STAFF REPORT
ACTION REQUIRED

Express Bus Network Study

Date:	June 15, 2017
To:	TTC Board
From:	Chief Executive Officer

Summary

This report responds to a TTC Board motion on March 26, 2014 that directed TTC staff to report back on the feasibility of implementing additional express bus routes in the City of Toronto.

The *Express Bus Network Study* (see **Attachment 1**) recommends a number of short (2017-2018), medium (2019-2021), and long-term (2022-2026) strategies and enhancements to improve the TTC's express bus network.

In the short-term between 2017 and 2018, the TTC recommends establishing a clear classification system for express routes. Existing express bus routes will be classified using a "two-tiered" approach which is temporarily named Tier 1 and Tier 2 until a communications plan is developed which will present opportunities for branding, numbering and naming these routes.

Tier 1 routes are all-day express corridors with high daily ridership and are designed to be a precursor to rapid transit. Tier 2 routes are generally peak-only services on corridors that experience high peak period demand. The TTC also recommends re-deploying existing articulated buses on certain express bus routes as vehicles become available between 2018 and 2021, implementing all-door boarding on 192 Airport Rocket on a trial basis, and working with City departments to install transit priority measures such as transit signal priority and queue jump lanes.

In the medium-term between 2019 and 2021, the *Express Bus Network Study* recommends implementing new and enhanced express bus routes. The number of express bus routes will change from 24 routes currently to between 23 and 28 routes at the end of 2021 (10 Tier 1, 13 Tier 2 and 5 Downtown Premium Fare Express Routes). The net decrease of one route includes the addition of five new routes less the cancellation of one route (196 York University Rocket) and potential phasing out of five routes (Downtown Premium Fare Express) subject to the implementation of viable alternative network improvements including the Line 1 ATC project and new low floor streetcars.

Overall, service improvements will be made on 5 new routes and 8 existing routes.

New Express Routes

- Lawrence West
- Islington
- Weston Road
- Dufferin
- Markham Road

Enhanced Express Routes

- Keele
- Steeles West
- Steeles East
- Sheppard West, west of Sheppard West Stn
- Sheppard East, east of Midland Avenue
- University of Toronto Scarborough Rocket
- Wilson
- York Mills

Service will be cancelled on the 196 York University Rocket when the Toronto York Spadina Subway extension opens in late 2017.

In the long-term (2022-2026), an additional eight routes have been identified as potential express route candidates or enhancements. Their implementation is subject to meeting the express service warrants that are established as part of this study. As such, the candidate routes' benefits and costs are not accounted for.

The net operating cost to implement the express bus network is approximately $13.1M per year once the plan has been fully implemented and ridership fully matures. The capital cost is $34.2 million to procure 38 articulated buses to implement the plan. The plan requires additional garage capacity which will become available when McNicoll Bus Garage opens in 2020. The capital costs to procure this facility are included in the TTC's 2017 Capital Plan and therefore are not accounted for here.

Overall, the enhanced and expanded express bus network will benefit nearly 70 million customer-trips annually, saving more than 3.1 million person-hours of customer journey time per year, and attracting 1.7 million additional customer-trips annually to the system when fully matured. One in every six TTC bus customers would use and benefit from the expanded express bus network.

The Express Bus Network is an upfront investment in operating expenses that will reduce future increases in resources as system ridership naturally increases. An upfront seven-year investment is required to mitigate immediate customer impacts so that the network is accepted and attractive to customers. Following five years of full implementation of the network, it will be more cost effective to accommodate customers on the Express Bus Network than the "status quo" approach of adding to local services with no express alternatives on these corridors.

Over the seven year period where the Express Bus Network will cost more than the "status quo" approach to increasing service, it will cost $7.50 per customer hour saved. When evaluating the benefits of a transportation initiative, Transport Canada assigns a value of travel time of $14 per hour. The economic opportunity presented by the travel time savings alone exceeds the cost to provide the travel time savings demonstrating that the Express Bus Network is good value for money.

It is recommended that the TTC Board approve the recommendations in this report. If approved, implementation of the new and enhanced express services will commence pending approval of future operating and capital budgets.

As with all routing or network changes, these service changes would be evaluated after a minimum of nine months of non-summer operation, and a report on the post-implementation review would be submitted to the Board.

Recommendations

It is recommended that the TTC Board:

1. Note that the Tier 1 and Tier 2 express bus route service standards were approved by the Board at its meeting on May 18, 2017 under the item - Update to Service Standards. This includes the conditions and criteria required to warrant express bus services and the minimum span of service and service frequency (*Express Bus Network Study* – section 4.1.2). At this time the designation of tiers is temporary pending that a communications plan will present opportunities for branding, numbering and naming these routes.
2. Approve using the TTC's single flat fare structure for Tier 1 and Tier 2 express routes with the exception of the Downtown Premium Fare Express routes which shall retain their current double flat fare structure.
3. Approve the implementation of all-door boarding on 192 Airport Rocket on a trial basis beginning with a pilot program in 2018.
4. Direct TTC staff to work with City of Toronto Transportation Planning and Transportation Services staff to implement transit priority measures including transit signal priority and queue jump lanes for existing express routes and report back jointly on progress.
5. Approve the Tier 1 and Tier 2 express bus routes identified in the express bus network to be implemented between 2019 and 2021 (*Express Bus Network Study* – section 4.2).
6. Direct TTC staff to evaluate the capacity and reliability improvements resulting from the implementation of the Line 1 ATC project and new low floor streetcars as viable alternatives to the poor performing Downtown Premium Fare Express routes and report back to the Board in 2021.
7. Direct TTC staff to include operating cost requirements starting with the 2019 TTC Operating Budget.
8. Direct TTC staff to include capital cost requirements in future capital budgets starting with the 2018 Capital Budget which will include 38 articulated buses (17 buses in 2020 and 21 buses in 2021) costing $34.2 million in the 2018-2027 TTC Bus Fleet Plan (*Express Bus Network Study* – section 5.4).
9. Forward this report to the City of Toronto's Planning and Transportation Services departments and Metrolinx.

Financial summary

The Board's approval of the *Express Bus Network* report and its recommendations sets the foundation for the implementation of the express bus network. The approval of this report does not have any immediate financial effect. The implementation of the express bus network will require Board and City Council approval in future operating and capital budgets starting in 2018 and continuing to 2021.

The 2018 capital budget will include the provision of 38 articulated buses (17 buses in 2020 and 21 buses in 2021) costing $34.2 million in the 2018-2027 TTC Bus Fleet Plan. This represents the full build-out capital cost.

The full build-out operating cost is $13.1M per annum, with a potential for $1.5M per annum in savings with the potential phase-out of the Downtown Premium Fare Express Routes as shown in **Figure 1.**

Figure 1: Operating Cost Summary (2017$)

New Customers & New Revenue	2019	2020	2021	2022	2023
Tier 1					
Operating Cost	$0.2M	$3.8M	$8.6M	$8.6M	$8.6M
All Door Boarding (Fare Inspection)	$0M	$0.5M	$0.5M	$0.5M	$0.5M
New Revenue	-$0.02M	-$0.7M	-$2.0M	-$2.3M	-$2.4M
Net Cost	$0.2M	$3.6M	$7.1M	$6.8M	$6.7M
Tier 2					
Operating Cost	$1.4M	$4.1M	$7.5M	$7.5M	$7.5M
New Revenue	$0.14M	-$0.5M	-$0.9M	-$1.0M	-$1.1M
Net Cost	$1.3M	$3.6M	$6.6M	$6.5M	$6.4M
Grand Total					
Total Net Cost	**$1.5M**	**$7.2M**	**$13.7M**	**$13.3M**	**$13.1M**
Potential Net Savings from Phasing-Out Downtown Premium Fare Express Routes	$0M	$0M	$-1.5M	$-1.5M	$-1.5M

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

Accessibility / equity matters

The TTC has made significant progress in moving towards providing barrier-free, accessible transit services to all customers. Presently, all TTC bus services are operated using accessible, low-floor buses. The new low-floor accessible streetcars are currently being deployed and all routes will have accessible streetcars by 2019. All subway stations will become accessible by 2025.

Improvements to the express bus network encourage and support more-spontaneous trip-making, which is an important part of making the conventional system attractive to potential new customers, such as Wheel-Trans registrants, and to all travellers in Toronto. This supports the Accessibility for Ontarians with Disabilities Act (AODA) objectives of more-spontaneous travel options for customers with disabilities, and the City's Poverty Reduction Strategy of making transit more accessible and attractive to everyone.

Decision history

At its March 26, 2014 meeting, the TTC Board approved a motion that directed TTC staff to report back on the feasibility of implementing additional express bus routes in the City of Toronto.

http://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2014/April_30/Minutes/index.jsp

At its August 19, 2014 meeting, the TTC Board approved the *Opportunities to Improve Transit Service in Toronto* report which recommended, among other things, expanding and enhancing the TTC's express bus services.

http://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2014/August_19/Supplementary_Reports/Opportunities_to_Improve_Transit_Service_in_Toronto.pdf

In 2015, Toronto City Council approved $95 million for TTC service enhancements. On March 11, 2015, City Council approved the TTC 2015 Operating Budget and 2015-2024 Capital Budget. These budgets included new funding, from the approved $95 million, for various service enhancements. This included the acquisition of 50 new buses to implement peak-period service improvements and new and/or enhanced express bus services in early 2016.

https://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2015/February_2/Reports/2015_TTC_AND_WHEEL_TRANS_OPERATING_BUDGETS.pdf

https://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2015/February_2/Reports/2015_2024_TTC_CAPITAL_BUDGET.pdf

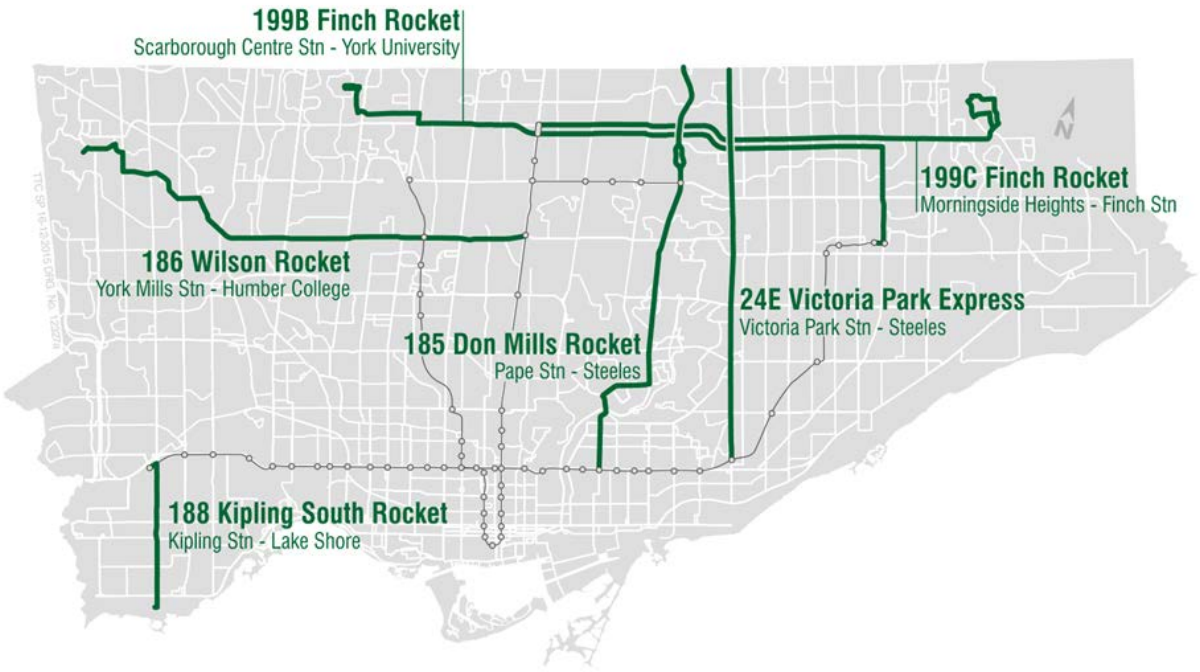
At its March 26, 2015 meeting, the TTC Board approved the *Express Bus Network Study Plan*. The Study's objectives include evaluating the TTC's various existing express services and recommending possible improvements and expansions to the express bus network, including a limited number of new express services to be introduced in early 2016.

http://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2015/March_26/Reports/Express_Bus_Route_Network_Study_Plan.pdf

At its January 21, 2016 meeting, staff provided the TTC Board with an update on the *Express Bus Network Study* which included notification that five new and enhanced express bus routes would be implemented in March 2016: 185 Don Mills Rocket, 188 Kipling South Rocket, 199BC Finch Rocket, 24E Victoria Park, and 186 Wilson Rocket as shown in **Figure 2**.

http://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2016/January_21/Reports/Status%20Update_Express_Bus_Study_Intro_of_First_New_Express_R.pdf

Figure 2: Express Bus Network Study – new and enhanced routes (March 2016)



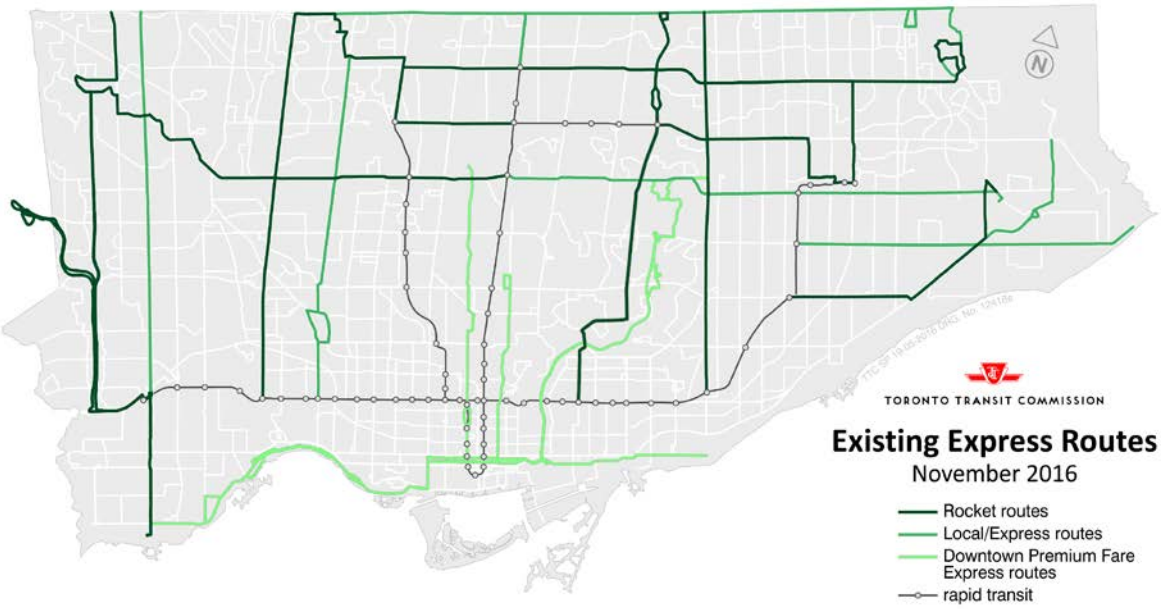
Issue background

There is widespread support for more and better-quality transit service in Toronto. There are many improvements underway or under study to expand the availability of rapid transit. Some of the most noteworthy projects include the Toronto-York Spadina Subway Extension, the Eglinton Crosstown Light Rail Transit, the Finch West Light Rail Transit and the Line 2 Scarborough Subway Extension which are all at various stages of design and/or construction.

While high-capacity, grade-separated rapid transit projects are an important part of developing a mature transit system, an enhanced express bus route network, which is fully and seamlessly integrated with the rapid transit network, would offer faster service and more capacity into many areas of the city which may or may not have good access to rapid transit services.

The TTC operates express bus services on 24 bus routes (see **Figure 3**), all of which operate during the peak periods from Monday to Friday, and 10 of which also operate at off-peak times. These express bus services have been consistently found to be popular with TTC customers, because they reduce customer journey time.

Figure 3: TTC express routes (as of November 2016)



The TTC is the 2nd largest transit agency in North America carrying nearly 540 million passengers per year. And, with 60% of all customers who travel on the TTC using bus services for at least part of their trip, and with more than 50% of total boardings occurring on bus services, TTC express services should be enhanced and expanded to ensure that the TTC continues to provide customers with high frequency, reliable, comfortable, and quick travel options.

Comments

TTC staff has completed the *Express Bus Network Study* (**Attachment 1**). The study evaluates the TTC's various types of express services and identifies possible improvements and expansions to the express bus network which would provide TTC customers with a bigger choice of rapid, reliable, and visible express bus services.

The TTC's "2013-2017 Five Year Corporate Plan" is a blueprint towards modernizing the TTC, improving customer satisfaction, and ultimately delivering the Commission's renewed vision of a transit system that makes Toronto proud. The Corporate Plan establishes that the TTC's core value is the Value of Time; both the quality and quantity of time customers spend on the TTC. Express bus services safeguard this value as they provide travel time savings for customers. The following is a summary of the key findings and recommendations of the *Express Bus Network Study* report.

Peer and performance review

The TTC conducted a peer review of 15 transit agencies across North America to understand how different transit agencies plan, operate, and market their express bus services (see **Figure 4**).

Figure 4: Peer review of North American transit agencies

The peer review revealed that, in general, there are two classifications of express services: corridor focused and commuter focused. Corridor focused services operate more frequent and in more periods of operation as they are specifically designed to serve all-day trip patterns. Corridor focused express routes have more transit priority capital investment, utilize all-door boarding as one method to minimize travel time, and are typically uniquely branded. Commuter focused services have limited investment as they focus on serving fairly limited peak-only demands. Transit agencies will operate more than one classification of express service to satisfy varying travel demand.

The TTC operates three types of express services: Rockets, Local/Express, and Downtown Premium Fare Express routes. Rocket and Local/Express are positive for system-wide performance as otherwise 5-10% more resources would be needed to serve the same number of passengers if parallel local services were to be exclusively used on express corridors. Due to the limited stop nature and longer travel patterns of customers, these express routes attract fewer customers per service hour than most surface routes across the system yet still provide a financial benefit to the system.

The Downtown Premium Fare Express routes are the worst performing routes system-wide during peak periods in regards to their utilization (boardings per hour), and therefore financial performance even when the double fare is considered.

TTC express bus services provide customers with substantial travel time savings. Most express bus routes save customers at least 20% in travel time compared to their local counterparts on common corridors. Express bus services are used for long-distance trips. The average trip length on express bus services is about 7 kilometres compared to 5 kilometres on conventional routes. Therefore, customers are travelling faster and for longer distances on express bus services therefore maximizing potential travel time benefits.

The planning background and performance review indicate that enhancing and expanding the TTC express bus network yields significant benefits for customers and the organization.

Early performance tracking of the five new and enhanced express routes introduced in March 2015 is promising. Typically it will take up to three years for ridership to mature on a route, with 75% of the ridership being generated in the first year. **Figure 5** below demonstrates that four of the five routes introduced have reached or exceeded their first-year ridership targets. It is clear customers take advantage express routes when they are available. The lower-than-expected ridership for 188 Kipling South Rocket will be investigated as part of the post-implementation review process which is being currently underway.

Figure 5: March 2016 Express Routes – Actual vs. Projected Ridership

Route	Year-1 Projected Ridership	Year 1- Actual Ridership	Year 1 - Actual vs Projected	Projected Matured Ridership
24E Victoria Park Express	4,200	6,300	150%	5,600
185 Don Mills Rocket	15,300	15,800	103%	20,400
186 Wilson Rocket	6,700	8,700	130%	8,900
188 Kipling South Rocket	4,100	3,400	83%	5,500
199 Finch Rocket	27,500	33,000	120%	36,000
Total	**57,800**	**67,200**	**116%**	**76,400**

Network design

Operating framework and service standards

TTC express routes will be classified using two tiers of service, whose naming / branding is to be confirmed as part of a future communication plan. The tiers will be delineated based on service characteristics. Tier 1 and Tier 2 express bus services are defined by the minimum span of service and minimum service frequency as shown in **Figure 6.** The designation of the tiers is subject to a forthcoming communications plan that will present opportunities for branding, numbering and naming these routes.

Figure 6: Tier 1 and Tier 2 - minimum span of service and frequency

Express classification	Minimum span of service	Minimum frequency
Tier 1	o Weekdays: 6am-10pm o Weekends: 8am-7pm	o 10 min or better (during peak periods) o 15 min or better (outside peak periods)
Tier 2	o Weekdays: 6am- 9am, 3pm-7pm	o 15 min or better

Tier 1 and Tier 2 service triggers include meeting specific demand, travel time savings, and economic conditions. Tier 1 express bus services must meet the Tier 2 conditions plus additional conditions which include a strategic condition or a higher passenger demand threshold.

Express Bus Network (2021)

Based on the service warrants and standards, an express bus network was developed. The network identifies 10 Tier 1 express routes and 13 Tier 2 routes which are listed in **Figure 7** and illustrated in **Figure 8**. The network is intended to be implemented by 2021. The potential phase-out of the Downtown Premium Fare Express routes is intended to commence in 2021 subject to the viability and successful implementation of alternative services described below.

Figure 7: Tier 1 and Tier 2 express routes

Tier 1 express routes	Tier 2 express routes
o Airport o Highway 27 o Jane o Dufferin o Don Mills o Steeles West o Steeles East o Finch o Sheppard East o Eglinton Ave East / Kingston Rd / Morningside	o Kipling o Kipling South o Islington o Weston o Keele o Victoria Park o Markham Rd o Eglinton Ave East / Kingston Rd / Meadowvale o Sheppard West o Wilson o Lawrence West o York Mills o Lawrence East

***196 York University Rocket will be discontinued in 2017 to coincide with the Line 1 extension.**

Long-term Express Bus Network (2026)

Figure 9 presents future potential express routes that could be implemented in the long-term between 2022 and 2026. Their implementation is subject to meeting the express service warrants that are established as part of this study. As such, the candidate routes' benefits and costs are not included in this study.

Addressing Social Equity

As part of the City of Toronto's Official Plan review, transportation projects are evaluated on the basis of social equity – that everyone has good access to work, school and other activities. This is supported by the City's Poverty Reduction Strategy which identifies transit as something that must be affordable, reliable and link residents with education, employment and cultural opportunities. The Express Bus Network is another means to that end.

Figure 10 illustrates the Express Bus Network in the context of neighbourhood investment areas and average family incomes. Every express bus route will serve at least one low income neighbourhood, and there is a strong grid of express bus service in neighborhood investment areas in northwest and eastern parts of the city. The Express Bus Network is well positioned to provide residents in low income areas and neighbourhood investment areas with better transit service.

