APPENDIX H

AIR QUALITY IMPACT ASSESSMENT

Imagine the result

Air Quality Impact Assessment

Ninth Line (Regional Road 13) Transportation Corridor Improvements: Highway 407 to 10 Side Road (Regional Road 10)

May 2016

Kim Theobald, B.Sc.
Intermediate Environmental Scientist

Malcolm Smith
Senior Environmental Engineer

Shawn Roberts, M.A.Sc
Principal Environmental Scientist

Air Quality Impact Assessment

Ninth Line (Regional Road 13)
Transportation Corridor
Improvements

Prepared for:
Halton Region

Prepared by:
ARCADIS Canada Inc.
121 Granton Drive
Unit 12
Richmond Hill
Ontario L4B 3N4
Tel 905 764 9380
Fax 905 764 9386

Our Ref.:
351003

Date:
May 2016

Tables

Acronyms and Abbreviations

AADT	Annual Average Daily Traffic
AAQC	Ambient Air Quality Criteria
CAC	Criteria Air Contaminant
CAAQS	Canadian Ambient Air Quality Standard
CCME	Canadian Councils of the Ministers of the Environment
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CWS	Canada-Wide Standard
EC	Environment Canada
GHG	Greenhouse Gas
g/h	Grams per hour

g/VKT	Grams per vehicle kilometre travelled
HDV	Heavy Duty Vehicle
km	Kilometre
km/h	Kilometres per hour
kt	Kilotonnes
LDV	Light Duty Vehicle
MOECC	Ministry of Environment and Climate Change
MTO	Ministry of Transportation
NO	Nitgrogen Oxide
NOx	Oxides of Nitrogen
NO_2	Nitrogen Dioxide
N_2O	Nitrous Oxide
O.Reg. 419/05	Ontario Regulation 419/05 - Local Air Quality
O_3	Ozone
$PM_{2.5}$	Particulate matter less than 2.5 microns
RR13	Regional Road 13
RVP	Reid Vapour Pressure
SO_2	Sulphur Dioxide
U.S. EPA	United States Environmental Protection Agency
$\mu g/m^3$	Micrograms per cubic metre

1. Introduction

1.1 Project Overview

Halton Region has initiated a Class Environmental Assessment (EA) to evaluate options to manage future traffic growth on Ninth Line (Regional Road 13) between Steeles Avenue and 10 Side Road in Halton Hills, Ontario (the Project). A preliminary review of options for improving the corridor was completed in January 2015, which evaluated several alternatives for widening Ninth Line to accommodate projected traffic growth, including widening about the centre, widening towards the east, and widening towards the west. The preferred design was selected from this review, which consisted primarily of widening Ninth Line about the existing centerline, with several segments widened on the east or west side depending on the location of existing homes in the area.

This Air Quality Impact Assessment has been prepared in support of the Class EA, and evaluates the potential for air quality impacts associated with the preferred design in accordance with Halton Region and Provincial guidelines for transportation projects.

1.2 Summary of Assessment Approach

The assessment of air quality impacts from the Project followed draft assessment guidance provided by Halton Region (2012). According to Halton Region guidance, transportation projects are classified as having potentially high air quality impacts and require a detailed Tier 3 modelling assessment. At minimum, a Tier 3 assessment includes:

- an emissions inventory of the proposed development and existing sources;
- air dispersion modelling using an approved approach for the assessment of air quality impacts of contaminants of concern at sensitive receptors;
- inclusion of background air quality concentrations in the assessment; and
- a summary of mitigative measures incorporated to the project.

Impacts from the construction of transportation projects do not require assessment.

Air quality concentrations have been predicted at select sensitive receptors for a base case scenario (2016) and two future (2031) operating scenarios – one which assumes that the Project does not proceed, and Ninth Line remains in the current configuration (Future No-Build), and one which assumes that the Project does proceed (Future

Build). The difference between these scenarios represents the incremental increase in air contaminant concentrations that is attributable to the Project.

To evaluate the potential impact of the Project on ambient air quality, the CAL3QHCR specialized transportation dispersion model was used to predict concentrations of the following contaminants of concern (as listed within Halton Region guidance): particulate matter less than 2.5 microns ($PM_{2.5}$), nitrogen dioxide (NO_2 – also including NOx and NO), sulphur dioxide (SO_2) and carbon monoxide (CO). Model predicted concentrations were added to local background concentrations and compared to applicable provincial and/or federal ambient air quality criteria. The air quality criteria used for this assessment are outlined in Section 2.

In addition to modelling air contaminants of concern, the change in greenhouse gas (GHG) emissions was also evaluated following the assessment approach outlined in Ontario Ministry of Transportation's guidance document for assessing air quality impacts of transportation projects (MTO 2012). Details of the complete assessment methodology are provided in Section 4.

2. Ambient Air Quality Criteria

The Ontario Ministry of the Environment and Climate Change (MOECC) has developed both Ambient Air Quality Criteria (AAQC) and air quality standards as measures to protect outdoor air quality. The term "standard" refers to a regulatory limit which is governed by *Ontario Regulation 419/05 – Air Pollution – Local Air Quality* (O.Reg. 419/05). Most of the standards developed under O.Reg. 419/05 are based on AAQCs; however, AAQCs and standards are used quite differently as described in the following paragraph.

An AAQC is a desirable concentration based on the protection against adverse effects on health and/or the environment and is meant to be used to assess general or "ambient" air quality conditions from all sources. As a result, the addition of a background contribution (i.e., sources other than project-related activities) is required before comparing to an AAQC. In contrast, an air standard is used to assess the incremental change in concentration of a contaminant resulting from a single facility. Under O.Reg. 419/05, the air standard must be met at the nearest point not located on a facility's property which is most often the property line.

As noted above, the purpose of this assessment is to evaluate the potential effects of the proposed Project on ambient air quality. Therefore, model predicted concentrations were added to local background concentrations and compared with applicable AAQCs. Details about the selected criteria for each air contaminant of concern are provided in the sections below.

2.1 Fine Particulate Matter ($PM_{2.5}$)

Particulate matter less than 2.5 microns ($PM_{2.5}$) is known as "respirable" particulate since the particles are generally small enough to be drawn in and deposited into the deepest portions of the lungs. In particular, many studies have indicated that airborne $PM_{2.5}$ is associated with various adverse health effects in people who have compromised respiratory systems from conditions such as asthma, chronic pneumonia and cardiovascular disease. Anthropogenic sources, such as combustion of fossil fuels like diesel, tend to be the largest contributor to $PM_{2.5}$ levels in the environment.

Footnote 8 of *Ontario's Ambient Air Quality Criteria* (AAQC) document (MOECC 2012) presents an ambient air quality guide for decision making for $PM_{2.5}$ of 30 µg/m^3 (24-hour average), which is based on the Canadian Council of the Ministers of the Environment (CCME) Canada-Wide Standard (CWS) for fine particulate matter (CCME 2000). However, the CCME has since replaced the CWS with a Canadian Ambient Air Quality Standard (CAAQS) which was officially enacted under the Canadian Environmental Protection Act on May 25, 2013 (CCME 2012). The 24-hour $PM_{2.5}$ CWS has been revised to 28 µg/m^3 (effective in 2015) and to 27 µg/m^3 (effective in 2020). The CCME has also established an annual $PM_{2.5}$ CAAQS for 2015 (10.0 µg/m^3) and for 2020 (8.8 µg/m^3).

It is assumed that Ontario will adopt the new $PM_{2.5}$ CAAQS and as a result, these new standards were considered in this assessment in lieu of the current CWS for $PM_{2.5}$. Since the operational life of the Project will extend beyond 2020, the 2020 CAAQS were applied in this assessment. Table 2-1 presents the $PM_{2.5}$ ambient air quality criteria used in this assessment.

Table 2-1 $PM_{2.5}$ Ambient Air Quality Assessment Criteria

Pollutant	Averaging Period	Source	Air Quality Criteria
$PM_{2.5}$	24-hour	CAAQS	27 [a]
	Annual	CAAQS	8.8 [b]

Notes:

[a] The Canadian Ambient Air Quality Standard (CAAQS) for 24-hr $PM_{2.5}$ is 28 µg/m^3 in 2015 and 27 µg/m^3 in 2020 based on the 98th percentile of 24-hour average concentrations, averaged over 3 consecutive years (CCME 2012). Since the Project will operate beyond 2020, the 2020 CAAQS was used.

[b] The Canadian Ambient Air Quality Standard (CAAQS) for annual $PM_{2.5}$ is 10 µg/m^3 in 2015 and 8.8 µg/m^3 in 2020. Since the Project will operate beyond 2020, the 2020 CAAQS was used.

2.2 Criteria Air Contaminants

Criteria Air Contaminants (CACs) including nitrogen oxides (NOx), sulphur oxides (SOx) and carbon monoxide (CO) are considered common pollutants released into the air by activities such as the combustion of fossil fuels.

Nitrogen dioxide (NO_2) is a reddish brown, highly reactive gas that is formed in the ambient air through the oxidation of nitric oxide (NO). Nitrogen oxides (NOx), the term used to describe the sum of NO, NO_2 and other oxides of nitrogen play a major role in the formation of ozone. NO_2 has adverse health effects at much lower concentrations than NO. Consequently, the Ontario AAQC is based on the health effects of NO_2. The AAQC for NO_2 is 400 µg/m^3 for a 1-hour averaging period and 200 µg/m^3 24-hour averaging period.

Sulphur dioxide (SO_2) is a colourless gas that smells like burnt matches. It can be oxidized to sulphur trioxide, which in the presence of water vapour, is readily transformed to sulphuric acid mist. SO_2 can be oxidized to form acid aerosols, and is a precursor of particulate sulphates, which are one of the main components of respirable particulates in the atmosphere. The AAQC for SO_2 is 690 µg/m^3 for a 1-hour averaging period, 275 µg/m^3 for a 24-hour averaging period and 55 µg/m^3 for an annual averaging period.

Carbon monoxide (CO) is a colourless, odourless gas, formed when carbon in fuel is not burned completely. It is a component of motor vehicle exhaust, with high concentrations of CO generally occurring in areas with heavy traffic congestion. The AAQC for CO is 36,200 µg/m^3 for a 1-hour averaging period and 15,700 µg/m^3 for an 8-hour averaging period.

The ambient air quality criteria for criteria air contaminants are shown in Table 2-2.

Table 2-2 Ambient Air Quality Criteria for NO_2, SO_2 and CO

Pollutant	**Ambient Air Quality Criteria (µg/m³)**			
	Annual	**24-hour**	**8-hour**	**1-hour**
NO_2	--	200	--	400
SO_2	55	275	--	690
CO	--	--	15,700	36,200

2.3 Volatile Organic Compounds

Other compounds that are emitted in vehicle exhaust are volatile organic compounds (VOC). As part of this assessment five typical VOC that are emitted from vehicles were included, these are; acetaldehyde, acrolein, benzene, 1-3 butadiene and formaldehyde.

The ambient air quality criteria associated with these VOCs are shown in Table 2-3.

