APPENDIX

B

TRAFFIC ANALYSIS SUMMARY MEMO

MEMORANDUM

TO: Jessica Dorgo, P.Eng., Halton Region
CC: Sandy Nairn, MCIP, RPP, WSP

FROM: Scott Fortner, P.Eng., WSP

SUBJECT: Steeles Avenue Municipal Class EA – Tremaine Road to Industrial Drive
Traffic Analysis Summary Update
Project 17M-00979-00

DATE: April 28, 2022

Introduction

Halton Region retained WSP Canada Group Limited (WSP) to undertake a Municipal Class Environmental Assessment (MCEA) for Steeles Avenue (Regional Road 8) from Tremaine Road (Regional Road 22) to Industrial Drive, in the Town of Milton. The need for additional capacity in the Steeles Avenue Corridor was identified in *The Halton Region Transportation Master Plan – The Road to Change*[1].

The widening of Steeles Avenue to four lanes has been completed from immediately west of Industrial Drive easterly. Construction of the realigned Tremaine Road and a roundabout at Steeles Avenue also included provisions for a four-lane approach immediately east of the roundabout. The review of the need for the widening of Steeles Avenue as part of the current undertaking includes the evaluation of future operating performance from west of Tremaine Road to east of Industrial Drive in addition to the consideration of the requirements for network continuity. This analysis approach also reflects corresponding upstream impacts within the project limits.

Background

The Halton Region Transportation Master Plan – The Road to Change[1] identified a need for the widening of Steeles Avenue from Tremaine Road (the westerly limit of the urban boundary) to Industrial Drive to address travel demand requirements by 2031. Currently, the CP Galt Subdivision (two tracks) crosses Steeles Avenue at grade between Tremaine Road and Peru Road. The MCEA Study will also review the need for a grade separation between Steeles Avenue and the CP railway.

This traffic analysis, completed as part of the Steeles Avenue MCEA Study, has been carried out in two parts by applying a travel demand forecasting approach established based on discussion with Halton Region. Travel demand forecasting includes a review of current travel demand and projected growth through the application of Halton Region's afternoon peak hour travel demand forecasting model. Demand modelling provides a basis for forecasting traffic growth impacts during the afternoon peak hour, when travel demand is typically highest. Traffic impacts have also been assessed on the basis of inverting the afternoon peak hour travel demand forecasts as a proxy for growth during the morning peak hour. Estimating impacts during each of the weekday peak hours ensures that potential lane geometry and traffic control requirements are fully represented by the traffic analysis.

Afternoon peak hour trips assigned by the demand forecasting model for the planned Milton Heights development area were removed from the demand forecasts generated by the model to establish a background growth projection without this development traffic. The modelled trip generation for the Milton Heights traffic zone was manually assigned to the study area road network based on the planned access

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[1] *The Road to Change Halton Region Transportation Master Plan 2031*, Dillon Consulting Limited in association with GHD Inc. and Aecom, September 2011

to Tremaine Road and Peru Road. Suitable trip distribution patterns were established from a detailed review of travel pattern data available from the *2016 Transportation Tomorrow Survey*[2].

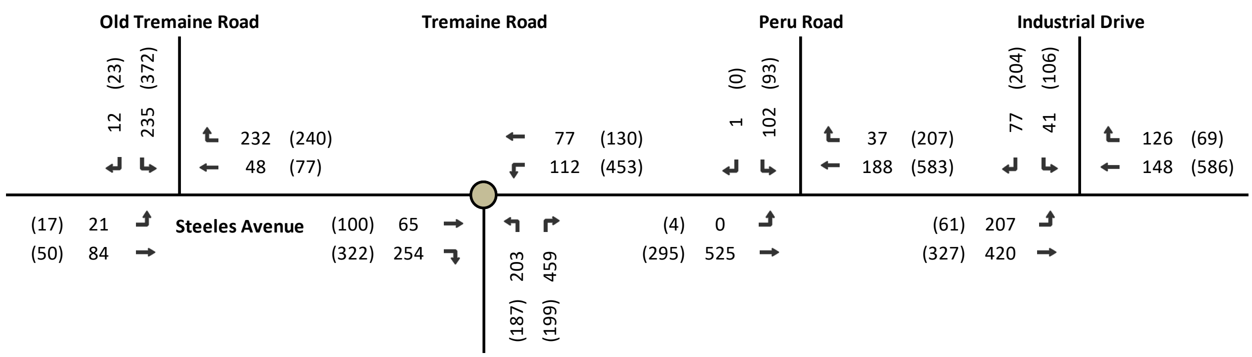
The travel demand forecasts for the peak hours provide the required input to the microsimulation analysis that has been undertaken during the second part of the traffic analysis to determine operational performance impacts. This assessment provides part of the input to establish the need and justification for the MCEA and the identification of a recommended improvement strategy to address future impacts.

A parallel work stream is investigating widening and alignment alternatives from a geometric perspective and impacts corresponding to the proposed CP grade separation. A high level *Roundabout Screening Assessment* has been carried out using the *Halton Region Roundabout Guidelines* and has been documented as part of the traffic analysis in support of the review of alternatives. The traffic analysis and engineering design work will be considered in the overall evaluation of a preferred solution.

Travel Demand Forecasting

Base-year turning movement volumes were established using the available turning movement data for the Steeles Avenue intersections with Old Tremaine Road, Tremaine Road, Peru Road and Industrial Drive. The 2017 turning movement volumes were balanced across the network to ensure that demand was not under-represented. The weekday morning and afternoon peak hour volumes are summarized below in *Exhibit 1*.