Figure 8: Express Bus Network (2021)

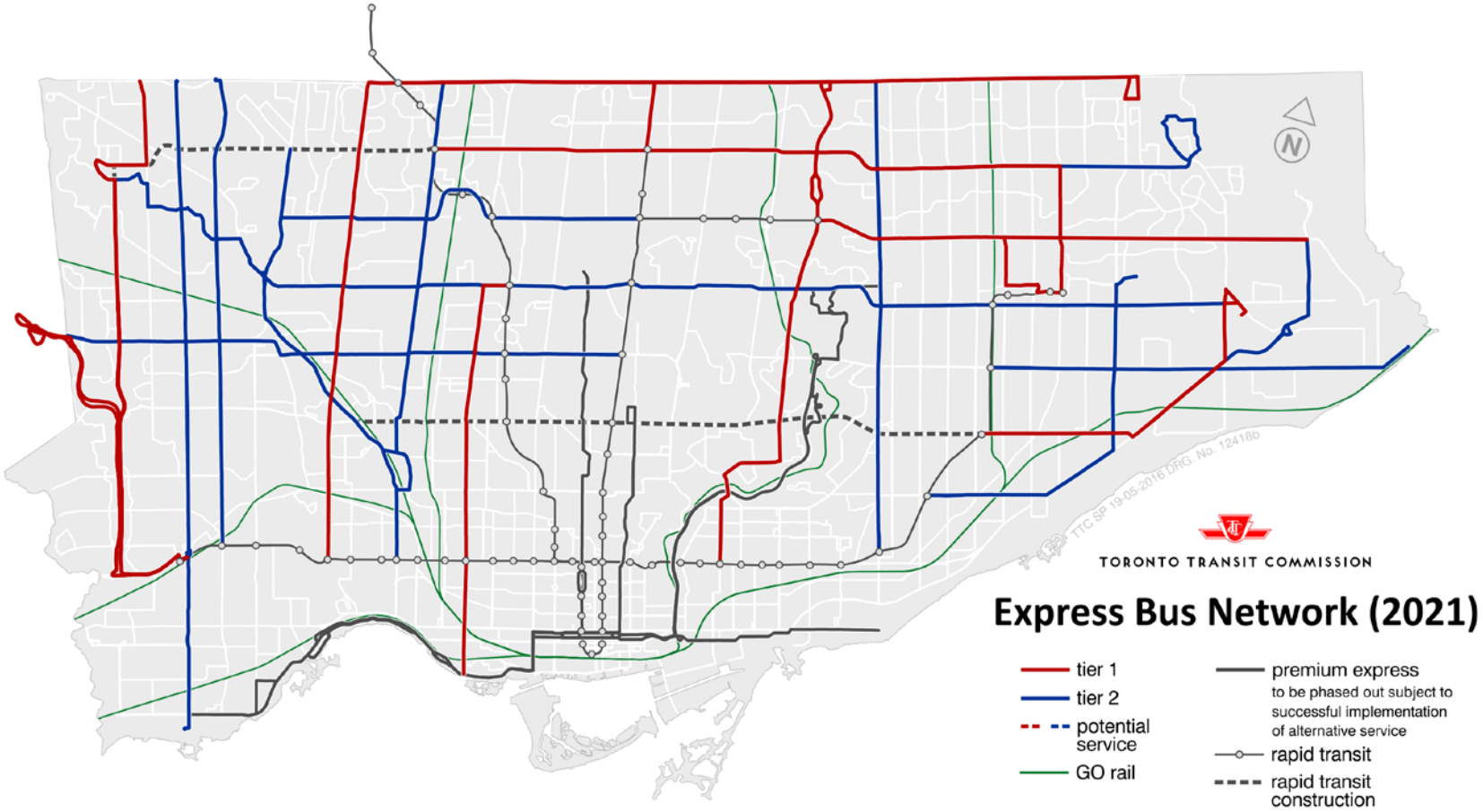


Figure 9: Long term Express Bus Network (2026)

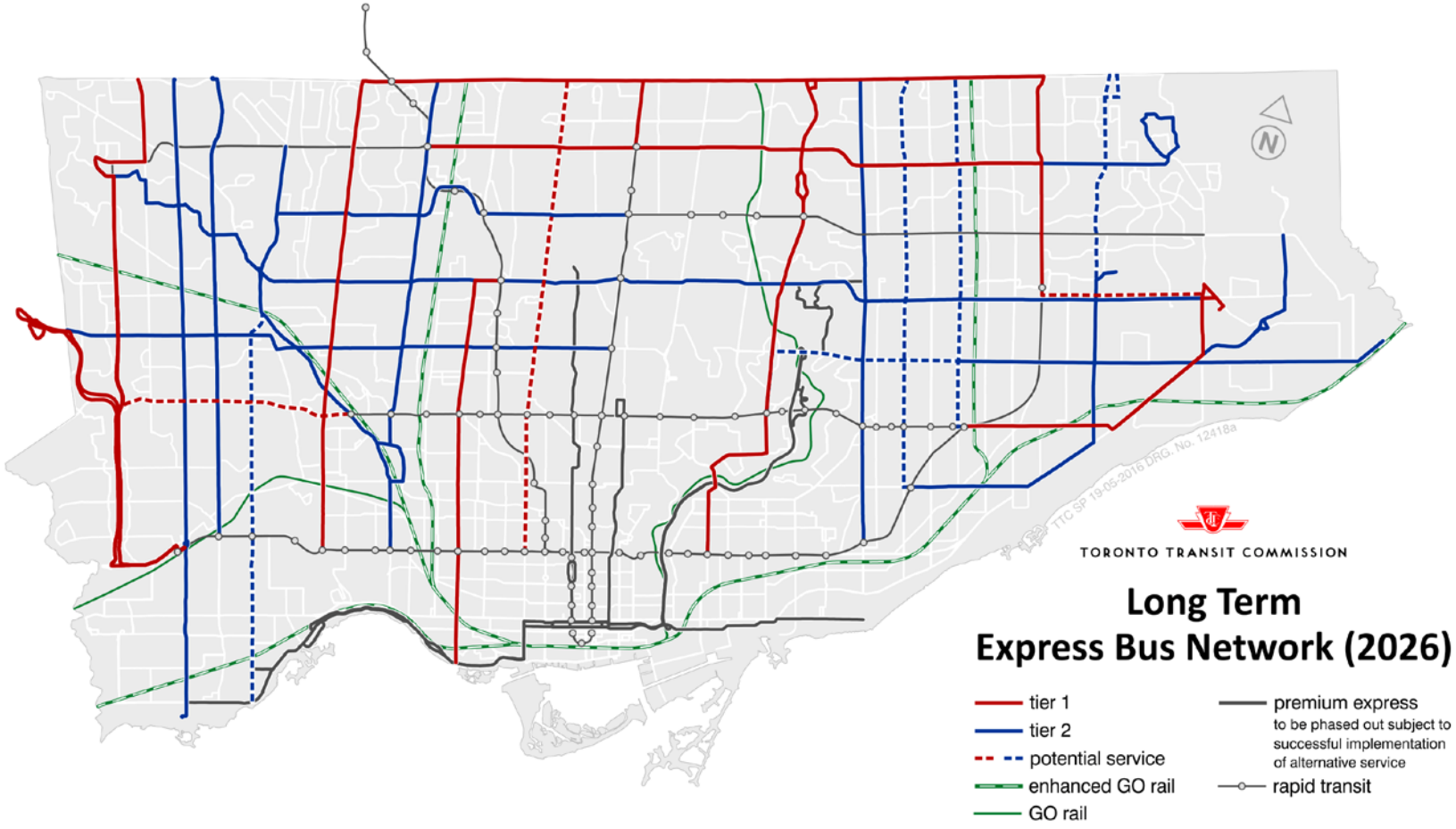
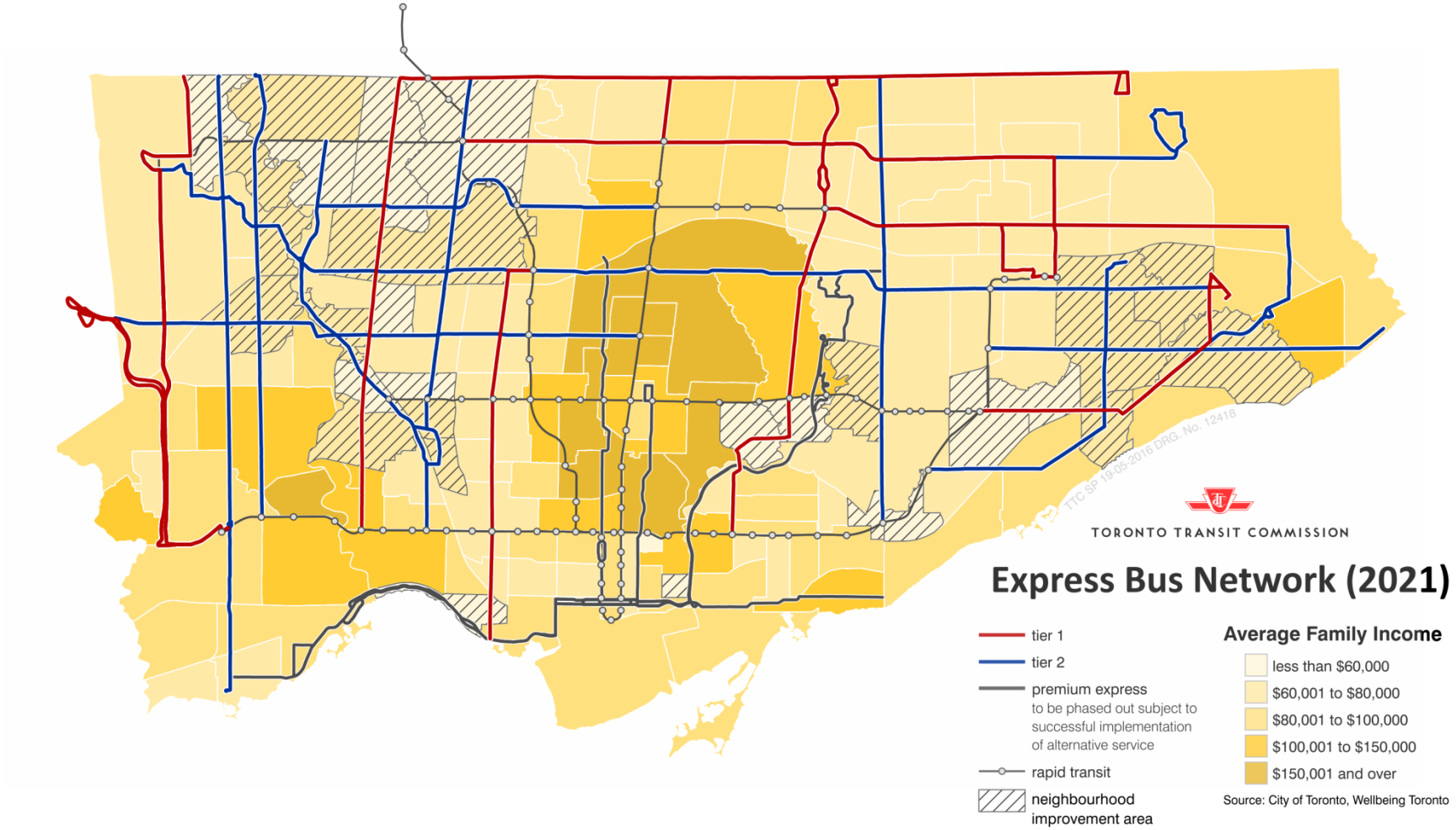


Figure 10: Express Bus Network and Neighbourhood Incomes



Downtown Premium Fare Express Routes

The Downtown Premium Fare Express routes serve 1,700 daily customers. **Figure 11** presents the cost per boarding, or the cost per passenger, for the Downtown Premium Fare Express routes in relation to all routes system wide. At a cost of about $8.00 to $11.00 per boarding, the cost per passenger on the Downtown Premium Fare Express routes is ten times more than the system-wide median and five times more than other express routes. These routes represent the five most expensive routes on a per passenger basis. These figures include the premium fare paid by these customers.

Figure 11: Net Cost per Boarding – Express Routes (Weekdays, Peak Periods)

Route	Net Cost per Boarding	Surface Network Ranking
System-Wide Median	**$1.30**	
Rocket Route Median	**$1.33**	
All Express Routes Median	**$2.49**	
Local/Express Branch Median	**$2.55**	
143 Downtown/Beach Express	$7.78	151
144 Downtown/Don Valley Express	$7.88	152
145 Downtown/Humber Bay Express	$10.22	153
Downtown Premium Median	**$10.22**	
141 Downtown/Mt Pleasant Express	$10.64	154
142 Downtown/Avenue Rd Express	$10.78	155

Furthermore, both the capital and operating resources can be better used elsewhere in the system, including re-investing these resources in the Express Bus Network. However, today these services are perceived as vital to their existing customers due to the capacity and operational issues experienced on both Line 1 and the 501 Queen Streetcar. Therefore, these routes could potentially be phased-out when operational and infrastructure improvements planned for Line 1 (i.e. Automatic Train Control project) and the 501 Queen streetcar (i.e. new LFLRVs, Waterfront transit improvements, transit priority) corridors are realized. TTC staff will evaluate the capacity and reliability improvements resulting from these projects as viable alternatives to the Downtown Premium Fare Express routes and report back to the Board in 2021.

Transit priority measures

The TTC works jointly with the City of Toronto Transportation Services and City Planning on ways to improve surface transit operations across the city. Among these initiatives includes a review and expansion of next generation transit signal priority (TSP) as well as the potential implementation of queue jump lanes. These measures are not a prerequisite to implement the proposed express bus network, but they are enhancements that will further improve the speed of express services and potentially reduce operating costs. The TTC has a capital budget of about $4.1 million for transit signal priority and $1.0 million for queue jump lanes for 2017, with funding for TSP falling to $3.4M between 2018 and 2020. With this funding the TTC and City can implement 80 transit signal priority installations per year, and up to three queue jump lanes per year. Potential transit priority measures on the Tier 1 Express Bus Network include are provided in **Figure 12.**

Figure 12: Transit Priority Measures for Tier 1 Corridors

Transit Signal Priority Corridors	Queue Jump Lane Locations
• Highway 27 (Dixon Road to Steeles Avenue West) • Steeles Avenue West (Yonge St to Pioneer Village Stn) • Steeles Avenue East (Yonge St to Staines Rd) • Sheppard Avenue East (Don Mills Stn to Meadowvale Rd) • McCowan Road (Finch Ave to Scarborough Centre Stn) • Dundas Street West (Kipling Stn to Highway 427)	• Steeles Ave West Westbound at Bathurst St • Steeles Ave East Eastbound at Don Mills Rd • Steeles Ave East Eastbound at Highway 404 • Finch Ave East Eastbound at Bayview Ave • Finch Ave East Westbound at Bayview Ave • Finch Ave East Eastbound at Victoria Park Ave • Finch Ave East Westbound at Victoria Park Ave • Finch Ave East Eastbound at Warden Ave • Finch Ave East Westbound at Warden Ave • Finch Ave East Westbound at Kennedy Road • Dufferin Street Northbound at Lawrence Ave W • Dufferin Street Southbound at Lawrence Ave W

Reducing passenger service time

Passenger service time (PST) – the time it takes for customers to board and alight at stops – represents about 20% of a route's run time. Since road and signal improvements are contingent of support from City of Toronto Planning and Transportation Services, the TTC has explored ways it can make bus service faster, with policies and practices it can control, to provide a true "express" experience. This is mainly achieved by reducing PST.

The first way to reduce PST is to reduce the number of stops the route serves. This is intrinsic and an obvious design solution for any express service. The second tool available is all-door boarding coupled with the operation of articulated buses on express corridors where feasible. By reducing fare transactions and allowing all-door boarding, PST can be reduced, providing considerable benefits to all customers. This can be further enhanced with larger articulated buses that have an additional set of doors. It is recommended to implement all-door boarding for Tier 1 express services only since Tier 1 routes operate during most periods every day of the week to reduce the potential of customer confusion. It is recommended that all door boarding be piloted and tested on the 192 Airport Rocket prior to full roll-out to ensure full benefits are realized.

Implementation plan and financial summary

Figure 13 presents the proposed implementation plan of the new and enhanced express bus routes. The exact roll-out of the network is subject to operating budget availability and approval, vehicle availability and additional garage storage capacity. Roll-out coincides with the opening of McNicoll Bus Garage which will provide enough storage capacity to store the vehicles required to operate the plan. 2019 service enhancements are only possible where no additional peak vehicles are required.

Figure 13: Implementation Plan

Tier	Corridor	Description of Enhancement
2019		
1	Eglinton Ave. E / Kingston Rd / Morningside	Off-peak enhancement.
2	York Mills	Off-peak enhancement.
2	Wilson	Off-peak enhancement.
2020		
1	Steeles East	Peak and off-peak enhancement.
1	Sheppard East	Peak and off-peak enhancement: Extension of express service to Meadowvale Loop. Conversion to articulated buses.
1	Jane	Conversion to articulated buses.
1	Highway 27	Conversion to articulated buses.
2	Sheppard West	Peak enhancement. Extension of express service to Weston Rd.
2	Markham Rd.	New express service.
2	Lawrence West	New express service.
2021		
1	Dufferin	New express service. Requires new vehicles.
1	Steeles West	Peak and off-peak enhancement. Conversion to articulated buses.
1	Finch	Peak and off-peak enhancement. Conversion to articulated buses.
2	Keele	Peak and off-peak enhancement.
2	Weston	New express service.
2	Islington	New express service.

Figure 14 presents operating costs related to service (i.e. operators and maintenance). The financial reports include the effect of the potential phasing out of the Downtown Premium Express routes in 2021 for costing purposes.

Figure 14: Total operating costs (in 2017$)

Operating Costs	2019	2020	2021
Tier 1	$0.2M	$3.8M	$8.6M
Tier 2	$1.4M	$4.1M	$7.5M
Total	$1.6M	$7.9M	$16.1M
Potential Savings from Phasing-Out Downtown Premium Fare Express Routes	$0M	0M	$-2.3M

Figure 15 presents the cumulative revenue projections for the express bus network over the three-year maturation period. New transit ridership typically does not appear overnight and typically takes three years following implementation to be fully realized. Note that the figures exclude the projections for the new services implemented in March 2016.

Figure 15: New customers and new revenue (in 2017$)

New Customers & New Revenue	2019	2020	2021	2022	2023
Tier 1					
New Customers	7,500	350,000	960,000	1,100,000	1,185,000
New Revenue	$0.02M	$0.7M	$2.0M	$2.3M	$2.4M
Tier 2					
New Customers	60,000	250,000	460,000	510,000	535,000
New Revenue	$0.12M	$0.5M	$0.9M	$1.0M	$1.1M
Grand Total					
New Customers	67,500	600,000	1,420,000	1,610,000	1,720,000
New Revenue	$0.14M	$1.2M	$2.9M	$3.3M	$3.5M
Lost Customers from Phasing-Out Downtown Premium Fare Express Routes	0	0	-289,000	-289,000	-289,000
Lost Revenue from Phasing-Out Downtown Premium Fare Express Routes	$0.0M	$0.0M	$-0.82M	$-0.82M	$-0.82M

Based on the total operating costs and fare revenue projections, **Figure 16** presents the net operating cost, or subsidy required, to implement the Express Bus Network including the net cost to implement all-door boarding.

Figure 16: Net operating costs (in 2017$)

New Customers & New Revenue	2019	2020	2021	2022	2023
Tier 1					
Operating Cost	$0.2M	$3.8M	$8.6M	$8.6M	$8.6M
All Door Boarding (Fare Inspection)	$0M	$0.5M	$0.5M	$0.5M	$0.5M
New Revenue	-$0.02M	-$0.7M	-$2.0M	-$2.3M	-$2.4M
Net Cost	$0.2M	$3.6M	$7.1M	$6.8M	$6.7M
Tier 2					
Operating Cost	$1.4M	$4.1M	$7.5M	$7.5M	$7.5M
New Revenue	$0.14M	-$0.5M	-$0.9M	-$1.0M	-$1.1M
Net Cost	$1.3M	$3.6M	$6.6M	$6.5M	$6.4M
Grand Total					
Total Net Cost	**$1.5M**	**$7.2M**	**$13.7M**	**$13.3M**	**$13.1M**
Potential Net Savings from Phasing-Out Downtown Premium Fare Express Routes	$0M	$0M	$-1.5M	$-1.5M	$-1.5M

With respect to the all-door boarding proposal on Tier 1 express services, Fare Inspectors would be required for a projected start date in 2020 pending completion of a successful pilot test. Based on the industry standard 4% customer inspection rate, and an achieved rate of 300 inspections per day, the number of Fare Inspectors required is 21 in 2020 increasing to 24 in 2021 and thereafter. The full operating cost of Fare Inspectors is $2.2M per annum. The addition of Fare Inspectors would result in a $1.7M reduction in fare evasion compared to the status quo. Together, this equates to a net cost of $0.5M per annum to implement all-door boarding.

The express bus network requires an expansion of the TTC's bus fleet. In total, 38 articulated buses are required to implement the express network: 32 in-service buses and 6 operating spares. The total capital cost is estimated at $34.2 million as seen in **Figure 17**. These buses would allow the TTC to reallocate buses amongst routes.

Figure 17: Capital costs (in 2017$)

Buses	
In-Service	**32**
Operating Spares	**6**
Total	**$34.2M**

The 38 buses would require additional bus garage storage and could not be implemented until the TTC secures this new bus facility. The costs to acquire a new bus facility are included in the TTC's 2016 Capital Budget and therefore are not captured in this report.

Customer and TTC Benefits

Ridership

The express bus network was assessed to quantify system benefits for both the TTC and its customers. Nearly 70 million customers are projected to use the express bus network annually and nearly 1.7 million trips will be attracted to the TTC due to the improved express service annually. One in every six bus customers would use the enhanced express bus network.

Leading with Investment

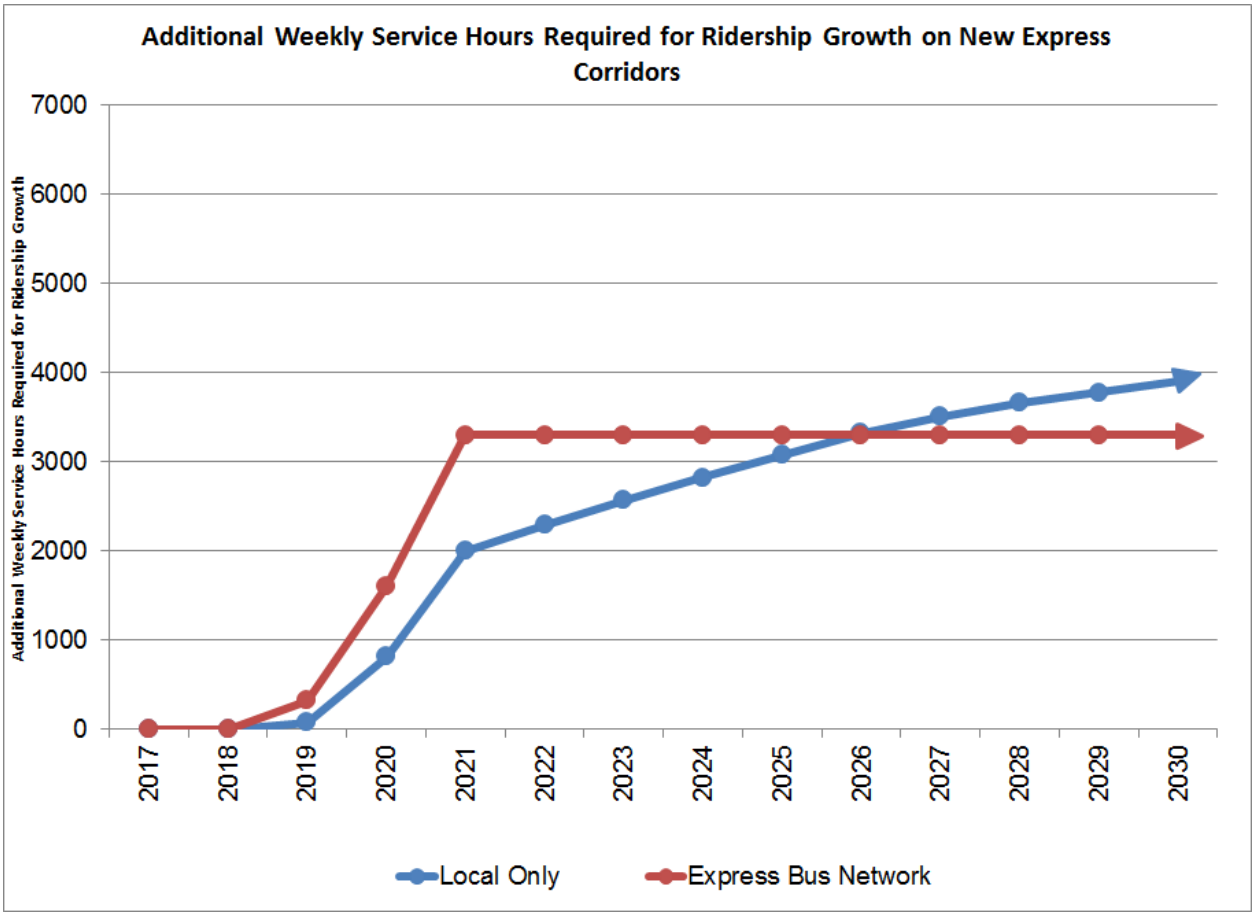
The Express Bus Network will position the TTC well to serve and attract future customers. However, it requires an upfront investment in operating hours and dollars. In order to ensure that the express bus network is an overall net benefit to customers, it is required to initially offer an express service that is frequent enough to be an attractive option for customers while not degrading the local service so significantly that customers avoid the system altogether. This means that more capacity will be on the street as the networks plan rolls out.

Over time additional resources will be required on the proposed corridors on their local services if express services are not provided. These local services cost more to provide the same capacity than what the Express Bus Network would provide. For example, in order to provide the same capacity on the new express corridors as proposed in the network with local services this would require an additional 1,250 weekly service hours for a total of 4,550 weekly service hours, which has an annual cost of approximately of $6M. This represents roughly an overall increase of 5% which is consistent with the findings of the performance review – that express buses can reduce operating needs on a corridor from 3 to 10%.

Figure 18 demonstrates that in five years following implementation of the Express Bus Network, the additional 3,300 weekly service hours required to operate the proposed plan would have been invested on these corridors in local service to support normal ridership growth. This would still not provide the additional customer benefits of improved travel times and additional capacity on busy transit corridors. There is more value expanding service on these corridors with express routes rather than status quo options.

Resources that would have been required in the future are being advanced to be invested in 2019 through to 2021 in the form of a robust and beneficial express bus network.

Figure 18: Service Hour Comparison, Local vs. New Express Services



Travel Time Savings

On average, TTC customers will save about 3 minutes on the bus leg of their journey, which can be applied to the total number of annual trips to generate annual time savings. If a customer averages 10 trips per week on a given service, this equates to 26 hours saved per year. Due to the sheer magnitude of customers using the services, the total time savings are immense. Overall, the express bus network will provide an additional 3.1 million customer hours in savings annually. One of the TTC's core values is respecting the customer's value of time. The express bus network is just one way to support this important corporate objective.

As noted, this investment is needed for a seven year period, after which it will cost more to move the same number of customers on the same corridors. When isolating the customer hours saved on the new or enhanced routes proposed during the seven-year period where additional costs will be incurred compared to the "status quo" option (e.g. between 2020 and 2026) this equates total of 3.15M customer hours saved at a cost of $23.6M.

Over the six year period, it will cost $7.50 per customer hour saved. When evaluating the benefits of a transportation initiative, Transport Canada assigns a value of travel time of $14[1] per hour. The economic opportunity presented by the travel time savings alone exceeds the cost to provide the travel time savings demonstrating that the Express Bus Network is good value for money.

Communications plan

This express bus network concept presents an opportunity for the TTC to enhance marketing for Tier 1 and/or Tier 2 services. As seen in the Peer Review, some transit agencies intentionally and specifically market some of their express services as a ridership growth initiative. Typically, this involves a special brand for these services coupled with unique route names and route numbers. Some agencies further enhance this brand with special vehicles, different uniforms for operators and different signs to mark where these express services stop. An aggressive advertisement campaign is usually associated with the initial implementation of these services. The goal of enhanced communications is that it will make these services more easily identifiable and ultimately attract new riders to the system. The communications plan will require a balance that recognizes operational challenges, funding, but most importantly, doing what's best for customers.

