



CITY OF BRAMPTON TRANSPORTATION MASTER PLAN UPDATE

TECHNICAL REPORT #4 - FUTURE TRANSIT PROVISIONS

AUGUST 2015



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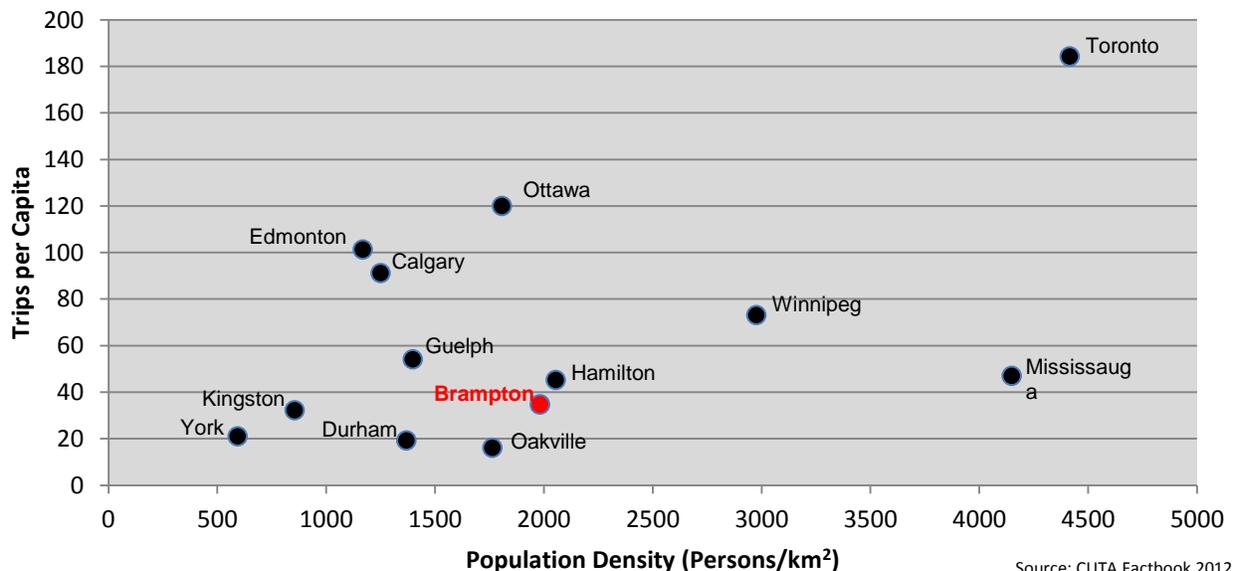
1. INTRODUCTION

Brampton Transit has experienced significant ridership increases and service expansion in recent years. Since the last Transportation and Transit Master Plan (TTMP) in 2009, there has been a 49% increase in transit ridership. Growth in transit has exceeded the 20% growth in population that has been realized in the same timeframe, resulting in an improved per capita ridership. These developments were fully documented in a separate Existing Transit Conditions report. The increase in transit ridership was achieved through improvements in the provision of transit services, particularly the ZUM corridor implementation and associated route structure and improved service frequencies.

Brampton’s rapid rate of population and employment growth is forecast to continue until 2031 at a rate of approximately 6% per year after which it will level off to a more modest, but still significant, 2% per year until 2041. These increases will call for a strong focus on the development of an efficient and effective transit system if mobility within the community and between Brampton and adjacent municipalities is to support the City’s economy and residents’ quality of life. The plan will require commitment and the dedication of resources to transit but the benefits in terms of ‘city building’ will be great. Dedication of resources to transit will require an expansion of the City’s transit services as well as increased services provided to GO Transit. Two-way, all-day transit service to GO train stations is an important transit priority to help reach transit ridership goals and to help improve mobility within the city.

Brampton Transit currently carries 6% of morning peak period trips in the city with GO Transit accounting for another 2%. Transit trips per capita in 2012 were 34.7. As the population grows, it will be necessary not only to maintain transit’s market share but to increase it significantly to enable the transportation system to function and avoid costly grid-lock. Figure 1.1 presents how various cities rate in terms of density and trips per capita.

Figure 1.1 – 2012 Service Utilization: Brampton and Other Comparable Canadian Cities





The expected trend is that a city with higher population density will typically show a greater number of trips per capita. It is noted that most GTA cities achieve less than 50 trips per capita, the exception being Toronto, which achieves almost 200 trips per capita. Comparing Brampton with other cities of similar densities (Calgary, Ottawa), there is the potential to achieve higher use of transit.

This Transportation Master Plan (TMP) is an update to the 2009 plan which identified a number of transit improvements to be implemented by 2031. The 2009 TTMP proposed the transit network for 2031 shown in Figure 1.2.

Figure 1.2 – 2031 Brampton Transit Network (from 2009 TTMP)



The current TMP Update is intended to review the previous plan and adjust the network and resource requirements to reflect changes in population, employment, and desired modal share for transit. This update also extends the planning horizon from 2031 to 2041. The recommendations for transit improvements in this report cover the time periods:

- 2016 to 2021;
- 2021 to 2031; and
- 2031 to 2041.



The recommended transit plan in this report is based on the EMME transportation model for Brampton that is described in a separate report titled Model Validation. For the model analysis, transit's modal share by 2031, and continuing to 2041, was set at 16%, which should be achievable provided appropriate investment in transit is made. This translates to 65 trips per capita by 2031 and 71 trips per capita by 2041 which, based on the success of transit in other cities of a similar size (Figure 1.1), should be achievable. However, it will require clear policy direction and a sustained investment stream to implement Light Rail, Bus Rapid Transit in exclusive lanes, expand the ZÜM network and provide the necessary Operation and Maintenance facilities and systems.

The model was developed for three years: 2011, 2031 and 2041. The 2011 model results together with the information in Brampton Transit's detailed Business Plan for 2013-2017 provide a current baseline upon which to assess the impact of future expansions on transit ridership, infrastructure and vehicle requirements.

2. TRANSIT DEMAND AND TRANSIT MODE SPLIT

The transit plan is intended to encourage transit ridership and to address deficiencies in network capacity. A modelling analysis was undertaken to gain an understanding of the scale of transit demand and identify key transit corridors (described in more detail in the report titled “Model Validation”). The model was developed to represent the existing 2011 demographics and transit operations in the morning peak period. It included a transit mode share of 6% which corresponds to current transit demand. The model identified a transit demand of 22,000 transit passengers per peak period for 2011.

It is important to note that Brampton’s planned population and employment growth is very fast, particularly from now until 2031 (Table 2-1). These forecasts were used in the EMME model to develop transportation scenarios for 2031 and 2041. For these two time frames, a target mode share of 16% was adopted. These scenarios enabled an assessment of the overall transportation demand and the role transit could play.

The transit demand identified for both the 2031 and 2041 planning horizons is shown in Table 2-1. The 72% growth in population from 2011 to 2041 along with the improved transit mode share resulted in 235% growth in transit demand. Upon further review, an annual growth rate in transit demand of 5.5% is forecast from 2011 to 2031, and 1.6% from 2031 to 2041. These are in line with the very high population and employment growth rates forecast between 2011 and 2031 as well as the improved transit share that is to be achieved during this timeframe. From 2031 to 2041, the rate of transit growth is not as high as it is assumed that a 16% mode share is already achieved and transit growth is related to population/employment growth alone.

Table 2-1 – Brampton’s Planned Growth

	2011	2031	2041
Population	523,900	842,800	899,500
Employment	182,000	291,400	325,200
% Transit	6%	16%	16%
Transit Demand	22,000	63,000	74,000

Source: City of Brampton, TAZ projections (population and employment) and Economic Development

The Brampton transportation demand modal scenarios for 2031 and 2041 identify corridors in which transit demand is high, and where auto capacity is reached, providing an indication of where additional transit priority infrastructure will be required. To promote the shift towards higher transit use, investment should be made in high quality transit infrastructure in the corridors where auto capacity has been reached, rather than expanding roads for general purpose lanes. The model was used to identify the corridors where transit demand is in excess of 1,000 passengers per peak period per direction (ppppd) as shown in Figure 2.1 and Figure 2.2. (The figures are provided in larger format in Appendix A). These are the corridors where higher quality transit services should be provided.