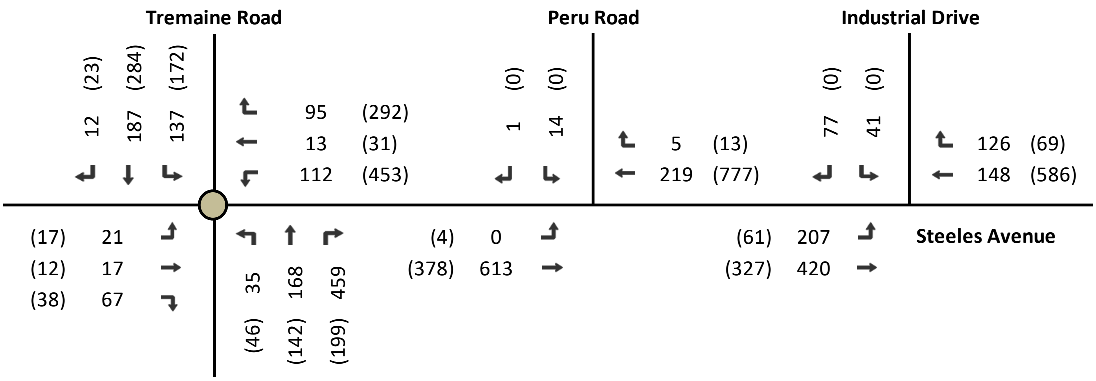
Exhibit 1 2017 AM (PM) Peak Hour Traffic Volumes



The existing turning movement volumes were adjusted to reflect the extension of Tremaine Road northerly from the roundabout, as well as the closure of Peru Road at Sixteen Mile Creek. Demand was estimated for these 26 residences on Peru Road south of Sixteen Mile Creek based on the trip rates outlined for *Single-Family Detached Housing* in *Institute of Transportation Engineers (ITE) Trip Generation* guide. These trips were assumed to be distributed along Steeles Avenue according to the current turning movement volume distributions. The balance of the existing Peru Road traffic was reassigned to Tremaine Road via 3rd Sideroad. The resulting 2017 traffic volumes are summarized below in *Exhibit 2*.

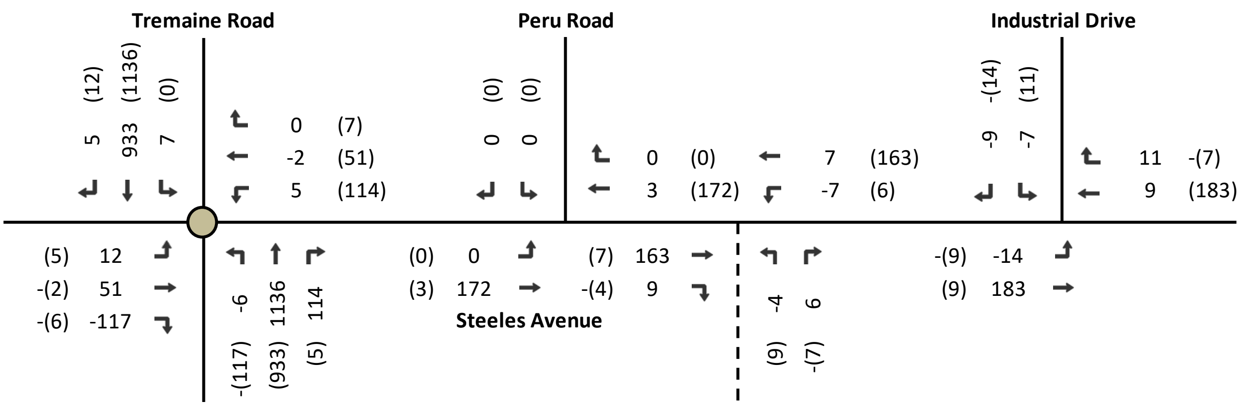
[2] *Transportation Tomorrow Survey*, Data Management Group, University of Toronto, 2016

Exhibit 2 2017 AM (PM) Peak Hour Traffic Volumes Reassigned



Each of the 2016 and 2031 afternoon peak hour turning movement volume projections extracted from the Region's travel demand forecasting model, for the study area intersections, was adjusted to remove the Milton Heights development traffic using select link analysis. The difference between the two *background* turning movement forecasts was assumed to reflect background traffic growth and is summarized below in *Exhibit 3*. Corresponding morning peak hour traffic volumes have been assumed to be the inversion of the modelled afternoon peak hour traffic growth.

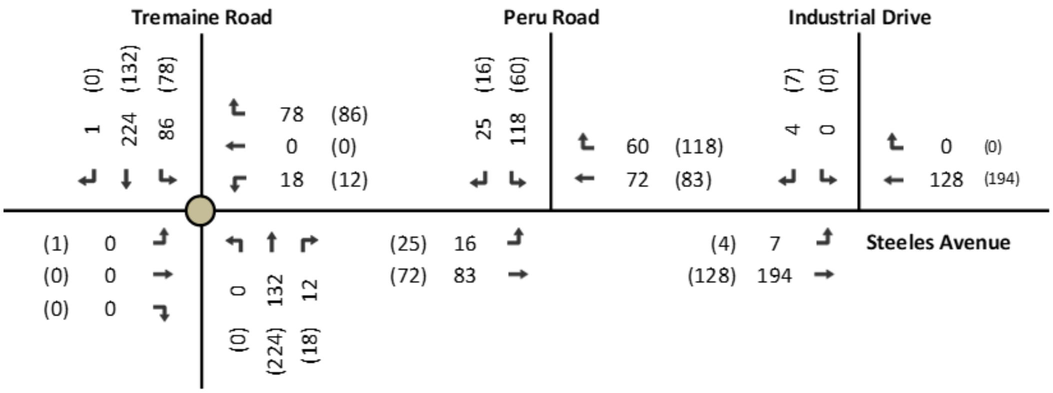
Exhibit 3 2031 Background AM (PM) Peak Hour Traffic Growth



The manual assignment of the afternoon peak hour trips included for the Milton Heights Secondary Planning Area in the Region's 2031 TDM, is summarized in *Exhibit 4*. As indicated in the introduction, this assignment is based on an assumed development trip distribution derived from a detailed review of travel pattern data available from the *2016 Transportation Tomorrow Survey*.

