City of Hamilton

Development of Policy Papers for Phase Two of the Transportation Master Plan for the City of Hamilton
AIR QUALITY POLICY PAPER

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For IBI Group

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1. INTRODUCTION

1.1 Study Background and Objectives

The City of Hamilton *City-wide Transportation Master Plan* will provide inputs to the *Growth Related Integrated Development Strategy* (GRIDS) and make recommendations to Council on the adoption of a City-wide Transportation Policy that is cognisant of Vision 2020 and other City of Hamilton long-term planning objectives. The project has been divided into three distinct phases. The first phase consisted of the technical calibration of the existing transportation model to reflect current transportation conditions in Hamilton. The second phase, which is the object of this and other policy papers, will focus on the development of 23 policy papers in the following areas: Travel Demand, Urban Development, System Performance, Infrastructure Planning and Infrastructure Financing. Following the completion of the Policy Papers, the City will proceed to develop transportation scenarios (Phase 3 of the project) based upon the results of the policy work performed in Phase 2 and the land use scenarios developed through the broader GRIDS study and will test the efficiency and viability of these scenarios by integrating them into the calibrated model.

This policy paper addresses the issue of **Air Quality**. The remainder of this introduction provides a brief overview of the link between transportation, air quality, human health and the environment. Section 2 provides an overview of the existing policy framework from a federal, provincial and local perspective. Section 3 provides supporting background information to guide the development of policies while Section 4 highlights experience and practices from other jurisdictions. Section 5 and Section 6 outline the development and refinement of policy options and potential supporting actions.

1.2 Scope of Policy Paper

Discussion of air emissions is often separated into two types if emissions: those with globally acting impacts and those with locally acting impacts. Air emissions that have globally acting impacts include emissions referred to as **Greenhouse Gas Emissions** (GHGs). These emissions are linked to global warming and other changes in climate, but can also have local impacts including the enhancement of other air emissions impacts due to changing weather patterns and increased temperatures. The other general category of emissions, those that have locally and regional acting impacts, are responsible for poor urban air quality. Emissions contributing to poor air quality are often referred to as **Criteria Air Contaminants** (CACs). They include Total Particulate Matter (TPM), Particulate Matter with a diameter less than 10 microns (PM_{10}), Particulate Matter with a diameter less than 2.5 microns ($PM_{2.5}$), Carbon Monoxide (CO), Nitrogen Oxides ($NO_{x)}$ Sulphur Oxides SO_x, and Volatile Organic Compounds (VOCs).

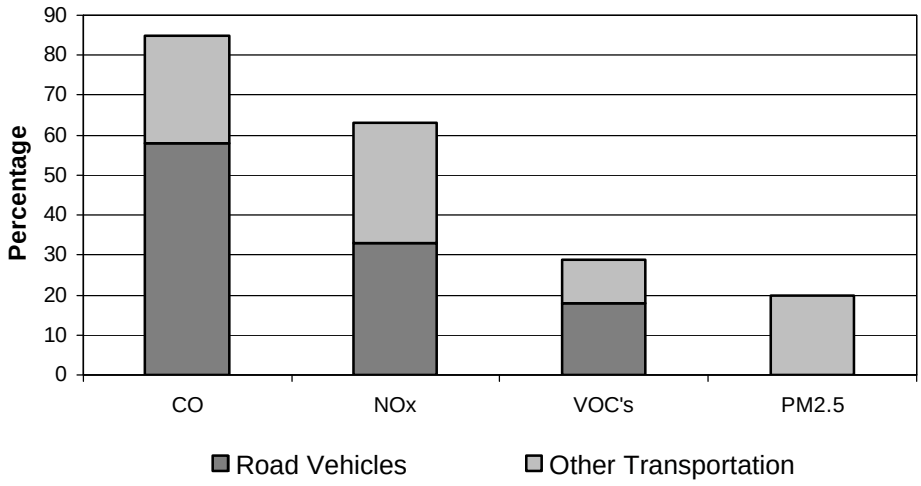
The focus of this policy paper is on air emissions as they pertain to local and regional air quality. The issues of climate change and the reduction of GHGs are addressed in a separate paper on transportation energy use and Greenhouse Gas Emissions. It is important to note; however, that while the impacts of the two types of emissions are somewhat different, the causes (namely the burning of fossil fuels) and potential solutions often overlap. It is important to recognize that both types of emissions can have an impact on the local environment, economy and public health.

1.3 Transportation and Air Quality

Transportation's contribution to air emissions varies by the type of pollutant as shown on Exhibit 1.1, the transportation sector is a contributor to emissions of carbon monoxide (CO), oxides of nitrogen (NO_X), and volatile organic compounds (VOC). Transportation is also a major contributor to particulate emissions, both through tailpipe emissions but more importantly from other sources such as road dust. According to the most recent "Air Quality in Ontario" Report published by the Ontario Ministry of the Environment (MOE)[1], road vehicles accounted for 58% of CO emissions, 33% of NO_X emissions and 18% of VOC emissions in Ontario in 2001.

Most air emissions from transportation are attributable to the operation of road vehicles including private vehicles (cars and light trucks/SUVs/minivans) and commercial vehicles. In 1995, light duty vehicles, including SUVs, were responsible for approximately 75% of the total transport emissions of carbon monoxide. Heavy duty trucks were responsible for 30% of the emissions of nitrogen oxides[2]. However, in the United States, studies indicate that 70-80 percent of the associated cancer risk from air pollution is due to particulate emissions from diesel engines[3].

Exhibit 1.1: Contribution of Transportation to Air Emissions



Source: Air Quality in Ontario 2001 Report (2001)

1.4 Effects of Air Quality

The effects of air emissions are wide ranging and include effects on both human health as well as the environment. Exhibit 1.2 provides a broad overview of the known or suspected effects of different types of pollutant from transportation. The impacts of air emissions on the environment are often tangible and include acid rain (mainly caused by sulphur emissions which transportation is only a small contributor), loss of agricultural productivity and reduced visibility. The impacts of air pollution on human health include eye, nose, and throat irritation, reduced lung capacity, aggravation of respiratory diseases, cancer, and premature death.

[1] Ministry of Environment, Ontario, Air Quality in Ontario, 2001, http://www.ene.gov.on.ca/envision/air/AirQuality/2001.htm
[2] Environment Canada, 1995 Criteria Air Contaminant Emissions for Canada, December 1999.
[3] American Lung Association and Environmental Defence, Closing the Diesel Divide, Protecting Public Health From Diesel Air Pollution, 2003.

While air quality impacts all age groups, it impacts the oldest and youngest segments of the population the most. The elderly and people suffering from cardio-respiratory problems such as asthma appear to be the most susceptible groups. Children and newborns are also sensitive to the health effects of air pollution since they take in more air than adults for their body weight and consequently, a higher level of pollutants[4].

Given the direct link between air quality and health, and the serious nature of impacts of air quality on the environment, the City of Hamilton has recognized a need to proactively address air quality as part of their Transportation Master Plan.

Exhibit 1.2: Major Impacts on Human Health and the Environment of Common Pollutants Associated with Vehicle Use

Emissions	Health impacts	Environmental impacts
Nitrogen oxides (NO_X) include nitric oxide (NO) and nitrogen dioxide (NO_2), which is formed from the oxidation of NO.	• NO_2 is a lung irritant at high concentrations, may lead to depression of the immure system, with children and the elderly being at risk.	• NO_2 reacts with water to form nitric acid (HNO3), an element of acid rain. • NO_2 contributes to the formation of ground-level ozone, is associated with suppressed vegetation growth and contributes to the corrosion of metals and degradation of various materials.
Carbon monoxide (CO) is a gas produced by the incomplete combustion of organic materials.	• Reduces the ability of the blood to carry oxygen at high concentrations.	
Volatile Organic compounds (VOCs) are a chemically diverse group of compounds that have at least one carbon atom.	• Many individual VOCs (e.g., benzene) are known to have or are suspected of having human health effects ranging from carcinogenicity to neurotoxicity at high concentrations..	• Contributes to the formation of ground-level ozone.
Ozone (O_3) is formed from the reaction of NO_X, VOCs, and sunlight.	• Associated with changes in lung function, decreased immune function, and possibly the development of chronic lung disease at high concentrations..	• Reduces agricultural productivity and the growth rate of trees. • Damages sensitive species of vegetation.
Particulate Matter (PM_{10}) is produced from road dust and tire wear.	• Associated with Increased respiratory infections, reduced breathing capacity, and potentially cancer at high concentrations.	• PM deposition on vegetation reduces photosynthesis; it also contributes to degradation of materials and reduced visibility.
Fine Particulate Matter (PM2.5) is produced from direct tailpipe emissions as well as the reaction of various pollutants in the atmosphere.	• Can cause breathing and respiratory symptoms, irritation, inflammation and damage to the lungs and premature deaths at high concentrations.	• Not yet well investigated, but likely to be found to cause health impacts in several species and the same environmental impacts as PM_{10}.

