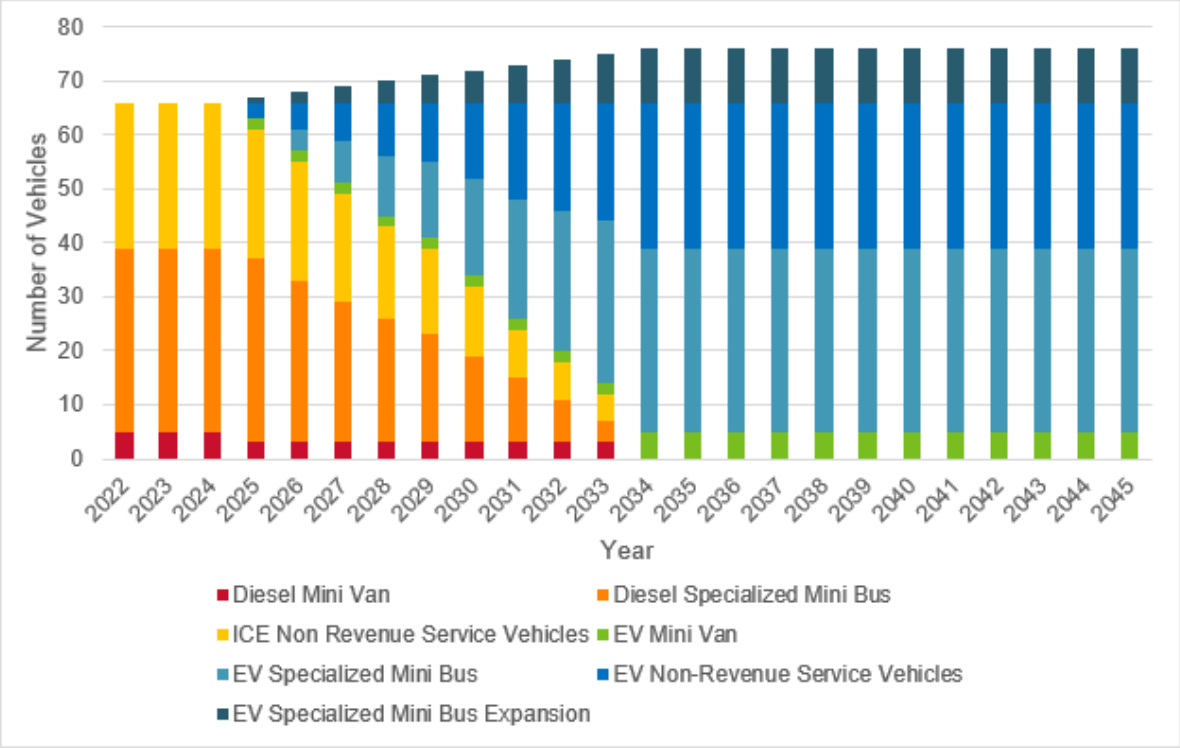
Figure 7: Pathway Option 2: Fleet Composition by Propulsion and Service Type



Specialized and Non-revenue Fleet

The transition plan also includes transition for the specialized and non-revenue fleet. The transition for this group of vehicle would be identical between Option 1 and Option 2. As noted above, analysis of the milage data of these vehicle types showed that these vehicles can be converted on a one-to-one basis. Therefore, transition of those type of vehicles follows the same requirement and expansion schedule as those for diesel vehicles. The change in composition of the specialized and non-revenue fleet is shown in the graph below.

Figure 8: Specialized and Non-Revenue Fleet Composition Forecast



Economic Analysis

An economical analysis has been completed to identify the estimated capital and operating impacts for two transition options. This modelling exercise includes both the Fleet and Facility infrastructure.

Capital Pricing

Prices for capital investments such as buses and chargers are based on averages of best available quotes from the manufacturers. For BEBs, costs are assumed to decrease by 5% per year until BEBs are on parity with diesel buses, and extended manufacturers' warranty are included in the initial cost.

Energy Pricing

Future diesel and gasoline prices uses the most recent wholesale pricing published by Natural Resources Canada (NRCAN) as the basis and are escalated, including inflation factor, based on EIA AEO projections less margins and taxes. Provincial road tax, federal excise tax and sales tax are assumed to be unchanged in nominal terms. Carbon Fuel Surcharge are projected to increase based on the published federal carbon tax escalation schedule. All taxes and surcharges are then added on top of the escaladed wholesale price. Electricity prices are based on Class B wholesale rates. Unlike for fuel prices, future electricity prices are only inflated to nominal dollar value of the year of consumption.

Maintenance Costs

Maintenance costs for diesel vehicles are obtained from DRT's internal data, while maintenance costs for BEBs are based on averages to date from the best available publications. Maintenance costs for diesel buses also include one drivetrain overhaul over the course of the vehicle's life (12 years). Maintenance costs for BEBs only include scheduled and unscheduled maintenance, while the battery replacement costs are to covered under the manufacturers extended warranty, which was added as an addition to the purchase price of the bus,

Nominal Costs

The total nominal capital and operating costs for each pathway option have been provided in nominal dollars for a 24-year window, from 2022 to 2045. Those are developed using 2021 dollars, a nominal discount rate of 8% and an inflation rate of 3% for a real discount rate of 4.9%. Discount rates are meant to estimate the equivalent present value of future cash flows based on the concept of time-value of money – that is, a dollar today is worth more than a dollar a year from now. Given the 20-year horizon of the transition plan financial impacts, the discount rate is used to adjust the forecasted cash flows. Impacts further into the future are more heavily discounted due to the greater length of time between today and the year the impact will occur in. The analysis shows a total nominal cost increase of $276 million for option 1 over BAU and an increase of $312 million for option 2. Both transition options were able to generate operational cost savings to offset some, but not all of increase in capital investments over the analysis timeframe.