Figure 2.1 – Brampton 2031 Model Output: Corridors Greater than 1,000 Passengers / Direction in Peak Period



Note: Transit Demand based upon modal split of auto-based trips



Figure 2.2 – Brampton 2041 Model Output: Corridors Greater than 1,000 Passengers / Direction in Peak Period



The 2009 TTMP, which identified infrastructure needs to 2031, addressed the majority of the corridors identified in the current assessment by providing a transit service and/or facility. The TMP Update modeling has identified additional corridors that will have exceeded the 1,000 ppppd threshold by 2031 in the revised model (Figure 2.1). These include Airport Rd and Bramalea Rd which were both identified previously as “potential ZUM corridors”. Torbram Rd and Dixie Rd which indicate volumes in excess of 1000 passengers have not been included in the higher order transit network as they are in close proximity to the higher order services proposed for the Bramalea Rd and Airport Rd corridors, which would likely attract and accommodate the transit demand.

By 2041, the Sandalwood Pkwy, Chinguacousy Rd, and Kennedy Rd will need to be added to the transit priority / rapid transit network (Figure 2.2).



3. TRANSIT PRIORITY AND RAPID TRANSIT NETWORK

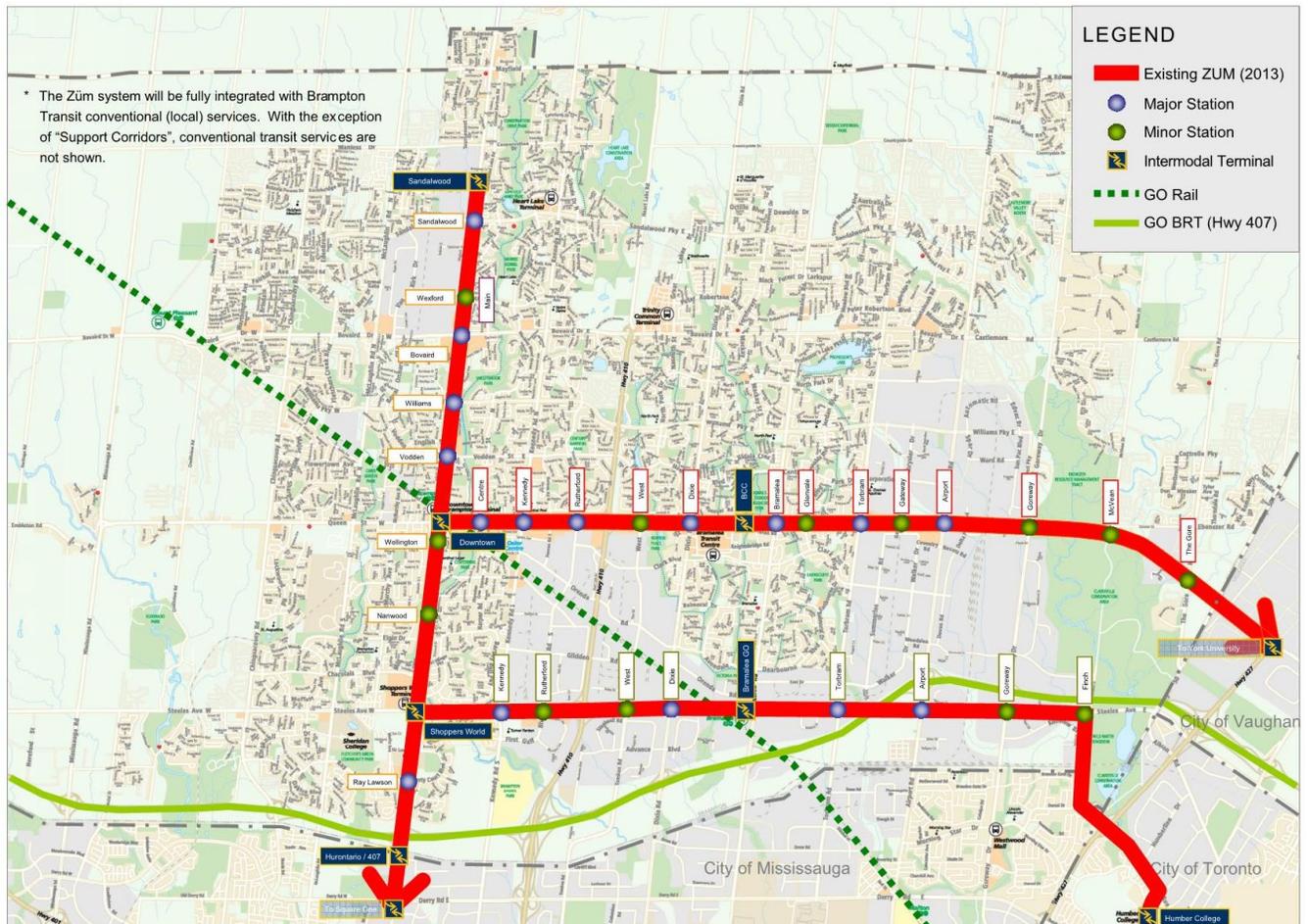
To support the projected transit demand, a number of infrastructure projects have been identified. These include rapid transit facilities such as light rail (LRT), bus rapid transit (BRT) as well as additional ZUM corridors. In addition to these higher order transit projects, regular infrastructure costs for elements like bus stops and shelters, communications, and technology enhancements have been included in the plan. The following sections describe the implementation plan for rapid transit and transit priority corridors in Brampton.

3.1 Existing 2013 Network

The current transit network includes ZUM facilities on Main St, Queen St and Steeles Ave as presented in Figure 3.1. In these corridors, specially branded buses operate frequent service in mixed traffic with transit priority at major intersections and include high quality stations and shelters.

There are numerous other conventional transit services that operate in Brampton which are not presented in the above figure. For a detailed review of existing services and facilities, refer to the Existing Transit Conditions report.