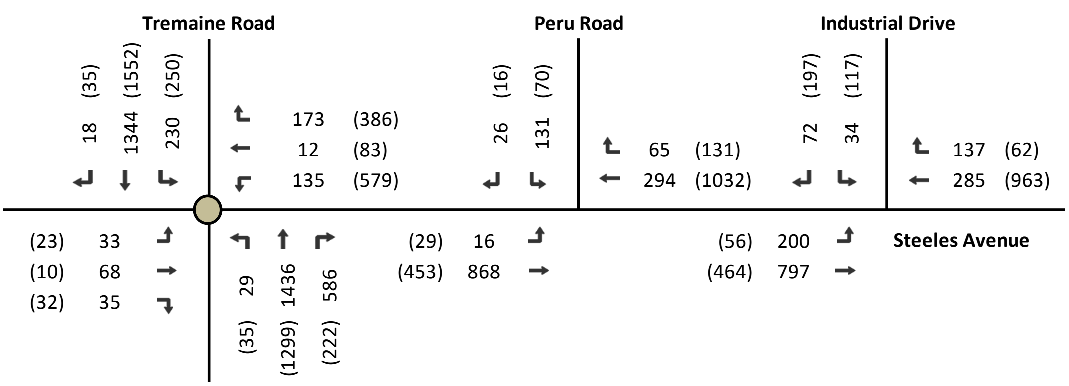
In the same manner that the afternoon peak hour turning movement volumes were inverted to reflect the corresponding morning peak hour travel demand for the background conditions, this same assumption was made to establish the morning peak hour traffic assignment for the Milton Heights Secondary Planning Area.

Exhibit 4 2031 Milton Heights AM (PM) Peak Hour Traffic Volumes



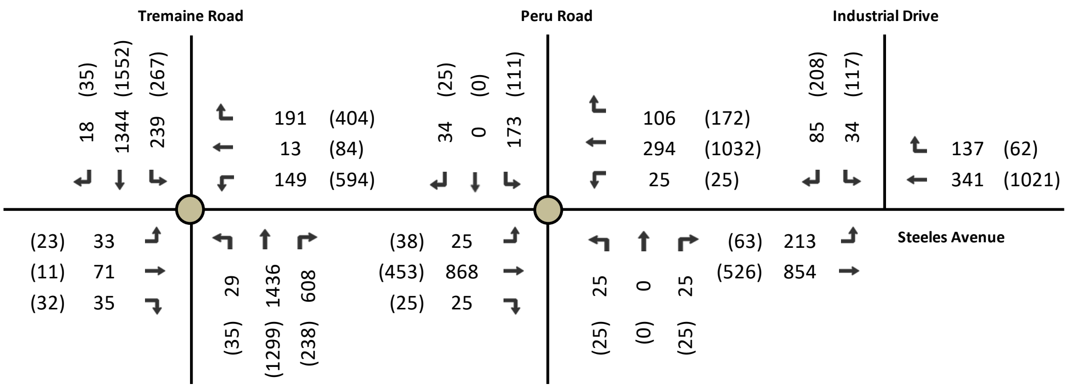
The sum of the 2017 base-year traffic volumes, the background traffic growth to 2031 and the 2031 Milton Heights traffic assignment above, to produce the 2031 Do Nothing Traffic Volume scenario, is summarized below in *Exhibit 5*. The 2016 to 2031 background traffic growth illustrated in *Exhibit 3* results in significant negative volumes in the case of the morning peak hour eastbound right-turn and afternoon peak hour northbound left-turn movements at the intersection of Steeles Avenue and Tremaine Road. The existing traffic volumes plus the assessed Milton Heights development traffic growth for these movements is less than this negative background growth and, therefore, the resulting 2031 volumes are still 'negative' volumes. Therefore, these 'negative' volumes were arbitrarily replaced with 35 vehicles each to represent and to be consistent with the other movements entering and departing the intersection on the west approach.

Exhibit 5 2031 AM (PM) Peak Hour Traffic Volumes: 2031 Do Nothing Scenario



The proposed realignment of Steeles Avenue between Tremaine Road and Industrial Drive would facilitate the railway grade separation. The existing Steeles Avenue alignment east of Peru Road would connect to the realigned Steeles Avenue opposite the entrance to the Milton Banquet and Conference Centre, approximately 340 m eat of Peru Road. All Peru Road traffic would access new Steeles Avenue using this connection. As a result of the realignment of Steeles Avenue, trips generated along existing Steeles Avenue east of Peru Road would also access new Steeles Avenue opposite the entrance to the Milton Banquet and Conference Centre. Trips generated along this section of existing Steeles Avenue and originating from or destined to new Steeles Avenue, have been assumed to be 50 inbound and 50 outbound trips during each to represent weekday peak hours. The traffic analysis also assumes that the demand generated by the Milton Banquet and Conference Centre is the same. This traffic generation was assigned to and from the east and west along Steeles Avenue using the existing turning movement distribution at Peru Road. The assumed trip generation for the uses along Steeles Avenue and for the Banquet and Conference Centre were assumed conservatively to be in addition to the demand assessed as part of the baseline or Do Nothing scenario. The resulting turning movement volume forecasts are summarized below in *Exhibit 6*.

