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Memo

To:	Mr. Jeffrey Reid, HBA, C.E.T., LET, Project Manager The Regional Municipality of Halton Infrastructure Planning & Policy Public Works	From:	Connie Lim, Boris Chen Stantec Consulting Ltd.
File:	165010586	Date:	September 10, 2019

Reference: **Regional Road 25 Transportation Corridor Improvements**
Municipal Class Environmental Assessment Study
Town of Milton / Town of Halton Hills
Potential Air Quality Impact due to Proposed Improvements

1.0 INTRODUCTION

This memo report provides an evaluation of the potential impact on the air quality resulting from the proposed improvements to Regional Road 25 between Steeles Avenue (Regional Road 8) and 5 Side Road, in the Town of Milton / Town of Halton Hills (the Project).

Regional Road 25 (RR 25) is a north-south major arterial Regional Road running through Halton Region. The need for additional capacity along RR 25 was identified in the Region's Transportation Master Plan (to 2031) – The Road to Change (2011). The Project is to support future growth and travel demands to 2031. The Project improvements include widening RR 25 from Steeles Avenue to 5 Side Road from four (4) to six (6) lanes, intersection improvements and active transportation to support all modes (such as public transit, cycling, walking) as per the Region's Active Transportation Master Plan (2015). The Study Area Map is provided in **Attachment A**.

This memo report forms part of the supporting documentation for the Municipal Class Environmental Assessment Study completed for the Project. This memo provides a review of pertinent air quality guidelines and standards, review of the existing ambient air quality, identifying sensitive receptors in the Project area, comparison of current and projected traffic, quantitative assessment and comparison of traffic emissions with and without the Project, and potential impact on air quality due to the Project.

2.0 AMBIENT AIR QUALITY IN PROJECT AREA

Ambient air quality in the Project area is influenced by emissions from local industrial sources and vehicular traffic. The regularly assessed contaminants of interest (COI) for transportation assessments in Ontario (as determined by the Ontario Ministry of Transportation (MTO) and that are listed in the MTO Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects (MTO Guide, 2012)), include the following criteria air contaminants (CACs) and volatile organic compounds (VOCs):

- Nitrogen Dioxide (NO_2)
- Carbon Monoxide (CO)
- Particulate Matter less than 10 microns (PM_{10})
- Particulate Matter less than 2.5 microns ($PM_{2.5}$)
- Acrolein
- Benzene
- 1,3-Butadiene

Reference: **Regional Road 25 Transportation Corridor Improvements**
Municipal Class Environmental Assessment Study
Town of Milton / Town of Halton Hills
Potential Air Quality Impact due to Proposed Improvements

- Acetaldehyde
- Formaldehyde

Relevant agencies and organizations in Canada and their applicable contaminant guidelines are:

- Ontario Ministry of the Environment, Conservation and Parks (MECP) Ambient Air Quality Criteria (AAQC)
- Canadian Council of Ministers of the Environment (CCME) Canadian Ambient Air Quality Standards (CAAQS)

A summary of the pertinent air quality objectives, guidelines, and standards for the COI is presented in **Table 1**. Proposed changes to AAQCs and CAAQS were also considered and included in the table.

Table 1: Summary of Applicable Air Quality Standards for COIs

COI	CAS No.	Basis	Air Quality Standard		
			1-Hour (µg/m^3)	24-Hour (µg/m^3)	Other Time Period (µg/m^3)
Nitrogen Oxides [A]	10102-44-0	AAQC	400	200	
		CAAQS	79 [B]		22.6; annual [B]
$PM_{2.5}$	-	CAAQS	-	28, 27 [C-1]	10, 8.8; annual [C-2]
PM_{10}	-	AAQC	-	50 [C-3]	-
Carbon monoxide	630-08-0	AAQC	36,200	-	15,700; 8-hour
1,3-butadiene	106-99-0	AAQC	-	10	2; annual
Acetaldehyde	75-07-0	AAQC	-	500	500; ½ hour
Acrolein	107-02-8	AAQC	4.5	0.4	-
Benzene	71-43-2	AAQC	-	2.3	0.45 annual
Formaldehyde	50-00-0	AAQC	-	65	-

Notes:

A Schedule 3 standards for NOx are based on health effects of NO_2, as NO_2 has adverse health effects at much lower concentrations than NO.

B CAAQS for 2025 for a one-hour average is 79 µg/m^3 and for an annual average is 22.6 µg/m^3. The hourly standard objective is referenced to the three-year average of the annual 98th percentile of the daily maximum one-hour average concentrations. The annual CAAQS is the average over a single calendar year of all 1-hour average concentrations. The criteria were converted from ppb to µg/m^3 based on a standard temperature of 25°C and pressure of 1 atm as per (Health Canada, 2016).

C-1 Canadian Ambient Air Quality Standards (CAAQS) for Fine Particulate Matter ($PM_{2.5}$), effective by 2015 and 2020, respectively (CCME 2012). The Fine Particulate Matter Objective is referenced to the 98th percentile daily average concentration averaged over 3 consecutive years.

C-2 Annual Canadian Ambient Air Quality Standards for Fine Particulate Matter $PM_{2.5}$, effective by 2015 and 2020, respectively (CCME, 2012). The Fine Particulate Matter Objective is referenced to the 3-year average of the annual average concentrations.

C-3 AAQC for PM_{10} is an interim AAQC provided as a guide for decision-making.

Reference: **Regional Road 25 Transportation Corridor Improvements**
Municipal Class Environmental Assessment Study
Town of Milton / Town of Halton Hills
Potential Air Quality Impact due to Proposed Improvements

Air quality measurement data from ambient air monitoring conducted by the National Air Pollution Surveillance Program (NAPS) operated by Environment Canada were reviewed. The NAPS program continuously measures NO_2, CO, ozone (O_3), and $PM_{2.5}$, as well as non-continuous monitoring of PM_{10}, VOCs and other contaminants. The NAPS network data used to characterize existing air quality in the Project area are presented in **Table 2** (below). The monitoring stations were selected for the evaluation based on their proximity to the Project. Where available, monitoring data for the most recent available years were reviewed. Data sets that were not included in the assessment as they were considered invalid per the MECP's Operations Manual for Air Quality Monitoring in Ontario (MECP, 2018a) are also noted below.

Table 2: NAPS Locations Included in the Study

COI	NAPS Station ID	NAPS Station Name	Station Address	Station City	Years	Excluded Data Sets [3]
NO_2	60428	Brampton	525 Main Street N. / Peel Manor	Brampton	2012 - 2016	
	61502	Kitchener	West Avenue and Homewood	Kitchener	2012 - 2016	
	60430	Toronto West	125 Resources Road	Toronto	2012 - 2016	
CO	60430	Toronto West	125 Resources Road	Toronto	2011 - 2015 [1]	
PM_{10}	60512	Hamilton Downtown	Elgin & Kelly	Hamilton	2012 - 2016	
$PM_{2.5}$	60428	Brampton	525 Main Street N. / Peel Manor	Brampton	2013 - 2017	
	61502	Kitchener	West Avenue and Homewood	Kitchener	2013 - 2017	
	60430	Toronto West	125 Resources Road	Toronto	2013 - 2017	
1,3-butadiene	60428	Brampton	525 Main Street N. / Peel Manor	Brampton	2012 - 2015 [1]	
	61502	Kitchener	West Avenue and Homewood	Kitchener	2012 - 2016	
Acetaldehyde	60439	Wallberg (UofT)	200 College Street - Roadside	Toronto	2014 - 2016 [2]	2014 [4]
	62601	Experimental Farm	Simcoe	Simcoe	2014 - 2016 [2]	2016
Acrolein	60439	Wallberg (UofT)	200 College Street - Roadside	Toronto	2014 - 2016 [2]	2014 [4]
	62601	Experimental Farm	Simcoe	Simcoe	2014 - 2016 [2]	2016
Benzene	60428	Brampton	525 Main Street N. / Peel Manor	Brampton	2012 - 2015 [1]	
	61502	Kitchener	West Avenue and Homewood	Kitchener	2012 – 2016	2013
Formaldehyde	60439	Wallberg (UofT)	200 College Street - Roadside	Toronto	2014 - 2016 [2]	2014 [4]
	62601	Experimental Farm	Simcoe	Simcoe	2014 - 2016 [2]	2016

Notes:

1 2016 data set incomplete at time of analysis.

2 Data not available prior to 2014.

3 Data sets for these years had less than 75% recovery rate and are therefore not considered valid as per MECP guidelines (MECP, 2018a).

4 Recovery rates for 2014, 2015 and 2016 were 35%, 73% and 74%, respectively. Although recovery rates were slightly below the required 75% recovery rate, 2015 and 2016 data were included in the assessment as this station provides more conservative data.