Figure 3.1 – Existing Brampton Transit Network

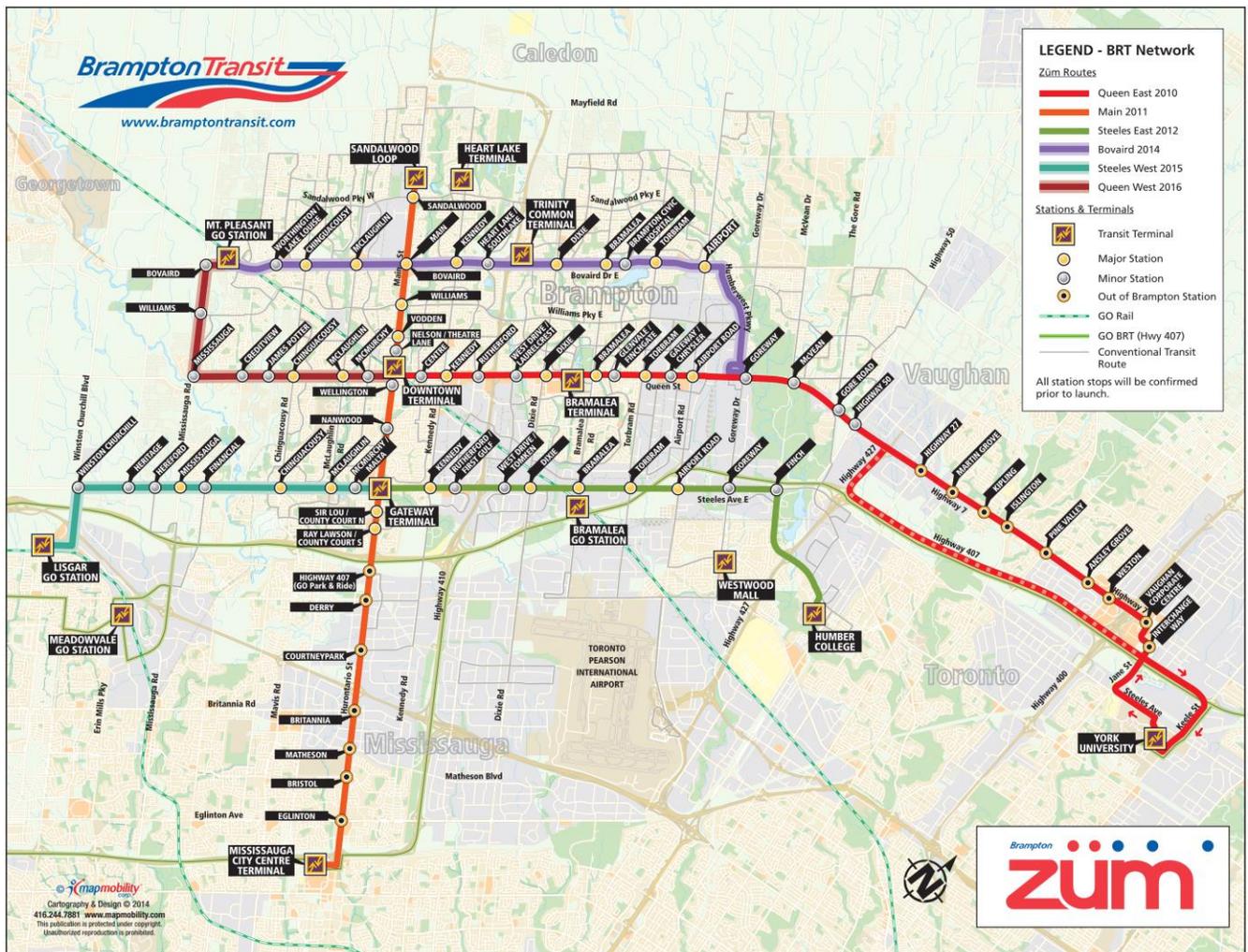


3.2 Five Year Business Plan (2013-2017)

According to the Brampton Transit Five Year Business Plan, additional ZÜM corridors are to be provided on Bovaird Dr from the Mt. Pleasant GO Station to Airport Road (2014), on Steeles Ave W between the Main St corridor and the Lisgar GO station (2015) and on Queen St W and Mississauga Rd connecting downtown Brampton to the Mt. Pleasant GO station (2016). The Five Year Business Plan is shown in **Figure 3.2**.

By 2017 all of the ZÜM BRT and most of the Primary Support Corridors identified in the 2009 TTMP (Figure 1.2) will have been implemented.

Figure 3.2 – Brampton Transit Five Year Business Plan (2013-2017)

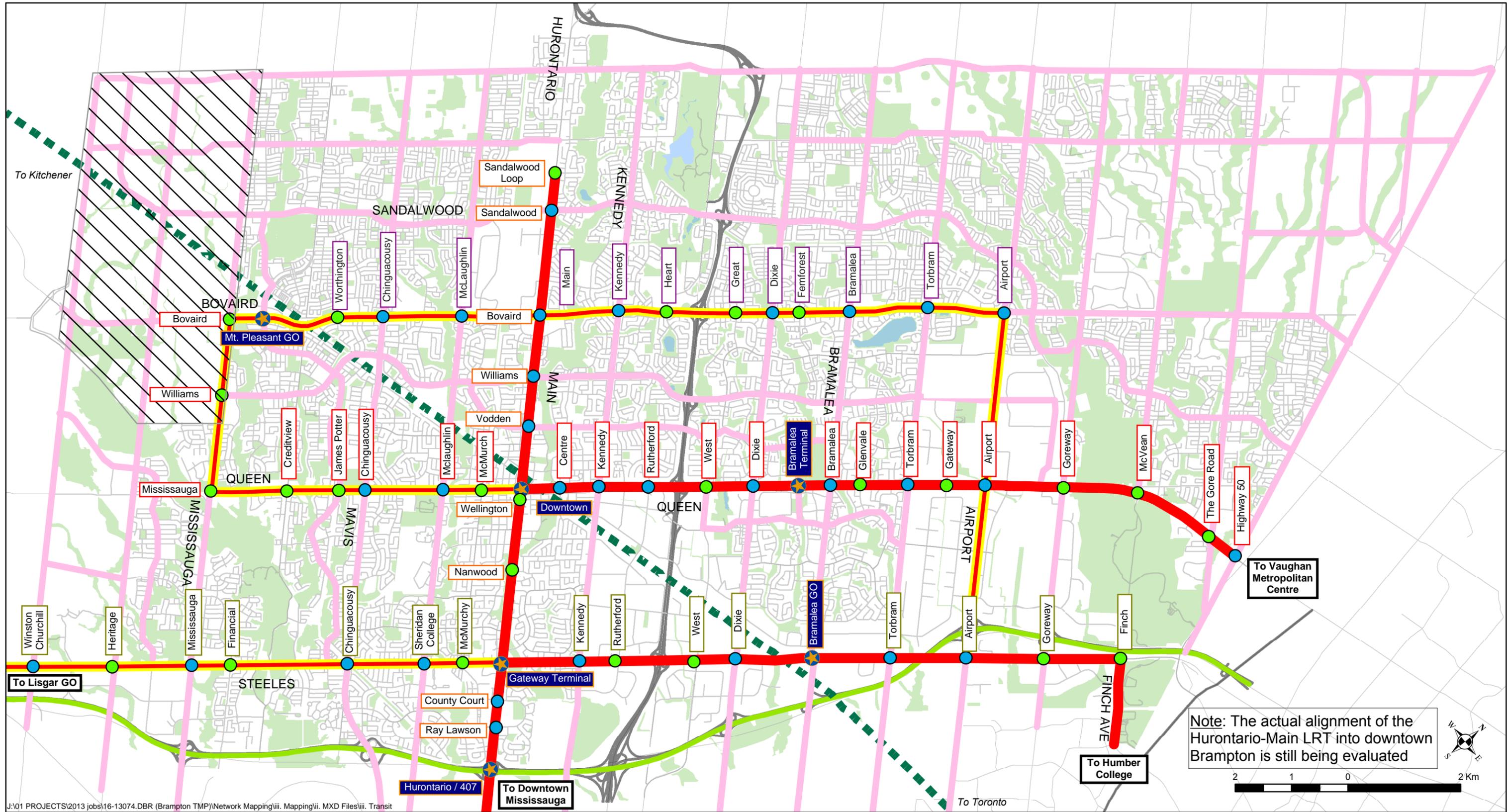


3.3 Recommended Network by 2021

To support the continued development of the ZÜM Network, it is proposed that the Airport Rd corridor (between Bovaird Dr and Steeles Ave), which was identified in the five year business plan as a potential BRT corridor, be implemented by 2021.

The transport demand model identified the Airport Rd corridor as one of the corridors that attracts a higher volume of transit riders (over 2,000 passengers / direction) in the peak periods. The transit demand forecast for this corridor is higher than that identified on Bovaird Dr which has already been included in the ZÜM network. The corridor also provides a strategic link connecting the ZÜM corridors on Bovaird Dr, Queen St, and Steeles Ave on the east side of Brampton.

Figure 3.3 presents the existing and proposed ZÜM corridors that are to be implemented by 2021.



