## APPENDIX G

### **Quantitative Multi-Modal Assessment**





# SCARBOROUGH CENTRE TMP

Quantitative Multi-Modal Assessment

JANUARY 2017



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#### 1.0 Introduction

Building upon Progress Memo #1, a quantitative multi-modal assessment was conducted to evaluate the existing performance of all transportation facilities within the Scarborough Centre Transportation Master Plan (SCTMP) study area. This includes quantifying the demand, utilization, comfort, convenience, conditions and level of service (LOS) for pedestrians, cyclists, transit riders and automobile drivers within Scarborough Centre. It should be noted that the goods movement analysis is currently being undertaken and will be provided at a later stage, pending consultations with the relevant stakeholders.

### 2.0 Methodology

The criteria used to quantitatively evaluate each mode of transportation differ. **Table 1** summarizes the method and resources used for each mode of travel:

Mode	Methodology	Outcome
Pedestrian	Pedestrian LOS in this report is measured using the following	Identification of segments
	criteria: Sidewalk width, grass or paved boulevard width from	within the study area that
	the sidewalk to travel lane, the presence of on-street parking,	have the best and worst
	traffic volumes and operating speeds.	pedestrian conditions.
	Cycling LOS evaluates the presence or absence of cycling	
	infrastructure within the study area. The following criteria	Identification of segments
	were used to determine cycling LOS: Bicycle lane width, curb	within the study area that
Cycling	lane width, on-street parking, heavy vehicle volume, overall	have the best and worst
	traffic volume, the percentage of right and left turns, speed	cycling conditions.
	limit and the number of travel lanes.	
	The transit analysis focuses on surface bus routes within the	Identification of the bus
	study area, examining departure and arrival demand and	stops, routes and
Transit	utilization, the presence of stops with a shelter and/or bench.	intersections that have the
	Analysis for Line 3 – Scarborough was not conducted due to	strongest demand and
	the anticipated Scarborough Subway Extension	utilization in the study area.
Automobile	The Highway Capacity Manual (HCM), Synchro Version 8 and	Identification of
	InterCalc software were used to evaluate operational	intersections/approaches
	conditions. This includes quantifying volume/capacity ratio	with traffic constraints.
	(V/C), delay and queue lengths, peak hour factors, and	
	percentage of heavy truck vehicles (based on existing network	
	configuration), traffic volumes and signal timing for	
	intersections within the study area.	

Table 1: Summary of Approach

#### 3.0 Pedestrian

Historically, the assessment of transportation services has primarily focused on vehicular traffic, with no existing and widely accepted standard LOS rating for pedestrians and cyclists. Nevertheless, quantifying the walking experience within the study area is important to identify areas with needed improvements. An analysis of pedestrian LOS was conducted, based on the table identified in **Appendix A**. The availability of sidewalks within the study area is shown in **Figure 1**.

As shown in **Figure 2**, the majority of pedestrian infrastructure in the Centre is an LOS E. LOS E is largely characterized by fragmented and disconnected sidewalk infrastructure, narrow sidewalks, high traffic speeds, and lack of physical separation between sidewalks and streets.

The Town Centre Commercial Precinct, which mainly encompasses the Scarborough Town Centre shopping mall, is predominately an LOS F, which indicates the absence of safe pedestrian infrastructure. LOS F streets signify that sidewalks are either entirely absent or are less than 1.5 metres in width. Examples of absent sidewalks are found on the west side of Brimley Road, Triton Road (Figure 3), and many segments of Progress Avenue near the Scarborough Town Centre shopping mall. Road channelization and lack of designated pedestrian crossings compound the negative impact of missing sidewalks and therefore limit pedestrian activity throughout the Centre.





Figure 2: Pedestrian level of service in the SCTMP study area

![](_page_6_Figure_1.jpeg)

#### Notes:

1 Enclosed pedestrian walkway on Progress Avenue bridge

2 Enclosed pedestrian bridge from McCowan TTC station

3 Separated pedestrian path that connects Progress Avenue pedestrian walkway (1) to the bridge from McCowan TTC Station (2); presence of street trees and other street enhancements \*Given LOS A despite failure to meet criteria; represents sidewalk enhancements (e.g. lighting, seating, streetscaping)

Figure 3: Triton Road (LOS F) (Source: Google Street View)

![](_page_7_Picture_1.jpeg)

The highest pedestrian LOS identified in the study area is an LOS A, which was assigned to separated pedestrian trails and walkways. The highest rating given to a sidewalk in the area, however, was LOS B. A Level of service B score indicates a pleasant pedestrian experience. Examples of this type of environment are found on Town Centre Court and segments of Borough Drive (**Figure 4**). The wide walkways, street trees, and parked cars act as buffers from the motorized traffic, contributing to the safety, comfort, and overall ambiance of the area. Furthermore, a limited number of streets do provide pedestrian-friendly sidewalks and other amenities that facilitate pedestrian activity, which is not captured in the pedestrian LOS table.