Conclusion

The *Express Bus Network Study* identifies a network of express bus services that will help support future rapid transit projects as well as municipal, provincial and corporate objectives. As part of this network the following initiatives or concepts have been explored and recommended:

For short-term implementation by 2017-2018:

- Institute a "two-tiered" approach to classify express services which will clearly delineate service offerings and characteristics:
    - Tier 1 services are all-day express corridors with high daily ridership and are designed to be a precursor to rapid transit
    - Tier 2 services are generally peak-only services on corridors that experience high peak demands and could use additional capacity
- Implement additional transit priority measures, such as queue jump lanes and transit signal priority to help facilitate faster bus services

[1] The estimated hourly value in 1990 dollars is $22.70 for air travellers, $10.10 for rail travellers, $9.10 for auto travellers and $8.40 for bus travellers. This value has been adjusted to 2017 dollars based on the Bank of Canada inflation calculator.
See: http://data.tc.gc.ca/archive/eng/corporate-services/finance-bca-122.htm
http://www.bankofcanada.ca/rates/related/inflation-calculator/

- Implement all-door boarding on the 192 Airport Rocket, on a trial basis
- Use articulated vehicles on Tier 1 services, where possible

For medium-term implementation by 2019-2021:

- Add service to the network as presented in the express bus network (2021) subject to funding, vehicle availability and ridership trends
- Potentially phase-out the Downtown Premium Fare Express routes due to their poor economic performance subject to the successful implementation of viable service alternatives and Board approval. These resources can be re-invested into the rest of the express network at a greater customer benefit.

For long-term implementation by 2022-2026:

- Add or enhance service to the network as presented in the long-term express bus network pending funding, vehicle availability, ridership trends and evolving long term rapid transit plans

As a result of these recommendations, the net operating cost for the recommended express bus network is approximately $13.1M per year once the plan has been fully implemented and ridership fully matures in 2023, with a potential of $1.5M in savings if the Downtown Premium Fare Express routes are phased-out. The network will benefit nearly 70 million customer trips annually, saving more than 3.0 million person-hours of customer time per year, and attract 1.7 million additional customer-trips to the system annually. One in every six bus customers would use the expanded express bus network.

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Attachments:

1. *Express Bus Network Study*

Express Bus Network Study

TORONTO TRANSIT COMMISSION

June 2017

TABLE OF CONTENTS

TABLE OF EXHIBITS

TABLE OF TABLES

1 INTRODUCTION

A 2015 study conducted by the Toronto Board of Trade concluded that Greater Toronto residents have among the longest commutes in North America. GTA residents spend on average of 66 minutes per day commuting back and forth between home and work. The Toronto Transit Commission (TTC) recognizes that in order to remain attractive, transit must offer a viable alternative to other modes of travel. The Toronto Transit Commission (TTC) operates an integrated multi-modal transit system consisting of buses, streetcars and subway services. Collectively, these services provide a high level of mobility and transportation for Toronto residents. The TTC is continually working to improve the quality and effectiveness of the services which it provides in order to maintain and grow ridership. This supports the City of Toronto's *Official Plan* which states that Toronto must become a more transit-oriented city in which people make more and better use of its transit system, as well as other sustainable modes of transportation such as walking and cycling.

The TTC, the City of Toronto, and Metrolinx are working together on a number of rapid transit projects to improve the quality and availability of transit services in Toronto. Some of the most noteworthy projects include the Toronto-York Spadina Subway Extension, the Eglinton Crosstown Light Rail Transit, the Finch West Light Rail Transit, the Line 2 Scarborough Subway Extension and the Relief Line which are all at various stages of design and/or construction.

While these rapid transit initiatives would bring many benefits to all travellers in the City of Toronto, it is important to remember that 60% of all people who travel on the TTC use bus services for at least part of their trip-making. In 2016, over 433 million customer-trips (or 51% of total customer-trips) were made on TTC bus services[1]. It is, therefore, very important for the TTC to also improve the quality and availability of its bus services which support and feed existing and future rapid transit service initiatives.

The August 2014 *Opportunities to Improve Transit Service in Toronto* report proposed an enhanced express bus network as a service initiative to make travel faster and more competitive. An enhanced express bus route network that is fully integrated with the existing and future rapid transit network would offer faster service and more capacity into many areas of the City. Understanding this, the TTC Board requested that staff report back on the feasibility of implementing additional express bus routes in the City of Toronto. This study is in response to this motion.

The objective of this study is to identify ways to enhance the TTC Express Route Network with service, policy, fleet, infrastructure, route management and communications improvements that would provide TTC customers with more rapid, dependable and recognizable express bus services.

[1] Customer-trips refers to the number of boardings.

This report is divided into six chapters. Four chapters represent the four major tasks that were carried out under the study.

- Background
  - A review of provincial, City and TTC reports and studies to identify objectives and strategies that support new and enhanced express bus services.

- Performance Review
  - A review of express route networks at other transit agencies across North America to identify best practices and emerging trends
  - An assessment of the TTC's existing express route performance

- Network Design
  - The development of a policy framework including service standards
  - The development of an express route network
  - The identification of operational strategies to support the recommended network

- Implementation Schedule & Business Plan
  - The identification of service, infrastructure, route management, communications, and financial resources to implement the recommended network

2 BACKGROUND

2.1 Planning Background

The importance of the bus network as part of the urban landscape has not been lost by urban and transit planners at both the municipal and provincial levels. Future growth plans and initiatives rely on non-automobile travel alternatives for their success. This section will briefly discuss relevant provincial, City and TTC plans, policies and past studies that support an enhanced local bus services and, in particular, expanded express bus services.

2.1.1 Province of Ontario: Plans, Policies and Initiatives

The Province of Ontario's *Places to Grow: The Growth Plan for the Greater Golden Horseshoe* is a 25-year plan with the objective to reduce traffic gridlock by offering a greater range of transportation options, including enhanced local bus service.

Furthermore, Metrolinx's Regional Transportation Plan, known as *The Big Move*, states that the Region's rapid transit network must be supported by comprehensive high quality municipal transit connections. This includes faster, more reliable bus services that express services can provide.

2.1.2 City of Toronto: Plans, Policies and Initiatives

The City of Toronto Official Plan strongly promotes increasing transit use for existing and future residents. The Official Plan supports transit priority throughout the City by giving buses and streetcars priority at signalized intersections. Furthermore, Official Plan Map 5 - Surface Transit Priority Network, supports the introduction of other priority measures such as reserved or dedicated lanes for buses and streetcars, and limiting or removing on-street parking during all or part of the day, along identified corridors.

The City of Toronto is currently in the process of reviewing its Official Plan transportation policies, including Map 5. A potential expansion of the surface transit priority network is being considered, in consultation with the TTC. Public consultation through the initial phase of the Official Plan review revealed that many people are frustrated by the long and uncertain lead-in time required for rapid transit projects to come into operation. Many feel that more immediate steps to improve transit services throughout the city need to be undertaken. Enhancements to the TTC's surface transit network of streetcar and bus routes provide a relatively quick and affordable opportunity to begin addressing these concerns.

The potential Enhanced Surface Transit Network (ESTN) is illustrated in **Exhibit** 1. The ESTN's scope is proposed to be broader and less vague than just transit "priority" and can include additional measures to improve route performance such as improved frequencies, higher capacity vehicles, express bus routes and all-door loading.

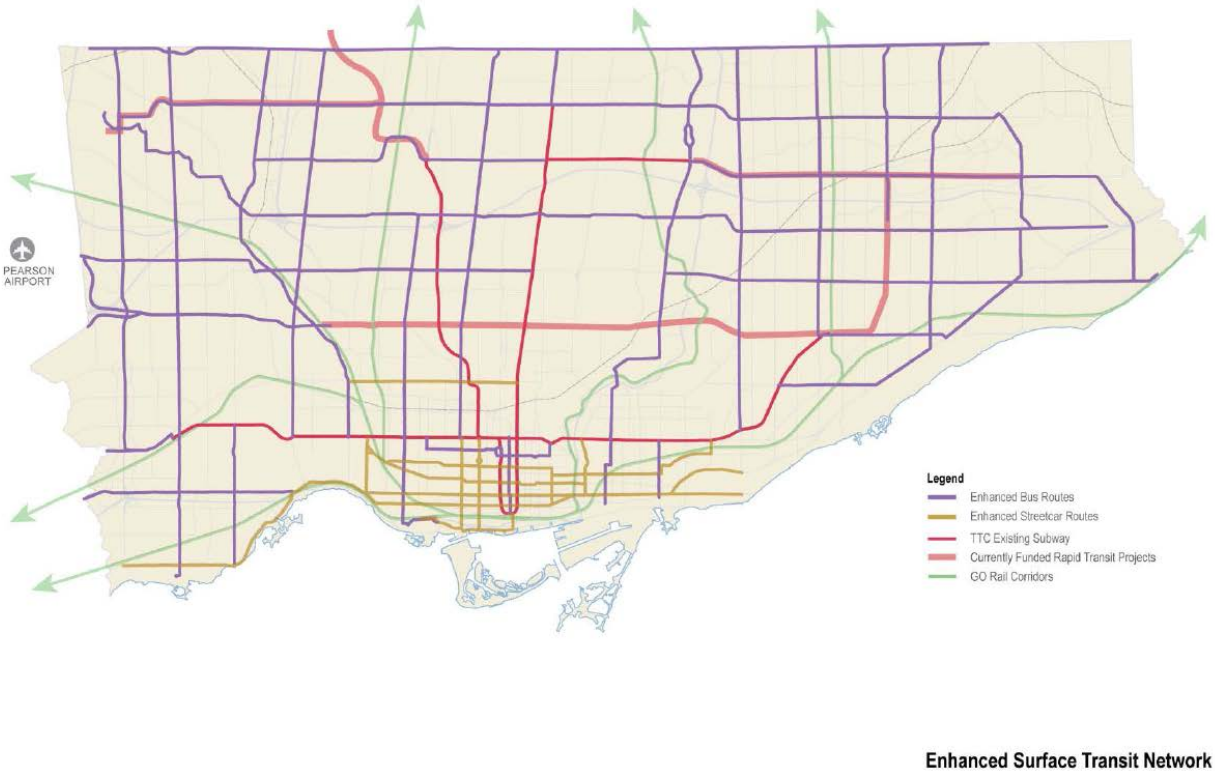


Exhibit 1: City of Toronto Official Plan 2014 Update: Enhanced Surface Transit Network

2.1.3 TTC: Plans, Policies and Initiatives

The TTC's *2013-2017 Five Year Corporate Plan* is a blueprint towards modernizing the TTC, improving customer satisfaction, and ultimately delivering the Commission's renewed vision of a transit system that makes Toronto proud. The Corporate Plan establishes that the TTC's core value is the Value of Time; both the quality and quantity of time customers spend on the TTC. Clearly, express bus routes can play a role in achieving this as they reduce travel time and help manage corridor service levels.

In March 2003, the TTC launched its *Ridership Growth Strategy* (RGS) which was designed to grow transit ridership in a substantial manner. The RGS set out a number of priorities to improve the system which would in turn increase ridership. One priority involved increasing service levels and capacity above and beyond current needs to stimulate demand. This included nominally increasing peak and off-peak service levels, the construction of transit rights-of-way and the continued roll-out of transit signal priority (TSP). Express bus routes were not explicitly mentioned in the RGS, however express buses can generate time savings for the customer, and in turn become more attractive to potential users. Express service, when subjected to clear service standards, is a cost-effective tool when adding capacity to a corridor with high demand.

Following the RGS, the TTC published the *Transit City Bus Plan* (TCBP) in August 2009. TCBP's objective was to advance improvements to bus services to support the City's former rapid transit expansion proposal named Transit City. Twenty-one bus routes were determined to be part of a specified core of routes and made up the Transit City Bus Network (TCBN). All 21 TCBN routes identified were slated for "Ten-minute-or-better" service, while 15 of the 21 routes were candidates for "New or Enhanced Express" as illustrated in **Exhibit 2.**

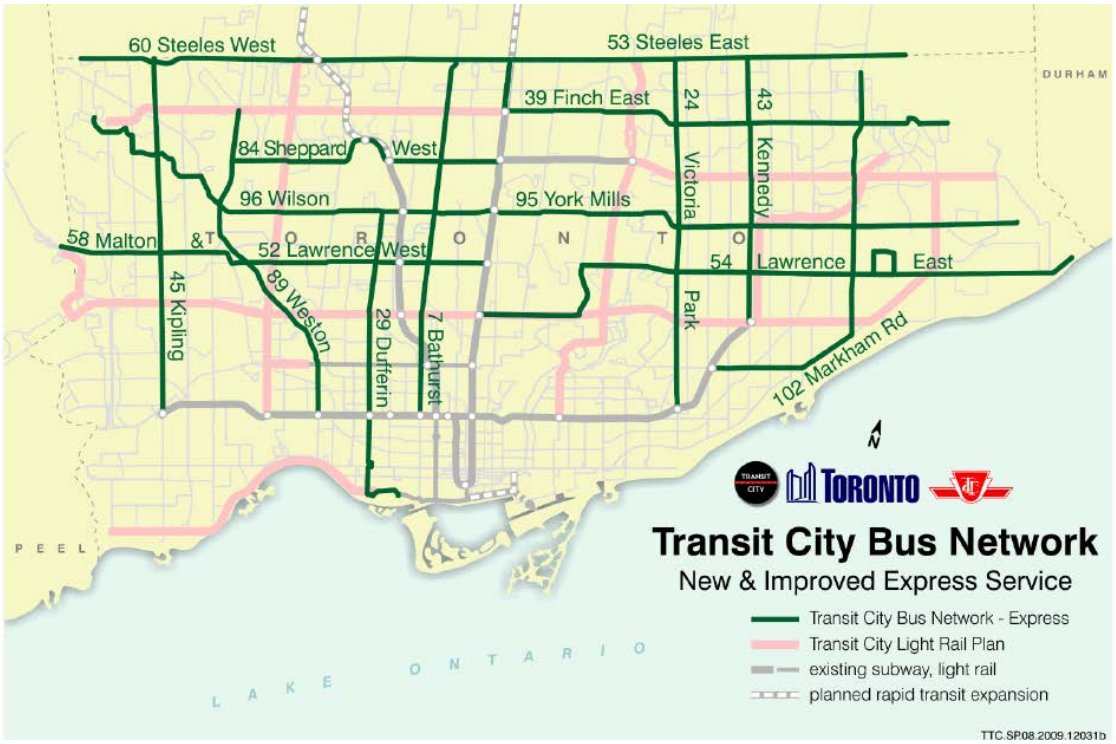


Exhibit 2: Transit City Bus Network – New & Improved Express Services

In August 2014, the TTC board endorsed a report called *Opportunities to Improve Transit Service in Toronto*. The report proposed short-to-medium term low-cost service enhancements. One of these initiatives proposed new or enhanced express bus services on 20 bus routes. New peak-period express service could be provided on 10 additional corridors, while some existing express services would have their service levels increased and receive off-peak service hours. In response, the TTC Board directed staff to initiate this *Express Bus Network Study* to repackage and refine express routes into a recognizable and integrated express bus network.

Based on the *Opportunities to Improve Transit Service in Toronto* report, on March 11, 2015 City Council approved $95 million in transit improvements which included new buses to expand the express bus network. On March 27, 2016, the TTC introduced five new or enhanced bus routes across Toronto on Don Mills Road, Finch Avenue West, Kipling Avenue, Victoria Park Avenue and Wilson Avenue. The introduction of these routes is considered the first wave of the expanded express bus network as advocated by the *Opportunities to Improve Transit Service in Toronto* report. These routes are illustrated in **Exhibit 3.**

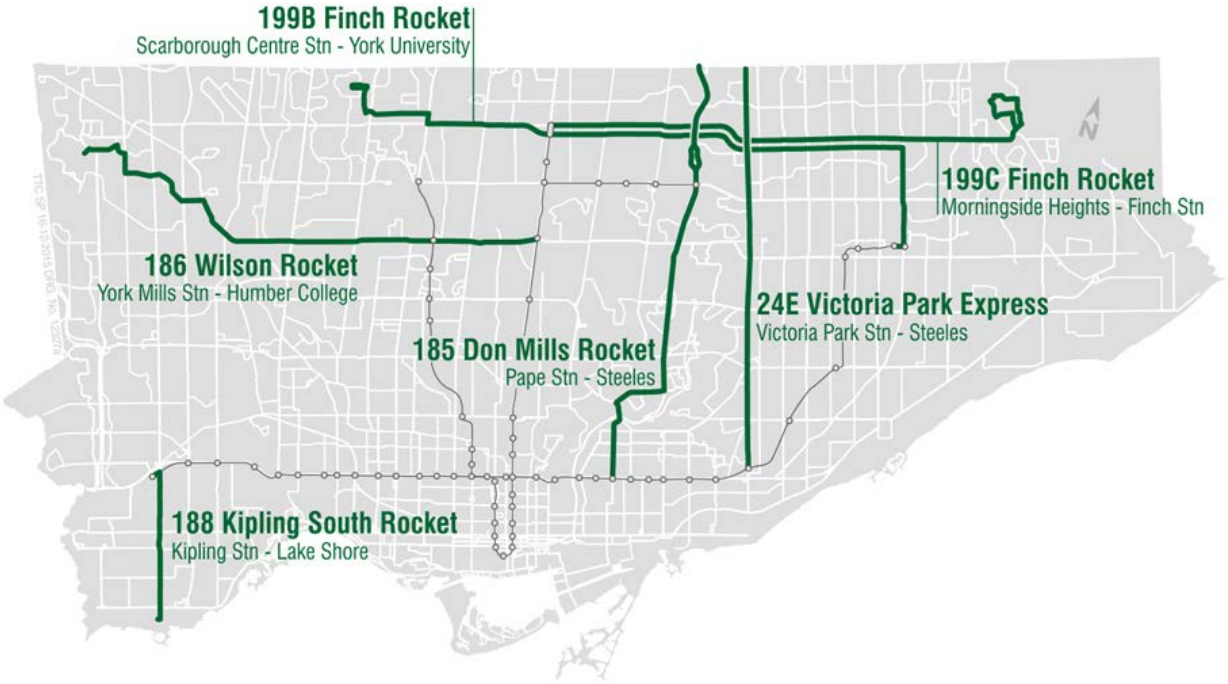


Exhibit 3: Five New and Enhanced Express Bus Routes

3 PERFORMANCE REVIEW

3.1 Peer Review

The TTC conducted a peer review of 15 transit agencies across North America to understand how other transit agencies plan, operate and market their express bus services.

The peer review serves numerous useful functions which include:

- Ensuring that the TTC's planning and operation of express bus services is in line with industry best practices
- Developing further understanding of the full potential and impacts of express bus services at a system-wide level
- Developing new ideas for application in the City of Toronto

Exhibit 4: Transit Agencies Surveyed

The transit agencies selected to participate in the peer review are illustrated in **Exhibit 4**. These transit agencies were selected for a number of reasons. Some agencies were selected because their service area and population and multi-modal transit network is similar to the TTC e.g. STM (Montreal) and CTA (Chicago). Other transit agencies were selected because they operate an extensive express bus network e.g. YRT / Viva (York Region).

3.1.1 Classifications of Express Services

The peer review revealed that there is no standard terminology for different types of express bus services. Each agency applies localized terms which include express, local/express, limited, BRT-light, etc. However, one important finding is that, despite the different terms used to describe express bus services, there are generally two distinct types or classifications of express services that are defined as follows.

1. Commuter Focused: Commuter focused services are designed to directly serve high demands between two major trip generators (i.e. a Post-Secondary Institution, employment district, high density neighbourhood) a large distance apart with a high speed service generally during peak hours. Most times, travel demand is dominated in one direction. In Toronto, examples of commuter focused express service are express branches of local routes such as the 45E Kipling or the 86E Scarborough and the 140 series Downtown Premium Express Routes.

2. Corridor Focused: Corridor focused routes are meant to serve diverse trip origins and destinations along established travel corridors. Usually a major trip generator is located at one or both ends of the line to act as anchor points to generate two-way demand during most periods of operation. An example of a corridor focused express service in Toronto is the 198 University of Toronto Scarborough Rocket or the 195 Jane Rocket.

Of the 15 transit agencies surveyed, 14 operate a commuter focused service while 13 agencies operate express services that focus on the movement of people along a specific corridor. Like the TTC, 12 agencies operate both classifications of express services.

3.1.2 Service and Operational Elements

The peer review identified operational elements for each express service classification. The operational elements are arranged into three main categories as follows:

1. Service Pattern
   a. stopping pattern: local/express vs. limited stop
   b. hours of operation
   c. frequency of service

2. Bus Preferential Treatments
   a. use of a transitway or busway separate from general traffic
   b. use of dedicated or reserved lanes adjacent to general traffic
   c. use of queue jump lanes
   d. use of transit signal priority

3. Fare Collection
   a. payment: On-board vs. off-board Ticket Vending Machine (TVM)
   b. use of All-door boarding & proof of payment (POP)

Service Pattern

Exhibit 5 summarizes the results of the peer review findings in regards to the service pattern characteristics. Corridor focused services exclusively operate at limited stop routes, while 80% of commuter focused services surveyed operate as local/express, where stops are serviced on the outer portions of the route but the middle portion of the route runs without stops or very wide stop spacing. This indicates that the stopping pattern is a key component when establishing an express service.

With respect to hours of operation and frequency, corridor focused express bus services operate longer and more frequently, usually 7 days a week with a frequency of 15 minutes or better, compared to a commuter focused service which are more limited as they are primarily work and school trips.

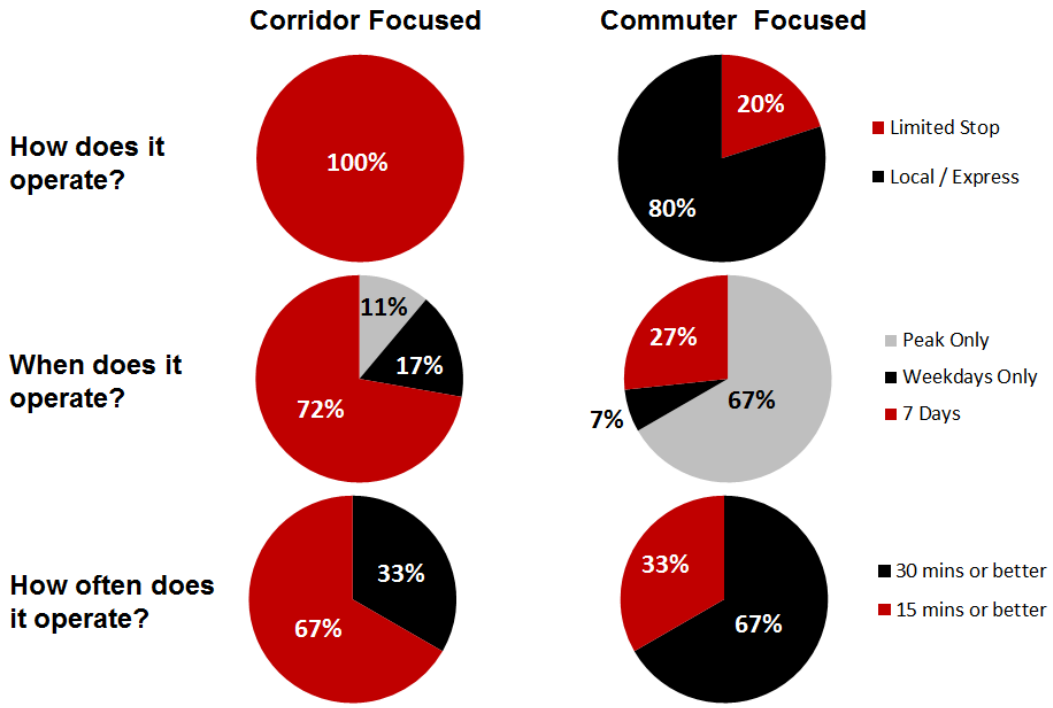


Exhibit 5: Peer Review – Service Pattern Characteristics for Express Bus Services

Bus Preferential Treatments

Exhibit 6 presents the percentage of express bus services that utilize specific bus preferential treatments. Most of these services make use of transit signal priority and queue jump lanes at congested signalized intersections to mitigate delays. The availability of dedicated or reserved lanes is less prevalent; however about 50% of transit agencies surveyed operate at least one corridor focused express services on dedicated or reserved bus lanes. Transitways or busways have only been constructed in about one quarter of the transit agencies surveyed. This is due to the relatively large cost compared to other bus preferential treatments. These transitways or busways can be used for multiple express services such as in Ottawa or for single services such as in York Region.

Overall, transit agencies invest more in bus preferential treatments for corridor focused services. This is because corridor focused services operate, in most cases, seven days a week in most operating periods, therefore the investment is better directed to improve this type of service.