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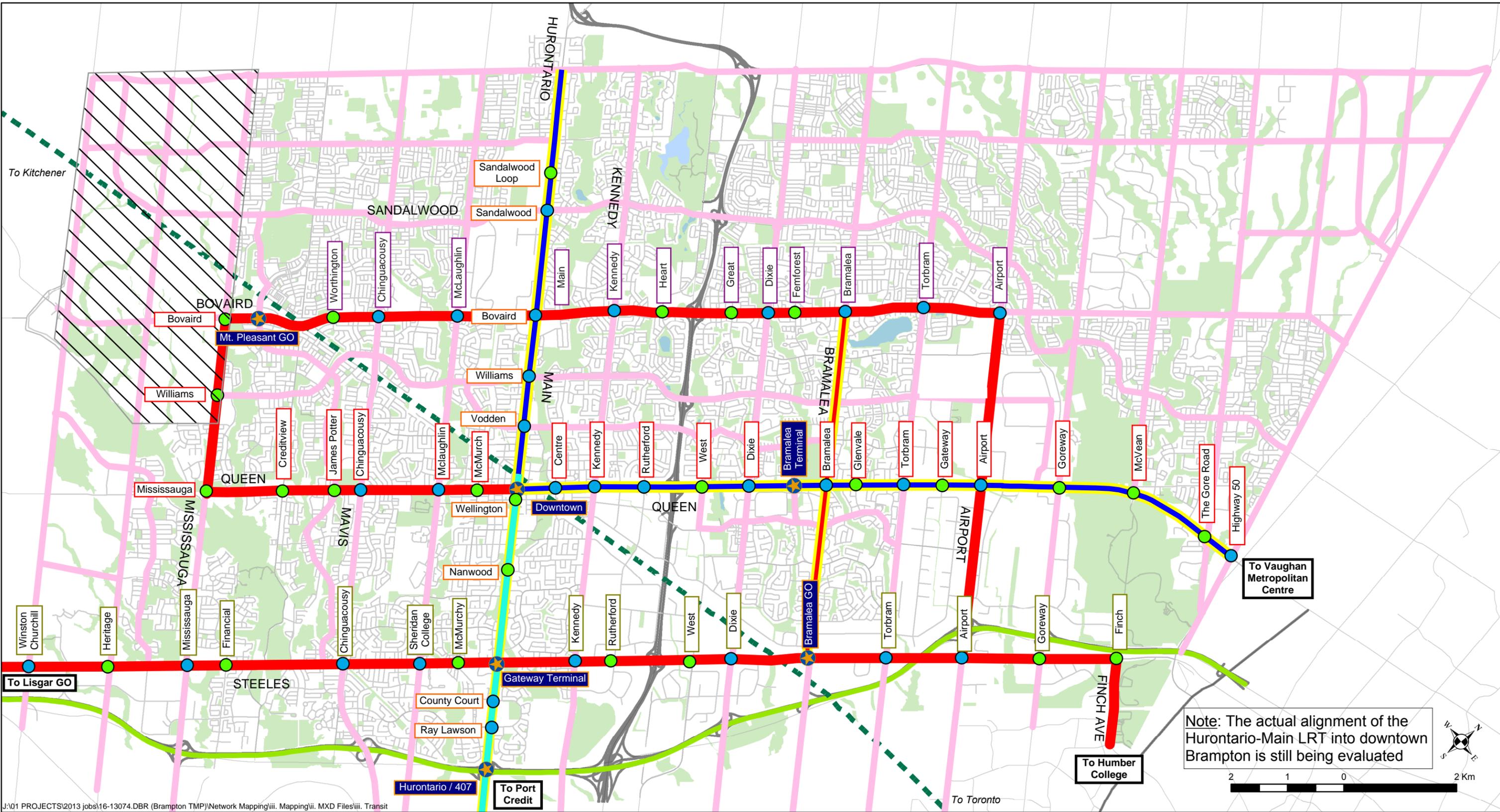
Figure 3.3
Recommended ZUM
Implementation by 2021

3.4 Recommended Network by 2031

To achieve the identified transit mode share target of 16% by 2031, it is recommended that higher order transit facilities be implemented in strategic locations. The existing ZÜM facility largely operates in mixed traffic with transit priority measures at intersections. By contrast, higher order transit (Rapid Transit) facilities, that could be bus or rail, operate in their own exclusive lanes with minimal impact from general auto traffic. Planning has been underway for the Main/Hurontario LRT which will travel from Mississauga to Downtown Brampton and the early implementation of this facility is recommended. The current study also recommends the addition of two Rapid Transit corridors connecting to the planned LRT terminus in downtown Brampton:

- Main Street Rapid Transit (Queen St to Mayfield Rd); and
- Queen Street Rapid Transit (Main St to Vaughan Metropolitan Centre).

These facilities represent the graduation from the existing ZÜM network to a true Rapid Transit facility. Roadway widening should not be undertaken along these roadways without the consideration of transit exclusivity, or transit/HOV designation. In addition to the Rapid Transit projects, an additional ZÜM corridor is proposed for implementation on Bramalea Rd by 2031 as shown in **Figure 3.4**.



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Note: The actual alignment of the Huronario-Main LRT into downtown Brampton is still being evaluated

Legend

- Existing ZUM (2021)
- New ZUM
- GO BRT (Hwy 407)
- New Rapid Transit
- GO Rail
- Support Corridor
- Conceptual Road Network for use in the Development Charges Background Study
- Major Station
- Minor Station
- ★ Intermodal Terminal

Figure 3.4
 Recommended Rapid Transit Implementation by 2031

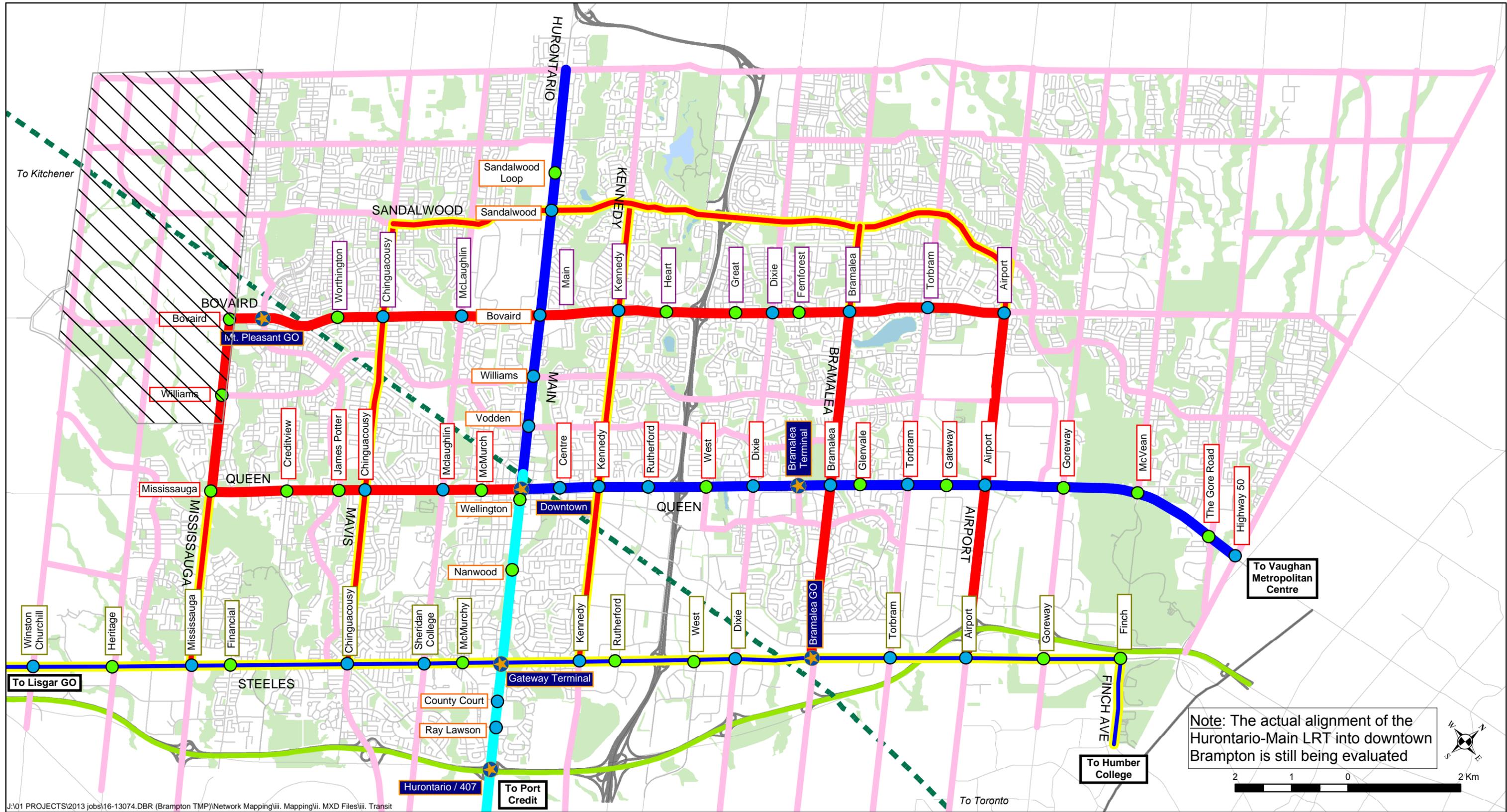


3.5 Recommended Network by 2041

The 2041 transit plan includes an additional Rapid Transit corridor on Steeles Ave as well as numerous additional ZÜM corridors that are required to support the increased transit growth in the northern areas. The Steeles Ave Rapid Transit corridor would operate between the Lisgar GO Terminal (off Winston Churchill Blvd in the west) and Humber College (off Finch Ave W in the east). This could be in the form of a rail or bus service operating in its own exclusive lanes and would intersect with the Main/Hurontario LRT.