Table 8: Total Nominal Cost Breakdown ($000's)

Cost Category	Diesel Baseline	Option 1	Option 2
Total Capital Impacts	$513,592	$899,965	$922,214
Vehicles	$513,592	$781,821	$804,145
Charging Equipment	$0	$103,742	$103,668
Infrastructure	$0	$14,401	$14,401
Total Operational Impacts	$3,508,681	$3,398,452	$3,411,686
Operations	$2,192,079	$2,575,269	$2,652,104
Maintenance	$824,661	$423,641	$381,504
Charger O&M	$0	$124,202	$126,253
Fuel Costs	$491,941	$101,566	$54,141
Electricity Costs	$0	$173,773	$197,684
Total Nominal Costs	$4,022,274	$4,298,417	$4,333,900

Capital Costs

The analysis includes bus purchases, charging infrastructure, and associated facility improvements under capital costs. BEBs are assumed to decrease in costs by 5% per year, until BEBs are on parity with diesel buses. Both the regular bus fleet as well as the specialized and non-revenue fleet were included in the analysis. In total, Option 1 requires an increase of $386 million in nominal capital costs across the 24-year period, while option 2 requires an increase of $409 million during the same period. The cost increases are driven by a large increase in bus purchase cost, and the additional charging and infrastructure investments which are not needed for diesel buses. The detailed breakdown of costs is shown in **Table 9**

Table 9: Capital Cost Estimates by Project Type ($000's)

Cost Category	Diesel Baseline	Option 1	Option 2
Conventional Fleet	$474,007	$835,816	$858,065
Buses	$474,007	$719,981	$742,305
40' Diesel Buses	$385,277	$45,528	$10,662
60' Diesel Buses	$88,730	$0	$0
40' Electric Buses	$0	$522,950	$580,140
60' Electric Buses	$0	$151,503	$151,503
Charging Equipment	$0	$101,433	$101,358
In-Depot Chargers	$0	$88,978	$90,389
Enroute Chargers	$0	$12,455	$10,969
Infrastructure	$0	$14,401	$14,401
Transformers	$0	$2,610	$2,610
Other Infrastructure Costs	$0	$11,791	$11,791
Specialized & Non-Revenue Fleet	$39,585	$64,149	$64,149
Vehicles	$39,585	$61,840	$61,840
Mini Vans	$3,404	$3,815	$3,815
Mini Buses	$30,787	$51,466	$51,466
Non-Revenue Vehicles	$5,394	$6,559	$6,559
Charging Equipment	$0	$2,309	$2,309
In-Depot Chargers Purchased	$0	$2,309	$2,309

Operating Costs

Operating costs are broken down into several categories as well – bus operations, bus maintenance, charger operation and maintenance, and propulsion costs which includes either fuel or electricity cost. Both the regular bus fleet as well as the specialized and non-revenue fleet were included in the analysis. Both transition pathway options were able to provide operational savings over the diesel baseline – option 1 would provide a nominal reduction of $110 million and option 2 would provide a nominal reduction of $97 million across the 24-year analysis period. The savings came from savings in maintenance and energy cost, which are partially offset by increases in bus operation cost and the addition of charger operation and maintenance cost. The detailed breakdown is shown in **Table 10**.

Table 10: Operating Cost Breakdown ($000's)

Cost Category	Diesel Baseline	Option 1	Option 2
Conventional Fleet	$3,330,517	$3,174,838	$3,188,071
Operations	$2,060,391	$2,443,581	$2,520,416
Diesel	$2,060,391	$402,648	$218,480
Electric	$0	$2,040,932	$2,301,936
Maintenance	$789,984	$406,186	$364,049
Diesel	$789,984	$160,466	$84,585
Electric	$0	$245,720	$279,464
Charger O&M	$0	$56,041	$58,092
Propulsion Costs	$480,142	$269,030	$245,515
Fuel Costs	$480,142	$99,176	$51,750
Electricity Costs	$0	$169,853	$193,764
Specialized & Non-Revenue Fleet	$178,164	$223,615	$223,615
Operations	$131,688	$131,688	$131,688

Diesel	$131,688	$49,639	$49,639
Electric	$0	$82,049	$82,049
Maintenance	$34,678	$17,455	$17,455
Diesel	$34,678	$7,430	$7,430
Electric	$0	$10,025	$10,025
Charger O&M	$0	$68,161	$68,161
Propulsion Costs	$11,799	$6,310	$6,310
Fuel Costs	$11,799	$2,390	$2,390
Electricity Costs	$0	$3,920	$3,920

NPV

A net present value (NPV) analysis has also been completed for the diesel baseline and the two transition options. The analysis discounts future costs back to present value terms using the effective real discount rate of 4.9%. The NPV of capital investment and operational costs in Option 1 is $124 million greater than the BAU whereas the total NPV of costs and investments under Option 2 is $146 million greater than the BAU. For the transition plan options, the greater upfront capital investments are discounted less than the future operational cost savings generated later in the analysis period.

Table 11: Net Present Value Analysis ($000's)

Cost Category	Diesel Baseline	Option 1	Option 2
NPV of Total Capital Costs	$309,473	$558,087	$577,332
Vehicles	$309,473	$480,072	$497,341
Charging Equipment	$0	$64,975	$66,951
Infrastructure	$0	$13,040	$13,040
Residual Value of Capital	$50,102	$83,022	$82,930
NPV of Total Operational Impacts	$1,880,571	$1,788,954	$1,792,071
Operations	$1,174,175	$1,331,682	$1,372,048
Maintenance	$441,388	$243,579	$219,103
Charger O&M	$0	$59,231	$60,236
Fuel Costs	$265,008	$73,590	$46,237
Electricity Costs	$0	$80,872	$94,447
Total NPV	$2,139,943	$2,264,020	$2,286,474

Capital Costs

Option 1 shows an increase of $249 million in the NPV of capital investments over the diesel baseline and Option 2 has an increase of $268 million in NPV of capital investments. As was the case with nominal costs, the cost increases are driven by increase in bus purchase cost, and the addition of charging and infrastructure investments. The detailed breakdown is shown in **Table 12**

Table 12: Capital Cost Breakdown using NPV ($000's)

Cost Category	Diesel Baseline	Option 1	Option 2
Conventional Fleet	$286,772	$521,448	$540,693
Buses	$286,772	$445,173	$462,442
40' Diesel Buses	$235,169	$38,134	$10,168
60' Diesel Buses	$51,603	$0	$0
40' Electric Buses	$0	$317,591	$362,826
60' Electric Buses	$0	$89,448	$89,448
Charging Equipment	$0	$63,235	$65,211
In-Depot Chargers	$0	$54,559	$55,920
Enroute Chargers	$0	$8,676	$9,290
Infrastructure	$0	$13,040	$13,040
Transformers	$0	$2,398	$2,398
Other Infrastructure Costs	$0	$10,642	$10,642
Specialized & Non-Revenue Fleet	$22,701	$36,639	$36,639
Vehicles	$22,701	$34,899	$34,899
Mini Vans	$1,791	$2,007	$2,007
Mini Buses	$17,820	$29,199	$29,199
Non-Revenue Vehicles	$3,090	$3,693	$3,693
Charging Equipment	$0	$1,740	$1,740
In-Depot Chargers Purchased	$0	$1,740	$1,740