Source: Transportation Association of Canada, Urban Transportation and Air Quality Briefing (Draft Version, January 2004)

[4] Heath Canada, Heath and Air Quality, http://www.hc-sc.gc.ca/hecs-sesc/air_quality/health_effects.htm

2. CURRENT SITUATION

2.1 Federal and Provincial Policy Framework

2.1.1 FEDERAL GOVERNMENT

The federal government is responsible for a number of initiatives and policies relating to air quality through the departments of Environment Canada, Natural Resources Canada and Transport Canada. Areas of involvement of the federal government include:

- developing and enforcing standards governing vehicles and fuels;
- developing and implementing transborder agreements governing air emissions;
- monitoring air quality;
- improving public awareness of air quality issues; and,
- funding programs aimed at reducing air emissions from transportation.

Federal government policy initiatives either in place or pending, which were established to manage and improve air quality in Canada include:

- **Sulphur in Diesel Fuel Regulations** (SOR/97-110) - (CEPA - P.C. 2002-1232 17 July 2002).
- **Sulphur in Gasoline Regulations** (SOR/99-236) - (CEPA - P.C. 1999-1023 4 June, 1999).
- **Alternative Fuels Act**: This act, taken into effect in 1997, serves to encourage the use of alternative fuels for federal government-owned vehicles (automobiles, light and medium duty trucks, vans and buses). The goal is for at least 75% of government driven cars to be alternative fuel cars by 2004. In this act, an alternative fuel refers to ethanol, methanol, propane, natural gas, hydrogen or electricity.
- **Canada-Wide Standards - Canadian Council of Ministers of the Environment:** Canada-Wide Standards (CWSs) can include qualitative or quantitative standards, guidelines, objectives, and criteria for protecting the environment and reducing the risk to human health. Ministers have endorsed Canada-Wide Standards for pollutants such as fine particulate matter ($PM_{2.5}$); ground-level ozone and benzene, among others.
- **Canada-U.S. Air Quality Agreement:** The general objective of the Parties is to control transboundary air pollution between the two countries. In general, this initiative does not apply to local transportation.
- **Ozone Annex to the Canada-U.S. Air Quality Agreement:** The objective of the annex is to control and reduce the anthropogenic emissions of nitrogen oxides (NO_X) and volatile organic compounds (VOC) that are precursors to the formation of ground-level ozone which contribute to transboundary air pollution. In general, this initiative does not apply to local transportation.

- **The National Air Pollution Surveillance (NAPS) Network** was established in 1969 as a joint program of the federal and provincial governments to monitor and assess the quality of the ambient air in Canadian urban centres, including Hamilton.

2.1.2 PROVINCIAL GOVERNMENT

The provincial government is responsible for a number of policies or initiatives that impact air emissions and air quality including:

- establishing air quality standards, for example relating to a new transportation facility;
- governance and funding of urban transport;
- supply of infrastructure, including provincial expressways and commuter rail infrastructure (GO transit);
- vehicle registration and licensing, including taxation by vehicle size/type;
- emissions testing/monitoring and regulation of emissions by vehicles in use.

Provincial governments also play a key role in determining how and which land-use policies are set through legislation that regulates municipal actions. The Province has also recently released a discussion paper outlining its growth plan and its intension to direct growth to existing areas and reduce sprawl, which may have a significant impact on reducing vehicle use and air emissions.[5].

Provincial government policy initiatives either in place or coming soon, which were established to manage and improve air quality in Ontario and directly affect transportation, include:

- **Anti-Smog Action Plan:** Key components of the Plan include:
  - Ontario's Smog Accord – the commitment of more than 50 signatory associations to cleaner air;
  - A commitment of signatories to a target of a 75 percent reduction by 2015 in the number of times the one-hour ozone criterion of 80 parts per billion is exceeded;
  - A 45 percent reduction in total NO_X and VOC emissions from the 1990 Ontario baseline;
  - A commitment to develop a particulate matter reduction strategy for Ontario;
  - "Quick start" actions to achieve immediate short-term reductions for identified initiatives;
  - Longer-term emission reduction plans and updating long-term plans on a 5-year cycle; and
  - Implementation of a disciplined management process and organizational structure.
- **Drive Clean Program:** Drive Clean requires mandatory vehicle emissions inspection and maintenance to reduce oxides of nitrogen (NO_X) and volatile organic compounds (VOCs) from vehicles, which are significant sources of smog-causing pollutants. Drive Clean also measures carbon monoxide (CO). The program requires that light-duty cars, trucks and vans have an emissions test every 2 years during registration renewal, with odd-model years tested in even calendar years and even-model years in odd calendar years. The program applies to vehicles that are more than 3 and less than 20

[5] Ministry of Public Infrastructure and Renewal, Ontario, Place to Grow: Better Choices. Brighter Future, http://www.placestogrow.pir.gov.on.ca/userfiles/HTML/nts_2_20438_1.html

model years old and requires a pass or conditional pass for vehicle registration renewal. The program has been implemented in phases. Phase 1: Testing became mandatory on April 1, 1999 in the Greater Toronto Area (the regions of Halton, Peel, Durham and York and the City of Toronto) and the City of Hamilton (the former Hamilton-Wentworth Region). The program was subsequently expanded and now includes all of Southern Ontario. Recently, the Ontario government announced that this program has achieved its objectives and may be discontinued.

- **Smog Patrol:** This is an on-road enforcement component of Drive Clean - which spot-checks trucks, buses and light duty vehicles that are gross emitters of smog-causing pollutants.

- **Air Quality Standards in Ontario:** The MOE has established standards, guidelines, objectives, criteria and other kinds of limits based on the presence or discharge of an airborne contaminant into the natural environment. The MOE sets two kinds of limits to protect air quality, one for ambient air quality and one for point of impingement. Ambient Air Quality Criteria (AAQCs) are used to assess the general quality of the air and are not enforceable, while "point of impingement" (POI) limits control air emissions from individual sources of pollution, such as factories, which are enforceable. Transportation facilities generally are governed by AAQCs. The MOE has developed AAQCs for numerous contaminants that are known to have the potential to cause harmful effects on human health or cause degradation to the environment. AAQCs are established under Regulation 337 and represent desirable ambient air quality levels. AAQC's are derived from limiting effects which include: health; odour; particulate; corrosion; vegetation; ozone depleting; soiling; effects on animals; and, visibility. In general, these factors are evaluated when completing an Environmental Assessment for a transportation project.

2.2 Review of Existing City of Hamilton Policies

Hamilton is a leader in the assessment of air quality and development of related policies. There are a significant number of policies initiatives currently in place in the City of Hamilton relating to air quality. The primary policies or related initiatives are briefing summarized below.

2.2.1 CITY OF HAMILTON - VISION 2020

Hamilton-Wentworth Regional Council adopted VISION 2020, The Sustainable Region in 1992. The VISION 2020 goal for improving air quality is "to ensure the region has the best air quality of any major urban area in Ontario and to reduce greenhouse gas emissions 20% from 1990 levels". [6] In 2003, the City of Hamilton re-established their commitment to Vision 2020.

Related to the Vision is the establishment of a number of indicators for measuring progress including:

- Number of O_3 (Ground Level Ozone) Criteria Exceedances
- Average SO_2 (Sulphur Dioxide Concentration)
- Average NO_2 (Nitrogen Dioxide Concentration)

[6] City of Hamilton website: http://www.vision2020.hamilton.ca/about/goals.asp

- Average PM_{10} (Inhalable Particulate Matter less than 10 microns in diameter Concentration)

- Hospitalization Rate for Respiratory Illness Per 100,000 People

2.2.2 CLEAN AIR HAMILTON

Clean Air Hamilton arose out of the Vision 2020 process as a means to address air quality issues in Hamilton and to achieve the Vision's goals. Clean Air Hamilton has completed or initiated a number of programs, some of which are aimed at reducing emissions from transportation. A complete summary of current programs is provided on the Clean Air Hamilton website: http://www.airquality.hamilton.on.ca/default.asp). The following is a brief summary of these programs.

- **Emissions Reduction Working Group:** The Emissions Reduction Working Group has developed an action plan to reduce emissions from industry, transportation and long range transport sources. The five priorities are local smog plan; fleet greening; fugitive dust control; industrial and inventories control and land use planning. Some of the projects the group has initiated or is working on include:

  – Local Smog Response Plan

  – City of Hamilton Commuter Challenge

  – NuVehicle Partnership

  – Tree Planting Initiative

- **Health and Environmental Impacts Working Group:** The Health and Environmental Impacts Working Group has a mandate to analyze air emissions and recommend actions or policy changes to improve air quality. The group has a responsibility to report to Council annually on the impacts of local air quality on human health. This task includes a reassessment of the current air quality and health data, as well as setting targets to evaluate Clean Air Hamilton performance in improving local air quality. One of the major projects undertaken by this group includes the **2003 Air Quality Health Assessment Study**, a report describing the link between air quality and health.