By 2041, additional corridors are identified for ZÜM transit facilities as shown in **Figure 3.5**. The growth in the north of Brampton calls for the inclusion of Sandalwood Pkwy as a ZÜM corridor, with connections to the Airport Rd ZÜM and a Bramalea ZÜM. Two additional ZÜM corridors have been identified which connect from the Sandalwood Pkwy ZÜM to Steeles Ave; Chinguacousy Rd and Kennedy Rd. While Kennedy Rd is in close proximity to the Main St corridor, there is potential for a transit technology other than buses to operate on Main St, therefore Kennedy Rd was included to support the bus operations through the core. A ZÜM facility has been included on Mississauga Rd connecting the Queen West ZÜM to Steeles Ave. The Airport Rd corridor is also identified for improved transit priority south of Steeles Ave connecting to Pearson Airport.

Although the modeling supports the implementation of these various ZÜM corridors after 2031, the City may consider implementing them before 2031 in order to help attract more transit ridership and help achieve the desired modal share for transit.



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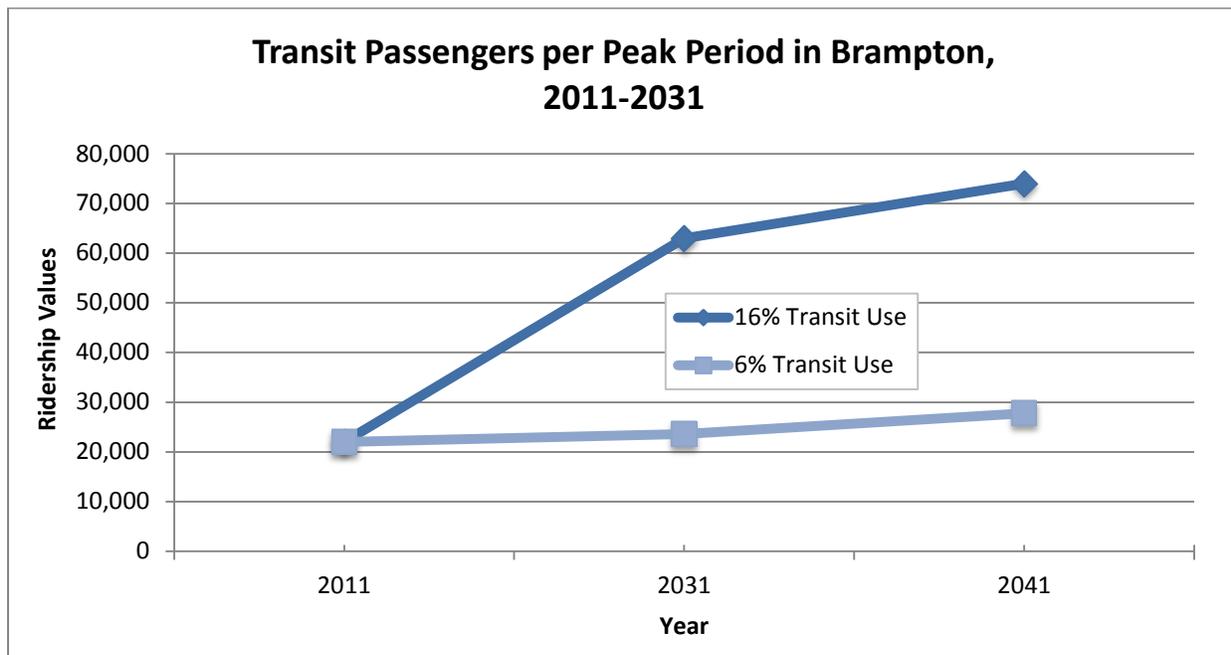
- Existing ZUM (2031)
- GO Rail
- GO BRT (Hwy 407)
- New ZUM
- Existing LRT (2031)
- Existing Rapid Transit
- New Rapid Transit
- Support Corridor
- Conceptual Road Network for use in the Development Charges Background Study
- Major Station
- Minor Station
- ★ Intermodal Terminal

Figure 3.5
Recommended Rapid Transit
Implementation by 2041

3.6 Ridership

The existing and forecasted ridership for Brampton Transit is presented in **Figure 3.6**. Two different ridership forecasts are shown, one based on the current transit mode share of 6% and the other based on a goal of 16% transit mode share. This provides a measure for effectively tracking the progress of recommended transit improvements, and seeing if the 16% mode share goal is being achieved. Ridership values can be assessed on an annual basis.

Figure 3.6 – Transit Passengers per Peak Period in Brampton, 2011-2031



3.7 GO Transit

GO Transit plays a key role in bridging the boundaries between municipalities and regions, making it an important factor in the growth of the City. GO train service on the Kitchener line, which provides connections to the Mount Pleasant, Brampton and Bramalea GO stations, only operates during peak periods on weekdays. This service is uni-directional, with the train travelling from Kitchener to Toronto in the a.m. and from Toronto to Kitchener in the p.m. peak. Including GO buses as well, the existing 2013 mode share for GO Transit is 2%. A target mode share of 4% is assumed in the network model. Increasing service on the Kitchener line to provide two-way all-day service is a key priority to meet the 4% mode share target and for providing more travel options and greater connectivity for people residing, working or visiting in Brampton.

4. INFRASTRUCTURE AND RESOURCES

4.1 Network Elements and Costs

High level costs estimates for LRT facilities that are identified have been developed based on a unit cost of \$50M/km. This cost is used to identify the scale of infrastructure and will vary depending on the need for structures and or grade separations that are required for the alignment. Similarly, a cost for BRT implementation is estimated at \$30M/km for an exclusive facility.

Costs for ZÜM corridors were estimated based on the number of major and minor stations and intersections along the alignment. Unit costs for major and minor stations were provided by Brampton transit as follows: \$258k for Major Station, \$175k for Minor Station, \$570k for Major intersection, and \$430k for Minor intersection.

The Brampton Transit Five Year Business Plan (2013-2017) and the 2012-2021 Capital Budget were reviewed for other cost elements such as for terminals, stops, vehicles, and other related transit infrastructure. This facilitated the identification of capital costs for this TMP Update (until 2041). It must be noted, however, that specific station locations, appropriate terminal points and detailed costing would be studied in more detail in future years before the plans are finalized.

4.1.1 Rapid Transit and Transit Priority Network

The Brampton Transit Five Year Business Plan (2013-2017) outlines the infrastructure and resource requirements for the near term. The following elements have already been budgeted in the Plan (approximately \$71M has been included in the budget for these projects).

- Bovaird ZÜM from Mt. Pleasant GO to Airport Rd (in 2014)
- Steeles W ZÜM from Main St to Lisgar GO (in 2015)
- Queen W ZÜM from Main St to Mississauga Rd and to Mt. Pleasant GO (in 2016)

The recommended transit plan for 2021 includes the Airport ZÜM corridor. Capital costs for the Airport Rd corridor were based on implementation of stations at Bovaird, Cottrelle, Williams, Queen, Clark, Woodslea, and Steeles Ave.