Table 2-3 Ambient Air Quality Criteria for Selected VOC

Pollutant	Ambient Air Quality Criteria (µg/m³)		
	Annual	24-hour	1-hour
Acetaldehyde	--	500	--
Acrolein	--	0.4	4.5
Benzene	0.45	2.3	--
1-3 Butadiene	2	10	--
Formaldehyde	--	65	--

2.4 Greenhouse Gases

Greenhouse Gases (GHGs) absorb and emit radiation within the thermal infrared range, which is the process regarded as the fundamental cause of the non-natural part of the "greenhouse effect." Greenhouse gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), ozone (O_3) and chlorofluorocarbons (CFCs). Fossil fuel combustion is the main source of GHG emissions related to this project, which results in emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

For a given mixture of different GHGs, the carbon dioxide equivalent (CO_2e) is the unit of measure used to describe the amount of CO_2 that would have the same global warming potential as a mixture of GHGs when measured over a time period (typically a 100 year period). The carbon dioxide equivalency for a gas is calculated by multiplying the mass (of the gas) by its global warming potential (GWP). For example, the global GWP for CH_4 over 100 years is 25 and for N_2O is 298 (IPPC 2007). This means that the emission of 1 tonne of CH_4 is equivalent, in its warming potential, to the emission of 25 tonnes of CO_2, and the emission of 1 tonne of N_2O is equivalent to the emission of 298 tonnes of CO_2.

There are no ambient air quality criteria for greenhouse gases.

3. Study Area Description

Ninth Line is currently a two-lane roadway with a posted speed limit of 80 km/h, and with gravel shoulders on either side. The land uses along the Ninth Line corridor between Highway 407 and 10 Side Road are primarily zoned for Agricultural use by the Town of Halton Hills, and are mainly used for farming and limited residential.

The preferred design for the widening of Ninth Line will result in an increase in the number of lanes from two to four (i.e., two lanes in each direction), with northbound and southbound traffic separated by a painted island. The preferred design also includes the addition of multi-use paths on either side of the roadway. The posted speed limit upon expansion is to remain at 80 km/h. The preferred design also includes on-road bicycle lanes and provision for multi-use paths on the boulevard, on either side of the roadway. The Study Area and a typical cross-section of the proposed right-of-way is provided in Figure 1.

4. Air Quality Impact Assessment Methodology

4.1 Identification of Sensitive Areas

The section of Ninth Line that is the subject of this assessment (between Steeles Avenue and 10 Side Road) is approximately 6.2 km in length. In order to identify the locations of all sensitive receptors adjacent to the right-of-way, a detailed review of recent aerial photography (dated Spring 2013) was completed as part of the noise assessment under the environmental assessment process. A total of 37 properties were identified as sensitive receptors (all residential). Out of the 37 receptors, 5 sensitive receptors were chosen as representative worst case points of reception (PORs) for detailed modelling in the noise impact assessment. The same 5 receptors were used to summarize the air quality modelling results (see Figure 1).

4.2 Background Air Quality

Ambient background concentrations used in air quality assessments represent the cumulative contribution of upwind sources such as industrial facilities, other roadways (e.g., Highway 401/407), and transboundary pollution that are not included in the modelling. It is important to add background concentrations to modelled concentrations in order to assess the combined effect of all sources at a specific receptor location. In order to capture emissions other than those directly related to the planned Project, historical background concentrations for each air contaminant of concern were calculated and added to model-predicted concentrations.

To establish background air quality concentrations in the Study Area, five (5) years of historical data for the period 2009 to 2013 was obtained from two local ambient air quality monitoring stations that were closest to the Study area. The closest station to the Project is located approximately 8 km southwest of the Study Area at the Bishop Reding Catholic Secondary School in Milton. It is operated by Halton Region and collects hourly measurements of $PM_{2.5}$, nitrogen oxides (NO, NO_2 and NOx), SO_2 and CO as well as ozone and meteorological data. The MOECC also measures air contaminants at various locations throughout Ontario, and reports on the state of Ontario's air quality on an annual basis. One MOECC monitoring station located approximately 10 km away in downtown Brampton has also been considered, but only measures $PM_{2.5}$ and NO_2. A single MOECC station that measures all compounds was not used as the data from the two selected stations were closer to the project and are more representative of the background concentrations in the vicinity of the Study Area.

The best estimator of a background concentration for a location is typically the average concentration. However to be conservative, the 90th percentile concentration is typically recommended as outlined in the Ontario Ministry of Transportation's guidance document for assessing air quality impacts of transportation projects (MTO 2012). The 90th percentile values are considered conservative as they represent values that will only be exceeded 10% of the time under adverse meteorological conditions. The 90th percentile 1-hour and 24-hour average values as well as annual values for the contaminants of concern are shown in Table 4-1.

Table 4-1 Background Data from the Milton and Brampton Stations, 2009 to 2013

Station	Contaminant	2009	2010	2011	2012	2013
Halton Region - Milton	**SO_2**					
	1-hr 90th percentile	7.9	7.9	7.9	7.9	7.9
	24-hr 90th percentile	6.7	6.1	5.6	6.1	6.3
	Annual	0.0	2.6	2.6	2.6	2.6
	$PM_{2.5}$					
	24-hr 90th percentile	10	13	12	12	15
	Annual	5	5	5	5	7
	NO_2					
	1-hr 90th percentile	47	41	47	41	36
	24-hr 90th percentile	39	33	38	33	26
	CO					
	1-hr 90th percentile	332	252	275	263	229
	8-hr 90th percentile[a]	325	239	268	255	222
MOECC - Brampton	**$PM_{2.5}$**					
	24-hr 90th percentile	11	12	12	12	15
	Annual	4	4	4	4	7
	NO_2					
	1-hr 90th percentile	55	45	47	47	40
	24-hr 90th percentile	47	38	40	37	32

Notes:
[a] Based on 8-hour rolling average values

For each contaminant of concern, selected background concentrations were based on the 5-year average of measured concentrations. For $PM_{2.5}$ and NO_2, the selected background concentrations are also based on the average of Milton and Brampton data.

Table 4-2 Representative Background Concentrations for Contaminants of Concern

Averaging Time	Background Concentrations for COC (µg/m^3)			
	$PM_{2.5}$	**NO_2**	**SO_2**	**CO**
1-hour	--	45	8	270
8-hour	--	--	--	262[a]
24-hour	12	36	6	--
Annual	5	--	2	--

Notes:
[a] Based on 8-hour rolling average values

VOC concentrations are measured at Environment Canada NAPS monitoring stations. The nearest station to the project that measures VOCs is Toronto (NAPS ID 60435 and 60418). For 1-3 butadiene and benzene the most current data, 2009 – 2013 was used for background concentrations (Station 60435). For acrolein, acetaldehyde and formaldehyde, the data was taken from older sampling (2002-2006 Station 60418) as more recent data is not available for these species for the area.. The 90th percentile 24-hour average concentrations for 1,3-butadiene, benzene, acetaldehyde, acrolein and formaldehyde monitored at NAPS monitoring stations are summarized in Table 4-3 below. All VOC monitoring at NAPS stations are over a 24-hr period; therefore, 1-hr 90th percentile VOC concentrations were calculated based on the methodology outlined in Table 7-1 of the MOE ESDM Procedure Document (MOE March 2009). Annual 90th percentile background concentrations were also calculated for 1,3-butadiene and benzene, which both have annual AAQC.

Table 4-3 Representative Background Concentrations for VOC of Concern

Contaminant	24-hr 90th Percentile	24-hr AAQC	Calculated 1-hr 90th Percentile*	1-hr AAQC	Calculated Annual 90th Percentile	Annual AAQC
1,3 – Butadiene	0.08	10	0.2	-	0.016	2
Benzene	0.87	2.3	2.1	-	0.168	0.45
Acetaldehyde	2.90	500	7.1	500	-	-
Acrolein	0.24	0.4	0.6	4.5	-	-
Formaldehyde	5.80	65	14.1	-	-	-

* The 5-year average of 24-hr 90th Percentile was converted to 1-hr and annual averaging periods using equation in Table 7-1 of MOE ESDM Procedure Document.

4.3 Estimation of Air Emissions

4.3.1 Assessment Scenarios

To put the Project into perspective over its lifetime, the assessment covered three different scenarios:

1. Base Case Conditions (2016) – The current configuration of Ninth Line based on 2016 traffic estimates.
2. Future No-Build (2031) – The current configuration of Ninth Line based on 2031 traffic estimates.
3. Future Build Preferred Option (2031) – The preferred Project design option for Ninth Line based on 2031 traffic estimates.

A detailed description of each of the three scenarios is provided below.

Base Case Conditions (2016) looks at the current configuration of the local road network and its use by an estimated fleet of vehicles in the commencement year of operations (2016). Emissions from the local road network were established using vehicle emission factors developed with the Mobile 6.2C model, annual average daily traffic (AADT) information and U.S. EPA road dust emission factors for $PM_{2.5}$. This emissions inventory was input into the CAL3QHCR model and maximum pollutant concentrations at sensitive receptors were calculated based on hourly meteorological data.

Future No-Build (2031) assumes there are no changes to the existing road network in the future year 2031. This scenario considers emissions factors developed with the Mobile 6.2C model for the year 2031. Future emissions reflect newer engine technologies and a future vehicle fleet mix assuming that the configuration of Ninth Line remains the same. Similar to the Base Case Scenario, the developed emissions inventory was input into the CAL3QHCR model and maximum pollutant concentrations at sensitive receptors were calculated based on hourly meteorological data.

Future Build (2031) assumes the Ninth Line corridor is widened using the preferred design option. Similar to the Future No-Build Scenario, future road emissions were based on emission factors developed with the Mobile 6.2C model for 2031, combined with the future vehicle fleet mix. The emissions inventory was input into the CAL3QHCR model to estimate the maximum pollutant concentrations at sensitive receptors based on hourly meteorological data.

4.3.2 Vehicle Emissions Estimation

4.3.2.1 Estimation of Road Traffic Volumes

The rate of contaminant emissions from a section of road is proportional to the number and types of vehicles on the road, as well as the speed at which they are travelling. Hourly road traffic flows for the existing and future road network within the Study Area were calculated based on annual average daily traffic (AADT) flows as well as hourly traffic profiles based on traffic counts from 2013.

Hourly traffic counts on Ninth Line and Steeles Avenue, inclusive of vehicle classification information, were provided by UEM for use in this study. UEM also provided traffic modelling data from Halton Region that provides the projected annual traffic growth rates for the Region, which accounts for planned Regional Road improvement projects. The hourly traffic count data was collected in 2013, and the annual growth rates from Halton Region were used to project these traffic volumes to the year at which operations commence (2016) and the horizon year for the assessment of air quality impacts (2031), which represents expected maximum hourly traffic flows. The 24-hour traffic volumes applied in this study are summarized in Table 4-4 (Ninth Line) and Table 4-5 (Steeles Avenue).