- **Research and Policy Development Working Group:** The Research and Policy Development Working Group was established to fill in research gaps identified by the Hamilton Air Quality Initiative (HAQI). Some of the projects worked on by this group in the past included:

  – Street Sweeping Initiative;

  – Chemical Sampling Project;

  – Truck Emissions Modeling Study.

- **Communications Working Group**: The Communications Working Group is responsible for developing strategies that convey the message of Clean Air Hamilton.

- **Anti-Idling Campaign:** The City of Hamilton, in partnership with the Hamilton Industrial Environmental Association (HIEA), is launching an anti-idling campaign. The aim of this city-wide campaign is to raise awareness about the adverse effects of

vehicle idling and to encourage a positive change in driving habits. To the anti-idling campaign has been voluntary and by-laws restricting idling have not been enacted. However, the anti-idling by-law is in the initial research stage and a by-law is intended to complement the voluntary program.

2.2.3 GREEN VENTURE

Green Venture's primary partner is the City of Hamilton. Since its inception, Green Venture has worked with the city to improve the local environment and economy by affecting changes in citizen behaviour and encouraging sustainable development. Hamilton-Wentworth Green Venture is a not-for-profit community based organization committed to energy, water and waste reduction, education, green space conservation and the greening of small businesses. Some of the programs initiated by Green Venture include the Commuter Challenge, Active and Safe Routes to School and the Tree Planting Program.[7]

2.2.4 ENVIRONMENT HAMILTON

Environment Hamilton is an incorporated not-for-profit organization that works to increase the ability of local residents to protect and enhance their environment and quality of life. It works toward the VISION 2020 goals through:

- Environmental monitoring projects (including urban forests, water and air);
- Support for the smart community planning and opposition to sprawl development;
- Making use of environmental law and policy;
- Projects to promote sustainable transportation and strengthen neighbourhoods; and,
- Making effective use of existing government channels to comment on projects and proposals with environmental and sustainability implications.[8]

[7] Green Venture website: http://www.greenventure.on.ca/
[8] City of Hamilton website: http://www.vision2020.hamilton.ca/partners/environment_hamilton.asp

3. SUPPORTING INFORMATION AND ANALYSES

3.1 Impact of Emissions from Transportation Health

In 2003, McMaster Institute of Environment and Health completed a study of the impact of air pollution on health[9]. This study was funded by the City of Hamilton and is considered to be "state-of-the art" in terms of air quality research. The study established a clear link between air quality and public health, and in particular a link between health and pollutants where transportation is a major contributor. Exhibit 3.1 below provides a summary of the results of that study and an indication of the relative role of transportation in the production of individual air emissions.

Exhibit 3.1: Health Impacts of Air Emissions

Pollutant	Non-traumatic deaths (a)	Respiratory admissions	Cardio-vascular admissions	Role of Transportation in production of Emissions (b)
PM_{10}	14	27	49	LOW
SO_2	16	20	26	LOW
NO_2	27	48	176	HIGH
CO	3	-	38	MODERATE
O_3	36	44	191	Varies (3)

(a) Based on "M-min adjusted" scenario, in Air Quality Assessment report. Figures should not be interpreted as exact numbers. This scenario is the most conservative of all scenarios examined.

(b) Based on figures presented in Exhibit 3.3. High = >50% of emissions from transportation, Moderate = 10% - 50% of emissions from transportation, low = <10% of emissions from transportation

(c) Ozone (O3) is formed from the reaction of NOx, VOCs, and sunlight. Transportation is a high contributor to NOx.

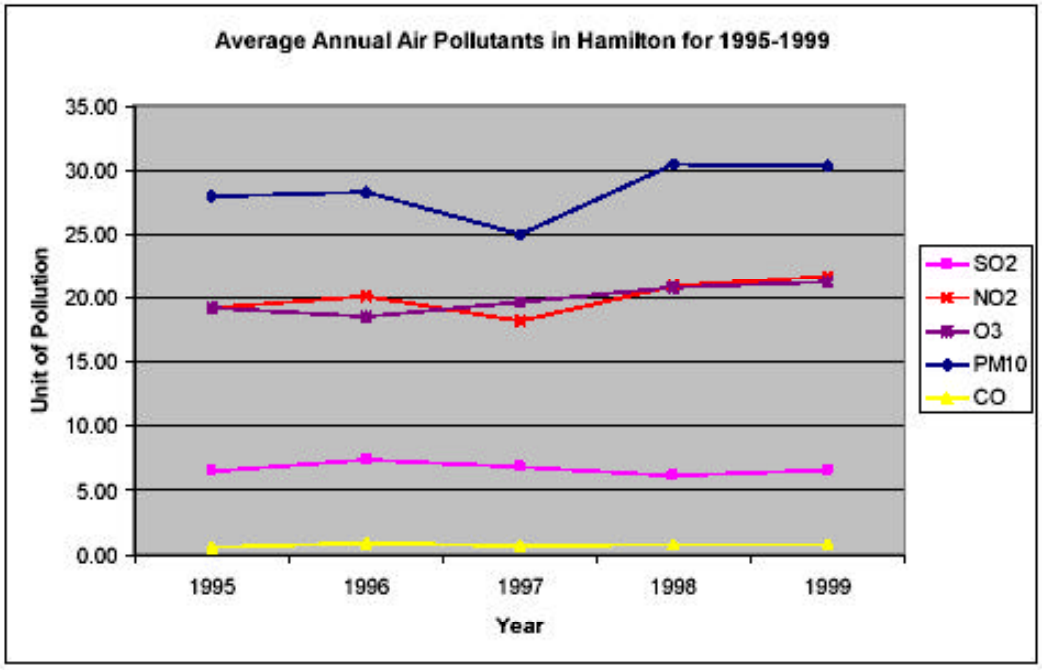
The above assessment shows that local vehicular emissions of NO_2 is a major contributor to the pollutant burden in the residential areas of Hamilton. NO_2 alone is responsible for about one-third of all non-traumatic deaths and hospital admissions due to air pollution. NO_2 is primarily related to vehicle emissions which indicates a key priority for transportation policy intervention. It also indicates that the transportation sector contributes significantly to CO and related health impacts.

[9] McMaster Institute of Environment and Health, A Public Health Assessment of Mortality and Hospital Admissions Attributable to Air Pollution in Hamilton, May 2003.

3.2 Trends in Air Quality in Hamilton

Air quality monitoring is frequently used to determine ambient pollutant levels, establish trends, and assess the effectiveness of mitigation strategies. Exhibit 3.2 shows the trends in pollutant levels from the period of 1995-1999. Following the exhibit is a summary of MOE historical ambient air quality measurements in Hamilton.

Exhibit 3.2: Change of Average Annual Air Pollutants in Hamilton, 1995-1999



Note: SO_2, NO_2, and O_3 expressed in parts per billion (ppb), CO expressed in parts per million (ppm) and PM_{10} expressed in $\mu g/m^3$

Source: McMaster Institute of Environment and Health, A Public Health Assessment of Mortality and Hospital Admissions Attributable to Air Pollution in Hamilton, May 2003.

- Historical ambient levels of carbon monoxide are well below the MOE's guidelines throughout the region.

- Historical ambient levels of nitrogen dioxide are well below the MOE's guidelines throughout the region.

- Historical readings of total suspended particulate matter (TSP) occasionally exceed the MOE's guideline level, especially near the industrial area of Hamilton. At the Region's Mount Albion/King site, the TSP levels were within the MOE's guidelines. The MOE reported that TSP levels decreased dramatically in the industrial zone over the period, 1999-2000, by 15-20% and levels across Hamilton are lower than in 1989 by 25-30%.

- Inhalable particulate matter (PM_{10}) levels exceeded the MOE's interim guideline level throughout the region, but not to the same extent as TSP. The PM_{10} background ambient levels were below the interim guideline 94% of the time at the MOE's Strathearne North station in 2001. This translates into 22 days per year above the

MOE's interim guideline. The MOE reported that PM_{10} levels have decreased by about 15% since 1991 and sulphate content in PM_{10} has decreased by 50% in most of Hamilton since that time.

- Hydrocarbon levels were measured and studied as individual compounds. All, except acrylonitrile, were found to be within the guidelines. Acrylonitrile is a solvent associated with casting industries and its levels will not be affected by vehicular emissions.

In conclusion, the various sizes of particulate matter remain an issue within the Hamilton airshed. The MOE reported that despite the improvements in ambient particulate matter levels across Hamilton, elevated short term peaks of particulates are recorded near the industrial sector.