- Airport ZÜM from Bovaird Dr to Bramalea GO (via Steeles Ave) 9.0km \$19M

By 2031 an LRT facility is to be in operation from Mississauga to Downtown Brampton. Costs for this facility are estimated based on implementation of the portion of the facility within the City of Brampton (north of Highway 407).

- Main/Hurontario LRT from HWY407 to Queen St 5.5km \$275M

The other two Rapid Transit corridors identified for implementation by 2031 have not yet been planned and could be either LRT or BRT. A range of costs are therefore provided for these facilities as follows:

- Queen Street Rapid Transit from Main St to Airport Rd 8.3km \$250M – \$415M
- Main Street Rapid Transit from Queen St to Mayfield Rd 7.1km \$215M – \$355M

The only additional ZÜM corridor that is included for implementation between 2021 and 2031 is on Bramalea Rd between Bovaird Dr and Steeles Ave. This facility was included based on the modeled 2031 transit demand, which indicates that this corridor attracts significant transit passengers in peak periods (between 2,000 and 5,500 ppppd) and could benefit from transit priority measures. The facility includes stations at Bovaird, N Park, Williams, Central Park, Queen, Clark, Balmoral, Avondale and at Steeles Ave.

- Bramalea ZÜM from Bovaird Dr. to Bramalea GO Station. 6.2km \$10M

The 2041 transit plan includes an additional Rapid Transit facility on Steeles Ave from the Lisgar GO Station to Humber College. Costs were estimated for the portion of the facility that is within the City of Brampton (between Winston Churchill and Finch Ave).

- Steeles Ave LRT from Winston Churchill to Finch Ave 19.3km \$580M – \$965M

Numerous ZÜM corridors should be implemented by the 2041 planning horizon as follows:

- Sandalwood ZÜM from Chinguacousy Rd. to Airport Rd. 11.5km \$18M
- Bramalea ZÜM from Bovaird to Sandalwood 1.6km \$2M
- Chinguacousy ZÜM from Sandalwood Pkwy. to Steeles Ave. 7.9km \$12M
- Kennedy ZÜM from Sandalwood Pkwy. to Steeles Ave. 8.2km \$13M
- Mississauga ZÜM from Queen St. to Steeles Ave. 3.1km \$5M
- Airport ZÜM from Steeles to Pearson Airport 5.5km n/a

The estimated costs for Rapid Transit and transit priority network implementation are presented in the table below:

Table 4-1 – Cost for Rapid Transit and Transit Priority Network (not including vehicles)

Year	Rapid Transit	ZÜM	Total
2014 – 2017	n/a	\$71M*	\$71M
2018 – 2021	n/a	\$9M	\$9M
2022 – 2031	\$740M – \$1,045M	\$9M	\$749M – \$1,054M
2032 – 2041	\$580M – \$965M	\$50M	\$630M – \$1,015M
TOTAL	\$1,320M – \$2,010M	\$139M	\$1,459M – \$2,149M

* from Brampton Five Year Business Plan (2013-2017) Transit Asset Management Strategy Working Paper

4.1.2 Terminals, Shelters, Pads and Stops

The 2012-2021 Capital Budget and Forecast Summary that is included in the Five Year Business Plan has costs for infrastructure related to the expansion of local service and the upgrade of existing equipment such as bus stops, pads and shelters. The existing plan, which includes adding approximately 35 stops per year for network growth, is continued throughout the life of the plan. From 2018 to 2041 it is assumed that 840 additional stops would be implemented for a total of 3,270 stops by 2041.

The existing landing pad program, which upgrades approximately 90 bus stops per year to be AODA compliant, is assumed to continue towards 100% accessibility, which is estimated to occur by year 2023. In addition, as part of Brampton Transit’s annual bus shelter program, 25 growth bus shelters and 15 replacement ones are installed each year. Brampton Transit adds approximately 35 stops each year, some of which are built and paid for by developers. In 2014, each bus shelter costs approximately \$7,000 and each concrete bus pad approximately \$3,000.

There is a new on-street transit terminal planned in 2016 in northeast Brampton with a budget of \$750,000 according to the ten year Capital Budget. To estimate the total costs for bus shelters pads and stops, a unit cost of \$3,400 per stop was assumed. Table 4-2 presents the number of additional stops required to accommodate system growth, the number of stops that are being replaced, and the resulting total number of new stops used to estimate the capital cost for each of the planning horizons.

Table 4-2 – Cost for Terminals, Shelters and Pads

Year	Growth	Replacement	New Stops	New Terminal	Total Cost
2014 – 2017	163	360	523	1	\$2.4M*
2018 – 2021	140	360	500		\$1.7M
2022 – 2031	350	177	527		\$1.8M
2032 – 2041	350	0	350		\$1.2M
TOTAL	1,003	897	1,900	1	\$7.1M

* from Brampton Five Year Business Plan (2013-2017) Transit Asset Management Strategy Working Paper

4.1.3 Other Infrastructure Costs

Other infrastructure costs that have been included in the Five Year Business Plan and 2012-2022 Capital Budget include the replacement of the transit communications systems (2014) and a new Smartbus server (2015). In 2018, an estimated \$5M has been budgeted for improvements to the fare collection system. It is anticipated that similar costs will be required up to 2041 therefore an additional \$10M has been included in the 2021-2031 timeframe as well as in the 2031-2041 timeframe for technology upgrades. Other infrastructure costs are summarized in Table 4-3.

Table 4-3 – Cost for Other Infrastructure

Year	Other Transit Infrastructure	Total Cost
2014 – 2017	Communications Replacement, Smartbus Server	\$2.0M
2018 – 2021	Fare Collection System	\$5.0M
2022 – 2031	Technology Upgrades	\$10.0M
2032 – 2041	Technology Upgrades	\$10.0M
TOTAL		\$27.0M

* Based on Brampton Five Year Business Plan (2013-2017) Transit Asset Management Strategy Working Paper

4.1.4 Vehicles and Maintenance Facilities

Brampton Transit’s current Business Plan includes plans to purchase buses for service expansion and replacement until the year 2017. This includes articulated buses for the ZUM system and 40-foot buses for conventional service growth. Thirty foot buses are also currently being considered for conventional service for the Mt. Pleasant development. From 2018 to 2041 there will be a need for continued fleet expansion to accommodate the forecast transit system and ridership growth. The plan has been developed on the basis of an 18-year life for buses, which is longer than many other North American transit systems use, and that buses are refurbished after 10-11 years.

Brampton Transit’s current 10-year vehicle acquisition plan shows continued purchase of 60-foot articulated buses for high-capacity service and a continuation of diesel-electric hybrid technology, which have reduced fuel consumption by about 25% in comparison with regular diesel buses, and have reduced maintenance costs.

A review of Brampton Transit’s current vehicle acquisition program to 2022 was undertaken to identify if additional resources would be required during this timeframe based on the revised demand. The analysis has confirmed that by 2017 there will be sufficient vehicles to accommodate the transit demand. Beyond 2017 however, the current vehicle acquisition plan does not include costs for additional BRT vehicles and annual growth vehicles are limited to between 1.9% and 2.5% of the active fleet, which would not be adequate to accommodate the forecast 5.5% growth to 2021 and beyond. The forecast 5.5% annual growth in transit demand from 2011 to 2031 and 1.6% from 2031 to 2041 was used to determine the number of active vehicles required. Table 4-4 presents the existing number of active vehicles in 2011, the planned vehicle acquisition to 2017, as well as the number of active vehicles that will be required by 2021, 2031, and 2041.

Table 4-4 – Resource Requirements

Year	Transit Demand	Active Vehicles	Replacement Vehicles	Refurbishment
2011	21,700	299*	Approximately 3% of fleet per year*	Average of \$120,000 per year*
2017	29,900	432*		
2021	37,000	509	Approximately 5.5% of fleet per year	\$130,000 per year
2031	63,000	867		
2041	73,500	1,012		

* from Brampton Five Year Business Plan (2013-2017) Transit Asset Management Strategy Working Paper

It is noted that with the implementation of LRT on Main Street, there will be an associated reduction in buses required to serve that corridor. A preliminary assessment has indicated that up to 34 buses could be saved across all service providers combined as passengers will be served by LRT instead. Brampton Transit would contribute to approximately one third of this reduction.