Exhibit 6 2031 AM (PM) Peak Hour Traffic Volumes: Steeles Avenue Realignment



Supplementary Traffic Growth Review

Halton Region requested that WSP determine the resulting growth rate for Steeles Avenue based on the analysis approach outlined above and compare this to the traffic growth rate identified by the demand model for the adjacent screenline west of Bronte Street, from Steeles Avenue to Britannia Road. A corresponding growth rate was also assessed for the study area segment of Steeles Avenue. The Milton Heights Secondary Planning Area development traffic forecast included in the 2016 demand model output was removed for the purpose of generating the required growth rates given that this development has not yet proceeded. A summary of the screenline and Steeles Avenue growth rates derived from the modelled forecasts to the projections summarized in the previous section under the heading *Travel Demand Forecasting*, is provided below in *Exhibit 7*.

Exhibit 7 Traffic Growth Comparison

ANALYSIS APPROACH	SCREENLINE/LINK	GROWTH	2016 BASE YEAR			2031 PLANNING HORIZON		
			EB	WB	Comb	EB	WB	Comb
Travel Demand Model Growth (Halton Region Model)	Screenline	Volume Growth Rate	2,509 -	4,941 -	7,450 -	4,153 4.4%	5,695 1.0%	9,848 2.1%
	Steeles Avenue	Volume Growth Rate	363 -	326 -	689 -	650 5.3%	1,058 15.0%	1,708 9.9%
Traffic Analysis Approach	Steeles Avenue	Volume Growth Rate	433 -	655 -	1,088 -	581 2.4%	1,025 4.0%	1,606 3.4%

Establishing growth rates by combining directional screenline forecasts generated from the Region's travel demand forecasting model was considered as an alternative in this analysis. The corresponding growth rate of 2.1% per annum (after accounting for the absence of the Milton Heights development in 2016) is less than the 3.4% per annum Steeles Avenue growth rate resulting from the traffic analysis undertaken based on the approach outlined in the previous section.

While the link-based growth rate established from the modelling alone is approximately 10% per annum, it is of note that the modelled 2031 demand (1,708 vehicles) is similar to that generated on the basis of the observed demand plus modelled growth plus Milton Heights traffic (1,606 vehicles). The difference between the link based rate generated by the model alone and that resulting from the traffic analysis approach is due to the fact that the modelled 2016 demand is approximately 37% less than the observed conditions (i.e. 689 vs. 1088 vehicles).

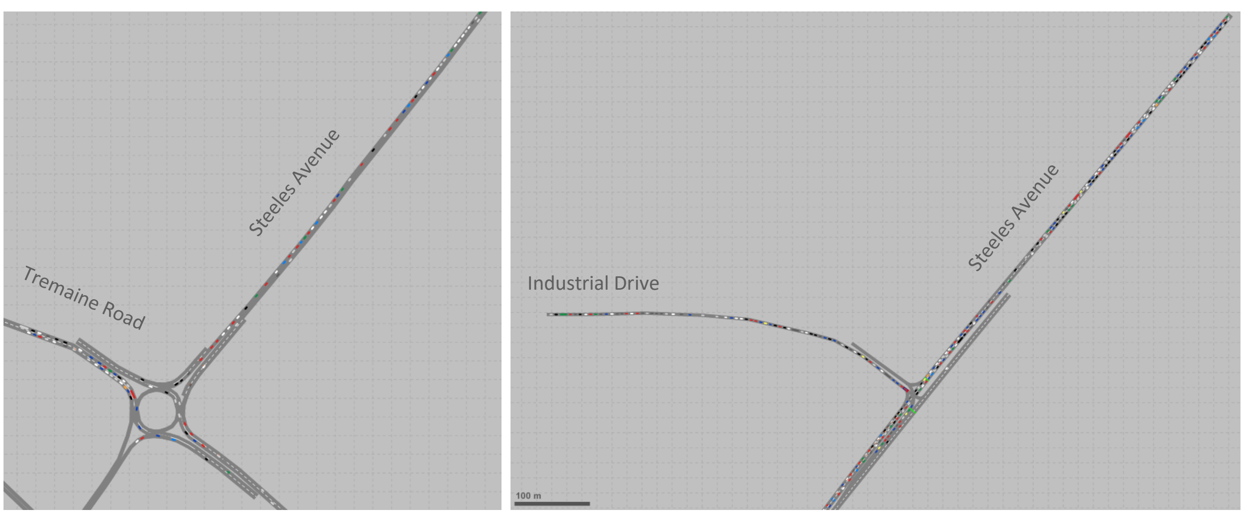
Another relevant factor when comparing the alternative forecasting strategies is to consider the fact that the application of a growth rate to existing demand to assess future impacts does not account for travel pattern shifts that are fully expected as a result of the introduction of the Highway 401 interchange at Tremaine Road. Based on this factor and the growth rate comparisons presented above, the operational analysis documented below reflects the travel demand forecasts summarized in *Exhibit 5*.

Level of Service Analysis

Afternoon peak hour traffic volume forecasts for Steeles Avenue reflect 2031 peak direction travel demand of between 1,050 and 1,160 vehicles and the corresponding peak direction forecasts during the morning peak hour range between and 890 and 1,000 vehicles. These demand levels exceed the Region's established link capacity of 850 vehicles per lane for an urban arterial roadway segment.