Operating Costs

NPV of operational cost savings total $92 million for option 1 and $89 million for option 2. As noted above, the discounting reduced the gap between the transition pathways and the diesel baseline compared to the same costs in nominal terms, resulting in less savings in NPV terms. The main drivers of the savings remain the same – bus maintenance and energy costs. The detailed breakdown is shown in **Table 13**

Table 13: Operating Cost Breakdown using NPV ($000's)

Cost Category	Diesel Baseline	Option 1	Option 2
Conventional Fleet	$1,782,163	$1,668,658	$1,671,775
Operations	$1,101,393	$1,258,894	$1,299,259
Diesel	$1,101,393	$293,706	$187,503
Electric	$0	$965,188	$1,111,756
Maintenance	$422,221	$232,643	$208,168
Diesel	$422,221	$116,175	$72,622
Electric	$0	$116,468	$135,546
Charger O&M	$0	$26,486	$27,491
Propulsion Costs	$258,550	$150,634	$136,856
Fuel Costs	$258,550	$71,628	$44,275
Electricity Costs	$0	$79,006	$92,581
Specialized & Non-Revenue Fleet	$98,415	$120,297	$120,297
Operations	$72,789	$72,789	$72,789
Diesel	$72,789	$33,662	$33,662
Electric	$0	$39,127	$39,127
Maintenance	$19,168	$10,936	$10,936

Cost Category	Diesel Baseline	Option 1	Option 2
Diesel	$19,168	$6,144	$6,144
Electric	$0	$4,792	$4,792
Charger O&M	$0	$32,745	$32,745
Propulsion Costs	$6,458	$3,828	$3,828
Fuel Costs	$6,458	$1,962	$1,962
Electricity Costs	$0	$1,866	$1,866

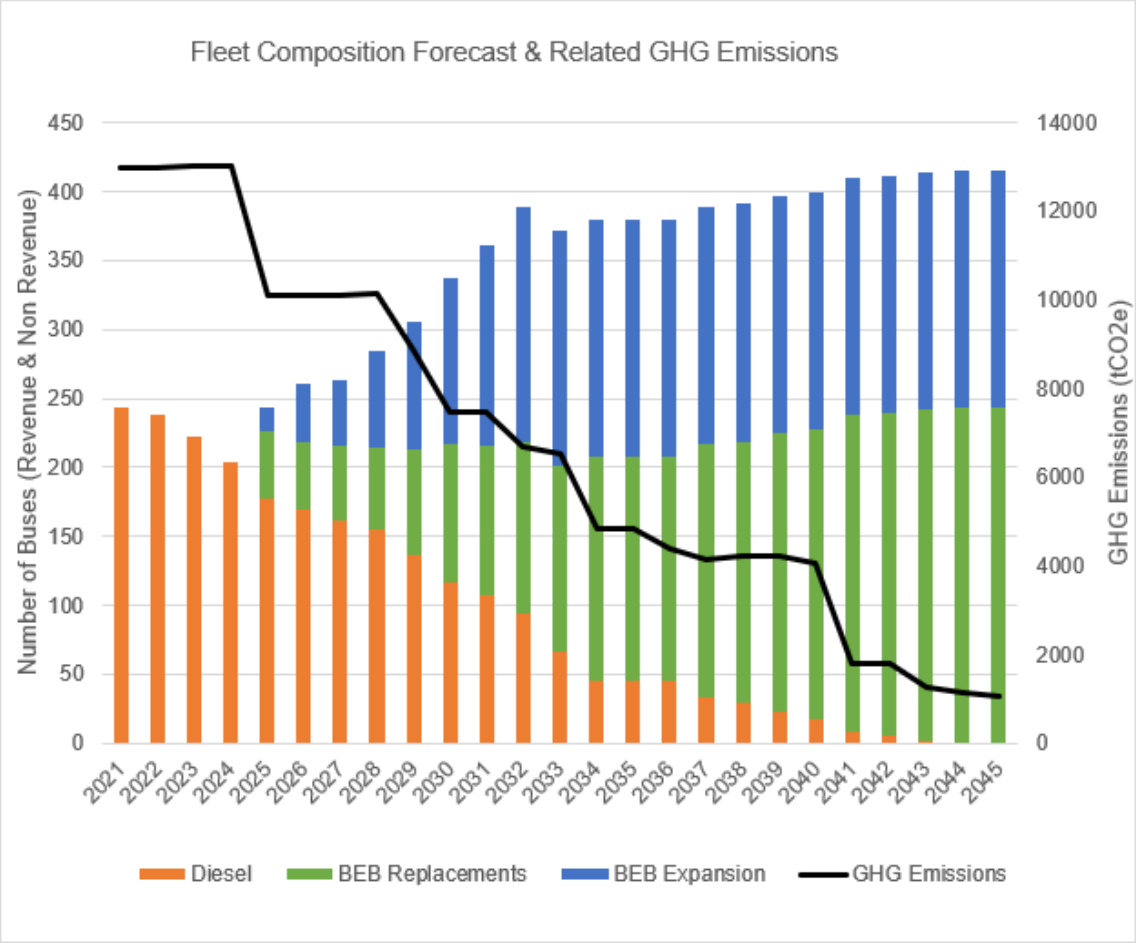
Emission Profiles

As part of the overall economic analysis and based on the energy modelling, the emission impact of each transition pathway was also estimated. Emissions for diesel buses were estimated based on an emission factor of 2.73 kgCO2eq / L of fuel burned and an average fuel efficiency of 46.33 L/100 km for regular heavy-duty buses and 23.52 L for the specialized fleet which were calculated from DRT internal data. Emissions for gasoline vehicles in the specialized and non-revenue fleet were estimated based on an emission factor of 2.31 kgCO2eq / L and an average fuel efficiency of 23.32 L/100 km. BEBs have no direct tailpipe emissions, but generation of the grid electricity consumed does have upstream emission. These upstream emissions were included in the analysis to maintain consistency with the calculation of 2019 emission target set by the CCAP. The assumed emission factor of 0.028 kgCO2eq / kWh is taken from the 2022 edition of Canada's Nation Inventory Report to the United Nations Framework Convention on Climate Change, as are the emission factors for diesel and gasoline.

Option 1

As shown in **Figure 9**, total emissions under Option 1 gradually trends down from 2024 onwards as BEBs are gradually introduced into the fleet. Total emissions, including conventional fleet, specialized fleet and non-revenue fleet, and both tailpipe and upstream emissions, would reach 1074t CO2e by 2045, the completion year of the transition. The remaining emission is predominately the product of upstream emissions from electricity generation.