This TMP Update also estimates additional costs for replacement vehicles from 2018 to 2041. In order for all of the vehicles to undergo replacement every 18 years, it is estimated that an average of 5.5% of the fleet should be replaced every year. An annual cost for vehicle refurbishment has been included in the 2013-2017 Business Plan, which has been carried forward in this TMP

Update. Table 4-5 includes the costs for acquisition of new vehicles for system growth and replacement of old vehicles as well as costs for vehicle refurbishment.

Table 4-5 – Vehicle Costs

Year	Growth & Replacement Vehicles	Refurbishment	Total Cost	Average Annual Cost
2014 – 2017	\$67M*	\$5M*	\$72M	\$18M
2018 – 2021	\$44M*+\$41M	\$3M	\$88M	\$22M
2022 – 2031	\$425M	\$13M	\$438M	\$44M
2032 – 2041	\$348M	\$13M	\$361M	\$36M
TOTAL	\$925M	\$34M	\$959M	

* from Brampton Five Year Business Plan (2013-2017) Transit Asset Management Strategy Working Paper

There will be a need for an additional Maintenance and Storage Facility (MSF) in 2021 when the fleet size exceeds the capacity of the two existing garages at Clark and Sandalwood, including the expansion of the Sandalwood facility. The total capacity of these facilities would be approximately 510 buses. By 2021, it was determined that 509 buses will be required to serve the transit demand. For the purposes of the capital plan, the new MSF is assumed to have capacity for 250 buses bringing the total bus capacity to 760 buses.

A further facility will therefore be needed in 2028 to support the fleet expansion since by 2029 approximately 780 buses will be required for service. Details regarding the planned fleet acquisition program are provided in Appendix B.

Although a full study will be required to identify the precise locations of these two garages, initial thoughts provided by Brampton Transit Staff are that, to enhance the efficiency of service and reduce dead-heading, the garages should be located in emerging growth areas. The first garage should be built in Northeast Brampton and the second in Southwest Brampton.

While Brampton Transit is not currently planning to purchase any double-decker buses, the need for two new garages in the period from 2018 to 2041 would make this possible. Double-decker buses are being increasingly used in Canada¹ for suburban commuter services for which the 84 seats they can provide make for a comfortable ride. However, articulated buses with 54 seats are more efficient for high-volume routes with rapid turn-over because of their three doors and ability to accommodate large numbers of standees.

The possibility of using Compressed Natural Gas (CNG) to fuel future buses is being considered by Brampton Transit staff but the additional infrastructure costs may rule this option out.

¹ OC Transpo and GO Transit are making widespread use of double decker buses.



For the purpose of this TMP Update, it is estimated that the cost of a garage to accommodate 250 buses would be approximately \$75M (based on a unit cost of \$300,000 / bus). These costs are included in the planned infrastructure costs for the year 2021 and 2028 as shown in Table 4-6.

Table 4-6 – Maintenance and Storage Facility (MSF) Costs

Year	Maintenance and Storage Facility	Total Cost
2014 – 2017		
2018 – 2021	Garage for 250 buses in 2021	\$75M
2022 – 2031	Garage for 250 buses in 2028	\$75M
2032 – 2041		
TOTAL		\$150M

4.1.5 Summary of Capital Costs

Table 4-7 summarizes the various infrastructure and vehicle costs for the various planning horizons.

Table 4-7 – Total Transit Capital Costs (\$ Millions)

Year	Network	Stops	Vehicles	MSF	Other	Total	Average Annual
2014 – 2017	\$71	\$2.4*	\$72*		\$2*	\$147	\$37
2018 – 2021	\$9	\$1.7	\$88	\$75	\$5	\$179	\$45
2022 – 2031	\$749 - \$1,054	\$1.8	\$438	\$75	\$10	\$1,274 - \$1,579	\$127 - \$158
2032 – 2041	\$630 - \$1,015	\$1.2	\$361		\$10	\$1,002 - \$1,387	\$100 - \$139
TOTAL	\$1,459 - \$2,149	\$7.1	\$959	\$150	\$27	\$2,602 - \$3,292	

* from Brampton Five Year Business Plan (2013-2017) Transit Asset Management Strategy Working Paper

The range of costs is provided as it is unknown at this time what Rapid Transit technology will be adopted for the Queen St corridor and Main St corridor north of Queen Street. It is noted that future infrastructure costs are higher than those already budgeted for near term projects. The implementation of Rapid Transit Infrastructure in the 2022-2031 and 2032-2041 timeframes has resulted in significantly higher average annual costs than those allocated for ZUM corridor implementation. Details about the capital costs are provided in Appendix B.



4.2 Operating Costs

Operating costs are directly related to revenue vehicle-km and hours of service. With more vehicles in service to achieve improved coverage and service frequency, it will cost more to operate the system. As ridership grows, services are improved to accommodate the demand and therefore ridership growth is directly related to the amount of service provided. It has been forecast that ridership will grow on the order of 5.5% annually from 2011 to 2031, and by 1.6% from 2031 to 2041. Operating costs have therefore been estimated assuming that the amount of service grows at the same rate. The 846,000 vehicle service hours provided in 2011 will therefore grow to approximately 1,503,000 vehicle hours by 2021 as shown in Table 4-8.

Table 4-8 – Transit Demand and Operational Costs (\$2013)

Year	Peak Transit Demand	Annual Service Hours	Annual Operating Cost	Annual Revenue (45% R/C)	Net Annual Operating Cost
2011	21,700	846,000	\$82.1M*		
2017	29,900	1,275,000	\$141.4M*		
2021	37,000	1,503,000	\$153.8M	\$69.2M	\$84.6M
2031	63,000	2,560,000	\$262.0M	\$117.9M	\$144.1M
2041	73,500	2,986,000	\$305.6M	\$137.5M	\$168.1M

* from Brampton Five Year Business Plan (2013-2017) Transit Asset Management Strategy Working Paper

A review of the existing operating costs suggests that in 2013 it cost approximately \$102 per hour of revenue service. While the Business Plan includes a 3% growth per year, this TMP Update maintains costs in constant dollars and the rate of \$102 per hour is used for estimating future annual operational costs to 2041. The increase in service hours therefore directly results in higher annual operational costs. The details supporting this analysis are provided in Appendix B.

The Financial Plan Working Paper that was developed in support of the Five Year Business Plan (2013-2017) reviewed fare and revenue to cost (R/C) ratio strategies. Brampton Transit achieved an R/C ratio of 43% in 2010 and 46% in 2011. The TMP Update maintains this existing R/C ratio with approximately 45% of operating costs being covered by revenue.

5. TRANSIT PRIORITY POLICY FRAMEWORK

5.1 Transit Priority Policy Framework

To achieve the high transit modal split of 16% by 2031, strong supportive policies will need to be in place. As well as financial policies that ensure the required transit infrastructure is available in a timely fashion, there will need to be policies that provide transit with priority over other road users when road capacity is limited. Below are some policies that could be adopted by the City of Brampton.

5.2 Network Corridors

The successful and timely implementation of Brampton's Transit Priority and Rapid Transit network will be a critical element in achieving the city's transportation objectives. The recommended network is comprised of three key components:

Rapid Transit corridors – fast, frequent transit service (BRT or LRT) operating in exclusive lanes with a high level of priority at crossing intersections.

In general, Rapid Transit corridors are recommended for implementation where potential transit ridership is high and where there is the ability to provide a catalyst for city-building projects that will enhance the economic and social health of the city.

Rapid Transit may be introduced when roads are widened, or where this is not an option, by designating a specific lane for transit.

ZÜM corridors – operating frequent service in HOV or general traffic lanes with clearly branded vehicles and station stops and with a high degree of transit priority at intersections; and

Transit priority corridors – establish a network of transit priority corridors where the traffic signal co-ordination is based upon a series of transit traffic signal pre-emptions.

