DURHAM – SCARBOROUGH
Bus Rapid Transit

Appendix B4 –
Ellesmere Road Truck Analysis

Prepared for Metrolinx
by IBI Group & Parsons

IBI GROUP
7th Floor – 55 St. Clair Avenue West
Toronto ON M4V 2Y7 Canada
tel 416 596 1930 fax 416 596 0644
ibigroup.com

Memorandum - DRAFT

To/Attention	Project File	**Date**	September 17, 2021
From	Syed Imam, Parsons	**Project No**	119887
cc	Scott Johnston, Margaret Parkhill		
Subject	Durham-Scarborough BRT: Analysis of Truck Operations along Ellesmere Road & Progress Avenue **DRAFT – Subject to City of Toronto Review**		

Widening Ellesmere Road to provide two centre-median transit-only lanes and four lanes for general traffic (two lanes per direction) is the preferred solution for the Durham Scarborough Bus Rapid Transit (BRT) project. This will transform the street into an urban corridor that supports future development, moves more people more efficiently, and will provide new active transportation infrastructure for walking and cycling.

Unsignalized intersections and driveways will become right-in right-out configuration only. This will enhance the safety performance of the road for all modes and provide the highest level of transit reliability. Left-turns will be relocated to signalized intersections only and will occur on a fully-protected left-turn phase. Fully protected left-turns will increase the safety performance of the signalized intersections by reducing conflict points between vehicles and vulnerable road users.

This memorandum summarizes the analysis of existing truck operations and future truck access along Ellesmere Road west of Markham Road. This study area was assessed in two segments: 1) between Grangeway Avenue and Bellamy Road, and 2) between Bellamy Road and Markham Road. The data used for this study was collected in September and October 2020, between the hours of 7:30 a.m. and 12 p.m. At this time, the province was in Stage 3 of re-opening, which started on July 31, 2020 in Toronto.[1] See Appendix A for truck type definitions.

Trucks and Access Locations: Grangeway Avenue to Bellamy Road

There are 13 unsignalized driveways along this segment of Ellesmere Road.

During the site visit, approximately 20 trucks per hour were observed turning into and out of the driveways on Ellesmere Road between Grangeway Avenue and Bellamy Road. Observations included:

- 75% of trucks were light or medium trucks
- 75% of trucks turned left in or out of the driveways

[1] https://globalnews.ca/news/6859636/ontario-coronavirus-timeline/

Exhibit 1: Driveway locations on Ellesmere Road between Grangeway Avenue and Bellamy Road

Trucks and Access Locations: Bellamy Road and Markham Road

There are 11 unsignalized driveways along this segment of Ellesmere Road, and one driveway at the signalized intersection of Dolly Varden Boulevard.

During the site visit, approximately 40 trucks per hour were observed turning into and out of the driveways on Ellesmere Road between Grangeway Avenue and Bellamy Road. Observations include:

- 70% of trucks turned right-in or right-out
- Of the 40 trucks per hour:
  - 90% or 36 trucks per hour were light or medium trucks
  - 10% or 4 heavy trucks per hour

More than 80% of the trucks observed used the signalized intersection at Dolly Varden Boulevard (location 11 in the graphic below).

Exhibit 2: Driveway locations on Ellesmere Road between Bellamy Road and Markham Road

Changes to Access with Durham-Scarborough BRT

Passenger vehicles, small and medium single unit trucks will be able to make U-turns at any of the signalized intersections along Ellesmere Road during the fully protected left-turn phase. Between Grangeway Avenue and Bellamy Road, signalized intersections include Grangeway Avenue, Parkington Crescent and Bellamy Avenue. Between Bellamy Road and Markham Road, signalized intersections include Dolly Varden Boulevard and Markham Road.

As part of the Durham-Scarborough BRT project, a new signal is proposed to be located at one of the driveways between driveway locations 4 to 7 shown in Exhibit 2. The project team recommends the signal be located at location 6, the driveway between 1970 and 1990

Ellesmere Road, to align with the load access to Centennial Recreation Centre. This location can be refined in detail design in consultation with City of Toronto.