Table 4-4 Summary of Traffic Data on Ninth Line (Regional Road 13)

Scenario	Year	Northbound Traffic			Southbound Traffic		
		Total	Commercial		Total	Commercial	
		(24-hr)	% Medium	% Heavy	(24-hr)	% Medium	% Heavy
Steeles Ave. to 5th Side Road							
Existing	2013	5,217	2.7%	4.5%	5,020	2.3%	4.6%
Commencement	2016	5,883	2.7%	4.5%	5,570	2.3%	4.6%
Future No-Build	2031	10,730	2.7%	4.5%	9,366	2.3%	4.6%
Future Build	2031	15,226	2.7%	4.5%	17,350	2.3%	4.6%
5th Side Road to 10th Side Road							
Existing	2013	5,663	2.2%	4.1%	6,053	2.1%	3.7%
Commencement	2016	6,386	2.2%	4.1%	6,716	2.1%	3.7%
Future No-Build	2031	11,647	2.2%	4.1%	11,294	2.1%	3.7%
Future Build	2031	16,571	2.2%	4.1%	20,920	2.1%	3.7%

Table 4-5 Summary of Traffic Data on Steeles Avenue (Regional Road 8)

Scenario	Year	Eastbound Traffic			Westbound Traffic		
		Total	Commercial		Total	Commercial	
		(24-hr)	% Medium	% Heavy	(24-hr)	% Medium	% Heavy
East of Ninth Line							
Existing	2013	10,454	2.8%	5.3%	9,033	2.5%	4.6%
Commencement	2016	11,213	2.8%	5.3%	8,966	2.5%	4.6%
Future No-Build	2031	15,922	2.8%	5.3%	8,637	2.5%	4.6%
Future Build	2031	17,889	2.8%	5.3%	12,619	2.5%	4.6%
West of Ninth Line							
Existing	2013	5,752	2.8%	5.2%	5,184	2.5%	4.6%
Commencement	2016	6,170	2.8%	5.2%	5,145	2.5%	4.6%
Future No-Build	2031	8,761	2.8%	5.2%	4,957	2.5%	4.6%
Future Build	2031	9,843	2.8%	5.2%	7,242	2.5%	4.6%

4.3.2.2 Vehicle Emissions

All contaminants of concern considered in this study are emitted in vehicle exhaust. Additionally, fine particulate ($PM_{2.5}$) is emitted from the roadway surface as a result of tire/break wear, and re-suspension of surface dust by: (1) the action of the tires on the surface; and (2) the wake created by the passing of the vehicle. Both tailpipe and mechanically generated fractions of $PM_{2.5}$ were included in this study. Tailpipe emissions from vehicles are a function of many variables. Some of the more important parameters are listed below:

- age of the vehicle (newer vehicles emit less);
- number of kilometers which the vehicle has driven;
- emission control equipment that may have been tampered with;
- type of fuel (gasoline, diesel);
- Reid Vapour Pressure (RVP) of gasoline used (adjusted seasonally);
- ambient air temperature;
- vehicle speed;
- rate of acceleration;
- time spent idling;
- type of vehicle (automobile, light truck, heavy truck, bus, etc.); and,
- cold or hot start mode.

Vehicular emissions are generally estimated by using emission factors in units of mass of contaminant emitted per vehicle, per distance travelled. To obtain a mass emission rate for a particular road section, the length of the road section is multiplied by the number of vehicles using that section to obtain the total number of vehicle kilometers travelled (VKT). The VKT are then multiplied by the appropriate emission factors.

The vehicular emission rates were estimated for base conditions (2016), and for the future horizon year 2031. Emission factors were obtained by running the MOBILE6.2C model (the ‘C’ denotes adjusted for the average Canadian fleet by Environment Canada). MOBILE6.2C was used for vehicle emission estimates as opposed to MOVES as it represents emission factors adjusted for typical Canadian vehicle as opposed to conditions represented in the United States, as does the MOVES program. The model outputs provided emission factors in grams per vehicle kilometer travelled (g/VKT) for all contaminants of concern. All expected technological and regulatory changes affecting future emissions are built into the MOBILE6.2C model run, in order to generate the most representative emission factors possible. MOBILE6.2C inputs are presented in Appendix A.

MOBILE 6.2C produces CO_2 emission factors, however, it does not provide estimates of CH_4 and N_2O emission factors. As noted in the MTO Guide (2012), this is due to the paucity of emission data for these latter two greenhouse gases. To estimate CH_4 and N_2O, the MTO Guide recommends using the ratios of CH_4 and N_2O emission factors with CO_2 factors for a given class of vehicle as available from Environment Canada's *National Inventory Report (NIR), 1990-2012 – Greenhouse Gas Sources and Sinks in Canada.* This is considered an adequate approach, given the smaller amounts of CH_4 and N_2O produced by road vehicles.

The latest Environment Canada NIR (2014) was used to derive the emission factor ratios shown in Table 4-6. Following the MTO Guide, similar classes of vehicles were combined, recognizing that traffic data will represent only these broader vehicle classes.

Table 4-6 Ratios of GHG Emission Factors

Vehicle class	CH_4/CO_2 ratio	N_2O/CO_2 ratio
LDV	1.03E-04	1.08E-04
HDV2B-HDV8B	9.12E-05	4.68E-05

Notes:
- The ratios are based on information in the appendices of Environment Canada's "National Inventory Report, 1990-2012 – Greenhouse Gas Sources and Sinks in Canada", 2014.
- The ratios were derived by dividing the g/L emission factors for CH_4 and N_20 with the corresponding factors for CO_2.

Table 4-7 summarizes the final emission factors used in the base case and future horizon year for idling conditions and at 80 km/h, which is the posted speed limit within the Study Area on Ninth Line and Steeles Avenue. Emission factors at 80 km/h are in g/VKT and emission factors at idle are in g/h.

Table 4-7 Tailpipe Emission Factors for Light- and Heavy-Duty Vehicles for 2016 and 2031

Year	Light-Duty Gasoline Vehicles					
	Speed (km/h)	***$PM_{2.5}$***	***NOx***	***SO_2***	***CO***	***CO_2e***
2016	Idle (g/h)	0.0441	1.6167	0.0105	39.25	1438
	80 (g/VKT)	0.0110	0.5999	0.0047	9.090	359
2031	Idle (g/h)	0.0301	0.6413	0.0107	33.63	1452
	80 (g/VKT)	0.0075	0.2131	0.0048	7.768	363
Year	**Heavy-Duty Diesel Vehicles**					
	Speed (km/h)	***$PM_{2.5}$***	***NOx***	***SO_2***	***CO***	***CO_2e***
2016	Idle (g/h)	0.1776	4.9083	0.0216	2.704	2912
	80 (g/VKT)	0.0499	2.2440	0.0054	0.3607	728

2031	Idle (g/h)	0.0455	0.6885	0.0216	0.6114	2714
	80 (g/VKT)	0.0114	0.3138	0.0054	0.0814	679

4.3.2.3 Mechanically Generated Dust Emissions

The U.S. EPA provides an emission factor to estimate the amount of dust suspended by vehicles on the road (U.S. EPA 2011), according to the following equation:

$$E = k(sL)^{0.91} \times (W)^{1.02}$$

Where:
E = particulate emission factor (g/VKT)
k = particle size multiplier = 0.15 (g/VKT) for $PM_{2.5}$
sL = silt loading (g/m^2)
  0.6 (< 500 vehicles per day)
  0.2 (500 – 5,000 vehicles per day)
  0.06 (5,000 – 10,000 vehicles per day)
  0.03 (> 10,000 vehicles per day)
W = weight of fleet (tons/vehicle)
  3.0 US Tons for cars (average)
  12.0 US tons for buses/trucks (average)
VKT = vehicle kilometers travelled

The mechanically generated dust emissions from vehicular travel on paved roads are not expected to change over time.

4.4 Air Dispersion Modelling

The quality of the air can be characterized as a measure of the amount of contaminants in a given volume of air. The typical unit of measurement is concentration or the number of micrograms of a chemical, or particles, per cubic meter of air (µg/m^3). This concentration will vary from point-to-point and from minute-to-minute in response to changing atmospheric conditions (e.g., wind speed, wind direction, atmospheric stability or mixing) and the amount of pollutant emitted.

To calculate the concentration of a contaminant at a specific receptor location, an atmospheric dispersion model is used. Air quality models take the emissions from a source (Section 4.3.2) and disperse them into the surrounding atmosphere typically using historical hourly meteorological data from a local weather station. The same meteorological conditions are used for all scenarios, therefore, the only differences between the model simulations are: (1) the amount of emissions released; and (2) the number or location of sources (road segments) that were input into the model. In general terms, if the emissions are decreased, the resulting impact on the surrounding community (gas or particulate concentrations) will be reduced. Conversely, if the emissions increase, the impacts will increase.

The atmospheric dispersion model used for this study was the transportation model CAL3QHCR, which is described in further detail in the following section.

4.4.1 CAL3QHCR

CAL3QHCR is a model developed specifically to predict the changes in downwind air quality resulting from vehicle emissions from free flowing traffic conditions and near roadway intersections (U.S. EPA 1995). The model combines the CALINE-3 (Benson 1979) line source dispersion model and a traffic algorithm for estimating vehicular queue lengths at signalized intersections. The CALINE-3 line source dispersion model predicts more realistic concentrations immediately around roads because of the initial mixing in the wake zone of the vehicle. This initial mixing, combined with the traffic algorithm for queuing (added emissions from idling vehicles), provides improved model predictions of the impact of vehicle tailpipe emissions adjacent to roadways.

The model also uses a queuing algorithm to account for increased emissions at signalized intersections due to idling vehicles (i.e., those waiting at a red light). To do this, signal timing and direction-specific traffic volumes are required. Based on information provided by UEM, the maximum signal cycle was assumed to be 90 seconds long with a yellow duration of 3 seconds. A saturation flow volume of 1,900 vehicles per hour was also assumed.

Since emission factors differ by vehicle class, the fleet mix was used to calculate a weighted emission factor for each contaminant for a given roadway based on the fraction of cars and medium and heavy trucks. Hourly traffic profiles were used to develop emission factors for each contaminant for each roadway for each hour of the day.

CAL3QHCR model guidance documents recommend using a release height of 0 m assuming light duty vehicles dominate the vehicle fleet. As some heavy duty vehicles are expected within the study area a release height of 1 m was used.

The model was originally designed to simulate dispersion of CO and PM_{10} from roadways. However, it is applicable to all gaseous pollutants, provided that minor alterations to the model source code are made. To model NOx and SO_2 emissions, the model was modified to reflect the difference in the contaminant molecular weight. To model $PM_{2.5}$ emissions, size specific settling and deposition velocities (0.02 cm/s and 0.1 cm/s respectively) were input to the model.

4.4.2 Meteorological Data

For CAL3QHCR modelling, hourly meteorological data is required, including: mixing height, temperature, cloud cover, cloud opacity, wind speed and wind direction. For calculating hourly mixing heights, upper air measurements are needed. Using upper air observations (twice daily), morning and afternoon mixing heights are calculated and, based on these measurements, hourly mixing heights are estimated using the U.S. EPA's regulatory meteorological pre-processor PCRAMMET.s

The meteorological data used for this assessment was developed by the Ontario Ministry of Environment and Climate Change. It is based on hourly surface meteorological data from Toronto Pearson International Airport and upper air (mixing height) data from Buffalo, New York for the period 1996 to 2000. Note that mixing heights are a regional parameter and do not change significantly over moderate distances. Buffalo is the closest upper air meteorological station to Toronto.