5.3 Proposed Policies

The City of Brampton will implement a seamless network of Rapid Transit, ZÜM and Transit Priority corridors as recommended in the TMP Update.

When roads designated for Rapid Transit are widened, an exclusive lane will immediately be provided for the use of transit/HOV vehicles.

The City of Brampton shall strive to secure funding partners, set aside appropriate funding in capital budgets and implement the Rapid Transit Network as recommended in this TMP Update.

The City of Brampton shall ensure the planning studies and business cases are developed for the recommended Rapid Transit network well in advance of implementation.

6. CONCLUSION

Introduction of two-way, all-day GO train service to the three GO train stations in Brampton is important to achieving mobility goals set forth in the TMP Update. Brampton Transit routes will service the GO train stations to distribute passengers to and from the stations, which will extend the reach of transit in the city by providing convenient connections to other origins and destinations.

Implementation of near term transit improvements that have been identified in the previous 2009 TTMP have already been included and budgeted in the 5 year Business plan (2013-2017). These ZÜM corridors have been carried forward as part of the TMP Update as follows:

- Bovaird ZÜM from Mt. Pleasant GO to Queen St. (in 2014)
- Steeles W ZÜM from Main St. to Lisgar GO (in 2015)
- Queen W ZÜM from Main St. to Mississauga Rd. and to Mt. Pleasant GO (in 2016)

To support the growth that is identified, an additional ZÜM corridor is recommended by 2021 as follows:

- Airport ZÜM from Steeles Ave. to Bovaird Dr.

In view of the very rapid growth of the City to 2031, the plan includes the early implementation of Light Rail Transit (LRT) and expansion of the ZÜM network in line with Metrolinx' 'Next Wave' of the 'Big Move' projects. In particular the plan includes the following for implementation by 2031:

- Hurontario-Main Street LRT: from southerly boundary to Downtown Brampton
- Hurontario-Main Street Rapid Transit: from Downtown Brampton to Mayfield
- Queen Street Rapid Transit: from Downtown Brampton to Airport Rd - the timing again should be well before 2031 as it is part of Metrolinx' Next Wave of Big Move Projects
- Bramalea ZÜM: from Steeles Ave. to Bovaird Dr.

From 2031 to 2041 the plan includes an additional rapid transit facility and numerous ZÜM corridors as follows:

- Steeles Rapid Transit: between Lisgar GO and Highway 427 (Humber College)
- Sandalwood ZÜM from Chinguacousy to Airport Rd
- Chinguacousy ZÜM from Sandalwood Dr. to Steeles Ave. W
- Kennedy ZÜM from Sandalwood Dr. to Steeles Ave. W
- Mississauga ZÜM from Queen St. W to Steeles Ave. W
- Airport ZÜM from Steeles Ave. to Pearson Airport

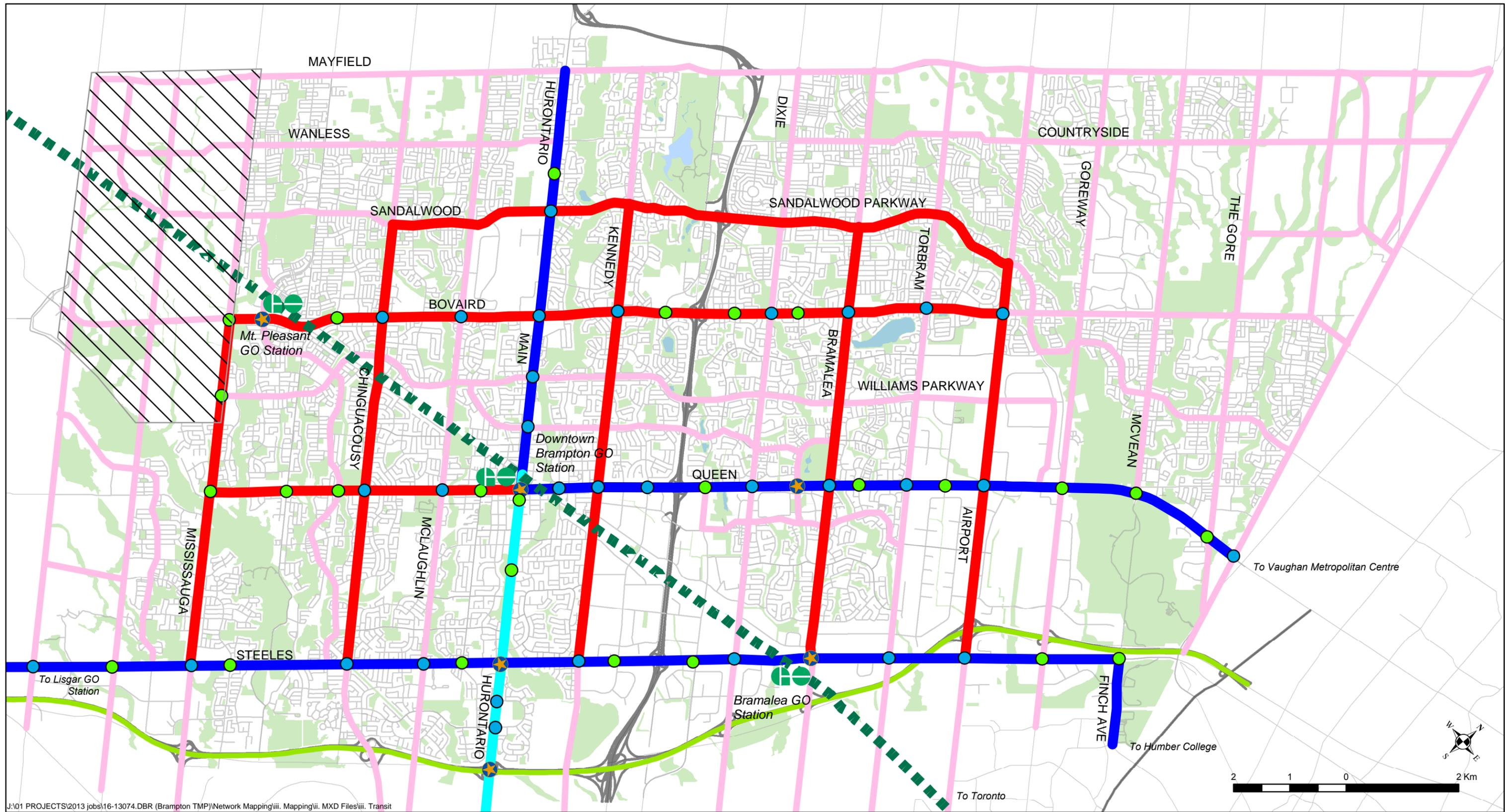
While this technical report has established a timeframe for the implementation of various ZÜM corridors, the City may consider implementing them ahead of schedule in order to help attract more transit ridership and help achieve the desired modal share for transit.

The ultimate transit map for 2041 is shown in Figure 6.1. In addition to the identified facilities, growth in transit ridership and improved transit mode share will require additional resources



including vehicles, stops and shelters, and increased operational costs. These elements, among others, have been identified for each of the planning horizons including their associated costs.

In addition to the network facilities, there will be costs for two major maintenance facilities and systems upgrades and the net operating costs will grow in concert with ridership growth.



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Legend

- █ Higher Order Rapid Transit
- █ ZUM
- █ Hurontario / Main LRT
- █ GO Rail
- Support Corridor
- GO Train Station
- Conceptual Road Network for use in the Development Charges Background Study

Notes:

1. All routes running outside of the City of Brampton will be determined through additional detailed service planning on strategic corridors.
2. Transit services will be provided to new growth areas in Bram West, Northwest Brampton, and Northeast Brampton. Determination of corridor types will be established through the Secondary Planning Process. Connections to key future transit routes outside of Brampton should be provided as required.
3. "Higher Order Transit" are projects identified by Metrolinx in the Big Move.

Figure 6.1
Recommended Transit Network Needs to 2041