The above review of historical ambient air quality measurements summarizes the state of air quality in Hamilton. It is important to understand the relative contribution of emissions by source sector. Exhibit 3.3 summarizes year 2001 emissions by source sector for the census division of Hamilton-Wentworth Regional Municipality. Contributions were derived using Environment Canada's 1995 Criteria Air Contaminant (CAC) emissions database.

Exhibit 3.3: Year 2001 Emissions by Source Sector for City of Hamilton (tons/year)

Source Sector	CO	Total VOC's	NO_X	PM_{10}	$PM_{2.5}$	SO_2
Biogenic	0	114,414	1,098	0	0	0
Industrial Sources	553,105	30,925	12,019	11,208	3,047	28,408
Non-Industrial Fuel Combustion and Other	9,443	7,615	1,620	4,644	1,732	471
Transportation	118,839	11,335	15,672	970	893	1,806
Dust from All Roads (Paved and Unpaved)	N/A	N/A	N/A	7,708	1,506	0
TOTAL	**681,387**	**164,289**	**30,408**	**24,530**	**7,178**	**164,289**

Note: n/a – not applicable

3.3 Hamilton in Comparison

According to the MOE's "Air Quality in Ontario 2001" report, Hamilton ranks amoung the worst cities in Ontario in terms of air quality. Measured levels of $PM_{2.5}$, SO_2, NO_2 and CO in Hamilton were consistently positioned within the top five polluting cities in Ontario. However, it should be noted that emissions from Hamilton were similar to that of other major industrial cities (i.e., Burlington, Windsor, Sarnia, etc.) in Ontario. In addition, these conclusions are somewhat dependent on the location of monitoring stations which, in the case of the figures quoted here, are close to the industrial area. Outside of the industrial areas emissions are comparable or better than other cities for most measured parameters.

From an international perspective, measurements in Hamilton were also consistent with those of other cities whose demographic includes a major industrial component (i.e., Buffalo, Cleveland, Detroit, etc.).

3.4 Contribution of Emissions by Mode

Exhibit 3.4 summarizes the relative contribution of emissions for four modes of transportation for Hamilton-Wentworth Regional Municipality. Estimates were derived using Environment Canada's 1995 CAC Emissions database.

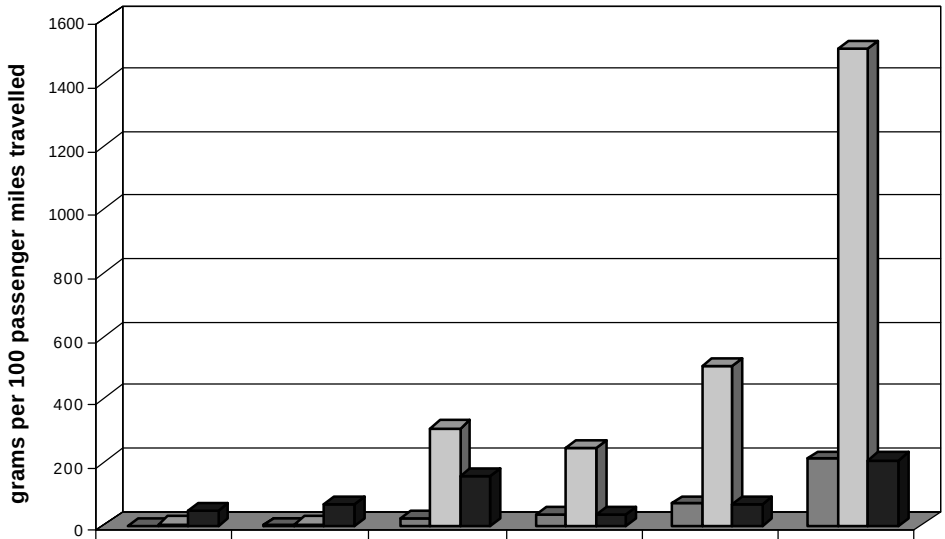
Exhibit 3.4: Year 2001 Emissions by Transportation Mode for City of Hamilton (tons/year)

Transportation Mode	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	Total VOC's
Highway	42,559	6,967	283	266	211	4,525
Off-Highway (e.g. construction vehicles, off-road motorcycles, etc)	73,588	8,016	577	532	512	6,079
Railroad	40	206	5	5	14	10
Aircraft	684	43	11	8	7	78
Marine	1969	440	94	83	1,063	644
TOTAL	**118,839**	**15,672**	**970**	**893**	**1,806**	**11,335**

The above table indicates that emissions from roadway vehicles are the major contributor from transportation sources to the Hamilton airshed. With the exception of SO_2 emissions from marine, the other modes have a relatively small contribution when compared to roadway vehicles.

When developing policies or evaluating design alternatives for transportation passenger modes, it is important to understand the relative contribution of each mode in terms of air quality impact. Exhibit 3.5 shows the relative pollutant contribution of six different urban transport modes. The results are presented as grams per 100 passenger miles travelled. It should be noted that these numbers were taken from a study conducted in 1989, and since that time fuel and control technologies have improved dramatically. Therefore, the estimates are conservative.

Exhibit 3.5: Pollution Emitted from Urban Transport Modes, for Typical Work Commutes (grams per 100 passenger miles travelled)



	Rapid Rail	Light Rail	Transit Bus	Van Pool	Car Pool	Auto (1 Occupant)
Hydrocarbons	0.3	0.4	20	36	70	209
Carbon Monoxide	2	3	305	242	502	1506
Nitrogen Oxides	49	69	154	38	69	206

Sources: American Public Transit Association, Mass Transit: "The Clean Air Alternative", Washington D.C. 1989

3.5 Future Outlook

Over the years, tailpipe emissions are expected to decrease due to improvements in control technologies and stricter fuel and emission regulations. In most cases, these decreases will more than off-set the increases due to increased vehicular travel.

The U.S. EPA's MOBILE6.2 model can be used to estimate tailpipe emission factors for a mix of vehicles, travel speeds and calendar years. Refer to Exhibits 3.6 –3.8 for sample graphs of MOBILE6.2 fleet-averaged results. The graphs indicate the following:

- Tailpipe emissions of CO, NO_X, and VOCs are significantly higher for slower average travel speeds (e.g., less than 30 km/h);
- Tailpipe emissions of CO and NO_X are higher for faster average travel speeds (e.g., greater than 80 km/h);
- Tailpipe emissions of CO are expected to be approximately 58% lower in 2021 compared to 2001;
- Tailpipe emissions of NO_X are expected to be approximately 81% lower in 2021 compared to 2001; and
- Tailpipe emissions of VOCs are expected to be approximately 77% lower in 2021 compared to 2001.

It should be noted that the emission factors reductions noted above are vehicle fleet or composite emission factors (MOBILE6.2 default fleet mix). The various vehicle types within the fleet contribute to the overall emission factor in different proportions. For example, heavy duty diesel trucks produce significantly more NO_X emissions compared to light duty gasoline cars, and light duty gasoline trucks produce significantly more CO emissions compared to light duty diesel trucks.

A dispersion model, such as the U.S. EPA's CAL3QHCR, can be used to predict pollutant concentrations at various receptors of interest located downwind of a given roadway. The CAL3QHCR dispersion model processes up to a full year of hourly meteorological data (e.g., wind speeds and directions) and predicts air pollutant concentrations near highways and arterial streets due to emissions from motor vehicles.

Exhibit 3.6: Projected Carbon Monoxide (CO) Fleet Emissions (2001-2021)