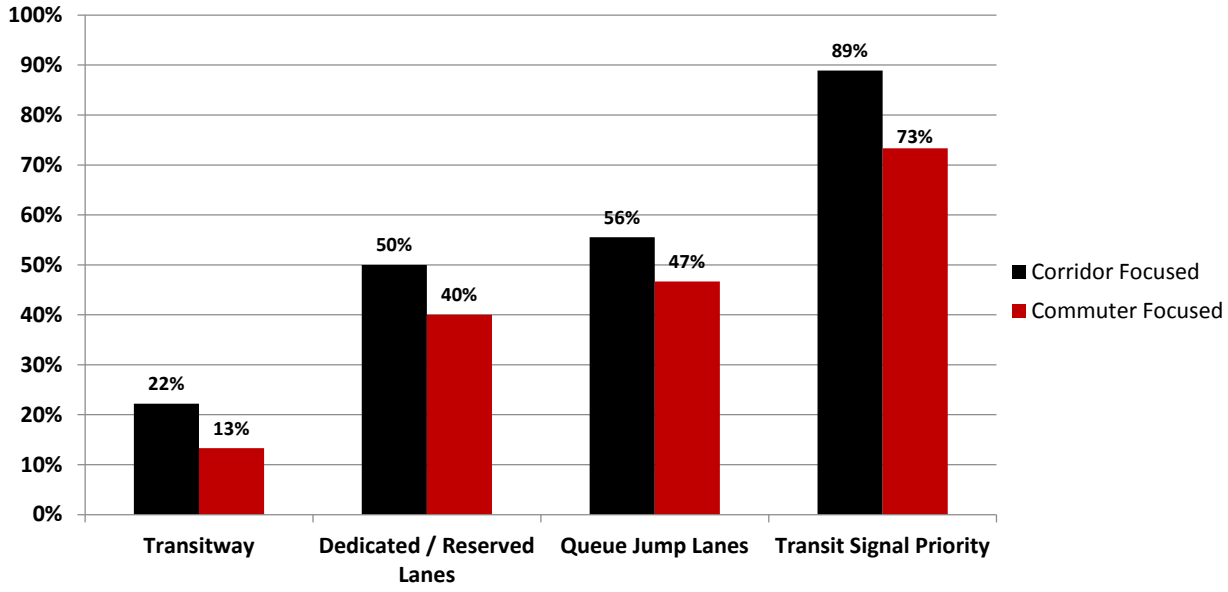


Exhibit 6: Peer Review – Bus Preferential Treatments for Express Bus Services

Fare Collection

Exhibit 7 summarizes fare collection methodologies. This is an important aspect of express services, as passenger service time can account for approximately 20% of a route's running time. Dwell time can be reduced by minimizing the driver / customer interaction in regards to fares. A proof-of-payment system in conjunction with all-door boarding significantly decreases stop service times and can be further enhanced by allowing passengers without a valid transfer or pass to purchase their fare prior to the vehicle arriving at the stop. More than 60% of corridor-focused services allow all-door boarding. Approximately 80% of the agencies surveyed have off-board ticket vending machines that allow the customers to purchase their fare prior to boarding.[2] Meanwhile, commuter focused services almost exclusively require that the customer pays their fare upon boarding the vehicle.

There are two reasons for the disparity in fare collection rules between the two service classifications. Firstly, the investment of TVMs and Fare Inspectors may not be justified for commuter-focused routes that operate limited frequency and span of service. Secondly, corridor focused services typically have limited stops with very high customer demands so that limiting

[2] One agency that supplies off-board ticket vending machines requires customers to show their ticket to the operator when boarding the bus.

on-board fare transactions and/or operator interactions is beneficial as it reduces passenger service time.

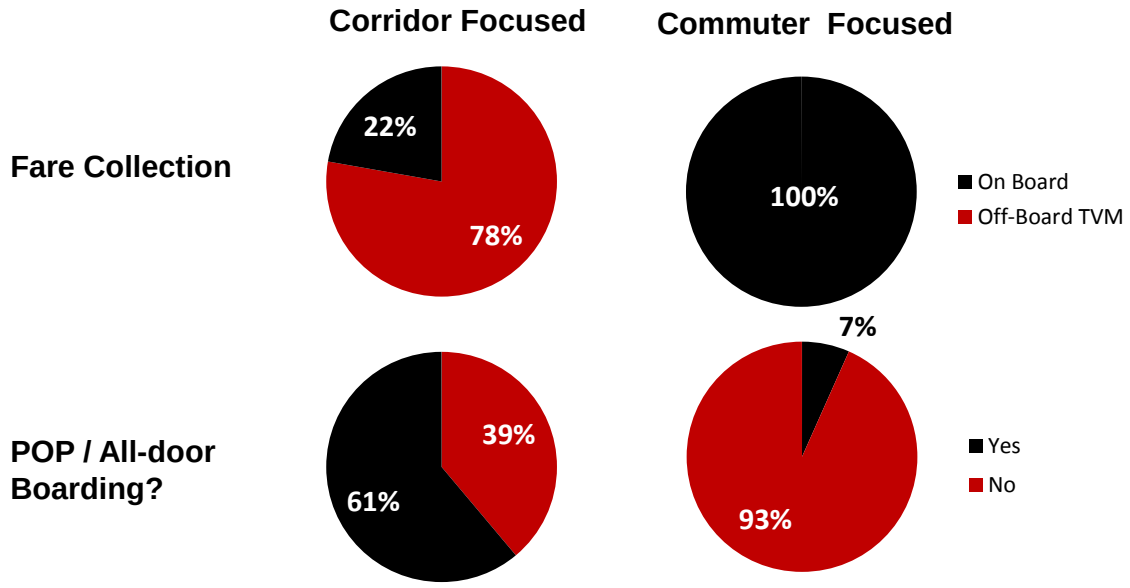


Exhibit 7: Peer Review – Fare Collection for Express Bus Services

Branding

Some transit agencies apply special branding to delineate their express or higher order services from their conventional routes. For example, Brampton Transit uses the Züm brand on their limited stop BRT-lite network and WMATA Metrobus (Washington) utilizes MetroExtra to name their network of limited stop express services. Other transit agencies, such as STM in Montreal, simply use route numbering to denote that the route is an express route, however, for the purpose of this study, this would not be considered special branding. **Exhibit 8** illustrates the percentage of express bus services that utilize special branding.

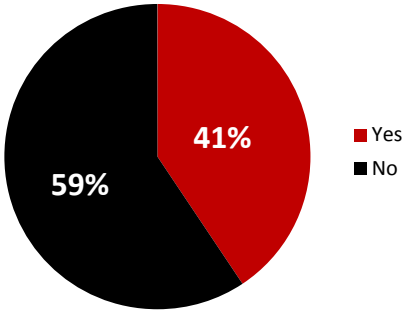


Exhibit 8: Peer Review – Use of Special Branding

Criteria for Designating Express Services

The peer review also investigated the measures used to determine how and when an express route is warranted. This can be achieved through many different metrics, and most transit agencies use more than one metric or standard to justify adding or removing express service from its system. These measures/standards can be roughly grouped as follows:

- Travel Speed Improvement: Will the implementation of an express route improve the customer's travel time by an appreciable amount?
- Ridership / Capacity: Is there enough ridership to justify an express route? Does the capacity of the existing local route need to be optimized?
- Strategic Land Use & Transit Oriented Development Planning: Does the corridor service large numbers of residents and employers? Will the route serve new growth areas?
- Average Trip Distance: What is the distance customers typically travel along a corridor? Longer distance trips are best served by express routes.
- Financial: Can the express route achieve the agency's stated financial standards to keep the route in operation?

Exhibit 9 summarizes the percentage of the transit agencies surveyed that utilize each warrant discussed above. It is no surprise that ridership and travel speed improvement are the most used metrics in evaluating the utility and need of an express route. Meanwhile the catchment area of an express route is also another important consideration when planning an express bus route system.

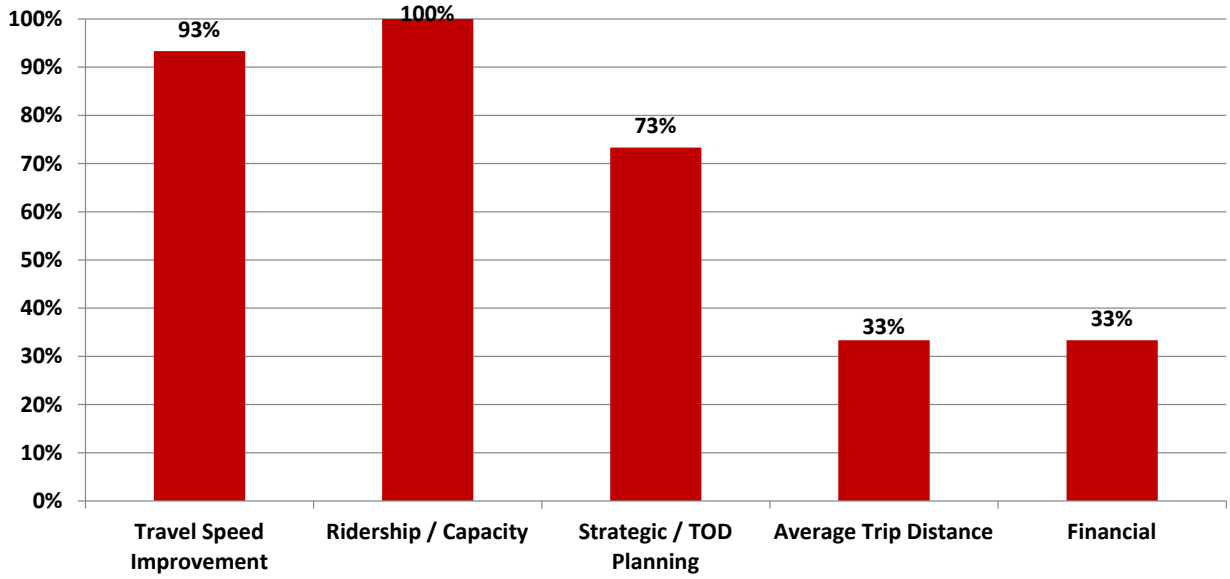


Exhibit 9: Peer Review – Service Triggers

3.1.3 Peer Review Summary

In summary, the peer review of express bus services at other comparable transit agencies across North America revealed the following:

- In general, there are two classifications of express services: commuter focused and corridor focused.
- Corridor focused services operate longer and more frequently as they are specifically designed to serve all-day trip patterns.
- Commuter focused services are more limited as they focus on serving fairly limited peak-only demands.
- Transit agencies will operate more than one classification of express services.
- There is more transit priority capital investment in corridor focused services due to the all-day nature of these routes.
- Corridor focused services utilize proof-of-payment and all-door boarding as one method to minimize travel time.
- Transit agencies employ a number of standards to determine when an express service should be implemented.

3.2 Existing TTC Express Network

The following section summarizes the TTC's existing express bus service offerings including attributes such as stopping pattern, hours of operation and the number of existing customers served.

3.2.1 TTC Express Service Classifications

The TTC operates three types, or classifications, of express services which are discussed below.

Rocket Service
Rocket routes are independent routes with their own route name and number which operate along an existing local transit corridor. They are designed to link major trip generators, such as a subway station and a post-secondary institution, making limited stops along the way. Rocket routes do not always travel along traditional transit corridors such as major arterial roads. Rather these routes can and will use freeways or busways to improve trip speed for the customer. Typically, Rocket services operate 7-days-a-week with service at all times except for late evenings. Rocket express routes are similar to the corridor focused classification noted in the Peer Review.

Local/Express Branch
Local/Express branch routes closely follow the routing of a main "parent" route which operates in parallel for most of the corridor. These routes use the same route number of its parent route but the letters 'E' or 'F' is appended to the end (e.g. 41E Keele). Typically these routes operate Monday-Friday at peak hours only with some exceptions. This service has been introduced on routes where passengers travel long distances to the subway from the extremities of Toronto. Not all Local/Express routes have the same stopping pattern. The different application of stopping patterns for Local/Express Branches has been a source of confusion for some customers. Local/Express Branch routes are similar to the commuter focused classification noted in the Peer Review.

Downtown Premium Fare Express
Downtown Premium Express routes target a very specific travel market, linking neighbourhoods in the City to Downtown Toronto with a direct trip during weekday peak hours only. These routes were implemented in response to customer feedback that travel alternatives between these areas and Downtown, such as the 501 Queen or a combination of a bus/subway trip, are slower and/or over-crowded during peak hours. Downtown Premium Express routes are similar to the commuter focused classification noted in the Peer Review.

In the AM peak period, these routes will collect passengers, stopping at every stop until a certain point and then run non-stop into the downtown where the bus resumes a "local" stopping pattern to allow passengers to disembark close to their destination. In the PM peak period, the reverse arrangement occurs. These routes have a high cost to operate. This is due to the fact that demand is uni-directional (inbound in the AM, outbound in the PM) meaning that return trips have very low ridership and therefore the number of passengers per kilometre is low. To account for the higher operating costs, an additional fare is charged to passengers.

3.2.2 Existing Express Services

Exhibit 10 and **Table 1** illustrate the TTC's existing express services and their characteristics such as its classification, stopping pattern, hours of operation and AM peak period frequency**.**

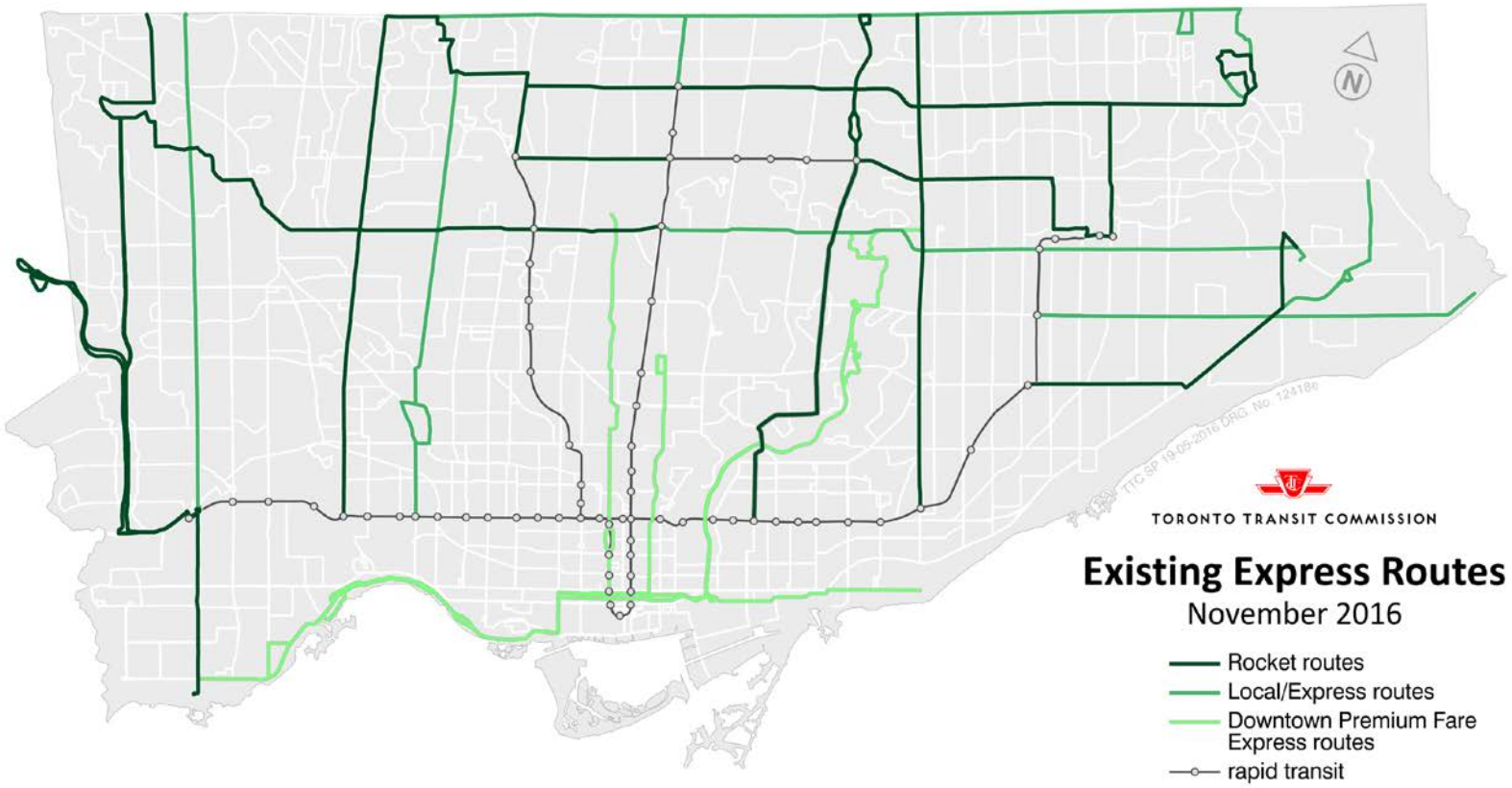


Exhibit 10: Existing TTC Express Bus Services

Table 1: Existing TTC Express Bus Services

Route Number	Route Name	Terminals	Service Type	Stopping Pattern	Periods of Operation	AM Peak Period Service Interval
24E	Victoria Park Express	Victoria Park Stn – Steeles Ave	Local / Express	Limited Stop	M - F Peak Periods	8’ 30”
41E	Keele Express	Keele Stn – York University	Local / Express	Limited Stop	M - F Peak Periods	13’ 30”
45E	Kipling Express	Kipling Stn – Steeles Ave	Local / Express	Local / Express	M - F Peak Periods	5’ 45”
53E	Steeles East Express	Finch Stn – Markham Road	Local / Express	Local / Express	M - F Peak Periods	13’ 00”
53F	Steeles East Express	Finch Stn – Staines Road	Local / Express	Local / Express	M - F Peak Periods	13’ 00”
54E	Lawrence East Express	Lawrence East Stn – Starspray Blvd	Local / Express	Local / Express	M - F Peak Periods	9’ 00”
60F	Steeles West Express	Finch Stn – York University	Local / Express	Limited Stop	M - F Peak Periods	8’ 00”
86E	Scarborough Express	Kennedy Stn – Sheppard Ave	Local / Express	Local / Express	M - F Peak Periods	4’ 30”
95E	York Mills Express	York Mills Stn – UTSC	Local / Express	Local / Express	M - F Peak Periods	9’ 00”
141	Downtown / Mt Pleasant Express	Eglinton – Downtown	Downtown Premium Express	Local / Express	M - F Peak Periods	4 Trips
142	Downtown / Avenue Rd Express	Hwy 401 – Downtown	Downtown Premium Express	Local / Express	M - F Peak Periods	30’ 00”
143	Downtown / Beach Express	Neville Park – Downtown	Downtown Premium Express	Local / Express	M - F Peak Periods	15’ 00”
144	Downtown / Don Valley Express	Wynford – Downtown	Downtown Premium Express	Local / Express	M - F Peak Periods	12 Trips
145	Downtown / Humber Bay Express	Kipling – Downtown	Downtown Premium Express	Local / Express	M - F Peak Periods	5 Trips

Route Number	Route Name	Terminals	Service Type	Stopping Pattern	Periods of Operation	AM Peak Period Service Interval
185	Don Mills Rocket	Pape Stn – Steeles Ave	Rocket	Limited Stop	M – F Peak Periods & Early Evenings; Weekend Mornings & Afternoons	6’ 30”
186	Wilson Rocket	York Mills Stn – Humber College	Rocket	Limited Stop	M – F Peak Periods & Mid-Day	9’ 30”
188	Kipling South Rocket	Kipling Stn – Humber College Lakeshore Campus	Rocket	Limited Stop	M – F Peak Periods & Mid-Day	7’ 30”
190	Scarborough Centre Rocket	Don Mills Stn – Scarborough Centre Stn	Rocket	Limited Stop	All periods	5’ 30”
191	Highway 27 Rocket	Kipling Stn – Steeles	Rocket	Local / Express	All periods	4’ 10”
192	Airport Rocket	Kipling Stn – Pearson Airport	Rocket	Limited Stop	All periods	10’ 00”
195	Jane Rocket	Jane Stn – York University	Rocket	Limited Stop	M – F Peak Periods & Early Evenings; Weekend Mornings & Afternoons	8’ 30”
196	York University Rocket	Sheppard Stn – York University	Rocket	Limited Stop	All periods	2’ 30”
198	U of T Scarborough Rocket	Kennedy Stn – UTSC	Rocket	Limited Stop	M – F Peak Periods & Early Evenings; Weekend Mornings & Afternoons	10’ 00”
199	Finch Rocket	York University – Morningside Heights	Rocket	Limited Stop	M – F Peak Periods & Early Evenings; Weekend Mornings & Afternoons	2’ 30”

Note: These statistics are valid for the October 9 to November 19 2016 board period.

3.3 Performance Review

Understanding the performance of the existing express bus route network will identify strengths and weaknesses to guide the planning for an expanded network. An extensive performance review has been performed at two levels. The first level is system focused and employs basic route efficiency metrics such as boardings per hour. This analysis is designed to determine the existing express bus routes' performance relative to all bus routes.

The second performance review level is designed to determine if existing express services meet the objectives that an express route is expected to (i.e. provide faster trips for customers who travel long distances on busy corridors). This route-level analysis involves more detailed statistics derived from data collected at the segment and stop level to determine trip lengths, load factors and speed improvements.

3.3.1 System-Wide Performance

There are a number of ridership driven statistics that indicate the attractiveness of a service and its financial performance:

- Service Hour Savings
- Boardings per Service Hour
- Cost per Boarding
- Cost per Service Hour

The ensuing analysis will illustrate each express route's performance, in the peak periods, using these statistics relative to the rest of the TTC's surface network.[3] Net full costs are used in these statistics. This includes the full cost to operate the service (cost per peak vehicle and operating costs) less fare revenue collected.

Service Hour Savings
The financial performance of express routes is due to deliberate service design decisions to move customers as fast as possible. By eliminating stops, passenger activity on the route is naturally reduced; lowering revenue and financial performance, but speed improvements are possible which has substantive benefits on long routes with long customer-trip lengths. Express services help manage and improve corridor capacity by better accommodating long-distance travel patterns. If express services did not exist, then more vehicles would be required to operate on the parallel local service to serve the same number of passengers, thereby increasing cost and worsening overall system performance.

[3] The following routes do not have their statistics presented due to the recent implementation of these services: 24E Victoria Park Express, 185 Don Mills Rocket, 186 Wilson Rocket, and 188 Kipling South Rocket. These routes will be formally reviewed in 2017.

For example, in the AM peak period, the 198 UofT Scarborough Rocket express route requires 6 buses to deliver a 10 minute frequency on a route that requires 60 minutes round trip. If the route served all local stops it would require 7 buses to deliver a 10 minute frequency because the round trip time increases to 70 minutes. Therefore, the 198 UofT Scarborough Rocket requires 17% less service hours in the AM peak period to deliver the same capacity as a local service. Over the entire year, the 198 UofT Scarborough Rocket requires $510,000 less than if the capacity was delivered by a local service.

Table 2 presents the percentage savings in service hours that an express service provides if the same capacity was to be provided on the local service through the same category. Typically 10-30% additional service hours would be required to provide the same capacity when reviewing each route or branch individually. For example, to provide the same capacity that 190 Scarborough Centre Rocket provides, it would cost an additional 30% in service hours in addition to the hours needed to operate the 190 Scarborough Centre Rocket.

Table 2: Service Hours Savings

Route	Service Hour Savings compared to Local Service at the Route Level
190 Scarborough Centre Rocket	30%
195 Jane Rocket	22%
95E York Mills Express	20%
Rocket Route Median	**20%**
96E Wilson Express	18%
198 U of T Scarborough Rocket	17%
45E Kipling Express	16%
Local/Express Branch Median	**15%**
54E Lawrence East	14%
All Express Routes Median	**14%**
86E Scarborough Express	14%
41E Keele Express	13%
199 Finch Rocket	12%
60F Steeles West Express	6%
53E/F Steeles East Express	1%
144 Downtown / Humber Bay Express	-48%
Downtown Premium Median	**-51%**
143 Downtown / Beach Express	-55%

When reviewing in the context of all services on a given corridor, the overall service hour savings are about 3-10%. Using the 190 Scarborough Centre Rocket example, this route makes it 10% cheaper to serve the demand of the Sheppard Avenue East corridor.

Greater savings are realized when there is a large ratio of capacity provided by the express service. Downtown Premium Fare routes actually cost more relative to their alternative, the 501 Queen, as these routes offer a fraction of the capacity that the 501 Queen provides.

Route	Service Hour Savings compared to Local Service at the Corridor Level
190 Scarborough Centre Rocket	10%
45E Kipling Express	9%
195 Jane Rocket	8%
86E Scarborough Express	7%
Rocket Route Median	**7%**
95E York Mills Express	5%
All Express Routes Median	**5%**
Local/Express Branch Median	**5%**
41E Keele Express	5%
199 Finch Rocket	5%
96E Wilson Express	4%
54E Lawrence East	3%
198 U of T Scarborough Rocket	3%
60F Steeles West Express	3%
53E/F Steeles East Express	3%
144 Downtown / Humber Bay Express	-6%
Downtown Premium Median	**-7%**
143 Downtown / Beach Express	-8%

Boardings per Service Hour

Boardings per Service Hour is a measure which indicates the effectiveness of the service in attracting customers relative to the amount of service provided. **Table 3** presents the Boardings per Service Hour for each express bus route. A system-wide ranking is also provided to illustrate where each route rates relative to the rest of the system. When "Local/Express" branch services are separated from their parent route, there are 155 surface routes in operation during peak periods.