Figure 2 shows the frequency of wind speed and direction based on the 5-year MOECC meteorological data set. The dominant wind direction is north-northwest, followed by a westerly direction. The average wind speed is 3.9 m/s (or 14 km/h).

Typically, five years of hourly meteorological data is used in dispersion modelling calculations as recommended by the U.S. EPA, in order to assess all of the possible combinations of meteorological conditions expected to occur in the modelled area. The CAL3QHCR model can process only one year of data per model run, therefore, the results for each year of meteorological data were compared to determine the overall maximum concentration for each contaminant out of all five years.

4.4.3 NOx to NO_2 Conversion

As discussed previously, NOx emissions are composed of nitric oxide (NO) and nitrogen dioxide (NO_2), with adverse health effects resulting from NO_2 at much lower concentrations than NO. Once NO is emitted to the atmosphere it begins to react with other contaminants (primarily ground-level ozone – O_3) to produce NO_2. Depending on the amount of ozone present, only a portion of NOx will be converted to NO_2.

However, for the purpose of this assessment, it has been conservatively assumed that all NOx will be converted to NO_2.

5. Air Quality Impact Assessment

5.1 CAL3QHCR Modelling Results

The output from CAL3QHCR is the maximum predicted 1-hour average concentration at each of the modelled receptor points based on a full year of meteorological data (i.e., 8,760 hours per year or 43,824 hours for 5 years of data). Hourly data is post-processed to determine maximum predicted 1-hour, 8-hour, 24-hour or annual average concentrations (averaging periods vary by contaminant ambient air quality criteria).

Tables 5.1 through 5.9 outline the maximum model predicted concentrations of criteria air contaminants (i.e., including background) for the five (5) representative sensitive receptor locations. The ambient background concentrations established in Section 4.2 were added to maximum model predicted concentrations to estimate worst case ambient concentrations that could be realized as a result of the proposed Project. As outlined in Section 4.2, background concentrations were developed from the Halton Region Milton station and the MOECC Brampton station.

As can be seen in the Tables below, for each scenario assessed, all maximum model predicted concentrations of $PM_{2.5}$, NO_2, SO_2 and CO for all averaging periods are well below applicable ambient air quality criteria even with the addition of background. As a result, no potential adverse air quality effects are expected due to the proposed widening of Ninth Line and mitigation of air quality effects is not required.

In addition, VOC compounds of acetaldehyde, acrolein, benzene, 1-3 butadiene and formaldehyde were modelled and the predicted results for averaging periods with applicable air quality criteria are presented in Table 5.10 through 5.18. As with the criteria air contaminants, all predictions are below applicable air quality criteria.

The model results are discussed in more detail below in Sections 5.1.1 and 5.1.2.

Table 5-1 24-hour Maximum $PM_{2.5}$ Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)
	24-hr Max Concentration (µg/m³)	24-hr Max Concentration (µg/m³)	% change from Base Case	24-hr Max Concentration µg/m³	% change from Base Case	% change from No-Build	
R1	12.5	12.4	-5%	12.8	69%	77%	27
R2	12.8	12.8	-4%	13.4	72%	80%	27
R3	12.6	12.7	9%	13.0	70%	55%	27
R4	12.9	13.2	25%	13.5	56%	25%	27
R5	12.5	12.5	9%	12.5	13%	3%	27

Note: All values include a background $PM_{2.5}$ concentration of 12 µg/m³.

Table 5-2 Maximum Annual $PM_{2.5}$ Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)
	Annual Max Concentration (µg/m³)	Annual Max Concentration (µg/m³)	% change from Base Case	Annual Max Concentration µg/m³	% change from Base Case	% change from No-Build	
R1	5.1	5.1	-4%	5.2	72%	78%	8.8
R2	5.2	5.2	-3%	5.4	75%	80%	8.8
R3	5.2	5.2	1%	5.3	73%	71%	8.8
R4	5.2	5.3	23%	5.4	60%	30%	8.8
R5	5.1	5.2	16%	5.2	37%	18%	8.8

Note: All values include a background $PM_{2.5}$ concentration of 5 µg/m³.

Table 5-3 1-hour Maximum NO_2 Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)
	1-hr Max Concentration (µg/m³)	1-hr Max Concentration (µg/m³)	% change from Base Case	1-hr Max Concentration µg/m³	% change from Base Case	% change from No-Build	
R1	96.3	72.0	-46%	93.2	-6%	73%	400
R2	130.3	91.7	-44%	130.8	1%	80%	400
R3	109.9	80.3	-44%	109.6	-0.4%	79%	400
R4	116.6	85.8	-42%	109.6	-9%	56%	400
R5	74.8	58.3	-52%	70.0	-15%	76%	400

Note: All values include a background NO_2 concentration of 43 µg/m³.

Table 5-4 24-hour Maximum NO_2 Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)
	24-hr Max Concentration (µg/m³)	24-hr Max Concentration (µg/m³)	% change from Base Case	24-hr Max Concentration µg/m³	% change from Base Case	% change from No-Build	
R1	39.9	37.3	-45%	39.8	-2%	77%	200
R2	44.8	40.0	-44%	44.9	1%	81%	200
R3	42.0	38.4	-44%	41.9	-0.3%	80%	200
R4	46.1	40.8	-44%	44.9	-10%	62%	200
R5	40.5	36.5	-62%	37.8	-42%	53%	200

Note: All values include a background NO_2 concentration of 34 µg/m³.

Table 5-5 1-hour Maximum SO_2 Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)
	1-hr Max Concentration (µg/m³)	1-hr Max Concentration (µg/m³)	% change from Base Case	1-hr Max Concentration µg/m³	% change from Base Case	% change from No-Build	
R1	8.4	8.6	73%	9.1	199%	73%	690
R2	8.6	9.1	74%	9.9	214%	80%	690
R3	8.5	8.8	74%	9.5	211%	79%	690
R4	8.5	9.0	79%	9.5	178%	56%	690
R5	8.2	8.3	49%	8.6	162%	76%	690

Note: All values include a background SO_2 concentration of 8 µg/m³.

Table 5-6 24-hour Maximum SO_2 Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)
	24-hr Max Concentration (µg/m³)	24-hr Max Concentration (µg/m³)	% change from Base Case	24-hr Max Concentration µg/m³	% change from Base Case	% change from No-Build	
R1	6.0	6.1	76%	6.1	210%	76%	275
R2	6.1	6.1	76%	6.2	220%	82%	275
R3	6.1	6.1	75%	6.2	212%	79%	275
R4	6.1	6.1	77%	6.2	187%	62%	275
R5	6.0	6.1	23%	6.1	86%	52%	275

Note: All values include a background SO_2 concentration of 6 µg/m³.

Table 5-7 Maximum Annual SO_2 Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)
	Annual Max Concentration (µg/m³)	Annual Max Concentration (µg/m³)	% change from Base Case	Annual Max Concentration µg/m³	% change from Base Case	% change from No-Build	
R1	2.0	2.0	73%	2.0	209%	79%	55
R2	2.0	2.0	79%	2.1	232%	85%	55
R3	2.0	2.0	71%	2.0	214%	83%	55
R4	2.0	2.0	75%	2.1	195%	69%	55
R5	2.0	2.0	38%	2.0	115%	56%	55

Note: All values include a background SO_2 concentration of 2 µg/m³.

Table 5-8 1-hour Maximum CO Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)
	1-hr Max Concentration (µg/m³)	1-hr Max Concentration (µg/m³)	% change from Base Case	1-hr Max Concentration µg/m³	% change from Base Case	% change from No-Build	
R1	943	1248	45%	1972	153%	74%	36,200
R2	1405	1934	47%	3280	165%	81%	36,200
R3	1138	1544	47%	2554	163%	79%	36,200
R4	1253	1753	51%	2575	135%	55%	36,200
R5	690	802	27%	1204	122%	76%	36,200

Note: All values include a background CO concentration of 270 µg/m³.

Table 5-9 8-hour Maximum CO Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)
	8-hr Max Concentration (µg/m³)	8-hr Max Concentration (µg/m³)	% change from Base Case	8-hr Max Concentration µg/m³	% change from Base Case	% change from No-Build	
R1	425	506	50%	665	148%	65%	15,700
R2	520	648	50%	921	155%	71%	15,700
R3	449	540	49%	736	154%	70%	15,700
R4	611	782	49%	1086	136%	58%	15,700
R5	418	425	5%	530	72%	64%	15,700

Note: All values include a background CO concentration of 262 µg/m³.

Table 5-10 1-hour Maximum Acetaldehyde Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)
	1-hr Max Concentration (µg/m³)	1-hr Max Concentration (µg/m³)	% change from Base Case	1-hr Max Concentration µg/m³	% change from Base Case	% change from No-Build	
R1	7.231	7.281	38%	7.412	138%	72%	500
R2	7.326	7.401	33%	7.642	140%	80%	500
R3	7.271	7.331	35%	7.511	140%	78%	500
R4	7.289	7.363	39%	7.510	117%	56%	500
R5	7.183	7.194	13%	7.266	100%	77%	500

Note: All values include a background acetaldehyde concentration of 7.1 µg/m³.

Table 5-11 24-hour Maximum Acetaldehyde Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m^3)
	24-hr Max Concentration (µg/m^3)	24-hr Max Concentration (µg/m^3)	% change from Base Case	24-hr Max Concentration µg/m^3	% change from Base Case	% change from No-Build	
R1	2.915	2.920	33%	2.936	140%	80%	500
R2	2.928	2.937	32%	2.968	143%	84%	500
R3	2.921	2.927	29%	2.949	133%	81%	500
R4	2.932	2.942	31%	2.968	113%	62%	500
R5	2.917	2.916	-6%	2.924	41%	50%	500

Note: All values include a background acetaldehyde concentration of 2.9 µg/m^3.

Table 5-12 1-hour Maximum Acrolein Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m^3)
	1-hr Max Concentration (µg/m^3)	1-hr Max Concentration (µg/m^3)	% change from Base Case	1-hr Max Concentration µg/m^3	% change from Base Case	% change from No-Build	
R1	0.615	0.626	73%	0.635	133%	35%	4.5
R2	0.626	0.643	65%	0.661	135%	42%	4.5
R3	0.620	0.633	65%	0.646	130%	39%	4.5
R4	0.622	0.638	73%	0.646	109%	21%	4.5
R5	0.610	0.613	30%	0.619	90%	46%	4.5

Note: All values include a background acrolein concentration of 0.6 µg/m^3.

Table 5-13 24-hour Maximum Acrolein Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (μg/m^3)
	24-hr Max Concentration (μg/m^3)	24-hr Max Concentration (μg/m^3)	% change from Base Case	24-hr Max Concentration μg/m^3	% change from Base Case	% change from No-Build	
R1	0.242	0.243	50%	0.244	100%	33%	0.4
R2	0.243	0.245	67%	0.248	167%	60%	0.4
R3	0.242	0.244	100%	0.246	200%	50%	0.4
R4	0.244	0.246	50%	0.248	100%	33%	0.4
R5	0.242	0.242	0%	0.243	50%	50%	0.4

Note: All values include a background acrolein concentration of 0.24 μg/m³.