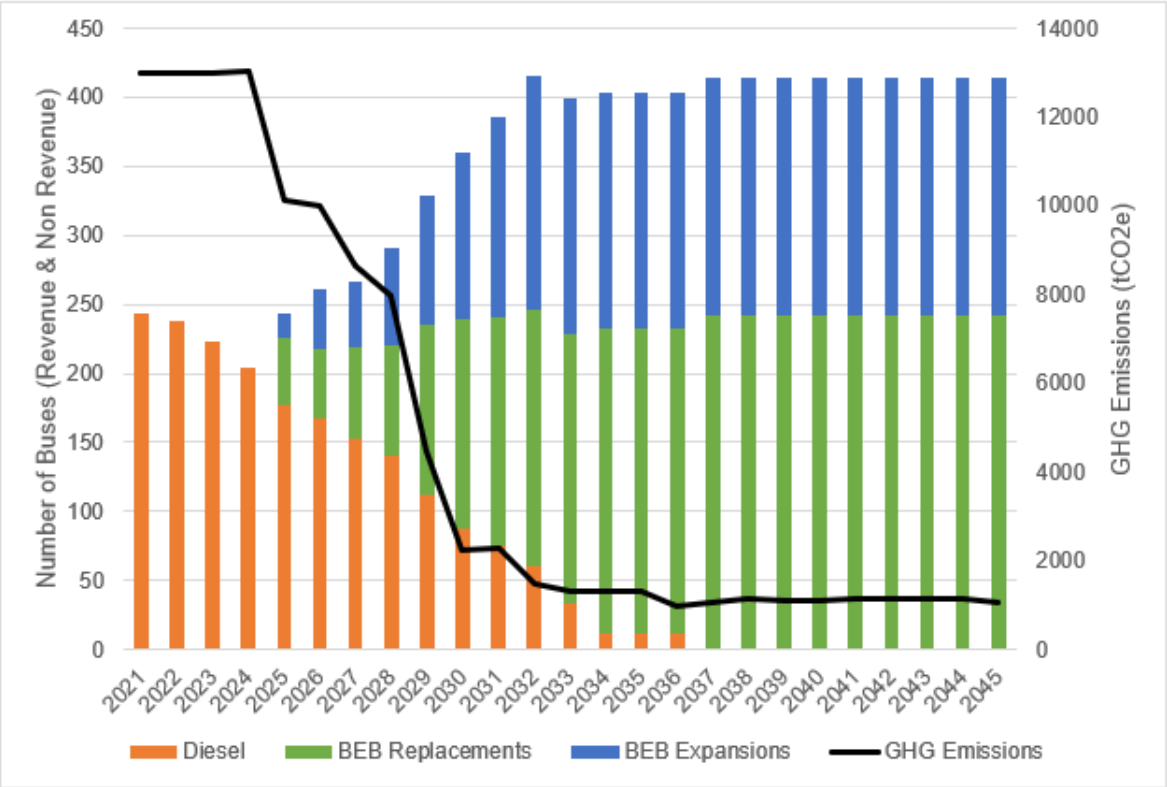
Figure 9: Fleet Composition Forecast & Related GHG Emissions (Pathway Option 1)



Option 2

As shown in **Figure 10**, total emissions under option 2 would decrease rapidly from 2024 to 2030 as BEBs are quickly introduced into the fleet under the more aggressive transition pathway. Total emissions including conventional fleet, specialized fleet and non-revenue fleet, and both tailpipe and upstream emissions, would reach a minimum of 1074t CO2eq by 2037, the completion year of the transition. The remaining emission is predominately the product of upstream emissions from electricity generation.

Figure 10: Fleet Composition Forecast & Related GHG Emissions (Pathway Option 2)



Conclusion and Future Considerations

Based on the technology review, the facility assessment, the energy analysis and the economic analysis presented in this report, the Transition Pathway Option 2 should be adopted by DRT as the preferred transition strategy towards a full zero emission fleet. Both proposed pathway options adopt relatively lower risk BEB technology as the propulsion system of choice. Both are able to meet or exceed the emission targets in the CCAP while also meeting the future service needs of DRT. The economic analysis has shown that neither Pathway Options can provide superior return on investments compared to the Business-as-Usual scenario, with financial pressures caused by the capital costs required for charging equipment and infrastructure upgrades. However, opportunities exist to reduce this financial pressure through available Federal financing and funding opportunities, anticipated price reductions with technology maturity, scale-up, and operational efficiencies with bus deployment and service.

The next logical steps would be to develop site plans of facilities slated to support the future ZEB fleet as part of the transition. In the case of Pathway 2, this would be the Raleigh and future North Oshawa facility. Connection assessments with the local utility,

should be held to discuss the transition plan presented in this report to ensure the necessary utility supply upgrades can be implemented and are in place in time to support the planned EV charging infrastructure.

It is also important to note that the conclusion of this report is based on the best available information at the time of writing. Both BEBs and hydrogen fuel cell technologies are very active areas of research and development. This report has already noted several new developments in battery technology, charging technology and hydrogen fuel supply. All of these developments should continue to drive down the cost of both technologies and improve the capabilities of both technologies in the years to come. It is therefore prudent for DRT to continue to track the technological development of both BEB and FCEB technologies and re-evaluate its transition plans in the future should it be necessary. The preferred timeframe of that re-evaluation should be between 2024-2026, prior to the construction of the proposed North Oshawa Facility, so that any infrastructure improvements need by changes to the transition plan can be accommodated at the new facility.

If this information is required in an accessible format, please contact 1-800-372-1102 ext. 3702

Durham Region Transit Report

To:	Durham Region Transit Executive Committee
From:	General Manager, Durham Region Transit
Report:	#2022-DRT-11
Date:	June 8, 2022

Subject:

Amending Agreement to the Metrolinx-905 PRESTO Operating Agreement

Recommendation:

That the Transit Executive Committee recommends to Regional Council:

A) That the Regional Chair and Regional Clerk execute an amendment to the PRESTO Operating Agreement between Metrolinx and the 905 transit agencies to provide the Region with the necessary revenue protection to enable the implementation of open payment fare transactions on Durham Region Transit vehicles; and

B) That the Regional Chair and Clerk have authority to execute any further documents or subsequent amendments related to the PRESTO Operating Agreement.