Monitoring data from all the selected monitoring stations as listed in **Table 2** were assessed to determine the background concentrations. With the exception of the background $PM_{2.5}$ concentration, the average 90th percentile concentrations for short-term averages (24-hour and less than 24-hour averages), and annual average concentrations over all five years (where available) at each station were calculated. The maximum calculated 90th percentile or annual average concentrations at all the selected stations were then used for characterizing the existing air quality for the Project area and for comparison with regulatory requirements. The use of the 90th percentile (for short-term averages) of the most recently measured monitoring data from the nearest MECP or Environment Canada monitoring stations to represent the background concentration is consistent with the MTO guidance document (MTO, 2012). For $PM_{2.5}$, to compare with the CAAQS, the

Reference: **Regional Road 25 Transportation Corridor Improvements**
Municipal Class Environmental Assessment Study
Town of Milton / Town of Halton Hills
Potential Air Quality Impact due to Proposed Improvements

maximum of the 98th percentile daily average concentrations averaged over 3 consecutive years, and the maximum of the 3-year annual averages at all selected stations are presented. The 90th percentile, 98th percentile or annual average concentrations for applicable averaging periods are listed below in **Table 3**. Current criteria as well as the most stringent proposed criteria are shown in this table for comparison.

Table 3: Summary of Background COI Air Quality Levels

COI	CAS No.	Averaging Period	Background Concentration	Air Quality Standard		% of Criteria
		(hours)	(µg/m³)	(µg/m³)	Reference	%
NO_2	10102-44-0	1	57.9	79 [1]	2025 CAAQS	N/A [1]
			61.0	400 [2]	AAQC	15%
		24	49.6	200	AAQC	25%
		Annual	30.8	22.6 [1]	2025 CAAQS	N/A [1]
CO	630-08-0	1	458	36200	AAQC	1%
		8	422	15700	AAQC	3%
PM_{10}	N/A	24	30.0	50	AAQC	60%
$PM_{2.5}$	N/A	24	24.1 [3]	28 [3] 27	2015 CAAQS 2020 CAAQS	86% [3]
		Annual	8.9 [3]	10 [3] 8.8	2015 CAAQS 2020 CAAQS	89% [3]
1,3-butadiene	106-99-0	24	0.090	10	AAQC	1%
		Annual	0.046	2	AAQC	2%
Acetaldehyde	75-07-0	0.5 [4]	5.4	500	AAQC	1.1%
		24	1.8	500	AAQC	0.4%
Acrolein	107-02-8	1 [4]	0.16	4.5	AAQC	4%
		24	0.068	0.4	AAQC	17%
Benzene	71-43-2	24	0.889	2.3	AAQC	39%
		Annual	0.531	0.45	AAQC	118%
Formaldehyde	50-00-0	24	3.20	65	AAQC	5%

Notes:

1 Background concentrations of NO_2 are not explicitly compared with the proposed CAAQS Air Quality Standard. The 1-hour and Annual 2025 CAAQS for NO_2 are referenced to the 98th percentile daily average concentration averaged over 3 consecutive years, and annual average concentration, respectively. Concentration conversion from ppb to µg/m³ is based on standard temperature of 25 degrees C and 1 atm (Health Canada, 2016).

2 NO_2 AAQC for one-hour and 24-hour averaging period. Concentration conversion from ppb to µg/m³ is based on standard temperature of 10 degrees C and 1 atm.

3 The 98th percentile and 3-year annual average background concentrations of $PM_{2.5}$ are compared with the current 2015 24-hour and Annual CAAQS for $PM_{2.5}$ which are referenced to the 98th percentile daily average concentration averaged over 3 consecutive years, and 3-year average of the annual average concentrations, respectively.

4 Concentration for this averaging period is converted from a one-hour or 24-hour concentration based on the MECP recommended conversion factor and methodology.

Reference: **Regional Road 25 Transportation Corridor Improvements**
Municipal Class Environmental Assessment Study
Town of Milton / Town of Halton Hills
Potential Air Quality Impact due to Proposed Improvements

Background levels for the COIs are below their applicable criteria with the exception of benzene. The annual background concentration of benzene exceeds the criteria by 18%. For the 24-hour averaging period, the background benzene level is less than 40% of the applicable criteria. Based on the Air Quality In Ontario 2016 Report (MECP, 2018b), the benzene annual means measured at the seven MECP monitoring stations ranged from 0.34 µg/m^3 to 0.70 µg/m^3, and exceeded the annual AAQC of 0.45 µg/m^3 at three of the seven monitoring stations. However, over the ten-year period from 2007 to 2016, there is a downward trend in benzene levels, and measured concentrations have decreased 28% in Ontario (MECP, 2018b).

3.0 NEARBY RECEPTORS

The Project is located within the Milton 401 Industrial / Business Park Secondary Planning Area. Land uses within the study area include business parks and employment areas, industrial use, institutional use, and greenland areas.

The area is mainly commercial / industrial, with a few sensitive land uses (including a daycare and residences) and places that allow for overnight accommodation use. These receptors and their setback distances from RR 25 are presented in the table below and in **Attachment A**, Figures 2 and 3 showing their locations and receptor IDs.

The sensitive receptors identified closest to RR 25 are the three houses and day care (approximately 30 m to 50 m from the road) located near the Escarpment Way / Peddie Road and RR 25 intersection. Based on the Official Plan, the existing residential uses located within the study area may be redeveloped in the future as non-residential. However, these have been conservatively included as sensitive receptors.

The Maplehurst Correctional Complex is included as one of the receptors. The closest setback distance is 29 m from RR 25, however, it is only a recreational sports field at this location. The main building of the Maplehurst Correctional Complex is at a setback distance of 80 m, and sleeping quarters likely have a further setback.

Based on active planning applications provided by Halton Region, there are development applications for industrial and commercial land use, including a proposed industrial subdivision at 2 Mansewood Court, office expansion at 2800 High Point Drive, proposed warehouses at 8300 and 8400 Parkhill Drive, and the proposed automobile retail buildings Guiseppe Zanchin and ZAG. There are currently no residential development applications in the Project area.

Reference: **Regional Road 25 Transportation Corridor Improvements**
Municipal Class Environmental Assessment Study
Town of Milton / Town of Halton Hills
Potential Air Quality Impact due to Proposed Improvements

Table 4: Receptors Identified in the Vicinity of the Project Area

Receptor ID	Identified Receptor	Location	Setback Distance from RR 25 (m)
R1	Three residential houses	8584 RR 25 8598 RR 25 8604 RR 25	Approximately 32-34 m
R2	Peekaboo Child Care	8611 Escarpment Way	50 m
R3	Hilton Home2 Suites	8490 Parkhill Drive	150 m
R4	Holiday Inn Express & Suites	2750 High Point Drive	150 m
R5	Maplehurst Correctional Complex (including recreational areas)	661 Martin Street	29 m (closest recreational area) 80 m (main building)
R6	Milton Bible Church	121 Chisholm Drive	170 m
R7	Best Western Hotel	161 Chisholm Drive	240 m

4.0 ROAD IMPROVEMENTS AND ACTIVE TRANSPORTATION NETWORK

Currently, there is an existing multi-use path between Steeles Avenue and Market Drive (west side), and sidewalk from Market Drive to Chisholm Drive (west side) within the Regional Road 25 corridor. Otherwise, there are limited active transportation facilities. The current facilities do not connect to a continuous north/south active transportation network.

Halton Region Council has approved the Active Transportation Master Plan (ATMP) which recommends Regional Walking and Cycling Networks to support and encourage people to walk and bike around Halton. Active transportation is any form of human-powered transportation, including walking, cycling, rollerblading, skateboarding, and moving with mobility devices. An active transportation network includes sidewalks, multi-use paths, crosswalks, on-road bike lanes and off-road trails. The objective of the Active Transportation Master Plan is to create a network that will make it easier for people to walk, bike and roll around Halton. In addition to the widening from four to six lanes, features of active transportation were considered in the RR 25 transportation corridor improvements and include multi-use pathways and on-road bike lanes on either side of the road to support a multimodal transportation network.

This Project will match into two construction projects recently completed, including:

- The widening of Steeles Avenue from Industrial Drive to Regional Road 25 from two to four lanes with on-road bike lanes (both directions), and an in-boulevard multi-use trail (both directions), completed in 2018; and

- The Ministry of Transportation Ontario (MTO) Regional Road 25/Highway 401 interchange improvements to accommodate an ultimate Highway 401 cross section of eight core commuter lanes and four collector lanes. This project includes a new structure over the Highway 401 with a six-lane cross section, on-road bike lanes and sidewalks on either side of the structure, completed in 2019.