Table 5-14 24-hour Maximum Benzene Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (μg/m^3)
	24-hr Max Concentration (μg/m^3)	24-hr Max Concentration (μg/m^3)	% change from Base Case	24-hr Max Concentration μg/m^3	% change from Base Case	% change from No-Build	
R1	0.952	1.060	132%	1.059	130%	-1%	2.3
R2	1.021	1.221	132%	1.229	138%	2%	2.3
R3	0.981	1.129	133%	1.132	136%	1%	2.3
R4	1.039	1.266	134%	1.230	113%	-9%	2.3
R5	0.957	1.014	66%	0.996	45%	-13%	2.3

Note: All values include a background benzene concentration of 0.87 μg/m³.

Table 5-15 Annual Maximum Benzene Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (μg/m^3)
	Annual Max Concentration (μg/m^3)	Annual Max Concentration (μg/m^3)	% change from Base Case	Annual Max Concentration μg/m^3	% change from Base Case	% change from No-Build	
R1	0.189	0.217	133%	0.218	138%	2%	0.45
R2	0.207	0.258	131%	0.261	138%	3%	0.45
R3	0.195	0.231	133%	0.233	141%	3%	0.45
R4	0.208	0.260	130%	0.255	118%	-5%	0.45
R5	0.194	0.215	81%	0.209	58%	-13%	0.45

Note: All values include a background benzene concentration of 0.168 μg/m³.

Table 5-16 24-hour Maximum 1-3 Butadiene Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (μg/m^3)
	24-hr Max Concentration (μg/m^3)	24-hr Max Concentration (μg/m^3)	% change from Base Case	24-hr Max Concentration μg/m^3	% change from Base Case	% change from No-Build	
R1	0.090	0.092	20%	0.101	110%	75%	10
R2	0.098	0.102	22%	0.121	128%	86%	10
R3	0.093	0.097	31%	0.110	131%	76%	10
R4	0.100	0.105	25%	0.121	105%	64%	10
R5	0.090	0.089	-10%	0.094	40%	56%	10

Note: All values include a background 1-3 butadiene concentration of 0.08 μg/m³.

Table 5-17 Annual Maximum 1-3 Butadiene Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)
	Annual Max Concentration (µg/m³)	Annual Max Concentration (µg/m³)	% change from Base Case	Annual Max Concentration µg/m³	% change from Base Case	% change from No-Build	
R1	0.018	0.019	50%	0.022	200%	100%	2
R2	0.021	0.022	20%	0.027	120%	83%	2
R3	0.019	0.020	33%	0.023	133%	75%	2
R4	0.021	0.022	20%	0.026	100%	67%	2
R5	0.019	0.019	0%	0.021	67%	67%	2

Note: All values include a background 1-3 butadiene concentration of 0.016 µg/m³.

Table 5-18 24-hour Maximum Formaldehyde Concentrations for Base Case, Future No-Build and Future Build Scenarios

Receptor ID	Base Case (2016)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)
	24-hr Max Concentration (µg/m³)	24-hr Max Concentration (µg/m³)	% change from Base Case	24-hr Max Concentration µg/m³	% change from Base Case	% change from No-Build	
R1	5.835	5.845	29%	5.879	126%	76%	65
R2	5.863	5.882	30%	5.948	135%	80%	65
R3	5.847	5.860	28%	5.908	130%	80%	65
R4	5.871	5.893	31%	5.950	111%	61%	65
R5	5.838	5.835	-8%	5.854	42%	54%	65

Note: All values include a background formaldehyde concentration of 5.8 µg/m³.

5.1.1 Comparison of Base Case Conditions (2016) to Future Scenarios (2031)

Model predicted maximum concentrations for all air contaminants and all scenarios were presented in Tables 5.1 to 5.18. In each Table, the percent change in contaminant concentrations for the two future scenarios relative to the base case scenario is also presented. As illustrated in Table 5-1 and Table 5-2, predicted concentrations of $PM_{2.5}$ are shown to decrease slightly at receptors R1 and R2 for the Future No-Build scenario relative to base conditions. The decrease is attributable to: (1) a decrease in the $PM_{2.5}$ tailpipe emission factor due to improvements in engine technologies; and (2) a decrease in the amount of silt loading on the roadway. In 2031, traffic counts between 5 Side Road and 10 Side Road increase above 10,000 AADT which actually lowers the amount of silt (and therefore re-suspended dust) on the road by a factor of 10 (see Section 4.3.2.3). Therefore, despite an increase in vehicle counts in the future, emissions and concentrations of $PM_{2.5}$ actually decrease in the vicinity of R1 and R2.

In contrast, $PM_{2.5}$ concentrations increase for the Future No-Build Scenario relative to base conditions at receptors R3, R4 and R5. Although northbound traffic counts increase above 10,000 AADT, southbound counts do not (see Table 4-4). As a result, the net effect is a slight increase in emissions between Steeles Avenue and 5 Side Road and an increase in $PM_{2.5}$ concentrations. Additionally, the effect is more pronounced on the east (or downwind) side of Ninth Line at R4 and R5. For the 2031 Future Build Scenario, $PM_{2.5}$ concentrations are predicted to increase relative to base conditions at all receptors. Despite the decrease in emission factors in 2031, the increase in traffic for the Future Build Scenario is great enough that the overall net effect is an increase in $PM_{2.5}$ concentrations relative to base conditions.

Table 5-3 and Table 5-4 show a decrease in 1-hour and 24-hour NO_2 concentrations for the Future No-Build Scenario relative to base conditions. This is due to a decrease in the NOx emission factor resulting from improving engine technologies. For the Future Build Scenario, NOx concentrations remain similar to or decrease relative to base conditions. Again, this is a result of the reduction in the NOx emission factor.

Tables 5.5 through 5.9 show that there is an increase in SO_2 and CO concentrations for the Future No-Build and Future Build scenarios relative to base conditions. This is a result of increased traffic counts along Ninth Line and Steeles Avenue. Although CO and SO_2 emission factors decrease in 2031 as a result of newer engine technologies, the decrease is not as substantial as NOx. Therefore, the net effect is an overall increase in CO and SO_2 concentrations.

Tables 5.10 through 5.18 show the percent change in VOC compounds assessed for the Future No-Build and Future Build scenarios relative to base conditions. The general trend is that concentrations increase for the Future scenarios. For some receptors the increase is minimal or sometimes decreases due to traffic changes and different technologies.

5.1.2 Comparison of Future No-Build and Future Build Scenarios

When assessing the merits of the proposed Ninth Line widening project compared to Future No-Build conditions, it is the incremental change in total model predicted concentrations between the two future cases that is the true measure of the future impact of the Project. The same background concentrations are added to the modelled concentrations for the future scenarios, therefore, when assessing the incremental change in the combined concentrations, the background concentration cancels out.

In Tables 5.1 through 5.18 above, the percent change in predicted concentrations for the Future Build Scenario relative to the Future No-Build Scenario is presented. As the Tables illustrate, for all contaminants and all averaging periods, model predicted concentrations are shown to increase for the Future Build Scenario relative to No-Build conditions at all receptor locations. On average, the percent difference between the Future Build Scenario and Future No-Build Scenario is on the order of 70%. This increase occurs for two reasons: (1) the increase in traffic as a result of widening Ninth Line (see Table 4-4 and Table 4-5); and (2) the decrease in separation distance between the receptors and the edge of the roadway. In other words, receptors become closer to a roadway with higher emissions. As a result, the effect is an increase in air contaminant concentrations at the receptor locations. However, as indicated previously, all predicted concentrations at representative worst case receptor locations remain below applicable ambient air quality criteria despite the increase in traffic due to the widening of Ninth Line.

5.2 Greenhouse Gas Emissions Analysis

To assess the potential effects of the Project on greenhouse gases (GHG), emissions were calculated for each scenario and compared to base conditions. Table 5-19 compares the annual estimates of carbon dioxide equivalent (CO_2e) emissions for Base Case, Future No-Build and Future Build conditions. Without the Project (i.e., Future No-Build), emissions are estimated to increase by 55% from 2016 to 2031. However, if the Project were to proceed, annual GHG emissions are estimated to be on the order 46,632 tonnes of CO_2e. Within the Study Area, this represents an increase of

143% relative to base case conditions or 56% relative to the Future No-Build Scenario. The increase is based on the overall increase in traffic volumes as a result of the Project.

Table 5-19 Annual CO_2e Emission Estimates for Base Case, Future No-Build and Future Build Scenarios

Scenario	Total CO_2e (tonnes/year)	% Change from Base Case	% Change from Future No-Build
Base Case (2016)	19,197	--	--
Future No Build (2031)	29,822	55%	--
Future Build (2031)	46,632	143%	56%

6. Conclusions

To manage future traffic growth on Ninth Line (Regional Road 13) between Steeles Avenue and 10 Side Road, Halton Region is proposing to widen Ninth Line. The air quality impacts of the preferred design, widening about the existing centerline, was evaluated with detailed air dispersion modelling. This is considered a Tier 3 assessment approach under the Halton Region draft air quality assessment guidelines (Halton Region 2012).

Emissions of $PM_{2.5}$, NOx, SO_2, CO, acrolein, benzene, acetaldehyde, 1-3 butadiene and formaldehyde were calculated using the Mobile 6.2C emissions model and input into the CAL3QHCR transportation model to determine the maximum concentrations at five (5) representative worst case sensitive receptor locations in the Study Area. Maximum predicted concentrations for each air contaminant of concern $PM_{2.5}$, NOx, SO_2, and CO) were added to background concentrations and compared to applicable ambient air quality criteria. Background concentrations are considered representative of other sources of air contaminants outside of the Study Area. Predictions for acrolein, benzene, acetaldehyde, 1-3 butadiene and formaldehyde were compared directly to the ambient air quality criteria as no monitored values are available for this area.

Overall, concentrations of $PM_{2.5}$, NO_2, SO_2, CO, acrolein, benzene, acetaldehyde, 1-3 butadiene and formaldehyde are predicted to increase at all five sensitive receptor locations as a result of the Project. However, all maximum concentrations predicted for the Project are well below applicable ambient air quality criteria. The increase in concentrations is a result of increased traffic volumes due to the widening of Ninth Line and the fact that the distance between the receptors and the edge of the roadway is reduced if the Project proceeds. On average, the increase relative to Future No-Build conditions is 70%.

Since there are no predicted adverse effects to air quality due to the Project, mitigation of air quality impacts is not required.

7. References

Benson, P.E. 1979. CALINE3 – A Versatile Dispersion Model for Predicting Air Pollutants Near Highways and Arterial Streets. Office of Transportation Laboratory, California Department of Transportation.

CCME (Canadian Council of Ministers of the Environment). 2000. Canada-Wide Standards for Particulate Matter (PM) and Ozone. June 5-6, 2000. Quebec City, PQ.