![](_page_7_Picture_3.jpeg)

Figure 4: Borough Drive (LOS B)

The street segments where sidewalk improvements have been made are marked with an asterisk in Figure 2. For example, the northeast corner of Brimley Road and Ellesmere Road (Figure 5) provides a large open space for pedestrians that is not accounted for in the pedestrian LOS table found in Appendix A.

Figure 5: Northeast corner of Brimley Road and Ellesmere Road provides an improved pedestrian experience (Source: Google Street View)

![](_page_8_Picture_2.jpeg)

While pedestrian LOS measures can be used to highlight areas where the built environment fails to provide adequate active transportation infrastructure, there are limitations to this method as these objective measures only capture some of what is occurring. These measures do not provide insight into how pedestrians perceive the quality of their environment nor do they represent a diversity of experiences within the pedestrian population (e.g. vulnerable users such as the elderly and disabled). Other studies of pedestrian LOS incorporate qualitative information on comfort, convenience, and perceived safety of pedestrian routes. In situations where the LOS rating determined by the table was overruled by a more accurate rating based on qualitative assessment of the area, streets were marked with an asterisk. Qualitative measures that were examined as part of Progress Memo #1, and incorporated into Figure 2, include the following:

- Mobility: Grade of path, crossing delay or detour
- Safety: Exposure to vehicles at mid-blocks. Exposure to vehicles at crossings
- Access: Crossing opportunities and level of access
- Information: Traveler information available including signage and wayfinding
- Amenity: Footpath pavement conditions, comfort and convenience features, security, aesthetics

**Figure 6** illustrates the 5 and 10-minute walkshed image originating at the proposed McCowan Gateway at the intersection of McCowan Road and Bushby Drive/Town Centre Court. The location was chosen based on its proximity to existing and proposed transit. As this figure shows, individuals can travel north as far as Highway 401 and can walk south of Ellesmere Road within 10 minutes. Greater impedance exists with respect to travelling east-west across the study area. Overall, the existing walkability of Scarborough Centre, is limited by the existing coarse auto-oriented street pattern.

![](_page_9_Figure_1.jpeg)

Figure 6: Five and ten minute walkshed image from proposed McCowan Gateway

#### 4.0 Cycling

An analysis of cycling LOS was conducted based on the LOS table identified in **Appendix A**. Overall, it can be concluded that the current cycling level of service in the study area is poor. There are no dedicated cycling facilities present, causing the majority of streets to be categorized as LOS E or F (**Figure 7**). LOS E or F indicates the absence of a dedicated cycling lane with relatively high traffic volumes and speeds of 60 km/h (e.g. Midland Avenue, Progress Avenue, Brimley Road, Ellesmere Road, McCowan Road, and Markham Road). This creates a dangerous cycling environment, as higher speeds result in less comfortable environments for cyclists.

![](_page_11_Figure_0.jpeg)

![](_page_11_Figure_1.jpeg)

\*Meets criteria for LOS A; however, no separation is provided between cyclists and other modes of transportation, producing unsafe/uncomfortable cycling conditions

Based on the above, a large number of conflict zones exist for cyclists in the study area, including the Highway 401 on and off ramps, arterial roads, grade separations, and major intersections. Overall, the existing conditions contribute to the poor cycling performance of the streets, which currently represent a deterrent to cycling within the study area.

Slower traffic speeds on industrial roads (e.g. Schick Court, Cosentino Drive) make it intrinsically safe for cyclists according to the LOS table, resulting in level of service (LOS) A scores. However, achieving LOS A does not necessarily mean that it is safe to be used by most cyclists. For example, Schick Court (**Figure 8**) is mostly used by heavy trucks, making it less comfortable or accessible for cyclists.

![](_page_12_Picture_2.jpeg)

Figure 8: Schick Court (Source: Google Street View)

#### 5.0 Transit

Scarborough Centre is a major transportation hub, with strong transit services via rapid transit (Line 3 – Scarborough) and local and regional bus routes. This includes 14 TTC bus routes (regular and express routes), 4 GO-Transit Buses, regional transit services (Greyhound, Coach Canada and Megabus). Detailed analysis of each TTC bus route and stop within the study area can be found in **Appendix B**. Analysis for TTC Line 3 - Scarborough was not conducted due to the anticipated Scarborough Subway Extension.