Reference: **Regional Road 25 Transportation Corridor Improvements**
Municipal Class Environmental Assessment Study
Town of Milton / Town of Halton Hills
Potential Air Quality Impact due to Proposed Improvements

5.0 TRAFFIC CHANGE AND POTENTIAL IMPACT ON AIR QUALITY

Traffic data from the existing scenario, future build scenario, and no-build scenario were compared to evaluate the potential impact on future air quality in the subject area due to the RR 25 improvements.

The current (base year 2016) AADT (Annual Average Daily Traffic) and HV% (percentage of heavy vehicles) data, and the predicted AADT and HV% for the future scenario (estimated Year 2031 data were used), on RR 25 for each road section are summarized in **Table 5**.

Table 5: Current and Future Traffic Data for Project Area

Regional Road 25 Segment		Year			
		2016		2031	
From	To	AADT	HV%	AADT	HV%
Steeles Avenue	Market Drive	31500	5%	51000	5%
Market Drive	Chisholm Drive	35000	7%	56000	7%
Chisholm Drive	Highway 401 EB O-R	38000	8%	61000	8%
Highway 401 EB O-R	Highway 401 WB O-R	32500	6%	53500	6%
Highway 401 WB O-R	High Point Drive	25000	13%	44000	13%
High Point Drive	James Snow Parkway	21000	15%	36000	15%
James Snow Parkway	Peddie Road	19000	18%	31000	18%
Peddie Road	5 Side Road	16000	15%	27000	15%

Note: Traffic data presented are based on Transportation Study for the RR 25 MCEA Study.

The table shows that the current vehicular traffic patterns (e.g., passenger cars, light / heavy trucks, etc.) and percentages are expected to be carried forward into the future, with heavy vehicle traffic consisting of 5% to 18% of total traffic, depending on the road section. For two-way traffic, the average AADT of the future build scenario is predicted to be on average 166% of the current daily traffic. The traffic volumes and vehicle distribution along RR 25, and estimated AADT data for future build and future no-build scenarios are expected to be the same. The Project to widen RR 25 (including intersection improvements) is to support future growth and travel demands (to 2031) and relieve traffic congestion / delay.

The Project also includes modifications to support road users of all modes as per the Region's Active Transportation Master Plan. Therefore, it is expected that there will be a shift to active transportation options such as cycling and walking, including the use of public transit and transportation demand management (i.e., carpooling), which will generate less CAC and greenhouse gas (GHG) emissions.

The traffic volume is expected to increase in the future (2031) scenario and may have an impact on nearby receptors due to increase in traffic emissions. The widening of RR 25 from four to six lanes would allow the traffic to move more smoothly and efficiently. Intersection improvements identified for the Project, such as a two-lane roundabout configuration at the intersection of RR 25 and 5 Side Road, would improve traffic flow at existing intersections which experience significant delay and queuing. In addition, the roundabout promotes continuous traffic flow and reduces vehicle idling compared to a signalized intersection. Therefore, with Project implementation, the vehicle engines would generate fewer emissions as a result of improved fuel combustion conditions, with less idling time compared to the future no-build scenario. In addition, as older

vehicles are gradually replaced by newer and lower emission vehicles, ongoing improvements in average tailpipe emissions per vehicle between now and 2031 would further reduce traffic emissions.

6.0 COMPARISON OF TRAFFIC EMISSIONS

To assess the changes in air quality due to Project improvements in traffic flow, vehicle tailpipe emissions from the future build scenario and no-build scenario were qualitatively estimated and compared to evaluate and provide an opinion on the potential impact on future air quality in the RR 25 corridor.

As indicated above, traffic increase is due to the future growth and travel demand of the Project area, and Project implementation is not assumed to have impact on traffic volumes and vehicle distribution. Therefore, comparison between the existing traffic emissions and future traffic emissions is not relevant to the Project. Also, as traffic volumes and traffic distribution are predicted to be the same for both future scenarios, emissions due to resuspension of loose material on the road surface from vehicles travelling along the road are assumed to be the same and not assessed in this study.

The road segment selected for the assessment is near the RR 25 and Escarpment Way / Peddie Road intersection, due to the close proximity of sensitive receptors (day care and residential houses less than 50 m from RR 25). The PM Peak hour traffic data were assessed as the traffic volumes are predicted to be higher than AM peak hour traffic.

Traffic volume and vehicle distribution data are presented in **Table 6** below for each direction of the intersection. The average vehicle speeds for each road direction for both future scenarios are also presented. As shown, vehicle speeds are lower without road improvement due to congestion and increased idling/delay times. Delays in the southbound direction along RR 25 is the most significant, with average vehicle speeds expected to be at 3 km/hour[1] in a 70 km/hour posted speed limit zone. With Project implementation, average vehicle speed is increased to 44 km/hour, with the number of stops per vehicle decreasing from 0.57 to 0.18. Detailed traffic projection and traffic data reports are provided in **Attachment B**.

[1] The model simulation recorded a low speed due to the extensive downstream queueing. Once the recommended improvements are implemented, congestion downstream is relieved and vehicle queuing is reduced.

Reference: **Regional Road 25 Transportation Corridor Improvements**
Municipal Class Environmental Assessment Study
Town of Milton / Town of Halton Hills
Potential Air Quality Impact due to Proposed Improvements

Table 6: Traffic Data at RR 25 and Escarpment Way / Peddie Road Intersection

Road Name	**RR 25**		**Escarpment Way / Peddie Road Intersection**		
Road Direction	North-South		East-West		
Future No-Build and Future Build Scenarios (2031 Forecast PM Peak Hour)					
Traffic volume - (volume per hour)	North bound	South bound		East bound	West bound
North of intersection	1271	1046	West of intersection	270	74
South of intersection	1175	1198	East of intersection	57	109
Percent of Trucks (Overall)	7%	13%		14%	23%
Percent of Cars (Overall)	93%	87%		86%	77%
Average speed (km/hour)					
Future No-Build Scenario	39	3		5	3
Future Build Scenario	56	44		12	8
Stops per Vehicle [1]					
Future No-Build Scenario	0.51	0.57		0.91	0.89
Future Build Scenario	0.11	0.18		0.88	0.84

Notes: Traffic data presented are based on Transportation Study for the RR 25 MCEA Study.
1. Stops Per Vehicle – Count of total number of vehicle stops at the intersection divided by the number of vehicles.

To quantify the emissions at this intersection for both scenarios, the estimation tool Motor Vehicle Emission Simulator (MOVES) developed by the U.S. EPA was used to predict the trend (i.e., increase or decrease in vehicle tailpipe emissions) and magnitude of changes. The emission rates are estimated based on the 2031 year vehicle fleet and average speeds of the vehicles travelling along this road segment for both build and no-build scenarios. The average vehicle speeds are based on traffic simulation of the two scenarios, and account for the idling and delay times along the modelled portion of the roadway. Other inputs used in MOVES include average temperature and relative humidity based on Climate Normals at the closest meteorology station with available data.

The hourly emission rates for each contaminant and each scenario are estimated based on the emission factors from MOVES, the number of vehicles, their distribution and length of the road segment. The emission rates for each scenario and a comparison of the emission rates are presented in the table below. A summary of the MOVES input parameters, and detailed emission inventory inputs and emission calculations are provided in **Attachment C**.

Reference: **Regional Road 25 Transportation Corridor Improvements**
Municipal Class Environmental Assessment Study
Town of Milton / Town of Halton Hills
Potential Air Quality Impact due to Proposed Improvements

Table 7: Comparison of Future No-Build and Future Build Vehicle Tailpipe Hourly Emission Rates (RR25 & Escarpment Way)

		Hourly Emission Rate - PM Peak Hour (g/s)		Difference in emissions [1] (g/s)	% Difference in Emissions [2]
Contaminant	**CAS#**	**Future No-Build Scenario**	**Future Build Scenario**		
NO2	10102-44-0	0.05	0.014	-0.035	-71%
CO	630-08-0	0.81	0.41	-0.40	-49%
$PM_{2.5}$	N/A	0.016	0.0048	-0.012	-71%
PM_{10}	N/A	0.092	0.0253	-0.067	-72%
Benzene	71-43-2	4.32E-04	1.69E-04	-2.64E-04	-61%
Acetaldehyde	75-07-0	7.02E-04	1.46E-04	-5.56E-04	-79%
Acrolein	107-02-8	1.03E-04	2.11E-05	-8.23E-05	-80%
1, 3-Butadiene	106-99-0	1.25E-05	2.38E-06	-1.01E-05	-81%
Formaldehyde	50-00-0	2.12E-03	4.29E-04	-0.002	-80%

Notes:
1. Difference in emissions = Future Build emission rate - Future No- Build emission rate
2. % Difference in Emissions = (Difference in Emissions / Future No-Build Emissions)

Compared with the future no-build scenario, there is a reduction in the hourly emission rates estimated for the future build scenario for all contaminants, which is expected due to improved vehicle speeds. As shown above, reductions in emissions range from 49% to 81% when compared with the future no-build scenario. The RR 25 corridor and study area intersections should show a similar emission reduction trend due to the road improvements. Therefore, a net benefit is expected on air quality in the Project area.