Canadian Council of Ministers of the Environment (CCME). 2012. Canadian Ambient Air Quality Standards (CAAQS) for Fine Particulate Matter (PM2.5) and Ozone. Available at: http://www.ccme.ca/ourwork/air.html?category_id=146#490 Accessed on: 12 Feb 2013.

Environment Canada (EC). 2014. National Inventory Report, 1990-2012 – Greenhouse Gas Sources and Sinks in Canada.

Halton Region. 2012. Draft Air Quality Assessment Guidelines. Legislative and Planning Services. December.

Intergovernmental Panel on Climate Change (IPCC). 2007. Chapter 2 of Contribution of Working Group I to the Fourth Assessment Report of the IPCC: Physical and Scientific Basis. Available at: http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-

Ontario Ministry of the Environment and Climate Change (MOECC). 2012. Ontario's Ambient Air Quality Criteria. Standards Development Branch. PIBS # 6570e31. April.

Ontario Ministry of Transportation. Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects. Environmental Policy Office. June.

United States Environmental Protection Agency (U.S. EPA). 2011. Compilation of Air Pollutant Emission Factors. AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Section 13.2.1 Paved Roads. January 2011.

United States Environmental Protection Agency (U.S.EPA). 1995. Addendum to the User's Guide to CAL3QHC Version 2.0 (CAL3QHCR User's Guide). September.

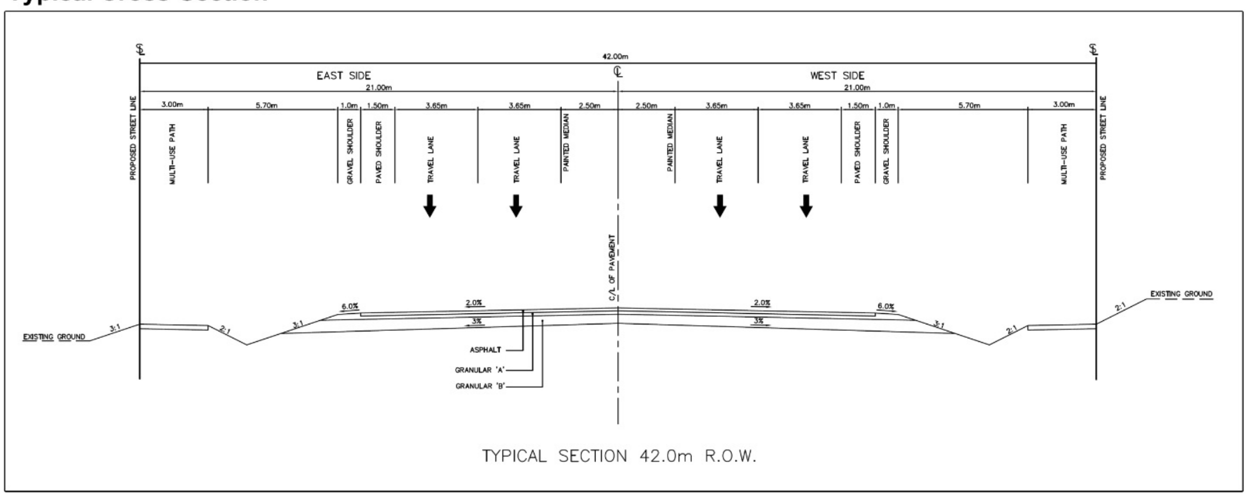
ARCADIS

Figures

Figure 1 Plan and Cross-Sectional Views of the Project

Plan View

Typical Cross-Section



LEGEND:

Sensitive Receptor

NOTES:

SCALE:

REVISIONS:

No.	Date	By	Revision

REFERENCE:

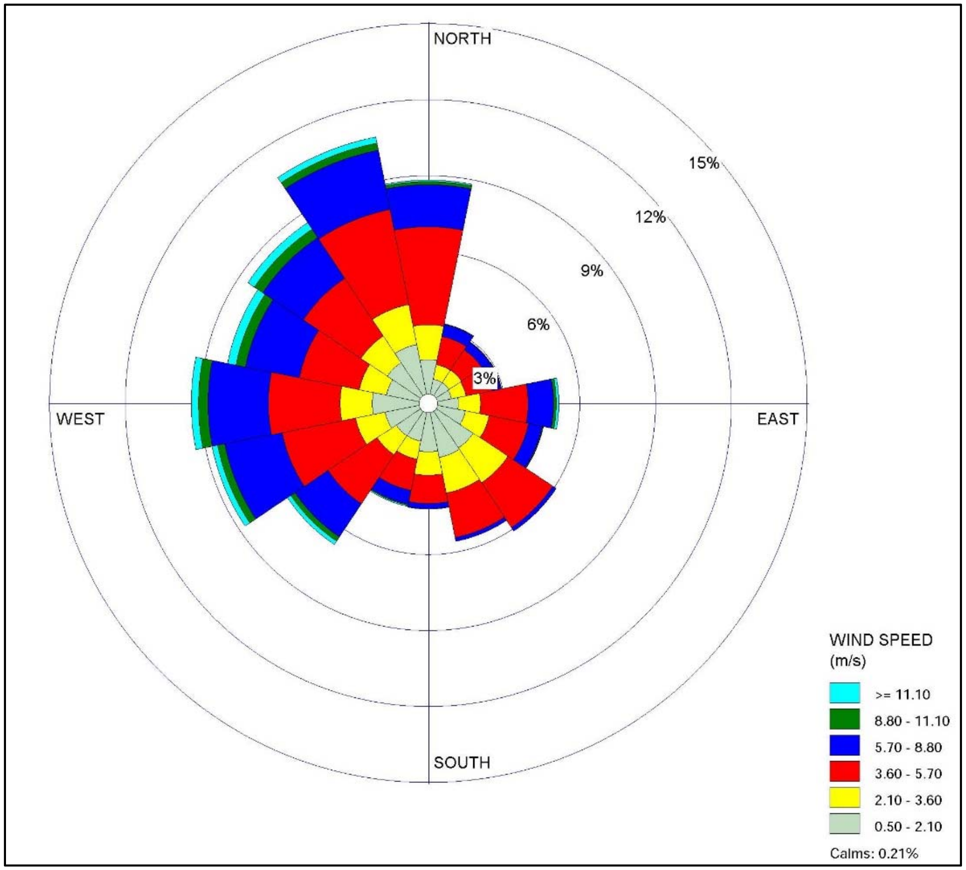
Halton Region

Plan and Cross-Sectional Views

Ninth Line (Regional Road 13)
Town of Halton Hills, Ontario

Drawn By: KT	Approved By: MAS	Figure No.: 1
Date: Apr. 2015	Project No.: 351003	

Figure 2 Wind Rose for Toronto Pearson International Airport, 1996-2000



ARCADIS

Appendix A

```
********** Header section **********
* File name/author/date of creation; ONP1B002010i3ssa.in Brett Taylor March 5
2010
* Reference number for this input file -  i3
* Lower case 'a' in the file name indicates the file estimates PM10 and HC as
VOC only. A lower case 'b' in the file name indicates the file estimates PM2.5
and HC as THC only.
* This file is designed for MOBILE6.2C and will provide output for  All
regions
* Biodiesel volume percent is zero (B0)  and the feedstock is Canola at 100%
market share.
* Estimates to be used in the Biodiesel Risk Assessment
* Sources to inputs are documented throughout.
* Each year will have twelve scenarios; one for each month.
* Assumes ultra-low sulphur Diesel at 10ppm.
* Spreadsheet edition
* For use with MOBILE(Feb2010)


MOBILE6 INPUT FILE
PARTICULATES       :
POLLUTANTS         : HC CO NOX
AIR TOXICS         :
SPREADSHEET        :
* DATABASE OUTPUT    :
* WITH FIELDNAMES    :
* DAILY OUTPUT       :

RUN DATA

********** Run  Section 12 ONP1 2010 B00 **********
> ONP1 2010 B00  - All MOBILE6.2C pollutants
EXPRESS HC AS VOC  :
NO REFUELING       :

* Specify  mileage accumulation rates
* Source: M6C-10-E.doc
* If actual data is not available for this year  use most recent available
year. Data used in this case was estimated for calendar year:
MILE ACCUM RATE    : MARv3.dat

* Specify  age distribution
* Source: M6C-10-E.doc
REG DIST           :  ONP1_2006.in

* Expand vehicle class descriptive output
EXPAND BUS EFS     :
EXPAND HDDV EFS    :
EXPAND HDGV EFS    :
EXPAND LDT EFS     :

IDLE PM EMISSIONS  :

* Expand exhaust emissions descriptive output
EXPAND EXHAUST     :

* Expand evaporative emissions descriptive output
EXPAND EVAPORATIVE :

* Specify  vehicle miles traveled (VMT) by average speed on freeways and
arterial roads
*SPEED VMT           :  Svmt_ON.def
```

```
* Because it is now post-1999 calendar year  sulphur levels in gasoline must
be specified
* using the FUEL PROGRAM command (see Advanced Training Guide manual  Day 1
page 46)
* Sulphur source: Environment Canada's Sulphur in Liquid Fuels annual report
* Max Sulphur content from CEPA Sulphur in Gasoline Regulation Registration
June 4  1999
* The regulation implies the use of 25ppm for years after 2004.
* The 4 rows and 8 columns below represent;
* row 1 - average sulphur levels (ppm) from 2000 to 2007
* row 2 - average sulphur levels (ppm) from 2008 to 2015
* row 3 - maximum sulphur levels (ppm) from 2000 to 2007
* row 4 - maximum sulphur levels (ppm) from 2008 to 2015
FUEL PROGRAM       : 4
450.0 390.0 330.0 160.0 52.0 25.0 25.0 25.0
25.0 25.0 25.0 25.0 25.0 25.0 25.0 25.0
500.0 500.0 500.0 500.0 500.0 25.0 25.0 25.0
25.0 25.0 25.0 25.0 25.0 25.0 25.0 25.0


* Specify  diesel fractions
* Source: M6C-10-E.doc
* If actual data is not available for this year  use most recent available
year. Data used in this case was estimated for calendar year:    2006
DIESEL FRACTIONS   :
0.0124 0.0115 0.0095 0.0136 0.0174 0.0123 0.0058 0.0072 0.0053 0.0043
0.0048 0.0056 0.0059 0.0062 0.0046 0.0055 0.0057 0.0200 0.0274 0.0512
0.0550 0.0727 0.0932 0.0578 0.0066
0.0977 0.0272 0.0204 0.0246 0.0320 0.0402 0.0562 0.0274 0.0842 0.1329
0.0341 0.0097 0.0116 0.0090 0.0155 0.0180 0.0080 0.0356 0.0532 0.0385
0.0692 0.0299 0.1176 0.1690 0.0047
0.0001 0.0000 0.0000 0.0001 0.0000 0.0003 0.0003 0.0042 0.0012 0.0008
0.0009 0.0006 0.0001 0.0001 0.0006 0.0004 0.0011 0.0192 0.0212 0.0334
0.0366 0.0486 0.0752 0.0285 0.0026
0.0019 0.0005 0.0000 0.0000 0.0000 0.0001 0.0098 0.0040 0.0072 0.0169
0.0198 0.0174 0.0095 0.0188 0.0107 0.0151 0.0103 0.0239 0.0299 0.0409
0.0313 0.0533 0.0569 0.0061 0.0026
0.0717 0.0778 0.0864 0.1280 0.1239 0.1295 0.1573 0.1734 0.2123 0.2865
0.2630 0.3230 0.2234 0.2083 0.1667 0.1326 0.1043 0.1393 0.2083 0.1964
0.1320 0.0840 0.0696 0.0073 0.0052
0.2872 0.3423 0.3990 0.3371 0.3656 0.3767 0.4308 0.5159 0.4905 0.4917
0.4293 0.5806 0.6090 0.2205 0.2628 0.2281 0.1814 0.2323 0.2914 0.2245
0.1695 0.3171 0.4478 0.5294 0.0899
0.3978 0.5267 0.7428 0.7032 0.7116 0.7241 0.7205 0.7536 0.7417 0.6960
0.7587 0.6729 0.6021 0.5096 0.3973 0.3080 0.2384 0.2628 0.2437 0.0888
0.0448 0.0847 0.0857 0.0000 0.1600
0.5201 0.8910 0.8755 0.8306 0.9052 0.8922 0.8148 0.8655 0.8840 0.8693
0.7493 0.7600 0.6584 0.6893 0.7267 0.8000 0.7866 0.8774 0.9351 0.8390
0.5758 0.2308 0.2500 0.5000 0.2400
0.9675 0.9742 0.9708 0.9434 0.9613 0.9605 0.9462 0.5366 0.7101 0.7205
0.6380 0.6232 0.7381 0.8393 0.6452 0.7170 0.4800 0.4167 0.2727 0.1500
0.1500 0.0000 0.1667 0.6364 0.1429
0.9585 0.9433 0.9342 0.9227 0.9440 0.9026 0.9461 0.9619 0.9833 0.9768
0.9644 0.9680 0.9709 0.9177 0.9379 0.8571 0.8305 0.8452 0.7679 0.8136
0.8438 0.6250 0.5882 0.4857 0.4402
0.9629 0.9789 0.9519 0.9422 0.9821 0.9738 0.9402 0.9539 0.9330 0.9373
0.9043 0.9302 0.9178 0.8810 0.9024 0.8880 0.9563 0.9433 0.8925 0.9111
0.7857 0.7273 0.6667 0.6842 0.3786
0.9494 0.9890 0.9605 0.9663 0.9661 0.9468 0.9739 0.9716 0.9820 0.9902
0.9698 0.9654 0.9781 0.9817 0.9660 0.9583 0.9856 0.9771 0.9588 0.9600
0.9740 0.8125 0.9667 0.9032 0.3250
0.9687 0.9871 0.9225 0.9505 0.9489 0.9461 0.9707 0.9819 0.9802 0.9722
0.9729 0.9677 0.9781 0.9806 0.9581 0.9879 0.9667 0.9774 1.0000 0.9130
```

```
1.0000 1.0000 1.0000 1.0000 0.3012
0.8281 0.7659 0.8525 0.8646 0.9344 0.8626 0.8377 0.8833 0.8432 0.9089
0.9086 0.8538 0.8184 0.8360 0.7897 0.7895 0.8325 0.8950 0.9474 0.9392
0.6190 0.9667 0.8868 0.9624 0.8842


********** Scenario Section 1 January 2009 Idle **********

SCENARIO RECORD    :  ONP1 2009 January B00
CALENDAR YEAR      :  2009

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1

* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.

FUEL RVP           :  15.0
GAS AROMATIC%      :  21.7
GAS OLEFIN%        :  6.2
GAS BENZENE%       :  0.70
E200               :  59.9
E300               :  85.7
OXYGENATE          :  MTBE 0.00 0.00
                   :  ETOH 10.2 1.00
                   :  ETBE 0.00 0.00
                   :  TAME 0.00 0.00

AVERAGE SPEED      : 2.5 arterial


********** Scenario Section 2 January 2009 40 km/hr **********

SCENARIO RECORD    :  ONP1 2009 January B00
CALENDAR YEAR      :  2009

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1

* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV
```

```
* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.

FUEL RVP           :  15.0
GAS AROMATIC%      :  21.7
GAS OLEFIN%        :  6.2
GAS BENZENE%       :  0.70
E200               :  59.9
E300               :  85.7
OXYGENATE          :  MTBE 0.00 0.00
                   :  ETOH 10.2 1.00
                   :  ETBE 0.00 0.00
                   :  TAME 0.00 0.00

AVERAGE SPEED      : 24.9 arterial


********** Scenario Section 3 January 2009 50 km/hr **********

SCENARIO RECORD    :  ONP1 2009 January B00
CALENDAR YEAR      :  2009

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1

* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.

FUEL RVP           :  15.0
GAS AROMATIC%      :  21.7
GAS OLEFIN%        :  6.2
GAS BENZENE%       :  0.70
E200               :  59.9
```

```
E300               :  85.7
OXYGENATE          :  MTBE 0.00 0.00
                   :  ETOH 10.2 1.00
                   :  ETBE 0.00 0.00
                   :  TAME 0.00 0.00

AVERAGE SPEED      : 31.1 arterial


********** Scenario Section 4 January 2009 60 km/hr **********


SCENARIO RECORD    :  ONP1 2009 January B00
CALENDAR YEAR      :  2009

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1

* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.

FUEL RVP           :  15.0
GAS AROMATIC%      :  21.7
GAS OLEFIN%        :  6.2
GAS BENZENE%       :  0.70
E200               :  59.9
E300               :  85.7
OXYGENATE          :  MTBE 0.00 0.00
                   :  ETOH 10.2 1.00
                   :  ETBE 0.00 0.00
                   :  TAME 0.00 0.00

AVERAGE SPEED      : 37.3 arterial


********** Scenario Section 5 January 2009 70 km/hr **********


SCENARIO RECORD    :  ONP1 2009 January B00
CALENDAR YEAR      :  2009

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1
```

```
* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.

FUEL RVP           :  15.0
GAS AROMATIC%      :  21.7
GAS OLEFIN%        :  6.2
GAS BENZENE%       :  0.70
E200               :  59.9
E300               :  85.7
OXYGENATE          :  MTBE 0.00 0.00
                   :  ETOH 10.2 1.00
                   :  ETBE 0.00 0.00
                   :  TAME 0.00 0.00

AVERAGE SPEED      : 43.5 arterial


********** Scenario Section 6 January 2009 80 km/hr **********


SCENARIO RECORD    :  ONP1 2009 January B00
CALENDAR YEAR      :  2009

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1

* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.
```

```
FUEL RVP            :  15.0
GAS AROMATIC%       :  21.7
GAS OLEFIN%         :  6.2
GAS BENZENE%        :  0.70
E200                :  59.9
E300                :  85.7
OXYGENATE           :  MTBE 0.00 0.00
                    :  ETOH 10.2 1.00
                    :  ETBE 0.00 0.00
                    :  TAME 0.00 0.00

AVERAGE SPEED       : 49.7 arterial


********** Scenario Section 7 January 2009 90 km/hr **********


SCENARIO RECORD     :  ONP1 2009 January B00
CALENDAR YEAR       :  2009

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH    :  1

* Specify PM10 size
PARTICLE SIZE       : 2.5
PARTICULATE EF      : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR       :  10.0

* Specify fuel economy file.
MPG ESTIMATES       : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP        :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.

FUEL RVP            :  15.0
GAS AROMATIC%       :  21.7
GAS OLEFIN%         :  6.2
GAS BENZENE%        :  0.70
E200                :  59.9
E300                :  85.7
OXYGENATE           :  MTBE 0.00 0.00
                    :  ETOH 10.2 1.00
                    :  ETBE 0.00 0.00
                    :  TAME 0.00 0.00

AVERAGE SPEED       :  55.9 arterial


********** Scenario Section 8 January 2009 100 km/hr **********


SCENARIO RECORD     :  ONP1 2009 January B00
```

```
CALENDAR YEAR      :  2009

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1

* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.

FUEL RVP           :  15.0
GAS AROMATIC%      :  21.7
GAS OLEFIN%        :  6.2
GAS BENZENE%       :  0.70
E200               :  59.9
E300               :  85.7
OXYGENATE          :  MTBE 0.00 0.00
                   :  ETOH 10.2 1.00
                   :  ETBE 0.00 0.00
                   :  TAME 0.00 0.00

AVERAGE SPEED      :  62.1 arterial

END OF RUN         :
```

```
********** Header section **********
* File name/author/date of creation; ONP1B002010i3ssa.in Brett Taylor March 5
2010
* Reference number for this input file -  i3