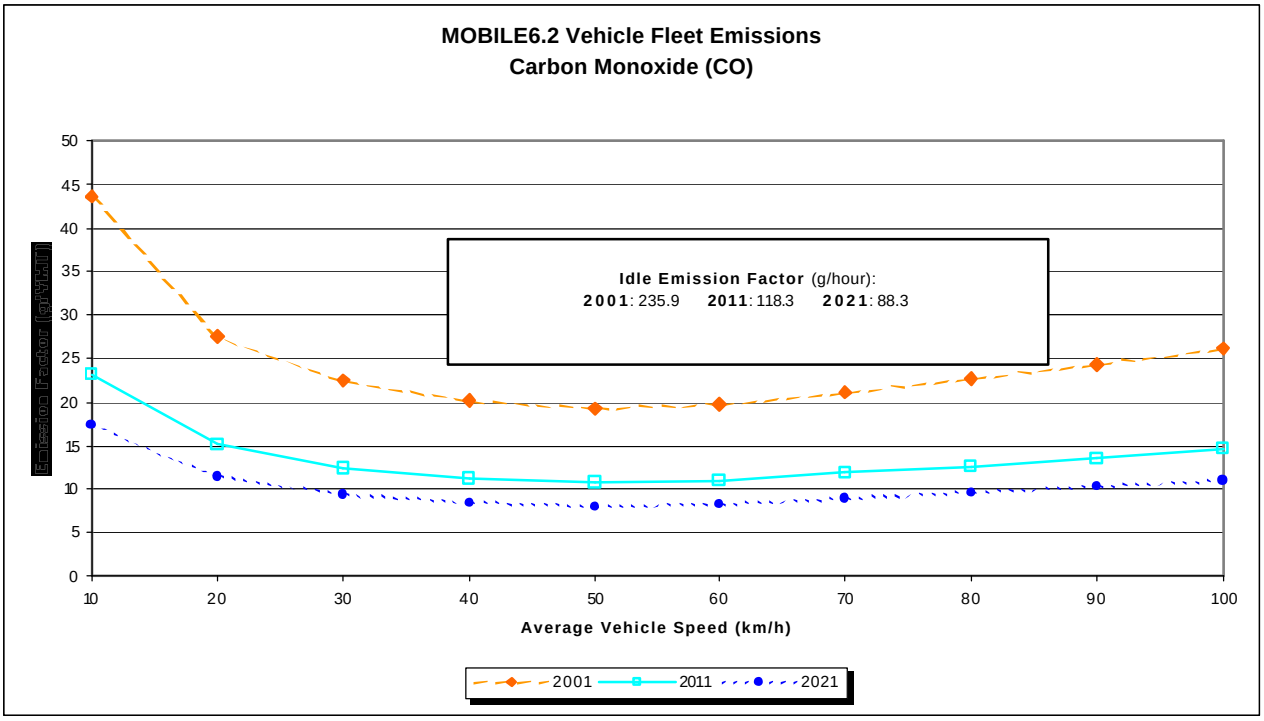


Exhibit 3.7: Projected Oxides of Nitrogen (NO_X) Fleet Emissions (2001-2021)

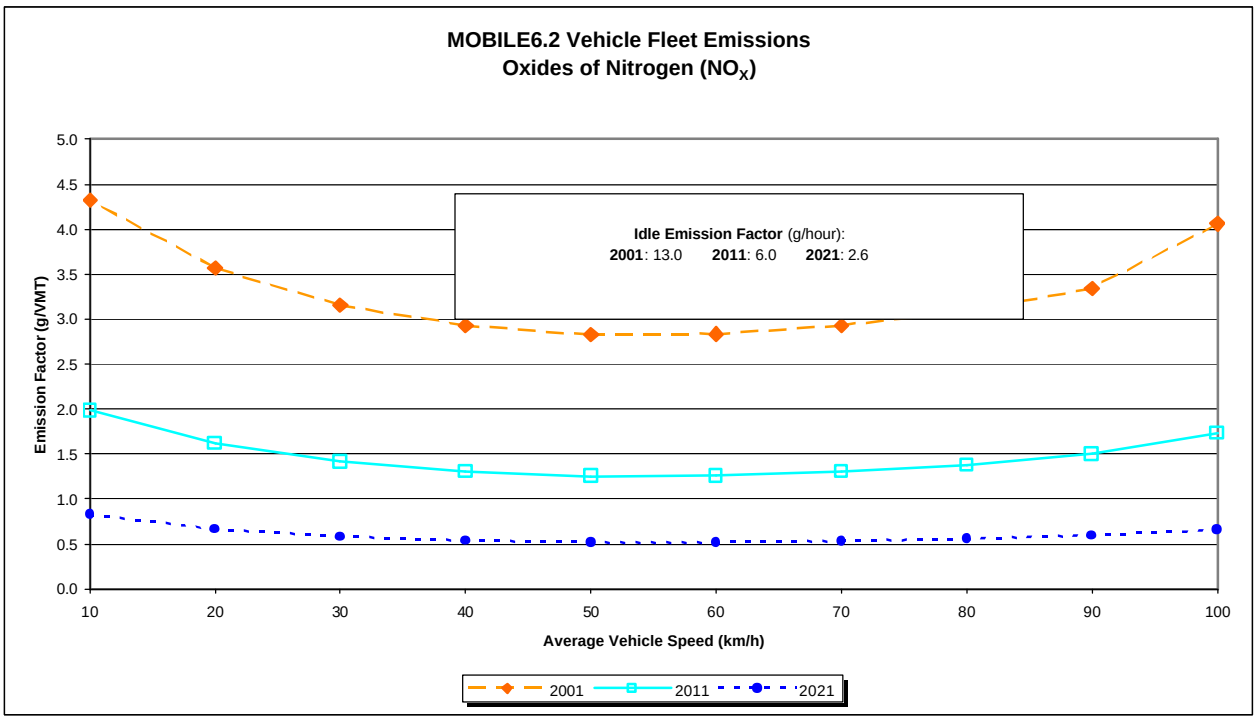
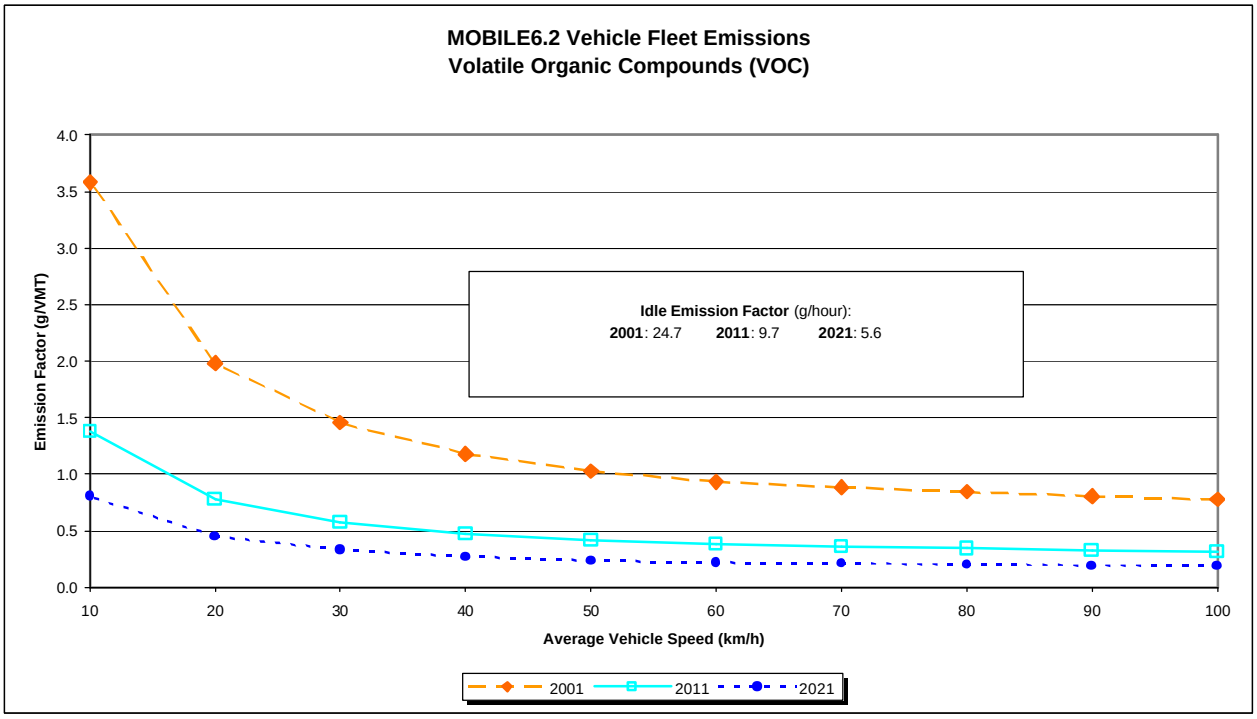


Exhibit 3.8: Projected Volatile Organic Compounds (VOC) Fleet Emissions (2001-2021)



3.6 Impact of Traffic Congestion on Emissions

Current emission and air dispersion models are somewhat limited in terms of their ability to model the impacts of congestion due to a lack of data on traffic volumes and driving cycles. The analysis requires an understanding of the time spent for a variety of vehicle speeds as it stops, accelerates, and slows down. The U.S. E.P.A. is currently developing a new version of MOBILE6, called MOVES, which will be able to estimate congestion emissions. However, this model is not expected to be released until the year 2010.

As part of the "Red Hill Creek Expressway Air Quality Assessment", RWDI and the traffic consultant made several assumptions and a reasonable worst-case congestion scenario was modelled for CO and NO_X. The results of this congestion scenario showed that the reduction in traffic volume (due to drivers choosing other routes or other modes) essentially offsets the increase in pollutant emissions resulting from slower travel speeds. As a result, lower impacts were predicted to occur under congested (but lower traffic volume) conditions compared to free flow conditions.

4. REVIEW OF PRACTICES IN OTHER JURISDICTIONS

Several jurisdictions known to have conducted extensive work in the area of air quality were reviewed. The remainder of this section summarizes the more noteworthy initiatives in other municipalities.