This study is limited to a comparison of emissions from vehicles, and air dispersion modelling was not included. Air dispersion modelling results would have the similar trend in concentration reduction at the applicable receptors due to the decrease of emission rates for each contaminant of concern.

The intersection at RR 25 and Escarpment Way / Peddie Road is one of the intersections which is projected to still operate below capacity by 2031 for the no-build Scenario, as shown in **Attachment B** Figure B-1 Traffic Assessment at Signalized Intersections on Regional Road 25 for Existing and Future Conditions. Road improvements may have more positive impacts at other intersections, such as the intersection at Chisholm Drive and at Market Drive, which are projected to operate over capacity for the no-build scenario and operate at capacity / approaching capacity with implementation of the RR 25 improvements. Considerable reductions in vehicle emissions and improvement in air quality at both these intersections and along the corridor are anticipated.

Reference: **Regional Road 25 Transportation Corridor Improvements**
Municipal Class Environmental Assessment Study
Town of Milton / Town of Halton Hills
Potential Air Quality Impact due to Proposed Improvements

7.0 EMISSION MITIGATION

During the construction phase of the Project, emissions to the atmosphere will occur primarily due to fuel combustion from vehicles and construction equipment, as well as fugitive dust from construction activities. While these emissions have the potential to cause a nuisance to nearby receptors, with the proper mitigation measures implemented, emissions from construction phase and adverse changes in local air quality can be controlled.

The Environment and Climate Change Canada guideline “Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities” provides recommendations for mitigation measures to reduce construction emissions. These measures include material wetting or use of chemical suppressants to reduce dust, use of wind barriers and limiting exposed areas which may be a source of dust, equipment washing, proper maintenance of construction equipment and vehicles, introduction of no-idling policy to control construction vehicle emissions where applicable, etc. It is recommended that best management practices be developed and implemented during the construction phase.

8.0 CLOSURE

The RR 25 corridor is mainly commercial / industrial with a few sensitive land uses and receptor locations. The ambient air quality in the Project area is affected by the nearby road traffic emission sources, as well as other human activities from commercial / industrial uses, and natural sources which all contribute to the background air quality level. The ambient background levels for the COIs assessed are below their applicable criteria with the exception of benzene, which exceeds the applicable annual AAQC by 18%. However, based on ambient monitoring data from the MECP over the past ten-years, there is a downward trend with 28% decrease in benzene levels between 2007 and 2016. The continued decrease may be due in part to the implementation of emission control technology in newer vehicles.

Due to future growth in the RR 25 corridor, traffic volumes are expected to increase to approximately 166% of current traffic volumes by 2031. Although there is potential for air quality to be impacted from increase in traffic volumes and traffic emissions, with Project implementation to widen RR25 to alleviate traffic congestion, traffic flow will improve, with less idling and improved fuel combustion conditions. A comparison of vehicle emissions from the future no-build and future build scenarios shows significant reductions in contaminant emission rates after Project implementation. In addition, on road vehicles will gradually be replaced by newer, lower emission vehicles. The Project also encourages the shift to other transportation options which would generate less traffic emissions (i.e., active transportation, transit and transportation demand management). Therefore, a net benefit in air quality is expected for the future build scenario compared with the future no-build scenario.

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Reference: **Regional Road 25 Transportation Corridor Improvements**
Municipal Class Environmental Assessment Study
Town of Milton / Town of Halton Hills
Potential Air Quality Impact due to Proposed Improvements

Attachments: Attachment A – Project Study Area, Maps Showing Special Receptor Locations
Attachment B – Traffic Assessment, Traffic Data Projections, Traffic Forecast Reports
Attachment C – Emission Estimation

REFERENCES

Ontario Ministry of the Environment, Conservation and Parks (MECP). 2018a. Operations manual for air quality monitoring in Ontario, 2018.

Ontario Ministry of the Environment, Conservation and Parks (MECP). 2018b. Air Quality In Ontario 2016 Report, 2018.

Ontario Ministry of Transportation (MTO), MTO Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects, 2012.

Health Canada, Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air Quality, December 2016.

Attachment A
Project Study Area, Maps Showing Special Receptor Locations

FIGURE 1: PROJECT STUDY AREA

FIGURE 2: SENSITIVE RECEPTORS R1 TO R4

FIGURE 3: SENSITIVE RECEPTORS R5 to R7

Attachment B
Traffic Assessment, Traffic Data Projections, Traffic Forecast Reports

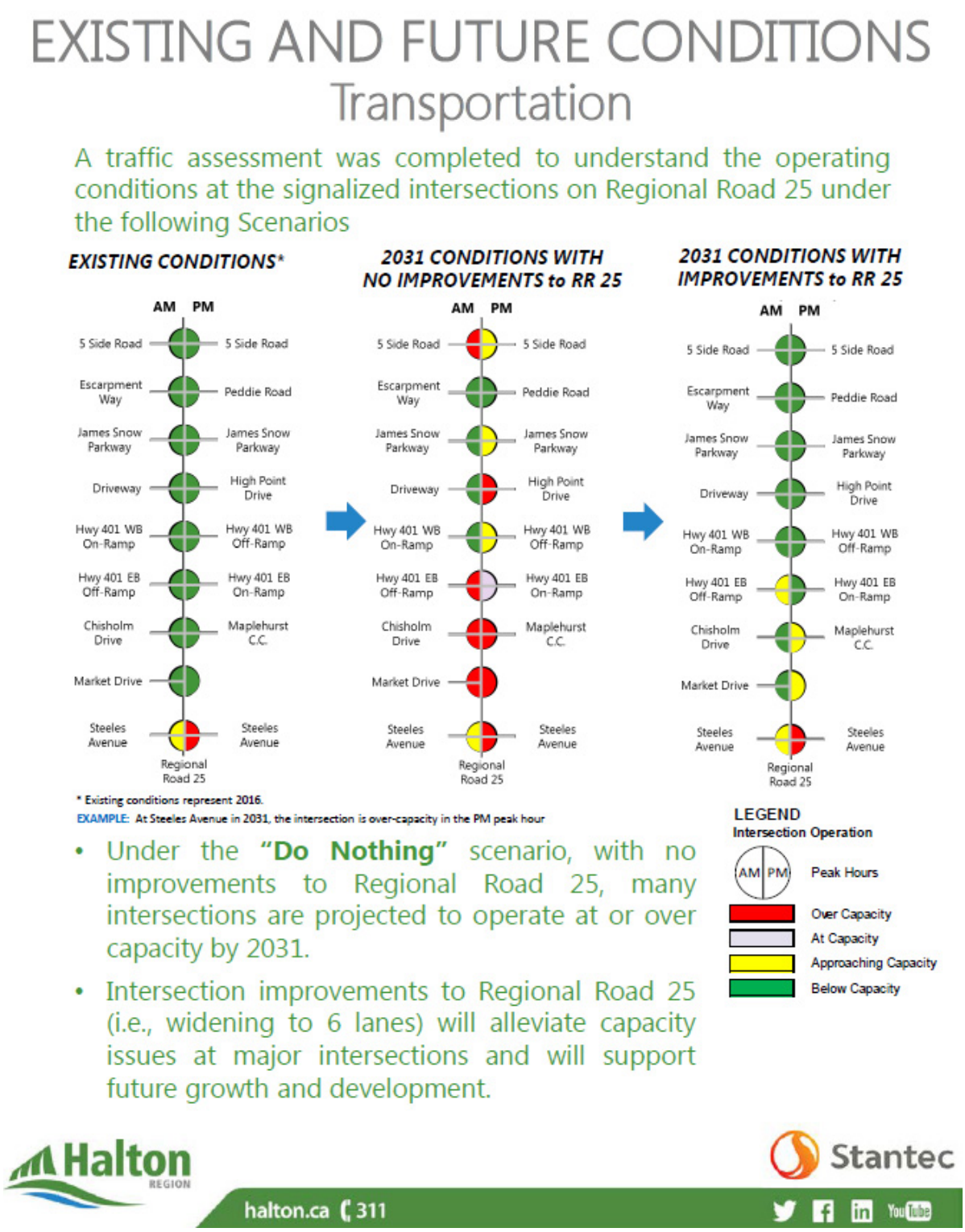

Figure B-1: Traffic Assessment at Signalized Intersections on Regional Road 25 for Existing and Future Conditions