* Lower case 'a' in the file name indicates the file estimates PM10 and HC as
VOC only. A lower case 'b' in the file name indicates the file estimates PM2.5
and HC as THC only.
* This file is designed for MOBILE6.2C and will provide output for  All
regions
* Biodiesel volume percent is zero (B0)  and the feedstock is Canola at 100%
market share.
* Estimates to be used in the Biodiesel Risk Assessment
* Sources to inputs are documented throughout.
* Each year will have twelve scenarios; one for each month.
* Assumes ultra-low sulphur Diesel at 10ppm.
* Spreadsheet edition
* For use with MOBILE(Feb2010)


MOBILE6 INPUT FILE
PARTICULATES        :
POLLUTANTS          : HC CO NOX
AIR TOXICS          :
SPREADSHEET         :
* DATABASE OUTPUT    :
* WITH FIELDNAMES    :
* DAILY OUTPUT       :

RUN DATA

********** Run  Section 12 ONP1 2010 B00 **********
> ONP1 2010 B00  - All MOBILE6.2C pollutants
EXPRESS HC AS VOC  :
NO REFUELING        :

* Specify  mileage accumulation rates
* Source: M6C-10-E.doc
* If actual data is not available for this year  use most recent available
year. Data used in this case was estimated for calendar year:
MILE ACCUM RATE    : MARv3.dat

* Specify  age distribution
* Source: M6C-10-E.doc
REG DIST            :  ONP1_2006.in

* Expand vehicle class descriptive output
EXPAND BUS EFS      :
EXPAND HDDV EFS     :
EXPAND HDGV EFS     :
EXPAND LDT EFS      :

IDLE PM EMISSIONS  :

* Expand exhaust emissions descriptive output
EXPAND EXHAUST      :

* Expand evaporative emissions descriptive output
EXPAND EVAPORATIVE :

* Specify  vehicle miles traveled (VMT) by average speed on freeways and
arterial roads
*SPEED VMT           :  Svmt_ON.def
```

```
* Because it is now post-1999 calendar year  sulphur levels in gasoline must
be specified
* using the FUEL PROGRAM command (see Advanced Training Guide manual  Day 1
page 46)
* Sulphur source: Environment Canada's Sulphur in Liquid Fuels annual report
* Max Sulphur content from CEPA Sulphur in Gasoline Regulation Registration
June 4  1999
* The regulation implies the use of 25ppm for years after 2004.
* The 4 rows and 8 columns below represent;
* row 1 - average sulphur levels (ppm) from 2000 to 2007
* row 2 - average sulphur levels (ppm) from 2008 to 2015
* row 3 - maximum sulphur levels (ppm) from 2000 to 2007
* row 4 - maximum sulphur levels (ppm) from 2008 to 2015
FUEL PROGRAM       : 4
450.0 390.0 330.0 160.0 52.0 25.0 25.0 25.0
25.0 25.0 25.0 25.0 25.0 25.0 25.0 25.0
500.0 500.0 500.0 500.0 500.0 25.0 25.0 25.0
25.0 25.0 25.0 25.0 25.0 25.0 25.0 25.0


* Specify  diesel fractions
* Source: M6C-10-E.doc
* If actual data is not available for this year  use most recent available
year. Data used in this case was estimated for calendar year:    2006
DIESEL FRACTIONS   :
0.0124 0.0115 0.0095 0.0136 0.0174 0.0123 0.0058 0.0072 0.0053 0.0043
0.0048 0.0056 0.0059 0.0062 0.0046 0.0055 0.0057 0.0200 0.0274 0.0512
0.0550 0.0727 0.0932 0.0578 0.0066
0.0977 0.0272 0.0204 0.0246 0.0320 0.0402 0.0562 0.0274 0.0842 0.1329
0.0341 0.0097 0.0116 0.0090 0.0155 0.0180 0.0080 0.0356 0.0532 0.0385
0.0692 0.0299 0.1176 0.1690 0.0047
0.0001 0.0000 0.0000 0.0001 0.0000 0.0003 0.0003 0.0042 0.0012 0.0008
0.0009 0.0006 0.0001 0.0001 0.0006 0.0004 0.0011 0.0192 0.0212 0.0334
0.0366 0.0486 0.0752 0.0285 0.0026
0.0019 0.0005 0.0000 0.0000 0.0000 0.0001 0.0098 0.0040 0.0072 0.0169
0.0198 0.0174 0.0095 0.0188 0.0107 0.0151 0.0103 0.0239 0.0299 0.0409
0.0313 0.0533 0.0569 0.0061 0.0026
0.0717 0.0778 0.0864 0.1280 0.1239 0.1295 0.1573 0.1734 0.2123 0.2865
0.2630 0.3230 0.2234 0.2083 0.1667 0.1326 0.1043 0.1393 0.2083 0.1964
0.1320 0.0840 0.0696 0.0073 0.0052
0.2872 0.3423 0.3990 0.3371 0.3656 0.3767 0.4308 0.5159 0.4905 0.4917
0.4293 0.5806 0.6090 0.2205 0.2628 0.2281 0.1814 0.2323 0.2914 0.2245
0.1695 0.3171 0.4478 0.5294 0.0899
0.3978 0.5267 0.7428 0.7032 0.7116 0.7241 0.7205 0.7536 0.7417 0.6960
0.7587 0.6729 0.6021 0.5096 0.3973 0.3080 0.2384 0.2628 0.2437 0.0888
0.0448 0.0847 0.0857 0.0000 0.1600
0.5201 0.8910 0.8755 0.8306 0.9052 0.8922 0.8148 0.8655 0.8840 0.8693
0.7493 0.7600 0.6584 0.6893 0.7267 0.8000 0.7866 0.8774 0.9351 0.8390
0.5758 0.2308 0.2500 0.5000 0.2400
0.9675 0.9742 0.9708 0.9434 0.9613 0.9605 0.9462 0.5366 0.7101 0.7205
0.6380 0.6232 0.7381 0.8393 0.6452 0.7170 0.4800 0.4167 0.2727 0.1500
0.1500 0.0000 0.1667 0.6364 0.1429
0.9585 0.9433 0.9342 0.9227 0.9440 0.9026 0.9461 0.9619 0.9833 0.9768
0.9644 0.9680 0.9709 0.9177 0.9379 0.8571 0.8305 0.8452 0.7679 0.8136
0.8438 0.6250 0.5882 0.4857 0.4402
0.9629 0.9789 0.9519 0.9422 0.9821 0.9738 0.9402 0.9539 0.9330 0.9373
0.9043 0.9302 0.9178 0.8810 0.9024 0.8880 0.9563 0.9433 0.8925 0.9111
0.7857 0.7273 0.6667 0.6842 0.3786
0.9494 0.9890 0.9605 0.9663 0.9661 0.9468 0.9739 0.9716 0.9820 0.9902
0.9698 0.9654 0.9781 0.9817 0.9660 0.9583 0.9856 0.9771 0.9588 0.9600
0.9740 0.8125 0.9667 0.9032 0.3250
0.9687 0.9871 0.9225 0.9505 0.9489 0.9461 0.9707 0.9819 0.9802 0.9722
0.9729 0.9677 0.9781 0.9806 0.9581 0.9879 0.9667 0.9774 1.0000 0.9130
```

```
1.0000 1.0000 1.0000 1.0000 0.3012
0.8281 0.7659 0.8525 0.8646 0.9344 0.8626 0.8377 0.8833 0.8432 0.9089
0.9086 0.8538 0.8184 0.8360 0.7897 0.7895 0.8325 0.8950 0.9474 0.9392
0.6190 0.9667 0.8868 0.9624 0.8842


********** Scenario Section 1 January 2031 Idle **********

SCENARIO RECORD    :  ONP1 2031 January B00
CALENDAR YEAR      :  2031

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1

* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.


FUEL RVP           :  15.0
GAS AROMATIC%      :  21.7
GAS OLEFIN%        :  6.2
GAS BENZENE%       :  0.70
E200               :  59.9
E300               :  85.7
OXYGENATE          :  MTBE 0.00 0.00
                   :  ETOH 10.2 1.00
                   :  ETBE 0.00 0.00
                   :  TAME 0.00 0.00

AVERAGE SPEED      : 2.5 arterial


********** Scenario Section 2 January 2031 40 km/hr **********

SCENARIO RECORD    :  ONP1 2031 January B00
CALENDAR YEAR      :  2031

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1

* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
```

```
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.


FUEL RVP           :  15.0
GAS AROMATIC%      :  21.7
GAS OLEFIN%        :  6.2
GAS BENZENE%       :  0.70
E200               :  59.9
E300               :  85.7
OXYGENATE          :  MTBE 0.00 0.00
                   :  ETOH 10.2 1.00
                   :  ETBE 0.00 0.00
                   :  TAME 0.00 0.00

AVERAGE SPEED      : 24.9 arterial


********** Scenario Section 3 January 2031 50 km/hr **********

SCENARIO RECORD    :  ONP1 2031 January B00
CALENDAR YEAR      :  2031

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1

* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.


FUEL RVP           :  15.0
GAS AROMATIC%      :  21.7
```

```
GAS OLEFIN%         :  6.2
GAS BENZENE%        :  0.70
E200                :  59.9
E300                :  85.7
OXYGENATE           :  MTBE 0.00 0.00
                    :  ETOH 10.2 1.00
                    :  ETBE 0.00 0.00
                    :  TAME 0.00 0.00

AVERAGE SPEED       : 31.1 arterial


********** Scenario Section 4 January 2031 60 km/hr **********


SCENARIO RECORD     :  ONP1 2031 January B00
CALENDAR YEAR       :  2031

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH    :  1

* Specify PM10 size
PARTICLE SIZE       : 2.5
PARTICULATE EF      : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR       :  10.0

* Specify fuel economy file.
MPG ESTIMATES       : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP        :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.


FUEL RVP            :  15.0
GAS AROMATIC%       :  21.7
GAS OLEFIN%         :  6.2
GAS BENZENE%        :  0.70
E200                :  59.9
E300                :  85.7
OXYGENATE           :  MTBE 0.00 0.00
                    :  ETOH 10.2 1.00
                    :  ETBE 0.00 0.00
                    :  TAME 0.00 0.00

AVERAGE SPEED       : 37.3 arterial


********** Scenario Section 5 January 2031 70 km/hr **********


SCENARIO RECORD     :  ONP1 2031 January B00
CALENDAR YEAR       :  2031
```

```
* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1

* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.


FUEL RVP           :  15.0
GAS AROMATIC%      :  21.7
GAS OLEFIN%        :  6.2
GAS BENZENE%       :  0.70
E200               :  59.9
E300               :  85.7
OXYGENATE          :  MTBE 0.00 0.00
                   :  ETOH 10.2 1.00
                   :  ETBE 0.00 0.00
                   :  TAME 0.00 0.00

AVERAGE SPEED      : 43.5 arterial


********** Scenario Section 6 January 2031 80 km/hr **********


SCENARIO RECORD    :  ONP1 2031 January B00
CALENDAR YEAR      :  2031

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1

* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT
```

```
* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.

FUEL RVP           :  15.0
GAS AROMATIC%      :  21.7
GAS OLEFIN%        :  6.2
GAS BENZENE%       :  0.70
E200               :  59.9
E300               :  85.7
OXYGENATE          :  MTBE 0.00 0.00
                   :  ETOH 10.2 1.00
                   :  ETBE 0.00 0.00
                   :  TAME 0.00 0.00

AVERAGE SPEED      : 49.7 arterial


********** Scenario Section 7 January 2031 90 km/hr **********


SCENARIO RECORD    :  ONP1 2031 January B00
CALENDAR YEAR      :  2031

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1

* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.


FUEL RVP           :  15.0
GAS AROMATIC%      :  21.7
GAS OLEFIN%        :  6.2
GAS BENZENE%       :  0.70
E200               :  59.9
E300               :  85.7
OXYGENATE          :  MTBE 0.00 0.00
                   :  ETOH 10.2 1.00
                   :  ETBE 0.00 0.00
                   :  TAME 0.00 0.00

AVERAGE SPEED      :  55.9 arterial
```

```
********** Scenario Section 8 January 2031 100 km/hr **********


SCENARIO RECORD    :  ONP1 2031 January B00
CALENDAR YEAR      :  2031

* Evaluation month is set to 7 for 'summer'; 1 for 'winter'. October 1 through
April 31 get 'winter' fuel properties; May 1 through September 31 get 'summer'
fuel properties (or special RVPs where applicable).
EVALUATION MONTH   :  1

* Specify PM10 size
PARTICLE SIZE      : 2.5
PARTICULATE EF     : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV

* On-road diesel sulphur content  in parts per million (ppm)  from Sulphur in
Liquid Fuels reports (OGEB)
DIESEL SULFUR      :  10.0

* Specify fuel economy file.
MPG ESTIMATES      : AEO2009.DAT


* Min/max temperatures from MSC's Monthly Data Report for 2006 TORONTO LESTER
B. PEARSON INT'L A
MIN/MAX TEMP       :  25.9 38.8

* Fuel properties from Alliance gasoline survey for Winter 2009.

FUEL RVP           :  15.0
GAS AROMATIC%      :  21.7
GAS OLEFIN%        :  6.2
GAS BENZENE%       :  0.70
E200               :  59.9
E300               :  85.7
OXYGENATE          :  MTBE 0.00 0.00
                   :  ETOH 10.2 1.00
                   :  ETBE 0.00 0.00
                   :  TAME 0.00 0.00

AVERAGE SPEED      :  62.1 arterial

END OF RUN         :
```