Table 3: Boardings per Service Hour – Express Routes (Weekdays, Peak Periods)

Route	Boardings per Service Hour	Surface Network Ranking
195 Jane Rocket	88.7	22
198 U of T Scarborough Rocket	69.0	71
96E Wilson Express	68.0	73
196 York University Rocket	64.3	78
System-Wide Median	**64.3**	
190 Scarborough Centre Rocket	63.8	79
Rocket Route Median	**63.8**	
41E Keele Express	56.3	102
191 Highway 27 Rocket	51.5	113
45E Kipling Express	50.7	115
192 Airport Rocket	50.2	117
199 Finch Rocket	49.7	118
54E Lawrence East Express	46.7	129
All Express Routes Median	**45.6**	
95E York Mills Express	44.6	133
Local/Express Branch Median	**44.6**	
53E Steeles East Express	44.6	135
86E Scarborough Express	42.5	138
60F Steeles West Express	38.5	142
141 Downtown/Mt Pleasant Express	25.0	149
144 Downtown/Don Valley Express	21.3	151
143 Downtown/Beach Express	16.6	152
Downtown Premium Median	**16.6**	
145 Downtown/Humber Bay Express	16.3	153
142 Downtown/Avenue Rd Express	12.8	155

The median value for all surface routes system wide is approximately 64 boardings per hour, while the median value for express routes is 46.7 boardings per hour. The 195 Jane Rocket experiences more than 88 boardings per service hour, making it the best performer of all express routes when reviewing the number of customers the service attracts per service hour.

Rocket services are near the surface route system-wide median value indicating that customers utilize these routes within expectations given the limited stop nature of this classification of service. The median value for Rocket services is 63.8 boardings per service hour.
The median value for "Local/Express" branch routes is 44.6 boardings per hour, which is slightly less than the median value for all express routes. These relatively low values are due to the operation of the "Local/Express" service type, since passengers can only board vehicles for a limited portion of the route. The rest of the time the vehicle is in service, it runs in "express" mode where passengers do not have the ability to board the bus in order to provide customers travelling the furthest a faster trip.

The five worst performers of all express routes are the five Downtown Premium Express routes – with less than 25 boardings per hour and a median value of 16.6 boardings per hour; all five routes are among the six worst performing routes across the system. One reason for the poor performance of the Downtown Premium Express routes is that they serve a very specific and limited travel market. Furthermore, while technically these routes operate in both directions during peak periods the trips in the off-peak direction carry a very limited number of passengers – effectively these routes are only carrying passengers for half of their service hours.

Net Cost per Boarding
The next performance indicator utilized in this performance review is an economic indicator, Cost per Boarding, which is defined as the full cost the TTC requires to operate a given route per customer, less the fare revenue collected. This data is presented in **Table 4**. The median value for all surface routes in the peak periods is a cost of $1.30 per boarding, while the median value for all express services is a cost of $2.35 per boarding. The difference occurs since express routes serve long distance trips that have limited opportunity to turn-over passengers.

The 195 Jane Rocket is the best performer of all express routes which is reflected by its high utilization as discussed above. Generally there is some correlation between boardings per service hour and the cost per boarding, however other factors such as route distance can increase the cost to operate which can change the rankings. This explains why long distance rocket services such as the 199 Finch Rocket and the 191 Highway 27 Rocket require a relatively higher cost per passenger, while shorter distance Rocket services remain close to the surface route system-wide median value. The 192 Airport Rocket requires a specialized fleet with it is a lower vehicle load standard requiring the use of additional resources to serve its passengers. However the majority of Rocket routes require a cost per passenger close to the system-wide median.

Table 4: Net Cost per Boarding – Express Routes (Weekdays, Peak Periods)

Route	Cost per Boarding	Surface Network Ranking
195 Jane Rocket	$0.67	32
96E Wilson Express	$1.14	68
System-Wide Median	**$1.30**	
198 U of T Scarborough Rocket	$1.30	79
196 York University Rocket	$1.31	80
190 Scarborough Centre Rocket	$1.33	82
Rocket Route Median	**$1.33**	
41E Keele Express	$1.56	101
45E Kipling Express	$1.99	117
54E Lawrence East Express	$2.05	123
199 Finch Rocket	$2.18	128
191 Highway 27 Rocket	$2.24	131
95E York Mills Express	$2.35	132
All Express Routes Median	**$2.49**	
Local/Express Branch Median	**$2.55**	
192 Airport Rocket	$2.63	136
86E Scarborough Express	$2.75	138
60F Steeles West Express	$2.78	140
53E Steeles East Express	$3.14	
143 Downtown/Beach Express	$7.78	151
144 Downtown/Don Valley Express	$7.88	152
145 Downtown/Humber Bay Express	$10.22	153
Downtown Premium Median	**$10.22**	
141 Downtown/Mt Pleasant Express	$10.64	154
142 Downtown/Avenue Rd Express	$10.78	155

Local/express branch services typically require a higher cost per boarding due to their stopping pattern necessitating fewer opportunities for customers to use these branches even though the total cost to operate the route is slightly lower than a parallel local service. It should be noted, however, that cost savings are achieved with these express services when compared to providing replacement capacity using a local service.

Again, the Downtown Premium Express services rank the worst across the system, ranking as the five worst performers in regards to this performance measure, requiring more than 7 times the system-wide median cost per boarding value even when the additional fare is included.

Cost per Service Hour

Cost per Service Hour is defined as the full cost the TTC requires per service hour, over and above the fare revenue collected, to operate a given route. The comparative analysis for express routes relative to system wide values is presented in **Table 5**. The median value for all surface routes in the peak periods is a cost of $80.69 per service hour, while the median value for all express services is $108.22.

Table 5: Cost per Service Hour – Express Routes (Weekdays, Peak Periods)

Route	Cost per Service Hour	Surface Network Ranking
195 Jane Rocket	$59.85	41
96E Wilson (express)	$77.56	67
System-Wide Median	**$80.69**	
196 York University Rocket	$84.00	83
190 Scarborough Centre Rocket	$84.61	87
41E Keele Express	$88.08	94
198 U of T Scarborough Rocket	$90.00	99
Rocket Route Median	**$90.00**	
54E Lawrence East Express	$95.83	110
45E Kipling Express	$101.00	119
95E York Mills Express	$104.79	124
Local/Express Branch Median	**$105.94**	
60F Steeles West Express	$107.08	126
199 Finch Rocket	$108.22	127
All Express Routes Median	**$111.32**	
191 Highway 27 Rocket	$115.18	137
86E Scarborough Express	$116.88	138
143 Downtown/Beach Express	$129.20	142
192 Airport Rocket	$132.00	144
142 Downtown/Avenue Rd Express	$137.50	147
53E Steeles East Express	$140.16	148
145 Downtown/Humber Bay Express	$167.00	153
Downtown Premium Median	**$167.00**	
144 Downtown/Don Valley Express	$168.17	154
141 Downtown/Mt Pleasant Express	$266.00	155

The 195 Jane Rocket has the lowest cost per service hour for all express routes. As with the cost per boarding statistic, longer distance Rocket services such as the 191 Highway 27 Rocket and the 199 Finch Rocket require a higher cost per service hour, while shorter distance Rocket services remain close to the surface route system-wide median value. Most Rocket services require costs around system wide levels with a median value of $90.00.

The Downtown Premium Express services require a very high cost per service hour, with a median cost of $167.00 per service hour – more than two times the system average. This poor performance is generated in large part due to low ridership and therefore revenue collected even when the premium fare is accounted for.

With the exception of the Downtown Premium Express services, all express services perform reasonably close to the all-express median, and it can be concluded that express routes are an important part of the TTC's route and network planning.

3.3.2 Route Level Performance

The system-wide performance review establishes that express routes play a positive role in the TTC's integrated transit network. The next step is the second performance review which focuses on the customer's travel behaviours and expectations. As such, five metrics have been identified which are described below:

- Average Travel Speed: Based on AM peak period data, this statistic is the average speed for a vehicle to complete a round trip. It is the expectation of the customer to experience a fast trip when using an express service.

- Travel Time Savings: Based on AM peak period data, this statistic is the percent change in travel time between the two terminus points of a route when compared to the same trip completed on the rest of the conventional network (rapid transit included). For Local/Express branch services, the segment where the route is serving all local stops is not considered. It is the expectation of the customer to realize significant time savings when using an express route.

- Average Trip Length: Based on data collected throughout a typical weekday, this metric estimates the average distance travelled by a passenger using the route. Ideally, express routes serve longer distance trips as they experience the greatest benefit from improved travel speed.

- Change in Average Trip Length: This compares the average trip length of the express route to the same measurement obtained from a local route analysis where both routes share a common segment. Some express routes do not have equivalent local services where a meaningful comparison can be made. It is expected that trip lengths on express services are higher than local services on common corridors.

- Bi-Directional Load Factor: This metric is a ratio of the busiest load point (customer volume) of the off-peak direction compared to the busiest load point in the peak direction during the AM peak period. No value can be higher than 100%. A value closer to 100% indicates the route is well-utilized in both directions, further advancing the case to add priority treatments along the corridor.

Table 6 summarizes these statistics for all express routes and provides median values for all express routes as well as each classification. In addition, graphical exhibits are prepared to better illustrate statistical performance of each route relative to each other.

Exhibit 11 illustrates the average travel speed for all express routes. The 192 Airport Rocket and 191 Highway 27 Rocket routes have the highest average travel speed since they operate along Highway 427 for a significant proportion of their route. Most express routes have a travel speed of about 25 km/h or better exceeding the system-wide average of 19 km/h. Local/Express branches have a higher operating speed than Rocket routes since they make fewer stops in their "Express" segment – therefore there is greater potential for travel time savings for a Local/Express branch.

Downtown Premium services, with the exception of 144 Downtown/Don Valley Express, are among the slowest routes in the express route hierarchy as these routes travel along congested arterial roads such as Eastern Ave, Mt. Pleasant Road and Avenue Road in addition to very slow travel speeds in the downtown core.

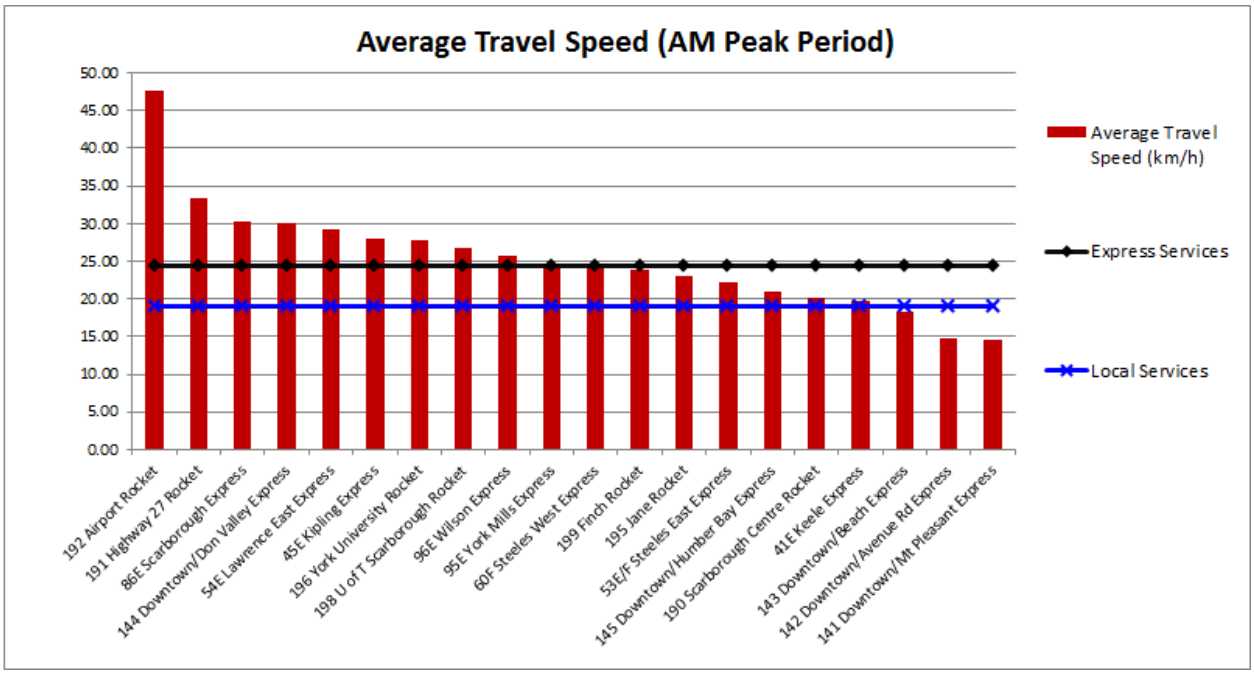


Exhibit 11: Average Travel Speed (AM Peak Period)

Table 6: Performance Review– Route Performance

Route	Average Travel Speed (AM Peak Period) (km/h)	Travel Time Savings (AM Peak Period)	Average Trip Length (km)	Change in Average Trip Length compared to Local Service	Bi-Directional Load Factor (AM Peak Period)
41E Keele Express	19.8	12%	5.3	22%	0.24
45E Kipling Express	28.1	10%	6.8	6%	0.39
53E/F Steeles East Express	22.2	3%	8.2	27%	0.37
54E Lawrence East Express	29.3	41%	4.6	20%	0.21
60F Steeles West Express	24.2	14%	5.1	2%	0.99
86E Scarborough Express	30.3	32%	8.0	44%	0.13
95E York Mills Express	24.4	19%	8.8	35%	0.70
96E Wilson Express	25.7	19%	6.0	27%	0.48
141 Downtown/Mt Pleasant Express	14.6	7%	7.6	N/A	N/A
142 Downtown/Avenue Rd Express	14.8	0%	7.8	N/A	N/A
143 Downtown/Beach Express	18.3	23%	7.8	N/A	N/A
144 Downtown/Don Valley Express	30.0	32%	20.4	N/A	N/A
145 Downtown/Humber Bay Express	20.9	39%	10.7	N/A	N/A
190 Scarborough Centre Rocket	20.2	26%	5.5	30%	0.57
191 Highway 27 Rocket	33.5	21%	13.2	N/A	0.82
192 Airport Rocket	47.6	46%	14.1	N/A	0.79
195 Jane Rocket	23.1	29%	4.9	26%	0.84
196 York University Rocket	27.8	60%	5.9	N/A	0.50
198 U of T Scarborough Rocket	26.8	17%	7.5	75%	0.85
199 Finch Rocket	23.8	9%	6.8	69%	0.37
All Express Routes Median	**24.3**	**20%**	**7.1**	**27%**	**0.39**
Express/Local Branch Median	**25.1**	**18%**	**5.6**	**25%**	**0.39**
Rocket Median	**26.8**	**26%**	**6.8**	**49%**	**0.79**
Downtown Premium Median	**18.3**	**23%**	**7.8**	**N/A**	**0.00**

Exhibit 12 illustrates the travel time savings that express services offer relative to conventional or local services. Almost all routes save the customer at least 10% travel time when compared to local services. The majority of express routes improve in vehicle travel time by 20% or more. The 196 York University Rocket and the 192 Airport Rocket offer the greatest savings as they utilize busways or freeways for most of their route. The Downtown Premium Express routes, despite their low operating speed provide substantial travel time savings compared to alternative routes.

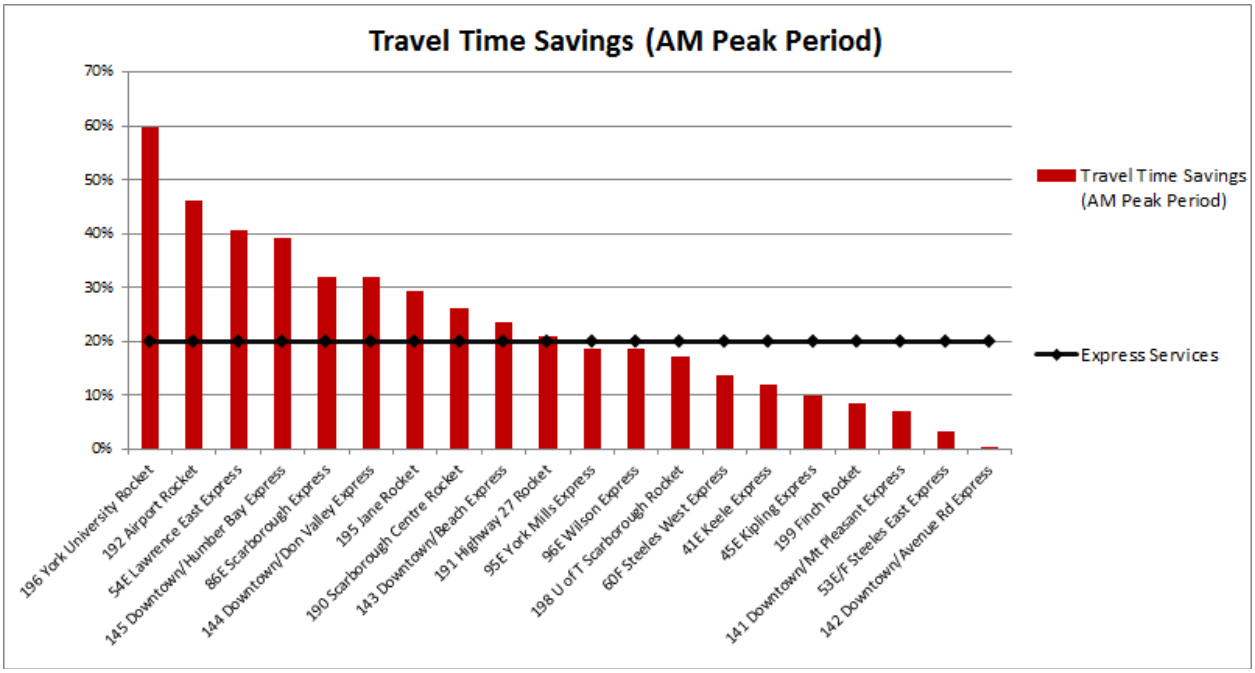


Exhibit 12: Travel Time Savings (AM Peak Period)

Exhibit 13 presents the average customer trip length for all express bus services. Typically customers travel about 7 kilometres on most express routes. The average trip length on local routes system wide is about 5 kilometres illustrating that customers traveling long distances value the improved speed of an express trip. The routes with the longest trip lengths have long segments with no stops between terminuses.

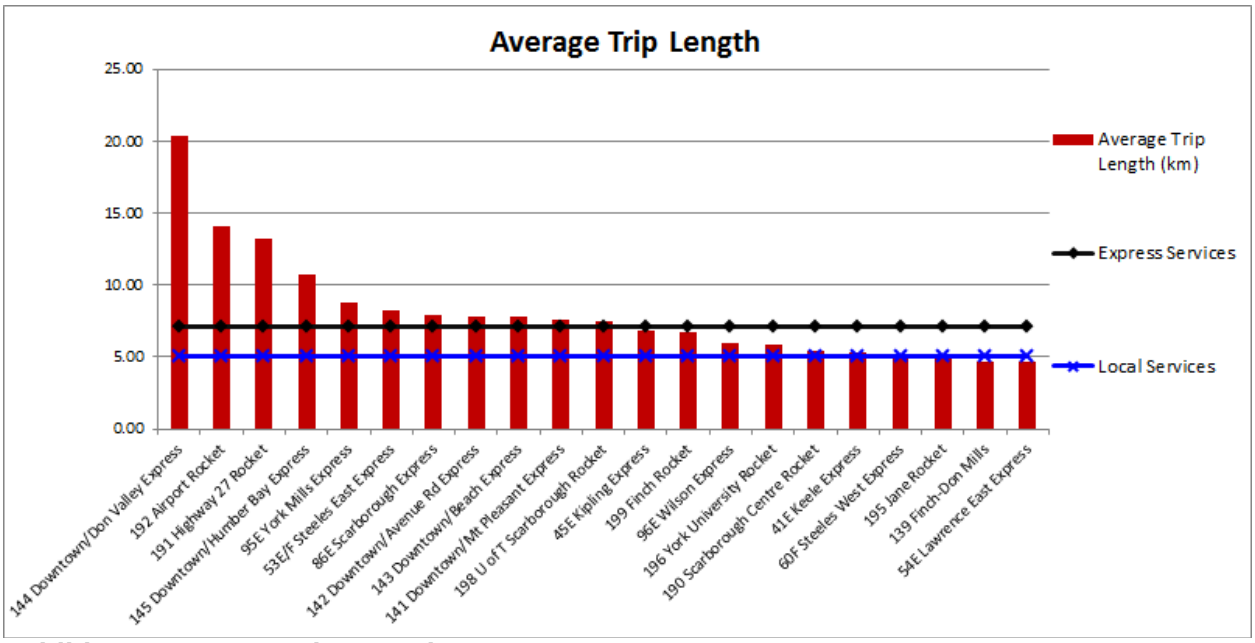


Exhibit 13: Average Trip Length

The change in customer trip length is clear when express routes link major trip generators as presented in **Exhibit 14**. For example, the 198 U of T Scarborough Rocket, 95E York Mills Express, 195 Jane Rocket and 41 Keele Express link post-secondary campuses with the subway network. Customers on these five routes travel at least 20% further on express routes compared to parallel local routes. This saves on customer journey time as it eliminates the need for a transfer in some cases in order to complete a similar trip on the local service network. Similar conclusions can be drawn for express routes that link the Yonge subway to Scarborough Town Centre, a major trip generator in the east.

There are some exceptions to this; the 60F Steeles West Express has a shorter average trip length as this branch is significantly shorter than the mainline local service. This however, reinforces the notion that express services are best positioned to support demands between the rapid transit network and major trip generators.

Overall, users of express bus services travel about 25% further than users on local routes, with customers on Rocket routes traveling 36% further than those on routes serving common corridors.

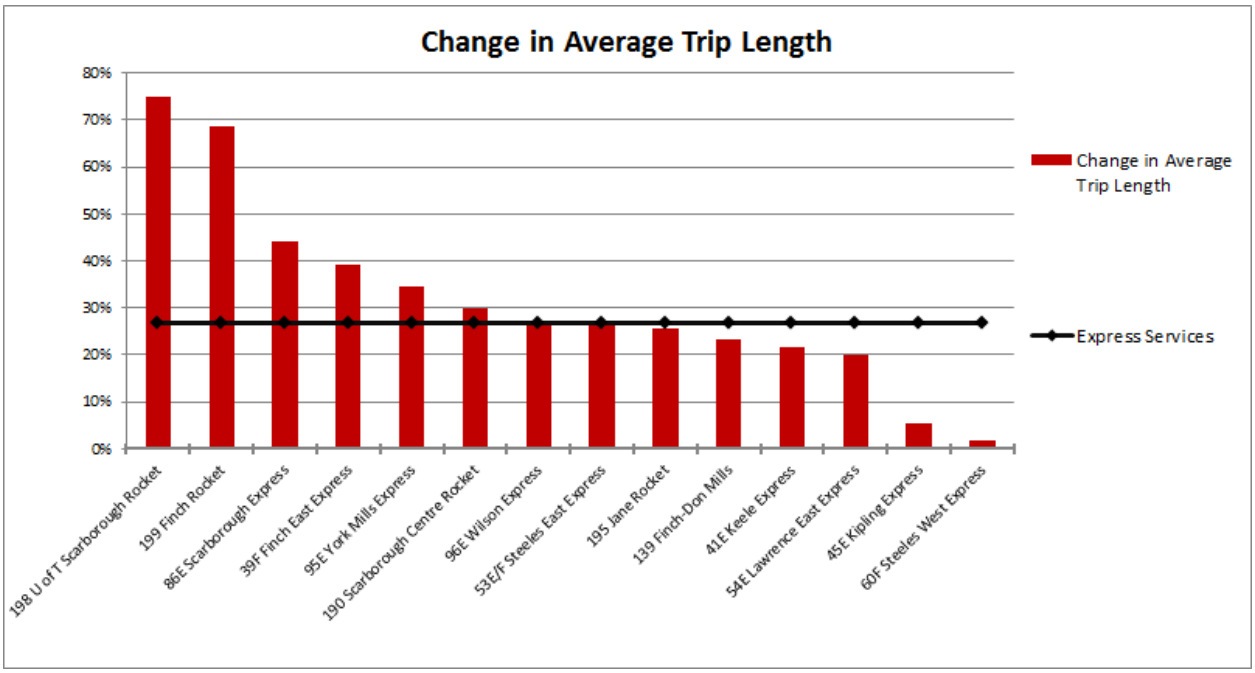


Exhibit 14: Change in Average Trip Length

The last statistic reviewed as part of this performance review is the Bi-Directional Load Factor based on peak load points in the AM peak period which is presented in **Exhibit 15**. Overall express bus routes have a median value load factor of 39%. The median values for Rocket routes is 79% indicating stronger two-way demand compared to Local/Express branch services. Downtown Premium services demands are almost entirely one-way.

Again, one can see the importance of having a major trip generator linked by an express service. The 60F Steeles West has a factor close to 100% and the 195 Jane Rocket has a factor of 85% since both routes serve York University and the subway. The University of Toronto Scarborough campus is linked by the 198 U of T Scarborough Rocket and the 95E York Mills Express and these routes have a bi-directional load factor greater than 80%. These routes serve two different travel segments, those heading inbound and those heading to major destinations on the periphery of the city. This contrast with Local/Express branches that are not anchored by a single trip generator, but by a subdivision such as the 45E Kipling Express, the 86E Scarborough Express and the 53E/F Steeles East Express where off-peak demands are less than 40% than demands traveling in the peak direction.