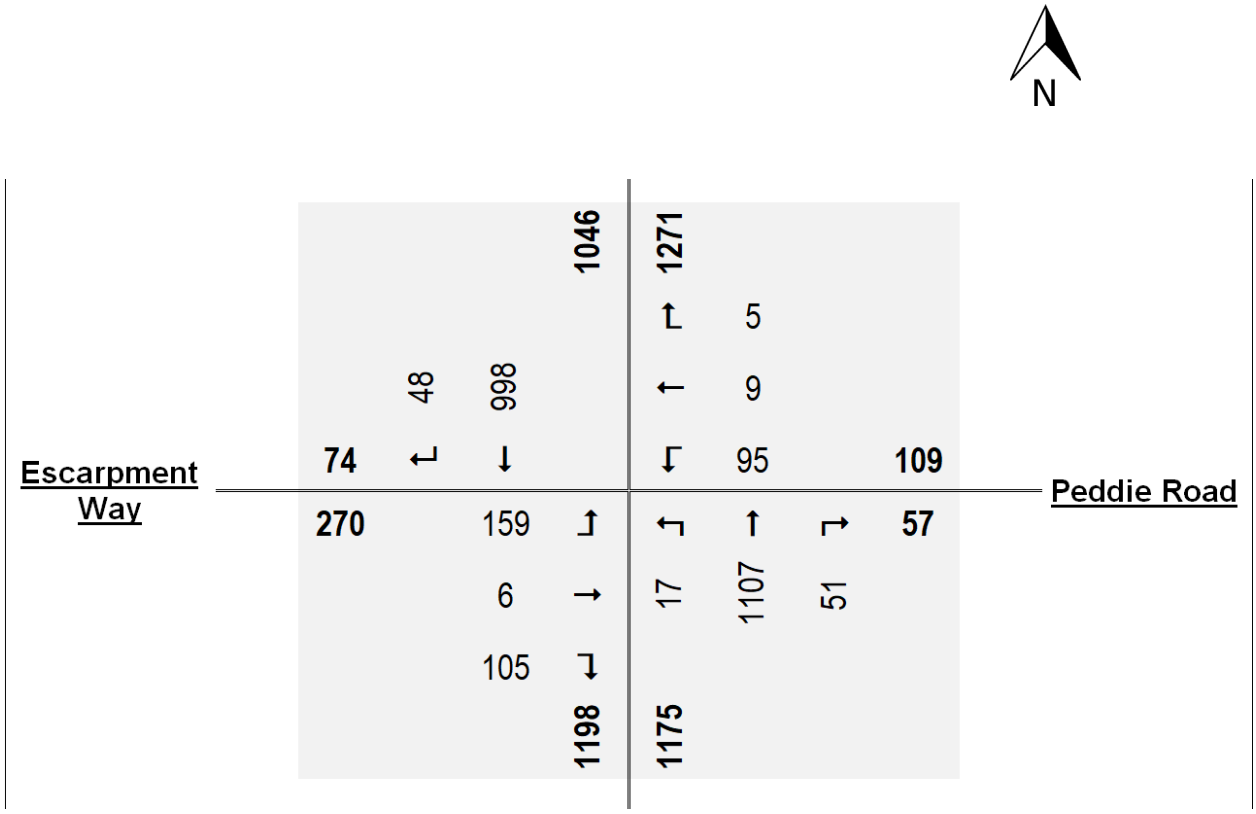

Figure B-2: RR 25 2031 PM Peak Hour Volumes

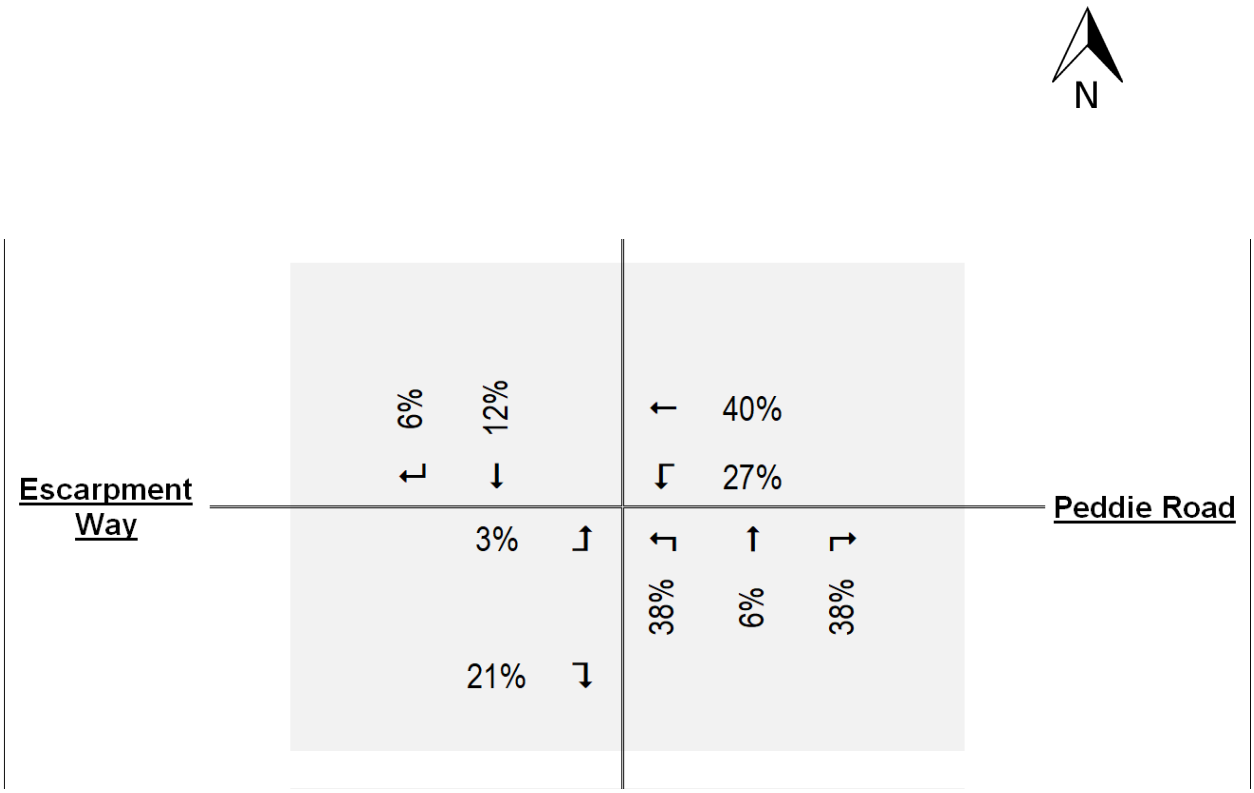

Figure B-3: RR 25 2031 PM Peak Hour Truck Percentages

Summary of All Intervals

Run Number	1	2	Air Quality\2031 Forecast\4 PM Peak Hour 'Do Nothing'\5				Avg
Start Time	4:45	4:45	4:45	4:45	4:45	4:45	4:45
End Time	6:00	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	75	75	75	75	75	75	75
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	8234	8016	8125	8339	8381	8475	8266
Vehs Exited	7680	7452	7661	7611	7773	7935	7685
Starting Vehs	793	758	837	673	733	773	755
Ending Vehs	1347	1322	1301	1401	1341	1313	1333
Travel Distance (km)	10284	10073	10340	10397	10643	10653	10398
Travel Time (hr)	2255.6	2469.0	2391.5	2180.5	2121.6	2327.6	2291.0
Total Delay (hr)	2047.6	2265.0	2182.6	1970.6	1907.3	2113.1	2081.0
Total Stops	30117	27826	29899	29610	30003	30769	29699
Fuel Used (l)	2547.7	2735.0	2672.2	2498.3	2472.9	2639.6	2594.3

Interval #0 Information Seeding

Start Time	4:45
End Time	5:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	5:00
End Time	6:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2	Air Quality\2031 Forecast\4 PM Peak Hour 'Do Nothing'\5				Avg
Vehs Entered	8234	8016	8125	8339	8381	8475	8266
Vehs Exited	7680	7452	7661	7611	7773	7935	7685
Starting Vehs	793	758	837	673	733	773	755
Ending Vehs	1347	1322	1301	1401	1341	1313	1333
Travel Distance (km)	10284	10073	10340	10397	10643	10653	10398
Travel Time (hr)	2255.6	2469.0	2391.5	2180.5	2121.6	2327.6	2291.0
Total Delay (hr)	2047.6	2265.0	2182.6	1970.6	1907.3	2113.1	2081.0
Total Stops	30117	27826	29899	29610	30003	30769	29699
Fuel Used (l)	2547.7	2735.0	2672.2	2498.3	2472.9	2639.6	2594.3