Alternative Routes for Heavy Trucks and Tractor Trailers

While the majority of trucks entering and exiting the driveways are light and medium sized, an alternative route was assessed for large trucks. Progress Avenue is a suitable route for heavy trucks and tractor trailers. Trucks would make a series of right turns to access the driveways along Ellesmere Road. This alternative route assumes that the trucks are travelling to/from the immediate area and are not able to divert using the broader transportation network.

Since Progress Avenue, Bellamy Road, and Markham Road all currently facilitate relatively large volumes of trucks turns, the alternative routing is expected to be free from geometric constraints such as turn radii.

Exhibit 3: Potential alternative routes for heavy trucks and tractor trailers

(a) Route today (Left-in) west of Bellamy Road *(b) Route today (Left-out) west of Markham Road*

Progress Avenue Truck Operations

Two signalized intersections were assessed to quantity the potential impact of 4 heavy trucks per hour using this alternative route: Progress Avenue at Bellamy Road / Corporate Drive and Progress Avenue at Markham Road.

Current performance at the two signalized intersections along the proposed alternative route was analysed: Bellamy Road/Corporate Drive and Markham Road. Development applications at 670 Progress Avenue and 42 Tuxedo Court involved detailed Synchro analysis for Progress Avenue at Bellamy Road/Corporate Drive, and Progress Road at Markham Road, respectively. Signal timing and turning movement count data were retrieved from these two previous development applications in the area from the City of Toronto's Application Information Centre website.

Turning movement counts for Progress Avenue at Markham Road were available for 2019, and an annual growth rate of 1.3% was applied. The growth rate is based on City Staff recommendations according to the 670 Progress Avenue Development Application.

Volumes for large trucks and the respective percentage for the turning movement at the two intersections are summarized below in **Table 1.**

Table 1: Large Truck Volume and Percent at Progress Avenue

Movement	Progress Avenue & Bellamy Road / Corporate Drive		Progress Avenue & Markham Road	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
EBL	0 (0%)	0 (0%)	8 (5%)	8 (2%)
EBR	4 (5%)	3 (1%)	7 (6%)	3 (2%)
WBL	4 (2%)	2 (1%)	8 (4%)	9 (4%)
WBR	15 (12%)	16 (16%)	2 (4%)	2 (1%)
NBL	0 (0%)	0 (0%)	0 (0%)	4 (4%)
NBR	3 (1%)	4 (1%)	12 (5%)	12 (5%)
SBL	16 (15%)	20 (15%)	2 (1%)	1 (1%)
SBR	0 (0%)	0 (0%)	13 (3%)	9 (3%)

Existing Conditions

Based on the turning movement count and signal timing data compiled for the two intersections of interest, the existing conditions are presented in **Table 2** for the a.m. peak hour and **Table 3** for the p.m. peak hour. The table summarizes overall intersection volume to capacity ratio, delay, and level of service, in addition to the performance of critical movements in the a.m. and p.m. peak periods. Critical movements are defined as those with LOS E or F or having a v/c ratio above 0.85.

Table 2: Existing Traffic Conditions along Progress Avenue (a.m. peak hour)

Intersection	AM Peak Hour							
	Overall			Critical Movements				
	V/C	Delay (s)	LOS	Dir	V/C	Delay (s)	LOS	95th Queue (m)
Progress Avenue & Bellamy Road / Corporate Drive	0.63	16.5	B	-	-	-	-	-
Progress Avenue & Markham Road	0.82	36.9	D	EBL	0.82	58.7	E	54.3

Table 3: Existing Traffic Conditions along Progress Avenue (p.m. peak hour)

Intersection	PM Peak Hour							
	Overall			Critical Movements				
	V/C	Delay (s)	LOS	Dir	V/C	Delay (s)	LOS	95th Queue (m)
Progress Avenue & Bellamy Road / Corporate Drive	0.93	21.0	C	WBL	0.93	67.3	E	83.0
Progress Avenue & Markham Road	1.17	56.5	E	EBL	0.88	45.9	D	102.1
				WBL	1.17	139.0	F	96.9
				NBT	1.01	61.4	E	202.8
				SBT	1.01	61.8	E	200.0

During the a.m. peak hour, Progress Avenue at Bellamy Road / Corporate Drive operates well below capacity, while Progress Avenue at Markham Road operates adequately. Given a short protected phase for the eastbound left movement at Progress Avenue and Markham Road, the delay is relatively high, but the movement still operates below capacity during the a.m. peak period.