Ridership data provided by the TTC indicates a given route's boardings, alightings, and average load for the morning and afternoon peaks hours. The date and source of the transit data for each route is provided in **Table 2**. The capacities of each TTC route were calculated as a function of the number of transit vehicles per peak hour on the date of the survey, the type of transit vehicle and the transit vehicle's capacity. The ridership demand is a function of the average load before or after boarding. The transit vehicle utilization percentage has been separated as before the transit stop (arrival demand) and after the transit stop (departure demand). It should be noted that bus services provided by the TTC fluctuate based on observed demand. The existing TTC transit capacity analysis is summarized in **Table 3** and **Table 4**.

TTC Route	Date of Survey	Source
9 Bellamy	September 6, 2015	TTC
16 McCowan	February 14, 2014	TTC
21 Brimley	January 31, 2015	TTC
38 Highland Creek	March 8, 2013	TTC
43 Kennedy	January 27, 2012	TTC
95 York Mills	October 22, 2013	TTC
129 McCowan North	October 3, 2014	TTC
130 Middlefield	January 8, 2013	TTC
131 Nugget	December 8, 2014	TTC
133 Neilson	January 11, 2013	TTC
134 Progress	April 2, 2013	TTC
169 Huntingwood	May 26, 2015	TTC
190 Scarborough Rocket	December 8, 2015	TTC
199 Finch Rocket	January 5, 2016	TTC

Table 2: Date and Source of Transit Ridership Data

Table 3: Highest utilization of TTC bus stop (per route) within Scarborough Centre during the morning peak hour (ranked based on departure)

Route	Direction	Location	Capacity *	Departure Demand	Departure Utilization **	Arrival Demand	Arrival Utilization **
AM PEAK HOU	R						
134 Progress	NB	Scarborough Centre Station	742	593	80%	0	0%
129 McCowan North	SB	Triton Road at McCowan Road	636	469	74%	469	74%
133 Neilson	SB	Ellesmere Road at Bellamy Road North	371	270	73%	266	72%
131 Nugget	WB	Triton Road at McCowan Road	477	319	67%	318	67%
95 York Mills	WB	Ellesmere Road at Brimley Road	848	523	62%	477	56%
130 Middlefield	SB	McCowan Road at Triton Road	265	160	60%	161	61%
38 Highland Creek	WB	Ellesmere Road at McCowan Road	424	254	60%	231	54%
21 Brimley	SB	Brimley Road at Progress Avenue	530	290	55%	290	55%
9 Bellamy	NB	88 Corporate Drive	212	95	45%	81	38%
16 McCowan	NB	McCowan Road at Ellesmere Road	477	209	44%	214	45%
190 Scarborough Centre Rocket	WB	Scarborough Centre Station	636	224	35%	14	2%
43 Kennedy	NB	Progress Avenue at Midland Avenue	265	54	20%	51	19%
199 Finch Rocket	WB	Scarborough Centre Station	1219	167	14%	14	2%
169 Huntingwood	EB	McCowan Road at Triton Road	159	17	11%	16	10%

\*Assume capacity of buses is 53 persons (Orion VII)

\*\*Departure and arrival utilization is based on observed conditions at the time of survey, but is not a fixed value. It is expected that the TTC will adjust services based on an increase or decrease in demand.

Route	Direction	Location	Capacity *	Departure Demand	Departure Utilization **	Arrival Demand	Arrival Utilization **
PM PEAK HOU	R						
133 Neilson	NB	Ellesmere Road at McCowan Road	477	418	88%	405	85%
129 McCowan North	NB	McCowan Road at Progress Avenue	795	683	86%	675	85%
21 Brimley	NB	Brimley Road at Progress Avenue	371	301	81%	292	79%
131 Nugget	EB	McCowan Road at Progress Avenue	424	329	78%	329	78%
38 Highland Creek	WB	Ellesmere Rd at Dolly Varden Boulevard	583	452	78%	441	76%
134 Progress	SB	100 Consilium Place	636	460	72%	437	69%
95 York Mills	EB	Ellesmere Road at Birkdale Road	265	190	72%	188	71%
16 McCowan	SB	McCowan Road at Ellesmere Road	530	322	61%	276	52%
9 Bellamy	SB	Bellamy Road North at Ellesmere Road	212	126	59%	111	52%
130 Middlefield	NB	McCowan Road at Progress Avenue	265	133	50%	131	49%
43 Kennedy	SB	Progress Avenue at Cosentino Drive	212	93	44%	90	42%
190 Scarborough Centre Rocket	WB	Scarborough Centre Station	795	318	40%	15	2%
199 Finch Rocket	WB	Scarborough Centre Station	795	199	25%	15	2%
169 Huntingwood	EB	McCowan Road at Triton Road	159	17	11%	18	11%