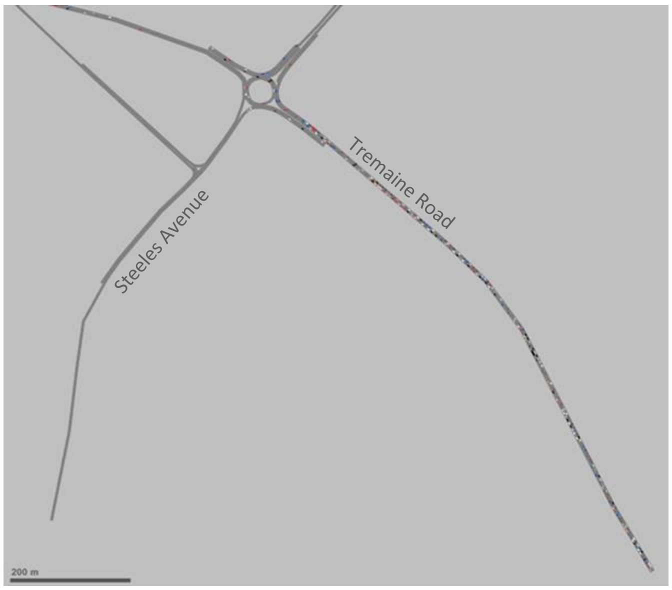
Future network and intersection operating performance was modelled using *Vissim,* and capacity utilization for the signalized intersection of Steeles Avenue at Industrial Drive was assessed using *Synchro*. The microsimulation confirms that modifications to the Steeles Avenue roundabout at Tremaine Road may be required to accommodate a westbound approach consisting of a westbound left-turn lane, a shared through/left-turn lane and a dedicated right-turn lane. The modelling also demonstrates the potential requirement for a revised northbound approach, including a shared left-turn/through lane, a through lane and a dedicated right-turn lane. These possible modifications will be reassessed during the detail design phase. Network impacts without these improvements are illustrated by the simulation screenshots provided in *Exhibits 8 and 9*.

Exhibit 8 PM Peak Hour Westbound Operating Constraints at Tremaine Road (Simulation Screenshots)



Predicted afternoon peak hour westbound left-turn demand onto Tremaine Road approaches 600 vehicles and result in operating constraints based on the current roundabout lane geometry. Assessed westbound queues could be expected to extend towards Martin Street without improvements to the westbound approach. Predicted morning peak hour northbound right-turn demand from Tremaine Road onto Steeles Avenue also approaches 600 vehicles and results in similarly prohibitive operating constraints to those in the westbound direction, based on the current roundabout lane geometry.

Exhibit 9 AM Peak Hour Northbound Operating Constraints at Tremaine Road (Simulation Screenshot)



With the recommended improvements to the westbound and northbound approaches, the level of service analysis identifies adequate operating conditions at the roundabout at Tremaine Road. The results of the modelling based on the current corridor and intersection lane geometry with the exception of the recommended roundabout improvements, are summarized below in *Exhibit 7*.

Exhibit 7 2031 Peak Hour Levels of Service: Do Nothing

Intersection/Movement	Weekday AM Peak Hour				Weekday PM Peak Hour			
	V/C	Delay	LOS	Queue[1]	V/C	Delay	LOS	Queue[1]
Steeles Ave at Tremaine Rd								
Eastbound Left/Through/Right	-	28/28/20 s	D/D/C	30 m	-	88/94/55 s	F/F/F	35 m
Westbound Left/Through/Right	-	13/12/9 s	B/B/A	13 m	-	31/41/17 s	D/E/C	123 m
Northbound Left/ Through	-	28/27 s	D/D	215 m	-	11/11 s	B/B	70 m
Northbound Right	-	6 s	A	0 m	-	1 s	A	0 m
Southbound Left/Through/Right	-	4/3/2 s	A/A/A	24 m	-	49/46/44 s	E/E/E	322 m
Steeles Ave at Peru Rd								
Eastbound Left/Through	-	3/1 s	A/A	0 m	-	20/6 s	C/A	41 m
Westbound Through/Right	-	1/1 s	A/A	0 m	-	3/2 s	A/A	0 m
Southbound Left Right	-	12/10 s	B/B	18 m	-	23/18 s	C/C	17 m
Steeles Ave at Industrial Rd								
Eastbound Left	0.28	8 s	A	24 m	0.18	17 s	B	11 m
Eastbound Through	0.29	3 s	A	30 m	0.18	4 s	A	25 m
Westbound Through/Right	0.16	2/2 s	A/A	20 m	0.41	5/4 s	A/A	49 m
Southbound Left	0.25	50 s	D	21 m	0.57	53 s	D	64 m
Southbound Right	0.38	6 s	A	12 m	0.73	9 s	A	20 m

Note: 1. Queue Lengths reflect 95th percentile queues

The recommended improvements for the roundabout lane geometry address the prohibitive impacts on the westbound and northbound approaches. All movements can be expected to operate with a level of service D or better during each of the peak hours with the exception of afternoon peak hour eastbound left turn and through movement levels of service F and a corresponding right-turn level of service E. These impacts are related entirely to the conflicting demand as the individual eastbound movement volumes are no greater than 32 vehicles.

Operating performance at the Peru Road intersection reflects a level-of-service C or better based on the current lane geometry and traffic control at this location. Similarly, operating performance at the Steeles Avenue intersection with Industrial Drive reflects individual movement levels of service D or better.