In the p.m. peak hour, the westbound left movement at Bellamy Road/Corporate Drive has high delay and is near capacity, despite the overall intersection operating adequately. At Progress Avenue and Markham Road, several movements operate at or above capacity, resulting in high overall delay and LOS. The westbound left, northbound through, and southbound through movements all operate with a volume to capacity ratio greater than 1.00, and LOS E or F.

Additional Capacity

Using the Synchro 10 software suite for operation analysis, the number of additional large trucks that each of the intersections could reasonably accommodate was identified. In some cases, individual movements significantly exceed capacity before intersection LOS becomes E or F. It was therefore assumed that intersection capacity was reached when either the intersection LOS reaches E or F, or when the addition of a large truck resulted in multiple opposing movements operating at a volume to capacity ratio above 1.00, or LOS F. This maximum additional truck capacity is rounded to the nearest 5 trucks per hour. **Table 4** below summarizes the additional capacity for large trucks.

Table 4: Additional Truck Capacity at Progress Avenue Intersections

	AM Peak Hour	PM Peak Hour
Progress Avenue & Bellamy Road / Corporate Drive	75 trucks/hr	20 trucks/hr
Progress Avenue & Markham Road	40 trucks/hr	0 trucks/hr

During the a.m. peak hour, both intersections have the capacity to accommodate significantly more large trucks from alternative routing.

During the p.m. peak hour, given that the westbound left movement at Progress Avenue and Bellamy Road/Corporate Drive is already near capacity, accommodating additional truck volume at the intersection is approximately 20 trucks/hr. However, this capacity is sufficient to accommodate the anticipated 4 heavy trucks per hour based on the 2020 site observations.

During the p.m. peak hour, the intersection of Progress Avenue and Markham Road is at capacity. However, given the alternative routing shown in Exhibit 3, will not add trucks to this intersection; rather trucks that currently travel northbound through on Markham Road (red line) will instead make an eastbound left from Progress Avenue (yellow line). This change for the anticipated 4 heavy trucks per hour will have no measurable difference in the operation of the intersection of Progress Avenue and Markham Road. The results are shown in Table 5 and Table 6.

Table 5: Analysis of Trucks using Alternative Route (a.m. peak hour)

Markham Road & Progress Avenue	AM Peak Hour							
	Overall			Critical Movements				
	V/C	Delay (s)	LOS	Dir	V/C	Delay (s)	LOS	95th Queue (m)
Existing Conditions	0.82	36.9	D	EBL	0.82	58.7	E	54.3
Relocate 4 NB trucks to EBL	0.85	37.0	D	EBL	0.85	63.6	E	58.6

Table 6: Analysis of Trucks using Alternative Route (p.m. peak hour)

Markham Road & Progress Avenue	PM Peak Hour							
	Overall			Critical Movements				
	V/C	Delay (s)	LOS	Dir	V/C	Delay (s)	LOS	95th Queue (m)
Existing Conditions	1.17	56.5	E	EBL	0.88	45.9	D	102.1
				WBL	1.17	139.0	F	96.9
				NBT	1.01	61.4	E	202.8
				SBT	1.01	61.8	E	200.0
Relocate 4 NBT trucks to EBL	1.17	55.9	E	EBL	0.90	48.5	D	106.8
				WBL	1.17	139.0	F	96.9
				NBT	0.99	58.8	E	201.0
				SBT	1.01	61.8	E	200.0

Summary

The Durham-Scarborough Bus Rapid Transit is proposed to operate in dedicated centre-median transit-only lanes along Ellesmere Road. This will transform the street into an urban corridor that supports future development, moves more people more efficiently, and will provide new active transportation infrastructure for walking and cycling.

Unsignalized intersections and driveways will become right-in right-out configuration only. Passenger vehicles and small trucks will be able to make U-turns at any of the signalized intersections along Ellesmere Road during the fully protected left-turn phase.