Table 4: Highest utilization of TTC bus stop (per route) within Scarborough Centre during the afternoon peak hour (ranked based on departure)

\*Assume capacity of buses is 53 persons (Orion VII)

\*\*Departure and arrival utilization is based on observed conditions at the time of survey, but is not a fixed value. It is expected that the TTC will adjust services based on an increase or decrease in demand.

The transit network, as shown in **Figure 9**, has 37 bus shelters, 28 marked bus stops, and 3 rapid transit (Line 3 - Scarborough) stops. It should be noted that TTC buses stop at the Scarborough Centre Bus Terminal, with the exception of the 95 York Mills bus route, which services stops along Ellesmere Road.

The 134 Progress Avenue TTC bus route is observed to have the highest utilization within the Centre (peak utilization of 80%). To enter/exit the terminal station, this bus route conducts a complex loop around Grangeway Avenue, Bushby Drive, McCowan Road and then Consilium Place. Approximately 600 people board/alight the 134 Progress Avenue TTC bus route at the Scarborough Centre Station during the morning peak hour. Furthermore, it was observed that the busiest bus stop/station in the study area, after the Scarborough Centre, is the bus shelter at the intersection of Corporate Drive and Lee Centre Drive, as 136 people utilize the route during the morning peak hour in the southbound direction. The above indicates that a large number of people who work and live in the residential and office developments on Corporate Drive are using the bus services to access the Civic and Town Centre Commercial Precincts (instead of walking and cycling), the communities and neighbourhoods north of Highway 401, and TTC Line 3 - Scarborough.

Other notable bus routes with strong demand during morning peak hour are TTC route 129 (McCowan North) and TTC route 133 (Neilson). Finally, it was noted that the intersections that service the most transit users are located predominantly on Ellesmere Road, at the intersections with Midland Avenue, Brimley Road, McCowan Road, Bellamy Road North, and Markham Road. Other notable intersections with heavy demand from transit users are Progress Avenue and Bellamy Road North, as well as Corporate Drive and Lee Centre Drive.

During the afternoon peak hour, TTC route 129 McCowan North has the highest ridership with 683 people utilizing the bus route during the afternoon peak hour, resulting in a peak utilization of 86%. It should be noted that 97% of users of TTC bus route 129 (McCowan North) board from Scarborough Centre Station. TTC route 133 (Neilson) is the second busiest bus route, with 500 people, and a peak utilization of 88%. The bus route operates between Scarborough Centre Station and the areas of Neilson Road, Crow Trail, and Morningside Heights. Both routes utilize Triton Road (at the intersection with McCowan) to enter the Scarborough Centre bus terminal.

It should be noted that complex maneuvers for some bus routes were observed within the study area. For example, at McCowan Road (between the intersection of Triton Road and Bushby Drive), buses pick up passengers at McCowan Station, only to conduct a difficult maneuver to make a left turn at Triton Road, to access the Scarborough Centre Bus Terminal. The buses only have approximately 40 metres to accelerate through 2 lanes of through traffic (60 km/h speed limit), which can result in delays for transit users during peak congestion periods.

Figure 9: Existing transit routes and stops in the SCTMP study area

![](_page_17_Figure_1.jpeg)

#### 6.0 Automobile

In order to better understand existing automobile traffic conditions, 47 intersections were assessed within Scarborough Centre. The outcome of this section is to identify intersections and approaches with traffic constraints and to quantify the percentage of drivers that by-pass the study area, as opposed to ending their journey in Scarborough Centre. Detailed results of the automobile analysis can be found in **Appendix C**.

Traffic conditions were defined as good, fair or poor based on the Highway Capacity Manual (HCM) level of service indicators. Synchro Version 8 and InterCalc software were used to calculate the Level Of Service for signalized and unsignalized intersections. **Table 5** details the level of service (LOS) categories and corresponding criteria.