It is relevant to point out that predicted operating performance at each of the Tremaine Road roundabout and the signalized intersection with Industrial Drive reflect a basic four-lane cross section on Steeles Avenue. This is despite the assumption that the existing cross-section is maintained between these limits with the exception of the local improvements recommended for the roundabout. Furthermore, while the operating performance at the existing Peru Road intersection is confirmed to reflect adequate side-street levels of service C, the planned realignment of Steeles Avenue will result in greater side street demand based on the trip generation for the residences and businesses along Steeles Avenue between Peru Road and Sixteen Mile Creek as well as a possible opposing driveway serving the Milton Banquet and Conference Centre.

While this additional traffic generated by the existing residences and businesses along Steeles Avenue represent acceptable level of service at key intersections, the traffic volume on Steeles Avenue is expected to approach the capacity of a 2-lane road (i.e. these demand levels exceed the Region's established link capacity of 850 vehicles per lane for an urban arterial roadway segment.) Furthermore, per *Halton Region Transportation Master Plan (2031) – The Road to Change*, Section 3.1.1, Steeles Avenue is the primary east-west Regional arterial road through Towns of Milton and Halton Hills. The section of Steeles Avenue between Bronte Street and Tremaine Road is a major connection to Tremaine Road, which is the westerly limit of the urban boundary in the Town of Milton and will provide a future connection to the Highway 401 / Tremaine Road interchange. From a regional network continuity perspective, Steeles Avenue is proposed to be widened to four-lane cross-section through the project limits.

Railway Grade Separation

The justification for a railway grade separation at realigned Steeles Avenue was evaluated on the basis of the existing and projected railway crossing indices. The combined direction peak hour travel demand reflects the 2017 conditions summarized in *Exhibit 2*. The estimated afternoon peak hour demand between Tremaine Road and Peru Road (after balancing intersection volumes and reassigning trips resulting from the Peru Road closure at Sixteen Mile Creek) reflects the volume at the future railway crossing.

A factor between the afternoon peak hour and daily travel demand was derived using available hourly 24-hour traffic volume data for May 2015. This factor was applied to the available 2017 afternoon peak hour demand to estimate the corresponding 2017 combined direction daily traffic volume.

Canadian Pacific Railway provided an estimate of the daily number of freight trains at the Steeles Avenue crossing in an e-mail in June 2017. This estimate of between 17 and 22 trains has been used to establish the current Railway Crossing Index summarized below in *Exhibit 8*. It should be noted that the train volume for CP is expected to change over the years, as well as the potential for future

Metrolinx services on the same corridor. For the purpose of the MCEA study, the above-noted train volume is used as the basis.

The proposed Steeles Avenue/CP railway grade separation was previously identified in the 2011 *Halton Region Transportation Master Plan (2031) – The Road to Change* as well as the Town of Milton Sherwood Survey Secondary Plan (2008). Furthermore, the need was confirmed on the basis of the railway crossing exposure index at the onset of the MCEA in June 2017.

At the time of the railway crossing exposure index review, most municipalities and road authorities considered that a railway grade separation may be warranted once the Railway Crossing Exposure Index reaches 200,000. The summary presented in *Exhibit 8* illustrates that the Exposure Index at the Steeles Avenue/CP crossing would exceed this threshold with a value of 230,850 based on the estimated 2017 daily travel demand and the low end of the range in daily train traffic identified by Canadian Pacific Railway. The Exposure index ranges between nearly 300,000 and 400,000 based on the other assessed conditions.

Exhibit 8 Railway Crossing Exposure Index

METRIC	VOLUME/EXPOSURE INDEX
May 2015 Afternoon Peak Hour Traffic Volume May 2015 24-Hour Volume May 2015 Peak Hour to 24-Hour Factor	894 10474 8.535%
2017 PM Peak Hour Volume 2031 PM Peak Hour Volume	1159 1530
2017 24-Hour Volume 2031 24-Hour Volume	13579 17926
2017 Daily Train Volume[1]	17 to 22
2017 Railway Crossing Exposure Index (Rounded) *2031 Railway Crossing Exposure Index (Rounded)*	*230,850 to 298,750* *304,750 to 394,350*

Old Steeles Avenue Roundabout Screening

A high-level assessment and evaluation of a suitable connection between the realigned Steeles Avenue and existing Steeles Avenue east of Peru Road was undertaken to evaluate the suitability of a roundabout at this location. This review was carried out in accordance with Halton Region Report No. *PW-44-12 Guidelines for Consideration of Installing Roundabouts on Regional Roads'* and *Attachment 1 to PW-44-12 Guidelines for the use of Modern Roundabouts on Regional Arterial Roadways*. This review also considered criteria outlined in *NCHRP Report 672 Roundabouts: An Informational Guide, Second Edition*, released by the Transportation Research Board.

An evaluation based on the suitability factors for roundabouts, included in the Guidelines for the use of Modern Roundabouts on Regional Arterial Roadways is provided in *Exhibit 9*. The guidelines indicate that where *yes* is indicated for two or more of the suitability factors, a roundabout should be considered in more detail. The summary presented in *Exhibit 9* indicates that there is sufficient property to accommodate a multi-lane roundabout, that it is located at a transition between rural and urban environments and that it could also serve as a gateway to future south end of the Milton Heights development area.