101: Regional Road 25 & 5 Side Road Performance by approach

Approach	EB	WB	NB	SB	All
Total Stops	316	324	701	299	1640
Stop/Veh	1.13	0.87	0.64	0.68	0.75
Travel Dist (km)	91.8	111.6	392.8	99.1	695.3
Travel Time (hr)	122.3	14.2	13.1	132.3	281.9
Avg Speed (kph)	3	9	30	2	7

102: Regional Road 25 & Escarpment Way/Peddie Road Performance by approach

Approach	EB	WB	NB	SB	All
Total Stops	231	99	515	330	1175
Stop/Veh	0.91	0.89	0.51	0.57	0.60
Travel Dist (km)	43.3	12.9	516.7	187.9	760.7
Travel Time (hr)	11.5	5.6	13.3	68.4	98.7
Avg Speed (kph)	5	3	39	3	9

103: Regional Road 25 & James Snow Pkwy Performance by approach

Approach	EB	WB	NB	SB	All
Total Stops	271	414	507	694	1886
Stop/Veh	0.74	0.94	0.49	1.08	0.76
Travel Dist (km)	51.9	70.1	278.2	298.3	698.6
Travel Time (hr)	5.5	14.6	11.3	145.8	177.3
Avg Speed (kph)	11	7	25	3	5

104: Regional Road 25 & Driveway/High Point Drive Performance by approach

Approach	EB	WB	NB	SB	All
Total Stops	34	402	711	1369	2516
Stop/Veh	0.71	0.87	0.59	1.43	0.94
Travel Dist (km)	5.1	59.6	515.2	256.1	836.0
Travel Time (hr)	0.5	105.5	16.8	57.9	180.7
Avg Speed (kph)	10	4	31	5	9

105: Regional Road 25 & Highway 401 Westbound Off-Ramp (N. Term) Performance by approach

Approach	WB	NB	SB	All
Total Stops	745	374	2145	3264
Stop/Veh	0.65	0.24	1.59	0.81
Travel Dist (km)	130.0	458.6	549.1	1137.7
Travel Time (hr)	68.5	14.8	102.1	185.4
Avg Speed (kph)	6	31	5	8

106: Regional Road 25 & Highway 401 Eastbound Off-Ramp (S. Term)/MTO Carpool Lot Performance by

Approach	EB	WB	NB	SB	All
Total Stops	429	93	2076	3020	5618
Stop/Veh	0.78	0.96	1.08	1.68	1.29
Travel Dist (km)	63.4	8.1	405.9	535.2	1012.5
Travel Time (hr)	119.7	2.0	35.1	79.0	235.8
Avg Speed (kph)	2	4	12	7	7

107: Regional Road 25 & Chisholm Drive/Maplehurst C.C. Performance by approach

Approach	EB	WB	NB	SB	All
Total Stops	357	126	2619	2308	5410
Stop/Veh	0.92	0.76	1.55	1.38	1.38
Travel Dist (km)	77.4	8.7	410.8	387.6	884.5
Travel Time (hr)	6.0	1.6	48.5	53.2	109.4
Avg Speed (kph)	13	6	8	8	8

108: Regional Road 25 & Market Drive Performance by approach

Approach	EB	NB	SB	All
Total Stops	1138	873	2099	4110
Stop/Veh	1.65	0.62	1.24	1.09
Travel Dist (km)	223.4	391.7	410.3	1025.4
Travel Time (hr)	48.7	92.7	40.5	181.9
Avg Speed (kph)	5	5	10	6

110: Martin Street/Regional Road 25 & Steeles Ave Performance by approach

Approach	EB	WB	NB	SB	All
Total Stops	541	487	748	899	2675
Stop/Veh	0.86	0.58	0.93	0.55	0.68
Travel Dist (km)	84.9	193.6	108.9	388.6	776.0
Travel Time (hr)	26.0	563.8	23.8	16.9	630.5
Avg Speed (kph)	3	5	5	23	7

Total Network Performance

Total Stops	29699
Stop/Veh	3.29
Travel Dist (km)	10398.2
Travel Time (hr)	2291.0
Avg Speed (kph)	9

Summary of All Intervals

Run Number	1	2 Air Quality\2031 Forecast\PM Peak Hour 'Full Corridor'					Avg
Start Time	4:45	4:45	4:45	4:45	4:45	4:45	4:45
End Time	6:00	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	75	75	75	75	75	75	75
Time Recorded (min)	60	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	10249	10125	10197	10287	9996	10221	10181
Vehs Exited	10246	10069	10252	10189	10123	10233	10186
Starting Vehs	570	545	665	550	620	576	580
Ending Vehs	573	601	610	648	493	564	574
Travel Distance (km)	14539	14261	14353	14315	14254	14540	14377
Travel Time (hr)	882.5	841.1	840.6	902.5	889.9	891.3	874.6
Total Delay (hr)	590.4	554.4	551.6	613.9	602.4	599.3	585.3
Total Stops	20309	19260	21810	21739	19894	20421	20575
Fuel Used (l)	1753.4	1694.1	1703.7	1754.1	1740.4	1763.5	1734.9

Interval #0 Information Seeding

Start Time	4:45
End Time	5:00
Total Time (min)	15

Volumes adjusted by Growth Factors.

No data recorded this interval.

Interval #1 Information Recording

Start Time	5:00
End Time	6:00
Total Time (min)	60

Volumes adjusted by Growth Factors.

Run Number	1	2 Air Quality\2031 Forecast\PM Peak Hour 'Full Corridor'					Avg
Vehs Entered	10249	10125	10197	10287	9996	10221	10181
Vehs Exited	10246	10069	10252	10189	10123	10233	10186
Starting Vehs	570	545	665	550	620	576	580
Ending Vehs	573	601	610	648	493	564	574
Travel Distance (km)	14539	14261	14353	14315	14254	14540	14377
Travel Time (hr)	882.5	841.1	840.6	902.5	889.9	891.3	874.6
Total Delay (hr)	590.4	554.4	551.6	613.9	602.4	599.3	585.3
Total Stops	20309	19260	21810	21739	19894	20421	20575
Fuel Used (l)	1753.4	1694.1	1703.7	1754.1	1740.4	1763.5	1734.9

101: Regional Road 25 & 5 Side Road Performance by approach

Approach	EB	WB	NB	SB	All
Total Stops	441	311	436	408	1596
Stop/Veh	0.82	0.79	0.34	0.53	0.54
Travel Dist (km)	194.3	119.1	452.2	192.0	957.6
Travel Time (hr)	8.1	6.4	11.4	7.7	33.6
Avg Speed (kph)	26	19	40	25	29

102: Regional Road 25 & Escarpment Way/Peddie Road Performance by approach

Approach	EB	WB	NB	SB	All
Total Stops	240	92	121	209	662
Stop/Veh	0.88	0.84	0.11	0.18	0.25
Travel Dist (km)	46.4	12.5	597.8	393.9	1050.7
Travel Time (hr)	4.0	1.8	10.7	8.9	25.4
Avg Speed (kph)	12	8	56	44	42

103: Regional Road 25 & James Snow Pkwy Performance by approach

Approach	EB	WB	NB	SB	All
Total Stops	269	379	419	536	1603
Stop/Veh	0.74	0.86	0.34	0.41	0.48
Travel Dist (km)	51.0	70.3	336.3	655.3	1112.8
Travel Time (hr)	3.8	6.5	12.3	17.1	39.8
Avg Speed (kph)	15	11	27	38	28

104: Regional Road 25 & Driveway/High Point Drive Performance by approach

Approach	EB	WB	NB	SB	All
Total Stops	43	516	735	713	2007
Stop/Veh	1.00	0.81	0.50	0.43	0.53
Travel Dist (km)	4.5	84.6	621.5	463.2	1173.9
Travel Time (hr)	0.6	14.7	19.1	18.1	52.5
Avg Speed (kph)	8	7	32	26	24

105: Regional Road 25 & Highway 401 Westbound Off-Ramp (N. Term) Performance by approach

Approach	WB	NB	SB	All
Total Stops	938	348	701	1987
Stop/Veh	0.76	0.18	0.32	0.37
Travel Dist (km)	143.0	585.1	927.9	1656.0
Travel Time (hr)	14.9	19.4	28.9	63.3
Avg Speed (kph)	10	30	32	26

106: Regional Road 25 & Highway 401 Eastbound Off-Ramp (S. Term)/MTO Carpool Lot Performance by

Approach	EB	WB	NB	SB	All
Total Stops	541	86	1469	757	2853
Stop/Veh	0.75	0.91	0.61	0.29	0.49
Travel Dist (km)	82.3	7.5	522.3	815.0	1427.1
Travel Time (hr)	8.4	1.8	31.0	27.4	68.6
Avg Speed (kph)	10	4	17	30	21