Category	LOS	Delay in seconds (unsignalized intersection)	Delay in seconds (signalized intersection)
Good	А	≤10	≤10
	В	10-25	10-15
Fair	С	20-35	15-25
	D	35-55	25-35
Poor	E	55-80	35-50
	F	>80	>50

Table 5: Auto LOS categories and vehicle control delay for unsignalized and signalized intersections (HCM)

As shown in **Figure 10**, some delay and queue lengths were observed at intersections along major arterial streets during the morning peak hour. Some congestion was observed on several left-turn movements on Ellesmere Road, McCowan Road, and Progress Avenue. The intersection of Midland Avenue and Ellesmere Road is also identified to have congestion on all left turns, westbound through and right turn approaches, resulting in the traffic operation levels being constrained at this intersection, due to high left turn volumes competing with high opposing through volumes. The intersection of McCowan Road and Ellesmere Road show high volumes of traffic in the eastbound left, westbound through and northbound left approaches; with long queues in the northbound left turn lane.

Figure 10: Auto level of service (morning peak hour) in the SCTMP study area

![](_page_20_Figure_1.jpeg)

With regards to the afternoon peak hour, as shown in **Figure 11**, traffic constraints were identified at intersections on Ellesmere Road, McCowan Road, Brimley Road and Markham Road. Intersections identified as experiencing poor traffic conditions are Markham Road at Progress Avenue, and Markham Road at Ellesmere Road, where heavy north/south through traffic inhibits left turns. The McCowan Road and Ellesmere Road intersection also operates at poor traffic conditions, where heavy eastbound traffic inhibits westbound left turns. Midland Avenue and Ellesmere Road show heavy volumes of left turn traffic in all but the southbound direction, resulting in fair traffic conditions. Similarly, fair traffic conditions can be seen on McCowan Road at Town Centre Court, and Brimley Road at Ellesmere Road and at a number of intersections along Progress Avenue.

Figure 11: Auto level of service (afternoon peak hour) in the SCTMP study area

![](_page_22_Figure_1.jpeg)

#### 7.0 Conclusions

The evolution towards a multi-modal urban centre, where transit, walking, and cycling are more attractive than driving, is a major challenge in Scarborough Centre. The goal of the Scarborough Centre Transportation Master Plan (SCTMP) will be to improve connections by supporting and encouraging sustainable and active modes of transportation and reducing automobile dependence. The findings of this assessment identify areas of improvement for transportation facilities within the study area. Based on the above analysis, the following conclusions are made:

Mode	Conclusions
Pedestrian	<ul> <li>The majority of pedestrian infrastructure in the Centre is categorized as LOS E. LOS E is largely characterized by fragmented and disconnected sidewalk infrastructure, narrow sidewalks, high traffic speeds, and lack of physical separation between sidewalks and streets.</li> <li>The Town Centre Commercial Precinct is predominantly an LOS F, which indicates the absence of safe pedestrian infrastructure. LOS F streets can indicate sidewalks are either entirely absent or are less than 1.5 metres in width</li> <li>The highest pedestrian LOS identified in the study area is an LOS B, which is predominantly in the Civic Precinct. LOS B indicates a pleasant pedestrian experience.</li> </ul>
Cycling	<ul> <li>There are no dedicated cycling facilities present, causing the majority of streets to be categorized as LOS E or F, which indicates the absence of a dedicated cycling lane on routes with relatively high traffic volumes and speeds</li> <li>A large number of conflict zones exist for cyclists in the study area, including the Highway 401 on and off ramps, arterial roads, grade separations, and major intersections.</li> </ul>
Transit	<ul> <li>Transit services in the study area have strong local and regional connections</li> <li>The busiest bus stop/station in the study area, after Scarborough Centre Station, is the bus shelter at the intersection of Corporate Drive and Lee Centre Drive, as 136 people utilize the stop during the morning peak hour in the southbound direction. This indicates that some communities that are within walking distance of the Civic and Town Centre Commercial Precincts choose to use transit due to poor pedestrian and cycling connectivity.</li> <li>Intersections that service the most transit users are located predominantly on Ellesmere Road, at intersections with Midland Avenue, Brimley Road, McCowan Road, Bellamy Road North and Markham Road. Other notable intersections with heavy demand from transit users are Progress Avenue and Bellamy Road North, as well as Corporate Drive and Lee Centre Drive.</li> <li>Several major bus routes in the study area conduct complex loops and maneuvers to enter the Scarborough Centre Bus terminal at the eastern section of Triton Road.</li> </ul>
Automobile	<ul> <li>Significant traffic constraints were observed at the intersections of Markham Road and Ellesmere Road, as well as McCowan Road and Ellesmere Road, during morning and afternoon peak hours. This is due to high left turn volumes competing with high opposing through volumes.</li> <li>The majority of intersections in the study area are operating at an acceptable level of service. This contributes to the attractiveness of driving in the study area.</li> </ul>