Exhibit 9 Evaluation of Suitability Factors for Roundabouts

NO.	SUITABILITY FACTOR	OUTCOME
1	Is there a historical safety problem at the intersection for motorists or pedestrians?	Yes ☐ No ☒
2	Are capacity problems currently being experienced or expected in the future?	Yes ☐ No ☒
3	Is there a high proportion of turning movements at the intersection?	Yes ☐ No ☒
4	Are traffic signals warranted, or expected to be warranted in the future?	Yes ☐ No ☒
5	Does the intersection experience high side-street delays under stop-control (but not enough to warrant traffic signals)?	Yes ☐ No ☒
6	Is there sufficient property at the intersection (i.e. over 50 metres clear diameter if considering a two-lane roundabout)?	Yes ☒ No ☐
7	Does the intersection have more than 4 legs, or unusual geometry?	Yes ☐ No ☒
8	Will planned modifications to the intersection require that nearby structures be widened (i.e. to accommodate left-turn lanes)?	Yes ☐ No ☒
9	Is the intersection located at a transition between rural and urban environments (i.e. an urban boundary) such that a roundabout could act as a means of speed transition?	Yes ☒ No ☐
10	Is the intersection located at a neighbourhood or commercial entry such that a roundabout could act as a gateway feature?	Yes ☒ No ☐

The guidelines also specify that there may be locations and site context conditions that can be problematic for installing roundabouts. Some of these conditions may also be problematic for stop-controlled or signalized intersections. While these conditions do not necessarily preclude a roundabout from consideration, mitigation may be required.

An evaluation based on the Contra-Indication factors for roundabouts, also included in the *Guidelines for the use of Modern Roundabouts on Regional Arterial Roadways* is provided in *Exhibit 10*. The guidelines indicate that where *yes* is indicated for one or more of the contra-indications, a roundabout may be problematic. It does not necessarily mean that a roundabout is not suitable, but that there may be design challenges or higher costs involved in mitigating the problematic condition(s). The summary presented in *Exhibit 10* indicates that there may be approaches where the stopping sight distance for a roundabout yield line may not be attainable and that the profile between the planned grade separation and the roundabout may be more than 4%. The side-street traffic volumes are also likely to be relatively low in comparison to the traffic volumes on realigned Steeles Avenue. This imbalance may lead to longer side-street delays for a roundabout treatment.

Exhibit 10 Evaluation of Contra-Indicators for Roundabouts

NO.	CONTRA-INDICATION	OUTCOME
1	Are there any approaches where stopping sight distance (SSD) of a roundabout yield line may not be attainable (i.e. the intersection is on a crest vertical curve)?	Yes ☒ No ☐
2	Is there an existing uncontrolled approach with a grade in excess of 4%?	Yes ☐ No ☒
3	Is there a closely-spaced traffic signal or railway crossing that would not be controlled with a nearby roundabout?	Yes ☐ No ☒
4	Is the intersection part of a coordinated arterial signal system, such that a roundabout would disrupt traffic platoons?	Yes ☐ No ☒
5	Does the intersection experience a heavy flow of through traffic on the major street opposed by relatively light traffic on the minor street?	Yes ☒ No ☐
6	Are there on-way streets or reversible traffic lanes approaching the intersection?	Yes ☐ No ☒
7	Are there known visually-impaired pedestrians that cross the intersection?	Yes ☐ No ☒

The Region's guidelines also indicate that a Roundabout Screening Assessment is appropriate for a new intersection on a Regional Road, such is the case for the planned junction of the realigned and existing Steeles Avenue approaches. A comparison of predicted operating performance for a roundabout and a two-way stop-controlled intersection provided the required input to the traffic operations criteria included as part the screening assessment. The levels of service reflect the travel demand summarized in *Exhibit 6* and are included in *Exhibit 11* for the roundabout alternative and *Exhibit 12* for the two-way stop-controlled intersection alternative.

Exhibit 11 2031 Peak Hour Level of Service: Roundabout at Old Steeles Avenue

Intersection/Movement	Weekday AM Peak Hour				Weekday PM Peak Hour			
	V/C	Delay	LOS	Queue[1]	V/C	Delay	LOS	Queue[1]
Steeles Ave at Tremaine Rd								
Eastbound Left/Through/Right	-	21/21/12 s	C/C/B	24 m	-	81/82/50 s	F/F/F	31 m
Westbound Left/Through/Right	-	11/9/12 s	B/A/B	20 m	-	25/29/20 s	C/D/C	79 m
Northbound Left/ Through	-	29/25 s	D/C	175 m	-	15/12 s	B/B	72 m
Northbound Right	-	5 s	A	0 m	-	2 s	A	0 m
Southbound Left/Through/Right	-	5/4/4 s	A/A/A	27 m	-	53/50/50 s	F/F/E	332 m
Steeles Ave at Old Steeles Ave								
Eastbound Left/Through/Right		2/2/2 s	A/A/A	10 m		1/1/1 s	A/A/A	4 m
Westbound Left/Through/Right	-	1/1/1 s	A/A/A	0 m	-	2/2/2 s	A/A/A	6 m
Northbound Left/Through/Right	-	10/0/4 s	B/A/A	6 m	-	3/0/1 s	A/A/A	5 m
Southbound Left/Through/Right	-	2/0/1 s	A/A/A	7 m	-	11/0/5 s	B/A/A	16 m

Note: 1. Queue Lengths reflect 95th percentile queues

Exhibit 11 2031 Peak Hour Level of Service: Roundabout at Old Steeles Avenue (Continued)

Intersection/Movement	Weekday AM Peak Hour				Weekday PM Peak Hour			
	V/C	Delay	LOS	Queue[1]	V/C	Delay	LOS	Queue[1]
Steeles Ave at Industrial Rd								
Eastbound Left	0.33	6 s	A	24 m	0.22	14 s	B	13 m
Eastbound Through	0.32	2 s	A	30 m	0.21	3 s	A	25 m
Westbound Through/Right	0.19	2/2 s	A/A	20 m	0.44	4/4 s	A/A	49 m
Southbound Left	0.25	52 s	D	18 m	0.53	55 s	D	57 m
Southbound Right	0.42	6 s	A	11 m	0.76	9 s	A	22 m