4.1 Region of Halton

The Region of Hamilton has several on-going initiatives aimed at improving air quality.

Halton Partners for Clean Air – The Halton Partners for Clean Air is a consortium of 12 public sector organizations, including: Halton Region, Town of Milton, Town of Halton Hills, Town of Oakville, City of Burlington, Halton District School Board, Halton District Catholic School Board, Conservation Halton, Halton Hills Hydro, Burlington Hydro, Milton Hydro, and Oakville Hydro. One of the key objectives of the Partnership is to reduce traffic congestion and associated environmental and health problems pertaining to air pollution around local schools. For example, the Partnership, in collaboration with its district school board partners, is exploring initiatives which can be undertaken to address this issue and protect the health of local students, which are vulnerable to air pollution related illnesses.

The Halton Smog Plan – Developed by the Halton Partners for Clean Air to address the impact of smog on health and the environment. The plan aims to reduce local pollution and exposure to poor air quality within Halton Region. Stage I strategies can be implemented immediately (i.e., in the year 2000), and include: implementing an anti idling policy for all public sector vehicles; at schools and day care centres ensure that drop off/pick up zones are anti idling areas; conduct routine inspections of all vehicles to ensure that they are well tuned, operating efficiently and meet the provincial "Drive Clean" standards, to name a few. Stage II strategies involve long-term goals and require additional pre-implementation planning, and include: the development of green fleet policies, which encourage the use of alternative fuel-powered fleet vehicles, which use such fuel as electricity, methanol, ethanol, natural gas, and propane; promote employee car and van pooling and the use, by employees, of public transit. This could be done by providing preferential parking spaces, free or subsidized transit passes, to name a few.

Halton Region's Strategic Plan – Halton Region's Strategic Plan was approved by Regional Council on October 24, 2001. Regional Council developed this Plan over the past year with the assistance of Regional staff. Community leaders, ratepayer groups and citizens also participated throughout the Strategic Planning process. The Strategic Plan includes: advocating for public transit; expanding Halton's Clean Air Partnership to include private sector partners; studying the feasibility for providing more bicycle lanes to encourage the public to reduce its reliance on the automobile; promoting public awareness of the impact of smog on public health.

4.2 Region of Peel

A number of key actions are being taken by the Region of Peel, the Cities of Mississauga and Brampton and the Town of Caledon to address air quality and climate change. The following identifies some of the most significant of these initiatives, which were presented as commitments for 2002-2003 at the Toronto Smog Summit in June 2002. (The following information is contained within the Region of Peel's document entitled "State of the Environment: Atmosphere Summary Report 2002").

City of Brampton – The City of Brampton has a number of initiatives related to air quality:

- Marketing Plan for Public Transit: To increase ridership, a marketing plan for public transit is being developed. The possibility of free incentives on "smog alert" days is under review by Transit staff.

- Anti-Idling By-Law: There is an anti-idling program in place for City vehicles at the present time. The current City by-law is being reviewed to determine if idling restrictions should be City-wide. The current by-law has location specific restrictions such as hospital entrances.

- Pilot Project for the use of Bio-diesel Fuel: A pilot project has begun to test the use of Bio-diesel fuel in 16 Works Department vehicles. It is claimed that reductions in emissions of up to 27 % can be achieved using B20 fuel (20% soy oil and 80% petroleum fuel) with no alterations required in the engine. If the pilot is successful, the use of this fuel would be expanded to the remainder of Brampton's diesel fleet.

- Natural Gas Vehicles: The City of Brampton will be investigating the use of compressed natural gas as an alternative fuel. Four pickup trucks are being purchased to test the system.

- Smog Alert Response Plan: A committee has been established to formulate a "Smog Alert" Response Plan for the City.

Town of Caledon – The Town of Caledon is pursuing a number of initiatives related to transportation and air quality:

- Investigating the use of soy-diesel in its diesel fleet

- Participation in Partners for Climate Protection

- Implementation of a Native Tree Seedling Distribution Program

- Working with local community partners such as the Caledon Environmental Advisory Committee, Healthy Lawns-Healthy People and the Caledon Countryside Alliance on air quality initiatives and an ecological footprint assessment.

City of Mississauga – The City of Mississauga is focusing on the following transportation-related initiatives as a means of improving air quality:

- Enhanced Service of Mississauga Transit, including using shuttle buses from GO stations

- Establishing a multiple Use Recreational Trail Network

- Completion of a Local Action Plan to Reduce Greenhouse Gas Emissions

- Implementing the Energenius Challenge, a corporate staff energy conservation and awareness program.

- Conducting fleet research as part of the City's Anti-Idling Campaign and investigating retrofitting equipment to reduce fuel and decrease exhaust emissions.

- Implementing a public awareness and education anti-idling campaign to encourage the reduction of unnecessary engine idling when parked.

4.3 Region of Waterloo

4.3.1 WATERLOO REGION'S CLEAN AIR PLAN

The Regional Municipality of Waterloo and lower level municipalities have agreed to implement *where feasible* the following plans and activities to reduce air pollution in Waterloo Region. (All information contained within this section can be found on the Regional Municipality of Waterloo website: (http://www.region.waterloo.on.ca/__85256AE8007223B1.nsf/0/C842E1668428740F85256B14005668D2?Open)

Short-Term Strategies

- Adopt or enhance a "Green Fleet" policy to ensure that all fleet vehicles and motorized equipment are maintained at peak efficiency, are placed with more efficient vehicles, use less polluting alternative fuels and that motor vehicle technology is optimized.
- Carry out emissions testing on all fleet vehicles on a regular basis or as prescribed (e.g. Drive Clean).
- To reduce the emission of volatile organic compounds during sunlight hours, establish a schedule of refueling fleet vehicles after sundown and before sunrise during the summer months (minimum before 9 a.m.m or after 3 p.m.)
- Develop and implement a municipal protocol that prohibits idling of vehicles when not in use.
- Continue to improve energy conservation and efficiencies in all facilities. Set improvement goals.
- Develop and implement incentives to encourage municipal staff to use public transportation and car pooling on a year round basis.
- Increase naturalized areas for all public lands in order to reduce municipal maintenance by motorized vehicles and reduce the use of pesticides. Develop incentives for residents to replace trees that have to be removed and encourage/enforce tree planting for all private and public develoments.
- Increase and improve walking and cycling routes in order to reduce vehicle use.
- Develop a Smog Alert Plan, including an early warning system for residents, which will provide regular media updates on air quality, and provide health warnings that help residents recognize smog-induced symptoms.
- Establish a program to increase awareness of the air quality benefits of public transit aimed at increasing ridership. Examples include: media advertising (radio, newspaper, television, billboards, bus boards, benches, bus shelters, etc.) and reduce/elminated fares on days when the Air Quality Index is predicted to exceed 50.
- Develop a municipal response plan on Smog Alert Days that reduces and prohibits, where possible, the following activities: Pesticide spraying; Use of gasoline powered equipment- gas mowers, weed cutters, leaf blowers, etc.; Use of oil-based paints, solvents and other volatile organic compounds emitting products; Street sweeping;

Refuelling vehicles during daylight hours; Road re-surfacing activities; and, Operation of crematoriums.

Long Term Strategies

- Support the *Waterloo Region Transportation Master Plan – Action Plan for Implementation* which reflects the community's desire to provide a balance between continuing to provide an efficient road transportation system while also shifting away from auto reliance and towards a greater use of transit, pedestrian and bicycling facilities.

- Support initiatives to provide public transportation for rural residents.

- Develop and conduct, with the assistance of Environmental Health and Environmental Groups, a broad public education campaign about smog including what residents can do to reduce their own emissions. This should build on initiatives which have already been undertaken and not duplicate efforts.

- Develop a plan for promoting the municipal clean air initiatives and sharing resources and technologies that reduce air pollutants amongst municipalities. Encourage industry, businesses and educational and health care institutions to participate.

- Develop a plan for telecommuting options, car pooling, variable work hours, flexible dress code, walking and cycling initiatives to reduce car use.

- Develop an audit plan that corporations can use to track activities and as a guide for achieving optimum performance for clean air initiatives.

- Incorporate the Waterloo Region Clean Air Plan into municipal strategic plans.

4.4 City of Toronto

The City of Toronto has established a number of air quality initiatives, some of which have been adopted by other municipalities in the GTA and Hamilton.

20/20 The Way to Clean Air – 20/20 The Way to Clean Air is a social marketing campaign developed by Toronto Public Health which includes partners from the surrounding GTA. The premise of this program is to supply information to the general public to allow them to reduce their Vehicle Kilometres Travelled (VKT) by 20% and their home energy use by a similar amount.