Report:

1. Purpose

1.1 The purpose of this report is to seek approval of an amending agreement that will provide the necessary revenue recovery commitments by Metrolinx to 905 transit agencies in order to enable the implementation of open payment fare transactions on Durham Region Transit (DRT) and other Greater Toronto and Hamilton Area transit agencies.

2. Background

2.1 The initial PRESTO Operating Agreement was approved by Regional Council in July 2006 for an initial ten-year period from October 2006 to October 2016, between the Province of Ontario, the City of Ottawa and the Greater Toronto and Hamilton Area transit agencies of Brampton, Burlington, Durham Region, Hamilton, Mississauga, Oakville and York Region, referred to as the 905 transit agencies. The Agreement established the roles, responsibilities and governance structure for all involved parties to address on-going operating requirements of the PRESTO electronic fare transaction system.

2.2 At its meeting of November 30, 2017, TEC authorized the execution of a new 10-year PRESTO operating agreement with Metrolinx for all 905 transit agencies. The agreement is in effect October 27, 2017 to October 27, 2027, with the option for a five year extension. The agreement sets out the roles and responsibilities of the respective parties in participating in the PRESTO electronic fare payment system. This includes implications for provincial gas tax eligibility, the establishment of commission fees paid to Metrolinx by transit agencies for core administrative and technical support functions, and minimum revenue guarantees for Metrolinx and revenue protections for 905 transit agencies based on PRESTO device availability.

3. Previous Reports

3.1 At its meeting of November 30, 2017, TEC authorized the execution of a new 10-year PRESTO operating agreement through October 2027 with Metrolinx for all 905 transit agencies including Durham Region Transit (#2017-DRT-22).

3.2 At its meeting on December 4, 2019, TEC approved the DRT Fare Strategy (#2019-DRT-25). The strategy establishes principles and objectives over the next five years to simplify DRT’s overall fare structure and incentivize and accelerate the transition to contactless PRESTO electronic fare payment options.

4. Open Payment

4.1 Open payment will enable customers to pay transit fares on all PRESTO equipped transit systems, including DRT, via contactless credit and debit card payments. This includes EMV credit, debit cards and pre-paid reloadable cards (i.e., cards with an embedded smart chip). Accepted credit cards (including pre-paid reloadable cards) consist of VISA, Mastercard, and AMEX, while debit cards include internationally issued VISA, Mastercard, and Interac cards.

4.2 With open payment, a customer will simply tap their credit or debit card on the PRESTO fare payment device when boarding a DRT vehicle. The same card is then tapped when transferring to a connecting DRT service and no fee is charged within the two hour transfer window. The fare for open payment transactions will be equivalent to DRT's standard cash fare (i.e. $4.00) providing another option for customers who do not have a PRESTO card, access to the PRESTO E-Ticket smartphone app or exact change for fares.

4.3 The initial launch of open payment with select 905 transit agencies is expected to take place in late summer 2022. DRT is expected to implement open payment with the remaining 905 transit agencies in the fall of 2022, allowing time for mobile PRESTO transaction devices to be enabled for open payment on DRT's demand response services (i.e. specialized and On Demand). Mobile wallet payment via smartphones is targeted for launch on 905 transit agencies in 2023.

4.4 To ensure successful launch of open payment, the 905 transit agencies have worked with PRESTO to undertake testing (including piloting by Metrolinx on UP Express) and to address revenue protection requirements related to the introduction of this new payment option. With existing PRESTO fare cards, customers tap their PRESTO card on the primary fare payment device at the front doorway when boarding the bus and the corresponding fare is deducted from the electronic purse value on the card or a monthly pass is detected and validated. In instances where the primary fare payment device is unavailable (e.g. due to technical issues), the bus operator can request that customers tap their PRESTO card on the Driver Control Unit next to the operator providing an important back-up fare payment option.

4.5 With open payment, the Driver Control Unit is unable to accept payment from credit or debit cards resulting in the absence of a back-up payment option should the primary fare payment device be unavailable. Under the current PRESTO Operating Agreement transit agencies are eligible for revenue recovery from Metrolinx when fare payment device availability is less than 98.0 per cent. For the purposes of open payment transactions, recognizing the absence of back-up fare payment options on the Driver Control Unit, transit agencies will be eligible to seek revenue recovery from Metrolinx under the amending agreement when PRESTO fare payment device availability is less than 99.5 per cent per calendar quarter.

4.6 Replacement of the original PRESTO devices onboard DRT vehicles was completed in late 2020. Current PRESTO device availability levels have been

regularly above 99.5% throughout 2021 and 2022 year to date. Strong performance is expected given the devices are relatively new, however the risk of device outages may increase as the devices age. Under the terms of the device replacement project, Metrolinx remains responsible for maintenance of the payment devices.

4.7 Metrolinx will also be liable for uncollected fares for all credit and debit card taps accepted by a fare payment device and will manage any chargebacks and related fees. If a customer's open payment credit or debit card is not in good standing (e.g., insufficient funds, credit limit reached, missed payments, suspected fraud) with the financial institution, PRESTO will put the open payment card on a deny list. Once a card is on the deny list, the customer will not be able to use it again on the PRESTO network until the unpaid fares are paid.

5. Financial Considerations

5.1 The amending agreement reduces the threshold for revenue recovery providing added protection for DRT from revenue loss due to fare payment device availability rates that fail to meet the 99.5 per cent service level per calendar quarter.

5.2 Metrolinx has committed to working with the 905 transit agencies to establish a simplified process for revenue recovery submissions, including possible automation of the notification and submission process when fare payment device availability falls below the 99.5 per cent service level.

6. Next Steps

6.1 A similar report to seek approval to execute the PRESTO Operating Agreement amendment to enable open payment will be presented by the Regional Treasurer to Regional Council pursuant to Sections 60 and 61 of Durham Region Transit Commission By-law Number 27-2021.

7. Relationship to Strategic Plan

7.1 This report aligns with/addresses the following strategic goals and priorities in the Durham Region Strategic Plan:

a. Service Excellence: Optimize resources and partnerships to deliver exceptional quality services and value

8. Conclusion

8.1 Open payment will offer transit customers another easy and convenient option for paying fares when boarding DRT vehicles. Approval of the amending agreement to the PRESTO Operating Agreement will enable DRT to move forward with other 905 transit agencies in implementing open payment in the fall of 2022. The amending agreement provides DRT with additional protection that lowers the risk of revenue loss resulting from the unavailability of PRESTO fare payment devices.