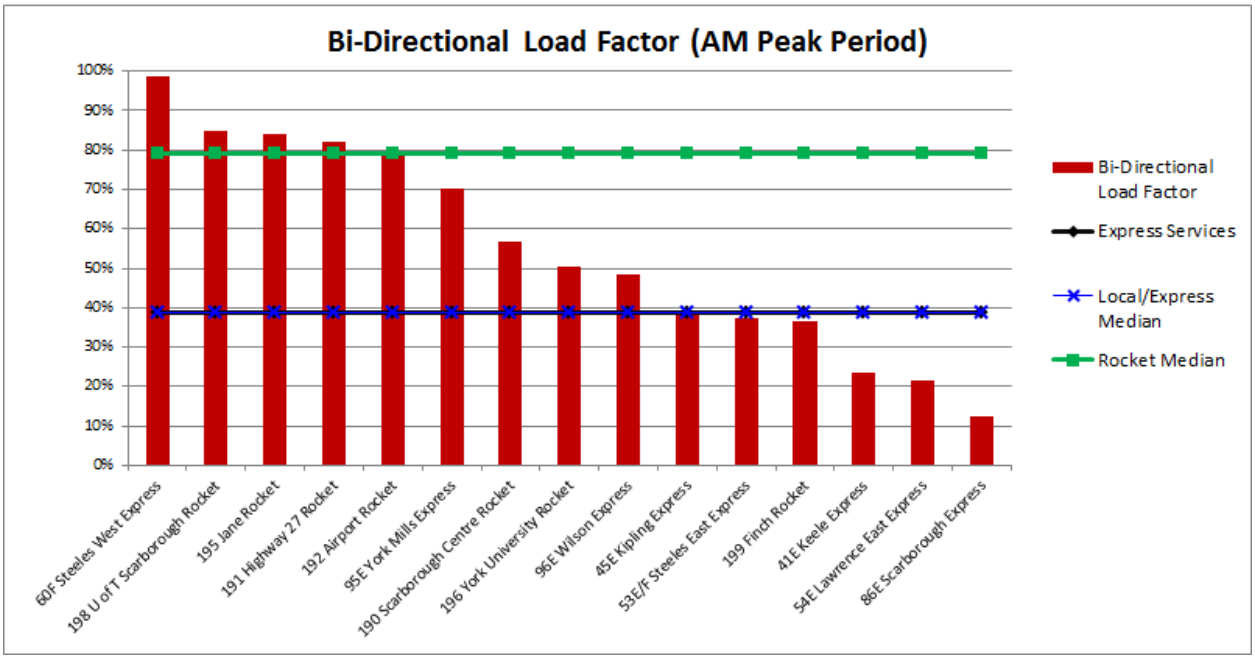


Exhibit 15: Bi-Directional Load Factor

3.3.3 Performance Review Conclusions

In summary, the Performance Review leads to the following findings and conclusions regarding the TTC's express bus network:

- Express routes are an effective use of managing limited resources by tailoring service to different and specific customer needs along busy transit corridors.

- Overall, express bus routes are positive for system-wide performance as otherwise more resources would be needed to serve the same number of passengers if parallel local services were to be exclusively used.

- Due to the limited stop nature and longer travel patterns, all three classifications of express services attract fewer customers per service hour than most surface routes across the system and therefore they require more cost than most routes across the system when viewed in isolation.

- The Downtown Premium Fare Express routes are the worst performing routes system-wide during peak periods in regards to their utilization (boardings per hour), and therefore financial performance.

- Existing express bus services offer customers a faster trip:
  - Most express bus routes operate at an average travel speed of 25 km/h compared to system wide average of 19 km/h.
  - Most express bus routes save customers at least 20% in travel time compared to their local counterparts on common corridors. Rocket routes save more than 25% as some routes operate on busways or freeways rather arterial roads.

- Express bus services are used for long-distance trips as long trips provide the greatest benefit from the improved travel speeds:
  - The average trip length on express bus services is about 7 kilometres compared to 5 kilometres on conventional routes.
  - Customers on Rocket routes travel almost 40% longer than customers on parallel local routes on common corridors, while Local/Express branch travel almost 20% further.

- Express bus services are most effective when anchored by two major trip generators (i.e. a subway station and post-secondary institution).
  - Express bus routes that link the subway network to a major trip generator have longer average trip lengths therefore providing the greatest benefit to customers.
  - Rocket routes, and some Local/Express branch routes, that are linked to major trip generators also experience greater bi-directional loading indicating these routes serve diverse travel patterns that justifies additional investment.

3.4 Opportunity Statement

There is support to reduce customer journey time, when considering provincial, municipal and corporate planning objectives. In a recent survey conducted by TTC staff, customers were asked to identify the most important improvement that the TTC could make to improve the overall quality of service. TTC customers have expressed that reducing overall travel time and improving service reliability are among the top four service improvements which customers most desire. Express buses are a proven way to achieve this.

The performance review demonstrates that the TTC's express bus routes are an effective use of limited resources that offer customers clear and identifiable benefits. With future ridership pressures on the TTC's bus network being forecasted, express buses are a tool in cost avoidance or mitigation. An expanded express bus network will provide additional capacity to transport customers long distances quickly, while freeing up capacity on local services.

Therefore, there is an opportunity to expand and enhance the express bus network. The development of the express bus network plan must address the following:

- Clearly define the TTC's express service type
- Formulate clear and transparent express Service Standards that guide decision making whether or not an express route is warranted
- Develop a short and long term express network plan that:
  - expands and improves service on existing express corridors
  - adds express service to new corridors
  - identifies operational strategies to improve service reliability and speed
  - generates meaningful benefits for TTC customers and the system itself
  - acts as an interim service along corridors identified for rapid transit projects
- Recommend a strategy to address the poor performance of the Downtown Premium Express Routes
- Identify resource requirements and propose an implementation plan

4 NETWORK DESIGN

4.1 Operating Framework

The operating framework outlines a set of principles that guide the development of the express bus network.

4.1.1 Service Classifications

The peer review revealed that transit agencies have a clear distinction between their express service and their conventional (or local) service. Usually express services are classified even further by service characteristics so that customers have a better understanding of what to expect from a specific route. These classifications can be conveyed to the customers using route names, route numbers or a special brand with dedicated vehicles. Today the TTC classifies their express services with three service types as outlined above in Section 3.1.1.

The purpose of this section is to review options to classify express services which will guide the development of the networks. This will lead to a recommended approach to classify express services.

Recommended Concept: Two Tiers of Service
The peer review indicates that most transit agencies offer two broad categories of express service. It is recommended that the TTC's express bus network be developed with two distinct tiers of service, whose naming is to be confirmed as part of a forthcoming communications plan. This is preferred as it provides flexibility in developing a network that best serves customers and is still simple enough to communicate to the public effectively. The two-tiered concept is aligned with best practices across the continent. Generally, the tiers will be delineated based on basic service characteristics such as the span of service.

The first tier of service (Tier 1) is designed to provide a bus rapid transit light service along very busy and strategic transit corridors. Tier 1 services will be similar to the corridor-type services that similar transit agencies operate. The routes and service enhancements are designed to somewhat mimic surface rapid transit, which entails limited stops, transit priority and most importantly a frequent service level during most operating periods. Therefore capital investment for transit priority should be prioritized for corridors where Tier 1 services will operate.

The second tier of service (Tier 2) is designed to supplement local bus service on busy corridors so that resources are deployed effectively to reliably manage capacity in response to customer travel needs. This tier of service will generally operate at the busiest periods of operation when capacity and reliability are most critical. These services will be peak-period focused with the intent to collect customers and transport them to a major node, similar to the corridor-type services identified in the Peer Review. Transit priority provisions will also enhance many of these corridors by reducing travel time and saving operating resources.

4.1.2 Express Bus Service Triggers and Standards

The following section specifies the standards to be applied in the selection of express routes and how they are expected to operate. All express routes must satisfy Tier 2 standards first before they can be considered as a Tier 1 service. Therefore, Tier 2 standards are presented first as Tier 1 standards are additional requirements.

Tier 2

Tier 2 express bus services will be considered when all of the following conditions are met during the defined minimum span of service operating the minimum service frequency:

- Minimum Span of Service
  - weekdays: morning & afternoon peak
- Service Frequency
  - 15 min or better
- Demand
  - existing local bus service on the corridor is every six minutes or better during peak periods
  - demand on the corridor for both local and express services must be at least 75% of the total corridor capacity except on weekend mornings
- Overall Benefit To Customers
  - re-allocation of existing resources must be done so to generate an overall net benefit to customers. Resources may be added to generate benefits, provided that the service can meet the Economic standard below.
- Speed and Travel Time Improvement
  - express service travel time must be approximately 20% less than the existing TTC alternative for each of the operating periods being considered; and the one-way distance between the start and end of the local route must be greater than10km or;
  - express service can be implemented on routes with a one-way distance of less than 10km, if the average customer trip length is 60% or more of the local route's one-way distance
- Economic[4]
  - the new service must attract a minimum number of new customers for every dollar spent;

[4] This measure ensures that investments in new service attract more customers than other investments the TTC could make to attract customers i.e. a reduction in fares. Based on 2015 ridership, revenue and assumed fare elasticity this value is 12 new customers per net $100 spent in additional subsidy.

If a corridor meets the service warrants, multiple route structures and stopping patterns can be applied depending on the corridor demand profile including:

- Limited stop
  - major intersections and nodes serving 50% in total of the transit corridor ridership at minimum; and
  - average stop spacing should be within 650 to 1,000 metres

- Local/express stop
  - while operating as an express, stops will be located only at major intersections and nodes that attract 10% of the total corridor's boardings at minimum
  - limited stop – every 650+ at minimum

New express bus stops can be added to an existing service provided that the resulting service change does not violate any of the preceding demand, speed, and economic standards and the service change is a net benefit to customers. Additional consideration should be given to stops that provide transfer opportunities to other routes for customers.

Tier 1

Tier 1 express bus service will be considered when all of the conditions for Tier 2 express bus services are met in addition to both of the following conditions.

- Minimum Span of Service
  - weekdays: morning & afternoon peak, midday, early evening (approximately 6am to 10pm)
  - weekends: morning & afternoon (approximately 8am to 7pm)

- Service Frequency
  - 10 min or better (during peak periods)
  - 15 min or better (outside peak periods)

- Economic
  - the new service must attract a minimum number of new customers for every dollar spent

- Strategic
  - the corridor has been identified as a strategic future rapid transit corridor or fills gaps in the rapid transit network as defined in Metrolinx's Regional Transit Plan and the City's official plan, or
  - the express service is able to support a minimum of 10,000 weekday customer-trips

If a corridor meets the Tier 1 service standards, a limited stop service will be established. The Tier 1 services would stop at major intersections and nodes.

New express bus stops can be added to the existing service provided that the resulting service change does not violate any of the preceding demand, speed, and economic standards and the service change is a net benefit to customers.

4.2 Express Bus Network (2021)

The recommended express bus network for implementation by 2021 is illustrated in **Exhibit 16**: Express Bus Network (2021) and periods of operation are outlined in **Table 7** and **Table 8**. This network includes all routes that comply with the service standards for express services as outlined in Section 4.1.2. The network assumes construction of the Line 2 Scarborough Extension, Line 5 Eglinton Crosstown LRT and Line 7 Finch West LRT as well as the completion of the Line 1 Extension to Vaughan Metropolitan Centre. Tier 1 services have not been selected on these rapid transit corridors because of the traffic and service disruptions related to construction. Tier 2 services are assumed to be peak period only services unless they link rapid transit stations with post-secondary institutions, which justifies an additional mid-day period.

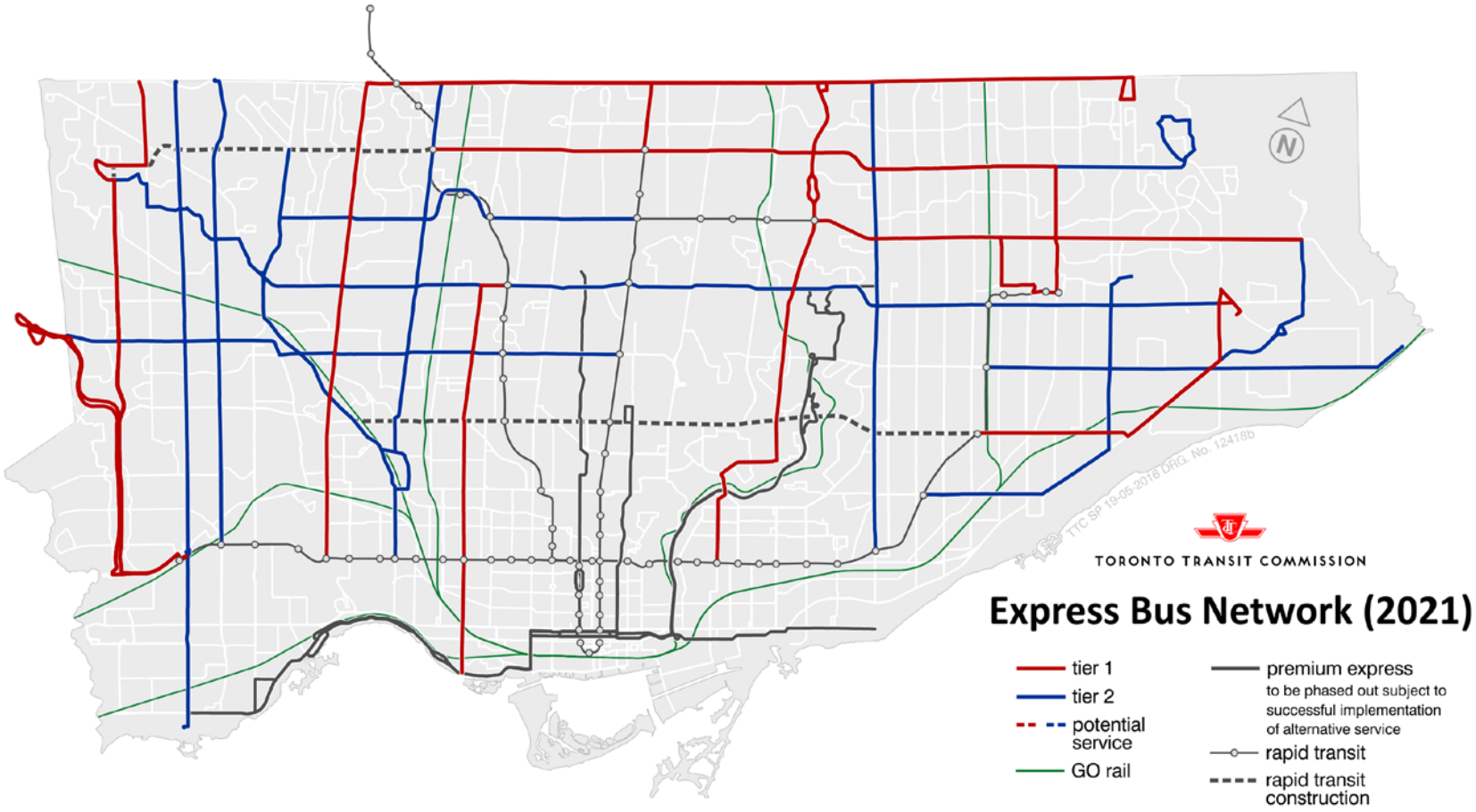


Exhibit 16: Express Bus Network (2021)

Table 7: Express Bus Network (2021) – Tier 1 Routes, Operating Periods

Tier 1 Corridors	Monday to Friday					Saturday				Sunday/Holiday			
	AM Peak	Midday	PM Peak	Early Evening	Late Evening	Morning	After-noon	Early Evening	Late Evening	Morning	After-noon	Early Evening	Late Evening
Airport Kipling Stn – Pearson Airport	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Highway 27 Kipling Stn – Steeles Ave	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Jane Jane Stn – Pioneer Village Stn	✔	✔	✔	✔		✔	✔			✔	✔		
Dufferin Dufferin Loop – Wilson Stn	✔	✔	✔	✔		✔	✔			✔	✔		
Don Mills Pape Stn – Steeles Ave	✔	✔	✔	✔		✔	✔			✔	✔		
Steeles West Pioneer Village Stn – Finch Stn	✔	✔	✔	✔		✔	✔			✔	✔		
Steeles East Finch Stn – Markham Rd	✔	✔	✔	✔		✔	✔			✔	✔		
Finch Finch West Stn – Scarborough Centre Stn	✔ *	✔	✔ *	✔	✔ **	✔	✔	✔ **	✔ **	✔	✔	✔ **	✔ **
Sheppard East Don Mills Stn – Meadowvale	✔	✔	✔	✔	✔ ***	✔	✔	✔ ***	✔ ***	✔	✔	✔ ***	✔ ***
Eglinton / Kingston Rd / Morningside Kennedy Stn – U of T Scarborough	✔	✔	✔	✔		✔	✔			✔	✔		

* 1) Additional peak period express service between Finch Stn and Morningside Heights.
** 2) Finch – Weekday late evening and weekend evening service between Finch Stn and Scarborough Centre Stn only
*** 3) Sheppard - Weekday late evening and weekend evening service between Don Mills Stn and Scarborough Centre Stn only

Table 8: Express Bus Network (2021) – Tier 2 Routes, Operating Periods

Tier 2 Corridors	Monday to Friday					Saturday				Sunday/Holiday			
	AM Peak	Midday	PM Peak	Early Evening	Late Evening	Morning	After-noon	Early Evening	Late Evening	Morning	After-noon	Early Evening	Late Evening
Kipling Kipling Stn – Steeles Ave	✔		✔										
Kipling South Kipling Stn – Humber College Lakeshore Campus	✔	✔	✔										
Islington Islington Stn – Steeles Ave	✔		✔										
Weston Keele Stn – Finch Ave	✔		✔										
Keele Keele Stn – Pioneer Village Stn	✔	✔	✔										
Victoria Park Victoria Park Stn – Steeles Ave	✔		✔										
Markham Rd Warden Stn – Centennial College Progress Campus	✔	✔	✔										
Eglinton / Kingston Rd / Meadowvale Kennedy Stn – Meadowvale	✔		✔										
Sheppard West Sheppard-Yonge Stn – Weston Rd	✔		✔										
Wilson York Mills Stn – Humber College Main Campus	✔	✔	✔										
Lawrence West Lawrence Stn – Pearson Airport	✔		✔										

Tier 2 Corridors	Monday to Friday					Saturday				Sunday/Holiday			
	AM Peak	Midday	PM Peak	Early Evening	Late Evening	Morning	After-noon	Early Evening	Late Evening	Morning	After-noon	Early Evening	Late Evening
York Mills York Mills Stn – U of T Scarborough	✔	✔	✔										
Lawrence East Lawrence East Stn – Starspray Blvd	✔		✔										

4.3 Long-Term Express Bus Network (2026)

Table 9 and **Exhibit 17** present the long term vision for the express bus network following the construction of Line 5 Eglinton LRT, Line 7 Finch West LRT, the Line 2 East Extension to Scarborough Centre, and Smart Track which are expected to be completed by 2026. The long term network, particularly in Scarborough, is designed to facilitate projected long term travel demands and flows that will change due to the rapid transit projects, as such the long term network considers Line 6 Sheppard East LRT. Additionally, the expanded rapid transit network presents opportunities to change or add express routes to "fill in the gaps" in the rapid transit network such as an express service on Eglinton Avenue West to Pearson Airport and Lawrence Avenue East between Science Centre station on Line 5 and the Rouge Hill community in Scarborough.

New routes or corridors added to the Long Term Express Network will be subject to further analysis and the full time operation of the aforementioned rapid transit projects. TTC staff is working with staff from the City and Metrolinx to ensure that our plans are consistent and included in their long term plans.

Table 9: Potential New Routes in Long Term Express Bus Network (2026)

Route/Corridor	Description
Tier 1	
Eglinton West Mt Dennis Stn – Pearson Airport	• New express service following completion of Line 5 Eglinton • Implementation subject to timing of construction of Crosstown LRT West construction
Ellesmere / Highland Creek Scarborough Centre Stn – University of Toronto Scarborough	• Enhancement to Tier 1 express service following completion of Line 2 Easterly Extension
Bathurst Bathurst Stn – Steeles Avenue West	• New express service
Tier 2	
Royal York Lakeshore Blvd – Weston Rd	• New express service
Lawrence East Science Centre Stn - Starspray	• Extension of express service following completion of Line 5 Eglinton from existing Lawrence East Stn to Science Centre Stn
Kennedy Kennedy Stn – Steeles	• New express service
Markham Road Centennial College – Steeles	• Extension of express service to Steeles Avenue
Warden Warden Stn – Steeles	• New express service

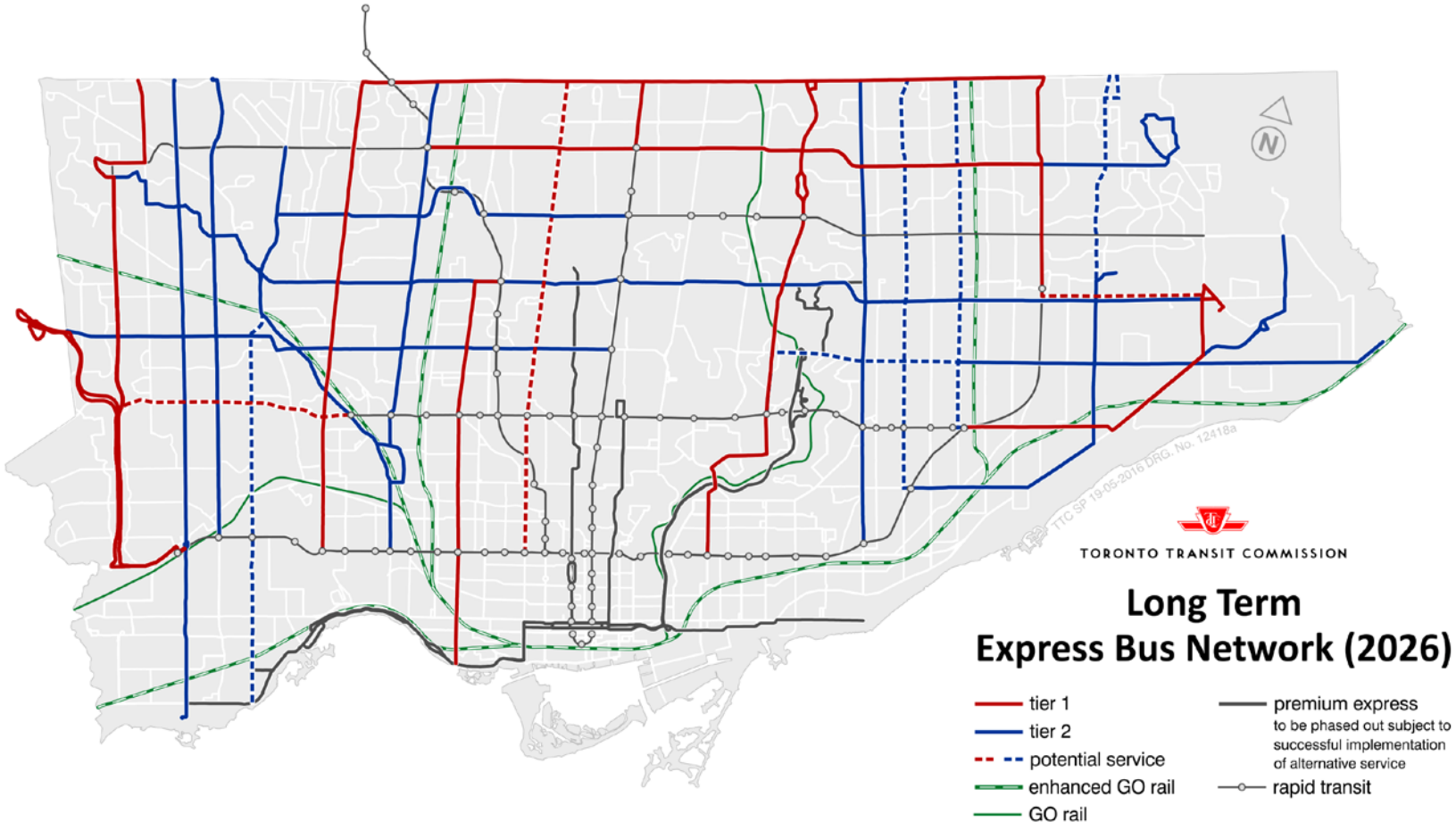


Exhibit 17: Long Term Express Bus Network (2026)

4.3.1 Strategic Direction for the Future of Downtown Premium Fare Express

Five TTC Downtown Premium Fare Express services operate during the peak periods from Monday to Friday. As demonstrated in the performance review, these routes perform poorly when compared to other express routes from a financial and productivity perspective. In allocating resources consideration is given to the service standards as well as customer benefits. There is a need to improve these services, if possible, or phase them out. One reason for their poor performance is that most of these routes only serve peak-oriented passenger flows in one direction, which is not financially efficient. Another reason is that the cost of using the service is prohibitive. A premium fare is charged on all five routes, which is double that of a regular TTC fare (two tokens, or $6.50 cash, or a monthly Metropass with a $41.50 per month Downtown Express sticker).

Three of the routes – 142 Downtown/Avenue Rd Express, 141 Downtown/Mt Pleasant Express, and 144 Downtown/Don Valley Express – offer a direct express ride to and from downtown, and a transfer-free bus ride that parallels the Yonge Subway service. Many of the customers who use Routes 141, 142, and 144 have the alternative of a ride on an east-west bus route to the Yonge Subway, and a subway ride to downtown. Two of the routes, the 143 Downtown/Beach Express and the 145 Downtown/Humber Bay Express, provide a fast express trip between their respective residential neighbourhoods and downtown, and parallels the 501 Queen streetcar service.

The Avenue Road and Mount Pleasant routes operated with regular fares first, when the service was introduced in 1990 until 1992. Ridership was relatively high, and continued to grow during those two years, demonstrating that the routes were popular with customers as a fast and direct alternative to downtown. In 1992, as an alternative to eliminating the routes during a period of transit service reductions across the system, a premium fare was introduced on these two routes (premium fares have always been charged on the 143 Downtown/Beach Express and the 144 Downtown/Don Valley Express and its predecessor routes). Ridership on the Avenue Road and Mount Pleasant routes is now less than 25 per cent of the level in 1991, before the premium fare was introduced.