While the majority of trucks entering and exiting the driveways are light and medium sized, an alternative route was assessed for large trucks. Progress Avenue is a suitable route for heavy trucks and tractor trailers. Trucks would make a series of right turns to access the driveways along Ellesmere Road. This alternative route assumes that the trucks are travelling to/from the immediate area and are not able to divert using the broader transportation network.

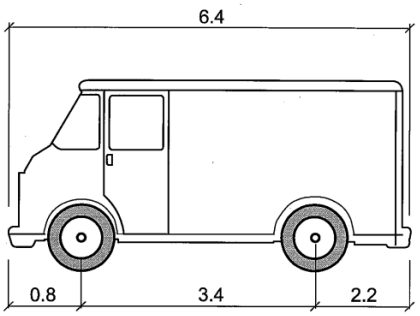
Two signalized intersections were assessed to quantity the potential impact of 4 heavy trucks per hour using this alternative route: Progress Avenue at Bellamy Road / Corporate Drive and Progress Avenue at Markham Road.

- During the a.m. peak hour, both intersections have the capacity to accommodate many more heavy trucks from alternative routing.
- During the p.m. peak hour, the intersection of Progress Avenue and Bellamy Road/Corporate Drive has the capacity to accommodate approximately 20 heavy trucks per hour, which is sufficient for the anticipated 4 heavy trucks per hour.
- During the p.m. peak hour, the intersection of Progress Avenue and Markham Road operates at capacity. However, the alternative route will not add trucks to this intersection; rather trucks that currently travel northbound through will instead make an eastbound left. As a result, this change for the anticipated 4 heavy trucks per hour will have no measurable difference in the operation of the intersection of Progress Avenue and Markham Road.

Appendix A: Truck Type Definitions

SOURCE: “Design Vehicle Dimensions for Use in Geometric Design” Technical Report, Transportation Association of Canada (1997)

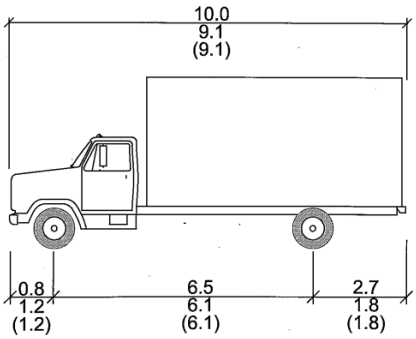
FIGURE 6.3
LIGHT SINGLE-UNIT TRUCK DIMENSIONS



LEGEND: *Proposed dimensions*

Notes: All dimensions are in metres
Figure not to scale.

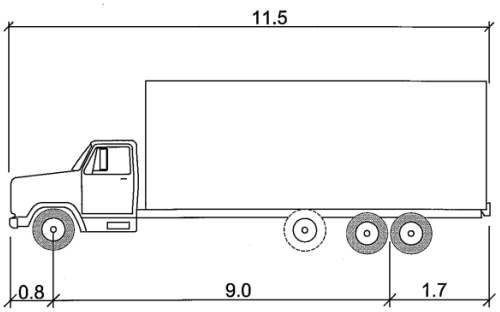
FIGURE 6.4
MEDIUM SINGLE-UNIT TRUCK DIMENSIONS



LEGEND: *Proposed dimensions*
TAC Design Vehicle
(AASHTO Vehicle)

Notes: All dimensions are in metres
Figure not to scale.

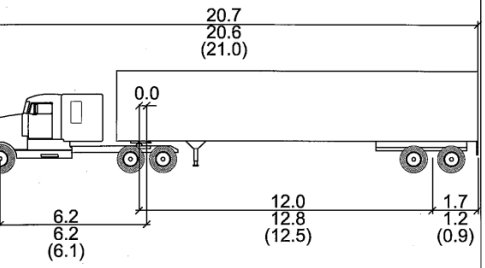
FIGURE 6.5
HEAVY SINGLE-UNIT TRUCK DIMENSIONS (TENTATIVE)



LEGEND: *Proposed dimensions*

Notes: All dimensions are in metres
Figure not to scale

FIGURE 6.6
WB-19 TRACTOR-SEMITRAILER DIMENSIONS



LEGEND: *Proposed dimensions*
TAC Design Vehicle
(AASHTO Vehicle)

Notes: All dimensions are in metres
Figure not to scale.