Respectfully submitted,

Original signed by

Bill Holmes
General Manager, DRT

Original signed by

Nancy Taylor, BBA, CPA, CA
Commissioner of Finance

Recommended for Presentation to

Committee Original signed by

Elaine C. Baxter-Trahair
Chief Administrative Officer

If this information is required in an accessible format, please contact 1-800-372-1102 ext. 3702

Durham Region Transit Report

To:	Durham Region Transit Executive Committee
From:	General Manager, Durham Region Transit
Report:	#2022-DRT-12
Date:	June 8, 2022

Subject:

Durham Region Transit Advisory Committee (TAC) Terms of Reference

Recommendation:

That the Transit Executive Committee recommends:

a) That the revised terms of reference for the Transit Advisory Committee Policy included as Attachment #1 be approved; and

b) That a copy of Report #2022-DRT-12 be forwarded to the area municipalities for information.

Report:

1. Purpose

1.1 The purpose of this report is to update the Transit Advisory Committee (TAC) Terms of Reference to reflect the new Advisory Committee Recruitment and Selection Policy adopted by Regional Council and to incorporate some additional amendments to update processes and ensure consistency in the terminology used.

2. Background

2.1 The Transit Advisory Committee (TAC) is a volunteer advisory committee established by the Durham Region Transit Commission and Regional Council on May 10, 2006. The Commission and Regional Council delegated the responsibility for TAC to the Transit Executive Committee on March 28, 2007.

2.2 On March 23, 2022, Regional Council approved a new Advisory Committee Recruitment and Selection Policy for the recruitment and selection of community members to Regional advisory committees. The Region of Durham currently has seven advisory committees of Regional Council and one advisory committee of the Durham Region Transit Commission.

2.3 Durham Region Transit and the Corporate Services – Legislative Services Division has completed a comprehensive review of the TAC Terms of Reference with the intent of identifying the revisions necessary to reflect the new Advisory Committee Recruitment and Selection Policy adopted by Regional Council and to incorporate some additional amendments to update processes and ensure consistency in the terminology used.

3. Previous Reports and Decisions

3.1 The Transit Executive Committee previously approved changes to the Transit Advisory Committee (TAC) Terms of Reference on March 22, 2018, through Report 2018-DRT-05

4. Revised Terms of Reference

4.1 Revised terms of reference for the Transit Advisory Committee (TAC) are included as Attachment #1 to this report.

4.2 The terms of reference have been amended to reflect the new Advisory Committee Recruitment and Selection Policy adopted by Regional Council. The proposed recruitment and selection process includes:

- The Region placing an advertisement seeking individuals interested in volunteering for appointment to TAC;
- Interested individuals submitting an application form to the Regional Clerk;
- DRT staff reviewing applications received and forwarding applications from qualified applicants to the respect area municipality;
- Local Councils nominating one representative for appointment;
- TEC appointing two members at large;
- TEC appointing two individuals from community groups representing persons with disabilities in Durham Region;
- The Durham Region Accessibility Advisory Committee nominating two members for appointment; and
- The student associations at Ontario Tech University, Durham College and Trent University jointly nominating one member for appointment.

4.3 The following revisions to update processes and ensure consistency with other Regional Advisory Committees are also recommended:

- Clarify DRT Senior Staff Member is an ex-officio member [Section 4.1 g)]
- Clarify the process for seeking replacements following resignation [Section 4.2]
- Clarify all members of TAC shall be appointed by the Executive Committee [Section 5.7]
- Update wording related to meeting schedule [Section 8.1]
- Include reference to Regional Procedural By-law [Section 8.2]
- Update terminology for quorum [Section 8.3]
- Update to reflect the current process of minutes being circulated to members of Council as part of the Council Information Package [Section 10.1]

4.4 Additional housekeeping revisions have also been made to clarify cross-references within the terms of reference, formatting for accessibility, and terminology for current DRT services.

5. Relationship to Strategic Plan

5.1 This report aligns with/addresses the following strategic goals and priorities in the Durham Region Strategic Plan:

a. Goal 2: Community Vitality

- Item 2.5: Build a healthy, inclusive, age-friendly community where everyone feels a sense of belonging

b. Goal 5: Service Excellence

- Item 5.1: Optimize resources and partnerships to deliver exceptional quality services and values
- Item 5.2: Collaborate for a seamless service experience
- Item 5.3: Demonstrate commitment to continuous quality improvement and communicating results
- Item 5.4: Drive organizational success through innovation, a skilled workforce, and modernized services

6. Conclusion

6.1 It is recommended that the revised terms of reference for the Transit Advisory Committee Policy included as Attachment #1 to this report be approved.

6.2 Following approval, the revised terms of reference will be posted on the Region's Committees Webpage and will also be available upon request.

6.3 This report has been prepared in consultation with Corporate Services – Legislative Services.

7. Attachments

Attachment #1: Revised Transit Advisory Committee Terms of Reference

Respectfully submitted,

Original signed by

Bill Holmes
General Manager, DRT

Recommended for Presentation to Committee

Original signed by

Elaine C. Baxter-Trahair
Chief Administrative Officer

Durham Region Transit Advisory Committee

Terms of Reference

June 2022

1. Goal

1.1 To provide input to the Durham Transit Executive Committee (Executive Committee) on public transit matters as they relate to the provision of conventional and demand response transit services in Durham Region.

2. Mandate

2.1 The Transit Advisory Committee (TAC) is a volunteer advisory committee established by the Commission and Regional Council on May 10, 2006 in accordance with these Terms of Reference. The Commission and Regional Council, on March 28, 2007, delegated the responsibility for TAC to the Executive Committee.

2.2 The TAC shall provide input to the Executive Committee on:

a) Policies and procedures with respect to the operation of conventional and demand response transit services in Durham Region;

b) The extent of service hours and days of operation; and

c) Operational rules and regulations relating to Durham Region Transit services.

2.3 The General Manager, the Executive Committee, and the Durham Region Transit Commission (Commission) have final authority on issues beyond the mandate of TAC.

2.4 The Terms of Reference provide for a balance between activities referred from Durham Region Transit (DRT) and the Executive Committee, and an allowance for the TAC to be proactive and advise on public transit matters identified by the members.