107: Regional Road 25 & Chisholm Drive/Maplehurst C.C. Performance by approach

Approach	EB	WB	NB	SB	All
Total Stops	369	122	1212	1161	2864
Stop/Veh	0.94	0.78	0.54	0.49	0.56
Travel Dist (km)	77.4	7.6	557.5	554.9	1197.4
Travel Time (hr)	7.0	1.8	27.6	25.9	62.2
Avg Speed (kph)	11	4	20	21	19

108: Regional Road 25 & Market Drive Performance by approach

Approach	EB	NB	SB	All
Total Stops	615	934	925	2474
Stop/Veh	0.89	0.48	0.41	0.50
Travel Dist (km)	229.9	563.6	558.3	1351.8
Travel Time (hr)	13.4	20.6	24.4	58.4
Avg Speed (kph)	17	27	23	23

110: Martin Street/Regional Road 25 & Steeles Ave Performance by approach

Approach	EB	WB	NB	SB	All
Total Stops	864	795	716	1760	4135
Stop/Veh	0.95	0.64	0.84	0.79	0.79
Travel Dist (km)	125.7	282.8	117.5	522.3	1048.3
Travel Time (hr)	12.9	322.4	13.7	29.3	378.4
Avg Speed (kph)	10	7	9	18	11

Total Network Performance

Total Stops	20575
Stop/Veh	1.91
Travel Dist (km)	14377.1
Travel Time (hr)	874.6
Avg Speed (kph)	25

Attachment C
Emission Estimation

Emission Inventory - Halton Region Regional Road 25 Road Widening Project

Sumamry of MOVES Input Parameters

Parameter	Input	Reference / Rationale
Scale	Custom County Domain	
Evaluation Year	2031	Project Future Build and Future No-Build Year
Evaluation Month(s)	January and July	Representative of winter and summer conditions
Day of Week	Weekdays	Traffic data is based on weekdays traffic
Meteorology	Daily average temperature and average relative humidity from Environment Canada Climate Normals recorded at Pearson Airport	Pearson Airport is the closest station with relative humidity data
Fuel Type	Gasoline Diesel	
Fuel Type / Source (Vehicle) Types	Gasoline: Passenger Car Passenger Truck Diesel: Light Commercial Truck Single Unit Short-haul Truck Combination Short-haul Truck	Mix of passenger cars/trucks and heavy trucks/ vehicles.
Road Type	Urban Unrestricted Access	Based on Project road type
Day of Week	Weekdays	Traffic data is based on weekdays traffic
Contaminants	Nitrogen Dioxide (NO_2) Carbon Monoxide (CO) Particulate Matter less than 10 microns (PM_{10}) Particulate Matter less than 2.5 microns ($PM_{2.5}$) Acrolein Benzene 1,3-Butadiene Acetaldehyde Formaldehyde	List of COI per MTO Guide
Vehicle Age Distribution	MOVES default for 2031	

Emission Inventory - Halton Region Regional Road 25 Road Widening Project

Source: Emissions from Vehicles Travelling in on Road - Future No-Build Scenario

Description:

Emissions from road traffic tailpipe emissions from vehicles from vehicles travelling along road. Tailpipe emission rates are based on the estimation tool U.S. EPA Motor Vehicle Emission Simulator (MOVES).
Emissions estimated here are based on future predicted traffic data and average vehicle speed.
PM Peak hour traffic was assessed as PM Peak hour traffic was higher than AM Peak hour traffic.
Particulate emissions from resuspension of loose material on the road surface were not estimated / included in this assessment as the comparison between Future Build and Future No-Build Scenarios have the same vehicle count and vehicle distribution. The particulate emissions would be the same for both scenarios.

Contaminant(s) of Concern:

NO2, SO2, PM2.5, PM10, CO, acetaldehyde, acrolein, benzene, 1,3-butadiene, benzo(a) pyrene, formaldehyde are included in the estimations.

Emission Calculations - Parameters Used:

Parameter	**Input for Road Traffic**									
Scenario	**Future No-Build**									
Operating Year	**2031**									
Road Name	**Regional Road 25**									
Road direction	**North-South**									
Intersection	**Link ID**		**Total traffic volume per hr**		**Distance travelled**		**Percent of Trucks**		**Percent of Cars**	
	North bound	**South Bound**	**North bound**	**South Bound**	**miles**	**km**	**North bound**	**South Bound**	**North bound**	**South Bound**
North of intersection	SLINE_N1	SLINE_S1	1271	1046	0.24	0.38	5.6%	11.7%	94.4%	88.3%
South of intersection	SLINE_N2	SLINE_S2	1175	1198	0.32	0.52	7.9%	14.0%	92.1%	86.0%
Overall average							6.7%	12.9%	93.3%	87.1%
Vehicle speed - (km per hour)			39	3						
- (mph)			24.2	1.9						
MOVES avg speed bin ID			6	1						

Road Name	**Escarpment Way / Peddie Road**									
Road direction	**East-West**									
Intersection	**Link ID**		**Total traffic volume per hr PM Peak**		**Distance travelled (miles)**	**Distance travelled (km)**	**Percent of Trucks**		**Percent of Cars**	
	East bound	**West bound**	**East bound**	**West bound**			**East bound**	**West bound**	**East bound**	**West bound**
West of intersection	SLINE_E1	SLINE_W1	270	74	0.11	0.17	9.9%	17.5%	90.1%	82.5%
East of intersection	SLINE_E2	SLINE_W2	57	109	0.07	0.12	34.0%	26.8%	66.0%	73.2%
Overall average							14.1%	23.1%	85.9%	76.9%
Vehicle speed - (km per hour)			5	3						
- (mph)			3.1	1.9						
MOVES avg speed bin ID			2	1						

Tailpipe Emissions
Hourly Emission Calculation for Vehicles Travelling on Road:

				Link ID	SLINE_N1	SLINE_N2	SLINE_S1	SLINE_S2	SLINE_E1	SLINE_E2	SLINE_W1	SLINE_W2	
				Road	RR25	RR25	RR25	RR25	Escarpment/Peddie	Escarpment/Peddie	Escarpment/Peddie	Escarpment/Peddie	
				Direction	North bound	North bound	South Bound	South Bound	East bound	East bound	West bound	West bound	
				Traffic Volume/hr	1271	1175	1046	1198	270	57	74	109	
				Distance (miles)	0.24	0.32	0.24	0.32	0.11	0.07	0.11	0.07	
				Average vehicle speed (mph)	24.2	24.2	1.9	1.9	3.1	3.1	1.9	1.9	
				MOVES Avg Speed Bin ID	6	6	1	1	2	2	1	1	
		Emission Factor (g/VMT) [1]					**Hourly Emission Rate [2]**						**Total**
Contaminant	**CAS#**	**Speed bin 6 RR25 NB**	**Speed bin 1 RR25 SB**	**Speed bin 2 Escarpment EB**	**Speed bin 1 Escarpment WB**	**g/s**	**g/s**	**g/s**	**g/s**	**g/s**	**g/s**	**g/s**	**g/s**	**g/s**
NOx	10102-44-0	0.095	0.659	0.387	1.151	0.008	0.010	0.045	0.071	0.003	0.000	0.002	0.003	0.140
NO2	10102-44-0	0.027	0.236	0.136	0.417	0.002	0.003	0.016	0.025	0.001	0.000	0.001	0.001	0.049
CO	630-08-0	1.137	3.217	2.191	3.189	0.095	0.120	0.221	0.346	0.017	0.003	0.007	0.007	0.808
$PM_{2.5}$	N/A	0.014	0.074	0.051	0.092	1.18E-03	1.49E-03	0.005	0.008	4.01E-04	5.98E-05	1.99E-04	2.07E-04	0.016
PM_{10}	N/A	0.080	0.415	0.298	0.467	6.67E-03	8.44E-03	0.028	0.045	2.36E-03	3.52E-04	1.01E-03	1.06E-03	0.092
TSP	N/A	0.080	0.415	0.298	0.467	6.67E-03	8.44E-03	0.028	0.045	2.36E-03	3.52E-04	1.01E-03	1.06E-03	0.092
SO_2	7446-09-5	0.002	0.013	0.007	0.016	1.96E-04	2.48E-04	0.001	0.001	5.85E-05	8.71E-06	3.50E-05	3.64E-05	0.003
Benzene	71-43-2	4.65E-04	1.87E-03	1.16E-03	2.23E-03	3.88E-05	4.90E-05	1.28E-04	2.01E-04	9.16E-06	1.37E-06	4.85E-06	5.04E-06	4.32E-04
Acetaldehyde	75-07-0	2.81E-04	3.50E-03	2.10E-03	6.16E-03	2.34E-05	2.97E-05	2.40E-04	3.76E-04	1.66E-05	2.48E-06	1.34E-05	1.39E-05	7.02E-04
Acrolein	107-02-8	4.03E-05	5.17E-04	3.10E-04	9.12E-04	3.36E-06	4.25E-06	3.54E-05	5.56E-05	2.45E-06	3.66E-07	1.98E-06	2.06E-06	1.03E-04
Benzo(a)pyrene	50-32-8	1.55E-06	4.82E-06	3.07E-06	4.68E-06	1.29E-07	1.63E-07	3.30E-07	5.18E-07	2.43E-08	3.62E-09	1.02E-08	1.06E-08	1.18E-06
1, 3-Butadiene	106-99-0	4.29E-06	6.28E-05	3.73E-05	1.12E-04	3.58E-07	4.53E-07	4.31E-06	6.75E-06	2.96E-07	4.40E-08	2.43E-07	2.53E-07	1.25E-05
Formaldehyde	50-00-0	0.001	0.011	0.006	0.019	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.002
VOC	106-99-0	0.029	0.236	0.125	0.257	0.002	0.003	0.016	0.025	0.001	0.000	0.001	0.001	0.049