Note: 1. Queue Lengths reflect 95th percentile queues

Exhibit 12 2031 Peak Hour Level of Service Stop Controlled Intersection at Old Steeles Avenue

Intersection/Movement	Weekday AM Peak Hour				Weekday PM Peak Hour			
	V/C	Delay	LOS	Queue[1]	V/C	Delay	LOS	Queue[1]
Steeles Ave at Tremaine Rd								
Eastbound Left/Through/Right	-	24/23/14 s	C/C/B	26 m	-	95/112/70 s	F/F/F	36 m
Westbound Left/Through/Right	-	11/8/12 s	B/A/B	20 m	-	29/32/24 s	D/D/C	87 m
Northbound Left/ Through	-	41/34 s	E/D	257 m	-	22/17 s	C/C	98 m
Northbound Right	-	8 s	A	0 m	-	2 s	A	0 m
Southbound Left/Through/Right	-	5/4/4 s	A/A/A	28 m	-	34/32/30 s	D/D/D	249 m
Steeles Ave at Old Steeles Ave								
Eastbound Left/Through/Right		3/1/1 s	A/A/A	0 m		9/0/1 s	A/A/A	0 m
Westbound Left/Through/Right	-	4/0/1 s	A/A/A	0 m	-	3/1/2 s	A/A/A	0 m
Northbound Left/Through/Right	-	13/0/7 s	B/A/A	8 m	-	19/0/7 s	C/A/A	8 m
Southbound Left/Through/Right	-	25/0/19 s	D/A/C	34 m	-	30/0/20 s	D/A/C	25 m
Steeles Ave at Industrial Rd								
Eastbound Left	0.33	7 s	A	28 m	0.22	13 s	B	10 m
Eastbound Through	0.32	2 s	A	32 m	0.21	3 s	A	23 m
Westbound Through/Right	0.19	2/2 s	A/A	20 m	0.44	4/4 s	A/A	48 m
Southbound Left	0.25	52 s	D	18 m	0.53	55 s	E	57 m
Southbound Right	0.42	5 s	A	11 m	0.76	9 s	A	21 m

The analysis presented in *Exhibits 11 and 12* demonstrates that operating performance at the junction of realigned Steeles Avenue and Old Steeles Avenue reflects individual movement levels of service B or better for the roundabout alternative and levels of service D or better for the stop-controlled intersection alternative.

An evaluation of socio-economic environment, transportation network and cost factors is presented below in *Exhibit 13*.

Exhibit 13 Evaluation of Alternative Control for Realigned Steeles Avenue at Old Steeles Avenue

CRITERIA	INTERSECTION	ROUNDABOUT
Socio-Economic Environment		
Property	Less property impacts associated with new roadway alignment	Additional property required to construct roundabout than intersection
Impact to Future Development Plans	None	None
Access to Existing and Future Land Use	Impacts Driveway to Milton Banquet and Conference Centre	Impacts Driveway to Milton Banquet and Conference Centre
Noise	Slightly more impact due to possible requirement for traffic signal control to address side-street sight-distance impacts	Slightly less impact compared to potentially traffic signal controlled intersection
Air Quality	Minor impacts to air quality level	Minor improvement to air quality level compared to stop controlled intersection
Overall (Social Environment)		
Transportation Network		
Traffic Operations & Safety	Consistent with surrounding network Offers opportunity for co-ordination along Steeles Avenue if intersection were to be signalized Greater safety risk due to greater conflict points and vehicular speed Potential collision severity greater Longer side-street delays and queues under stop-control and longer delays and queues on major street approaches if intersection were to be signalized	Consistent with surrounding network Provides generally improved level of service during off-peak hours Lower safety risk due to fewer conflict points and lower vehicular speed Potential collision severity lower Shorter side-street delays and queues with roundabout and shorter delays and queues on major street approaches compared to a signalized intersection alternative
Provision for Active Transportation and Transit	Reduced impacts for visually impaired pedestrians if intersection were to be signalized	Pedestrians have shorter crossing distances and must consider only one direction of slower moving conflicting traffic at a time Cyclists have options for negotiating roundabout, depending on skill/comfort level
Emergency Response	Offers opportunities for signal pre-emptions for emergency vehicles if intersection were to be signalized	No signal pre-emption for emergency vehicles
Utilities	Similar impact to roundabout	Similar impact to intersection
Connections to Roadways	Unlikely to have impact on adjacent intersections	Unlikely to have impact on adjacent intersections
Overall (Transportation)		

Exhibit 13 Evaluation of Alternative Control for Realigned Steeles Avenue at Old Steeles Avenue (Cont'd)

CRITERIA	INTERSECTION	ROUNDABOUT
Cost		
Construction Cost	Potentially higher capital cost if intersection were to be signalized and slightly lower property cost for the Roundabout	Potentially lower capital cost if intersection were to be signalized and slightly higher property cost for the roundabout.
Operations and Maintenance Cost	Operating and maintenance costs if the intersection were to be signalized	No cost for traffic signal maintenance and higher maintenance cost for illumination
Overall (Cost)		
Overall Summary		

Legend: Least Preferred Most Preferred

Based on the available information, we believe that the benefits of a roundabout configuration at the realigned Steeles Avenue intersection with existing Steeles Avenue outweigh the benefits of a two-way stop-controlled or signalized intersection configuration. Our recommendation is, therefore, for a roundabout at this location. The type of intersection control will be confirmed during the future detailed design stage.