2.5 TAC shall report to the Executive Committee.

3. Scope of Activities

3.1 The scope of the TAC may include activities such as:

a) Providing input on issues and concerns of public transit users;

b) Providing input on the implementation of Provincial and Federal legislation, policies, and guidelines related to the public transit industry;

c) Providing input on urban and rural service policy including transit service plans, transit marketing and communication plans, and on-street passenger amenities and route infrastructure;

d) Providing input on the identification and implementation of programs that create public awareness and educate residents on the benefits of public transit; and

e) Providing a forum for transit stakeholder groups to identify issues affecting the delivery of transit service and to provide input to the Executive Committee on the disposition of these issues

4. Composition

4.1 TAC will be comprised of 17 members in total (16 voting and one non voting) with representation from each area municipality, as follows:

a) Eight (8) public transit users nominated for appointment by the area municipalities who represent a diversity of transit users and transit stakeholders in the community

b) Two (2) members at large appointed by the Executive Committee from the applications received but not nominated by local municipalities who use public transit service;

c) Two (2) members appointed by the Executive Committee from applications received from various community groups representing persons with disabilities in Durham Region;

d) Two (2) members nominated for appointment by the Durham Region Accessibility Advisory Committee (AAC);

e) One (1) member jointly nominated for appointment by the student associations at Ontario Tech University, Durham College and Trent University, or their designate;

f) One (1) member of the Transit Executive Committee (the Chair or their designate); and

g) One (1) DRT senior staff member (the General Manager or their designate) as an Ex-officio member in a non-voting capacity.

4.2 Membership shall be a four-year term corresponding with the term of Regional Council or until such time as new appointments are made. If a member chooses to resign, the Region will seek a replacement in accordance with Section 5.

4.3 At the discretion of TAC, non-attendance at three consecutive meetings will be sufficient grounds for replacement.

5. Membership Selection

5.1 The Region will place an advertisement seeking individuals interested in volunteering for appointment to TAC. Interested individuals will be required to submit an application form to the Regional Clerk outlining their interest and qualifications.

5.2 DRT will review the applications received in consideration of Section 12. Applications from qualified applicants will be forwarded to the respective area municipality with a request that the local Council nominate one representative for appointment. Should a municipality not receive an application for appointment to TAC, then the appointment for that municipality will remain vacant unless that Municipal Council receives a subsequent expression of interest and opts to approve an appointment during the term of Regional Council. The Executive Committee, from the remaining applications received, shall appoint two members at large.

5.3 DRT shall contact community groups representing persons with disabilities in Durham Region and invite them to volunteer for TAC. Interested individuals will be required to submit an application form to the Regional Clerk and provide a brief resume outlining their interest and qualifications. The Executive Committee shall appoint two members from the applications received.

5.4 In nominating members to TAC, the relevance of the applicant’s personal experience with transit and interests to the mandate of the TAC will be important considerations. Regard shall also be given to residency within the Region and availability to attend meetings. An elaboration of the selection criteria is provided in Section 12.

5.5 DRT will formally request the Durham Region Accessibility Advisory Committee to nominate two individuals to represent the Region's Accessibility Advisory Committee.

5.6 DRT will formally request the student associations at UOIT, Durham College and Trent University to jointly nominate an individual, and his/her designate, to represent college and university students.

5.7 All members of the TAC shall be appointed by the Executive Committee.

5.8 In the case of a vacancy, the approach described in Section 5 will generally be followed.

6. Officers

6.1 The member of the Transit Executive Committee on TAC (the Chair or their designate) shall be the Chair of TAC and the voting members of TAC shall elect a Vice- Chair from amongst themselves to serve for the Term of Council.

7. Support Services

7.1 The DRT senior staff member, through DRT administrative staff, shall serve as the DRT staff liaison to TAC.

7.2 The DRT senior staff member, through DRT administrative staff, will provide administrative and technical support to TAC.

7.3 DRT administrative staff will coordinate meeting agendas.

7.4 The Region will provide secretarial and other support services to TAC.

8. Meetings

8.1 TAC will meet at the Regional Headquarters. TAC will establish a meeting schedule at its inaugural meeting, taking into account the business needs and schedule of the Commission, the Executive Committee and Regional Council. TAC will provide the Executive Committee with a schedule of meetings in December for the following year. Special meetings may be held at the discretion of the Chair or DRT staff.

8.2 Unless otherwise determined, all TAC meetings shall be open to the public. As an Advisory Committee, the TAC is subject to the Regional Procedural By-law, unless otherwise specified in these Terms of Reference.

8.3 A quorum for TAC meetings shall be a majority of the sitting TAC (voting) members.

9. Delegations

9.1 Any person(s) wishing to appear before TAC as a delegate must submit a written request to delegations@durham.ca advising of the topic or item on which they wish to speak, which will then be forwarded to the staff liaison in Durham Region Transit.

9.2 All requests for delegations must be received at least one week prior to the meeting date to ensure that the delegation is included on the agenda.

9.3 Any person wishing to address TAC as a delegate, who has not previously arranged to do so, may be granted permission only by a majority vote of TAC members present at the meeting.

10. Minutes and Agenda

10.1 The minutes of each TAC meeting will be submitted for approval at the next meeting. Unapproved minutes will be circulated to members of the Executive Committee as part of the Council Information Package (CIP) prepared by the Regional Clerk.

10.2 The TAC agenda will be prepared by DRT administrative staff and the DRT General Manager or their delegate.

11. Transit Advisory Committee Recommendations

11.1 The concurring votes of a majority of members present and voting are necessary to carry any recommendation. TAC recommendations will be presented to the Executive Committee as a standing item on Executive Committee agendas.

12. Membership Eligibility Criteria and Availability

12.1 Voting members are to be residents of The Regional Municipality of Durham.

12.2 Voting members represent a diversity of transit users and transit stakeholders in the community. The relevance of the applicant’s personal experience with transit and interests to the mandate of the TAC will be important considerations.

12.3 It is important that voting members be able to attend all TAC meetings that are held during evening hours and be able to undertake some ad hoc work outside of

the regular meetings as may be required from time to time to address transit issues coming before the TAC.

If this information is required in an accessible format, please contact 1-800-372-1102 ext. 3702

The Regional Municipality of Durham Report

To:	Durham Region Transit Executive Committee
From:	General Manager, Durham Region Transit
Report:	#2022-DRT-13
Date:	June 8, 2022

Subject:

Update Demand Response Service

Recommendation:

That the Transit Executive Committee recommends

That this report be received for information.

Report:

1. Purpose

1.1 The purpose of this report is to update the Transit Executive Committee (TEC) on the status of the transition to a single Demand Response Service.

2. Background

2.1 On September 28, 2020, the Phase 1 recovery service plan was launched as part of DRT's ridership recovery framework. The service plan included On Demand, a demand responsive service, operating in low ridership zones within urban areas and rural areas across the Region. DRT On Demand was supported by the launch of a new technology platform, one of the TEC approved recommendations arising from the rural transit review in June 2020.