Notes:
1) Emission factors are from the estimation tool U.S. EPA Motor Vehicle Emission Simulator (MOVES), for the selected year, traffic vehicle distribution, and average speed for the section of road/direction of road.

Emission Inventory - Halton Region Regional Road 25 Road Widening Project

Source: Emissions from Vehicles Travelling in on Road - Future Build Scenario

Description:

Emissions from road traffic tailpipe emissions from vehicles from vehicles travelling along road. Tailpipe emission rates are based on the estimation tool U.S. EPA Motor Vehicle Emission Simulator (MOVES).
Emissions estimated here are based on future predicted traffic data and average vehicle speed.
PM Peak hour traffic was assessed as PM Peak hour traffic was higher than AM Peak hour traffic.
Particulate emissions from resuspension of loose material on the road surface were not estimated / included in this assessment as the comparison between Future Build and Future No-Build Scenarios were assumed to have the same vehicle count and vehicle distribution. The particulate emissions would be the same for both scenarios.

Contaminant(s) of Concern:

NO2, SO2, PM2.5, PM10, CO, acetaldehyde, acrolein, benzene, 1,3-butadiene, benzo(a) pyrene, formaldehyde are included in the estimations.

Emission Calculations - Parameters Used:

Parameter	**Input for Road Traffic**									
Scenario	**Future Build**									
Operating Year	**2031**									
Road Name	**Regional Road 25**									
Road direction	**North-South**									
Intersection	**Link ID**		**Total traffic volume per hr PM Peak**		**Distance travelled (miles)**	**Distance travelled (km)**	**Percent of Trucks**		**Percent of Cars**	
	North bound	**South Bound**	**North bound**	**South Bound**			**North bound**	**South Bound**	**North bound**	**South Bound**
North of intersection	SLINE_N1	SLINE_S1	1271	1046	0.24	0.38	5.6%	11.7%	94.4%	88.3%
South of intersection	SLINE_N2	SLINE_S2	1175	1198	0.32	0.52	7.9%	14.0%	92.1%	86.0%
Overall average							6.7%	12.9%	93.3%	87.1%
Vehicle speed - (km per hour)			56	44						
- (mph)			34.8	27.3						
MOVES avg speed bin ID			8	7						

Road Name	**Escarpment Way / Peddie Road**									
Road direction	**East-West**									
Intersection	**Link ID**		**Total traffic volume per hr PM Peak**		**Distance travelled (miles)**	**Distance travelled (km)**	**Parameter**		**Road name**	
	East bound	**West bound**	**East bound**	**West bound**			**East bound**	**West bound**	**East bound**	**West bound**
West of intersection	SLINE_E1	SLINE_W1	270	74	0.11	0.17	9.9%	17.5%	90.1%	82.5%
East of intersection	SLINE_E2	SLINE_W2	57	109	0.07	0.12	34.0%	26.8%	66.0%	73.2%
Overall average							14.1%	23.1%	85.9%	76.9%
Vehicle speed - (km per hour)			12	8						
- (mph)			7.5	5.0						
MOVES avg speed bin ID			2	2						

Tailpipe Emissions
Hourly Emission Calculation for Vehicles Travelling on Road:

				Link ID	SLINE_N1	SLINE_N2	SLINE_S1	SLINE_S2	SLINE_E1	SLINE_E2	SLINE_W1	SLINE_W2	
				Road	RR25	RR25	RR25	RR25	Escarpment/Peddie	Escarpment/Peddie	Escarpment/Peddie	Escarpment/Peddie	
				Direction	North bound	North bound	South Bound	South Bound	East bound	East bound	West bound	West bound	
				Traffic Volume/hr	1271	1175	1046	1198	270	57	74	109	
				Distance (miles)	0.24	0.32	0.24	0.32	0.11	0.07	0.11	0.07	
				Average vehicle speed (mph)	34.8	34.8	27.3	27.3	7.5	7.5	5.0	5.0	
				MOVES Avg Speed Bin ID	8	8	7	7	2	2	2	2	
		Emission Factor (g/VMT) [1]				**Hourly Emission Rate [2]**							**Total**
Contaminant	**CAS#**	**Speed bin 8 RR25 NB**	**Speed bin 7 RR25 SB**	**Speed bin 2 Escarpment EB**	**Speed bin 2 Escarpment WB**	**g/s**	**g/s**	**g/s**	**g/s**	**g/s**	**g/s**	**g/s**	**g/s**	**g/s**
NOx	10102-44-0	0.085	0.141	0.387	0.609	0.007	0.009	0.010	0.015	0.003	0.0005	0.0013	0.0014	0.046
NO2	10102-44-0	0.023	0.045	0.136	0.218	0.002	0.002	0.003	0.005	0.001	0.0002	0.0005	0.0005	0.014
CO	630-08-0	1.031	1.074	2.191	2.141	0.086	0.109	0.074	0.115	0.017	0.0026	0.0046	0.0048	0.408
$PM_{2.5}$	N/A	0.010	0.014	0.051	0.064	8.08E-04	1.02E-03	9.30E-04	1.46E-03	4.01E-04	5.98E-05	1.38E-04	1.43E-04	0.005
PM_{10}	N/A	0.050	0.070	0.298	0.363	4.20E-03	5.31E-03	4.80E-03	7.52E-03	2.36E-03	3.52E-04	7.88E-04	8.19E-04	0.025
TSP	N/A	0.050	0.070	0.298	0.363	4.20E-03	5.31E-03	4.80E-03	7.52E-03	2.36E-03	3.52E-04	7.88E-04	8.19E-04	0.025
SO_2	7446-09-5	0.002	0.003	0.007	0.009	1.64E-04	2.08E-04	1.74E-04	2.73E-04	5.85E-05	8.71E-06	1.92E-05	2.00E-05	0.001
Benzene	71-43-2	4.09E-04	4.44E-04	1.16E-03	1.32E-03	3.41E-05	4.31E-05	3.05E-05	4.77E-05	9.16E-06	1.37E-06	2.86E-06	2.98E-06	1.69E-04
Acetaldehyde	75-07-0	2.29E-04	4.32E-04	2.10E-03	3.38E-03	1.91E-05	2.41E-05	2.96E-05	4.64E-05	1.66E-05	2.48E-06	7.34E-06	7.63E-06	1.46E-04
Acrolein	107-02-8	3.26E-05	6.28E-05	3.10E-04	5.00E-04	2.72E-06	3.44E-06	4.31E-06	6.76E-06	2.45E-06	3.66E-07	1.08E-06	1.13E-06	2.11E-05
Benzo(a)pyrene	50-32-8	1.31E-06	4.82E-06	3.07E-06	2.93E-06	1.09E-07	1.38E-07	3.30E-07	5.18E-07	2.43E-08	3.62E-09	6.36E-09	6.61E-09	1.13E-06
1, 3-Butadiene	106-99-0	3.40E-06	7.20E-06	3.73E-05	6.09E-05	2.83E-07	3.58E-07	4.94E-07	7.75E-07	2.96E-07	4.40E-08	1.32E-07	1.37E-07	2.38E-06
Formaldehyde	50-00-0	0.001	0.001	0.006	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VOC	106-99-0	0.023	0.027	0.125	0.136	0.002	0.002	0.002	0.003	0.001	0.000	0.000	0.000	0.011

Notes:
1) Emission factors are from the estimation tool U.S. EPA Motor Vehicle Emission Simulator (MOVES), for the selected year, traffic vehicle distribution, and average speed for the section of road/direction of road.