Toronto Atmospheric Fund – The Toronto City Council established the Toronto Atmospheric Fund (TAF) in 1991 to finance local initiatives to combat global warming and improve air quality in Toronto.[10]

Clean Air Partnership (CAP) – CAP was specifically created to extend the reach and impact of projects initiated through the Toronto Atmospheric Fund. Working in partnership with utilities, schools, businesses, governments and community groups, the Clean Air Partnership (CAP) develops and delivers market and community-based strategies to reduce energy use and clean the air.[11] **CAP**'s programs focus on engaging the community to reduce local greenhouse gas and smog precursor emissions.

[10] City of Toronto website: http://www.toronto.ca/taf/
[11] City of Toronto website: http://www.toronto.ca/cleanairpartnership/about_cap.htm

GTA Clean Air Council – The GTA Clean Air Council is an inter-governmental group of representatives from all levels of government within the GTA. Its primary goal is to organize an annual smog summit and local for a across the GTA as an opportunity for all stakeholders to discuss issues of concern and participate in strategies to improve air quality across the GTA. To help reduce air pollution in the GTA, the Clean Air Council emphasizes the following directions:

- Embracing annual Smog Summits and supporting the development of the Inter-governmental Declaration to be signed by government representatives at the Smog Summits;
- working between annual Smog Summits to follow-up on the needed actions that were identified at the Summits;
- liaising with GTA municipalities on their clean air initiatives;
- creating an inventory of clean air initiatives of private and /or public sector organizations working on improving the GTA's regional air quality;
- promoting a better understanding of air quality problems and their implications for public health, especially in urban environments;
- promoting clean air initiatives and smog reduction best practices through various means, such as workshops for government decision-makers, corporations, professional groups, and the public; and
- liaising, through the Federation of Canadian Municipalities, with other municipalities across Canada to share best practices for reducing smog and air pollution.[12]

The GTA Clean Air Council also organizes the **Smog Summit** is an annual gathering of representatives from industry, the community and all levels of government in the Greater Toronto Area (GTA).

Idling Control By-Law – This by-law is intended to reduce unnecessary vehicle idling in the City. It limits idling to no more than three minutes in a given 60 minute period. The by-law allows transit vehicles to idle when picking up or discharging passengers and also allows limited idling when transit vehicles are waiting for passengers. As well, the by-law provides for idling during extreme outdoor temperatures to ensure heating or cooling inside a vehicle. [13]

Better Transportation Partnership (BTP) – Established by the Energy Efficiency Office (EEO), the Better Transportation Partnership (BTP) is a public-private partnership created to reduce smog emissions within the City by seeking out new and emerging transportation technologies, such as low and zero emission vehicles and other commercially viable opportunities. By early 2003, over 100 alternatively fuelled vehicles were funded for purchase by the BTP and incorporated into the City of Toronto fleet. These are mainly natural gas fuelled and hybrid vehicles. In the future, other types of fuels will be incorporated into the program.[14]

4.5 American Initiatives

In the United States, new State Implementation Plans (SIP) are being developed to address air quality concerns. The SIPs are due between the years 2006 and 2008 to map out how the states

[12] City of Toronto website: http://www.toronto.ca/gtacac/missionstatement.htm
[13] City of Toronto website: http://www.toronto.ca/transportation/onstreet/idling.htm
[14] City of Toronto website: http://www.toronto.ca/energy/transportation.htm

will reduce levels of ozone, $PM_{2.5}$ and haze. Like Canada, there are many other programs that will reduce emissions and thus reduce cross-border transport of air contaminants. It is the rigorous application of these current government initiatives and other programs that will appear over the next ten years and will contribute to the desired improvement in Ontario's air quality.

5. IDENTIFICATION OF POLICY OPTIONS

Air quality is a challenging issue to address due to the fact that air pollution comes from a number of sources that are difficult to trace, including transportation. However, two things are clear:

- 1) Transportation is a major contributor to air quality problems in Hamilton; and,
- 2) Air emissions from all sources are unlikely to be reduced to levels where there is no human or environmental impact in the foreseeable future without significant policy intervention.

It is therefore appropriate that the City of Hamilton's Transportation Master Plan address ways to reduce the impacts of transportation on air quality.

There are five key areas by which the impacts of transportation on air quality can be reduced. These are listed below and each is discussed further in the following sections:

- Reducing vehicle use;
- Shifting travel to less-polluting modes;
- Reducing the impacts of vehicle use;
- Improving education and awareness;
- Mitigation initiatives.

5.1 Reducing Vehicle Use

Communities across Canada are looking at ways to reduce vehicle use as part of their air quality strategies. One of the challenges is that population continues to increase and combined with the fact that people are generally travelling more, vehicle use has not decreased but has instead increased significantly. For example, between 1986 and 2001, the number of daily trips by car per person in Hamilton increased from 1.55 trips per day to 1.74 trips per day, while at the same time population increased.

There are a number of basic approaches for reducing vehicle use, including:

- Substituting passenger trips through telecommunications (e.g. telecommuting, teleconferencing);
- Increasing the number of passengers per vehicle (e.g. ridesharing, carpooling);
- Substituting or reducing the number of freight movements by increasing vehicle load factors and reducing trips lengths (e.g. promoting locally produced goods);
- Reducing the length of trips by creating opportunities that are closer together, including more compact forms of population and employment; and,
- Reducing trips on poor air quality days.

5.2 Shifting Travel to Less-Polluting Modes

Recognizing that people still need to travel and consume goods, a complementary strategy to reducing vehicle use is to shift trips to less polluting modes. As quantified in Section 3.3, single occupant vehicles contribute significantly more to air emissions on a per-kilometre basis than transit while walking and cycling produce no emissions.

Strategies for shifting travel to transit, walking and cycling are addressed in companion policy papers and generally include the following:

- Making public transit an attractive and competitive mode compared to private automobiles by increasing service levels and improving travel times. various other incentives may exist such as offering incentives to residents on smog alert days to use public transit (i.e. reduced fare);

- Continue to expand the cycling network including on-street and off-street facilities in order to improve the cycling environment and attract more individuals to this mode. Measure to encourage cycling also include providing amenities for cyclists at their place or work or business; and,

- Promoting employee car-pooling and other travel demand management initiatives.

At a more strategic level, breaking the "auto-habit" may also involve pricing incentives and disincentives such that the environmental and social (i.e. full costs) of transportation are reflected in transportation prices.

5.3 Reducing the Impacts of Vehicle Use

Various studies have shown that achieving significant reductions in air pollution will require a combination of demand and supply solutions[15]. As discussed in Section 3.4, it is forecast significant improvements in vehicle technologies will be made over the next 10-20 years, with the result being fewer emissions per vehicle-kilometre. However, increases in travel demand will have the effect of off-setting these improvements somewhat.

Options to reduce the impact of vehicle use could involve the following:

- Promote the use of alternative forms of fuel (e.g. ethanol, bio diesel) and propulsion systems (e.g. hybrid vehicles, electric vehicles) which produce fewer emissions, possibly starting with the for the City's vehicle fleet;

- Reducing congestion, which in turn reduces emissions causes from unnecessary idling. Reducing congestion may be achieved through strategic road capacity improvements, as well as reducing vehicle use.

5.4 Improving Education and Awareness

Numerous studies have shown that there immediate and long terms health effects associated with poor air quality (see Section 1.4). Many cities across Canada, as well as Environment Canada, are attempting to make people more aware of the health effects of poor air quality and options for reducing exposure. One of the challenges associated with this is that reducing air pollution on poor air quality days should involve promoting walking and cycling. However, it is also recommended

[15] Making Transportation Sustainable, A Case Study of the Quebec City – Windsor Corridor, Environment Canada, March 2002.

that strenuous exercise be avoided on poor air quality days. While there are obvious concerns about exercising in conditions of poor air quality, the benefits of the exercise likely outweigh the risks of increased exposure to air pollution, provided caution is used in areas of high pollution and on days when air quality is poor[16].

A comprehensive air quality strategy should include education and awareness initiatives to:

- make individuals, businesses and industry more aware of the impacts of transportation choices on air quality, particularly during periods of poor air quality; and,
- making individuals aware of the health risks of poor air quality and options for mitigating these risks.

Within the context of this transportation master plan, some of the potential policy options include:

- Promoting education initiatives aimed at reducing vehicle use (e.g. promoting car-pooling, ridesharing, transit, etc.);
- Educating people on the benefits of properly maintaining vehicles; and,
- Considering options for large corporations (starting with the City of Hamilton) to reduce activities that contribute to poor air quality during smog days. Transportation related activities could include, road re-surfacing activities, fleet refuelling, goods movement, etc.

Education and awareness initiatives specifically related to transportation must be complimented by initiatives addressing other sources of air pollution. While these are beyond the scope of this transportation master plan, other areas to address may include pesticide spraying; use of gasoline powered equipment-gas movers, weed cutters, leaf blowers, barbeques, etc.; use of oil-based paints, solvents and other volatile organic compounds emitting products.