As part of this study, the elimination of the fare premium was considered along with increasing service levels for these routes to conform to the Tier 2 service standards. Despite this, the analysis documented in **Table 10** reveals these routes would still be the worst performers in the system and the additional customers attracted to the system as a result of these changes would not meet the current standard.

Simply put, the resources deployed today on the Downtown Premium Fare Express routes could be better used if used elsewhere in the system. For example, the resources could be re-allocated to support the eventual full implementation of proposed express bus network. The hours and some of the buses required to operate the Downtown Premium Fare Express routes in the AM peak period could be re-allocated to add express service on two Tier 2 corridors such as Sheppard West, Lawrence West, Markham Road, Weston Road or Islington. Over 10,000

daily existing customers would experience benefit with the addition of the new express services compared to the 1,700 daily customers would be impacted by the loss.

Table 10: Downtown Premium Fare Express – Impacts by Removing Premium Fare & Instituting Tier 2 Express Standards

Route	Existing Customers	Customers Post Changes	Boardings per Service Hour	Cost per service hour	Cost per Boarding	Customers Gained Per Net $100 Spent
141 Downtown / Mt Pleasant Express	125	185	4	$153.03	$46.20	1
142 Downtown / Avenue Rd Express	255	345	5	$150.63	$27.39	1
143 Downtown / Beach Express	415	530	9	$140.78	$14.95	2
144 Downtown / Don Valley Express	640	750	9	$166.60	$18.23	1
145 Downtown / Humber Bay Express	245	310	6	$163.83	$26.92	1

However, the service provided along routes such as the 141 Downtown/Mt Pleasant Express, 142 Downtown/Avenue Rd Express, and 144 Downtown/Don Valley Express routes do play a small role in managing the very high demand for the over-capacity Line 1 – Yonge subway during peak periods. The 143 Downtown/Beach Express and 145 Downtown/Humber Bay Express provide a faster, and a more reliable trip compared to the 501 Queen streetcar.

It is anticipated that two major projects on the Line 1 – Yonge subway and the Queen streetcar respectively will increase capacity, improve service reliability and provide a viable option to customers compared to the Downtown Premium Fare Express routes. The first project is the ATC signal upgrade project on Line 1 which will boost subway capacity by up to 20%. The additional capacity will easily accommodate customer trips on the 142 Downtown/Avenue Rd Express, 141 Downtown/Mt Pleasant Express, and 144 Downtown/Don Valley Express routes. The expected completion date of this project is 2020.

The second project is the deployment of the new streetcars (LFLRVs) on the 501 Queen Streetcar. With the new vehicles, it is expected there will be additional capacity on the line along with reliability improvements. This should adequately serve 143 Downtown/Beach Express and 145 Downtown/Humber Bay Express customers. The conversion to LFLRVs is expected to be complete in 2019. Post-implementation monitoring will confirm if this is an appropriate course of action to serve displaced 143 Downtown/Beach Express and 145 Downtown/Humber Bay Express customers. Furthermore, the City of Toronto is undertaking a planning study, “Waterfront Transit Reset” to review transit options to better serve the City’s growing Waterfront,

including Humber Bay and Beach residents who commute to Downtown Toronto. The final details of this study will provide additional solutions to better serve customers in the long term.

No further investment in the Downtown Premium Fare Express services is recommended and these services should be phased-out pending the successful implementation of service alternatives.

4.3.2 Addressing Social Equity

As part of the City of Toronto's Official Plan review, transportation projects are evaluated on the basis of social equity – that everyone has good access to work, school and other activities. This is supported by the City's Poverty Reduction Strategy which identifies transit as something that must be affordable, reliable and link residents with education, employment and cultural opportunities. The Express Bus Network is another means to that end.

Exhibit 18 illustrates the Express Bus Network in the context of neighbourhood investment areas and average family incomes. Every express bus route will serve at least one low income neighbourhood, and there is a strong grid of express bus service in neighborhood investment areas in northwest and eastern parts of the city. The Express Bus Network is well positioned to provide residents in low income areas and neighbourhood investment areas with better transit service.

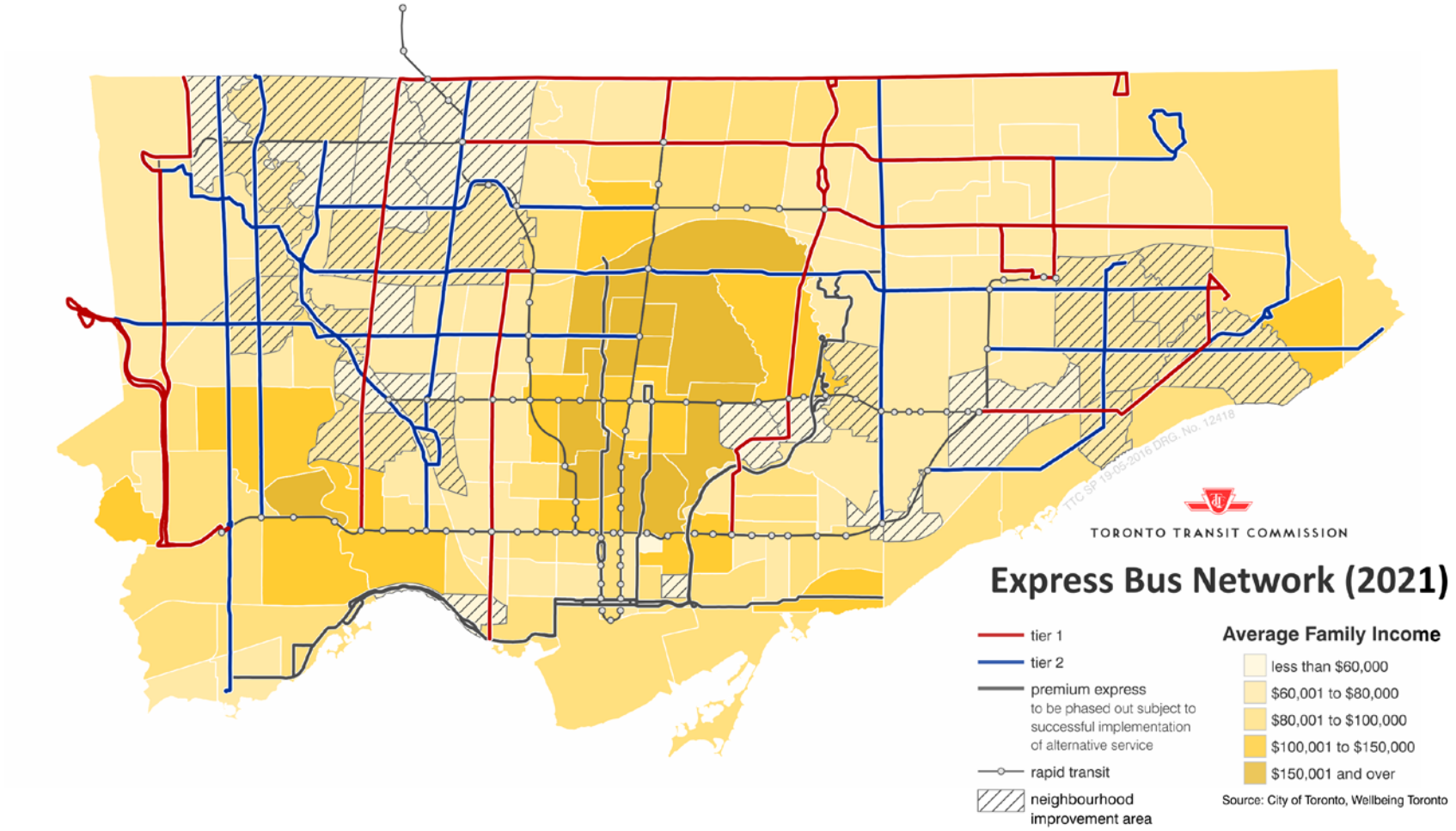


Exhibit 18: Express Bus Network and Neighbourhood Incomes

4.4 Operational Enhancements

Operational enhancements will further increase customer benefits and help ensure that the express bus network's objectives – namely fast, reliable service – can be achieved. These strategies typically involve infrastructure improvements such as road widening in select areas or changes to traffic signals. This section will detail the tools available to support improved express services which will make the TTC's surface transit offerings more attractive to customers.

4.4.1 Dedicated Rights of Way for Buses

Dedicated rights-of-ways (ROWs) remove buses from mixed traffic further increasing the route's speed and reliability. In some cases these dedicated ROWs come in the form of a completely grade separated Transitway, as seen in Ottawa, or in dedicated bus lanes in the middle of the roadway, which is used in York Region. While these improvements have large benefits, they are extremely capital intensive and require lots of road space. The scale of such an improvement is beyond the scope of the study.

4.4.2 Special Lanes for Buses

High Occupancy Vehicle (HOV) and/or Bus-Only lanes are currently provided at several locations throughout Toronto. The location of these lanes is aligned with some Tier 1 express bus services and it is intended that these services take advantage of these lanes where possible. These corridors include:

- Airport / Highway 27: Dundas Street from Kipling Stn to Highway 427
- Don Mills: Pape Ave, Overlea Blvd. and Don Mills Road from Pape Stn to Steeles Ave
- Eglinton Ave East / Kingston Rd / Morningside: Eglinton Ave. East from Kennedy Stn to Kingston Rd

Across the City of Toronto, the TTC and the City have identified potential HOV and Bus Only lanes on the following road ways in the long-term:

- Steeles Avenue East Bus Only lanes
- McCowan Road Bus Only lanes
- Sheppard Bus Only lanes (if LRT not constructed)
- 427 Transitway

Although special lanes help buses move more quickly in highly congested areas, there is a high degree of non-compliance whereby motorists who do not have enough passengers to qualify as an "HOV" vehicle, use these lanes. There is public perception that this can be done with little risk of being penalized. This reduces the benefit of these lanes for transit. As with HOV lanes, there are non-compliance issues with Bus-Only lanes. The benefits of Bus-Only lanes might be improved through greater enforcement. Approval for this type of enforcement would be required from the provincial government, including an amendment to the Highway Traffic Act. Further assessment of this improvement to Bus Only lanes will continue, but implementation in the short-term will not be possible.

4.4.3 Transit Signal Priority

Significant portions of travel time can be spent waiting on-board buses which are stopped at traffic signals. Transit signal priority (TSP) has proven to be effective in reducing these delays and thereby improving travel times for customers. TTC buses and streetcars emit an electrical signal which allows them to be detected on the approach to a signal priority equipped intersection. The traffic control system, upon detection of an approaching transit vehicle, adjusts the signal timings to either hold the signal on green until the transit vehicle travels through the intersection, or shortens the green signal on the side street, so that the approaching transit vehicle gets a green signal sooner. TSP can also be used to expedite or extend special signal phases (such as a left-turn green-arrow phase) to benefit transit. TSP is currently in place on the Dufferin, Bathurst, Jane, and Finch corridors. TSP is also provided at most intersections on streetcar routes.

Providing transit signal priority at a given intersection means that each bus will get through that intersection more quickly. Transit signal priority reduces the average transit delay by 8 seconds on an approach to a signalised intersection (16 seconds round trip) during the busier traffic periods and by 6 seconds during the less busy periods. When enough intersections are equipped along a route, the fact that buses get through each intersection more quickly means that every bus will complete its full trip along the route more quickly. This, in turn, means that each bus will operate at a faster speed, thereby providing more trips. The end result is more daily trips (which means more customer capacity) being provided by the same number or fewer buses.

Transit signal priority also allows more regular and consistent operation through intersections, so there will be an overall improvement in reliability (more even spacing and less bunching) over the whole route. Depending on the frequency of service and the number of signals through which the route operates, TSP will not only make the service faster and more reliable, it will also increase the capacity of the route by one or more vehicles without having to add any vehicles to the route.

There are approximately 2,200 signalized intersections in the City of Toronto, almost all of which have transit service operating through them. Approximately 350 intersections are already equipped with transit signal priority. **Exhibit 19** illustrates the outstanding express bus corridors that require TSP in order to maximize speed and customer benefits for the corridor. A total of 134 signals are required for Tier 1 services and another 363 signals are required for Tier 2 services. Given the all-day everyday nature of Tier 1 services, it would have greater impact to install TSP along Tier 1 corridors prior to addressing Tier 2 corridors. An evaluation framework balancing customer benefits, costs and timelines is required to prioritize locations.

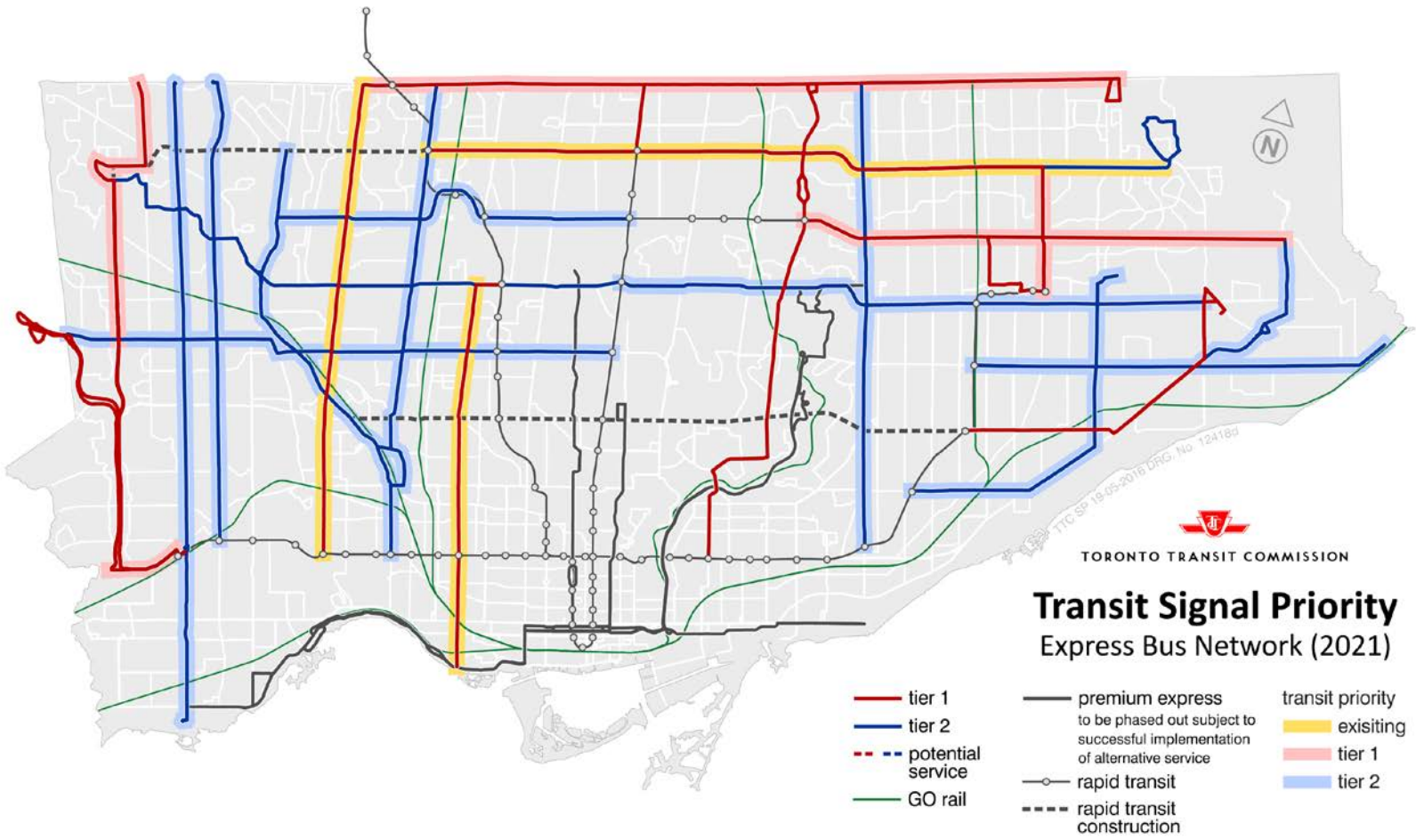


Exhibit 19: Transit Signal Priority for Express Corridors

4.4.4 Queue Jump Lanes

Queue-jump lanes represent another tool for improving the productivity and regularity of bus operations; they can be very effective at reducing delays at intersections. A queue-jump lane may be created by lengthening an existing right-turn lane at an intersection (or creating a new lane). This allows buses to by-pass a long queue of cars in the adjacent through-lanes, and then merges back into through traffic as they travel through the intersection. An illustration of this is shown in **Exhibit 20**.

Queue jump lanes at intersections of major arterials reduce the average delay by 30 to 60 seconds and the maximum delay by 2 to 4 minutes during the busiest traffic periods. Several queue jump lanes on a route will make the service faster and much more reliable and increase the capacity of the route by one or more buses without having to add any buses to the route.

Eighteen locations for potential queue jump lanes have been identified for both Tier 1 and Tier 2 corridors as illustrated in **Exhibit 21**.

Like the recommendation for TSP, the all-day, everyday operation of Tier 1 services might be a deciding factor in prioritizing queue jump lanes on Tier 1 corridors. The exact roll-out and prioritization will be subject to a framework that considers costs, timeline, moratorium on construction and customer benefit.

Approval and implementation of queue-jump lanes is subject to a set of evaluation criteria agreed upon between the City and TTC. The criteria consider the benefits and impacts to all road users.

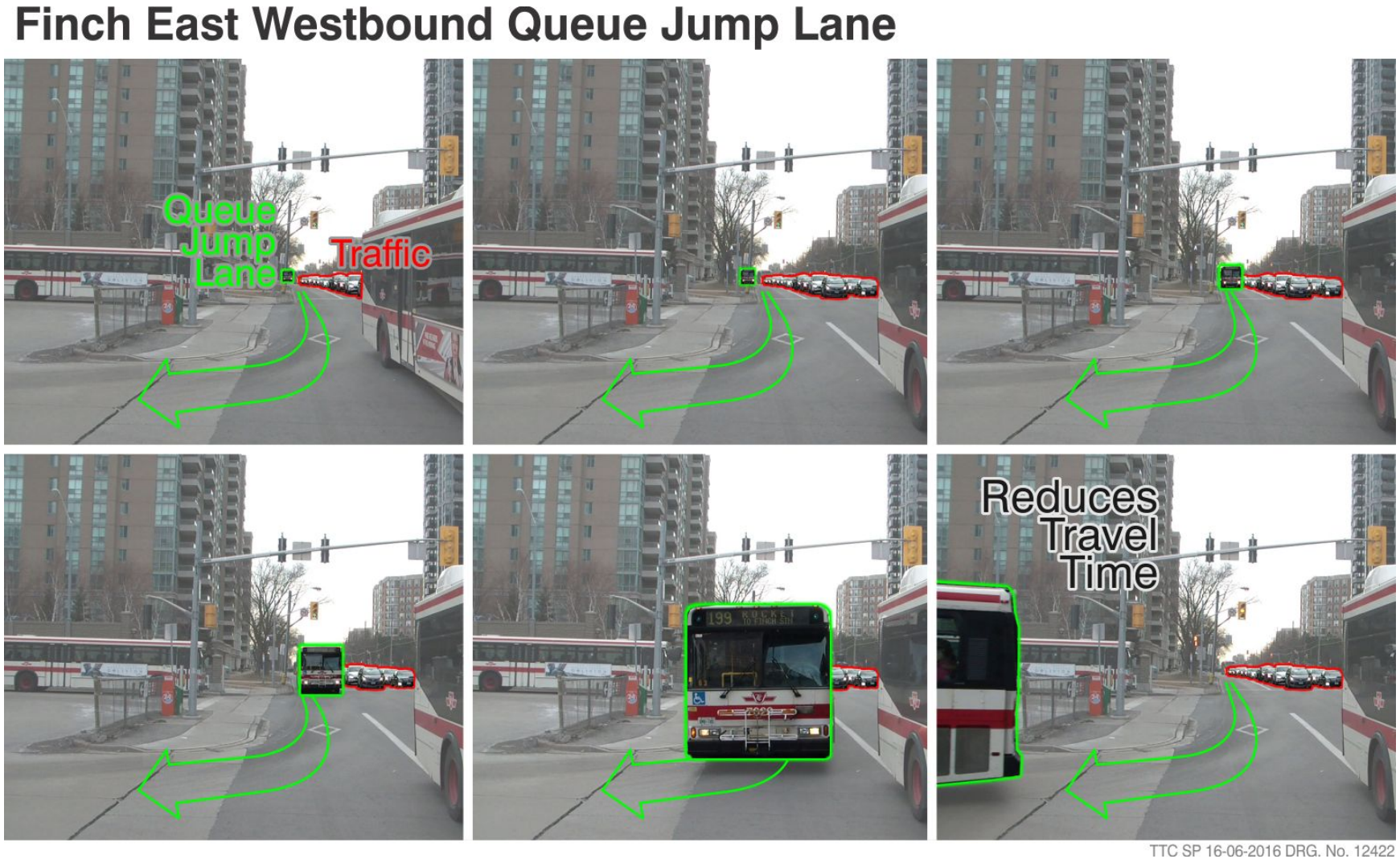


Exhibit 20: Example of Queue-Jump Lane

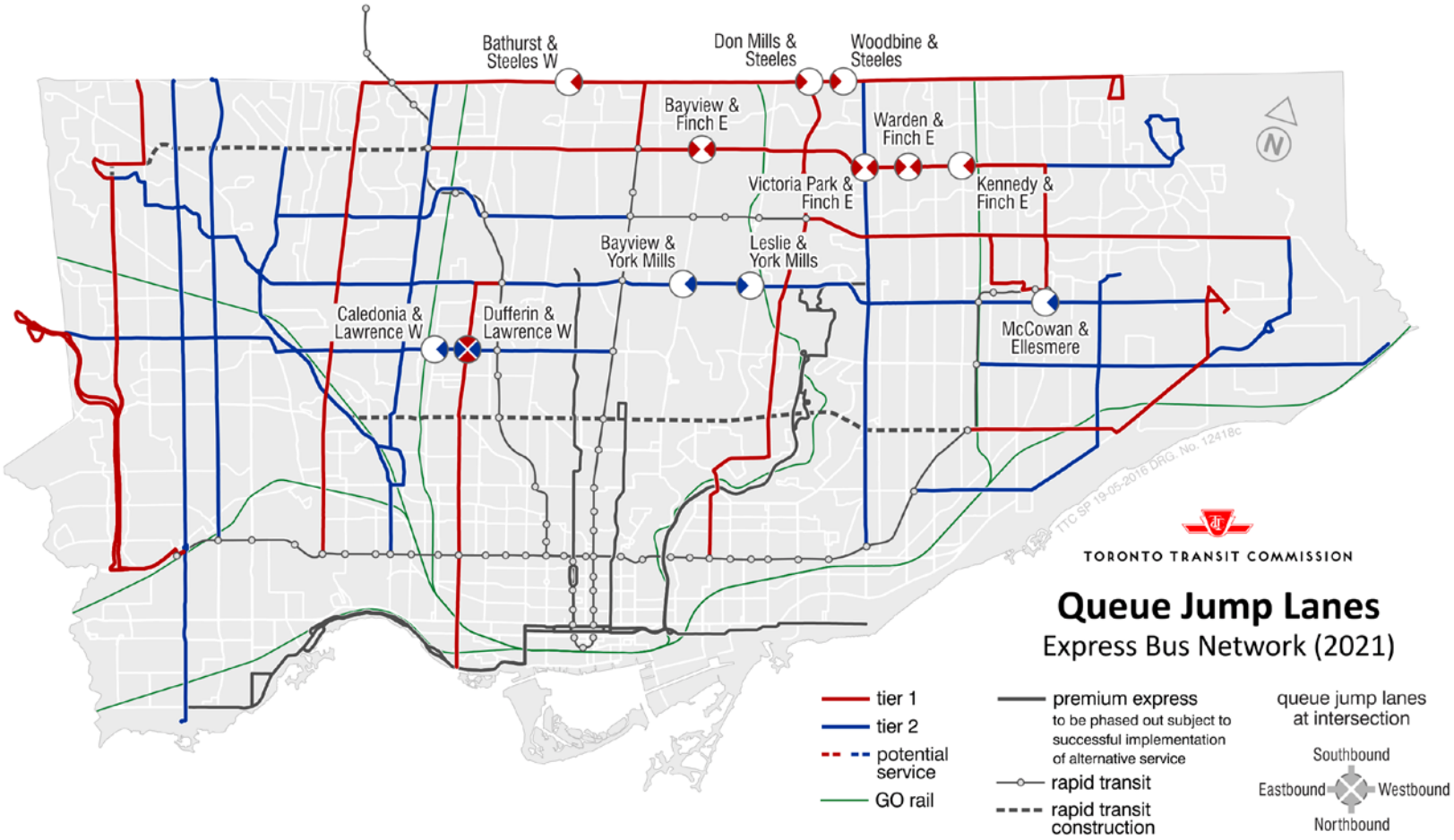


Exhibit 21: Potential Queue-Jump Lane Locations

4.4.5 Route Supervision and Monitoring

Effective route supervision is fundamental to the provision of good transit service. Route Supervisors undertake many types of work, all geared to ensure good service reliability including monitoring/adjusting transit service and responding to emergencies and customer service issues. On-street supervision is essential to providing good customer service because it allows direct observation of crowding and scheduling issues, with real-time adjustments as well as development of longer-term solutions. Route supervision will be vital to the initial roll out of many of the new express services. The VISION CAD/AVL system, which will be in place, will further enhance the route supervisor's abilities to manage these services.