2.2 DRT On Demand enhanced transit services across the Region of Durham by providing all residents access to frequent and reliable service. Residents within urban On Demand zones are accessing transit within 30 minutes of requesting a trip; rural residents are accessing On Demand within 45 minutes of trip requests. Trip requests are scheduled in real time and the technology platform optimizes available resources and system productivity.

2.3 Specialized Transit, operating since DRT was formed in 2006, is also a demand responsive service available to eligible customers.

2.4 In 2021, DRT launched The Route Ahead, its three-year plan to guide transit services during the pandemic recovery period as DRT rebuilds ridership, adapts service to new and emerging travel patterns, and builds the foundation for future service growth. The strategy identified On Demand as being an important service supporting customers when scheduled service is not available in some areas.

2.5 In October 2021, TEC approved the transition to a single demand response service by amalgamating Specialized Transit and On Demand.

3. Previous Reports

3.1 TEC approved the recommendations and strategy contained in report #2020-DRT-12, Review of transit services in rural Durham, including replacing scheduled bus service in low-demand rural areas of the region with an On Demand service, and to adopt a scalable advanced technology platform capable of dispatching both On Demand and Specialized Transit trips to provide greater efficiencies.

3.2 TEC received for information report #2021-DRT-09, On Demand outcomes and next steps, which provided an update for the On Demand system implemented in September 2020 as part of the Ridership Recovery framework.

3.3 TEC approved the recommended strategy outlined in Report #2021-DRT-20, The Route Ahead, Durham Region Transit 2022-2025 Service Strategy which will leverage Demand Responsive services to provide flexible mobility to all areas of the Region where demand cannot sustain 30-minute scheduled bus service.

3.4 TEC approved the recommendations contained in Report #2021-DRT-25, Demand Responsive Services, including the amalgamation of Specialized Transit and On Demand into a single Demand Responsive Service to achieve a more spontaneous, equitable, reliable, and customer-focused service. The findings and

recommendations of the Durham Region Transit Demand Response Transit Study conducted by Ernst and Young LLP (EY) included:

Integrating Specialized and On Demand services
Improving the integration of third-party contractors to drive a “one DRT” experience
Implement an automated dispatching software and related app for the seamless integration of On Demand and Specialized trip bookings that can meet both customer and business/operational requirements

4. Discussion

Based on the recommendations of the EY Demand Responsive service study, activities are underway to advance the integration of Specialized Transit and On Demand services.

4.1 Contracted Services

Contracted services have historically been delivered by several transportation providers, each generally operating within a specific geographic area of the Region. On June 1, 2022, the service contracts will be operated by a single entity.

As identified in the Rural Review and the EY Demand Responsive Service study, the contractor will operate dedicated and branded vehicles, operators will be in uniform operators, and there are enhanced training requirements to improve the customer experience and move toward a “One DRT” service offering centered around a high-quality and consistent customer experience.

In alignment with Regional climate objectives, the contractor will be using hybrid-elect sedans and vans.

4.2 Demand Response software

a) Current State

DRT utilizes two software platforms to deliver Demand Response services: Trapeze is used by Specialized Transit, and the Spare platform is used by On Demand. Each platform has its strengths but operating two separate systems prevents operating shared fleets, requires Booking Agents and service planners to operate in two separate environments, and results in different features and trip opportunities available to either customer group.

b) Single Demand Response software

Operating a single platform will simplify operations and service management and will improve efficiencies and the effectiveness of services available to all customers. In the event of unplanned service disruptions or changes in demand, a single software platform ensures greater flexibility to manage the service and mitigate impacts to customers.

A single platform will also enable DRT to harmonize trip-booking features for customers. All Demand Response customers will have access to the same tools and information and resources including real-time trip updates, same-day bookings, and web-based trip booking.

4.3 Transition Phasing

a) Phase 1 – Supplemental Contractor

On June 1, 2022, the new contractor began delivery of On Demand and Specialized Transit service trips. All vehicles are now DRT-branded to be easily identified by customers and residents, and operators are uniformed and trained to provide a consistent customer experience.

Where operationally beneficial, current On Demand and Specialized Transit customers may travel on the same vehicle. This will improve the efficiency of service and provide additional capacity for more DRT customers trips.

b) Phase 2 – Technology Platform transition

The transition to a single software platform is planned to be configured and tested by the end of September 2022.

c) Phase 3 – Single Operational Fleet

The final phase of the transition is planned to be launched by the end of 2022. All demand response vehicles, including vehicles operators by DRT and the contractor, will be available for single or shared On Demand and Specialized Transit trips. This will lead to greater operational efficiency and more trip capacity. Customers who had traditionally travelled within a single service, On Demand or

Specialized Transit, may now be travelling on the same vehicles as other Demand Response customers.

4.4 Customer Impacts

d) On Demand

- Software Platform

Under a single platform, customers will continue to be able to book their trips through an online application or by telephone with a Booking Agent. A communications plan will ensure customers are aware of any changes.

- Service Delivery

In June 2022, all On Demand customers will be travelling on DRT branded vehicles. Customers whose trip is delivered by the contractor may share the vehicle with both Specialized Transit and On Demand customers.

By the end of 2022, all demand response customer trips may be shared.

a) Specialized Transit

- Software

Customers will continue to book trips using a telephone by contacting DRT Booking Agents. When fully operational, customers will have the option to access the same App as current On Demand customers.

- Service Delivery

In June 2022, customers will be travelling on DRT branded vehicles operated by DRT and the contractor. Customers whose trip is operated by the contractor may travel with On Demand customers.

By the end of 2022, all demand response customer trips may be shared.

5. Relationship to Strategic Plan

5.1 This report aligns with/addresses the following strategic goals and priorities in the Durham Regin Strategic Plan.

a) Environmental Sustainability

Demonstrate leadership in sustainability and addressing climate change

b) Service Excellence

Optimize resources and partnerships to deliver exceptional quality services and value

Drive organizational success through innovation, a skilled workforce, and modernized services

6. Conclusion

6.1 DRT continues to advance the transition to a single Demand Responsive Service that will provide customers and residents a spontaneous, equitable, reliable, and customer-focused service. The operational and software transitions are expected to be completed by the end of 2022. The transition to a mature service is expected to be achieved by 2024.

6.2 A community engagement strategy will be implemented during Fall 2022 to ensure residents and current customers are fully aware of the transition and the enhanced service features that will be available to all customers using the Demand Response service.

Respectfully submitted,

Original signed by

Bill Holmes
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Recommended for Presentation to Committee

Original signed by

Elaine C. Baxter-Trahair
Chief Administrative Officer