5.5 Mitigation Initiatives

A final strategy for reducing the impacts of transportation on air quality involves mitigation measures. The most commonly sued approach is tree-planting. Trees have the ability to filter air emissions and also provide shade and environmental comfort that is conducive to walking and cycling.

Typically, mitigating measures such as tree-planting programs are outside of the scope of a Transportation Master Plan.

[16] Health Canada, Clean Air Champions - "Getting Active For Cleaner Air" - Education Resource Kit http://www.hc-sc.gc.ca/hecs-sesc/air_quality/publications/clean_air_champions/health_impacts.htm

6. RECOMMENDED POLICIES

Options to reducing the impacts of transportation activities on air quality cross a number of different areas including travel demand and mode choices, vehicle technologies and education and awareness issues. Many of these subjects are addressed in specific policy papers (e.g. transit, walking and cycling). Some are also outside of the scope of the City of Hamilton, specifically changing vehicle technologies.

It is also recognized that many initiatives aimed at improving air quality are being implemented or planned by Clean Air Hamilton. Accordingly, the proposed policies developed for the Transportation Master Plan should complement, rather than replace, the policies, objectives and goals of Clean Air Hamilton.

Recognizing these overlapping issues and potential jurisdictional constraints, the following policies are proposed for inclusion in the Transportation Master Plan.

Recommended Policy

Reduce the need for motorized travel and number of daily trips per capita by locating activities closer together, and promoting a mix of land uses in each community.

Implementation

- Ensure that existing and new neighbourhoods include adequate parks, recreation facilities and schools that are located within walking distance (see Urban Structure and Land Use Paper)
- Explicitly consider the impacts of new development on travel demand and vehicle-kilometres of travel generated and attempt to locate new large activity generators to minimize travel effort.
- Promote initiatives which reduce commuter trips or shift trips to non-motorized modes of travel and transit (see Travel Demand Management Policy Paper)
- Adopt an employee trip reduction program for municipal employees, including ride-matching programs, discounted transit passes and reduced free-parking.

Recommended Policy

Provide a balanced transportation system where walking, cycling, transit and shared-ride transportation are financially attractive, experienced as attractive modes and competitive in terms of efficiency by comparison to the private automobile

Implementation

- Increase transit service levels in major corridors and consider options to serve lower density areas using smaller community-based transit services. (See transit policy paper)
- Consider the full costs of transportation, including environmental and air quality impacts in all major transportation decisions.
- Adopt a planning framework where options to address congestion consider capacity and service level improvements for non-motorized transportation and transit, prior to considering road expansion. Explicitly consider the impacts of induced travel resulting from road expansion and the implications on air quality.
- Continue to support the City of Hamilton Commuter Challenge

Recommended Policy

Reduce the impacts of motorized travel by promoting more fuel-efficient and lower emission vehicles, starting with the municipal vehicle fleet.

Implementation

- Continue to purchase natural gas-powered buses for the HSR fleet, provided they remain cost competitive and provide emissions reductions over alternative vehicle technologies. Alternative technologies such as hybrid-buses and fuel cell buses should be evaluated as these technologies evolve and become readily available.
- All vehicles used for municipal purposes should be *Low Emission Vehicles*[17], except where intended service function would be compromised (e.g. emergency services)
- Implement a limited time demonstration project where Ultra-Low Emission Vehicles[18] (e.g. hybrid vehicles) or Zero Emission Vehicles would be provided free parking in all municipal lots. While this may have the effect of promoting auto use, the primary intention would be to send a message that the City of Hamilton promotes clean vehicle choices.
- Work with senior government as well as other municipalities to implement programs to promote more efficient vehicle choices.

Recommended Policy

Support Clean Air Hamilton and other agencies (Green Venture, Environment Hamilton) in their efforts to increase awareness of air quality issues, including the impacts of transportation on air quality and the steps that can be taken to minimize exposure to poor air quality.

Implementation

- Work through the media to raise the issue of air quality.
- Consider free transit on one or all poor air quality days as a means of promoting transit and providing travel options.
- Implement the City of Hamilton Anti-idling campaign and implement by-laws to enforce the idling time limits.

Recommended Policy

Design transportation infrastructure to incorporate opportunities for tree planting and other forms of vegetation that help to improve localized air quality.

Implementation

- In the design of new streets and reconstruction of existing streets, provide a green boulevard including trees between the pavement edge and sidewalk and, where appropriate provide a wider planting boulevard between the sidewalk edge and property limit.
- Identify opportunities for tree planting in new developments, including commercial parking lots, green spaces, boulevard and off-street sidewalks and trails.

[17] A "Low Emission Vehicle" (LEV) is one of four categories of emissions standards under the LEV (Low Emission Vehicle) regulations. In order to be certified as LEVs, vehicles must meet stringent emission levels for non-methane organic gases (NMOG), oxides of nitrogen, and carbon monoxide (CO) on emissions certification tests. In order of increasing stringency, the vehicle categories are transitional low-emission vehicles (TLEVs), low-emission vehicles (LEVs) , ultra-low emission vehicles (ULEVs), and zero-emission vehicles (ZEVs). A Honda Civic is an example of a LEV.

[18] An "Ultra Low Emission Vehicle" (ULEV) is the second most stringent vehicle class under the LEV (Low Emission Vehicle) regulations. Most Hybrid vehicles would meet the emission standards for ULEVs.

Recommended Policy
Monitor transportation activities that impact air quality, including vehicle use (passenger and goods) and congestion levels.
Implementation
• Continue City-wide traffic count programs to measure vehicle trips at key locations. • Utilize readily available sources (Transportation Tomorrow Survey, Fuel Sales Data, Statistics Canada Journey to Work Data) to monitor and explore underlying factors influencing travel.

7. IMPACTS OF POLICY OPTIONS

7.1 Assessment Factors

Assessment of policy options is based on factors for achieving sustainable growth and development across all of the policy papers developed in this project. They fall under the three major categories of **social, economic and environmental** impacts, and they are described briefly below.

Exhibit 7.1: Assessment Factors

Impact	Acts on	Description (or examples)
Social	Residential communities	Improves quality of life in neighbourhoods
	Safety and security	Reduces collisions; improves personal safety and security
	Ease of implementation & governance	Provides clarity, measurability, accountability
Economic	Development	Attracts employment, capital, optimal use of transportation infrastructure capacity, and future land use
	Land value	Increases land value, or does not decrease land values
	Operating and capital costs	Reduces or defers public and private costs of transportation capital (construction or acquisition of fixed infrastructure and rolling stock) and operations (maintenance, enforcement, delay, fuel, etc.)
	Congestion	Improves traffic flow (or slows deterioration thereof)
Environmental	Air quality	Reduction of Criteria Air Contaminants
	Noise and vibration	Minimizes noise impacts
	Natural environment	Improves water quality, green spaces, flora and fauna, etc.

The rating system that will be used to apply these criteria is a visual five-point scale, to reflect a range from strong positive impact to strong negative impact. (**+, +, o, --, --**)

+ Represents the strong positive impact, **o** represents absence of significant impact either way, and **--** represents strong negative impact.

7.2 Summary of Evaluation

The factors described in Section 7.1 are applied to the policy options described in Section 6. The results of a preliminary qualitative assessment using the rating scheme described previously are provided in Exhibit 7-2.

Exhibit 7.2: Impacts of Policy Options

Policy Option	Social			Economic				Environmental		
	Residential Communities	Safety and Security	Ease of Implementation and Governance	Development	Land Value	Operating and Capital Costs	Congestion	Air Quality	Noise and Vibration	Natural Environment
Reduce the need for motorized travel and number of daily trips per capita by locating activities closer together, and promoting a mix of land uses in each community.	+	+	-	+	+/-	+	+	+	+	+
Provide a balanced transportation system where walking, cycling, transit and shared-ride transportation are financially attractive, experienced as attractive modes and competitive in terms of efficiency by comparison to the private automobile.	+	+	+	+	+	+/-	+	+	+	+
Reduce the impacts of motorized travel by promoting more fuel-efficient and lower emission vehicles, starting with the municipal vehicle fleet.	+	0	-	+	0	-	+	+	+	+
Support Clean Air Hamilton and other agencies (Green Venture, Environment Hamilton) in their efforts to increase awareness of air quality issues, including the impacts of transportation on air quality and the steps that can be taken to minimize exposure to poor air quality.	+	+	+	+	0	0	+	+	+	+
Design transportation infrastructure to incorporate opportunities for tree planting and other forms of vegetation that help to improve localized air quality.	+	+	+	+	0	-	-	+	+	+
Monitor transportation activities that impact air quality, including vehicle use (passenger and goods) and congestion levels.	+	0	+	0	0	-	+	+	+	+