4.4.6 Reducing Passenger Service Time

Passenger service time (PST) – the time it takes for customers to board and alight at stops – represents about 20% of a route's run time. Since road and signal improvements are contingent of support from City of Toronto Planning and Transportation Services, the TTC has explored ways it can make bus service faster, with policies and practices it can control, to provide a true "express" experience. This is mainly achieved by reducing PST.

The first way to reduce PST is to reduce the number of stops the route serves. This is intrinsic and an obvious design solution for any express service, but nonetheless it is still a major strategy that must be identified. As such, all express routes will be designed with fewer stops than its local counterpart whilst respecting the stop spacing standards as outlined in Section 4.1.2.

The second tool available is all-door boarding coupled with the operation of larger high-capacity vehicles (articulated buses) on express corridors where feasible. By reducing fare transactions and allowing all-door boarding, PST can be reduced, providing considerable benefits to all customers. This can be further enhanced with larger articulated buses that have an additional set of doors. Larger buses will improve internal vehicle circulation; therefore customers will have an easier and faster time to board and alight vehicles.

One advantage of using articulated buses on express routes is that the reduction in the number of stops will keep these larger and heavier vehicles moving. On routes with lots of stops such as 29 Dufferin, the articulated buses take longer to decelerate and accelerate to service stops due to their size, thereby increasing the route run time. Reducing the number of stops limits the number of times the vehicle must decelerate and accelerate and therefore the vehicle can maintain a more constant speed. Fundamentally, it is more efficient to use the larger vehicles on routes with fewer stops such as express services.

It is recommended that all-door boarding be implemented for Tier 1 Express services. It is not recommended on Tier 2 services since peak-only all door boarding may be confusing to customers. This enhancement will require Fare Inspectors to enforce the fare strategy; these needs are detailed in Chapter 5. If all-door boarding is pursued this will need an additional communications plan that will possibly need to be linked to the marketing and branding of these services.

Since implementation of all-door boarding would be limited to Tier 1 Express service the use of articulated buses will mainly be confined to Tier 1 Express services as well. This is, however ultimately dependent on the feasibility of the corridors and rapid transit stations being able to accommodate articulated buses. Potential express corridors with articulated bus operation are listed below. Actual deployment of articulated buses on these corridors is subject to final review prior to implementation. Most corridors already have articulated buses serving either the express or local routes:

- Highway 27
- Jane Street
- Dufferin Street
- Steeles East and West
- Finch East and West
- Sheppard East

As part of the implementation plan it is assumed that these corridors will have articulated buses on the express services, while local services on these corridors will be using regular 40-foot vehicles.

5 IMPLEMENTATION PLAN & NEXT STEPS

The implementation plan identifies the approximate implementation dates of the new services, the resources required to operate the network, and the next steps required to advance the express bus network.

Due to inadequate garage storage capacity that dictates the number of vehicles available for peak service, the exact implementation of the network cannot proceed immediately. As a result of this restriction the implementation will be rolled out in 2020 which will coincide with the opening of the McNicoll Bus Garage which will provide additional capacity.

5.1 Implementation Plan

This section presents the implementation of the express bus network between 2019 and 2021 including weekly hours and vehicle requirements. 2019 service enhancements are only possible where no additional peak vehicles are required.

Table 11 presents the express bus network resource requirements and proposed year of implementation. This identifies the additional peak vehicles need to operate the service and the associated increase in weekly hours. The exact roll-out of the network is subject to operating budget availability and approval. Where Tier 1 routes are assumed to utilize articulated vehicles, it is assumed their local counterpart will use regular 40-foot vehicles.

Beyond the additional costs to provide the service, implementation will be primarily driven by vehicle availability and additional garage storage capacity.

Table 11: Implementation Plan

Tier	Corridor	Description of Enhancement	Additional Weekly Hours	Change in Peak 60-foot Vehicles	Change in Peak 40-foot Vehicles
	2019				
1	Eglinton Ave. E / Kingston Rd / Morningside	Off-peak enhancement.	35	0	0
2	York Mills	Off-peak enhancement.	240	0	0
2	Wilson	Off-peak enhancement.	50	0	0
		Subtotal	**325**	**0**	**0**
	2020				
1	Steeles East	Peak and off-peak enhancement.	230	-4	+7
1	Sheppard East	Peak and off-peak enhancement: Extension of express service to Meadowvale Loop. Conversion to articulated busses.	500	-6	+6
1	Jane	Conversion to articulated busses.	0	+10	-12
1	Highway 27	Conversion to articulated busses.	0	+14	-19
2	Sheppard West	Peak enhancement. Extension of express service to Weston Rd.	110	0	+2
2	Markham Rd.	New express service.	255	0	+3
2	Lawrence West	New express service.	190	0	+6
		Subtotal	**1,285**	**+14**	**-7**
	2021				
1	Dufferin	New express service. Requires new vehicles.	735	-14	+24
1	Steeles West	Peak and off-peak enhancement. Conversion to articulated busses.	255	+7	-8
1	Finch	Peak and off-peak enhancement. Conversion to articulated busses.	0	+25	-30
2	Keele	Peak and off-peak enhancement.	270	0	+2
2	Weston	New express service.	235	0	+5
2	Islington	New express service.	195	0	+5
		Subtotal	**1,690**	**+18**	**-2**
		Grand Total	**3,300**	**+32**	**-9**

5.2 Customer Benefits

The express bus network's new and enhanced express services were assessed to quantify system benefits for both the TTC and its customers. These benefits include:

- ridership & new customers to the system
- improved travel times (customer minutes saved)
- additional capacity on busy corridors during peak hours and long term cost avoidance

These benefits are quantified and provided for each route in the ensuing section.

5.2.1 Ridership & New Customers to the System

Weekday daily and annual ridership projections for each express route are provided below in **Table 12**. Most customers will be diverted from existing services. Where service is added or modified, the projected increase in annual system-wide ridership due to the enhancements is also provided.

About 70 million customers-trips annually are projected to use the express bus network as ridership matures due to the projected travel speed improvements. About 1.7 million customer-trips annually will be attracted to the TTC due to improved express offerings. One in every six bus customers will use the express bus network.

Table 12: Ridership & Additional Customers

Route	Weekday Daily Customers	Annual Customers	New Annual Customer-Trips
Tier 1			
Airport	5,300	1,620,000	-
Highway 27	12,800	3,920,000	-
Jane	11,500	3,520,000	-
Dufferin	14,200	4,350,000	285,000
Don Mills	20,400	6,240,000	-
Steeles West	7,100	2,170,000	135,000
Steeles East	13,500	4,130,000	250,000
Finch	37,600	11,500,000	300,000
Sheppard East	20,900	6,400,000	205,000
Eglinton Ave East / Kingston Rd / Morningside	6,700	2,050,000	10,000
Subtotal	**150,000**	**45,900,000**	**1,185,000**
Tier 2			
Kipling	5,300	1,610,000	-
Kipling South	7,200	2,200,000	-
Weston	5,100	1,560,000	95,000
Keele	7,500	1,880,000	65,000

Route	Weekday Daily Customers	Annual Customers	New Annual Customer-Trips
Victoria Park	5,600	1,710,000	-
Markham Rd	9,800	3,000,000	140,000
Eglinton Ave East / Kingston Rd / Meadowvale	3,400	1,040,000	-
Sheppard West	9,900	2,650,000	40,000
Wilson	8,000	2,450,000	10,000
Lawrence West	5,900	1,810,000	60,000
York Mills	7,500	1,880,000	70,000
Lawrence East	2,800	860,000	-
Islington	5,000	1,250,000	55,000
Subtotal	**79,700**	**23,900,000**	**535,000**
Grand Total	**229,700**	**69,800,000**	**1,720,000**

5.2.2 Leading With Investment

The Express Bus Network is one way the TTC will be well-positioned to serve and attract future customers. However, it requires an upfront investment in operating hours and dollars. In order to ensure that the express bus network is an overall net benefit to customers, it is required to initially offer an express service that is frequent enough to be an attractive option for customers while not degrading the local service so significantly that customers avoid the system altogether. A “big-bang” approach is needed when rolling out express service on a corridor. This means that more capacity will be on the street as the network’s plan rolls out. **Table 13** shows the proposed change in capacity and the resulting crowding levels in the AM peak hour.

Table 13: Customer Benefits – Additional Corridor AM Peak Hour Capacity

Corridor	Existing Hourly Capacity	Proposed Hourly Capacity	Change	2021 Crowding
Airport	250	250	0	95%
Highway 27	680	760	+80	85%
Jane	970	970	0	100%*
Dufferin	1,140	1,270	+130	90%
Don Mills	940	940	0	90%
Steeles West	1,260	1,380	+120	80%
Steeles East	1,650	1,780	+130	75%
Finch	2,240	2,240	0	100%*
Sheppard East	1,390	1,470	+80	75%
Eglinton Ave East / Kingston Rd / Morningside	310	310	0	95%
Kipling	840	840	0	95%
Kipling South	820	820	0	95%
Islington	560	750	+190	80%
Weston	640	820	+180	80%
Keele	670	730	+60	85%
Victoria Park	900	900	0	95%
Markham Rd	610	760	+150	75%
Eglinton Ave East / Kingston Rd / Meadowvale	1,220	1,220	0	85%
Sheppard West	1,130	1,130	0	80%
Wilson	960	960	0	85%
Lawrence West	1,020	1,180	+160	85%
York Mills	1,210	1,210	0	85%
Lawrence East	1,020	1,020	0	75%

* This route may require additional resources prior to 2021.

While it is not typical to provide additional capacity beyond what demand levels require, over time additional resources will be required on the proposed corridors on their local services. As noted, these local services will have a higher cost to provide the same capacity than the Express Bus Network would provide.

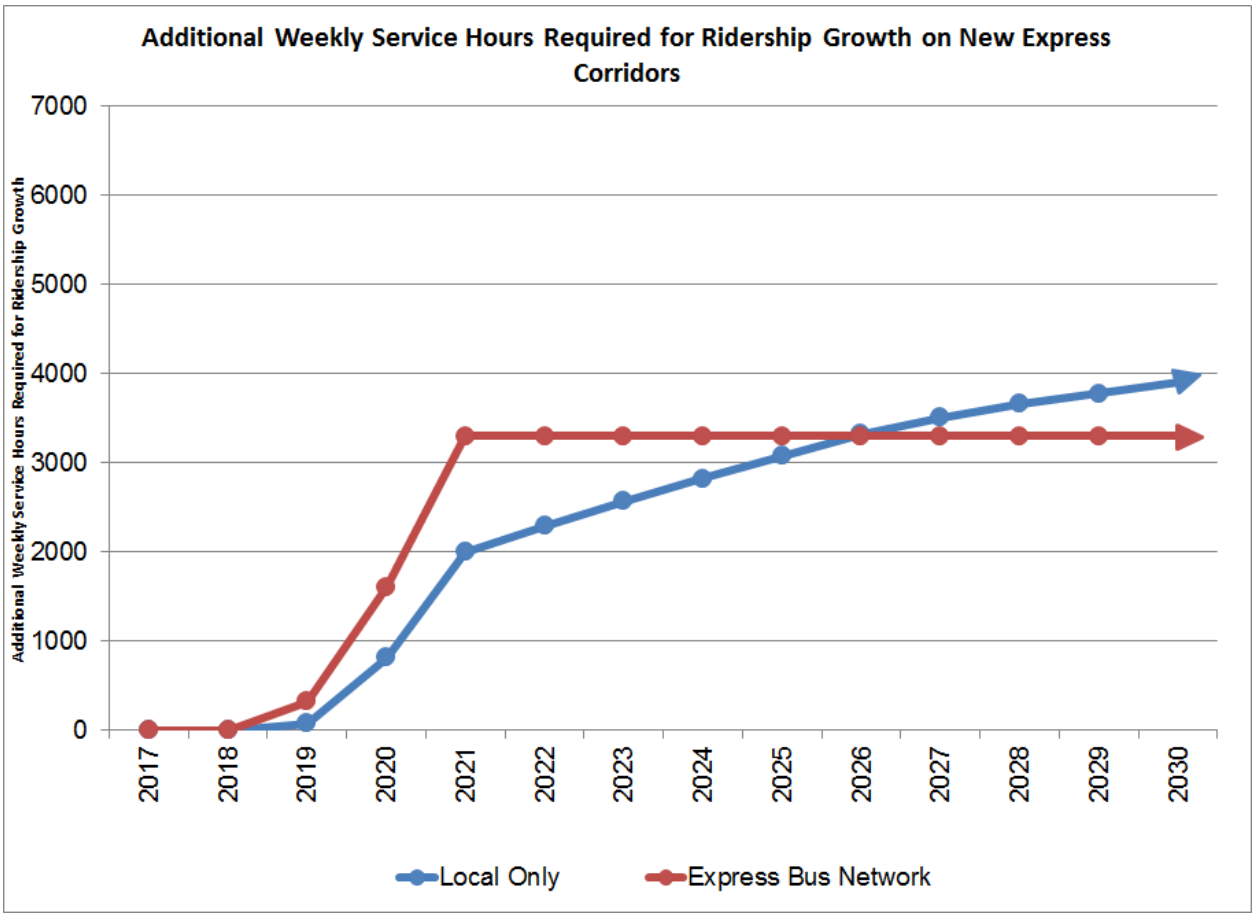
For example, in order to provide the same capacity on the new express corridors as proposed in the network with local services this would require an additional 1,250 weekly service hours for a total of 4,550 weekly service hours, which has an annual cost of approximately of $6M. This represents roughly an overall increase of 5% which is consistent with the findings of the performance review – that express buses can reduce operating needs on a corridor from 3 to 10%.

Exhibit 22 illustrates that in 2026, or five years after full implementation of the Express Bus Network, the additional 3,300 weekly service hours required to operate the proposed plan would need to be invested on these corridors in local service to support ridership growth. This would

still not provide the additional customer benefits of improved travel times and additional capacity on busy transit corridors. There is more value expanding service on these corridors with express routes rather than status quo options.

Resources that would have been required in the future are being advanced to be invested in 2019 through to 2021 in the form of a beneficial express bus network.

Exhibit 22: Service Hour Comparison, Local vs. New Express Services



5.2.3 Improved Travel Times

Table 14 below quantifies the annualized customer time savings as result of the express bus network. On average, customers will save about three minutes on the bus leg of their journey, which can be applied to the total number of annual trips to generate annual time savings. If a customer averages 10 trips per week on a given service, this equates to 26 hours saved per year.

Due to the sheer magnitude of customers using the services, the total time savings are immense. Tier 1 services will produce 2.2 million customer-hours in savings over a calendar year, meanwhile Tier 2 provides for a grand total of 900,000 customer hours of savings. Overall, the express bus network will provide an additional 3.1 million customer hours in savings annually. One of the TTC's core values is respecting the customer's value of time. The express bus network is just one way to support this important corporate objective.

Table 14: Customer Benefits – Travel Time Savings

Route	Customer Hours Saved
Tier 1	
Airport	180,000
Highway 27	430,000
Jane	140,000
Dufferin	80,000
Don Mills	175,000
Steeles West	60,000
Steeles East	255,000
Finch	550,000
Sheppard East	235,000
Eglinton Ave East / Kingston Rd / Morningside	120,000
Subtotal	**2.2M**
Tier 2	
Kipling	90,000
Kipling South	90,000
Weston	50,000
Keele	50,000
Victoria Park	35,000
Markham Rd	35,000
Eglinton Ave East / Kingston Rd / Meadowvale	70,000
Sheppard West	82,000
Wilson	80,000
Lawrence West	25,000
York Mills	175,000
Lawrence East	35,000
Islington	95,000
Subtotal	**0.9M**
Grand Total	**3.1M**

5.3 Net Cost: Operating Costs and Revenues

Total operating costs, fare revenue, and net operating costs for the proposed express bus network are presented in this section. The costs and revenues do not include the potential phase-out of the Downtown Premium Express routes. Instead, it is provided as a separate line item beginning in 2021.

Table 15 presents the total operating costs required to implement the express bus network. These operating costs are related to service (i.e. operators and maintenance). As noted, the exact implementation dates will be determined closer to the opening of McNicoll Bus Garage.

Table 15: Total Operating Costs (in 2017$)

Operating Costs	2019	2020	2021
Tier 1	$0.2M	$3.8M	$8.6M
Tier 2	$1.4M	$4.1M	$7.5M
Total	**$1.6M**	**$7.9M**	**$16.1M**
Potential Savings from Phasing-Out Downtown Premium Fare Express Routes	$0M	0M	$-2.3M

Fare revenue from new transit customers reduces the subsidy, or net cost, required to operate service. New transit ridership typically does not appear overnight and typically takes three years following implementation to be fully realized. This is also the case for new fare revenue as it is tied to new customers. **Table 16** presents the cumulative revenue projections for the express bus network over the three-year maturation period. Note that the figures exclude the projections for the new services implemented in March 2016.

Table 16: New Revenue and Net Operating Cost (in 2017$)

New Customers & New Revenue	2019	2020	2021	2022	2023
Tier 1					
New Customers	7,500	350,000	960,000	1,100,000	1,185,000
New Revenue	$0.02M	$0.7M	$2.0M	$2.3M	$2.4M
Tier 2					
New Customers	60,000	250,000	460,000	510,000	535,000
New Revenue	$0.12M	$0.5M	$0.9M	$1.0M	$1.1M
Grand Total					
New Customers	67,500	600,000	1,420,000	1,610,000	1,720,000
New Revenue	$0.14M	$1.2M	$2.9M	$3.3M	$3.5M
Lost Customers from Phasing-Out Downtown Premium Fare Express Routes	0	0	-289,000	-289,000	-289,000
Lost Revenue from Phasing-Out Downtown Premium Fare Express Routes	$0.0M	$0.0M	$-0.82M	$-0.82M	$-0.82M

Based on the total operating costs and fare revenue projections, **Table 16** presents the net operating cost, or subsidy required, to implement the express bus network including the net cost to implement all-door boarding.

Table 17: Net Operating Cost (2017$)

New Customers & New Revenue	2019	2020	2021	2022	2023
Tier 1					
Operating Cost	$0.2M	$3.8M	$8.6M	$8.6M	$8.6M
All Door Boarding (Fare Inspection)	$0M	$0.5M	$0.5M	$0.5M	$0.5M
New Revenue	-$0.02M	-$0.7M	-$2.0M	-$2.3M	-$2.4M
Net Cost	$0.2M	$3.6M	$7.1M	$6.8M	$6.7M
Tier 2					
Operating Cost	$1.4M	$4.1M	$7.5M	$7.5M	$7.5M
New Revenue	$0.14M	-$0.5M	-$0.9M	-$1.0M	-$1.1M
Net Cost	$1.3M	$3.6M	$6.6M	$6.5M	$6.4M
Grand Total					
Total Net Cost	**$1.5M**	**$7.2M**	**$13.7M**	**$13.3M**	**$13.1M**
Potential Net Savings from Phasing-Out Downtown Premium Fare Express Routes	$0M	$0M	$-1.5M	$-1.5M	$-1.5M

With respect to the all-door boarding proposal on Tier 1 express services, Fare Inspectors would be required for a projected start date in 2020 pending completion of a successful pilot test. Based on the industry standard 4% customer inspection rate, and an achieved rate of 300 inspections per day, the number of Fare Inspectors required is 21 in 2020 increasing to 24 in 2021 and thereafter. The full operating cost of Fare Inspectors is $2.2M per annum. The addition of Fare Inspectors would result in a $1.7M reduction in fare evasion compared to the status quo. Together, this equates to a net cost of $0.5M per annum to implement all-door boarding.

As noted, the investment in the express bus network is needed for a seven-year period, after which it will cost more to move the same number of customers on the same corridors if investment occurred on local services only. When isolating the customer hours saved on the new or enhanced routes proposed during the seven-year period where additional costs will be incurred, compared to the “status quo” option (e.g. between 2019 and 2026) this equates total of 3.15M customer hours saved at a cost of $23.6M.

Over the seven year period, it will cost $7.50 per customer hour saved. When evaluating the benefits of a transportation initiative, Transport Canada assigns a value of travel time of $14[5] per hour. The economic opportunity presented by the travel time savings alone exceeds the cost to provide the travel time savings.

5.4 Capital Costs

The express bus network will require an expansion of the TTC's bus fleet. In total, 32 18-metre buses are required to implement the express network. An additional 6 vehicles will be needed as operating spares based on the target 18% spare ratio. The total capital cost for the 38 buses is estimated at $34.2 million as seen in **Table 18**.

Table 18: Capital Costs (in 2017$)

18m Buses	Total
In-Service	**32**
Operating Spares	**6**
Total Cost	**$34.2M**

The total of 38 buses can be accommodated with additional bus garage storage i.e. (McNicoll Bus Garage). The Express Bus Network cannot be fully implemented until the TTC opens this new bus facility.

5.5 Transit Priority

The TTC works jointly with the City of Toronto Transportation Services and City Planning on ways to improve surface transit operations across the city. Among these initiatives includes expansion of transit signal priority (TSP) as well as the potential implementation of queue jump lanes.

These measures are not prerequisite to implement the proposed express bus network, but they are enhancements that will further improve the speed of express services and potentially reduce operating costs. Transit signal priority reduces the average transit delay by 8 seconds on an approach to a signalised intersection (16 seconds round trip) during the busier traffic periods and by 6 seconds during the less busy periods. When enough intersections are equipped along

[5] The estimated hourly value in 1990 dollars is $22.70 for air travellers, $10.10 for rail travellers, $9.10 for auto travellers and $8.40 for bus travellers. This value has been adjusted to 2017 dollars based on the Bank of Canada inflation calculator.
See: http://data.tc.gc.ca/archive/eng/corporate-services/finance-bca-122.htm
http://www.bankofcanada.ca/rates/related/inflation-calculator/

a route, the fact that buses get through each intersection more quickly means that every bus will complete its full trip along the route more quickly. Queue jump lanes at intersections of major arterials reduce the average delay by 30 to 60 seconds and the maximum delay by 2 to 4 minutes during the busiest traffic periods. Several queue jump lanes on a route will make the service faster and much more reliable and increase the capacity of the route by one or more buses without having to add any buses to the route.

The TTC has funds available in the capital budget for transit signal priority and queue jump lanes that can be used between 2017 and 2020.

The transit priority measures discussed in Section 4.4 is a very comprehensive list of small scale improvements that can and will support the express bus network. These improvements will be prioritized and implemented within existing funding. It is recommended that the transit priority program continue to implement transit priority measures with existing funding while taking into account the TTC express bus network.

5.6 Communications Plan

As seen in the Peer Review, some transit agencies intentionally and specifically market some of their express services as a ridership growth initiative (e.g. Metro Rapid in Los Angeles). Typically, this involves a special brand for these services coupled with unique route names and route numbers. Some agencies further enhance this brand with special vehicles, next bus arrival information displays and different signs to mark where these express services stop. An aggressive advertisement campaign is usually associated with the initial implementation of these services.

This express bus network concept presents an opportunity for the TTC to enhance marketing for Tier 1 and/or Tier 2 services. The goal of enhanced communications is that it will make these services more easily identifiable and ultimately attract new riders to the system.

Enhanced branding or marketing does not need to be exhaustive or as expensive as what some transit agencies have employed. Furthermore, some measures may result in some difficulties in actually providing the service or other TTC services – for example if a special vehicle is used to operate Tier 1 service it can create some challenges for Bus Maintenance to schedule inspections or repairs if the fleet is limited. The use of articulated buses on Tier 1 routes would not create additional challenges for the TTC bus maintenance staff, as they already have resources in place to maintain these vehicles.

The introduction of all-door boarding on Tier 1 services, would benefit from specially branded vehicles so that customers can distinguish when one service utilizes all-door boarding and another does not.

Enhanced branding is not just confined to the model or colour of the vehicles. It can also include stylistic improvements or changes to bus stops or way-finding signage within rapid transit

stations to better promote the service. For example, next vehicle arrival screens could be installed at express bus stops. As another example, at Kipling Station, special floor decals direct customers to the bus bay for the existing 192 Airport Rocket. These relatively simple enhancements can go a long way in improving the visibility of the Express services.

The communications plan will require a balance that recognizes operational challenges, funding, but most importantly, doing what's best for customers. The Communications Plan will further explore options to enhance the marketing or branding of these express services in a manner that best attracts riders.

6 SUMMARY

This report has identified a network of new and enhanced express bus services that will help support future rapid transit projects as well as municipal, provincial and corporate objectives. As part of this network the following initiatives or concepts have been explored and recommended:

- A “two-tiered” approach to classify express services which will clearly delineate service offerings and characteristics:
  - Tier 1 services are all-day express corridors with high daily ridership and are designed to be a precursor to rapid transit
  - Tier 2 services are generally peak-only services on corridors that experience high peak demands and could use additional capacity

- The implementation of additional transit priority measures, such as queue jump lanes and transit signal priority to help facilitate faster bus services

- All-door boarding as an enhancement for Tier 1 express services as part of the TTC’s fare strategy. This should first be pursued with a year-long pilot on route(s) that already meet the Tier 1 standard.

- The use of articulated vehicles on Tier 1 services, where possible

- The potential phase-out of the Downtown Premium Fare Express routes due to their poor economic performance subject to the successful implementation of service alternatives.

As a result of these recommendations, the net operating cost for the recommended express bus network (2021) is approximately $13.1M per year once the plan has been fully implemented. The network will benefit about 70 million customer trips annually, saving more than 3.1 million person-hours of customer time per annum, and attract 1.7 million additional customer-trips to the system annually. One in every six bus customers will use the express bus network.